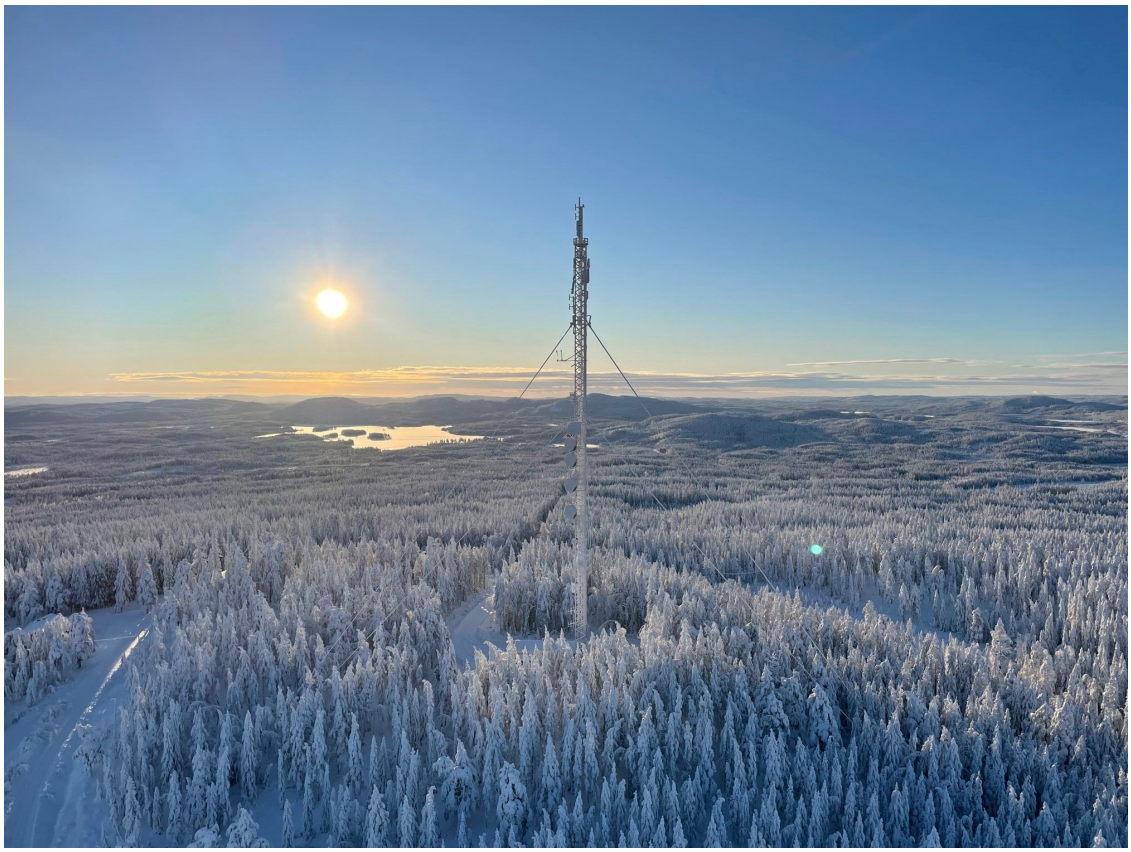
CHALMERS
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6G Infrastructure Integration

Rollout Strategies from a Tower Company Perspective

Master's thesis in Master Programme Design and Construction Project Management

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Department of Electrical Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2026
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Department of Electrical Engineering
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Abstract

The development of the sixth generation of mobile networks is expected to introduce new requirements for telecommunications hardware, including increased capacity, lower latency, higher reliability, and more distributed network architectures. However, while existing research often focuses on the technological advancements of 6G, less attention has been given to the practical infrastructure implications of future roll-out strategies.

This thesis investigates how 6G may influence telecommunications infrastructure requirements from a tower company perspective. The study is based on a literature review and eleven semi-structured interviews with actors from the telecommunications ecosystem, including operators, technology providers, public infrastructure actors, healthcare, transport, logistics, and automotive representatives.

The findings indicate that 6G deployment is likely to be gradual, selective, and economically driven rather than rapid and nationwide. Currently, a clear business case for 6G is lacking. Future infrastructure development is therefore expected to rely primarily on upgrading and reusing existing sites, complemented by targeted densification in high-value environments such as industrial facilities, transport hubs, healthcare infrastructure, and dense urban areas. The study also highlights resilience, private networks, indoor coverage, and neutral host models as increasingly important factors for future telecommunications infrastructure.

Keywords: 6G, Telecommunications Infrastructure, 6G Deployment, Future Networks, Infrastructure Sharing, Network Resilience

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Finally, we are grateful to all interview participants who shared their time, knowledge, and perspectives. Their insights have been essential for understanding the practical challenges and opportunities related to future telecommunications infrastructure and 6G rollout.

Melkersson & Parmalm, Gothenburg, June 2026

Nomenclature

Below is the nomenclature of acronyms and technical terms that have been used throughout this thesis.

Acronyms

$3GPP$	3rd Generation Partnership Project
AI	Artificial Intelligence
CA	Carrier Aggregation
$CapEx$	Capital Expenditure
DAS	Distributed Antenna System
$eMBB$	Enhanced Mobile Broadband
$HAPS$	High-Altitude Platform Stations
IMT	International Mobile Telecommunications
IoT	Internet of Things
ITU	International Telecommunication Union
$JCAS$	Joint Communication and Sensing
LEO	Low Earth Orbit
$LMICs$	Low and middle income countries
LTE	Long Term Evolution
MEC	Multi-access Edge Computing
$MIMO$	Multiple-Input Multiple-Output
ML	Machine Learning
MNO	Mobile Network Operator
NTN	Non-Terrestrial Networks
$OpEx$	Operational Expenditure
PTS	Swedish Post and Telecom Authority
RAN	Radio Access Network

RRU	Remote Radio Unit
$SAGSIN$	Space–Air–Ground–Sea Integrated Network
SMS	Short Message Service
$SWEN$	Swedish Emergency Network
THz	Terahertz
$URLLC$	Ultra-Reliable Low-Latency Communication
$V2X$	Vehicle-to-Everything
XR	Extended Reality

Technical Terms

Backhaul	Connection between base stations and the core network, carrying user traffic and control data.
Fronthaul	Connection between the centralized baseband unit and remote radio units in the network architecture, carrying control signaling, synchronization, and sometimes user data.
Core	Central part of a mobile network managing services and routing.
SmallCell	Low-power cellular base station used for densification.
BaseBandUnit	Processes the digital radio signals, handling tasks such as modulation, encoding, and communication with the core network.
EdgeComputing	Processing data near the source instead of in a centralized cloud to reduce latency and improve performance.
EndDevice	User equipment that connect to the network, such as smartphones, IoT devices, sensors, XR equipment, vehicles, drones, and other connected devices

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1

Introduction

1.1 Background

The rapid evolution of mobile communication technologies has fundamentally transformed digital connectivity and infrastructure requirements over the past decades. Since the introduction of first-generation (1G) systems in the 1980s, each new generation of mobile networks has expanded both technological capabilities and societal reliance on wireless communication (Jiang & Han, 2024). While early systems primarily supported voice communication, subsequent generations have enabled text messaging, mobile internet access, and, more recently, high-speed data services and real-time connectivity. Today, mobile networks form a critical backbone of modern economies, supporting a wide range of applications across industries and public services.

This development has been driven by a continuous increase in data demand, fueled by the widespread adoption of smartphones, cloud computing, and digital platforms. At the same time, the digitalization of industries has accelerated the need for reliable and high-capacity connectivity. Technologies such as the Internet of Things (IoT), autonomous systems, and advanced analytics require networks capable of handling large volumes of data with low latency and high reliability (Jiang & Han, 2024).

The deployment of fifth-generation (5G) networks represents a significant step in this transformation, introducing capabilities such as enhanced mobile broadband, ultra-reliable low-latency communication, and support for massive numbers of connected devices. However, even as 5G continues to be rolled out globally, research and standardization efforts for sixth-generation (6G) networks are already underway. 6G is expected to be introduced around 2030 and aims to further extend the capabilities of mobile communication systems (Ericsson, 2024b). Proposed features include ultra-high data rates, near-instantaneous latency, AI-native network architectures, and the integration of communication and sensing functionalities.

Despite these technological ambitions, the physical infrastructure required to support future network generations remains a critical but less explored aspect. Previous generational transitions have demonstrated a clear trend toward increasing network densification, greater equipment complexity, and rising energy demand.

Looking ahead, the characteristics associated with 6G, including the use of higher frequency bands and advanced functionalities, suggest that these trends may intensify. This raises important questions regarding how future networks will be deployed, how infrastructure will need to evolve, and which sectors are likely to drive early adoption. However, current research has primarily focused on technological capabilities, with limited attention given to the practical implications for telecommunications infrastructure.

Against this background, there is a need to better understand how 6G may influence infrastructure requirements, including antenna density, equipment configuration, site typologies, and deployment strategies. Such insights are essential for stakeholders involved in network planning, infrastructure investment, and the long-term development of telecommunications systems.

1.2 Problem Discussion

The deployment of future mobile networks is expected to place increasing demands on the physical infrastructure supporting telecommunications systems. Expanding network capacity, coverage, and service reliability requires not only technological advancements but also investments in sites, fiber backhaul, power supply, and supporting infrastructure. These requirements create challenges related to cost, energy consumption, permitting processes, and coordination among a growing number of stakeholders.

The transition toward 6G is expected to intensify these challenges. Emerging 6G visions emphasize the use of higher frequency bands, such as sub-THz spectrum, alongside advanced functionalities including AI-native networks and integrated communication and sensing. These developments are likely to require a fundamental shift in how networks are designed and deployed, moving from relatively centralized, tower-based architectures toward highly distributed and heterogeneous infrastructure systems. This may involve a dense fabric of small cells, increased indoor deployment, and the integration of terrestrial and non-terrestrial network components.

At the same time, the trajectory of previous generational rollouts suggests that expectations regarding new technologies often diverge from realized outcomes. For example, while 5G was initially framed as enabling a wide range of transformative use cases, its deployment has largely been driven by enhanced mobile broadband and incremental upgrades to existing infrastructure. This highlights the uncertainty surrounding how 6G will be adopted in practice, particularly in terms of which sectors will act as early adopters and how demand for infrastructure will materialize.

In addition, the growing reliance on mobile networks for critical societal functions, including healthcare, transport, and industrial operations, places increasing emphasis on network resilience. Future infrastructure will need to ensure not only high performance but also robustness against disruptions, raising new challenges related

to redundancy, energy supply, and system reliability.

Taken together, these developments point to a complex and uncertain landscape in which the future infrastructure requirements of 6G remain insufficiently understood.

1.3 Purpose

The purpose of this thesis is to analyze how the emergence of 6G is expected to influence telecommunications infrastructure requirements, with a particular focus on antenna density, equipment configuration, site typologies, and spatial deployment. By combining insights from previous generational transitions with empirical findings from industry interviews, the study aims to identify likely early adopters of 6G and assess the implications for infrastructure demand, rollout strategies, and resilience in next-generation networks.

1.4 Scope and limitations

This study is geographically limited to Sweden and focuses on the Swedish telecommunications market and infrastructure context. The analysis primarily considers national conditions related to network deployment, regulation, infrastructure ownership structures, and industrial adoption patterns. While international developments in 6G research and standardization are included to provide contextual understanding, the empirical analysis and conclusions are intended to reflect the Swedish context specifically.

The study is further limited to land-based telecommunications infrastructure. Consequently, satellite-based communication systems, subsea cable infrastructure, and maritime or airborne network solutions are excluded from the analysis.

In terms of technological scope, the thesis concentrates on infrastructure-related implications of 6G rather than detailed technical standardization or radio engineering performance analysis. The study does not aim to predict exact technical specifications of 6G, as the technology remains under development, but instead analyzes expected infrastructure trends and deployment implications based on existing literature, previous generational transitions, and expert interviews.

1.5 Research Questions

- Which sectors and applications are likely to act as early adopters of 6G, and what implications does this have for infrastructure demand?
- How may 6G influence antenna density, equipment requirements, and physical placement across different site typologies?
- What are the expected implications for the rollout of 6G, based on experiences

from previous generational transitions and emerging 6G technologies?

- Which resilience factors will be critical for next-generation telecommunications infrastructure?

2

Literature Review

2.1 Historical Infrastructure Trends Leading Towards 6G

The evolution of telecommunications generations has influenced infrastructure requirements over time. By examining the development from 1G to 5G, key trends such as densification, increased site complexity, and rising energy demand can be identified. These trends provide important context for understanding the potential implications of 6G.

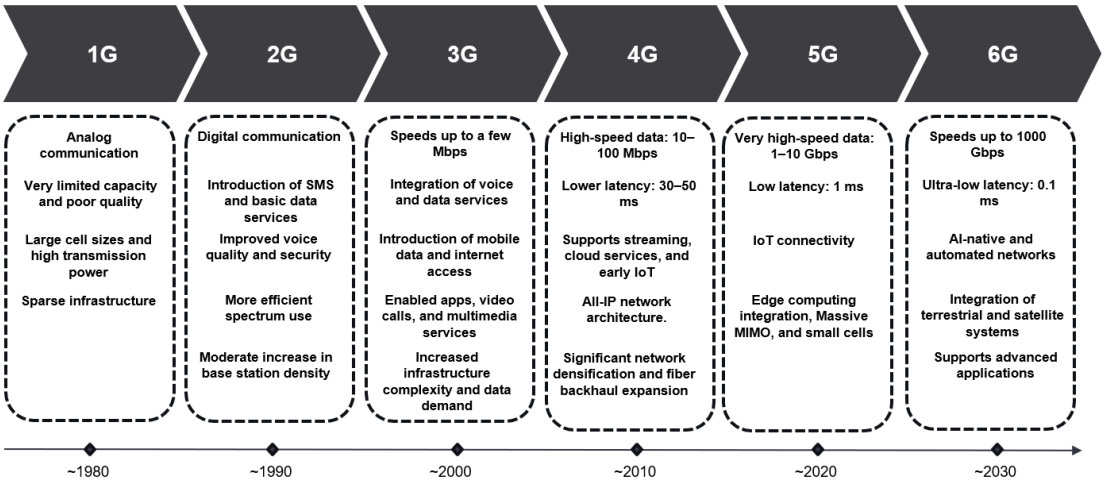


Figure 2.1: Evolution of mobile network generations from 1G to 6G, illustrating key technological advancements and performance improvements. Source: Authors' own illustration.

2.1.1 First Generation

The first generation of telecommunication technology began roll-out in the 1980s, marking the beginning of large-scale public mobile communication systems (Jiang & Han, 2024). The infrastructure was scarce and early mobile communication systems were originally designed with very high transmission power levels (e.g., around 100

W) to provide city-wide coverage from a single base station. The equipment was bulky and required a lot of space close to the site. The technology was used mainly for analog voice calls, however, the capacity was limited and the quality was poor.

2.1.2 Second Generation

The second generation (2G) of telecommunication technology was introduced to the networks during the 1990s (Jiang & Han, 2024). This new technology allowed for some data traffic and SMS. Compared to earlier systems, lower transmission power and the practice of cell splitting led to increased site densification. Sectorization was also introduced, typically dividing a site into three sectors, which required towers to support multiple antennas instead of a single antenna. In low and middle income countries (LMICs), the 2G network is still active and maintained, creating problems for each new generation implemented.

2.1.3 Third Generation

The transition from 2G to third generation (3G) marked the beginning of increased network densification (Jiang & Han, 2024). Smaller cells were introduced to improve coverage in dense environments and indoors. In 3G networks most processing functionality was centralized in the radio network controller, which was not located at the site. This means that the energy demand per site and structural loads on towers remained relatively limited compared to later generations.

2.1.4 Fourth Generation

With the introduction of fourth generation (4G), the radio network controller was removed as a separate network element and its function was integrated into the base stations (Jiang & Han, 2024). The changed required larger base-band units, increased processor capacity, higher energy supply, and additional on-site storage. The introduction of MIMO led to larger and more complex antennas being implemented on the sites. Furthermore, Carrier Aggregation (CA), which combines multiple frequency bands, increased the number of antennas, cables, and Remote Radio Units (RRUs) installed at each site. To meet growing capacity demand, particularly in urban areas, densification also followed as a part of the 4G roll-out.

2.1.5 Fifth Generation

The deployment of 5G, particularly through the deployment of Massive MIMO technology, increased the amount of equipment installed at each site (Jiang & Han, 2024). Massive MIMO radio equipment is larger and more energy-intensive than previous generations, leading to higher structural loads and increased power demand. At the same time, particularly when deployed in higher frequency bands, 5G has shorter propagation range and weaker penetration than lower-frequency legacy networks, which increases the need for network densification. As a result, Non-Standalone 5G deployments have significantly increased the load on existing sites, as new Massive MIMO radios are added alongside legacy 4G equipment. This further intensifies

requirements on tower space, power availability, and structural capacity, while continuing to drive infrastructure densification (Jiang & Han, 2024).

2.1.6 Sixth Generation

With 6G, the infrastructure might evolve from traditional tower based sites into a dense network of small cells (Roessel et al., 2023). This means that there might be a dense fabric of distributed connectivity points with only 6G technology alongside larger sites with several different types of equipment which is common today. The use of higher frequency bands, such as sub-THz spectrum, with significantly shorter range, will require densification not just outdoors, but indoors as well. Beyond data transmission, the base stations are expected to also act as radar sensors (Joint Communication and Sensing, JCAS) and as local AI computing nodes (Roessel et al., 2023). Non-Terrestrial Networks (NTNs), including satellite and airborne communication systems, already exist. In the context of 6G, a key development is expected to be the integration of NTN capabilities into 3GPP-defined terrestrial networks, enabling more seamless three-dimensional coverage. This would introduce fundamentally different requirements for aspects such as energy efficiency, synchronization and more.

2.1.7 Evolutionary Summary

Across network generations, infrastructure requirements have transitioned from sparse, high-power macro networks toward dense, complex, and highly energy-intensive systems. For tower companies, this implies that the value of infrastructure assets has evolved from elevation and geographic coverage toward hosting capacity, power availability, fiber access, and suitability for densification.

2.2 The Sixth Generation of Telecommunications Technology

6G represents the next evolutionary step in mobile communication systems. It is currently under development and implementation is expected to start around the end of the decade. Continuing the evolution of previous generations, 6G aims to introduce new capabilities, architectural principles, and performance targets, while addressing limitations identified in 5G.

At this stage, 6G is not yet defined to a standard, but rather in a rapidly evolving process of ongoing research, early validation test, and initial standardization activities. This chapter provides an overview of the current understanding of 6G, including its defining characteristics, development status, and key uncertainties and challenges that may influence its implementation.

2.2.1 Vision and Design Goals of 6G

The vision and design goals of 6G are shaped both by the limitations of previous generations and the anticipated demands of future mobile communication systems. This section outlines key targets and research that currently define the direction of 6G development.

2.2.1.1 Extreme Data Speeds

Significantly increased achievable data rates compared to 5G is one of the central design objectives of 6G. Current research indicate peak data rate targets of at least 1 Tbps, with potential scenarios such as wireless backhaul and fronthaul (see nomenclature) aiming towards 10 Tbps (Li et al., 2025; Siddiky et al., 2025). In parallel to this, the user experience data rate is projected to reach at least 10 Gbps. This is a substantial increase from the 100 Mbps target defined for 5G. These figures are, however, aspirational research projections rather than established requirements. The ITU-R IMT-2030 framework instead gives 50–200 Gbit/s as possible research values for peak data rate and 300–500 Mbit/s for user-experienced data rate (International Telecommunication Union, 2023).

There are two main motivations for the need of this target data speed. First, global mobile data traffic is expected to drastically increase toward 2030, driven by higher device density and data intensive services (Abdel Hakeem et al., 2022; Li et al., 2025). Second, new and evolving technologies such as, for example, extended reality (XR) and industrial digital twins require sustained multi-gigabyte throughput with low latency and high reliability.

The bandwidth used today, the sub-6 GHz spectrum, does not allow for terabit-per-second data speeds due to limited bandwidth (Jiang et al., 2024). This leads to research being done on the usage of new spectrum domains, particularly the terahertz band (0.1-10 THz), which offers extremely wide bandwidths suitable for these extreme data speeds. While THz signals suffer from high path loss and atmospheric absorption, they enable ultra-high-capacity links over short distances, making them suitable for dense urban deployments, indoor hotspots, and high-capacity backhaul connections.

For tower companies, this implies that demand for different infrastructure than macro-sites may rise with the next generation of 6G. Denser and more localized deployment typologies, such as rooftops, indoor systems and street-level small cells could play a larger role in the future telecommunication networks. As a result, access to fiber, power, physical space, and suitable locations in dense urban or indoor environments may become increasingly important infrastructure assets in a 6G context.

2.2.1.2 Sub-Millisecond and Deterministic Latency in 6G

With 5G, Ultra-Reliable Low-Latency Communication (URLLC) was introduced, which allowed users to experience latency targets around one millisecond (Abdel

Hakeem et al., 2022; Li et al., 2025). 6G targets and research aims to reduce this by an additional order of magnitude, allowing for user-experienced latencies to approach 0.1 milliseconds.

The main motivation for sub-millisecond and deterministic latency comes from applications that require real-time interaction and control. These include industrial automation and collaborative robotics, remote operation systems, connected autonomous systems, and immersive XR (Siddiky et al., 2025). In these applications, predictable and minimal delay is crucial to ensure safety, stability, and user experience.

2.2.1.3 Joint Communication and Sensing

A key emerging technology in 6G is JCAS. The central idea is to merge wireless communication and environmental sensing, akin to radar, into a unified system, rather than as separate infrastructure (Jiang et al., 2024; Siddiky et al., 2025). 6G is expected to utilize higher frequency bands and more advanced antenna systems than previous generations, and communication and sensing are expected to rely on overlapping hardware components, spectrum resources, and signal processing methods, making co-integration effective from both performance and efficiency perspectives.

JCAS introduces a symbiotic relationship between sensing and communication (Jiang et al., 2024). Sensing capabilities can support communication by enabling the network to infer environmental geometry and mobility dynamics, improving things such as beam alignment, blockage prediction, and link robustness, particularly in dense areas sensitive to obstruction and misalignment. Conversely, by combining observations across multiple access points and devices, the system can extend sensing coverage and improve situational awareness beyond what a single sensing unit can provide. In this way, the communication network itself functions as a sensing platform.

High-precision localization and real-time environmental awareness are the main motivation for the research of JCAS. Use-cases include connected and autonomous mobility, industrial automation and robotics, and XR services, where precise positioning and context awareness is crucial (Jiang et al., 2024; Roessel et al., 2023). However, key challenges remain, including managing interference between sensing and communication tasks, and mitigating hardware constraints that become more pronounced at very high frequencies.

2.2.1.4 Non-Terrestrial Networks

Non-Terrestrial Networks showcases an important architectural expansion in the development of 6G, with the goal of extending connectivity beyond traditional ground-based cellular infrastructure (Li et al., 2025; Siddiky et al., 2025). The concept of integrating a combination of space-based, aerial, and terrestrial communication systems is often described as Space–Air–Ground–Sea Integrated Network (SAGSIN). This idea reflects the change from the traditional two-dimensional coverage toward a three-dimensional communication architecture. However, this concept is not new

for 6G. Integrating satellite systems with cellular networks predates 6G, and even 5G. 3GPP Release 17 represents the first standardized support for NTN, enabling satellites and high-altitude platforms to operate as part of the 5G radio access network (3GPP, 2023). NTNs incorporate several complementary layers. Satellite systems, in particular Low Earth Orbit (LEO) constellations, are expected to play a central role in NTN due to their relatively low latency and broad coverage capabilities (Li et al., 2025; Siddiky et al., 2025). Together with aerial platforms such as High-Altitude Platform Stations (HAPS), rapidly deployable coverage becomes a possibility, acting as temporary base stations (Abdel Hakeem et al., 2022). These complement terrestrial infrastructure by extending coverage to environments where traditional networks are difficult or uneconomical to deploy, such as remote rural areas, maritime areas, or air transportation corridors.

Despite possessing great potential, NTNs introduce several technical challenges. To maintain stable connections, problems caused by the high mobility of satellites and aerial platforms, such as complex handover management and significant Doppler effects, must be addressed (Siddiky et al., 2025).

NTN is unlikely to replace terrestrial infrastructure in high-capacity, but may have implications in remote areas and in resilience planning.

2.2.1.5 Edge Computing

Edge computing, in particular Multi-access Edge Computing (MEC), is expected to play a central role as an architectural component of 6G (EIM et al., 2024). The reliance on distant centralized cloud infrastructure is reduced with edge computing by placing computing and storage resources closer to end users. This enables faster processing of time-sensitive tasks (Roessel et al., 2023). This is important in the development of 6G, where communication, computation, and intelligence are increasingly integrated into a shared system architecture.

In contrast to earlier network generations, 6G envisions a more distributed computing environment in which workloads can be dynamically allocated across devices, edge nodes, and central cloud resources (Roessel et al., 2023). This allows processes critical to latency to be handled locally at the network edge, while tasks that are less time-sensitive or computationally heavier are processed further upstream. Such a distributed approach is closely linked to the broader ambition of 6G supporting real-time and context-aware services. This means that edge computing is extra relevant for applications requiring rapid decision-making and continuous data processing, such as industrial automation, autonomous systems, immersive XR, and AI-enabled services (EIM et al., 2024; Li et al., 2025; Roessel et al., 2023). This becomes particularly important in relation to AI-enabled services. AI services depend heavily on computing speed, which may cause problems with end-user devices having limited computing capacity and centralized cloud processing can introduce latency and bottlenecks (NGMN Alliance, 2026). This means that 6G networks are expected to support distributed edge computing in order to enable real-time processing and efficient resource usage close to the data source. Given this, edge computing may

become important not only for traditional latency-sensitive applications, but also for future AI-native network services. The offloading of demanding computational tasks from end devices to nearby edge servers also opens up the possibility of reducing device energy consumption, improved responsiveness, and relieved pressure on core network and backhaul resources.

There are challenges that comes with increased edge computing. Since edge nodes have more limited computational capacity than centralized cloud data centers, efficient orchestration and resource allocation become essential (EIM et al., 2024; Roessel et al., 2023). Other areas that need to be addressed include maintaining service continuity for mobile users, particularly when moving between different edge nodes, and efficiently managing distributed computing and data resources.

2.2.1.6 Native AI

Artificial Intelligence (AI) is expected to play a fundamental role in 6G, evolving from a support tool in previous generations to an integrated component in the network architecture (Roessel et al., 2023; Siddiky et al., 2025). This means that AI can be used as an integral part of the system design, enabling more adaptive, autonomous, and data-driven network operation.

To complement traditional user and control planes, 6G network architecture introduces the concept of an AI-plane (Roessel et al., 2023; Siddiky et al., 2025). This allows for new use-cases, such as real-time analytics, predictive decision-making, and automated resource management. AI is expected to operate across multiple layers of the network, supporting functions such as traffic prediction.

As AI becomes increasingly embedded in network operation and user-facing services, issues related to transparency, reliability, and governance also gain importance (Siddiky et al., 2025). Efforts to ensure that AI-driven decisions remain interpretable and aligned with regulatory and societal requirements can also be expected.

2.2.1.7 Energy Efficiency

With 6G, a shift from purely performance-driven network evolution toward a more environmentally sustainable telecommunication system is to be expected (Li et al., 2025; Siddiky et al., 2025). With mobile data traffic expected to increase significantly toward 2030, substantial improvements in energy efficiency, often described as being 10 to 100 times more efficient than 5G, are an important aspect of 6G research.

One of the ways 6G aims to achieve this is by implementing a tighter approach between communication and computation (Roessel et al., 2023; Siddiky et al., 2025). This means using AI-driven resource management and distributed computing across cloud and edge environments, and by doing this dynamically allocating processing tasks to minimize energy consumption. This creates a more efficient use of both network and device resources, especially for applications involving intensive data processing. Similar approaches can also be found at the device level. In experimental

environments, AI-driven functionality allocation has been used to monitor device energy status in real time and offload heavy computational tasks to edge resources when needed (Roessel et al., 2023). This approach has significantly decreased power consumption, up to 50 percent, and processing load, showing how intelligent task distribution can improve energy efficiency in 6G systems.

However, increased system complexity with technologies such as ultra-massive Multiple-Input Multiple-Output (MIMO) and operation at higher frequencies, introduces higher energy demands. To deal with this, 6G is expected to employ intelligent network management, including dynamic activation and sleep modes for network elements, as well as more efficient hardware design and integration of renewable energy sources where applicable (Li et al., 2025).

For infrastructure owners, energy efficiency is not only a technical design goal, but also practical site and network constraints. Even if the goal is to make 6G network components more energy efficient, increased densification may lead to a larger number of sites, antennas, and supporting systems. As a result, the aggregated energy consumption of the network may still increase. This makes access to reliable power supply, backup capacity, energy-efficient equipment, and cost-effective site operation increasingly important for infrastructure owners.

2.2.2 Stage of development

The development of the sixth-generation mobile communication systems is currently situated in a transitional phase between early-stage research and formal pre-standardization (Khorsandi et al., 2025). This phase is characterized by research combining conceptual exploration, initial technological validation, and the gradual establishment of a structured standardization process. Driving the development forward is a mix of international standardization programs, primarily the International Telecommunication Union (ITU) and the 3rd Generation Partnership Project (3GPP), alongside large research initiatives and industrial collaboration such as the European Hexa-X-II project (Khorsandi et al., 2025).

A major indication of a shift towards a more concrete phase in the 6G development is the ongoing work within ITU and 3GPP (CMCC et al., 2024; *Framework and overall objectives of the future development of IMT for 2030 and beyond*, 2023; Madapatha et al., 2025). With the IMT-2030 framework, the ITU laid an important foundation for standardization work, defining the overarching vision, usage scenarios, and capability requirements for future mobile systems. In parallel, 3GPP has now initiated the first formal 6G-related studies. 3GPP Release 20 represents the beginning of structured 6G standardization work, with an emphasis on study items rather than finalized technical specifications (Qualcomm Technologies, Inc., 2025). In *Figure 2.2*, the timeline for 3GPP releases is illustrated, showing that the first 6G focused release, Release 21, is predicted to be finalized in 2028. This means that the first specifications should be presented no later than the end of 2028 (Ericsson, 2024b).

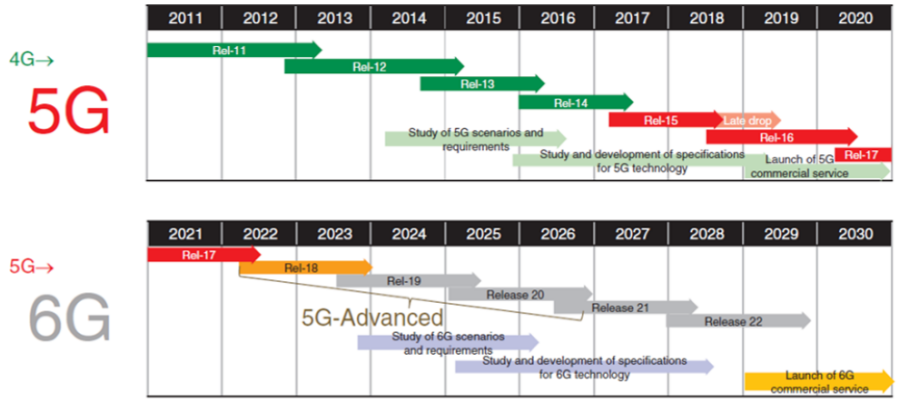


Figure 2.2: Overview of the 3GPP release timeline, adapted from (NTT Corporation, 2023)

2.2.3 Uncertainties, limitations and challenges

In the development of 6G, several uncertainties and challenges remain across technical, societal, and environmental domains. From a technical perspective, the integration of ML and AI into the network architecture introduces large reliability concerns (3GPP, 2026). Many AI models operate with very limited transparency, making it difficult to verify their decision-making processes and to guarantee predictable behavior. This is problematic in scenarios where network decisions must be robust and deterministic. Issues such as model hallucinations and learning based on trial and error raises questions regarding controllability in critical applications.

Another key challenge with the new technologies emerging with 6G is related to JCAS. While the concept enables networks to simultaneously communicate and sense, there are still issues with the technology that has to be studied (3GPP, 2026; Kerboeuf et al., 2025). Multi-path propagation, a phenomenon that can introduce false detections and positioning, is hindering the technology's practical implementation. Achieving the level of synchronization across distributed network elements required also remains a significant technical obstacle.

The challenges remaining with 6G are not only technical, they also include a number of societal and economic uncertainties. There is a risk that advanced digital infrastructure may contribute to the growth of existing inequalities, particularly if access to 6G services are distributed unevenly across regions or demographic groups (Madapatha et al., 2025). In addition to this, the extensive use of data-driven technologies raises concerns regarding privacy, cybersecurity, and accountability. There are still questions related to data ownership, system failures, and liability in automated decision-making systems that remain unsolved (3GPP, 2026).

Another critical uncertainty remaining related to 6G is the economic viability. The rollout of next-generation telecommunications is predicted to require large-scale infrastructure and hardware upgrades, sparking concerns over whether MNOs and other stakeholders have to invest (Madapatha et al., 2025). Beyond return on in-

vestment uncertainty, the large capital requirements threaten to consolidate the market, potentially reducing competition to a handful of dominant actors capable of financing such deployments.

Finally, environmental considerations introduce further uncertainties. Due to the early stage of development and the dependence on external factors such as local energy systems and user behavior, assessing the long term sustainability of 6G remains challenging (Madapatha et al., 2025). The goal is to improve energy efficiency with 6G, however, the expansion of network infrastructure, increased device density, and reliance on advanced hardware may lead to higher overall resource consumption and electronic waste. As a result, reducing the system-level energy consumption while balancing performance improvements remains a challenge.

2.3 Expectations Versus Outcomes: Lessons from 4G and 5G

The rollout of previous mobile network generations demonstrates that expectations surrounding new telecommunications technologies often differ from actual deployment patterns and realized impacts. Analyzing the gap between anticipated and realized outcomes of previous generations provides an important contextual foundation for assessing the potential trajectory of new generations.

2.3.1 4G: Expectations and Realized Impacts

The introduction of 4G, primarily based on Long Term Evolution (LTE) standards, was widely framed as a transformative leap toward mobile broadband (He et al., 2012). Expectations included dramatically higher data speeds, lower latency, seamless video streaming, and the enablement of new digital services such as app-based platforms and cloud integration. Policymakers and industry actors anticipated rapid diffusion and substantial productivity gains driven by ubiquitous high-speed connectivity.

In practice, 4G did enable a mobile data explosion and facilitated the rise of platform-based business models such as Uber, Instagram, and streaming services (Edquist et al., 2018). Global mobile data traffic increased exponentially during the 4G era. However, the rollout was uneven across regions, with rural areas often lagging due to lower returns on investment and infrastructure constraints. Moreover, many of the productivity gains were incremental rather than revolutionary, and the transformative effects materialized gradually rather than immediately.

From an infrastructure perspective, 4G deployment largely relied on upgrading existing macro sites and spectrum refarming rather than entirely new site construction. While densification occurred in urban areas, the extent of physical infrastructure expansion was more moderate than early narratives suggested.

2.3.2 5G: Expectations and Early Deployment Outcomes

5G was introduced with even more ambitious expectations. It was framed not only as a faster mobile broadband technology but as a foundational infrastructure for the Fourth Industrial Revolution. Anticipated use cases included autonomous vehicles, massive IoT, smart cities, remote surgery, and industrial automation enabled by ultra-low latency and network slicing (GSMA Intelligence, 2024).

In reality, the initial phase of 5G deployment has primarily focused on enhanced mobile broadband (eMBB), delivering higher speeds and increased network capacity in dense urban areas rather than enabling widespread industrial transformation (Ericsson, 2024a; GSMA Intelligence, 2024). Much of the demand has been driven by consumer and enterprise mobile broadband usage, including increasing data consumption, video streaming, and the growing need for network capacity in populated areas. Many advanced use cases, such as autonomous transport, remote surgery, and large-scale industrial IoT, remain in pilot phases or limited deployments. Similarly, the business case for standalone 5G networks and network slicing has proven more complex than initially anticipated, particularly outside high-density markets. As a result, the early commercial success of 5G has been more closely linked to incremental improvements in connectivity and capacity than to the transformative applications that featured prominently in early visions of the technology.

Infrastructure requirements for 5G have involved greater densification, including small cells and rooftop installations, especially in high-frequency bands such as mmWave. However, the anticipated massive wave of new standalone sites has been moderated by cost considerations and regulatory barriers. In many cases, operators have relied on upgrading existing towers and sharing infrastructure to manage capital expenditures.

2.4 Tower Companies

Tower companies have emerged as specialized providers of passive telecommunications infrastructure, enabling mobile network operators to expand coverage and capacity without owning and managing the underlying tower assets themselves. Through shared infrastructure models, these firms reduce deployment costs, improve operational efficiency, and support the expansion of mobile networks across different markets.

2.4.1 Ownership and Business Model Structure

The ownership and business model structure of telecommunications infrastructure has undergone significant transformation over the past two decades. Traditionally, MNOs operated under a vertically integrated model, owning passive infrastructure such as towers and masts, controlling active network equipment, holding spectrum licenses, and providing retail services to end users (Cambini & Jiang, 2009). Under this model, infrastructure was considered a strategic asset embedded within the operator's broader competitive positioning, enabling control over network quality,

coverage, and competitive differentiation (Cambini & Jiang, 2009). However, increasing capital intensity, technological complexity, and regulatory encouragement of infrastructure sharing have gradually reshaped this structure.

Three dominant ownership models can be distinguished within telecommunications infrastructure. First, the traditional vertically integrated operator model, where infrastructure ownership remains internal to the MNO. In this structure, control over passive and active assets is retained within a single firm, enabling strategic coordination of investment, coverage, and service differentiation (Cambini & Jiang, 2009; Williamson, 1985). Second, network sharing arrangements and joint ventures, where multiple operators jointly own and operate infrastructure to reduce duplication, share investment risks, and improve capital efficiency. Such cooperative models have been increasingly encouraged by regulators to facilitate cost-effective rollout while preserving service-level competition (Body of European Regulators for Electronic Communications, 2020; Organisation for Economic Co-operation and Development, 2019). Third, the independent tower company model, in which passive infrastructure is structurally separated from mobile operators and owned by specialized firms that lease capacity to multiple tenants. This model represents a form of vertical separation within the telecommunications value chain and reflects a broader trend toward infrastructure specialization and financialization observed in capital-intensive network industries (Helm, 2010; Inderst & Stewart, 2014).

2.4.1.1 Structural Transition in Infrastructure Ownership Models

Globally, the emergence of independent tower companies has been driven by several structural developments within the telecommunications industry. The rollout of 4G and particularly 5G networks significantly increased capital expenditure requirements due to higher network densification needs, rising spectrum costs, fiber backhaul expansion, and increasing infrastructure complexity (Cole et al., 2024). As mobile network operators faced growing pressure to expand network capacity while maintaining profitability, infrastructure sharing and outsourcing models became increasingly attractive.

Separating passive infrastructure ownership from network operations enabled operators to reduce capital intensity, improve financial flexibility, and focus more directly on service provision and active network management. At the same time, the increasing need for multi-operator infrastructure sharing supported the growth of specialized tower companies operating neutral-host and multi-tenant business models (Cole et al., 2024; Organisation for Economic Co-operation and Development, 2019). This development contributed to the expansion of large-scale independent tower firms and a gradual shift toward more infrastructure-specialized ownership structures within the telecommunications sector.

In Europe, this transformation has been further reinforced by regulatory frameworks encouraging infrastructure sharing to reduce environmental impact and accelerate deployment. The rise of pan-European tower operators illustrates the consolidation and financialization of passive infrastructure assets (McKinsey & Company, 2021).

Through acquisitions and long-term leasing agreements, independent tower companies have institutionalized a model in which infrastructure ownership is separated from service provision, positioning towers as a distinct infrastructure asset class within capital markets.

2.4.1.2 Swedish ownership transformation

The Swedish market reflects these broader international developments, albeit with specific institutional characteristics. Historically, operators such as Telia Company, Tele2, and Telenor maintained substantial control over their infrastructure portfolios within vertically integrated structures (Cambini & Jiang, 2009). However, increasing deployment costs associated with successive network generations, combined with intensified competition in the Swedish mobile market, stimulated the formation of infrastructure sharing arrangements aimed at improving capital efficiency (Organisation for Economic Co-operation and Development, 2019; Oughton & Frias, 2018). Regulatory authorities across Europe have further supported such arrangements as a means to accelerate rollout while reducing environmental and financial duplication (BEREC, 2020).

A notable example is Net4Mobility, a joint venture between Tele2 and Telenor established to coordinate and manage shared network infrastructure. Such arrangements reduced duplication of physical sites, enabled cost-sharing particularly in less densely populated areas, and allowed operators to maintain competition at the service level while rationalizing infrastructure investment (Post- och telestyrelsen, 2023).

Building on these sharing arrangements, the Swedish telecommunications landscape has more recently experienced a gradual shift toward increased involvement of independent infrastructure actors. This transition reflects a move beyond cooperative ownership models toward structural separation of passive assets from mobile network operators. It has been partly driven by acquisitions and portfolio expansions by European tower companies, one example is Cellnex Telecom, a Spanish tower company, which acquired HI3G Towers in Sweden. Through long-term leasing agreements and site acquisitions, independent tower firms have expanded their presence in the Nordic region, reinforcing the separation between passive infrastructure ownership and active network operation (Cellnex Telecom S.A., 2023).

The growing role of specialized tower firms mirrors a broader financialization of telecommunications infrastructure, in which passive assets are increasingly treated as long-term, yield-generating investments attractive to institutional capital (Helm, 2010; Inderst & Stewart, 2014). Consequently, infrastructure ownership in Sweden has progressively shifted from vertically integrated control, to shared operational models, and further toward independent, financially oriented infrastructure specialization.

2.4.2 Infrastructure Typologies

Telecommunications infrastructure can be categorized into several typologies depending on physical structure, deployment environment, and network function. These typologies are central to understanding how mobile networks are deployed and how tower companies structure their asset portfolios (Dahlman et al., 2018). Historically, macro towers have represented the dominant infrastructure form, providing wide-area coverage through high-elevation antenna installations (Andrews et al., 2014). However, increasing network densification requirements associated with newer network generations have expanded the range of infrastructure typologies used in modern telecommunications systems.

Macro towers remain the backbone of mobile network coverage. These structures typically consist of ground-based towers or masts supporting multiple antenna systems and are designed to provide coverage across large geographic areas (Dahlman et al., 2018). Macro sites often host multiple tenants, allowing different mobile network operators to share infrastructure while maintaining independent network equipment. This multi-tenant model enables efficient use of physical infrastructure and represents the core revenue model for many tower companies (American Tower Corporation, 2023; Organisation for Economic Co-operation and Development, 2019). Such infrastructure sharing arrangements reduce duplication of physical assets while improving capital efficiency in mobile network deployment (Body of European Regulators for Electronic Communications, 2020).

In addition to traditional macro towers, several structural variations are commonly used depending on geographical, technical, and urban requirements. Monopoles are single-pole tower structures frequently deployed in urban and suburban areas where space constraints and aesthetic considerations limit the feasibility of lattice towers. Compared to lattice towers, monopoles require a smaller ground footprint and are generally faster to deploy, although they typically support lower equipment loads and heights (GSMA, 2021). Lattice towers, by contrast, consist of steel framework constructions designed for high load-bearing capacity and are widely used in rural or high-capacity macro deployments where structural robustness is required.

Guyed masts represent another typology, consisting of tall vertical masts stabilized by tensioned guy wires anchored to the ground. These structures are cost-efficient for achieving significant heights and are often deployed in sparsely populated rural areas where land availability is less constrained (Dahlman et al., 2018).

Rooftop sites also constitute an important category of telecommunications infrastructure, particularly in dense urban environments. These installations place antennas and radio equipment on existing building rooftops, reducing the need for standalone towers while improving urban coverage and capacity (Andrews et al., 2014).

Indoor telecommunications infrastructure has also become an increasingly important typology as mobile data consumption continues to grow within buildings and enclosed environments. Indoor systems are specifically designed to provide reliable

wireless connectivity inside offices, shopping malls, airports, hospitals, industrial facilities, and residential complexes where outdoor macro signals may experience significant attenuation due to building materials and structural design (Cisco Systems, 2022).

2.4.3 Passive vs active infrastructure

Telecommunications infrastructure is commonly divided into passive and active infrastructure. This distinction is important in the telecommunications industry, particularly in relation to infrastructure sharing and the emergence of independent tower companies.

Passive infrastructure refers to the physical and non-electronic components that support telecommunications networks (Body of European Regulators for Electronic Communications, 2020; Organisation for Economic Co-operation and Development, 2019). Examples include towers, masts, rooftop structures, shelters, power systems, ducts, and site facilities. These assets provide the physical foundation for network deployment but do not themselves process or transmit telecommunications signals. Passive sharing is generally considered technically simpler and is the most widely adopted form of infrastructure sharing. Common forms include site sharing and tower sharing, where operators colocate equipment on the same physical structures while maintaining separate active equipment.

Active infrastructure consists of the electronic and software-based components responsible for signal transmission and network operation (Dahlman et al., 2018). This includes antennas, radios, base stations, transmission equipment, baseband units, and core network systems. Active sharing therefore involves a deeper level of cooperation between operators, where network elements such as RAN, backhaul systems, or even core network functions may be shared.

The distinction between passive and active sharing is significant because the two approaches differ in complexity, economic impact, and competitive implications. Passive sharing generally provides substantial cost savings while maintaining a relatively high degree of operational independence between operators (Abdalla, 2025). Active sharing can generate even greater cost reductions but requires more advanced technical coordination and may introduce concerns related to operational control, and network performance.

Historically, mobile network operators owned both passive and active infrastructure within vertically integrated business models. However, increasing deployment costs associated with 4G, 5G, and future 6G networks have encouraged a gradual separation between infrastructure ownership and service provision. This has contributed to the rise of specialized tower companies that primarily manage passive infrastructure, while mobile operators increasingly focus on spectrum management, active network equipment, and service delivery.

As telecommunications networks evolve toward more distributed and software-defined

architectures, the boundary between passive and active infrastructure may become increasingly interconnected. Technologies such as cloud-RAN, edge computing, and virtualized network functions require closer integration between physical infrastructure and active network operations, potentially expanding the role of infrastructure providers in future network ecosystems.

2.4.3.1 Distributed Antenna Systems

Distributed Antenna Systems (DAS) deployed through neutral host models have emerged as an increasingly important infrastructure solution in modern telecommunications networks. In a neutral host model, an independent third party builds, owns, and operates a shared network infrastructure platform that can be utilized by multiple MNOs.

The model has gained attention due to its potential to reduce both capital expenditure (CapEx) and operational expenditure (OpEx) through infrastructure sharing (GSMA, 2024). Instead of multiple operators deploying parallel hardware systems in the same location, infrastructure can be consolidated into a shared platform. This enables more efficient utilization of physical infrastructure and reduces duplication of equipment deployment.

Distributed Antenna Systems are particularly relevant in indoor environments and dense urban areas where higher frequency bands experience signal penetration challenges (Analysys Mason, 2024). DAS solutions distribute radio signals through networks of low-power antennas connected through fiber or other transmission systems, allowing coverage to be extended closer to end users (GSMA, 2024). Such systems are commonly used in locations where traditional macro-cell coverage is insufficient, including commercial buildings, transport hubs, stadiums, and other high-density environments.

Another commonly highlighted benefit of shared infrastructure systems is reduced energy consumption and environmental impact (GSMA, 2024). Shared infrastructure requires less hardware and lower overall power consumption compared to multiple parallel deployments from competing operators. Infrastructure sharing may therefore contribute to improved resource efficiency and reduced physical footprint of telecommunications infrastructure.

At the same time, there are ongoing discussions regarding the technical evolution and limitations of DAS solutions. Traditional passive DAS architectures may face challenges in supporting future requirements associated with higher capacity demands and advanced MIMO technologies without increasingly complex cabling systems (Analysys Mason, 2024; Ericsson, 2025). More advanced active DAS solutions can address some of these limitations, although they may introduce additional operational requirements related to power consumption, thermal management, and physical infrastructure complexity.

2.4.4 Strategic Role in Network Generations

The strategic role of tower companies is closely linked to the technological and economic requirements of successive mobile network generations. As network performance demands have increased, so too has the importance of efficient infrastructure deployment and management, positioning tower companies as increasingly central actors within the telecommunications value chain.

During the 4G era, the role of tower companies was relatively limited, as deployment strategies largely relied on upgrading existing macro tower infrastructure and refarming spectrum. Infrastructure expansion was primarily incremental, with operators maintaining significant control over their asset portfolios. Tower companies contributed mainly through site leasing and passive infrastructure management, supporting the expansion of mobile broadband coverage without fundamentally altering deployment strategies (Oughton & Frias, 2018).

With the transition to 5G, the strategic importance of tower companies increased significantly. Higher frequency spectrum bands and greater capacity demands required network densification, particularly in urban areas. This led to increased deployment of small cells, rooftop installations, and additional macro sites. Tower companies became key enablers of this densification process by providing shared infrastructure solutions that allowed multiple operators to reduce capital expenditures while expanding network capacity. As a result, their role shifted from passive asset owners to strategic infrastructure partners involved in large-scale network rollout (Organisation for Economic Co-operation and Development, 2019).

Looking ahead, emerging discussions around 6G suggest a further expansion in the role of tower companies. Anticipated requirements such as ultra-low latency, high reliability, and integration with edge computing indicate that infrastructure will become more distributed and functionally integrated with digital services. This may involve new types of infrastructure assets and closer coordination between infrastructure providers and network operators. In this context, tower companies may evolve from providers of passive infrastructure to broader infrastructure platforms supporting both connectivity and computational capabilities.

Overall, the evolution of mobile network generations has transformed tower companies from relatively peripheral actors into central components of the telecommunications ecosystem. Their ability to support densification, manage shared infrastructure, and adapt to increasing network complexity will be critical for enabling future network deployment.

2.4.5 Financial & Investment Characteristics

Tower companies operate under a business model characterized by high upfront capital expenditure and stable, long-term revenue streams. The construction or acquisition of telecommunications sites requires significant initial investment, including land access, permitting, and physical infrastructure development. However, once a site is operational, the marginal cost of adding additional tenants is relatively low.

This creates strong operating leverage, where profitability increases significantly as more tenants are added to a single site.

A central feature of the tower company model is the use of long-term lease agreements with mobile network operators. These contracts typically span 10 to 20 years and often include inflation-linked price escalations, providing predictable and recurring cash flows. The stability of these revenues makes tower companies attractive to institutional investors seeking low-risk, yield-generating assets (Helm, 2010; Inderst & Stewart, 2014). As a result, telecommunications infrastructure has increasingly been treated as a distinct asset class within global capital markets.

The multi-tenant leasing model is a key driver of value creation. By hosting multiple operators on the same infrastructure, tower companies can significantly increase revenue without proportional increases in cost. The tenancy ratio, defined as the average number of tenants per site, is therefore a critical performance indicator. Higher tenancy ratios improve capital efficiency and return on investment, incentivizing tower companies to maximize co-location across their portfolios (American Tower Corporation, 2023; Organisation for Economic Co-operation and Development, 2019).

From an investment perspective, tower companies often pursue growth through portfolio expansion and acquisition strategies. This includes purchasing existing tower portfolios from mobile operators through sale-leaseback agreements, as well as developing new sites in high-demand areas. Such strategies allow operators to release capital tied up in infrastructure while securing long-term access to sites, further reinforcing the separation between infrastructure ownership and service provision.

At the same time, the financial logic of tower companies influences infrastructure deployment decisions. Investments are typically prioritized in areas with high demand and strong tenancy potential, such as dense urban environments. This may contribute to uneven deployment patterns, where rural or low-density areas receive less investment due to lower expected returns. Consequently, while tower companies improve capital efficiency and enable large-scale rollout, their investment strategies are also shaped by market-based return requirements.

2.5 Resilience in Telecommunications Infrastructure

Resilience has emerged as a central concept in the study of critical infrastructure systems, reflecting the increasing need to ensure continuity of essential services under conditions of uncertainty and disruption. Modern societies are highly dependent on interconnected infrastructure systems, including energy, transportation, and telecommunications, which together support economic activity, governance, and public safety (Linkov et al., 2014).

In recent years, the risk landscape surrounding critical infrastructure has evolved

significantly. Disruptions are no longer limited to natural hazards or technical failures but increasingly include cyberattacks, geopolitical tensions, and hybrid threats (Roshanaei, 2021). These developments have shifted the focus from efficiency and optimization toward robustness, adaptability, and recovery capacity.

Within this broader context, telecommunications infrastructure plays a particularly critical role, as it underpins the functioning of other infrastructure systems and enables coordination across sectors. As such, ensuring the resilience of telecommunications networks is essential for maintaining societal stability.

2.5.1 Conceptualizing Resilience

Resilience is a multidimensional concept that has been defined in various ways across disciplines. In infrastructure research, resilience is commonly understood as the ability of a system to prepare for, absorb, recover from, and adapt to adverse events (Linkov et al., 2014).

This definition highlights that resilience extends beyond resistance to failure and includes the capacity for recovery and adaptation. In contrast to traditional approaches focused on risk prevention, resilience emphasizes the ability to function under uncertainty and changing conditions. This reflects the increasing importance of continuous connectivity in modern societies, where even short disruptions can have significant economic and societal consequences.

2.5.2 Resilience in Telecommunications Infrastructure

Telecommunications infrastructure is characterized by high levels of complexity, interdependence, and technological evolution. Networks consist of both physical components, such as base stations, cables, and data centers, and digital systems that manage communication flows (Sendin et al., 2021). The resilience of telecommunications systems is particularly important because of their role as an enabling infrastructure. Failures in communication networks can cascade into other sectors, affecting emergency services, financial systems, transportation, and healthcare.

Furthermore, the transition toward next-generation networks, including 5G and future 6G systems, is increasing both the capabilities and vulnerabilities of telecommunications infrastructure (Garg et al., 2021; Khaloopour et al., 2024). While these technologies enable higher capacity, lower latency, and new applications, they also introduce greater system complexity and new points of failure.

2.5.3 Evolving Threat Landscape

The need for resilience in telecommunications infrastructure is driven by an increasingly complex and dynamic threat landscape. Threats can be divided into the following subcategories.

2.5.3.1 Cyber Threats

Cyber threats have become a defining feature of modern infrastructure systems. Telecommunications networks are frequent targets of cyberattacks aimed at espionage, disruption, or sabotage (Post- och telestyrelsen, 2026). These attacks can involve both direct disruptions, such as denial-of-service attacks, and more covert strategies, including long-term infiltration of network systems.

2.5.3.2 Physical and Environmental Threats

Physical damage to infrastructure, including cables, base stations, and energy systems, remains a significant risk (Post- och telestyrelsen, 2026). Such damage may result from natural hazards, accidents, or intentional sabotage. In highly interconnected systems, even localized disruptions can have widespread consequences.

2.5.3.3 Geopolitical and Hybrid Threats

Recent geopolitical developments have highlighted the vulnerability of telecommunications infrastructure to state-sponsored and hybrid threats (Post- och telestyrelsen, 2026). Modern conflicts increasingly target communication systems through a combination of cyber operations and physical attacks, demonstrating the strategic importance of telecommunications networks.

2.5.3.4 Supply Chain and System Dependencies

Telecommunications systems depend on global supply chains for equipment, software, and maintenance. Disruptions in these supply chains can limit the ability to repair and maintain infrastructure, thereby reducing resilience.

Additionally, the strong dependency on energy systems introduces further vulnerability, as power outages can lead to cascading failures in communication networks.

2.5.4 Dimensions of Resilience

Resilience in critical infrastructure systems is commonly conceptualized through different resilience capacities that describe how systems respond to disruptions and long-term change (Linkov et al., 2014; Organisation for Economic Co-operation and Development, 2024).

2.5.4.1 Absorptive Capacity

Absorptive capacity refers to the ability of infrastructure systems to withstand disruptions while maintaining acceptable levels of functionality (Linkov et al., 2014). In telecommunications infrastructure, this includes redundancy, backup power systems, robust network architecture, and fault-tolerant system design that enable networks to continue operating during disturbances.

2.5.4.2 Adaptive Capacity

Adaptive capacity concerns the ability of systems to adjust operations and respond dynamically to changing conditions, emerging threats, or evolving technological requirements (Linkov et al., 2014; Walker & Salt, 2006). Within telecommunications infrastructure, adaptive capacity is increasingly important due to growing network complexity associated with 5G and future 6G systems.

2.5.4.3 Restorative Capacity

Restorative capacity refers to the ability to recover functionality following disruptions through repair, restoration, and operational recovery processes (Hollnagel et al., 2006). In telecommunications systems, this includes maintenance operations, incident response, disaster recovery procedures, and the rapid restoration of network services.

2.5.4.4 Transformative Capacity

Transformative capacity refers to the ability of infrastructure systems to fundamentally evolve and restructure in response to long-term technological, environmental, or societal changes (Walker & Salt, 2006). In the context of telecommunications infrastructure, transformative capacity may involve the transition toward new network architectures, increased virtualization, infrastructure sharing models, and the deployment of future 6G systems.

2.5.5 Resilience in the Swedish Context

The importance of resilience in telecommunications infrastructure is particularly evident in the Swedish context, where electronic communications are considered essential for both societal functionality and national security. As highlighted by the Swedish Post and Telecom Authority (PTS), reliable communication systems are fundamental to the functioning of modern society and must be maintained even under crisis conditions or heightened security threats (PTS, 2026).

Recent assessments indicate that the threat environment facing Sweden has become more severe and complex, with increasing exposure to cyberattacks, sabotage, and geopolitical risks. Telecommunications infrastructure has been identified as a critical target, requiring enhanced preparedness and protective measures (Post- och telestyrelsen, 2026).

2.5.6 Operationalizing Resilience: The Case of SWEN

An example of how resilience can be implemented in practice is the Swedish Emergency Network (SWEN), developed to support critical communication needs in situations of crisis, emergency, and national defense.

SWEN is designed as a hybrid system that combines commercial mobile networks with state-controlled infrastructure, ensuring both scalability and control over criti-

cal components (Swedish Civil Defence and Resilience Agency, 2025). Key resilience features include redundancy through multiple operators, dedicated spectrum, and prioritization of mission-critical services.

This approach reflects a broader trend toward hybrid infrastructure models that balance efficiency with resilience.

2.5.7 Trade-offs in Resilience Design

Designing resilient telecommunications systems involves several trade-offs (Woods, 2015). Increasing redundancy and robustness often comes at the expense of higher costs and reduced efficiency. Similarly, centralized systems may offer greater control but can introduce single points of failure, while decentralized systems enhance resilience but increase complexity.

Understanding and managing these trade-offs is essential for developing sustainable and resilient infrastructure systems.

2.5.8 Implications for 6G Infrastructure

Looking ahead, the transition toward 6G is expected to further increase the importance of resilience. Future networks are anticipated to support critical applications such as autonomous systems, remote healthcare, industrial automation, and intelligent infrastructure. At the same time, 6G systems are expected to become increasingly complex due to higher levels of virtualization, densification, interconnectivity, and cross-layer integration, creating additional vulnerabilities and interdependencies within telecommunications infrastructure (Khaloopour et al., 2024). As societies become increasingly dependent on digital connectivity, disruptions caused by technical failures, cyberattacks, or natural disasters may have significant societal consequences. Consequently, resilience is increasingly viewed as a core design principle in the development of next-generation telecommunications systems.

One of the key architectural developments expected to enhance resilience in future 6G networks is the integration of NTNs. Beyond enabling near-global connectivity, NTNs can provide an additional layer of network redundancy by complementing terrestrial infrastructure (Roessel et al., 2023). During natural disasters, large-scale outages, or other events causing infrastructure failures, satellite and aerial platforms can maintain connectivity in both densely and sparsely populated areas when terrestrial networks are disrupted (Siddiky et al., 2025). As a result, NTNs are increasingly regarded as an important component of resilient next-generation telecommunications systems.

A central positive aspect emphasized in the literature is the possibility of designing resilience directly into the architecture of future networks through so-called "resilience-by-design" principles (Khaloopour et al., 2024). Rather than treating resilience as a reactive capability implemented after failures occur, 6G systems may incorporate proactive protective measures, self-awareness mechanisms, and dy-

namic reconfiguration capabilities already during the design phase. Such capabilities could allow networks to detect disruptions, adapt to changing operating conditions, and maintain critical functionality even during failures or cyberattacks. Moreover, through intelligent resource allocation and automated reconfiguration, 6G networks may become better equipped to handle uneven traffic loads, equipment failures, and unexpected disturbances while maintaining service continuity. In this sense, the increasing complexity of 6G is not only a source of vulnerability but also a potential enabler of more adaptive, intelligent, and resilient infrastructure systems.

Furthermore, recent literature highlights that resilience in future 6G systems is expected to rely increasingly on intelligent and autonomous network management. Emerging concepts such as AI-native network functions, digital twin networks, autonomous orchestration, and network slicing are anticipated to play a central role in enabling adaptive and self-healing telecommunications systems (International Telecommunication Union, 2023; Next Generation Mobile Networks Alliance, 2024). Through real-time monitoring, predictive analytics, and automated reconfiguration, these technologies may improve the ability of networks to detect disruptions, optimize resource allocation, and maintain operational continuity during failures or cyberattacks.

At the same time, the literature also emphasizes that these developments may introduce new forms of systemic complexity and interdependence (Woods, 2015). Increased reliance on distributed cloud architectures, AI-driven decision-making, and interconnected virtualized network functions may create additional dependency chains and potential cascading failure mechanisms within future telecommunications systems. Consequently, several researchers argue that resilience in 6G must be addressed not only through redundancy and physical robustness, but also through intelligent coordination, interoperability, and secure management of increasingly autonomous network environments.

3

Methods

3.1 Research Design

This study applies a qualitative and exploratory research design to investigate how future 6G telecommunications infrastructure may be implemented, which sectors are likely to act as early adopters, and how deployment and physical placement of infrastructure may evolve. Since 6G remains an emerging and largely undeveloped technological field, an exploratory approach was considered appropriate for examining expectations, industry perspectives, and potential infrastructure implications.

The research design follows an iterative process combining literature review and empirical data collection. Initially, a literature review was conducted to establish a theoretical and contextual foundation related to telecommunications infrastructure development, previous generational transitions, 6G visions, infrastructure typologies, and potential early adopter sectors.

Based on the findings from the literature review, sectors considered likely to drive early implementation of 6G technologies were identified. Semi-structured interviews were subsequently conducted with representatives from these sectors to gather empirical insights regarding infrastructure requirements, deployment strategies, resilience factors, and expected technological developments.

The study applies an abductive research approach, where theory and empirical observations were continuously compared and refined throughout the research process. Insights from the interviews were analyzed thematically and iteratively in relation to previous research and industry perspectives. This enabled the study to continuously refine its understanding of emerging infrastructure requirements and deployment challenges associated with future 6G networks.

Furthermore, the study incorporates a cross-sectoral perspective, as representatives from several industries and organizational contexts were interviewed to identify both common patterns and sector-specific differences regarding future telecommunications infrastructure development.

3.2 Data Collection

All interviews except one were conducted via Microsoft Teams, recorded, and transcribed for analysis. One interview was conducted in person. To ensure confidentiality, respondents have been anonymized and are presented based on their respective industry.

3.2.1 Interview Participants - 1st Round

The first round of interviews was conducted with representatives from a broad range of industries and organizations connected to telecommunications infrastructure and advanced connectivity solutions. The purpose of this initial interview round was to explore expectations regarding future 6G development, identify potential early adopter sectors, and examine how future telecommunications infrastructure requirements may differ across industries and application areas.

The interviews were semi-structured in nature, allowing respondents to discuss both current telecommunication infrastructure challenges and future technological developments in a flexible and open-ended manner.

Table 3.1: Summary of interview participants 1st round

ID	Industry	Interview Length
R1	Harbour and logistics infrastructure	45 min
R2	Telecommunications equipment and system development	47 min
R3	Enterprise connectivity and private network solutions	41 min
R4	Autonomous systems (automotive/mining)	29 min
R5	Public healthcare and regional infrastructure (private 5G operator)	50 min
R6	Mobile network operator (telecommunications services)	35 min

3.2.2 Interview Participants - 2nd Round

The second round of interviews was conducted to validate, deepen, and further refine findings from the initial interview round. Based on patterns and themes identified during the first phase of data collection, the second round focused more specifically on infrastructure deployment, resilience considerations and equipment placement.

This second interview round also functioned as a form of validation by enabling comparison between perspectives from different sectors and organizational contexts. The interviews contributed to strengthening the study's understanding of how future

6G infrastructure may be deployed in practice and how infrastructure requirements may differ depending on application areas and operational environments.

Table 3.2: Summary of interview participants 2nd round

ID	Industry	Interview Length
R7	Swedish Transport Administration	50 min
R8	Telecommunications and networking technology	46 min
R9	Telecommunications economics, policy, and business model researcher	41 min
R10	National telecommunications regulation and critical communications infrastructure authority	60 min
R11	Autonomy and Connectivity, Cars	42 min

3.2.3 Sample Selection

The sample selection process was conducted in multiple stages and combined purposive sampling with elements of snowball sampling. Initially, the study aimed to identify industries and sectors that are likely to become early adopters of 6G technologies. This identification process was based on the literature review, industry reports, and discussions with researchers and industry experts.

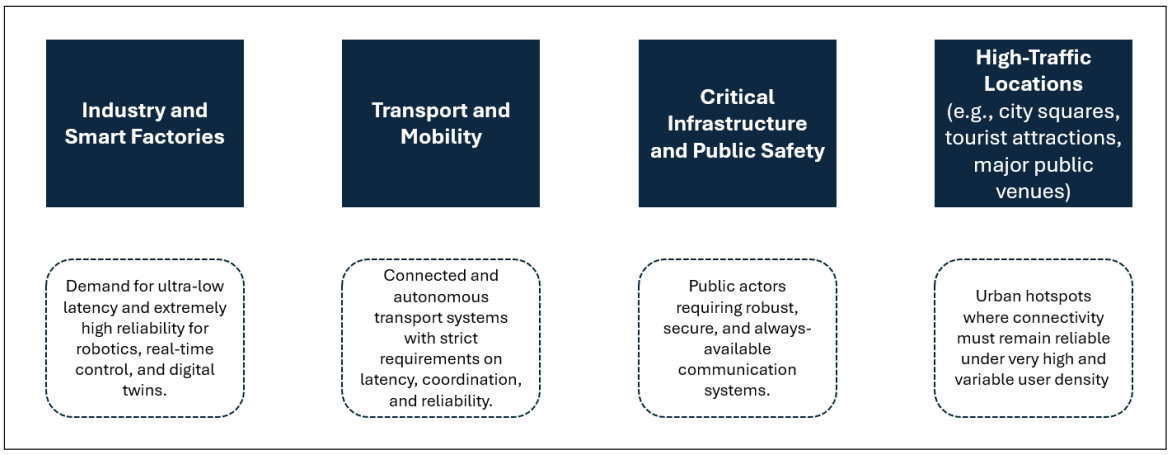


Figure 3.1: Industries and application areas identified as potential early adopters of 6G technologies.

Figure 3.1 illustrates the primary industry categories identified during the initial mapping process. These sectors were considered particularly relevant due to their expected future requirements regarding ultra-low latency, and high-capacity connectivity in future 6G networks. In addition, several of the identified sectors represent large-scale markets with expected long-term demand for advanced connectivity

solutions, making them strategically important for early 6G implementation and infrastructure investments.

Based on this initial mapping, relevant organizations and professionals operating within these industries were identified and contacted. The selection focused on respondents with experience and knowledge related to telecommunications infrastructure, network deployment, digitalization, or advanced connectivity solutions within their respective sectors. The objective was not to achieve statistical representativeness, but rather to obtain informed perspectives from actors considered relevant for understanding future infrastructure requirements associated with 6G.

In addition to the initial purposive selection, a snowball sampling approach was applied throughout the interview process. At the end of each interview, respondents were asked to recommend additional individuals or organizations that could contribute relevant knowledge to the study. This approach enabled access to further industry experts and facilitated the identification of respondents with specialized competence and experience related to telecommunications infrastructure and potential 6G application areas.

3.3 Data Analysis Method

The empirical material was analyzed using thematic analysis. The analysis involved familiarization with the interview material, initial coding, identification of recurring themes, and interpretation of patterns related to telecommunications infrastructure and 6G deployment.

3.4 Method Reflection

This section reflects upon the methodological choices made throughout the study and discusses factors related to the quality, trustworthiness, and ethical aspects of the research process.

3.4.1 Validity and Reliability

Validity and reliability are important criteria for assessing the quality and trustworthiness of research (Bryman & Bell, 2017). In qualitative research, validity concerns whether the study investigates and captures what it intends to study, while reliability relates to the consistency and transparency of the research process and whether similar conclusions could be reached if the study were conducted again under comparable conditions.

In this study, validity has been examined through the combination of a literature review and empirical data collection. By connecting empirical findings to previous research and industry reports, the study applies a form of triangulation, which strengthens the credibility of the analysis and reduces the risk of conclusions being based solely on individual perceptions or speculative assumptions.

The study also sought to strengthen validity by interviewing respondents from different parts of the telecommunications ecosystem, including mobile network operators, telecommunications equipment providers, enterprise network actors, transport infrastructure, healthcare infrastructure, autonomous systems industries, and others. This diversity of perspectives contributed to a broader understanding of how future 6G infrastructure may develop and how requirements may differ between sectors and applications.

All interviews except one were conducted digitally via Microsoft Teams, recorded with permission from the respondents, and transcribed for analysis. The interview conducted in person was, however, also recorded and transcribed digitally. This reduced the risk of information loss and enabled repeated review of the empirical material during the analysis process. Furthermore, the iterative approach to data analysis, where empirical findings were continuously compared with theory and previous interviews, contributed to a more consistent interpretation of the collected material.

Qualitative studies are inherently context-dependent, which limits the extent to which the findings can be generalized to other geographical markets or future technological conditions.

3.4.2 Ethical Considerations

Ethical considerations are an important aspect of research, particularly when conducting interviews and collecting empirical data from individuals and organizations (Bryman & Bell, 2017). This study has therefore considered several ethical principles related to consent, confidentiality, and the handling of interview material.

Prior to each interview, all respondents were informed about the purpose of the study, how the collected information would be used, and that participation was voluntary. Permission to conduct and use the interviews for academic purposes was obtained from all interview participants before the interviews were carried out.

To ensure confidentiality and reduce the risk of identifying individual respondents, the interview participants have been anonymized throughout the thesis. Instead of presenting names or company identities, respondents are only referred to by their industry or organizational context together with a respondent identifier (e.g., R1, R2). This approach was considered important as several interviewees discussed strategic perspectives and future infrastructure developments within their respective sectors.

The collected interview material has been handled solely for the purpose of this research and has not been shared outside the study. Furthermore, the study aims to present the respondents' perspectives accurately and objectively in order to avoid misrepresentation or selective interpretation of the empirical findings.

3.5 Use of AI

In the preparation of this thesis, AI-based tools were utilized to support both the research and writing processes. The literature review was assisted by *Consensus*, which was used to identify and search for relevant scientific literature. Additionally, *ChatGPT* was used to support the authors' understanding of complex sections during the review of academic papers and to assist in the analysis of interview transcriptions. Furthermore, the *Writefull* feature integrated in Overleaf was used to assist the writing process by providing grammar and style suggestions.

The use of these tools contributed to improving the efficiency of the literature review, interview analysis, and writing process while supporting clarity and accuracy in scientific communication.

4

Results

4.1 Overview of Empirical Findings

This section presents the empirical findings from eleven semi-structured interviews conducted with stakeholders across the telecommunications ecosystem. The respondents represent a diverse set of industries, including transport and logistics infrastructure, telecommunications technology development, private network solutions, industrial automation, public healthcare, mobile network operations, telecommunications research, and regulatory authorities.

The inclusion of both demand-side actors (e.g. ports, healthcare, industrial users), supply-side actors (e.g. telecom developers and solution providers), and a mobile network operator enables a comprehensive analysis of how 6G is perceived across the value chain.

Across all interviews, a consistent pattern emerges: while technological capabilities are advancing rapidly, the adoption of next-generation mobile technologies is constrained primarily by economic, organizational, and structural factors rather than by technical limitations.

4.2 Lack of Immediate Business Case for 6G

A central finding across all interviews is the absence of clearly defined and monetizable use cases for advanced mobile network technologies. While both 5G and 6G promise significant improvements in speed, latency, and reliability, these capabilities are not currently perceived as sufficient to justify large-scale investments. This uncertainty was also reflected in the interviews. The R2 interviewee emphasized that the main challenge may not be the technical development itself, but rather the commercial logic behind it:

> But what is the business model? [...] Someone has to identify something that people actually want, something that creates real added value. I think that is much more difficult than the engineering or technical challenges. If no one can see how to make money from it, then what? (R2, 2026, own translation)

From an automotive perspective, R4 and R11 emphasized that adoption decisions are strictly driven by cost-benefit considerations. Technologies are only implemented if they provide clear operational or economic value, rather than for technological advancement alone. Similarly, infrastructure users such as ports highlighted that existing systems are often sufficient, reducing the urgency for adopting new network generations. R11 further reinforces this finding. The interviewee stated that 5G is being integrated into new vehicles primarily as a form of future-proofing, rather than because current vehicle functions require 5G capabilities. As R11 explained:

> We will put 5G in all cars, mainly in order to be future-proof. We do not see any very clear use cases today that actually require 5G. (R11, 2026, own translation)

From a telecommunication and enterprise (R3) perspective, it was also noted that increased performance, particularly higher data rates, does not inherently create business value. Instead, value must be derived from applications built on top of the network. This is further reinforced by the operator perspective, where it was emphasized that even 5G has not yet been fully monetized, and that operators are still in the process of extracting value from existing investments before transitioning to 6G.

The operator interview further reinforces the lack of an immediate business case for 6G. Operators are still in the process of activating and monetizing 5G standalone, making the idea of 6G premature from a business standpoint. The interviewee also questioned whether further increase in data speeds alone create customer value, discussing if the difference between very fast and even faster connectivity is possible to monetize.

This view is further supported by research and regulatory perspectives. R9 argued that the investment capacity of mobile operators has become more constrained compared to earlier network generations. This is partly due to high spectrum costs and changing revenue streams. R10 discussed that previous expectations of extensive densification in both 4G and 5G have not been realized to the extent once predicted, since the cost of building additional infrastructure simply does not generate enough revenue. Together, these perspectives reinforce the finding that future 6G deployment will depend less on technical development alone and more on whether new customers, services, public funding mechanisms, or other investment incentives can create a viable business case.

R6 also highlighted that user demand for higher performance has begun to plateau, as incremental improvements in speed provide limited additional value for end-users.

These findings suggest that the development of 6G is currently technology-driven rather than demand-driven, with capabilities exceeding immediate market needs.

4.3 Digital Maturity and Organizational Readiness

The interviews reveal that varying levels of digital maturity significantly influence the adoption of advanced connectivity solutions. Several sectors, particularly in logistics and heavy industry, are still in earlier stages of digital transformation, where basic automation and system integration remain ongoing challenges. As interviewee R1 mentioned:

> I perceive a gap in terms of digital maturity. Discussing 6G, higher speeds than 5G, and satellite-level precision feels somewhat unfamiliar. That is not where the current needs are. The low-hanging fruit is considerably lower. (R1, 2026, own translation)

For example, industrial applications such as autonomous vehicles already require reliable connectivity, but these needs can largely be met with existing technologies such as 4G and 5G. The primary challenge lies not in network performance, but in ensuring stable and predictable communication, particularly avoiding latency spikes and connection instability.

The interview R7 adds an institutional perspective to digital maturity. While 6G may support applications such as automated train operation, video-based monitoring and more, the interviewee emphasized that implementation in the context of railways depends on long standardization processes, certifications, and vehicle migration. This indicates that organizational readiness in infrastructure sectors is not only a question of technological capability, but also of bureaucracy, equipment lifespans, and operational coordination.

R10 adds a similar perspective from the regulatory side. Several early 5G use cases, especially within the automotive sector, were largely defined from a telecommunications perspective rather than from the actual needs and regulatory constraints of the target industries. This suggests that organizational readiness also depends on whether surrounding regulatory and institutional systems are prepared to support new applications.

Similarly, in healthcare (R5), the focus is currently on implementing and scaling 5G-based solutions, with 6G perceived as a longer-term development rather than an immediate priority.

This indicates that adoption is constrained by organizational readiness and system integration capabilities rather than technological limitations.

4.4 Automation as Key Driver

Despite the current lack of strong business cases, automation is consistently identified as the primary long-term driver of demand for advanced connectivity. Across

industries, including mining, transport, and healthcare, future applications such as autonomous systems, remote operations, and advanced monitoring are expected to increase the need for reliable and low-latency communication.

In industrial environments, the need for real-time communication is driven by safety-critical operations, such as emergency stop systems and remote control of machinery. However, these applications do not necessarily require extreme data rates, but rather consistent and predictable latency.

From an MNOs (R6) perspective, future demand is also expected to shift toward supporting a larger number of connected devices and machine-to-machine communication rather than increasing individual data speeds.

In healthcare (R5), advanced use cases such as remote diagnostics, home-based care, and real-time patient monitoring are enabled by 5G and may be further enhanced by future network generations. However, even in this context, 5G is already considered a major technological step, with 6G offering incremental improvements rather than fundamentally new capabilities. As interviewee R5 states, 6G still feels far away:

> Of course, 6G, with the capabilities we are discussing, opens up entirely new possibilities. It could allow us to move even more [healthcare services] into the home. However, I believe this is still quite far ahead. (R5, 2026, own translation)

R7 presents a cautious view of automation as a demand driver. In the context of railways, automated applications such as train operation, video monitoring, and predictive maintenance are discussed. However, the interviewee emphasized that full automation remains difficult due to operational edge cases and the need for human intervention. This implies that automation may increase connectivity demand in the long term, but its adoption is likely to be gradual and strongly dependent on industry specific constraints.

R10 shares this cautious view. In relation to autonomous vehicles, the interviewee emphasized that vehicle manufacturers are unlikely to make core vehicle functionality dependent on mobile networks. It is more likely to function as an additional layer that improves performance in specific situations. This indicates that automation may create demand for advanced connectivity in specific targeted use cases rather than a nationwide coverage.

R11 provides a cautious perspective from the automotive industry. While autonomous vehicles are often used in telecommunications narratives as an example of why ultra-low latency and high network availability will be required, R11 challenged this assumption. The respondent argues that since perfect coverage cannot be guaranteed, vehicles must be operated safely without relying on continuous mobile network coverage.

Thus, while automation and mission-critical applications are important drivers, they do not yet necessitate the transition to 6G.

4.5 Shift Toward Private and Localized Networks

A clear trend across the interviews is the increasing importance of private networks. Both industrial and public sector actors emphasize the need for control, reliability, and independence from public network operators.

In industrial settings, private networks are preferred to ensure stable connectivity and avoid disruptions that could impact production. Similarly, in healthcare, private 5G networks are implemented to guarantee communication capabilities even in crisis or emergency situations.

This trend is further reinforced by concerns related to resilience, cybersecurity, and geopolitical dependencies. The healthcare respondent explicitly highlighted the importance of reducing reliance on external actors and maintaining operational control over critical infrastructure. As interviewee R5 stated to emphasize the growing demand for resilience and redundancy:

> It comes down to one single question: what dependencies do you have on the outside world in order to produce your services or products? (R5, 2026, own translation)

From the operator perspective, private networks are also seen as an emerging but complex development, raising questions regarding integration, spectrum allocation, and interoperability with public networks.

These findings indicate a structural shift in the telecommunications landscape, from centralized, operator-driven networks toward decentralized, application-specific, and locally controlled infrastructures.

4.6 Infrastructure Implications: Densification and Deployment Constraints

The interviews indicate that future network generations may create technical pressure toward increased infrastructure density, particularly if higher frequency bands and more localized services become central to deployment. However, the additional interviews also show that densification should not be understood as an automatic or uniform outcome of 6G. Instead, densification is likely to be selective and shaped by business cases, spectrum strategy, regulatory requirements, and the possibility of reusing existing sites.

Densification presents significant challenges, particularly in non-urban environments. In industrial settings such as mining, the main cost driver is not the network equipment itself, but the installation of supporting infrastructure, including fibre connections and power supply.

Similarly, in healthcare infrastructure, the complexity of deploying networks in ex-

isting buildings, including older facilities, creates additional constraints. The need to install fibre, create technical rooms, and adapt physical environments represents a major barrier to deployment.

From the operator perspective, it is expected that existing sites will be reused and upgraded rather than replaced, due to the high cost of building new sites. Instead of large-scale expansion, infrastructure development is likely to focus on adding new frequency bands, increasing capacity, and deploying smaller, more targeted solutions. To emphasize the new requirements coming with 6G, R6 states:

> With these new frequency bands, the frequencies are so high that the signal will be heavily blocked by buildings. The key challenge, therefore, is to get the signal indoors. (R6, 2026, own translation)

However, both R9 and R10 challenge the assumption that 6G will lead to broad network densification. Both interviewees argue that 4G nor 5G led to the level of street-level densification that had previously been anticipated, as operators have largely relied on existing infrastructure and incremental upgrades. These perspectives suggest that future densification is more likely to occur in specific environments, such as industrial sites, or where coverage obligations, public funding, or targeted use cases create a concrete need.

These findings suggest that infrastructure deployment challenges, rather than technological limitations, will play a critical role in shaping the rollout of 6G.

4.7 Gradual and Selective Rollout of 6G

Based on both industry experience and previous generational transitions, the rollout of 6G is expected to be gradual and selective rather than rapid and widespread.

Several respondents emphasized that even 5G is not yet fully implemented or utilized, and that the transition to 6G will likely follow a similar pattern, characterized by incremental upgrades and coexistence with existing technologies. Interviewee R6 mentions this:

> We are only now beginning to activate 5G standalone. Given that 5G has not yet become clearly profitable, moving towards 6G still feels premature. (R6, 2026, own translation)

R8 supports the expectation of a selective rollout by arguing that 6G functionality is likely to first appear in high-value areas with high traffic volumes or clear industrial demand. Following this, other regions may only experience incremental upgrades. This indicates that 6G deployment may develop unevenly, creating concentrated "islands" of advanced capability rather than equal national coverage.

From an operator perspective, 6G is not expected to reach commercial relevance until well into the 2030s, reflecting long development cycles, delayed return on in-

vestment, and the need for mature ecosystems including devices and applications. As interviewee R4 stated:

> 6G for me is 2030. I don't look much further than 2027, I would say for now. So it's completely out of the question. (R4, 2026)

From a public sector perspective, it was explicitly stated that 6G is not expected to be a "game changer" in the short term, but rather an extension of existing capabilities.

This aligns with broader observations that technological expectations often exceed actual deployment speed, particularly when economic and regulatory factors are taken into account.

4.8 Resilience and Independence as Critical Factors

Resilience emerges as a critical theme across multiple interviews, particularly in the context of public sector and mission-critical applications. This includes not only cybersecurity, but also physical robustness, redundancy, and independence from external dependencies.

In healthcare, the ability to maintain communication during crises, including potential disruptions to public networks, is a key driver for investing in private infrastructure. This includes redundancy through multiple core networks and backup power systems. The R5 interviewee emphasizes:

> I would say that we do it in order to create a greater degree of self-determination, and above all to secure certain parts of our operations in the event of a crisis or, even worse, a wartime situation. (R5, 2026, own translation)

From an operator perspective, resilience is increasingly reflected in requirements for backup systems, energy supply, and network availability, as telecommunications infrastructure becomes more critical to societal functions.

More broadly, geopolitical considerations and concerns about external dependencies are influencing infrastructure decisions. The need for control over critical systems is increasingly seen as essential for ensuring operational continuity. The R7 interviewee describes it as follows:

> Mobile operators build what could be described as a fair-weather network. If you take an axe to one of their systems, everything goes down. If the same thing happens in our network, everything continues to function. (R7, 2026, own translation)

R8 adds an important trade-off to the resilience discussion. A more distributed

architecture simultaneously improves redundancy by adding more nodes, but at the same time it means more physical assets that need to be protected.

R9 broadens the resilience discussion by showing that resilience cannot be reduced to cyber security, military threats, or technical standards alone. R9 emphasized that resilience also includes natural disasters and climate related disruptions. In these situations, NTN could become relevant as an extra layer of redundancy if terrestrial infrastructure is damaged or unavailable.

These findings suggest that resilience in next-generation networks will extend beyond technical performance to include broader considerations of autonomy, security, and system robustness.

4.9 Telecommunications as a Part of the Infrastructure Ecosystem

Several of the interviews indicate that telecommunications is increasingly understood as an integrated part of the broader infrastructure ecosystem, rather than as a separate technological system. Several interviewees emphasized that mobile connectivity is becoming closely connected to urban planning, building design, public sector operations, and critical societal functions.

Respondent R9 discussed this topic as an important shift in how telecommunications infrastructure should be viewed. The interviewee emphasized that this is especially important when discussing the densification of the network by building small cells. From this perspective, the rollout of future networks will depend heavily on actors that are able to manage physical infrastructure in built environments, including permits, municipal coordination, local regulations, and integration with existing urban structures. This suggests that the complexity of future telecommunications deployment may increasingly resemble traditional infrastructure development. R9 summarizes the topic:

> This is becoming a matter of civil engineering, in the sense of basic infrastructure planning. It is increasingly about fundamental infrastructure questions, similar to roads, water, electricity, and buildings. (R9, 2026, own translation)

R3 and R6 both highlight a similar perspective related to indoor coverage. Since a large share of mobile data traffic is consumed indoors, it is becoming harder to rely only on outdoor macro sites for coverage and capacity. R3 discusses a solution using a neutral host model, where instead of each operator installing their own equipment, the operators can connect to shared equipment. This would mean that connectivity becomes part of the building's common infrastructure, comparable to electricity, water, or ventilation systems.

Several interviewees also describe telecommunications as a critical societal base layer.

R5 argues that healthcare now depends on mobile networks alongside electricity, ventilation, and water. R10 adds that public services, such as elder care, increasingly depend on mobile networks, which in turn raises demand for redundancy and resilience. R6 confirms this from an MNO perspective, that mobile networks are increasingly treated as important societal services, with stricter requirements for backup power, site protection, and security classification.

Overall, the findings suggest that the role of telecommunications infrastructure is expanding. The interviews point toward a future where network deployment cannot be understood only as a technical telecom issue, but must also be considered a matter of city planning, resilience, and long-term critical infrastructure.

4.10 Summary of Key Findings

The empirical findings can be summarized in four main points:

- The adoption of 6G is constrained by a lack of clear business cases, particularly from an operator perspective.
- Digital maturity and organizational readiness are key factors influencing adoption across industries.
- Automation and mission-critical applications remain important long-term drivers of demand, but the need for 6G is likely to be concentrated in specific localized use cases, such as remote operations, rather than broad nationwide autonomous vehicle functionality.
- There is a structural shift toward private and localized networks, driven by requirements for control, resilience, and security.
- Infrastructure development is likely to focus on upgrading and reusing existing sites, while densification is expected to occur selectively where business cases, public funding, coverage obligations, or specific local use cases justify additional infrastructure.
- The rollout of 6G is expected to be gradual, economically driven, and delayed into the 2030s.
- Resilience and independence are emerging as critical factors in the design and implementation of next-generation telecommunications infrastructure.
- Regulatory and institutional conditions, including spectrum policy, certification requirements, public procurement, and municipal planning, are central factors shaping how future network infrastructure can be deployed.
- Tower companies and neutral infrastructure actors may become more strategically important if future networks require greater coordination of physical sites, indoor coverage, edge computing, or shared infrastructure.

5

Discussion

5.1 Densification and New Infrastructure Typologies

The findings indicate that future 6G deployment may increase the technical pressure toward densification, particularly in environments requiring extremely low latency, high reliability, and high-capacity connectivity. However, the interviews simultaneously challenge the assumption that 6G will automatically lead to widespread small-cell deployment across all environments.

Several respondents emphasized that previous expectations regarding densification during both the 4G and 5G rollouts were not realized to the extent initially anticipated. According to both regulatory and operator perspectives, operators have largely relied on incremental upgrades of existing infrastructure rather than large-scale deployment of entirely new site networks. This suggests that future densification is likely to occur selectively in areas where strong business cases, industrial demand, or coverage obligations justify additional infrastructure investments.

At the same time, emerging 6G-related technologies such as URLLC, JCAS, edge computing, and advanced V2X applications may create new localized infrastructure requirements. Rather than relying exclusively on traditional macro sites, future deployments may increasingly require hybrid infrastructure architectures combining macro towers, indoor DAS systems, edge nodes, fiber densification, and localized private networks.

The findings from industrial and healthcare respondents particularly reinforce the importance of stable and predictable latency rather than only increased data speeds. This implies that future infrastructure development may focus less on maximizing theoretical peak performance and more on ensuring localized reliability, resilience, and operational continuity in mission-critical environments.

Consequently, the transition toward 6G may not simply represent a quantitative expansion of infrastructure, but rather a qualitative transformation toward more distributed, application-specific, and infrastructure-integrated network architectures.

5.2 Telecommunication as a Part of the Infrastructure Ecosystem

The interviews suggest that telecommunications infrastructure is increasingly being perceived as a foundational component of the broader infrastructure ecosystem rather than as a standalone digital service. Similar to electricity grids, transport systems, water supply networks, and energy transmission infrastructure, connectivity is becoming deeply integrated into the functioning of modern society.

Telecommunications will become an increasingly important consideration in the planning and development of new cities, urban areas, buildings, and transport systems. As future services such as autonomous mobility, smart infrastructure, digital healthcare, industrial automation, and intelligent energy systems become more dependent on reliable connectivity, telecommunications infrastructure will need to be integrated into the early stages of infrastructure planning rather than added as an afterthought.

The findings further indicate that future telecommunications deployment may become increasingly dependent on access to physical infrastructure and the ability to coordinate across multiple stakeholders. Several interviewees highlighted challenges related to buildings, fibre backhaul, power supply, municipal permits, and access to suitable deployment locations. Consequently, the rollout of future networks may increasingly resemble traditional infrastructure projects, where planning processes, regulatory approvals, stakeholder coordination, and long-term investment decisions are as important as the underlying technology itself. This development may require closer collaboration between mobile network operators, municipalities, property developers, utility providers, and infrastructure owners to ensure that connectivity requirements are incorporated into infrastructure planning and development processes from the outset.

Cooperation between MNOs and property owners may also need to become a more standardized part of future network deployment. As most mobile traffic is generated indoors, and according to R6, this trend is likely to continue, connectivity should increasingly be planned as a part of a building's basic infrastructure rather than added afterwards. Early coordination between operators, property owners, and neutral infrastructure providers could reduce duplicate installations, lower installment complexity, and support shared indoor infrastructure installations such as DAS.

The increasing adoption of private networks further strengthens this interpretation. Rather than relying entirely on public operators, several organizations are seeking greater control over their communication infrastructure in order to improve resilience, cybersecurity, and operational independence. In this sense, telecommunications infrastructure increasingly resembles other forms of critical infrastructure where redundancy, backup systems, and self-determination are central design principles.

From this perspective, the transition toward 6G should not only be understood as a technological evolution within telecommunications, but also as part of a broader infrastructure transformation. Connectivity is becoming embedded within the physical and operational structures of cities and industries, suggesting that the success of future network deployments will depend not only on technological advances but also on how effectively telecommunications infrastructure can be integrated into wider infrastructure planning, governance, and investment processes.

5.3 Early Adopters

The early adoption of 6G is unlikely to follow one, clearly defined sectorial pattern. The interviews point towards a fragmented adoption where different actors may invest in the technology for different reasons. While some early deployment may be driven by MNOs wanting to demonstrate technological leadership, environments where 6G can help solve specific operational problems is more likely to drive substantial demand.

This perspective is also supported by the rollout of previous generations. Although significant attention was initially given to certain anticipated use cases and industries during the introduction of both 4G and 5G, the most influential adoption drivers ultimately emerged gradually and were not always those originally expected. Rather than a sudden transition driven by a single sector or application, deployment evolved incrementally as ecosystems matured, devices became available, and new use cases demonstrated clear value. The findings suggest that 6G may follow a similar trajectory, where the most important applications and demand drivers are likely to emerge over time rather than being fully identifiable at the outset of deployment.

The automotive industry is frequently presented as one of the most important potential drivers of future 6G demand. The transition towards connected, electric, and increasingly autonomous vehicles creates a potentially large market for advanced connectivity solutions. In particular, the development of Vehicle-to-Everything (V2X) communication is expected to increase requirements for ultra-low latency, high reliability, and high-capacity networks capable of supporting real-time communication between vehicles, infrastructure, and other connected devices.

However, the interviews also challenge the assumption that the automotive sector will become an obvious early adopter of 6G. Although V2X and autonomous mobility are often highlighted in 6G visions, several interviewees emphasized that vehicle manufacturers are unlikely to make core vehicle functionality dependent on continuous mobile network coverage. Instead of being the backbone of V2X systems, mobile connectivity is more likely to function as an additional layer that improves performance, coordination, or situational awareness in specific contexts.

However, some significant challenges remain before large-scale adoption can occur. Regulatory issues related to interoperability and standardization must be resolved to enable seamless communication between vehicles from different manufacturers.

Furthermore, uncertainties regarding business models, infrastructure ownership, investment responsibilities, and the deployment of network equipment may influence both the timing and extent of 6G adoption within the automotive sector. Consequently, while the automotive industry appears to be a promising early adopter due to its market size and connectivity needs, its development will depend not only on technological progress but also on the resolution of regulatory and commercial challenges.

5.4 Resilience and Infrastructure Implications

The findings indicate that resilience is becoming a central consideration in the development and deployment of future telecommunications infrastructure. While resilience has traditionally been associated with technical robustness and cybersecurity, the interviews suggest that stakeholders increasingly view resilience as a broader concept encompassing operational continuity, organizational independence, and the ability to maintain critical services during crises. This development appears to be driven not only by the transition toward future generations of telecommunications technology, but also by a broader shift in the external environment. Increasing geopolitical tensions, heightened cyber threats, concerns regarding critical infrastructure protection, and growing awareness of societal vulnerabilities have elevated resilience as a strategic priority across multiple sectors. Consequently, resilience is increasingly viewed not merely as a technical network characteristic, but as a fundamental requirement for ensuring the continuity of critical societal functions in an increasingly uncertain and interconnected world.

The growing interest in private networks can be interpreted through the lens of absorptive capacity. By establishing dedicated communication infrastructure, organizations seek to reduce their dependence on external actors and ensure that critical functions can continue operating during disruptions. This reflects the literature's emphasis on redundancy, backup systems, and fault-tolerant design as key mechanisms for maintaining functionality under adverse conditions.

The findings also highlight the importance of adaptive capacity. Several respondents emphasized the need for telecommunications infrastructure that can respond to changing operational requirements, emerging threats, and evolving technological environments. This aligns with recent research suggesting that future 6G systems will increasingly rely on intelligent network management, autonomous orchestration, and dynamic resource allocation to adapt to disruptions in real time.

Furthermore, resilience was frequently discussed in relation to crisis preparedness and societal continuity. The emphasis on backup power systems, multiple communication paths, and alternative network solutions reflects restorative capacity, where the focus is on maintaining or rapidly restoring critical services following disruptions. At the same time, concerns regarding geopolitical uncertainty, cyber threats, and external dependencies illustrate how resilience is increasingly viewed as a strategic capability rather than merely a technical property.

The findings also support the notion of transformative capacity. The shift toward private networks, distributed architectures, hybrid communication systems, and greater integration between telecommunications and other infrastructure sectors suggests that resilience is driving structural changes in how telecommunications infrastructure is designed and governed. Rather than simply improving existing systems, organizations appear to be reconsidering the underlying architecture and ownership models of critical communication infrastructure.

Taken together, the findings support the argument that resilience is evolving from a supplementary design consideration to a fundamental principle guiding the development of future telecommunications infrastructure. As connectivity becomes increasingly embedded within critical societal functions, the ability to absorb, adapt to, recover from, and transform in response to disruptions may become as important as traditional performance metrics such as speed, capacity, and latency.

5.5 Expected Timeline for 6G Rollout

The findings from the interview conducted within the automotive industry align closely with the timeline presented by 3GPP regarding the expected rollout of 6G around 2030. At the same time, the interviews indicate that many industrial actors have not yet begun actively preparing for the transition toward 6G. This is noteworthy considering that 3GPP has already initiated early standardization activities through Release 20 and Release 21, where foundational planning and technical development related to future 6G systems are being discussed. Current expectations from 3GPP, particularly through Release 21, suggest that the first technical specifications for 6G may begin to emerge around 2028, creating a gradual transition period leading up to commercial deployment around 2030. However, the findings also indicate that if industrial actors do not become more proactive and forward-looking in their preparations, the large-scale commercialization and adoption of 6G-enabled applications may occur later than the currently anticipated timeline.

5.6 Tower Companies as Neutral Hosts of Active Infrastructure

One implication of the findings is that the transition from 5G to 6G may create opportunities for tower companies to move beyond their traditional role as owners of passive infrastructure. Interviewee R6 emphasized that the deployment of denser 5G networks, and in the future likely even denser 6G networks, will require large investments from MNOs. In this context, tower companies could become more strategically important if they are able to provide not only passive infrastructure, but also specific active infrastructure. This would reduce the complexity of deployment for MNOs, as it would reduce the amount of infrastructure needed to be built for a new site to be constructed.

5.6.1 Neutral Host Transmission

The fiber and transmission aspect is important since it represents a concrete way for tower companies to capture a large part of the infrastructure value chain. According to R6, relying on radio links for transmissions is becoming outdated and direct fiber connections between hubs and sites are essential for meeting future latency requirements. If tower companies can offer infrastructure where fiber is already deployed, the threshold for MNOs to expand their network and build new sites becomes significantly lower. This means that neutral transmission infrastructure could become a business case for tower companies, as several different operators could lease access to the same fiber solutions.

5.6.2 Neutral Host DAS

The development of neutral host DAS is another possible area of business that points toward a possible expansion beyond traditional passive infrastructure ownership. With the trends pointing towards increased deployment in indoor areas, dense urban capacity, and shared infrastructure platforms, 6G may give tower companies an opportunity to move further into selected forms of active infrastructure. By owning and operating neutral host DAS, tower companies may be able to secure a larger part of the value chain. This would grant tower companies a different market position as neutral infrastructure providers able to deliver coverage, capacity, and resilience as a managed service. This could be especially relevant in areas where MNO deployments are economically inefficient, such as hospitals, transport hubs, commercial buildings, industrial campuses, and dense urban areas.

The interview findings support this interpretation. According to R6, more advanced DAS systems are currently being discussed within the industry as a possible complement, or even as an alternative, to traditional small cell deployments in dense urban areas. According to the same interviewee, new DAS systems may not only remain relevant for indoor coverage in 6G, but could evolve into a broader strategy for dense city environments where capacity, coverage, and infrastructure efficiency become increasingly critical.

This suggests that neutral host DAS should not only be understood as a technical solution for indoor coverage, but also as a possible strategic position for tower companies in the 6G ecosystem. If tower companies can combine neutral ownership, operational competence, and trust from multiple MNOs, they may be able to move from passive infrastructure leasing toward managed connectivity services. However, the literature also indicates that this development depends on whether concerns around operator control, differentiation, reliability, and technical complexity can be managed.

A shared DAS infrastructure could potentially support 6G deployment in dense urban environments where traditional macro-cell architectures may struggle to provide efficient coverage. By distributing radio functionality closer to end users, neutral host solutions may enable more stable and localized connectivity while reducing the

need for multiple parallel infrastructure deployments.

5.6.3 Neutral Host Edge Computing

A further possible extension of this neutral host model could be as the role of tower companies in edge computing infrastructure. According to the literature, with 6G, distributed computing architectures will become more common. This means that computing and storage resources are placed closer to end users in order to reduce latency and support time-sensitive applications. The interview findings reflect a similar future development. R8 describes a future where communication and compute are increasingly treated as a part of the same system. R3 similarly argues that intelligence and processing may be offloaded from devices, vehicles, and robots to nearby telecommunication sites. R6 also emphasizes that the need for lower latency will create a need for intelligence at the base station rather than at a distant, centralized data centre.

For tower companies, this could mean another opportunity to expand from only owning passive infrastructure to owning active infrastructure as well. If edge computing, or other computational capabilities, needs to be installed at telecommunication sites, it may be inefficient for MNOs to install separate server capacity, power systems, cooling solutions, maintenance processes, and other essential equipment. A neutral host model for edge computing could therefore allow tower companies to provide shared active infrastructure that multiple operators or service providers can access. This would follow the logic for neutral host DAS or transmission, but extend the business even further into digital infrastructure. R9 discussed this, and emphasized that the strategic value of tower companies could increase significantly if AI functionality becomes embedded in radio base stations. In such a scenario, tower companies would no longer only control physical locations, but also parts of the infrastructure needed for distributed AI and edge computing.

However, this opportunity still remains uncertain. Even if edge computing is often described as an important architectural component of 6G, it is still not certain to which extent it will actually be deployed at telecom sites. This mostly depends on the maturity of relevant use cases, operator investment capacity, energy and cooling requirements, orchestration complexity, and questions of security and operational control. R3 also emphasize that edge computing could become very expensive for operators. This might strengthen the case for shared a shared model, but only if the neutral host can guarantee sufficient reliability, trust, and technical capability. Therefore, edge computing should be understood as a potential future business case for tower companies rather than neutral extension of the current tower company model.

5.6.4 Possibility of Tower Companies as Neutral Hosts

The neutral host approach may also offer advantages from an urban infrastructure and property management perspective. Shared systems can reduce cable duplication, minimize equipment installations, simplify maintenance operations, and help

cities manage increasing connectivity demands within limited physical and aesthetic constraints.

However, the findings also indicate several challenges associated with shared infrastructure models. One concern among operators relates to competitive differentiation (Analysys Mason, 2024). Historically, network quality and coverage have represented important sources of competition between MNOs. Increased reliance on shared infrastructure may reduce opportunities for operators to differentiate themselves through superior physical network deployment.

Operators may also express concerns regarding operational control and service reliability when infrastructure ownership is transferred to third-party providers (Analysys Mason, 2024). Dependence on external infrastructure actors may create vulnerabilities related to maintenance, troubleshooting, and service continuity. In addition, shared infrastructure environments raise questions regarding resilience, data confidentiality, and the exchange of operational insights between competing actors.

Overall, the findings indicate that neutral host models may play an increasingly important role in future network deployment, particularly in high-density urban environments. At the same time, the transition toward shared infrastructure architectures introduces new strategic, technical, and organizational challenges that require further consideration in the context of 6G development.

5.7 Future Research

The exploratory nature of this thesis has revealed a number of potential avenues for future research. The following list outlines several topics that are considered particularly interesting candidates for further study.

- Neutral host transmission, DAS, and edge computing could potentially be attractive business cases for tower companies. However, the exact structure of such a business model remains uncertain and would need to be further developed in practice.
- Future research could analyze how resilience requirements affect the cost structure of telecommunications infrastructure, especially regarding backup power, redundancy, site protection, and crisis preparedness.
- Analyze the possibility of cross-border collaborative partnerships and joint ventures to contribute to a more rapid rollout of new technologies across different markets and regions.

6

Conclusion

This thesis concludes that the rollout of 6G is likely to be gradual, selective, and economically driven rather than rapid and nationwide. The empirical findings show that a clear business case is still lacking, regardless of the major technical advancements expected with 6G. Several potential early adopters, including transport, healthcare, industry, and automotive applications, view the next generation of telecommunications technology as a long-term development rather than an immediate operational need at the moment.

The infrastructure implications of 6G are therefore expected to be concentrated in specific environments rather than distributed evenly across the network. Existing macro sites are likely to remain the most important typology and will probably be upgraded and reused where possible. Additional densification may occur in dense urban areas, industrial sites, healthcare facilities, transport hubs, and indoor environments where advanced connectivity can create clear operational value.

The findings also show that telecommunications infrastructure is increasingly becoming part of the broader infrastructure ecosystem. Future rollout strategies will depend not only on radio technology, but also on access to buildings, fiber, power supply, permits, backup systems, and coordination with municipalities, property owners, and other infrastructure actors. This may create opportunities for tower companies to move beyond passive infrastructure ownership and take a larger role in neutral host solutions, indoor coverage, transmission infrastructure, and potentially edge computing. This also has implications for the construction industry, where mobile network connectivity must be treated as a critical need, similar to water or electricity supply.

Resilience is expected to play a larger role in future telecommunications infrastructure. As mobile networks support more critical societal functions, infrastructure must be designed for redundancy, robustness, independence, and operational continuity. This is, however, not mainly due to the evolution toward 6G, but rather a consequence of geopolitical changes worldwide.

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A

Appendix 1

A.1 Original Citations

"Men vad är business modellen liksom? [...] Någon måste kommit på någonting som folk vill ha. Och som man tycker är något som ger något mervärde och jag tror det är mycket svårare än de ingenjörsmässiga, liksom tekniska utmaningarna. Följa liksom business modell..." . "Men om ingen säger att de kan tjäna pengar på det då?

"Jag upplever ett avstånd till... digitalt mognadsmässigt. Så att börja diskutera 6G och högre hastigheter än 5G och precisionssatellit... det känns lite främmande faktiskt. Det är inte där det finns. Frukterna hänger betydligt lägre."

"Och det är klart att 6G med precis det vi pratar om... öppnar ju upp för helt andra grejer. Vi kan alltså flytta ut ännu mer... Men för att jag tror att det ligger en bra bit fram"

"Det handlar om en enda fråga. Det handlar om vilka beroenden har du till din omvärld för att du ska kunna producera dina tjänster eller produkter"

"Och de här nya banden här då? Då är ju så höga höga frekvenser... så är ju problemet att det kommer ju bli totalt blockat av alla huskroppar, så det gäller att få in signalen i husen då"

"Vi står precis i introduktionen på att aktivera upp 5G SA, stand alone. Om man tänker att vi inte tjänar pengar på 5G, så att komma upp till 6G då?"

"...vi gör det ju skulle jag vilja säga på grund av att skapa en egen rådighet. Att och också framför allt ska jag säga, äh att säkerställa vissa delar av vår verksamhet också i händelse av kris eller ännu värre, en krigssituation"

"...mobiloperatörerna bygger ju någonting som man kallar för vackert vädernät... tar du in en yxa i ett av deras system så är det tack och god natt. Gör du detsamma i vårat nät då funkar ju allt frid och fröjd va?"

"Det är en fråga om, som man säger civil engineering, det vill säga väg och vatten,

byggnadsteknik ungefär. Att det behöver bli grundläggande infrastrukturfrågor."

"Vi ska stoppa in 5G i alla bilar. Det gör vi ju för nya bilar... framförallt för att vara framtidssäker då vi inte ser några supertydliga use cases idag som egentligen kräver 5G"

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