

# Making 6G Profitable

How will business and technology factors combine for a successful 5G-to-6G transition?

September 2024

## Executive Summary

The telecommunications industry has outlined a promising vision for 6G based on technology innovation, immersive customer experiences, and vertical industry propositions. However, caution is currently tempering optimism. That is because the journey to 6G starts from 5G's lackluster commercial performance, a factor that weighs on communication service providers' investment plans. There are concerns that the industry's 10-year upgrade cycle and technology-led approach, which suited earlier eras, are only tenuously connected to future commercial imperatives.

To address these concerns, industry experts from different geographies and industry sectors shared their insights on what needs to improve. Firstly, how will 6G affect the structure of the communications market? Secondly, what factors will drive the industry to change? And finally, what market development milestones need to materialize in coming years to demonstrate that industry is on the right track?

A recurring conclusion is that the industry first needs to pivot from 5G's cautious and cost-control mindset to one that is visionary about 6G business prospects. This must stem from breakthrough value propositions in the consumer segment and under-addressed demand from defense and enterprise markets. In terms of financial discipline, 6G profitability will have spending and operational change implications. These involve internal investments in R&D, software infrastructure, agile operations, and partnering with vertical industry specialists and start-ups. The broader scope of 6G compared to prior Gs means that there will also be changes from policy measures linked to information management, technology sovereignty and sustainability. The industry faces considerable change, much of it arising from sources outside of traditional industry boundaries.

# Table of Contents

<b>1. Context</b>	2
<b>2. Approach and Outputs</b>	2
<b>3. Industry Frameworks and Models</b>	3
3.1 We are Governed by Industry Timetables and 'Clock Speeds'	3
3.2 3GPP and the ITU Shape Standardization	3
3.3 Software is Winning Against Communications Spending	5
3.4 Consumers Dominate While the Enterprise Segment is Under-served	5
3.5 Macro-model: From Linear Value Chain to Platforms and Ecosystems	6
3.6 Micro-model: Three Elements Inside the 'Telco'	8
3.7 Cost Containment Drives Present-day Strategy	9
<b>4. What Factors Are Driving Industry Change?</b>	10
4.1 Business Pragmatism	10
4.2 Political Intervention	12
4.3 Technical Innovation	12
<b>5. Changes to Anticipate</b>	14
5.1 Pivot to a Visionary Mindset	14
5.2 Policy Context Will Introduce New Rules	16
5.3 Connecting Technology Innovation to Market Development	18
5.4 Risks	19
<b>6. Acknowledgments</b>	21



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# 1. Context

Academics and technologists are excited about 6G innovation and frontier research topics. Communications service providers are anxious because their 5G investments and infrastructure changes have yet to pay off. Governments aspire to technological sovereignty, because communications systems are a part of a nation's critical infrastructure while industrial policies and R&D investments offer platforms for economic prosperity. Can 6G reconcile these different motivations against a backdrop of disappointing financial performance and weaker than anticipated adoption of 5G?

This report was prepared ahead of a panel discussion at 6GWorld's 6GSymposium Fall 2024. It gathers perspectives from commercial, industry policy, strategy, and technology viewpoints from communications industry experts across the world. In exploring causes of concern and optimism about the future, it launches a multi-disciplinary debate about the industry's path to a successful and profitable 6G.

# 2. Approach and Outputs

The preoccupations of most people in the telecommunications industry, experts included, are of immediate concerns. Their planning horizon is a matter of a few years. The research for this report invited about twenty experts across the communications ecosystem to think beyond gradual changes and focus on 'big picture' dynamics. Their geographic representation spans Europe, India, South Korea, and the USA. As illustrated, questions on three topics guided the discussions.



The following sections of this report synthesize interviewee observations and insights.

## 3. Industry Frameworks and Models

Interviewees used several frameworks to describe their view of the telecommunications industry landscape. Time was a recurring topic. Standardization was another, with an emphasis on the role of 3GPP. Other topics drew on distinctions between hardware and software as well as those between consumer and enterprise customer segments. Macro-level discussions about the industry value chain focused on the evolution from a linear model to a mesh that connects many more supply-side participants.

Telco operating models seem ill-suited to structural changes in the industry. There is a weakness in matching emerging pockets of demand to service offerings that commercial networks are provisioned to support.

### 3.1 We are Governed by Industry Timetables and ‘Clock Speeds’

The ITU’s IMT Vision process defines the industry timetable of launching a new G every decade. Acting as the industry’s main cog, the ITU cycle drives pre-standardization and standardization work in 3GPP. The vendor community then builds 3GPP and other technical specifications into network equipment for the telcos to deploy and commercialize, principally via access and connectivity service offerings.

There are pros and cons to this framework. It has rallied a sizeable industry to a degree that has delivered near ubiquitous and affordable mobile communications across the world. However, the world is changing. It is no longer possible to anticipate communications needs ten years out. Pressures to shorten commercialization lead times, the growing speed of business and technology innovation and the adoption of agile software practices are forcing a faster clock speed on the industry.

### 3.2 3GPP and the ITU Shape Standardization

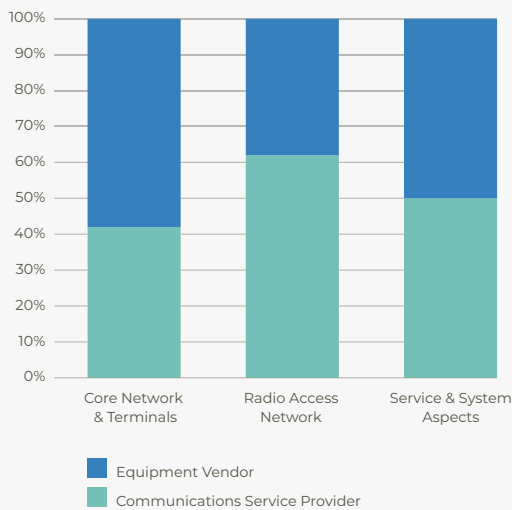
3GPP is central to the communications industry for its convening power and mission to deliver technical specifications for a global 6G standard. In the past, the communications industry benefitted from global standardization which made communications services universally accessible and affordable to the general population. In the case of 6G, global consensus is at risk. While there is a widely held aspiration for a single 6G standard, industry representatives are privately concerned about the risks of politically motivated, regional fragmentation.

Other standardization aspects apply to the ITU’s role in setting a timetable and direction for the communications industry. The ITU lays down the industry’s ten-year cadence in the form of IMT Vision statements; the Vision for IMT 2030 corresponds to 6G. In directional terms, the industry perceives the ITU as prioritizing communications services for the masses, notably in developing economies; there is less consideration of the commercial realities facing the industry ecosystem.

The ITU's operating framework governs 3GPP's model of issuing standardization Releases every few years. These Releases consist of families of new capabilities. From a software industry perspective, some industry participants question whether the 3GPP approach might change to emphasize features over Releases. As one interviewee framed it, could the industry work with more frequent updates, such as a 6.1G followed by a 6.2G and so on? Another questioned whether generational transitions to future G's need to involve major step-changes and 10-year cycles. Could innovation reaching the market be continuous instead of stepwise?

Beyond 3GPP, there are important and complementary standardization efforts in other bodies, notably via the IEEE for the 802.11 family of Wi-Fi standards. This is important when viewing 6G as a system of systems that brings together complementary and externally developed technologies. The convergence between satellite and terrestrial networking is one example. Another one that interviewees cited was Open RAN. One possibility from contemplating technology convergence is to see greater collaboration among standardization bodies. It is conceivable, for example, that Open RAN standardization efforts might be migrated into 3GPP. From an organizational standpoint, the O-RAN Alliance could then become a 3GPP Market Representation Partner (MRP).

**3GPP Working Group Chair and Vice-Chair Positions (2005 to Present)**



SOURCE: 3GPP (retrieved 2024)

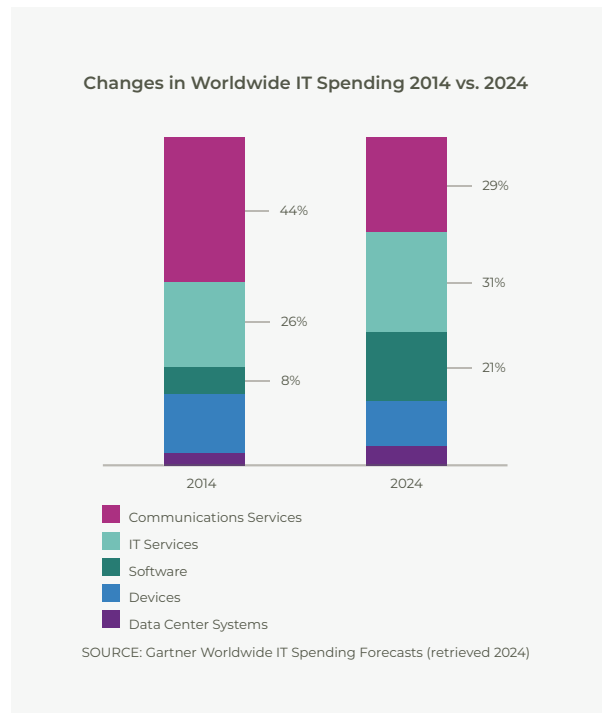
Given the importance of vertical enterprises to the commercial success of 6G, gaps in knowledge and requirements mean that non-telco businesses need to become more involved in 3GPP. To date, representatives from communications service providers and network equipment vendors dominate the roll call of 3GPP's Chair and Vice-Chair positions. Will 6G's emphasis on enterprise use cases result in greater contributions from vertical industry representatives or even leadership positions?

The 3GPP operating model and standardization timetable also lends itself to large organizations and patient innovators. However, the investment and multi-year commitments involved in being actively involved can make 3GPP inaccessible to small and medium-sized enterprises (SMEs). Recognizing that standardization is important, SMEs are inclined to 'standardize' around frameworks that are quicker to develop and trial. Examples include the TM Forum's Open Digital Architecture and the GSMA's Open Gateway initiatives. The growing importance of

business-oriented applications and software deployment techniques are expected to generate demand for frameworks that ride on top of 3GPP standards.

### 3.3 Software is Winning Against Communications Spending

Changes in worldwide IT spending over the past ten years illustrate the squeeze on telecommunications service providers. From 2014 to 2024, there was a drop in the share of spending on communications services from 44% to 29%. Over the same period, spending on IT services increased from 26% to 31% while software spending jumped from 8% to 21%. This is a world of software and services.



In operational and investment terms, interviewees noted that software spending is taking precedence over hardware across the communications industry. This is evident in investment planning, operations, and infrastructure. Almost 75% of 3GPP specifications are on the way to being software-enabled. Adoption of AI, cloud, and network disaggregation approaches accentuates the use of software-oriented techniques. This leads to more agile innovation and operational practices. However, legacy systems can drain investment capacity and limit a telco's ability to change.

There are several industry implications from software's rise to prominence. It will be possible to tailor a communications system for a particular use case by implementing only the necessary (software) components from the 3GPP specifications. For example, the deployment of a local, private network might not require roaming or interconnection capabilities.

Many other possibilities might arise because the 6G era is being characterized as more of a long tail market than a high-volume, subscriptions business. The emergence of specialist and direct-to-enterprise private 5G network providers is a leading indicator of developments to come as are the business models of challenger and new-entrant telcos.

### 3.4 Consumers Dominate While the Enterprise Segment is Under-served

To date, the mobile communications story has been about delivering affordable, near-ubiquitous access to basic communications services for the world's population. 3GPP's roadmap progressed from voice to messaging and then data services. These milestones expanded the scope of what counts as basic communications.



Targets for population coverage and GDP growth shaped the pace of industry growth. With 5G, however, the industry is running out of road in the consumer market because most of the world's population can access a mobile network. Many consumers possess multiple devices, and the higher capacity offered by 5G is not discernibly better than 4G to warrant a steep change in what service providers can charge.

The communications industry is now pivoting to the enterprise market. One reason is that 5G specifications contain capabilities that can satisfy some of the emerging communications needs of different industry sectors. Another is timing as enterprises adopt digital transformation strategies which rely on communications for information-enabling technologies including AI, the IoT and digital twins. Industry analysts value the economic potential of digital transformation and Industry 4.0 initiatives in the multi-trillions of dollars. This is the growth opportunity that is causing a communications industry pivot.

Across the world, conflict hotspots are highlighting the benefits of agile and communications-intensive approaches to warfare. As large nations move to a war-economy footing, the defense sector represents another market opportunity for the communications industry.

These developments are not without their challenges. Communications service providers operate with a 'flat and thin' model that maps to mass-market and nationwide services. Can they accommodate 'narrow and deep' enterprise requirements that might not require nationwide coverage or a single provider? The transition to serving high-value economic clusters might present risks to national coverage for higher throughput communications. That might necessitate policy or regulatory action to ensure adequate rural and digital-divide coverage.

Another industry level challenge is to engage with the enterprise sector. Incumbent telcos are set up to serve the consumer segment. ARPU and customer satisfaction ratings prominent on management dashboards. Can these organizations adapt to focus on vertical industry performance metrics such as manufacturing volumes, factory uptime or medical patients treated?

Several years into the 5G journey, there is ample evidence that most enterprises and their CIOs do not know much about 5G or how it might help their business operations. The educational gap is considerable and not one-sided.

### 3.5 Macro-model: From Linear Value Chain to Platforms and Ecosystems

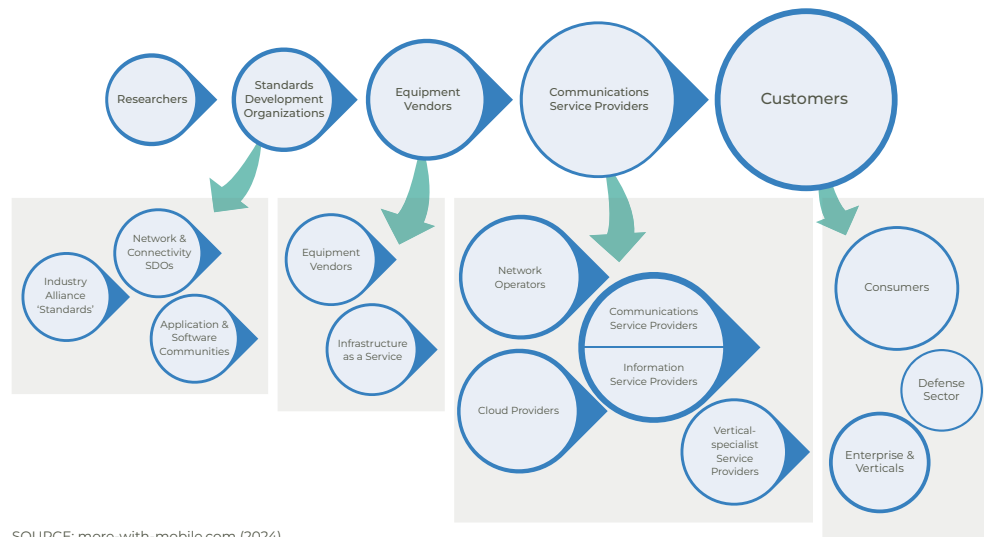
A high-level model of the communications industry involves a progression of value creating activities and key entities. This begins with the research community, comprising academic institutions, national research agencies, and private sector technology innovators. Much of their output is subsequently channeled through standards development organizations (SDO), primarily 3GPP, before being developed



into network equipment and communication devices. Communications service providers are next in the value chain that leads to the ultimate customers, whose expenditure finances the industry.

The industry has been evolving from this linear structure to a mesh model that involves many more participants and many more interactions. For the 6G era, other communications technologies, such as non-terrestrial networks, fixed networks, and Wi-Fi, will complement 3GPP's technical specifications. To make these work together will involve multiple SDOs, industry alliances and software communities developing procedures to collaborate and create value.

From Linear to Mesh Value-chains in the Communications Industry

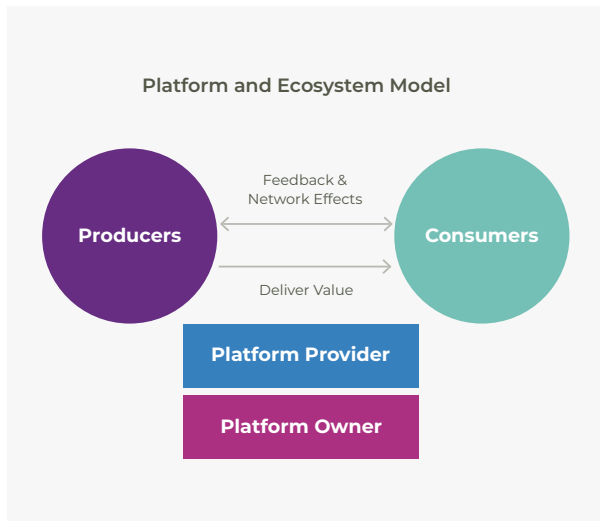


SOURCE: more-with-mobile.com (2024)

In the equipment vendor segment, new sub-segments are likely to join present-day network infrastructure and device suppliers because of stronger support for open interfaces and supply-side competition. For some new entrants, there is increasing potential to bypass communications service providers and serve customers directly, especially as enterprise customers become a target for 5G and 6G service propositions.

The communications service provider segment, already separating into connectivity and information service provider segments, will continue to evolve. This is partly a function of communications systems becoming increasingly essential to life-critical services and national infrastructure.

There is a case for treating communications systems as a general-purpose technology (GPT) that unites connectivity, cloud computing, content provision, contextual intelligence, marketplaces, and ecommerce capabilities. This concept would treat 6G networks as open-interface platforms that make programmable capabilities accessible to operational teams, external developers, and third-party service providers. They, in turn, would leverage these capabilities to tailor high-value communications and information services to different consumer categories.



To put this concept into practice, platforms would operate within marketplace ecosystems that enable many more interactions and greater dynamism between producers and consumers. The platform provider exposes platform capabilities via open interfaces, orchestration tools and a framework of rules to govern producer-consumer interactions.

This model implies an inversion of the traditional telco business model, from internal service development to a greater reliance on external providers. These can include re-sellers, application developers, systems integrators, and information service providers.

An important operational challenge is to harness external resources and labor to shift production from inside the firm to outside it. The process of boosting platform usage intensity drives positive network effects and infrastructure economics. AirBnB and Uber are examples of platform business models and inverted-firm strategies. Both mobilized external resources in the form of accommodation and private vehicles, respectively.

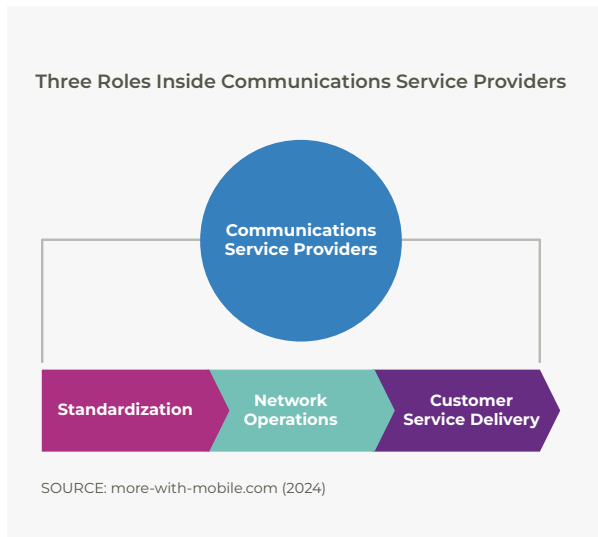
Early experience of exposing network APIs demonstrates the need for horizontal collaboration among communications service providers. This is necessary both to make GPT capabilities uniformly accessible and to create a degree of market scale that will entice developer communities.

Network virtualization is another factor that will affect the communications service provider segment and increase the role of cloud services. There are contrasting industry views on the role of private vs. public cloud infrastructure and the tradeoffs between cost economics and strategic control of key assets and customer accountability.

### 3.6 Micro-model: Three Elements Inside the 'Telco'

The linear, left-to-right industry model involves the supply side delivering connectivity and communications technology to the service consumer. This model is under strain because 6G needs to be market responsive and demand led, with influence flowing more in the right-to-left direction. This development reveals challenges in the existing telco model. The semblance of a monolithic presence in the traditional value chain masks three important components – standardization, network operations and customer service delivery.

As things stand, there is an acceptance that telco representatives participating in pre-standardization and standardization bodies are proxies for market demand. In practice, however, their input tends to emphasize technology, as each new G aims to make communications faster. This places more emphasis on network operators' needs than on what services users are willing to pay for. As one interviewee put it, "we are



always defining a pipe, so we end up with a white box with nothing inside; that makes it difficult for one telco to differentiate itself from another.” Those in charge of network operations in telcos view each new G as a change in the air-interface technology. That translates into the task of financing and managing RAN upgrades. It falls to the service delivery part of the organization to publicize new Gs and to develop connectivity propositions with the network capabilities at their disposal. This multi-party structure is at the root of suggestions for communications service providers to separate along NetCo/ServCo lines.

With 6G, this sequential model is changing because there is a stronger imperative to connect demand to standardization and to adapt go-to-market aspects of innovation and standardization. The distance between ITU goals, 3GPP standardization and business needs requires a better approach that connects to business needs and commercial realities. If there is a break-up of existing communications service provider models, it is unclear which entities will contribute input to the standardization process.

### 3.7 Cost Containment Drives Present-day Strategy

One consequence of the current financial pressures on communications service providers is to foster a cost containment mindset. The context for this is that consumer revenue projections are expected to remain flat for several years. That is because almost everybody that needs a mobile phone has one and most people are not expecting to increase their spending for higher throughput. Under these circumstances, cost control and operational efficiencies are obvious targets for management attention.

With 6G looming, there is a lack of appetite among network operators to increase capital investment. One way of expressing this is as a hope that 6G will re-use existing cell-sites and not necessitate network build out investments. This runs counter to the use of higher frequency spectrum for high bandwidth and immersive experiences which are likely to involve network densification investments.

Even where telcos turn to public-cloud solutions, their actions are viewed through the lens of operational cost saving tactics. Instead of offering a vision about future growth opportunities, this approach suggests that communications service providers are not able to exert control over their destinies. Many telcos are also turning to divestment strategies as another means of cost reduction.

The strategic dilemma is that new market opportunities for 6G will call for a significant shift from present-day defensiveness. How might this change materialize?

## 4. What Factors Are Driving Industry Change?

Communications service providers sit on the critical path that connects supply-side telecoms innovation to end-user demand. End-user spending on communications services feeds the industry ecosystem and is under sustained pressure. This has led to the sector's defensive mindset and its preoccupation tactical initiatives and cost-containment financial metrics. Concerns over the healthy revenue growth also inhibit longer-range preparations for prospective 6G opportunities and expansion. In recent years, it has been common for industry executives, especially those from European markets, to operate with a cost-containment mindset. "Do we need 6G when we are still coming to terms with 5G?" is not an unusual observation.

While a few operators are taking a visionary approach, there remains a need for more widespread change if new initiatives are to have more than a peripheral industry impact.


Making strategic changes will be difficult. Interviewees noted that in the absence of an industry-wide crisis, there are three other avenues for significant and long-term industry change. These involve business pragmatism, political intervention, and technical innovation.

### What Factors Are Driving Industry Change

BUSINESS PRAGMATISM	POLITICAL INTERVENTION	TECHNICAL INNOVATION
<ul style="list-style-type: none"><li>• New commercial models (NetCo/ServCo)</li><li>• Target enterprise sector needs (business criticality, customer KPIs)</li><li>• Adapt to AI and software industry dynamics</li></ul>	<ul style="list-style-type: none"><li>• National R&amp;D initiatives</li><li>• Principles-based technology development</li><li>• Defense sector</li><li>• Spectrum, net neutrality, cybersecurity policies</li><li>• Digital-rights, competition law regulation (AI, privacy)</li></ul>	<ul style="list-style-type: none"><li>• User device innovation (consumer)</li><li>• Joint communications &amp; sensing</li><li>• Availability and affordability of industrial-use devices</li></ul>

### 4.1 Business Pragmatism

Business pragmatism manifests itself in several ways. Financial restructuring, divestment of network infrastructure, and asset-sharing commercial models are example approaches. However, these are operational in nature and less focused on visionary concepts for 6G. The UK's Shared Rural Network initiative is an example of how four network operators - EE, O2, Three and Vodafone – agreed to invest in a shared network of new and existing phone masts with oversight provided by a jointly owned company called Digital Mobile Spectrum Limited. This is an example of a commercial arrangement satisfying a regulatory obligation to deliver 95% coverage across the whole



of the UK. Whereas service providers historically treated their network infrastructure as a differentiator, this development might be a promising indicator of service delivery taking precedence over network ownership and wide-area footprints. A logical next step is the emergence of NetCo-ServCo business structures and consolidation within country markets. Although not dependent on 6G, the timing of these developments could trigger an industry reassessment about delivering ubiquitous connectivity, an IMT-2030 target, on commercially sound terms.

Another candidate for business pragmatism stems from customer segment differences and the projected rise in enterprise sector demand. For context, consumers in general tolerate best-effort services for their everyday communications needs. Few of their usage scenarios involve critical communications. This is not the case for enterprise communications where user expectations focus on service quality, systems reliability, and business criticality. Pragmatism about enterprise customer needs requires communications service providers to align their commercial operations to satisfy enterprise customer KPIs. Instead of focusing on technical metrics (latency, users per cell site, etc.), ARPU and customer satisfaction ratings, they would target output production and up-time for manufacturing customers. Or healthcare interventions in the medical sector.

A broadening of target metrics would incentivize service providers to develop service propositions that go beyond the provision of wide-area connectivity. Service providers would also need to develop mechanisms to offer service-level assurances. This might involve better use of end-to-end service delivery data, enhanced with 6G's native-AI capabilities. It might also drive pragmatism in contractual terms via pay-for-performance and financial risk-management models. Enterprise-5G and network-API propositions might provide the context to develop new concepts in the coming years, laying the foundations for industry knowhow and tested frameworks in time for 6G's deployment.

The mounting adoption of software industry practices is another factor that might drive pragmatism in the communications industry. There are reports that the use of cloud-native software for core network functions, for example, speeds up network deployment by orders of magnitude. In tandem with operational workflow changes, software strategies also improve the clock speed on service innovation. The longer-term implications are changes in operational procedures, workforce development and a switch between CapEx and OpEx expenditures.

A stronger role for 6G's native-AI capabilities could speed up the transition to more agile operations and a retrenchment from legacy back-end systems and their investment demands. The ability of AI to abstract deep technical knowledge will bring network programmability and service creation within the reach of developers and product managers. This will add fuel to the NetCo-ServCo debate. It will also require infrastructure owners to develop platform and ecosystem business models with corresponding commercial and risk-management offers.

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## 4.2 Political Intervention

One consequence of near ubiquitous cellular connectivity and the widespread dependency on mobile communications is to place communications networks at the heart of each nation's critical infrastructure. Adding geopolitical rivalry and concerns about external technology dependency to the mix increases the prospects for political intervention in the communications industry.

One means of strengthening a nation's influence over future generation communications systems is through investment. Several governments have committed significant budgets to 6G R&D, in effect financing strategic innovation and laying the foundations for national industry strategies. Like-minded nations have articulated principles to influence technology sovereignty, trustworthy supply chains and the development of 6G through international collaboration. Examples of national level initiatives include South Korea's target to be the first to launch 6G systems and India's announcement for its research community to contribute 10% of all 6G patents.

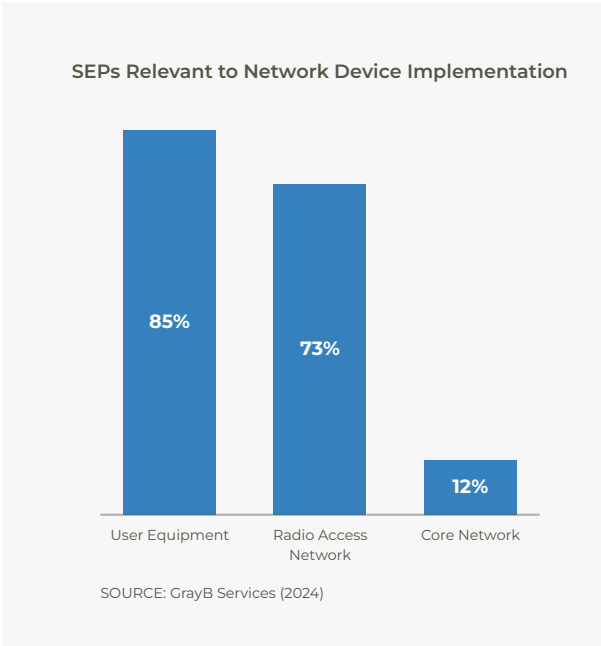
Another geopolitical factor that will drive the communications sector is the rise in defense sector funding. An important market development twist will arise from experimentation in application areas that appear unpromising when assessed on purely commercial grounds. Dependable communications and localized networking for military teams, drones for attack, delivery systems, remote observation, and IoT-sensing are example cases that will push technical innovation. These are likely to have spillover benefits for technologies and services in consumer and enterprise markets. For example, design concepts for dependable communications might influence 6G's goals on how to deploy trustworthy and resilient networks. Other spillover benefits might include intelligent techniques for managing communications from sleep mode or ultra-long service life IoT devices. Such developments will present opportunities for researchers and commercial vendor communities.

Closer to the communications industry, there are other areas where government intervention will affect the future course of 6G. The obvious areas relate to spectrum and net neutrality policies, both of which shape markets. From a critical, public infrastructure standpoint, cybersecurity protections will lead to obligations that define operating models and cost structures. Inevitably, digital rights issues, AI and privacy regulation, and competition law are other areas where governments interventions will have an impact on industry structures and market opportunities.

## 4.3 Technical Innovation

Technical innovation represents a third driver of industry change. It can enable new markets, expose new sources of value and, as in the aspiration of Open RAN proponents, create the conditions for competition and SME market entry.

One reference point for exploring the potential of technical innovation involves the early 2000 euphoria surrounding the auction of 3G spectrum. Then, valuations and industry



optimism focused on market projections for an extensive list of data-oriented services that would compensate for the revenue gap caused by declining voice revenues. The industry went on to experience a period of disappointment, much like the current sentiment around 5G and the IMT-2020 use-cases for URLLC and mMTC. The positive lesson from the 3G era comes from the Apple iPhone. It transformed the market by recasting users' experiences and exposing new value from users' mobile devices. Making this happen required visionary thinking. It also relied on a business model and technical innovations such as the App Store, Gorilla glass and user-interface design.

What might the equivalent dynamic look like for the 5G to 6G transition? The user equipment category, more than core network services, seems central to answering the question of unlocking new market opportunities. The accompanying illustration shows

how user equipment and RAN dominate the SEP activity relevant to network device implementation. This is a reminder that the industry motivations prioritize high-volume, hardware opportunities.

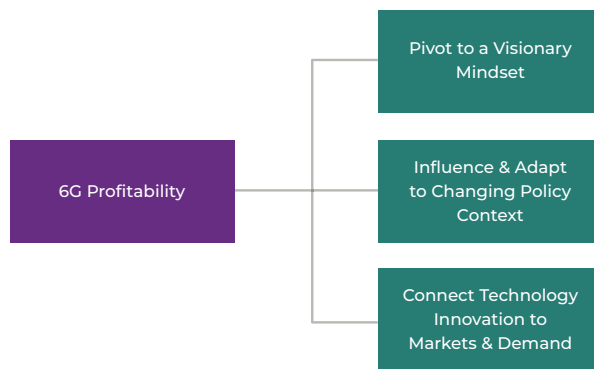
In the case of 6G, what form factor, technical capabilities and user-interface might generate consumer-level market volumes? There are high hopes for ocular devices and extended reality (XR) experiences although these currently involve cumbersome and energy-hungry devices. Advances in language-based AI technologies, context information systems and personal agents represent an alternative pathway for future generations of audio-vocal interfaces. Key 6G technologies – joint- and integrated communications and sensing – could add a new dimension to contextual information and enhanced sensing so there is an opportunity to create new service propositions that can increase consumer spending. There is also a role for native-AI in devices and networks to enable more intelligent and responsive services by bringing together user-generated content, cross-silo information, and contextual insights.

The industry also needs to address demand for industrial-type devices. The lack of industrial IoT device ecosystem is a contributing factor in the slow adoption of 5G in the industrial sector. There is a difficulty here because the volumes associated with non-consumer devices and chipsets are commercially less appealing to technology suppliers. Smartphone business models geared to high volumes, high retail prices and two-to-three-year replacement cycles do not fit the profile of industrial applications.

The sheer size of the Chinese market, with its growing innovation and integration of IoT in business applications could sway industry developments more widely. This poses a dilemma for markets that seek to reduce their dependence on China-sourced technology.

## 5. Changes to Anticipate

Commercial 6G operations are expected to happen about five years from now. Much needs to happen over this period for 6G to have a stronger and more positive market impact compared to 5G. Firstly, industry participants need to move beyond business pragmatism and pivot to a visionary mindset, targeting new revenues from defense and enterprise sector opportunities. Equipment suppliers and service providers need to target development- and application-oriented research, to partner more with specialists and start-ups, and to engage in technology acquisitions.



A visionary mindset applies also to the cost side of the profitability equation. Cloud-native techniques, software defined networks and virtualization are all expected to have an impact on investment cycles, financial decision making and operational agility.

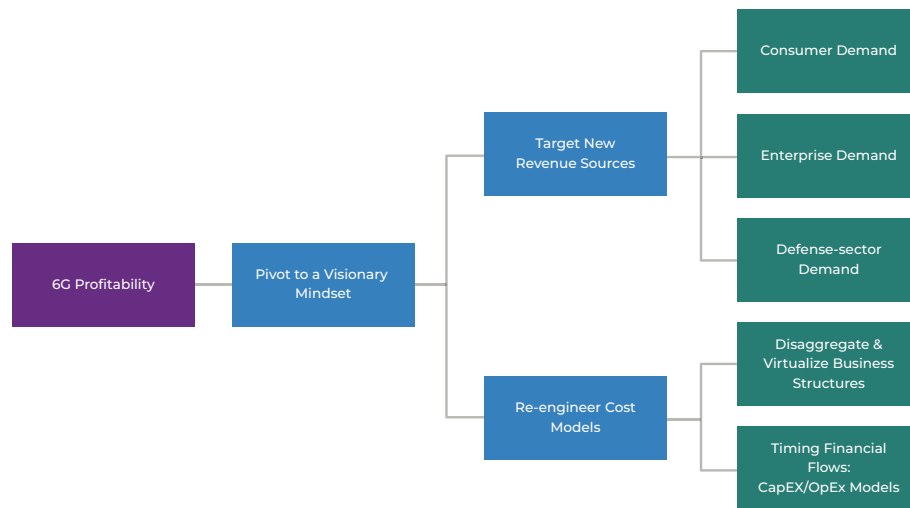
There will also be industry milestones as the policy context takes shape across a range of long-established and new market dimensions. The industry can also anticipate developments that aim to connect technology innovation to markets and demand. Industry investments into the 6G usage scenarios that define the IMT-2030 vision and regulation of technologies that are complementary to the communications sector will define milestones in the journey to 6G.

### 5.1 Pivot to a Visionary Mindset

The communications market is operating with a cautious mindset, having invested in 5G without seeing strong commercial returns. Cost control and patience are key watchwords, tempered by the notion that 6G looms on the horizon before 5G has been fully commercialized. Common themes among the interviewees are the need to 'switch from cost-control to opportunity' and act with a 'visionary mindset.'

In 'following the money' to new revenues, one frame of reference is to explore new consumer propositions while developing new markets to address the defense and enterprise sectors. In the case of consumer users, they have access to multiple models





and voice service providers; competitive differentiation is no longer about network quality. New consumer revenue streams can come from new experiences, new modes of interaction and an increased dependency on personal communications devices. These will depend on innovations in devices, information-services, and trustworthiness, analogous to the iPhone phenomenon.

While there will still be a need for competitive coverage at a national level, opportunities will emerge to service buildings, factories, and transportation hubs, both for landlords and their tenants. To address these place and user categories, communications services providers will need to develop brands and distribution channels that align with enterprise customer segments.

Having invested heavily in aligning their brands with connectivity for consumers, communications service providers have insufficient brand association with enterprise customer solutions. Some of these new enterprise customers might not require full stack 6G systems. Others will prioritize service dependability and service quality guarantees. These factors imply the need to develop new propositions, not just technically but along end-to-end service quality and commercial risk-sharing dimensions.

The defense segment is likely to present more immediate opportunities for startups and innovators in areas related to sensing, low production-volume devices, communications security, and portable 'out-of-a-box' networks.

The cost side of the profitability equation will have an impact on business structures. There will be gains from retiring legacy systems. Unlike other industries, the communications sector delivered at scale without emphasizing optimization or automation strategies which look more appealing with advances from innovation in 6G. Other cost decisions will determine investments in service-development via internal R&D, partnering with start-ups, and technology-provider acquisitions.

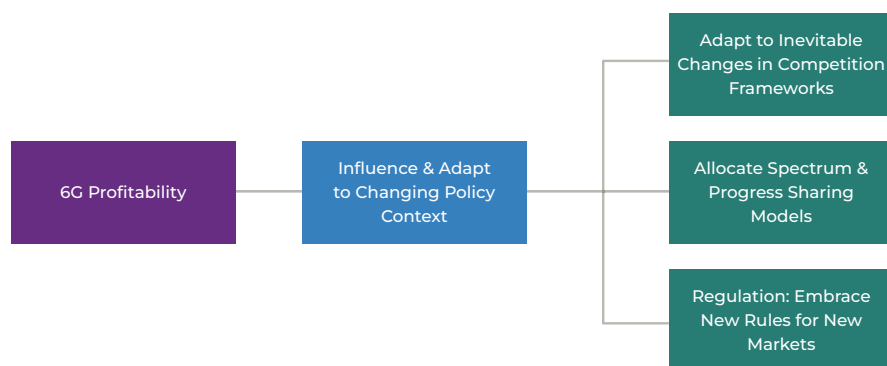
Treating networks as a competitive differentiator will cease to be the norm. 6G's goal of delivering ubiquitous coverage will involve multiple access technologies, an example of which is the alignment of cellular and non-terrestrial networks. There will be stronger incentives to increase network and network-function usage by third parties (e.g., developers and specialist service providers) via platform and ecosystem strategies. NetCo-Servco separations, neutral host orchestration and the formation of developer ecosystems will be early indicators that this dynamic is gaining momentum.

There should also be an impact on cost timings. Software defined networks and virtualization will enable shorter investment cycles and more rapid innovation. Aspirations to move away from the industry's current ten-year cadence should also smooth the industry's peak to trough expenditure profile.


## 5.2 Policy Context Will Introduce New Rules

Competition is an important driver of national industry strategy and technology sovereignty policies. Government leaders have proposed key design principles for the advancement of 6G and formed coalitions of like-minded partners. The next step is to translate these ideas into action in ways that balance the role of established suppliers while encouraging competitive entry from innovators and new entrants.

6G is also a part of national industry strategies through government funding of R&D programs and national objectives to be a leading force in 6G. In the case of India, there is a target for the country's research and business communities to contribute 10% of all 6G patents. There is a fine balance between these developments having a positive impact on the 6G market and not undermining the goal of a single, global standard.



There is a different complexion on in-country competition with policy makers seeking competitive markets. US policy makers are supporting Open-RAN to foster innovation and a competitive supplier base. How far will this support go before the industry sector becomes self-sustaining?



In Europe, there is a debate about the merits of requiring several mobile network operators in each country to ensure consumer choice and competition. This might not represent the best model to address other customer segments or to make best use of the industry's investment capacity. Industry consolidation, which will depend on policy change, might be a necessary step for the sector's viability and continuing investment in network infrastructure.

At the same time, the nature of markets is changing. The border between communications and information service providers is blurring. Digital Markets regulation identifies 'gatekeeper' digital platforms and seeks to make markets in which they operate fairer and more contestable. The changes wrought by regulation are sure to affect traditional communications markets.

Spectrum is another factor in the policy mix. The communications industry continues to advocate for the allocation and global harmonization of additional spectrum bands for 6G. The ITU's WRC-27 is the next key milestone in this process. Once spectrum becomes available, the next step involves assignment. In the USA, one consequence of a lack of political consensus is a lapse in the FCC's authority to auction spectrum. While this affects near-term needs, the 6G market is watching for longer-term predictability.

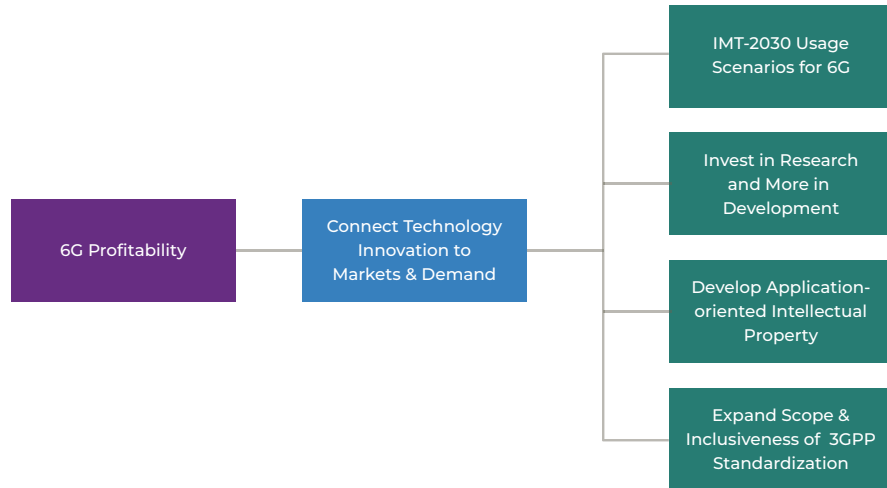
Sharing concepts are a third area related to spectrum policy. Sharing is becoming a reality with early lessons from the use of CBRS spectrum in the USA and sandbox experiments in other parts of the world. Aside from technical issues, market developments to monitor include enabling factors such as the launch of increasingly dynamic spectrum information sharing resources with associated commercial and oversight models.

The third major area for policy applies to new forms of regulation. Rules on the development and use of AI are key, given the technology's importance in 6G systems. The intensive use of energy and water resources for AI and data centers should send a warning about another avenue for regulation within the broader context of energy efficiency and life-cycle sustainability goals. Finally, given the data intensity and personalization featuring in 6G use cases, the industry should anticipate regulation on privacy and digital rights topics.

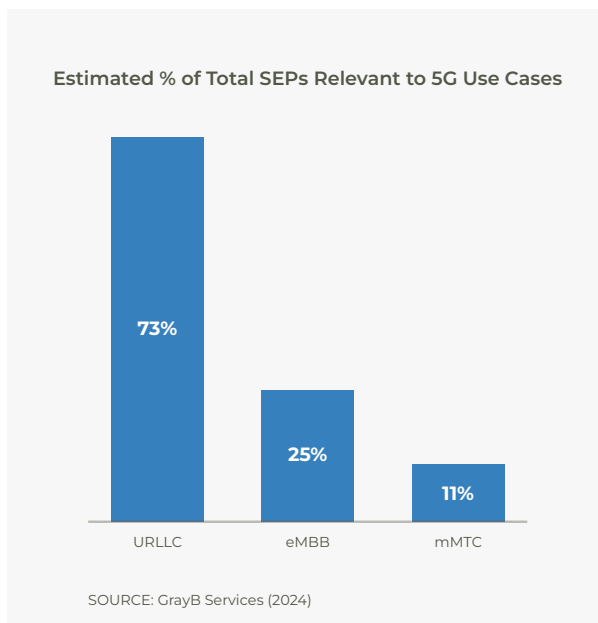
From a market adoption standpoint and in anticipation of emerging market needs, the communications industry has initiated a discussion about key value indicators (KVI) for 6G. In terms of market developments to anticipate, there is a question as to whether these will feature via 3GPP activities or whether they will emerge from non-telco sector regulatory agencies.

### 5.3 Connecting Technology Innovation to Market Development

The IMT-2030 Vision highlights six usage scenarios for 6G. Three of these - immersive communications, massive communications, and hyper-reliable & low latency communications - are extensions of the IMT-2020 Vision. Three others are new: ubiquitous connectivity, AI and communications, and integrated sensing and communication.



Patent declarations will be one measure of progress towards these use cases. These will add to the URLLC, eMBB and mMTC categories associated with 5G as illustrated by the distribution of Standard Essential patents (SEPs) below. The relative weight of URLLC patents should see a rise in the mMTC category, addressing enterprise IoT demand, and the three additional use case scenarios defined by IMT 2030.



Many of the 5G SEPs were filed before the 5G development era (i.e., 2016 or earlier). They reflect innovators' expectations to enable a higher grade of connectivity in gaming and industrial application areas. The illustration also carries a warning about the delivery chain between innovation and market demand. The weight of URLLC SEPs does not appear to have materialized in service propositions or revenue generating market adoption. Part of the improvement for 6G will involve closing the information gap between the communications industry and user organizations. The 6G SNS JU offers one example of how this might be achieved in the form of a standards tracker for the 5G to 6G journey.

Targets around ubiquitous connectivity should see developments in multi-access systems. This is

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evident from the satellite sector's growing attendance both at the August 2024 3GPP working group meetings and in GSMA activities. The goal of ubiquitous connectivity should also see developments in lower cost hardware to serve the economics of global south and frontier America markets.

Since 3GPP focuses primarily on technology, there should also be signs of implementation and deployment-oriented standardization in other industry bodies. These include the GSMA, the Linux Foundation, the TM Forum, and the Open RAN Alliance. The first three of these have already started to experiment beyond purely technical issues by addressing market development, distribution channel and developer engagement challenges in exposing network APIs.


The increased emphasis on applied and demand-led technologies needs to manifest itself through bigger spending on the 'development' part of R&D. Some of the evidence to prove that 6G technology will satisfy market demand will involve earlier and active involvement from defense and vertical industry representatives. As one interviewee described it, there should be more vertical industry participants with early participants progressing from observer to contributor status at 3GPP. There also needs to be an active and technology-pull aspect via market-readiness trials.

Established standardization models are likely to evolve for the 6G era. There is interest in speeding up standardization's clock-speed, encouraging collaboration across major standardization institutions (e.g., between cellular and Wi-Fi camps), and leveraging software disciplines to release features more frequently. Open-source techniques have a role to play, with implications for the evolution of open standards and open-source business models. Open RAN standardization is a test of whether durable standardization can succeed outside of 3GPP's operating model. The Open RAN process is in its early phases. Advocates and industry observers are studying how well the market develops and whether standardization can continue over multiple years with a roadmap that is able to accommodate future standardization needs.

## 5.4 Risks

The challenges facing the industry are less about technology and more to do with embracing change. The imperative to build networks for affordable, mass-market voice and connectivity services is plateauing. There is limited market upside when almost everyone that wants a cell phone or personal communications device has one.

The market to come represents another S-curve with industry participants holding high expectations for service innovation, more demanding defense and enterprise customer segments and opportunities for new, vendor and service-provider entrants. These developments will force change onto long-established industry bodies, government agencies and commercial providers. This raises the question of how well they can adapt organizationally and operationally.



There is also a need for more research into the evolution towards a software dominated future with a faster clock-speed and pace of business innovation. Will the faster deployment of communications systems introduce hidden vulnerabilities? If so, what will it take to underwrite society's need for fault tolerant critical infrastructure? These are the biggest risks for 6G given the hurdles involved in changing habits, adjusting to modern-day business and career incentives, and striking the right balance between innovation and negative externalities linked to next generation communications services.

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