



ASEAN 5G SKILLS FRAMEWORK



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Winner Project
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The ASEAN 5G Skills Framework provides a region-wide view of 5G deployment across ASEAN. It is intended to guide policymakers, industry players and enterprises by outlining the 5G landscape, identifying critical roles and skills across the value chain, and highlighting key gaps that must be addressed to enable effective adoption and commercialisation. As such, it serves as a strategic reference to support workforce development, strengthen digital capabilities and accelerate enterprise transformation.

The framework is particularly relevant as ASEAN member states progress at different stages of 5G maturity. By offering a common reference point, it enables cross-country collaboration, knowledge sharing and alignment of talent development efforts to build a future-ready regional workforce. This report also acknowledges the inclusion of Timor-Leste as ASEAN's newest member, recognising its role in the region's long-term digital and workforce development journey despite its later-stage incorporation into the study.

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Forward

Executive Chairman of Malaysian Communications and Multimedia Commission (MCMC)

ASEAN stands at an important point in its digital transformation journey. Across the region, governments, industries and communities are embracing new technologies to drive economic growth, improve public services and create new opportunities for businesses and citizens alike. Among these technologies, 5G has emerged as a key enabler that will accelerate innovation, strengthen regional competitiveness and support ASEAN's vision of a more connected and digitally inclusive future.

As investments in 5G infrastructure continue to grow, attention must also be given to a critical factor that will determine the success of this transformation: people. Realising the full benefits of 5G requires more than networks and technology. It requires a workforce equipped with the knowledge, skills and capabilities to design, deploy, operate and harness the possibilities that 5G enables across industries and sectors.

The diversity of ASEAN presents a unique opportunity to harness to realise respective 5G aspirations. Member States are progressing through different stages of 5G deployment and adoption, resulting in varying workforce requirements and priorities. At the same time, rapid technological advancements are changing the skills needed for both emerging and existing occupations. This creates an urgent need for a structured and forward-looking approach to workforce development that can support countries at different stages of their 5G journey.

The ASEAN 5G Skills Framework has been developed to address this need. By identifying critical roles and priority skills across the 5G ecosystem, the framework provides a common reference point for governments, industry players, enterprises, educational institutions and training providers. It is intended to support more informed workforce planning, strengthen talent development efforts and foster greater alignment between industry demand and skills development initiatives across the region.

This framework reflects the collective contributions of stakeholders from across ASEAN, whose insights and expertise have helped shape a practical and regionally relevant resource. Their collaboration demonstrates a shared commitment to strengthening workforce capabilities and maximising the value that 5G can deliver for our region's economies and societies.

I would like to express my sincere appreciation to all stakeholders who contributed to the development of this framework, including representatives from Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam. Their commitment was further recognised when the ASEAN 5G Skills Framework and Capacity Development Platform was named the Winner Project under WSIS Action Line C1 at the World Summit on the Information Society (WSIS) Prizes 2026, reflecting ASEAN's shared commitment to developing future-ready digital talent and strengthening workforce capabilities across the region.

As we look ahead, the development of digital talent will be as important as the deployment of digital infrastructure. By working together to build a skilled, adaptable and future-ready workforce, ASEAN can unlock the full potential of 5G and create lasting economic and social benefits for generations to come.



**YBhg. Tan Sri Mohamad Salim
bin Fateh Din**
Chairman, MCMC

CHAPTER 1

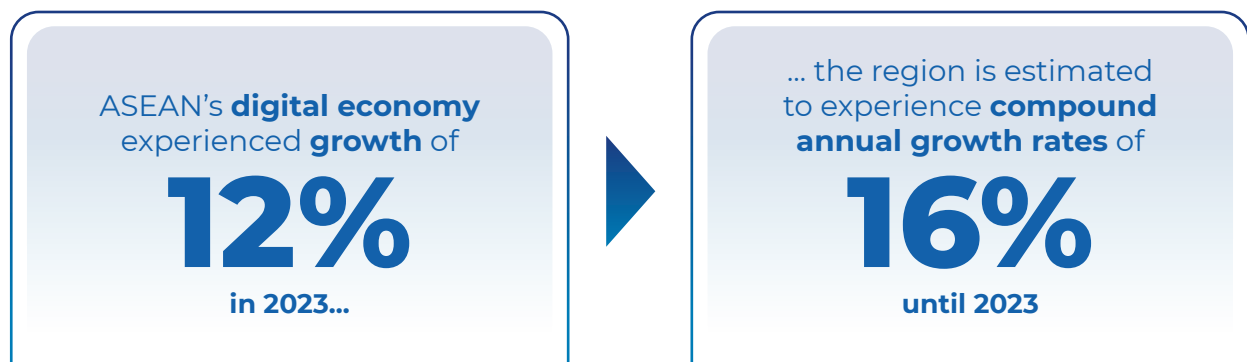
ASEAN 5G LANDSCAPE OVERVIEW

ASEAN 5G Overview

ASEAN is rapidly advancing its digital transformation, with the promise of 5G as the cornerstone of its technological evolution

The global 5th Generation (5G) landscape has experienced promising growth and transformation, with global 5G connections reaching over 2 billion worldwide and estimated to surpass 5.5 billion by 2030.

Recognising digitisation as a key driver for national and regional growth, the Association of Southeast Asian Nations (ASEAN) has made significant strides in developing its digital market...



As one of the most dynamic economic regions globally, ASEAN is positioned to further enhance its digital economy and establish the region within the global digital landscape. ASEAN's 5G adoption is driven by the need for enhanced connectivity, economic competitiveness and digital inclusion. With a combined population of over 670 million and a fast-growing digital economy, the region stands to benefit significantly from the deployment of next-generation mobile networks.

ASEAN's 5G journey has been marked by diverse progress across member states, reflecting variations in infrastructure readiness, regulatory frameworks and adoption levels. Member states such as Singapore, Thailand and Malaysia have taken early leadership roles, launching commercial 5G networks and pioneering industry use cases, while others are steadily progressing towards nationwide rollout. The region's 5G landscape is shaped by strategic government policies, private sector investments and regional cooperation aimed at accelerating digital connectivity. Despite the momentum, challenges remain. Spectrum allocation, infrastructure deployment and affordability are key considerations in ensuring widespread 5G accessibility and enterprise applications.

5G represents a major leap in mobile network technology, engineered to deliver faster data transmission, minimal latency and the ability to connect to a vast number of devices simultaneously. Unlike its predecessors, 5G is not merely an upgrade, it is a catalyst for innovation, unlocking new possibilities that will enhance digital experiences and drive transformative growth across the ASEAN region.

Key Features of 5G

1



Higher Data Speeds

Up to 100 times faster speeds and greater capacity than 4th Generation (4G)

2



Ultra-Low Latency

Response times as low as one millisecond, making real-time applications possible

3



Massive Connectivity

Supports up to a million devices per km², making it ideal for smart cities and large-scale Internet of Things (IoT) deployments

4



Network Slicing

Creates multiple networks on a single physical infrastructure, enabling tailored services and resource efficiency

5



Energy and Spectral Efficiency

Improved energy consumption per bit and spectrum utilisation for greener networks

6



Virtualisation Capability

Extends deployment reach and allows fungible, cost-effective implementation

5G Redefines Enterprise Connectivity & Operations

The rollout of 5G is influencing a change in industries and societies by enabling new levels of connectivity, faster speeds and greater efficiency.

More than just an upgrade in network performance, 5G is enabling change in how enterprises connect and operate. Beyond higher speeds, 5G facilitates real-time data exchange, smarter automation and more efficient systems. From powering Artificial Intelligence (AI) and IoT to enabling advanced industrial applications, 5G is laying the foundation for a more inclusive, resilient and future-ready ASEAN.

As a next-generation network, 5G is an enabler of digital advancement across multiple sectors. This report will examine its impact on industries such as manufacturing, oil and gas, transport, logistics and power and utilities, highlighting how 5G drives efficiency, automation and competitiveness. These featured sectors benefit from the three foundational service categories of 5G that streamlines operations, drives automation and improves decision-making, supporting ASEAN's ongoing digital integration.

The three foundational service categories of 5G are Enhanced Mobile Broadband, Ultra-Reliable Low Latency Communications and Massive Machine-Type Communications



Enhanced Mobile Broadband (eMBB)

Supports high-definition video streaming, immersive Augmented Reality (AR) / Virtual Reality (VR) experiences and cloud-based applications



Ultra-Reliable Low Latency Communications (URLLC)

Enables real-time, high-reliability communications needed for industries such as autonomous driving



Massive Machine-Type Communications (mMTC)

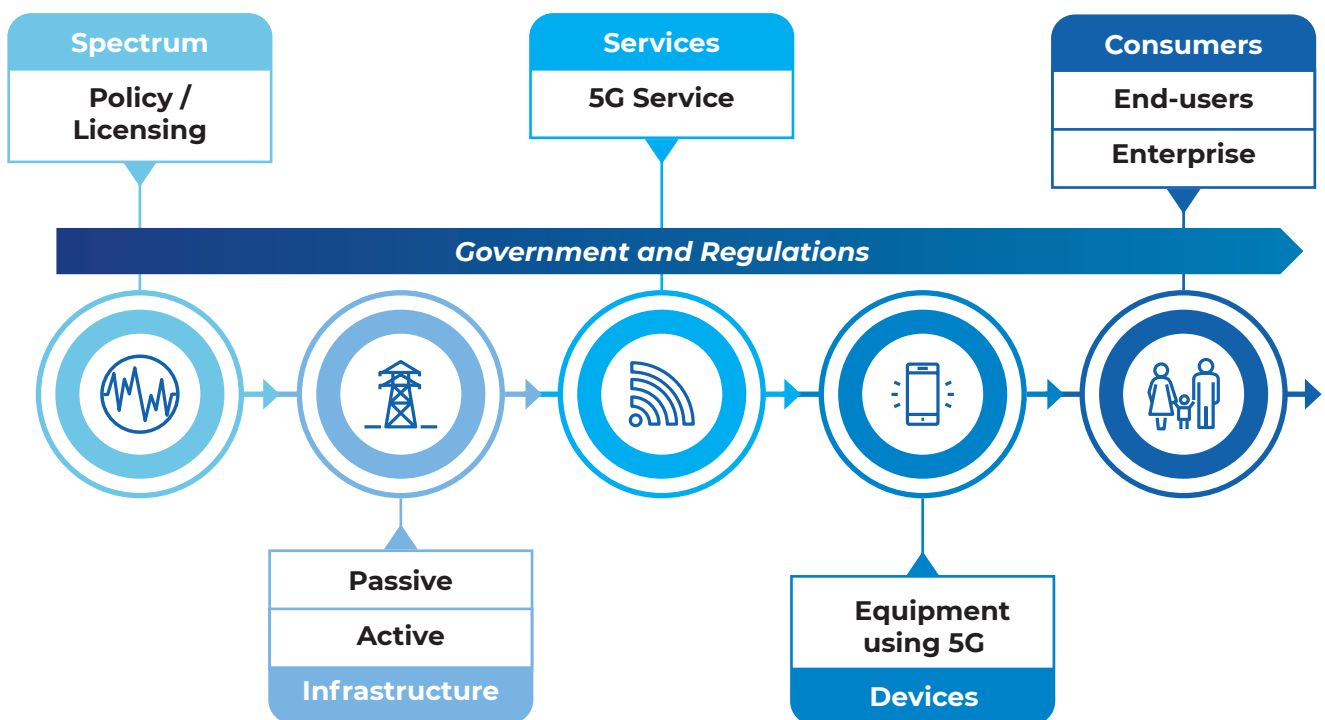
Provides reliable, scalable connectivity for high density of connected devices, with minimal human intervention

5G Value Chain: From Spectrum to Consumers

The successful deployment and utilisation of 5G technology relies on interconnected components that occur sequentially. Each stage plays a critical role in enabling the next, ultimately delivering value to consumers.

Below is an overview of the 5G ecosystem and lifecycle, highlighting these essential components through the 5G value chain.

5G Value Chain



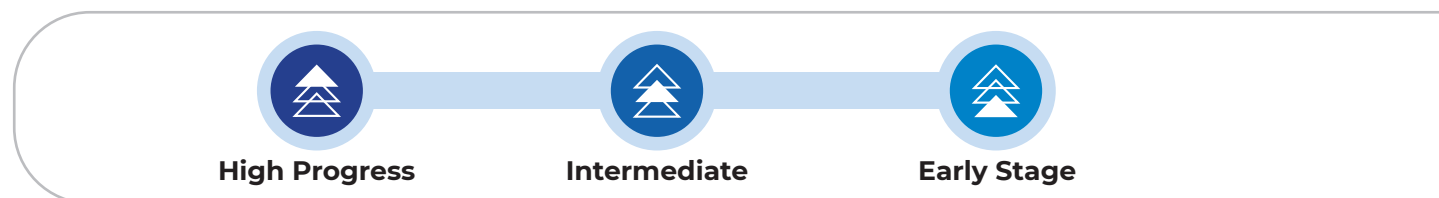
This report is structured on the core components of the 5G value chain – spectrum, infrastructure, services devices and consumers, with government and regulations playing an overarching role. While there are adjacent domains that are highly relevant and in some cases critical, to 5G success, they have been considered extensions of the primary ecosystem outlined in this report and are therefore regarded as beyond its scope.

Understanding the 5G Value Chain

Value Chain	Description
 Government and Regulations	Governments serve as a critical enabler of 5G, shaping national and regional ecosystems through regulatory and policy oversight. With an overarching role, effective governance ensures equitable adoption, protects national interests and provides strategic direction for ecosystem stakeholders. Across ASEAN, the extensiveness of government regulations and involvement differs, influencing the pace, coverage and structure of 5G rollout.
 Spectrum	Spectrum is the foundation of 5G connectivity, as it determines speed, coverage and capacity of networks. Governments and regulatory bodies allocate spectrum through licensing and auctions.
 Infrastructure	5G infrastructure comprises of physical and digital assets required to deploy and maintain networks, including passive infrastructure - physical infrastructure that supports 5G telecommunication networks and active infrastructure - focuses on design, deploy, managing and optimising the 5G core telecommunication infrastructure covering wired, wireless and cloud-based solutions.
 Services	5G unlocks new business models, enhanced user experiences and industry applications. Service providers play a crucial role in delivering solutions that leverage 5G's ultra-low latency and high bandwidth. This component is supported by system integrators to design, deploy and manage end-to-end 5G-enabled solutions tailored to enterprise requirements.
 Devices	5G-enabled devices acts as the interface between the network and end-users, ranging from smartphones to industrial IoT sensors and smart city infrastructure. This component is supported by system integrators to ensure seamless interoperability between 5G-enabled hardware and complex enterprise systems, adapting device functionalities to specific industry needs.
 Consumers	Consumers drive demand for 5G and influence adoption rates across sectors, from end-users to enterprises and governments. Their needs and concerns shape how 5G networks and services evolve. All preceding elements of the value chain – spanning spectrum allocation, infrastructure development, service and device availability, ultimately converge to enable and support adoption.

The Current State of 5G across ASEAN

ASEAN's 5G development reveals a clear maturation pathway, with countries progressing through three distinct stages based on their deployment capabilities, regulatory frameworks and market adoption.



This progression reflects how 5G success depends on the convergence of multiple factors: technical infrastructure, regulatory enablement, market readiness and sectoral engagement. Coverage metrics in this analysis captures both network reach (population coverage) and actual user experience (time spent on 5G networks), providing a comprehensive view of deployment effectiveness.

The following table maps each ASEAN member state's position across the 5G value chain components:

		High Progress		Intermediate	
					
Launch Status		✓ 2018	✓ 2020	✓ 2021	✓ 2019
Spectrum Band Availability	Low	✓	✓	✓	✓
	Med	✓	✓	✓	✓
	High	✓	✓	✓	✗
5G Coverage		98%	95%	92%	70% ¹
NSA ² / SA ³		SA	NSA, SA	NSA, SA	NSA, SA
Featured Sectors	Manufacturing	●	●	●	●
	Oil & Gas	○	○	●	○
	Transport	●	●	●	○
	Logistics	●	●	●	○
	Power & Utilities	●	●	●	○
Government Initiatives		✓	✓	✓	✓

Note: Information presented is based on data from 2024 or the latest available year at the time of compilation.

¹=implementation in key cities in Visayas and Mindanao

²NSA: Non Stand-alone, ³SA: Stand-alone

Source: GSMA, Insights from stakeholders engaged, EY analysis



High Progress

High Progress countries have moved beyond basic deployment to achieve comprehensive enterprise integration across sectors. The most advanced are now transitioning from adoption-focused strategies to innovation-driven ecosystems that leverage 5G's full potential.



Intermediate

Intermediate countries face a critical juncture where infrastructure limitations and regulatory gaps constrain their ability to scale deployment, despite ongoing progress in foundational development.



Early Stage

Early Stage countries are laying essential groundwork through policy development and strategic investments, positioning themselves for future acceleration.

Early Stage



✓ 2021	✓ 2023	✓ 2024	✓ 2020	Trial 2024	Target 2025	Target N/A
✗	✓	✓	✓	-	-	-
✓	✓	✓	✓	-	-	-
✗	✓	✗	✗	-	-	-
23%	92%	N/A	17%	-	-	-
NSA	NSA	NSA	NSA	NSA	-	-
●	◐	◐	◐	◐	◐	○
○	◐	○	○	○	○	○
○	◐	◐	○	◐	○	○
●	◐	○	○	○	○	○
○	○	○	○	○	○	○
✓	✓	✓	✓	✗	✗	✗

Legend:



Deployed



Pilot/Trail



Interest expressed



None

N/A Not publicly available

Network Establishment through Spectrum and Infrastructure

Spectrum allocation and management plays a crucial role as the foundation of preparing 5G networks for deployment, as it determines connectivity capacity, speed and reach

ASEAN governments have adopted varied approaches to spectrum allocation, shaped by:



Regulatory Frameworks



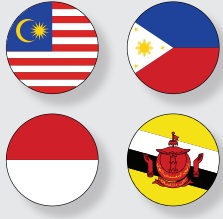
Market Dynamics



National Priorities

These allocation strategies influence competition, network deployment speed and investment incentives, ultimately shaping the region's 5G landscape.

Approaches to 5G Spectrum Allocation

	Rationale	Applicability across ASEAN*
 Spectrum Auctions Governments auction off spectrum licenses to the highest bidders	- Generates government revenue to reinvest in digital infrastructure and public services - Encourages competition and efficient use through market-driven pricing - Awards spectrum to operators with strong business cases, ensuring sustainable rollout	
 Beauty Contest Determined by proposal submissions, outlining technical and investment plans and social impact	- Allocates spectrum based on technical expertise, service commitments and innovation - Aligns with long-term development goals - Enables smaller players to compete based on proposal quality	
 Administrative Allocation Regulators assign spectrum directly to selected operators or state-owned entities	- Enables faster spectrum assignment and quicker rollout - Lowers spectrum costs for operators supporting affordable services - Supports national priorities by directing spectrum to towards public benefit	

Note*: Not all ASEAN member states are included due to lack of available information or 5G roll-out

As shown in the table above, spectrum allocation approaches vary across ASEAN, with member states selecting models that align with their national priorities, policy goals and market maturity. Rather than adhering to a single method, many adopt blended approaches to balance efficiency, competition and development needs. For instance, Malaysia evolved from administrative allocation to include competitive bidding processes, allowing regulators to better match spectrum assignments with operator capabilities while supporting emerging technologies.



CASE STUDY

5G Network in Malaysia



Malaysia implemented an administrative spectrum allocation in 2021, assigning 5G deployment to Digital Nasional Berhad (DNB) under the Single Wholesale Network (SWN) model. This centralised approach aimed to harmonise spectrum use and streamline infrastructure rollout by enabling regulators to directly manage provider selection.

As of 2026, Malaysia's 5G landscape is undergoing a shift with the introduction of a second network provider whereby U Mobile has been appointed to deploy its own 5G network, marking the transition to a dual network model. While regulatory oversight continues to ensure spectrum harmonisation, this evolution is expected to enhance market competition, increase deployment flexibility, accelerate nationwide coverage and potentially reduce costs for end users.

Phase 1:
Single Wholesale Network

Phase 2:
Dual Network

Jan 2025



Centralised 5G deployment model owns, builds and operates the entire 5G network infrastructure.

Mobile Network Operators (MNOs) do not build their own networks but instead buy access to this shared infrastructure.



Dual Network Model introduces a second entity alongside the original network provider, allowing two separate infrastructures to operate.

Each entity builds and manages its own 5G network, giving MNOs the option to choose between them.

Key Takeaways



Cost efficient deployment

– Reduces duplication of infrastructure, lowering costs and speeding up nationwide 5G coverage



Competition and innovation

– Drive improvements in service quality, pricing and technological innovation



Equal and fair access – Access to the network for all MNOs without having to invest heavily in their own infrastructure



Flexibility – MNOs have more choices but ensuring interoperability between networks is crucial to maintain seamless connectivity



Risk of monopolistic behaviour

– The success of the SWN requires effective governance, transparency and regulation



Governance complexity

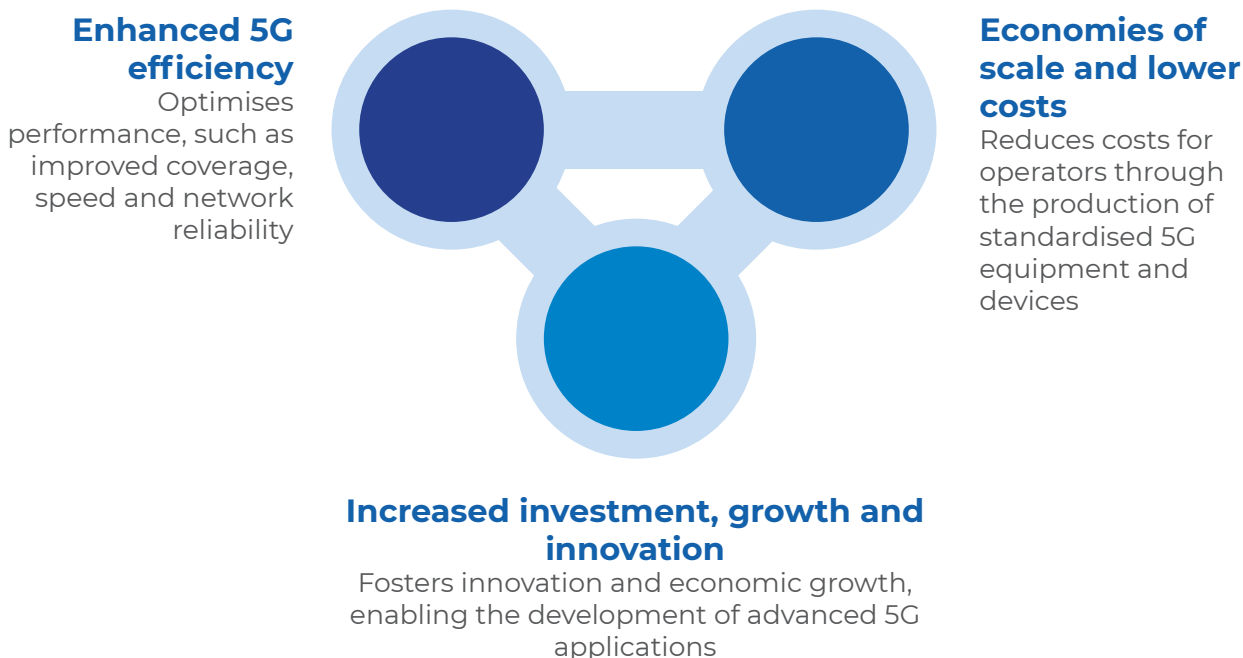
– Without strong coordination, there is risk of network fragmentation and inefficiencies

Harmonisation of Spectrum Allocation

Spectrum harmonisation is the strategic coordination of radio frequency (RF) allocation within and across countries to enable seamless and efficient wireless communication. It plays a crucial role in the successful deployment of 5G by minimising interference, optimising network performance and facilitating cross-border connectivity.

This coordination operates at both national and international levels. Domestically, it ensures optimal frequency allocation and reduces interference to enhance service quality. Internationally, it enables global roaming, IoT expansion and cross-border trade, collectively maximising the potential of 5G and advanced wireless technologies.

Key Benefits of Spectrum Harmonisation





The ASEAN Digital Masterplan 2025 aims to position the region as a leading community and economic bloc. Recognising spectrum harmonisation as fundamental to this vision, ASEAN committed to achieving regional coordination by 2025 as part of increasing broadband infrastructure quality and coverage.



CASE STUDY

ITU Initiatives to Enhance 5G



The International Telecommunication Union (ITU), representing over 193 member states including all ASEAN member states, supports spectrum harmonisation by providing globally recognised guidelines, frameworks and initiatives for structured 5G planning and implementation:



Spectrum management frameworks

- Develops frameworks on spectrum management
- Collaborates with stakeholders to establish compatibility across countries and regions



Global coordination

- Facilitates agreements to align allocations
- Organises World Radiocommunication Conferences



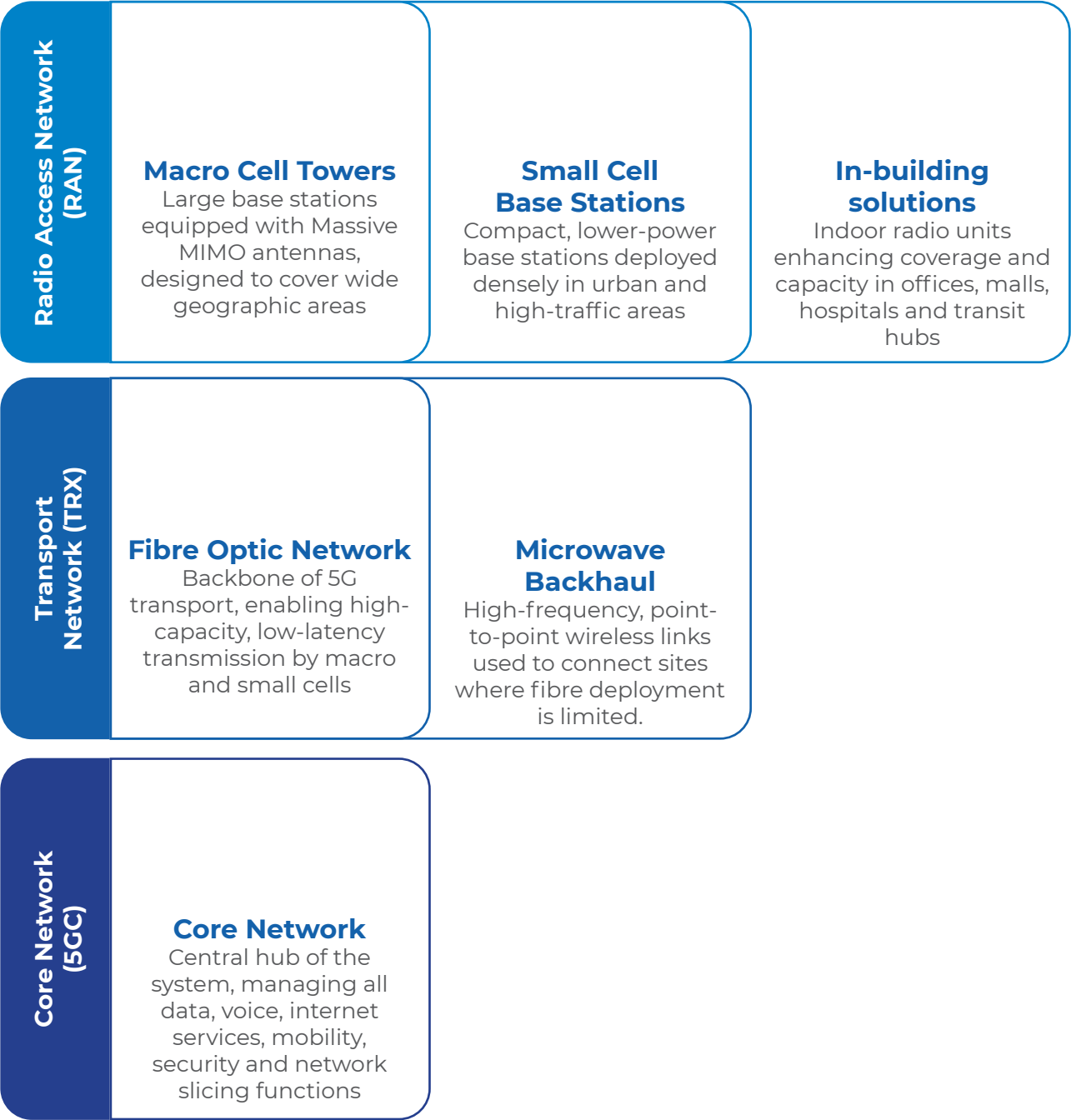
Capacity building and training

- Offers training programs workshops to enhance technical and regulatory skills of personnel across countries of varying progress levels

Given ASEAN's diverse regulatory environments and varying 5G maturity levels, aligning with globally recognised frameworks such as those of the ITU will provide the standardisation needed for effective regional integration while ensuring consistency across member states.

Infrastructure Development across ASEAN

Key Components of 5G Infrastructure

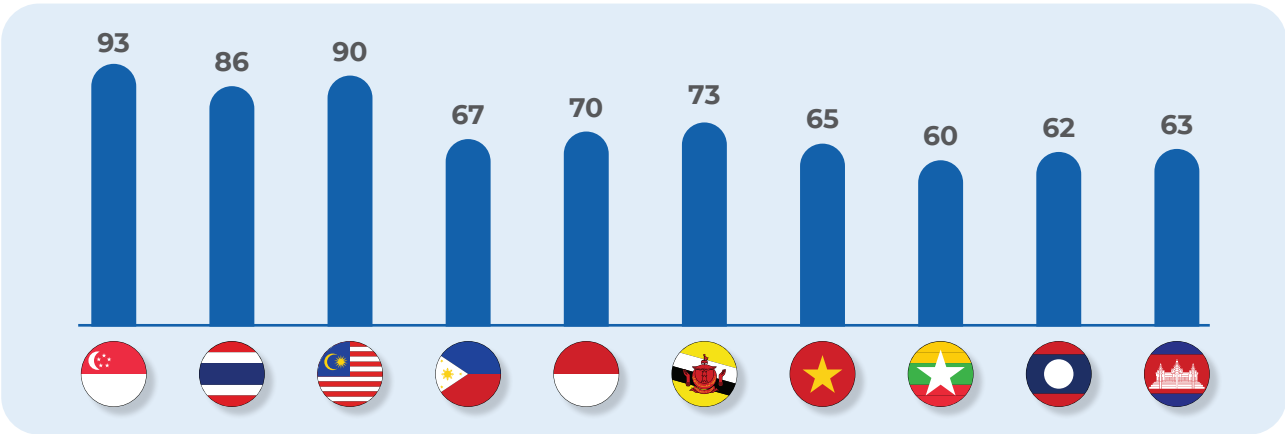


ASEAN member states show varying 5G network readiness, shaped by economic landscapes, population distributions and national priorities.

Singapore, Malaysia and Thailand benefit from advanced fibre networks and high base station densities, providing strong foundations for broad deployment. The Philippines and Indonesia, with large populations and complex geographies, are steadily advancing their networks, balancing urban rollouts with extending connectivity across dispersed regions. Meanwhile, Laos and Cambodia are investing in fibre deployment and network expansion to strengthen connectivity foundations.

The graph below illustrates these readiness differences across ASEAN member states, incorporating spectrum allocation for a comprehensive view of network capabilities.

ASEAN 5G Infrastructure Readiness Ranking



Note: Timor Leste has not been included due to lack of available information
Source: GSMA Mobile Connectivity Index

These variations directly impact deployment speed and efficiency. Singapore’s robust foundation enables seamless network expansion, while Indonesia’s rapid urban deployments in cities such as Jakarta require substantial investment for nationwide coverage, particularly in remote areas.

Enterprise adoption faces additional constraints from limited availability of true 5G-native devices. Many enterprises rely on 4G converters or aggregated modules—solutions that, while useful in bridging gaps, restrict networks’ ability to fully support high-volume, low-latency industrial applications.

CASE STUDY Factors Influencing 5G Scalability		
	Singapore – Favourable conditions to scale	Indonesia – Challenges to scale
Geographical conditions	- Small landmass with minimal terrain barriers - Densely urbanised	- Vast landmass with over 17,000 islands - Geographical diversity (e.g., mountainous areas, remote islands)
Population Distribution	- High population density - Easier to target demand areas	- Spread across rural and urban areas - Harder to prioritise deployment zones
Government Alignment	Centralised government enables efficient policy rollout and coordination	- Potential misalignment among local governments - Slower site access and permit approvals
Social Factors	Stronger enforcement and higher public awareness reduce risks such as vandalism	Cases of vandalism due to low awareness – need for public education and community engagement

Regional Infrastructure Sharing Opportunity

Infrastructure sharing involves telecom operators collaborating to share network resources such as towers, antennas, spectrum and core networks. While common within individual countries, ASEAN stands to benefit from regional application of this approach. Regional sharing supports seamless cross-border roaming, digital services and trade.

Given the region's diverse starting points, this collaborative approach offers an opportunity to accelerate 5G development while efficiently addressing coverage disparities and maximising shared resources across member states.



CASE STUDY

Leveraging Shared Infrastructure



The 3 major mobile operators in South Korea established an agreement to share their respective 5G networks in remote and rural areas

- Ensured consistent and widespread 5G coverage – an initial challenge for South Korea due to the shorter ranges of high-frequency bands
- Reduced the substantial financial investment required to establish a 5G infrastructure network, in which 3 operators committed a collective USD2.1 billion as part of the Korean New Deal



Cost Efficiency

Lower capital expenditure (CAPEX) by minimising duplicate infrastructure investment and operational expenditure (OPEX) through shared maintenance and streamlined operations



Faster Deployment and Coverage Expansion

Accelerates 5G rollout, particularly in rural and underserved areas where independent deployment may be cost-prohibitive



Facilitates Connectivity

Essential for seamless roaming and connectivity within a country or regions, supporting cross-border digital services, smart cities and regional trade

Closing the Digital Divide

The urban-rural divide presents a challenge for 5G networks, as operators typically prioritise urban centers due to higher population density, greater demand and favorable infrastructure conditions. Bridging this gap is essential to realise 5G's potential, as rural regions lack high-speed connectivity.

ASEAN member states face the task of serving both urban and rural populations while balancing densification strategies in cities with dispersed coverage models for remote regions.

Geographic Barriers

Challenging terrains including mountains, forests and remote locations create logistical complexities for traditional base station and fibre optic deployments across rural ASEAN.

Innovative infrastructure solutions:

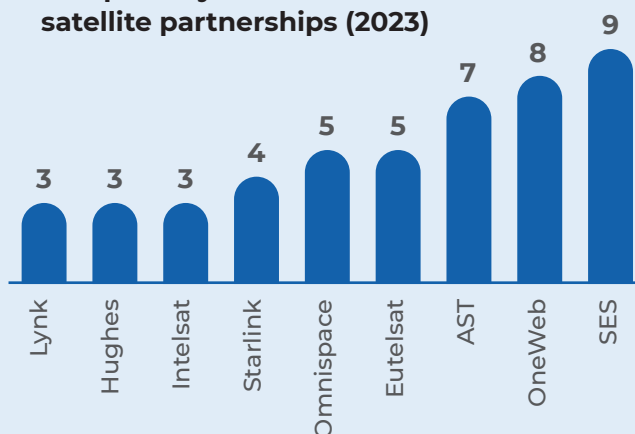
Small cells, low-cost equipment and satellite-based solutions offer more flexible alternatives that can overcome geographic barriers cost-effectively, allowing for adaptable deployment in difficult environments.



CASE STUDY

Low Earth Orbit (LEO) Satellites

of publicly announced telco-satellite partnerships (2023)



Satellite connectivity is disrupting traditional telecom models, with new companies launching LEO constellations. What was once seen as a backup option is now becoming a game-changer.

With the dawn of the 5G era, satellite's high-throughput and LEO constellations will cut latency by 10x, powering lightning-fast 5G backhaul.

Existing Connectivity Gaps

Many rural regions already lack reliable broadband access, creating an infrastructure gap that complicates the transition to advanced 5G technologies. This digital divide represents both a challenge and an opportunity for leapfrogging to next-generation networks.

Public-Private Partnerships:

Collaborative financing models can share the burden and risks of rural expansion, enabling accelerated rollouts while ensuring comprehensive coverage reaches underserved communities.



CASE STUDY

Telkomsel's 5G Public-Private Partnership



In collaboration with the Indonesian Ministry of Communications and Informatics (KOMINFO), Telkomsel has partnered with Ericsson and Qualcomm to conduct advanced 5G trials, focusing on Fixed Wireless Access (FWA) technology using 3.5 GHz and 26 GHz frequency spectrum.

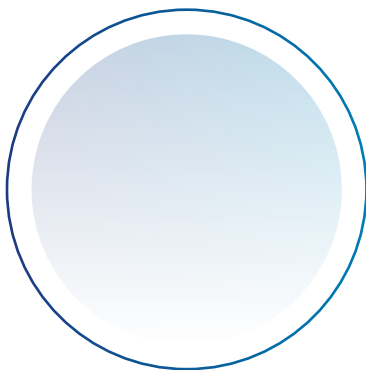
These trials aim to expand 5G coverage across Indonesia, including rural and remote areas.

Leveraging on Services and Devices to Deploy 5G

5G success extends beyond network infrastructure—it transforms connectivity into tangible services and devices that deliver real value

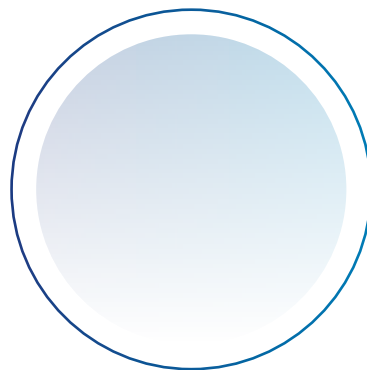
The success of 5G rollout depends heavily on the effective introduction, adoption and scaling of services and devices, as these are the critical touchpoints that demonstrate the tangibility of 5G's value for both enterprises and end users.

All elements of the 5G value chain, from spectrum allocation to network rollout, ultimately converge at the consumer level where the technology's full potential is realised.



For end users...

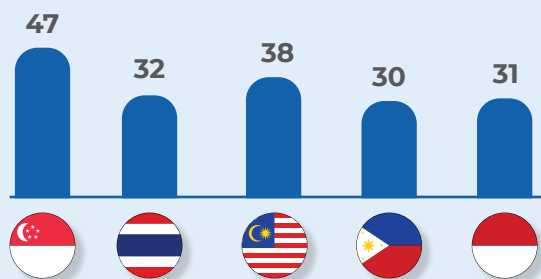
- Faster speeds
- Lower latency
- New digital experiences



For enterprises...

- Enhanced connectivity
- Automation
- Cross-industry innovation

Services



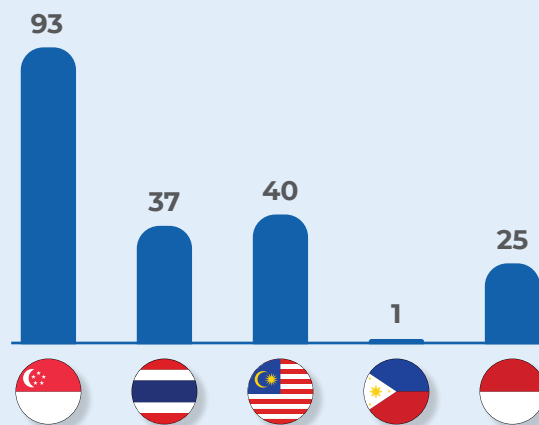
Note: Chart focuses on 5 countries with most advanced 5G current state based on data availability

Source: GSMA 5G Connectivity Index

The five ASEAN member states with the most advanced 5G landscapes have demonstrated similar revenue growth trends, with Singapore leading through nationwide coverage, robust infrastructure and enterprise focus.

Revenue growth serves as a key indicator of successful monetisation, reflecting rising demand for high-value solutions. The chart above highlights effective service deployment across the region.

Devices



Note: Chart focuses on 5 countries with most advanced 5G current state based on data availability

Source: GSMA 5G Connectivity Index

ASEAN member states show varying progress in device affordability, with Singapore significantly ahead.

Device affordability directly impacts accessibility, determining how readily consumers integrate the technology into daily use. As costs decline for 5G-enabled smartphones, IoT devices and industrial equipment, adoption rates increase, driving greater utilisation of 5G networks.



CASE STUDY

Government Initiative to Drive Device Affordability



Malaysia's Pakej 5G RAHMAH initiative, spearheaded by the Malaysian Communications and Digital Ministry in collaboration with five telecommunication companies, was launched in August 2023. This initiative aims to accelerate 5G adoption among underserved communities. By bundling 5G-enabled devices with affordable data plans and additional incentives, the initiative reduces financial barriers for low-income groups and civil servants.

Recorded **98,979** subscriptions in the first 2 months

Beyond making 5G more accessible, Pakej 5G RAHMAH is a strategic move to drive digital inclusion, ensuring broader participation in Malaysia's evolving digital economy while fostering a more equitable technological landscape.

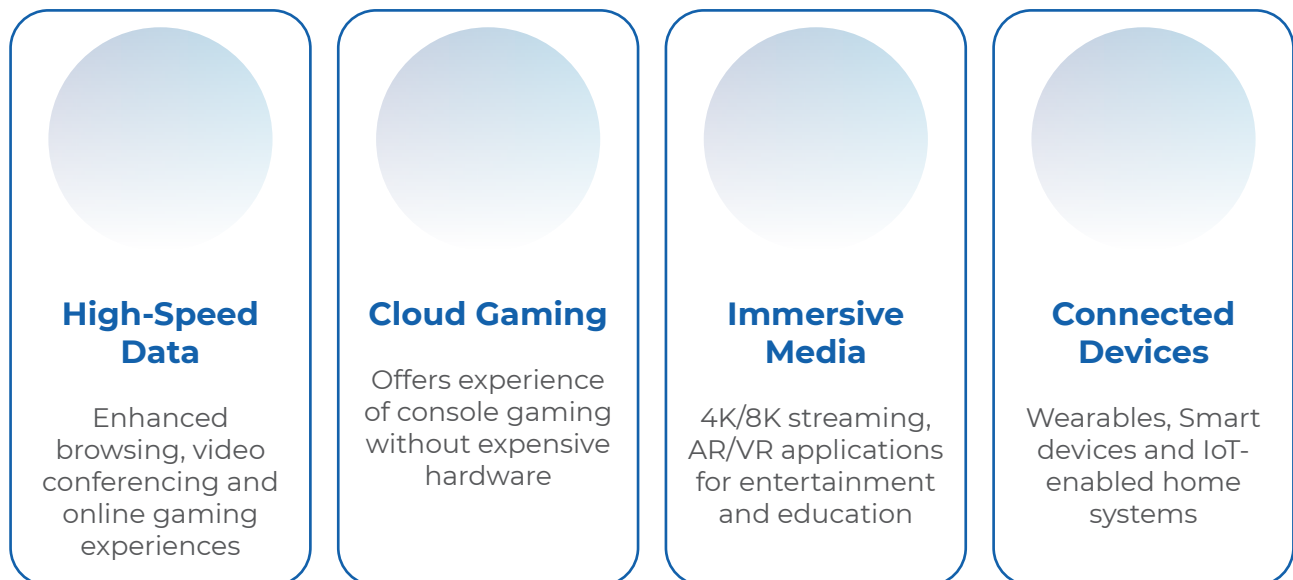
5G Service Adoption

ASEAN's 5G deployment has evolved from initial consumer-focused applications to enterprise solutions. While early adoption centered on high-speed mobile connectivity, gaming and streaming through eMBB capabilities, maturing networks now enable industrial transformation via URLLC and mMTC technologies.

End user-centric 5G Adoption

Initial 5G rollout across ASEAN prioritised consumer applications, with telecom operators delivering eMBB services that provide faster speeds, lower latency and greater network capacity than 4G. In Intermediate and Early Stage markets, operators focus on strengthening connectivity to broaden end-user access, emphasising mobile services and fixed wireless access as cost-effective alternatives to fibre infrastructure, particularly in areas with limited fixed connectivity.

As 5G adoption progresses, consumer demands continue to shape service development, with notable consumer-centric 5G services including:



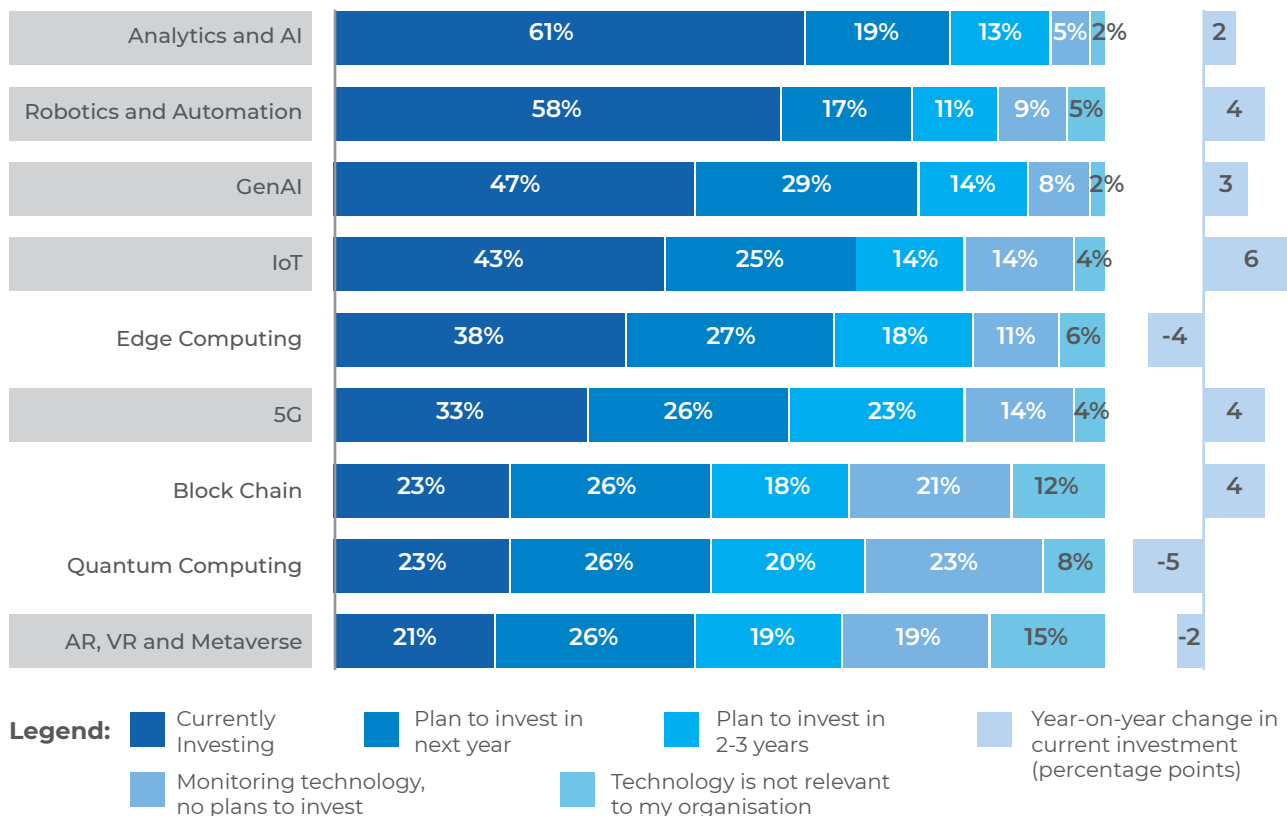
Enterprise Technology Transformation

Beyond consumer applications, enterprises are increasingly tapping into 5G to revolutionise connectivity, automate processes and enable real-time data exchange across sectors. ASEAN markets increasingly emphasise enterprise 5G adoption, moving beyond basic connectivity to integrated business solutions. High Progress markets in ASEAN are placing greater emphasis on enterprise adoption of 5G, moving beyond basic connectivity to integrated business solutions.

As telecom providers shift their focus towards enterprise solutions, tailored 5G applications such as private 5G networks, edge computing and network slicing are emerging as critical enablers for industry-specific use cases. This shift reflects growing enterprise investment in 5G and related technologies across industrial sectors, with 5G serving as a foundational enabler for AI, GenAI, IoT, analytics, robotics, automation, AR and VR capabilities.

Global data indicates 5G experiencing the highest year-on-year investment growth, followed by GenAI and IoT, highlighting its strategic importance for next-generation business transformation and economic growth across ASEAN.

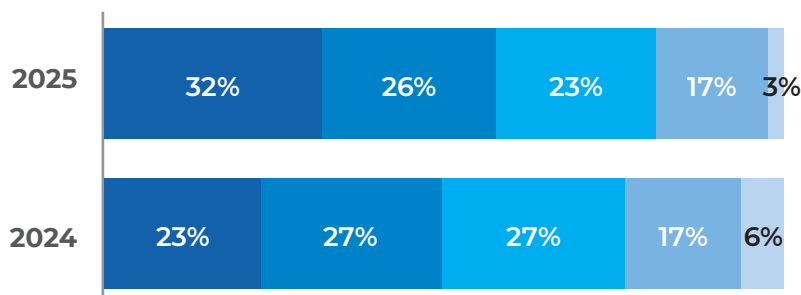
Global Technology Investment by Enterprises



Source: EY Reimagining Industry Futures Study 2025

Past, Current and Future 5G Investments in Asia

The three-year outlook for 5G investment remains robust, driven by APAC enterprises' demand for advanced network solutions. Many countries are preparing for 5G SA deployments and 5G Advanced (5GA) implementation, which will enable enterprise solutions with ultra-low latency. Commercial 5G SA rollouts are already accelerating across key Asia-Pacific markets.



Source: EY Reimagining Industry Futures Study 2025

5 Trends Shaping ASEAN's 5G Landscape

With ongoing progress of ASEAN's 5G landscape, several trends are emerging as the region moves toward 5G deployment. These trends also highlight the growing interest and integration of 5G across various sectors.



TREND 1

Telecommunication Companies Moving Towards B2B2X

Telecommunication companies move towards a B2B2X (Business-to-Business-to-Customer) business model is a strategic shift from the traditional focus on connectivity services to partnerships with enterprises to offer end-to-end solutions.



TREND 2

5G enabled AI, IoT and Automation

5G-enabled AI, IoT and automation are transforming industries by delivering high-speed, low-latency connectivity for real-time data processing, intelligent decision-making and increased operational productivity.



TREND 3

The Rise of Private 5G Networks

With enterprises increasingly adopting 5G, there is demand for dedicated networks offering full control, enhanced security and high performance. Thus, making private 5G crucial for industries such as manufacturing, oil and gas, transport and logistics.



TREND 4

Enterprise Adoption Challenges with ROI

Enterprises face challenges in justifying the Return on Investment (ROI) of 5G. The high upfront costs and complexity of integrating 5G into existing systems, make it challenging for enterprises to quantify the long-term value and tangible benefits.



TREND 5

Upskilling for Emerging Technology Deployment

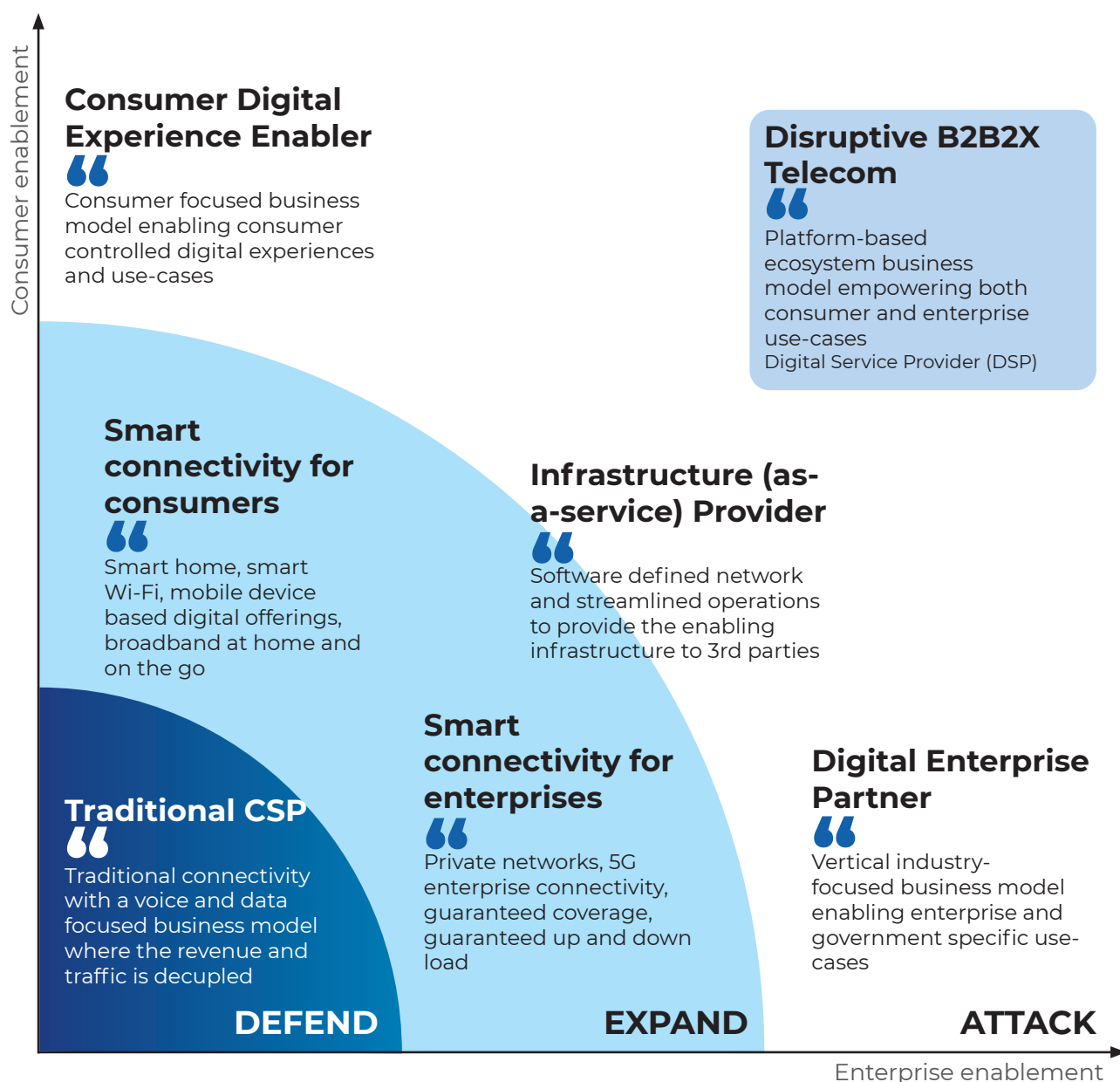
Upskilling for 5G deployment is crucial to equipping the workforce with the skills needed to effectively adopt and leverage 5G as industries increasingly embrace innovations such as 5G, AI and IoT.

These five key trends reveal the complex dynamics shaping ASEAN's 5G landscape. Realising these opportunities across the region requires addressing three fundamental enablers: establishing robust network infrastructure through spectrum allocation and physical deployment, leveraging services and devices to drive market adoption and developing workforce capabilities to harness 5G's transformative potential.

**TREND 1****Telecommunication Companies Moving Towards B2B2X**

Enterprise adoption is driving telecommunications companies toward B2B2X business models, representing a strategic shift from traditional connectivity services to partnerships delivering end-to-end solutions. In telecommunications, “B2B2X” describes service providers collaborating with enterprises to deliver solutions to end customers through Intermediaries such as resellers or system integrators.

As consumers and enterprises demand enhanced services and experiences, telecommunications companies are transforming into B2B2X Digital Service Providers. Within the region, Singapore is leading the trend, leveraging the B2B2X model. The chart below illustrates the need to leverage on the B2B2X business model to address consumer demands and remain competitive in the digital landscape, thus driving enterprises forward.

Transforming Enterprises Towards B2B2X

Source: EY Reimagining Industry Futures Study 2025



TREND 1

Sectors Harnessing 5G for Industry Innovation

As enterprise adoption of 5G gains momentum across the region, opportunities are emerging for enterprises to drive efficiency, reduce operational costs and unlock new revenue streams.

In ASEAN, five featured sectors have been identified as core areas for 5G-driven transformation: manufacturing, oil and gas, transport, logistics and power and utilities. These industries stand to benefit from 5G's ability to support large-scale IoT integration, real-time analytics and automation.

Featured Sectors	Examples of 5G Adoption
Manufacturing	Smart factories, real-time data exchange, automation, robotics and AI-driven maintenance
Oil and Gas	Supports remote monitoring, predictive maintenance and AI-driven safety protocols, optimising extraction, refining and distribution
Transport	Real-time tracking, autonomous vehicles and advanced operations across airports, ports and rail systems
Logistics	Smart warehousing, intelligent inventory management and smart delivery systems improve last-mile efficiency and supply chain visibility
Power and Utilities	Smart grids, predictive maintenance and real-time monitoring

**TREND 1**

Beyond these featured sectors, agriculture, government, healthcare, education and smart cities are also leveraging 5G to enhance efficiency, productivity and service delivery. In agriculture, 5G powers precision farming through real-time monitoring of soil conditions, crop health and autonomous machinery. Governments are integrating 5G to optimise processes, drive energy sustainability, personalise services and improve citizen engagement.

In healthcare, URLLC has the potential to enable remote surgeries, real-time diagnostics and AI-driven patient monitoring, leading to improved medical outcomes. However, adoption in healthcare across ASEAN remains limited by fragmented digital infrastructure, regulatory requirements and operational complexity.

Patient telemetry data often travels through third-party vendors over public networks with anonymisation, requiring additional processes for integration with hospital systems. Similarly, robotic surgery trials face logistical and regulatory challenges, including specialised equipment needs and on-site clinical teams, that constrain widespread rollout. More immediate benefits are expected from enhanced remote monitoring and telemedicine applications supported by secure, low-latency connectivity.

These practical considerations are not unique to healthcare. Across sectors, the feasibility of 5G use cases depends on factors such as system maturity, cost, policy alignment and operational readiness. Recognising the difference between technical possibility and practical adoption is critical for prioritising investments and enabling sustainable 5G integration.

To fully harness 5G's potential, enterprises across sectors are deploying specialised technological solutions. From critical infrastructure management in manufacturing to industrial automation, each application highlights how 5G is transforming traditional operations and driving innovation.



TREND 1

ASEAN as a 5G-enabled Industrial Powerhouse

ASEAN member states are positioning themselves as global industrial hubs. The China+1 strategy has prompted enterprises to view ASEAN as a strategic alternative, driven by its expanding manufacturing base, cost-competitive workforce and growing digital infrastructure.

At the forefront of this transformation are Singapore and Thailand, both adopting industry-centric approaches to 5G deployment. By prioritising Industry 4.0, they are leveraging 5G to drive innovation within industrial zones and trade hubs – cementing their roles as key players in the shifting global economy.



CASE STUDY

Smart Port Operations in Tuas Port



Singtel and Ericsson partnered in 2024 to deploy advanced 5G connectivity at Singapore's Tuas Port, operated by the Port of Singapore Authority, targeting to handle 65 million TEUs annually.



- 5G Network Slicing: Dedicated network slice to provide mission-critical connectivity
- Real-time Shipment Tracking: Seamless, real-time data exchange across port operations for improved cargo visibility and traffic flow
- Remote Crane Operations: Ultra-reliable, low-latency communications for precision crane operations, reducing human error and improving safety
- Predictive Maintenance: 5G-powered predictive maintenance and drone surveillance to pre-empt equipment failures and reduce downtime



CASE STUDY

5G Fully-Connected Factory



Midea, Advanced Info Service, China Unicom and Huawei partnered to establish Southeast Asia's first 5G fully-connected smart factory in Chonburi, Thailand in 2024.



- Private Network: Dedicated network deployed across 160,000 sqm. for seamless, secure and high-speed connectivity for factory operations
- Automated Guided Vehicles (AGVs): 5G-enabled AGVs with path planning and real-time environmental sensing for efficient material movement
- Quality Inspection: AI inspection system improved first-time yield by 4% and reduced rework rates by 75%, enhancing production quality
- Remote Robotic Control: Real-time connection enabling safe remote operation of robotics, improving worker safety and operational efficiency



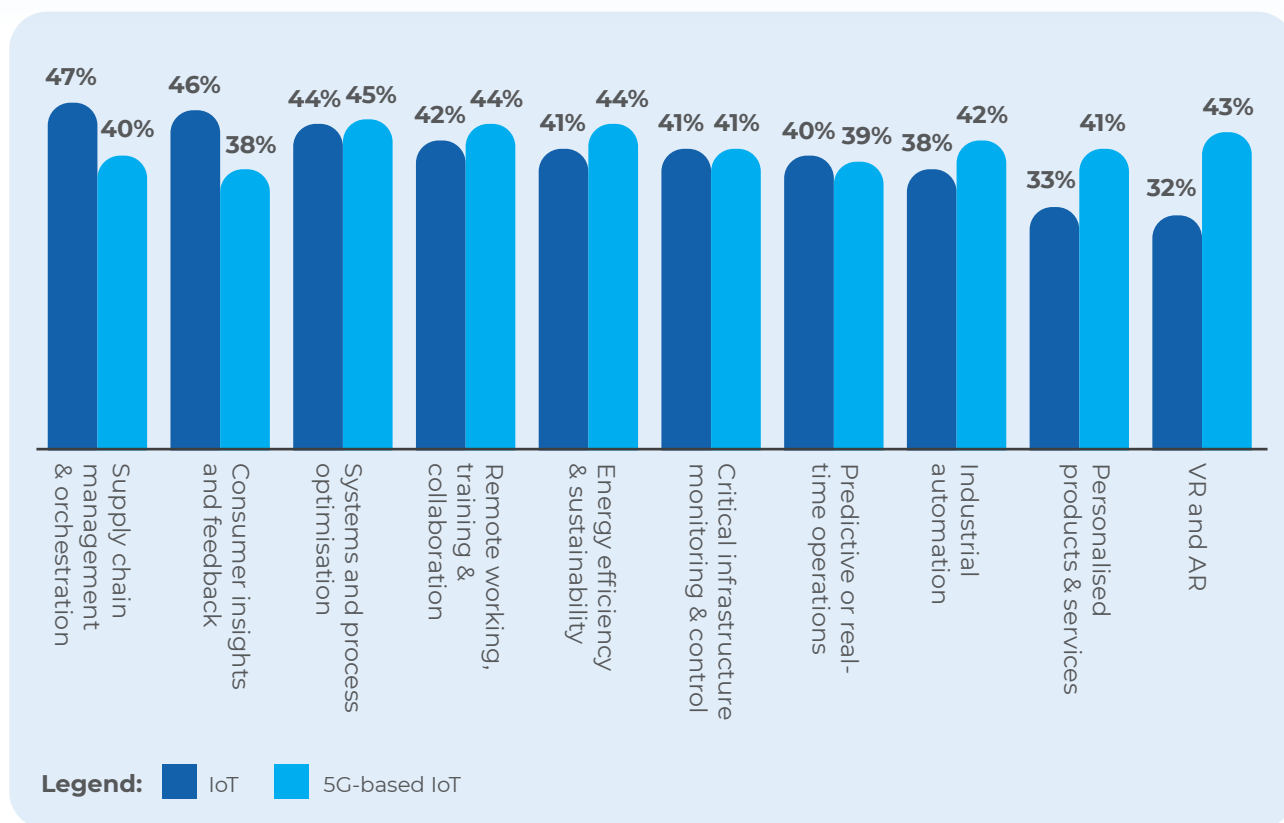
TREND 2

5G enabled AI, IoT and Automation

For ASEAN to unlock the industrial potential of 5G, its ability to support AI, large-scale Industrial IoT and automation is crucial, making these technologies the cornerstone of enterprise adoption. With URLLC and mMTC, 5G enables seamless connectivity between machines, sensors and devices, allowing industries to operate with greater efficiency, precision and intelligence.

Beyond delivering standalone benefits, AI, Industrial IoT and automation serve as the foundation for a broader ecosystem of advanced technologies. 5G acts as the connective layer that allows these technologies to function cohesively and at scale. Common use cases include smart manufacturing, robotics and automation, predictive maintenance and digital twins.

Global Assessment : Evolution of Investment by Industry Vertical



Source: EY Insights Global Telecommunications Trends 2025



TREND 2

5G and IoT are advancing in tandem, with each technology reinforcing the other, particularly in manufacturing. This synergy is evident in the rapid evolution of robotics, driven by Industrial IoT and automation. Industrial robot deployments are rising steadily, especially in the APAC region, which has seen a 7% growth. This growth is expanding the operational robot fleet and signaling a shift towards advanced manufacturing automation.



CASE STUDY

Clarion 5G Advanced Manufacturing



Clarion partnered with YTL Communications' Yes 5G Private Network and Cnergenz to develop Malaysia's first 5G-enabled advanced manufacturing line, leveraging AI and robotics to digitally transform traditional manufacturing processes



- Yes Private Network: Deployed a high-capacity, secure private 5G network, offering connectivity essential for mission-critical operations
- AI-Powered Autonomous Mobile Robots (AMR): AMRs supplied by Cnergenz automate material handling and streamline production
- Cloud-Based Inventory Systems: Real-time tracking and efficient materials management, contributing to a 70% reduction in processing time

While these use cases highlight the vast potential applications of 5G, it has been noted that 5G has yet to become critical for scaling AI and IoT. With Singapore taking a more measured perspective on adoption of 5G-enabled AI, IoT and automation, industry players highlight that adoption remains largely exploratory and confined to niche applications due to the limited maturity of existing hardware.

Many connected devices are yet to possess the specifications necessary to fully leverage advanced 5G-enabled AI capabilities. Therefore, in Singapore, advancements in device capabilities is required to realise the full potential of 5G-enabled AI, IoT and automation.

Despite this, 5GA continues to gain more traction and will improve connectivity, surpassing even 5G itself. Enhanced sensing capabilities allow industries to process more data in real-time, optimising operations and decision-making. Additionally, the integration of beamforming technology will boost network efficiency by directing signals more precisely, ensuring reliable communication even in dense environments. Together, these advancements will power smarter, more connected industries, transforming how enterprises operate and interact with the world around them.



TREND 2

Operating Models for Commercialisation of 5G

Enterprises across industries are exploring various 5G operating models to meet specific performance, security and scalability needs. These models offer different levels of control, investment and integration flexibility, enabling enterprises to select the approach best suited to their operational context.

	Rationale	Enterprises Adoption
Public Network Utilising the existing 5G infrastructure provided by public carriers	- Reduces significant capital expenditure on infrastructure by leveraging public networks, paying only for usage - Offers greater coverage through extensive geographic coverage of public networks, thus facilitating connectivity across multiple locations	NON-EXHAUSTIVE
Private Network Dedicated 5G network exclusively built and operated for an enterprise	- Provides robust security through advanced encryption and access controls, safeguarding sensitive data - Ensures optimal performance through tailored network parameters based on the needs of specific operational requirements	
Network Slicing Creating virtual networks within a shared 5G infrastructure tailored to enterprise needs	- Enables enterprises to scale operations efficiently, by adaption network slices based on changing demands - Offers enhanced performance and security by dedicating resources to specific uses, while saving cost through optimisation of allocation	
Network Leasing Renting 5G capabilities and services from providers such as Singtel's Paragon platform	- Simplifies the adoption of 5G, through support services and plug-and-play solutions to be leveraged on based on the needs and existing capabilities within enterprises - Avoids need for upfront investments on infrastructure	

While each model presents distinct advantages, growing demands for data sovereignty, tailored performance and enhanced network autonomy are accelerating the adoption of private 5G networks. Unlike shared infrastructure or public networks, private 5G enables enterprises to design and manage connectivity on their own terms. This approach is gaining traction in industries where standard networks may not meet the stringent demands of real-time operations and security.

**TREND 3****The Rise of Private 5G Networks**

Private 5G networks offer dedicated, high-performance connectivity designed to meet the unique needs of each enterprise. These networks can be physically dedicated or virtually isolated from public networks, providing enterprises tailored systems that meet strict requirements for security, performance and reliability. The focus extends beyond infrastructure to establishing private systems that ensure data security, operational efficiency and uninterrupted service.

This is particularly crucial for sectors such as manufacturing, oil and gas, transport and logistics, where real-time data exchange and automation are pivotal to driving outcomes. Many enterprises are looking towards private 5G networks, independent of public telecom providers, to address these demands.

Demand-Side Drivers	Supply-Side Drivers
- Push for digital transformation and smarter operations - Need for data security and better network control - Growing interest in moving beyond Wi-Fi and traditional networks - Demand for reliable, real-time connectivity for mission-critical operations	- Advancements in 5G capabilities (low latency, high reliability, security) - Spectrum policies allowing enterprises to build own networks - Availability of plug-and-play private 5G solutions - New players and competitive vendor landscape making solutions accessible

Beyond connectivity, private 5G networks play a central role in digitalisation efforts across sectors. By offering enhanced network customisation, whether in coverage, bandwidth or latency, they enable enterprises to minimise inefficiencies, boost productivity and unlock new digital capabilities. Their versatility makes them ideal for deployment across a wide array of enterprise use cases.

**CASE STUDY****Private Network for Smart Manufacturing**

Singtel partnered with Hyundai Motor Group to deploy a private 5G campus network at the Hyundai Motor Group Innovation Centre in Singapore, Hyundai's first electric vehicle production facility in the region



- Cell-based production and digital twin technology with integration of robotics and AI tech
- Transformative brand experience through flexible vehicle customisation, VR factory tour
- Smart urban mobility hub aims for shared growth with Singapore's local enterprises



TREND 3

While Hyundai's deployment marks a milestone, limited spectrum availability and high costs continue to pose challenges for private 5G across ASEAN. Stakeholders across countries with varying 5G deployment have flagged spectrum as a key barrier to progress. This has led telecommunication companies to explore workaround solutions such as network slicing, indoor-only deployments and local breakouts to meet enterprise demands. While functional, these workarounds have limitations and reinforce the urgent need for clearer regulations and dedicated spectrum allocation across the region.



CASE STUDY

Trailblazing Deployment of Private 5G in Malaysia



PETRONAS

PETRONAS has deployed private 5G networks across key operational sites, with two of them publicly announced, marking a major step forward in elevating connectivity, safety and efficiency within the oil and gas sector.

As one of the first movers of private 5G adoption in Malaysia, by embedding private 5G into high-value industrial environments, PETRONAS is not only accelerating its own digital transformation – but also setting a new benchmark for innovation in the industry.

REGASIFICATION TERMINAL SUNGAI UDANG (RGTSU), MELAKA

Malaysia's First Industrial Private 5G Site

PETRONAS LIQUIFIED NATURAL GAS (LNG) COMPLEX, SARAWAK

Scaling 5G at a World-Class LNG Facility



Elevates operational efficiency and safety by integrating with intelligent systems such as drones, robotics and AI



Provides highly secure, reliable connection for real-time monitoring, analytics and remote maintenance



Supports the delivery of safe, reliable, cost-efficient and environmentally optimised energy solutions

**TREND 4****Enterprise Adoption Challenges with ROI**

While 5G presents new revenue potential through enhanced connectivity and enterprise applications, enterprises across ASEAN face adoption challenges, primarily due to difficulties in justifying ROI. High initial CAPEX and the costs of retrofitting legacy systems deter investment, especially when current operations run effectively on more affordable technologies such as 4G or traditional Wi-Fi. Stakeholders across the region echoed this sentiment, noting that the perceived sufficiency of existing infrastructure weakens the business case for transition.

This points to a critical challenge: enterprises evaluating 5G through a short-term lens struggle to justify adoption. Without commercially viable industry-relevant use cases that leverage 5G's unique capabilities, many see limited incentive to move beyond 4G. Instead, enterprises must reframe ROI to focus on long-term value creation.

This issue is particularly pronounced in smaller ASEAN markets, where lower average revenue per user (ARPU) undermines commercial viability. Stakeholders from these markets highlighted increased hesitance to invest in large-scale 5G rollouts without clear signs of sustainable business demands.

Affordability presents an even greater challenge for micro, small and medium-sized enterprises (MSMEs), which comprise 95-99% of enterprises in ASEAN and account for over half of employment. Despite this, their relatively low GDP contribution and export share signal a productivity gap and untapped digital potential. Limited awareness, technical expertise and financial resources further constrain their adoption of capital-intensive technologies with uncertain short-term returns.

To address these challenges, alternative models are emerging. Network slicing enables telecom operators to divide a public 5G network into multiple networks, each customised to meet individual enterprise needs. This allows MSMEs to access enterprise-grade connectivity, reliability and service-level guarantees without needing to build and manage their own infrastructure. Additionally, shared infrastructure models, such as neutral host networks and 5G-as-a-Service offerings, further reduce costs and complexity, helping MSMEs integrate 5G and engage in the region's digital economy.

The next wave of innovation is enhancing the viability and affordability of these models. Open RAN reduces reliance on proprietary hardware, Reduced Capability (RedCap) 5G devices offer simpler, lower-cost connectivity for industrial and IoT use cases and Network-as-a-Service (NaaS) reduces infrastructure costs. Alongside economies of scale, these developments are lowering barriers to entry and expanding 5G beyond large capital-rich enterprises.

Recognising these challenges, ASEAN governments, telecom operators and ecosystem partners are collaborating to foster a more inclusive 5G environment. Government grants, early-adopter incentives and innovation funding schemes play a crucial role in encouraging enterprise adoption. However, while such mechanisms are vital in driving adoption, long-term success will depend on whether enterprises can identify clear and compelling business value.



TREND 4



CASE STUDY

Inclusive 5G Innovation Hub



The 5G Ecosystem Innovation Centre was launched in partnership with the Digital Economy Promotion Agency (DEPA), the Ministry of Digital Economy and Society (MDES) and Huawei, with an investment of over THB 475 million



- Objective: Incubate 100 local Small-Medium Enterprises (SMEs) and startups over three years to accelerate 5G adoption and innovation
- Impact: Ecosystem development – provides MSME'S access to 5G infrastructure, technical training and ecosystem partnerships
- Focus areas: Supports 5G use case development in sectors such as manufacturing, healthcare, logistics and transport

Establishing a Local 5G Ecosystem

Localising the 5G ecosystem helps reduce device costs by promoting domestic manufacturing, encouraging competition and decreasing reliance on expensive imports. By establishing local production facilities for 5G components, countries can lower supply chain expenses, tariffs and logistical costs associated with foreign procurement.

A localised ecosystem also creates economies of scale, enabling manufacturers to produce devices at lower unit costs while ensuring compatibility with regional network infrastructure. Additionally, government policies that support research, development and workforce training contribute to building a sustainable, self-sufficient 5G market. This ultimately makes devices more affordable and accelerates widespread adoption.



CASE STUDY

Ericsson Manufacturing Facility



In partnership with Flex, Ericsson established a 5G equipment production facility in Penang, Malaysia as part of its manufacturing footprint expansion. The strategic location provides accessibility to 5G equipment and devices for both Malaysia and the broader ASEAN region.

This facility demonstrates the positive implications of developing a local 5G ecosystem, from manufacturing through to solution development. It enables Malaysia to lower production costs through local manufacturing, thereby driving device affordability. For ASEAN, the facility serves as a regional production hub, ensuring steady equipment supply while reducing logistical costs.

**TREND 4**

The Implications of Operating Costs on ROI

Enterprise costs across ASEAN vary, with labour and operational expenses shaping strategic priorities. In high-cost economies such as Singapore, elevated staffing expenditures create incentives for rapid technological advancement, including 5G integration, to enhance productivity, reduce dependency on human capital and accelerate cost recovery. This dynamic positions Singapore as a leading case for technology-driven efficiency.

Singapore's economic structure demonstrates how cost-intensive environments can catalyse quicker adoption of advanced technologies to safeguard competitiveness and improve performance. By contrast, in countries such as Malaysia and Vietnam, where labour remains relatively affordable, the business case is less straightforward. Lower human capital costs reduce the urgency to automate, particularly when existing technologies such as 4G continue to meet operational needs.

This highlights the importance of tailoring 5G business cases to local economic realities. In markets with lower labour costs, successful adoption will depend on identifying use cases where 5G delivers clear value beyond current capabilities, whether through improved safety, precision or real-time responsiveness not achievable with existing systems.

**TREND 5****Upskilling for Emerging Technology Deployment**

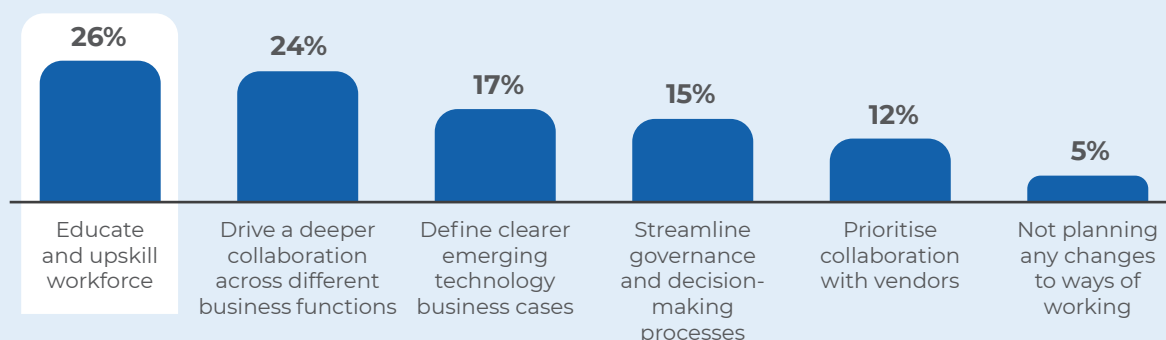
As 5G revolutionises connectivity and enables the expansion of technologies, the ASEAN workforce will continue to experience shifts in job roles, skills and overall workforce dynamics. The scale and speed at which 5G will impact enterprises will necessitate new approaches to talent development and workforce planning.

Recognising this, regional operators see value in learning from more advanced peers such as Singapore, Thailand and Malaysia, particularly in aligning 5G strategies with commercial viability and long-term sustainability. These cross-market learnings can further enhance ASEAN's ability to harness the full potential of 5G and strengthen the region's position as a digital leader in the global landscape.

As ASEAN economies continue to gradually accelerate 5G adoption, the demand for expertise in Network Operations and Management, Solutions-as-a-Service (SaaS) and Device Engineering and Development will grow. This shift presents both opportunities and challenges, enhancing efficiency, creating new job roles and driving economic innovation while also requiring proactive workforce reskilling to prevent displacement. A focus on ensuring that the workforce is equipped with the necessary skills to navigate this evolving landscape is thereby necessary to maximise the economic opportunities of 5G for ASEAN member states.

Enterprises have begun recognising the importance of talent in establishing the region as a leader in the 5G landscape. This is reflected in outcomes from the EY Reimagining Industry Futures Study 2025. The identification of critical roles needed for 5G will be assessed further in this report.

Organisational Change Required to Accelerate Emerging Technology



Source: EY Insights Global Telecommunications Trends 2025

The 2025 edition of the EY Reimagining Industry Futures Annual Study is based on responses from 1,635 enterprises across sectors. The questions included aimed to explore enterprise behaviors, attitudes and intentions toward emerging technologies.

The results highlight recognition by enterprises that workforce education and upskilling are the most important change required to accelerate emerging technology deployments in the next year. This aligns to the growing recognition that while infrastructure and technological advancements are essential, human capital remains the driving force behind successful 5G implementation and broader digital transformation efforts.

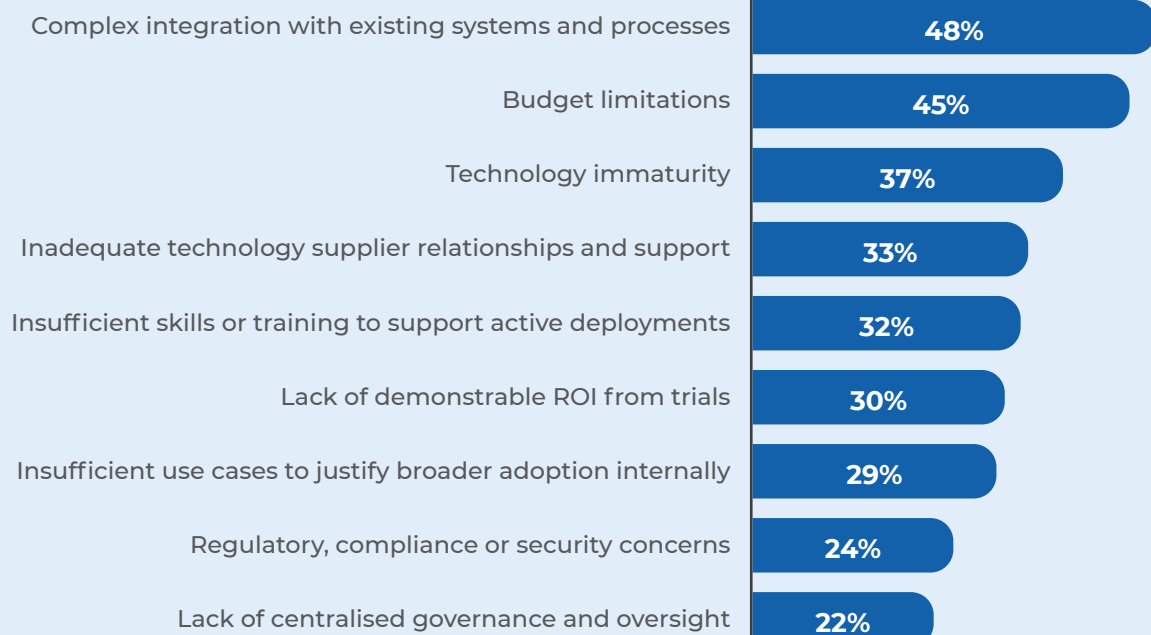
**TREND 5**

Preparing ASEAN's workforce for a 5G-driven future is crucial to maintaining regional competitiveness and accelerating industrial transformation.

As 5G adoption expands, featured sectors such as manufacturing, oil and gas, transport, logistics and power and utilities will undergo rapid technological shifts, demanding new digital skills. Targeted upskilling initiatives will be key to ensuring ASEAN fully capitalises on 5G's economic potential and maintains competitive advantage in the global digital economy

Barriers Impacting the Scaling of Emerging Technologies

The EY Reimagining Industry Futures Study 2025 highlights the potential for 'insufficient skills and training to support deployment of emerging technologies' as a critical barrier preventing enterprises from scaling these technologies.



Source: EY Insights Global Telecommunications Trends 2025



TREND 5



CASE STUDY

Opportunities to Upskill Singapore's Workforce



Through coordinated national initiatives, academic-industry partnerships and innovation platforms, Singapore has established programmes that prepare the workforce with the necessary skills for a 5G-enabled future. Key structures include employment training programmes, microcredential offerings, corporate training tracks and industry testbeds.



- **5G Academy:** The 5G Academy offers training programmes tailored to students, working professionals and organisations. These deliver courses from business-case framing to deep technical modules.
- **Certification:** Certification pathways such as the “5G University Program” support workforce readiness by allowing 150 students annually to receive foundational training in cellular communications.
- **5G Garage:** A hands-on testbed supporting hands-on training as well as live prototype and proof of concept (POC) development. This establishment upskills 250 final-year engineering students and engages enterprises in smart city, healthcare and transport use cases.

This emphasis on workforce readiness is not unique to Singapore. Other countries, such as Brunei, are also advancing upskilling efforts through academic-industry collaboration, ensuring workforce readiness

This reinforces the notion that the key to preparing enterprises for the future lies in talent. To align the workforce with the evolving digital landscape and the shift toward 5G enablement, role transformations and skill enhancements are key considerations to be prioritised as essential steps for progress.

Insights from engagement sessions with stakeholders across ASEAN further supported this, with consensus across countries at various stages of progress in agreement with the need for comprehensive upskilling across all relevant areas (i.e., technical, commercial, interpersonal). This comprehensive approach ensures workforce preparedness for 5G deployment and implementation.

**TREND 5****Workforce Skill Gaps in ASEAN**

With rapid digitalisation, many in ASEAN including those in critical 5G roles lack the skills needed to fully leverage 5G advancements. A World Economic Forum study highlighted that 64% of ASEAN workers require significant reskilling, particularly in areas such as cybersecurity, AI and IoT.

Projected Job Transformations

5G was targeted to generate approximately 6 million jobs in ASEAN by 2025, aligning with the ongoing shift in workforce demands. As new roles emerge and existing jobs evolve, adapting to these changes will be crucial for staying relevant in an increasingly digital world.

Government Initiatives to Drive ASEAN's 5G Landscape

To harness the potential of 5G and position ASEAN for the future digital economy, government policies and strategic investments will be critical. A key focus is the development of structured upskilling programs to equip workers with technical expertise for emerging 5G-driven roles, from network engineering to AI-powered applications. Government-led initiatives and regional strategies such as the ASEAN Digital Masterplan 2025 will play a pivotal role in shaping workforce capabilities through public-private partnerships, targeted incentives for skills development and education system alignment with industry needs. By investing in talent development, ASEAN can maximise 5G's economic and industrial potential.

Complementing these efforts, the ASEAN 5G Skills Framework serves as a strategic guide for member states, industry leaders and enterprises to navigate the evolving 5G landscape. The framework defines critical roles across the 5G value chain – spanning infrastructure, services and devices – and identifies skills required for a future-ready workforce, thereby supporting the development of targeted upskilling initiatives. By promoting a structured, skills-first approach, the framework ensures workforce strategies remain aligned with technological advancements and relevant to a wide range of stakeholder groups. Strengthening regional talent through this framework will be key to enhancing ASEAN's global competitiveness in the 5G era, with strategic planning focused on the next three years.

CHAPTER 2

ASEAN 5G SKILLS FRAMEWORK

Foundations of the ASEAN 5G Skills Framework

This Skills Framework will be crucial in positioning ASEAN in the global digital economy as workforce development becomes increasingly vital

As part of this Skills Framework, critical roles have been identified across the value chain. These roles reflect the shift in talent demands as 5G technologies are deployed, commercialised and scaled throughout the region. Beyond role identification, the framework maps relevant technical, cross-functional and emerging skills derived from both critical roles and enterprise use cases, ensuring alignment with practical implementation needs.

To develop this framework, a set of selection criteria was developed to prioritise efforts and ensure relevance. This process enabled the identification of critical roles and featured sectors fundamental to 5G network rollout, allowing talent development efforts to be focused and effective in supporting ASEAN's 5G ambitions.

Selection Criteria

Critical Roles

Roles that directly influence the successful deployment, management and optimisation of 5G networks, services and devices

1

5G Relevance

Roles involved with 5G technologies, including deployment, management and related activities

2

Talent Demand

Roles that have high demand for talent due to the scale of operations, rapid industry growth or task complexities

Featured Sectors

Enterprise use cases on 5G technology to solve operational challenges, improve productivity or create new revenue streams

1

5G Adoption

Strengthens the sector's growth by implementing 5G-related technological use cases

2

Economic Impact

Measures a sector's economic growth by its share of national output and the job roles it creates to spur development

50 critical roles have been identified across the 5G value chain, encompassing infrastructure, services and devices components. These roles reflect the broad spectrum of talent needed to support the deployment, optimisation and commercialisation of 5G technologies. However, the relevance and prioritisation of these roles vary across ASEAN, depending on each country's current state of 5G development, underscoring the importance of tailoring skills development strategies to each country's specific context.

1	Infrastructure Project Manager	18	4G/5G Core Network Engineer	35	Infrastructure Project Manager
2	Site Acquisition Specialist	19	Inbuilding DAS Engineer	36	Site Acquisition Specialist
3	Telecommunications Infrastructure Designer	20	Automation, AI and Orchestration Engineer	37	Telecommunications Infrastructure Designer
4	Fibre Optic Technician	21	Data Centre Architect	38	Fibre Optic Technician
5	Radio Frequency Planning Engineer	22	Data Centre Network Engineer	39	Radio Frequency Planning Engineer
6	Network Architect	23	Data Centre Security Specialist	40	Network Architect
7	Optimisation Engineer	24	Data Centre Critical Facilities Engineer	41	Optimisation Engineer
8	Systems Engineer	25	Data Centre Operations Engineer	42	Systems Engineer
9	5G Wireless Network Engineer	26	DevSecOps Engineer	43	5G Wireless Network Engineer
10	Transmission Engineer	27	Security Architect	44	Transmission Engineer
11	NOC Engineer	28	IoT Solutions Architect	45	NOC Engineer
12	Cloud Core Network Engineer	29	IoT Systems Engineer	46	Cloud Core Network Engineer
13	Cloud Security Architect	30	IoT Software Engineer	47	Cloud Security Architect
14	Cloud Infrastructure Engineer	31	Business Strategy and Modelling	48	Cloud Infrastructure Engineer
15	Cloud Applications Engineer	32	Customer and Market Insights Analyst	49	Cloud Applications Engineer
16	SOC VAPT Manager	33	Presales Solution Architect (Industry Vertical)	50	SOC VAPT Manager
17	5G Cybersecurity Specialist	34	5G Solutions Architect		

Legend: ■ Passive Infrastructure ■ Active Infrastructure ■ Services ■ Devices



APPROACH

To ensure the ASEAN 5G Skills Framework's relevance and applicability, a comprehensive validation and socialisation session process was undertaken. This involved obtaining insights across ASEAN member states, ranging from High Progress, leading with advanced 5G rollouts and enterprise solutioning; to Intermediate, progressing steadily but constrained by infrastructure or regulation; to Early Stage, laying the groundwork with core infrastructure and enabling policies.



High Progress countries:
Singapore, Thailand, Malaysia



Intermediate countries:
Philippines, Indonesia



Early Stage countries:
Brunei, Vietnam, Cambodia, Laos, Myanmar, Timor Leste*

A total of 47 organisations participated in these engagements, offering diverse perspectives across the 5G value chain, from industry players such as network operators and technology providers to industry associations and enterprises. Their input proved instrumental in surfacing country-specific priorities and highlighting how 5G readiness varies across the region.

*Note: *Engagement sessions with Vietnam and Timor Leste could not be conducted. Nevertheless, relevant insights for these 2 stated countries were obtained through sessions with organisations and representatives from other ASEAN member states*

Beyond these roles, the broader telecommunications sector includes additional roles that provide essential ecosystem support. Roles such as Policy and Regulatory Affairs Managers, Site Reliability Engineers and Satellite Link Planners remain strategically important. While not specific to 5G deployment, these positions ensure the stable infrastructure upon which all telecommunications innovations, including 5G, depend.

Having identified these critical roles, the analysis now turns to examining the skills required to perform them effectively and support 5G adoption across ASEAN. These skills have been identified through a dual lens: examining both the demands of the critical roles and the technical and functional capabilities required to deliver enterprise use cases. Together, they form a targeted foundation for future-focused upskilling and workforce development, enabling ASEAN to leverage the opportunities presented by 5G technology while addressing the region's varied developmental stages and market conditions.

Five Featured Sectors and their Relevant Enterprise Use Cases

As 5G continues to roll out across the ASEAN region, enterprise adoption of 5G capabilities has the potential to generate new revenue streams across sectors, including manufacturing, oil and gas, transport, logistics, power and utilities, healthcare, agriculture, financial services, construction, media and entertainment, education, mining, telecommunications and tourism. These industries can unlock significant productivity improvements and innovative offerings through 5G implementation.

Within this skills framework, manufacturing, oil and gas, power and utilities, logistics and transport have been featured based on their substantial economic contributions across member states, creating high demand for 5G deployment. This framework identifies capabilities required to implement use cases in these sectors, drawing from trials and deployments across ASEAN, with core skills remaining consistent across sectors pursuing adoption. By connecting these skills to practical applications, the framework provides ASEAN enterprises a reference for building capabilities essential for 5G adoption and value realisation.

Manufacturing

5G-enabled Advanced Manufacturing	Trial / POC
5G-enabled Built-To-Order Electric Vehicle Factory	Completed Deployment
First Overseas 5G Factory	Completed Deployment

Oil and Gas

5G Private Network for Enterprise Use	Completed Deployment
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Transport

5G Inbuilding Airport Coverage	Completed Deployment
Autonomous Bus Demonstration	Trial / POC
Maritime 5G Coverage	Trial / POC

Logistics

5G-powered AI Autonomous Inventory Management System	Completed Deployment
5G Smart Warehouse Transformation in Indonesia	Completed Deployment
5G-enabled Shipment Tracking	Completed Deployment
5G Warehouse	Trial / POC

Power and Utilities

Smart Nation Sensor Platform	Trial / POC
Punggol Northshore Smart Homes	Trial / POC

The Central Role of Telecommunications in 5G Enterprise Adoption

The telecommunications sector is the foundational enabler of all 5G enterprise use cases. Enterprises adopting 5G rely on telecommunications infrastructure to provide the necessary connectivity and network architecture for deployment. Rather than functioning as a standalone technology, 5G operates as part of the broader telecommunications ecosystem, delivering high-speed, low-latency communication across enterprise environments. Providers support this through public, private or hybrid network models tailored to specific business needs. As the telecommunications sector enables other sectors to adopt 5G, it is also applying the technology to enhance its own operations and meet evolving service demands.

5G Redefines Enterprise Connectivity & Operations

The skills analysis reveals that human-centric capabilities, such as Adaptability, Communication and Collaboration, are essential for translating 5G innovation into real-world impact. While technical skills drive innovation, these human-centric capabilities ensure that solutions are executed efficiently, teams work cohesively and organisations adapt resiliently to change

A total of 18 power skills were identified and grouped into two skill clusters:

Power Skills Clusters	Innovation and Delivery <i>10 skills</i>	Social Intelligence <i>8 skills</i>
	Skills that enable individuals to be creative, adapt effectively to changing circumstances and elevate personal effectiveness to drive results.	Skills that enable individuals to understand different perspectives, collaborate effectively to achieve common goals, develop others and lead with empathy to inspire and guide teams.

69% of organisations consider soft skills (power skills) to be **equally as important** as technical skills (prime skills)

For example, during 5G deployments, engineers must pair technical expertise with effective communication to align cross-functional teams and stakeholders. This remains essential whether managing large-scale rollouts in Early Stage countries or optimising private networks in advanced industrial settings.

The criticality of power skills varies by 5G maturity level:

- **High Progress countries:** Underpin agile adaptation, continuous innovation and cross-domain coordination in complex environments
- **Intermediate countries:** Connect fragmented efforts and guide industries through new collaborative models
- **Early Stage countries:** Navigate ambiguity, align multi-stakeholder interests and build momentum from limited digital foundational

Recognising this universal importance, power skills are mapped across all 50 critical roles within the ASEAN 5G Skills Framework, emphasising their value alongside technical expertise in workforce development and digital transformation readiness.

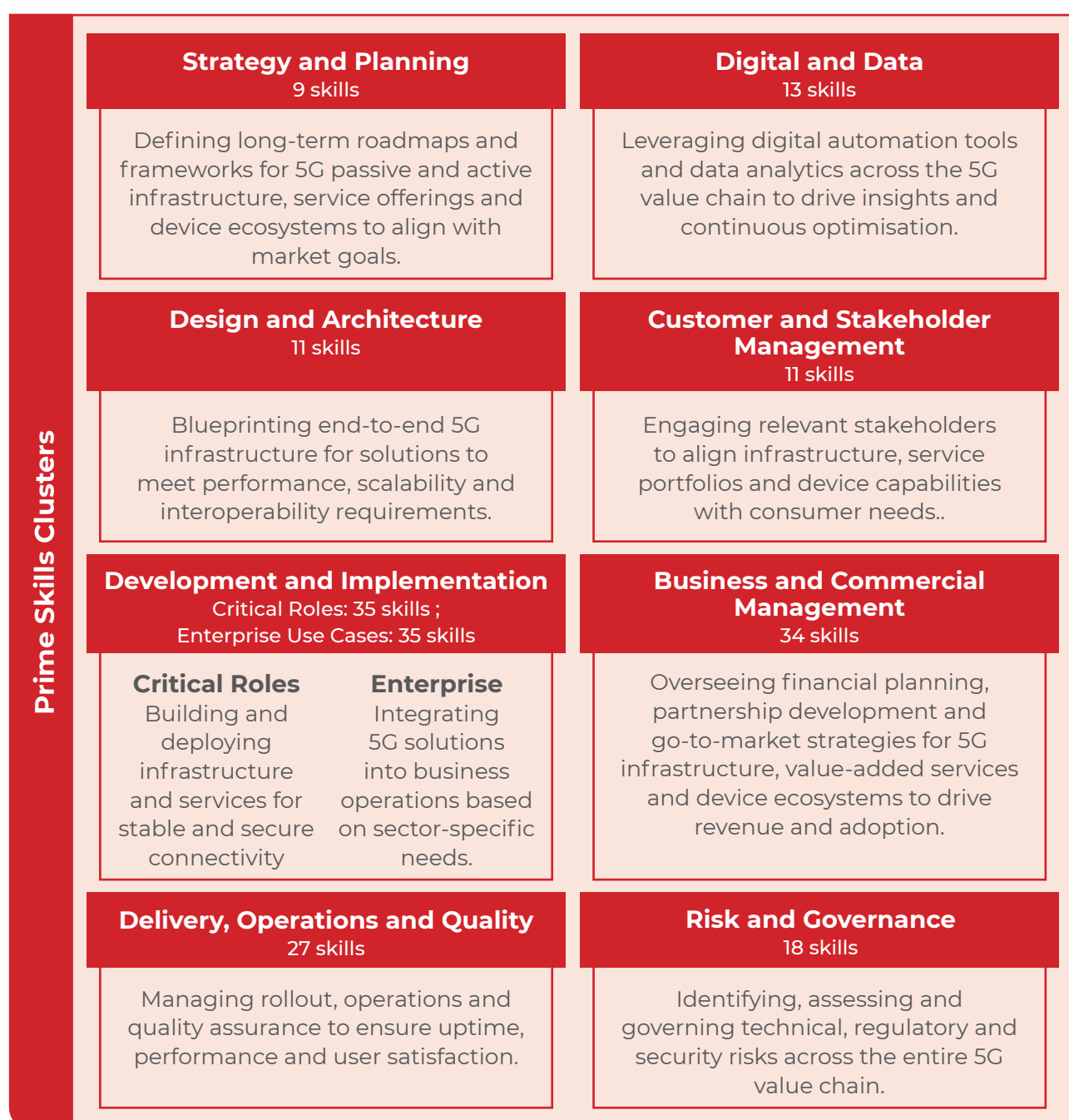
Aligned to the power skills within this framework,
79% of employers consider **Leadership** to be the most in-demand power skill

Prime Skills

Technical capabilities form the specialised foundation for 5G network deployment and operations. These encompass network architecture design, system integration, infrastructure optimisation and advanced use case development. Prime skills enable the technical implementation of complex 5G solutions, from basic connectivity to industry-specific applications.

Together with power skills, they ensure countries can effectively harness 5G's potential to drive innovation, improve connectivity and support industry-specific applications across diverse economic contexts.

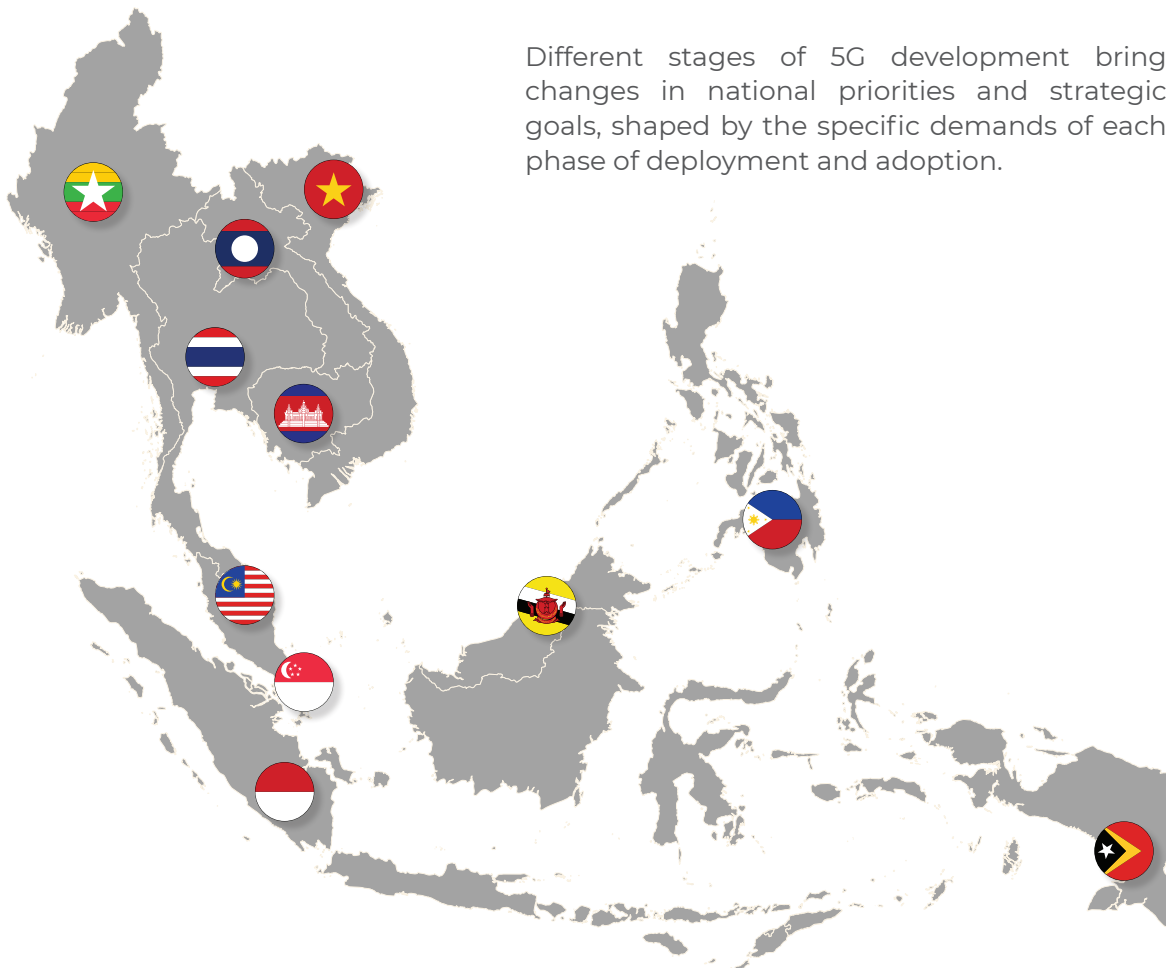
A total of 193 prime skills were identified and grouped into eight skill clusters:



Note: Refer to 'Skills' section for detailed view of skills, definitions and priority skills identified

Key Findings by 5G Current State

As countries advance through various stages of 5G deployment, role and skill requirements evolve to reflect shifting priorities in supporting adoption.



Different stages of 5G development bring changes in national priorities and strategic goals, shaped by the specific demands of each phase of deployment and adoption.

These shifting requirements influence which roles become most critical across the 5G value chain and determine the specific skills needed to support effective implementation.

Observations based on a country's current state reveal which capabilities are most essential at their stage, providing a foundation for tailoring talent development and investment approaches to match their unique position.

Importance of Roles and Skills in Relation to the Current State of 5G across ASEAN

		No.	5G Value Chain	Current State of 5G across ASEAN*		
				High Progress	Intermediate	Early Stage
						
Critical Roles	1		Priorities have shifted from 5G deployment to intelligent optimisation and maintenance of existing networks	Scaling 5G connectivity through continued infrastructure deployment for increased coverage	Critical roles exist but will need to be upskilled to meet rollout requirements	
	24	Infrastructure				
	25		Enterprise-facing roles are vital to drive 5G adoption by leveraging sector (vertical) specific knowledge to tailor solutioning			
		Services				
Sectors	50		Growing need for technical roles to develop more 5G use cases to drive enterprise interest towards 5G application and adoption		Several critical roles do not exist and will need to be developed to meet future service requirements and to raise awareness among enterprises on 5G	
	1	Devices				
	1		Emphasis on data processing capabilities within enterprises to fully leverage 5G's potential			
	5	Consumers (Enterprises)				

Note: *Key insights consolidated from engagement sessions with multiple stakeholders across ASEAN

Workforce development must respond to these distinct talent demands of each development stage. Early Stage countries require network planning engineers and regulatory specialists to establish foundational infrastructure, while High Progress countries need solutions architects and industry specialists to drive specialised use cases. This evolution requires adaptive strategies that balance immediate implementation needs with longer-term capability building to position ASEAN countries for sustained competitive advantage.

High Progress Countries



In High Progress countries, such as Singapore, Thailand and Malaysia, 5G talent development is advancing alongside mature deployment stages, with coverage exceeding 90% of their populations. Having established foundational infrastructure, industry players are now leveraging 5G's advanced capabilities to develop innovative, customised enterprise solutions, while enterprises identify core capabilities needed to transform 5G applications into tangible value.

Evolving from 5G Deployment to Intelligent Optimisation

This maturity in infrastructure has enabled a strategic shift from network expansion to intelligent optimisation, enhancing the efficiency, intelligence and scalability of existing networks. This transformation is driven by the growing complexity of 5G-enabled services, from massive IoT to mission-critical enterprise applications. To support these demands, telecommunication companies are evolving their architecture toward virtualised, software-defined and AI-driven systems that enable network slicing, real-time orchestration and predictive maintenance.

These developments are reshaping critical infrastructure roles. While positions tied to physical network expansion remain important for densification and coverage enhancement, priority is moving toward talent that can manage virtualised environments, automate network operations and optimise performance through AI. Roles such as Automation, AI and Orchestration Engineers and Optimisation Engineers are becoming pivotal in transforming 5G networks into responsive, service-centric platforms that drive enterprise innovation.

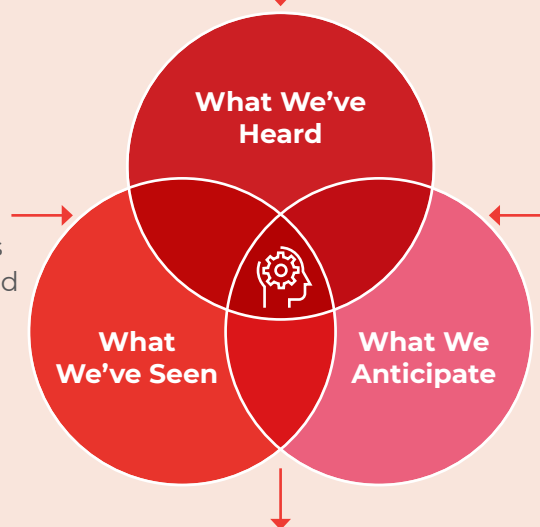


ROLE SPOTLIGHT

Automation, AI and Orchestration Engineer

Industry representatives highlighted a significant challenge i.e., automation efforts are currently managed in silos across core network, (RAN) and transmission domains

This fragmentation echoes global industry research, which finds that automation is often distributed across networking, DevOps and cloud teams—lacking unified orchestration



Disjointed efforts may complicate integration and limit the full potential of AI, leading to slower responses to network issues, higher operational overhead and missed opportunities for proactive issue resolution

The role of an Automation, AI and Orchestration Engineer is becoming increasingly critical. This role is able to bridge silos by coordinating cross-domain automation, translating AI insights into policy-based orchestration and enabling scalable, secure operations across hybrid and multi-cloud environments.

These evolving roles are reflected in changing skill demand patterns. The Development and Implementation cluster emerges as the most dominant across critical roles, accounting for a significant portion of identified skills and reflecting growing importance in areas that drive technical execution, development, integration and scaling of 5G solutions.

These skills are actively shaping 5G's future by enabling the operationalisation of emerging technologies. Edge Computing and Network Virtualisation, while established technologies, are becoming more prevalent as 5G's low-latency environment makes real-time, decentralised processing more viable. Meanwhile, Network Orchestration and Automation are gaining importance to manage software-defined network complexity and enable dynamic service provisioning.

Central to this evolution is AI integration. AI Application in Product Development emerges as the most frequently mapped skill within the cluster, appearing in 76% of critical roles. Industry insights reveal two primary forms: AI embedded in solutions (such as self-organising networks and predictive optimisation) and AI as a productivity tool for workforce enhancement (including planning, testing and documentation).

At least **74%** of business leaders in **Singapore, Thailand and Malaysia** believe that **AI skills** are critical for driving business competitiveness and industry advancement

As solution-embedded AI evolves alongside increasing network sophistication, AI-driven workflows are already reshaping how teams design, build and optimise services. This is accelerating demand for professionals who can integrate deep technical knowledge with AI capabilities, enabling organisations to adapt to fast-changing technologies and deliver value in virtualised, intelligent 5G environments.

Yet in practice, these advancements are creating different operational models across markets. Advanced markets are developing "Dark NOC" approaches where AI handles end-to-end network monitoring and incident resolution, allowing human operators to focus on network optimisation and complex troubleshooting. This evolution redefines rather than eliminates the NOC Engineer role, shifting it toward higher-value activities. Meanwhile, countries in earlier 5G development phases are still reliant on human-centered network operations and have yet to develop the expertise and operational frameworks that will support future automation.

These shifts in role design occur against a backdrop of ongoing talent challenges. Despite growing investment in upskilling, stakeholder insights reveal that retention remains a key issue in High Progress markets. Singapore struggles with a small, highly sought-after talent pool; Malaysia continues to face brain drain as skilled professionals pursue opportunities abroad; and Thailand experiences high attrition rates, particularly in strategic and delivery-focused roles. To maintain momentum in 5G development, countries must not only deepen technical capabilities but also strengthen the structural foundations of their workforce.

Enterprise-Facing Roles are Vital to Drive 5G Adoption

With foundational infrastructure largely in place and efforts shifting toward intelligent network optimisation, High Progress ASEAN member states are gradually moving into the next phase: supporting enterprise adoption. While enterprise uptake remains a work in progress, often limited to pioneering firms, telecommunication providers increasingly view enterprise solutions as a pathway for future revenue growth, especially as growth from consumer segments begins to plateau. This shift from infrastructure deployment to business implementation is reshaping how enterprises approach 5G. Rather than focusing solely on pilots, enterprises are beginning to explore strategic integration of 5G capabilities to address performance challenges and unlock operational efficiencies. In this context, 5G is evolving from a network upgrade into a key enabler of innovation and value creation, with speed of progress varying across sectors and countries within ASEAN.

To support this transition, enterprise-facing roles have become essential. As companies move towards more complex models such as B2B2X, there is a growing need for professionals who can bridge technical understanding with business imperatives. These roles are crucial in designing practical, scalable solutions that align with enterprise priorities and function across broader digital ecosystems.



CASE STUDY

Pioneering B2B2X Integration: 5G Innovation Programme in Singapore



Infocomm Media Development Authority's (IMDA) 5G Innovation Programme positions Singapore as a regional hub for B2B2X innovation by fostering collaboration between industry, startups and public agencies. The initiative accelerates 5G adoption across sectors such as healthcare, manufacturing and logistics through funding and partnerships. A key project includes 5G-powered AR for remote medical consultations in underserved areas. By advancing sector-specific applications, Singapore sets a model for integrating 5G into enterprise operations through the B2B2X approach.

Enterprise-focused positions in High Progress markets are increasingly cross-functional, serving as critical bridges between complex 5G capabilities and commercially viable offerings. Strategy, product development and solutioning roles, such as NaaS Product Managers, Platform Category Managers, Product Managers (Industry Vertical), Data Product Managers and Security Product Managers, are key players in the shift toward Everything-as-a-Service (XaaS), building modular, flexible platforms tailored to enterprise goals. Presales and solutioning experts contextualise enterprise needs and align 5G capabilities to sector-specific requirements, while operations and application support roles ensure service reliability, especially in business-critical environments.

As 5G implementations expand across industries, delivering solutions now demands measurable business value. Business and Commercial Management capabilities have become critical enablers of enterprise adoption, particularly within B2B2X business models. This evolution requires technical professionals to grasp sector-specific dynamics, operational constraints and commercial goals. For example, an engineer designing a 5G-enabled application must understand not only latency and edge computing but also operational realities, cost sensitivities and compliance requirements to ensure solutions meet enterprise expectations.

This emphasis on value creation fuels demand for multidisciplinary talent who combine technical proficiency with business insight and industry knowledge. While technical experts can readily acquire business understanding, it is equally important for business professionals to develop foundational technical literacy. This mutual comprehension fosters collaboration across teams, ensuring 5G solutions are both feasible and strategically sound.

The importance of this multiskilling approach is particularly evident in resource-constrained markets. In Singapore, for instance, stakeholders emphasise developing cross-functional capabilities within their relatively small national workforce to reduce role fragmentation and increase efficiency. This makes it critical for individuals to possess both technical and commercial capabilities to meet the needs of evolving 5G use cases.

Among the 10 skill clusters identified, Business and Commercial Management proves essential for High Progress markets, encompassing prime skills such as Project Management, Business Opportunities Development and Product Design and Development. This cluster features in 25 of the 50 critical roles identified, indicating that half of all essential 5G positions require some level of business capability. This underscores a fundamental shift in workforce requirements: business-aligned skills are no longer confined to commercial functions but are increasingly embedded across technical roles.

For High Progress countries advancing enterprise 5G adoption via B2B2X models, cultivating these cross-functional skill sets ensures that 5G solutions respond effectively to real-world enterprise needs, enabling telecommunication companies to deliver tangible business outcomes through deeper partnerships and ecosystem collaboration.



ROLE SPOTLIGHT

Product Manager (Industry Verticals)

Applicant Requirements:	Skill
Experience with GenAI and AI/Machine Learning (ML) technologies and full-stack product development, validation, testing	Technical-execution skills
- Deep understanding of industry-specific workflows cases to drive differentiated customer outcomes - Ability to engage with key stakeholders	Business-execution skills
Experience in product management, with a track record of launching and scaling enterprise software products	Blend of both technical and business execution skills

This job posting exemplifies the cross-functional nature of a Product Manager (Industry Verticals) role, demonstrating the need for both advanced technical expertise in 5G applications and strong business acumen to align solutions with client needs

Data Processing within Enterprises to Fully Leverage 5G Applications

While telecommunication companies are building cross-functional capabilities to support enterprise partnerships, success in B2B2X business models equally depends on enterprises developing their own internal readiness to fully realise 5G's potential. This shifts enterprises from passive adopters to active co-creators of value across digital ecosystems. Many are working collaboratively with system integrators and telecommunication companies for solution design and application deployment, yet without internal capability development, the business potential of 5G cannot be achieved even with robust external partnerships.

Central to this enterprise readiness is data capability. With 5G generating vast, continuous streams of data, enterprises require the skills to collect, interpret and act on this information to drive operational efficiency and innovation. Cross-sector analyses consistently reveal strong demand for data-related skills, particularly in Data Engineering, Data Analytics and Data Visualisation. These capabilities are essential for transforming raw connectivity into operational intelligence.

IoT deployments supported by 5G networks enable continuous monitoring, predictive maintenance and dynamic asset management across operations. To fully harness these benefits, enterprises, particularly large manufacturers in areas such as semiconductors, electronics and medical devices, are increasingly considering the adoption of advanced analytical techniques such as Digital Twin Modelling and Simulation. These approaches allow organisations to create virtual representations of physical systems, test interventions without operational risk and predict outcomes before implementation, significantly enhancing resilience and optimising performance.

Equally critical are Edge Computing and Real-time Data Processing capabilities, especially in sectors such as logistics and power and utilities. In these time-sensitive environments, processing data at the network edge reduces latency, supports autonomous decision-making and enables immediate operational responses, such as instant machine adjustments or automated fault mitigation.

The strategic outcome is a continuous, data-driven feedback system where enterprises can sense, process and respond instantaneously. To unlock this capability, enterprises need a workforce that can bridge data insights with business value, transforming information into strategic action. In B2B2X business models, this ability to operationalise intelligence distinguishes 5G from mere infrastructure upgrade to a source of sustained competitive advantage.

Intermediate Countries



Intermediate markets, namely the Philippines and Indonesia are expanding nationwide connectivity and network resilience, laying groundwork for advanced 5G applications. As infrastructure matures, enterprise adoption is accelerating, driving demand for sector-specific use cases and specialised talent to turn 5G potential into business value.

Scaling 5G Connectivity through Infrastructure Development

Infrastructure development remains a priority in Intermediate 5G markets, focusing on expanding reach, improving service resilience and enabling broader digital transformation. The objective is scaling both coverage and network capacity to meet rising data demands while enabling emerging 5G use cases across industries.

The core challenge lies in extending reliable 5G connectivity beyond urban centers to rural and underserved regions. Unlike urban areas where network densification addresses high user density, rural deployment struggles with broader coverage gaps, infrastructure costs and lower commercial viability.

This demand drives strong recruitment for passive infrastructure specialists, including Site Acquisition Specialists, Telecommunications Infrastructure Designers and Fibre Optic Technicians. These professionals oversee end-to-end deployment from site identification through construction and installation, ensuring efficient, safe and compliant infrastructure delivery.

Simultaneously, active infrastructure roles are increasingly critical as networks grow in complexity. RAN Engineers, System Engineers and Transmission Engineers focus on RAN, core network integration and transmission systems essential for advanced 5G features. These systems include new frequency bands, intelligent optimisation and network slicing capabilities. These roles ensure new infrastructure is operational and future-ready.

While physical infrastructure expansion continues, Intermediate markets are simultaneously investing in digital architecture, particularly data centres and cloud environments. The surge in consumer traffic and rise of latency-sensitive services increase need for distributed infrastructure. In markets such as Philippines and Indonesia, where large rural populations and complex geographies challenge traditional fibre rollout, cloud-based solutions offer alternatives. These solutions extend 5G reach without extensive fixed-line investment.



CASE STUDY

Expanding Rural 5G Infrastructure in Indonesia



Indonesia is scaling 5G coverage, reaching 23% of the population in 2024 with plans to expand to 59% by 2027. The government prioritises connecting rural and underserved communities through targeted initiatives. The Telecommunication Accessibility Agency (BAKTI) exemplifies this, with plans to build 630 base transceiver stations in remote areas by 2024 to connect around 21 million people and bridge the digital divide, despite logistical and security challenges. This nationwide push is driving demand for skilled professionals in network deployment, maintenance and rural connectivity solutions.

As countries progress beyond initial 5G rollouts, their infrastructure needs evolve from achieving basic coverage to delivering high-performance services across wider geographic areas. This evolution requires supporting digital architecture to enable advanced capabilities.

Cloud environments enable distributed computing for low-latency responsiveness. Data systems ensure massive information flows from 5G networks can be processed, stored and secured efficiently. Data centres across the region serve as critical enablers of the broader digital economy, supporting content delivery, enterprise applications and latency-sensitive services. This regional infrastructure provides benefits across borders, regardless of individual countries' domestic capacity. While not every ASEAN country currently hosts major data centre investments, the distributed nature of this infrastructure still supports cross-border connectivity and services.

Without this supporting digital architecture, Intermediate markets risk stalling at basic connectivity, unable to progress toward enterprise-grade applications.



CASE STUDY

ASEAN Data Centre Boom



ASEAN has rapidly emerged as a global hotspot for data centre investment, with a total of 306 data centres across Singapore, Thailand, Malaysia, Indonesia and Vietnam. The investment trajectory is projected to grow at a Compound Annual Growth Rate (CAGR) of 9.6% by 2029, surpassing the global average CAGR of 8.2%. This growth trajectory underscores the region's potential to become a major digital hub, driving significant investment and economic development. Intermediate countries within ASEAN have a valuable opportunity to leverage this progress to continue scaling their digital infrastructure, attracting further investment and fostering innovation

- Increased number of data centres supports broader adoption of AI, 5G and cloud computing
- Proximity of data centres to regional hub reduces reliance on long-haul data routing for network performance
- Localised data infrastructure enables edge computing required for low-latency 5G applications

Scaling data infrastructure is not just a technological upgrade, it is a critical enabler for countries aiming to strengthen their position in the digital economy and realise the full potential of 5G

To support this evolution, these markets must build complementary capabilities in cloud computing to deploy and manage systems across dispersed geographies. Data management, modeling and architecture skills are critical for organising vast data flows from 5G-enabled applications. Data protection expertise safeguards security in increasingly decentralised environments.

This integrated approach combines physical deployment with cloud-enabled flexibility. It positions Intermediate markets to move beyond basic consumer connectivity toward enterprise-level integration. As these capabilities mature, they enable advanced services such as mobile edge computing, dynamic network slicing and real-time analytics. This foundation supports sustained digital transformation across rapidly developing economies.

Use Case Development as Foundational Enterprise Adoption

In Intermediate 5G markets, enterprise adoption depends on the availability of connectivity. With 5G coverage often limited to selected urban areas, the potential for widespread enterprise adoption remains constrained, particularly in remote and underserved locations. Robust network coverage remains a prerequisite for enabling meaningful enterprise applications.

Infrastructure rollout and network resilience remain primary priorities. However, growing awareness of 5G's transformative potential is creating early momentum toward enterprise-led innovation. This marks a critical transition where technical capability must translate into commercial opportunity.

Enterprise adoption remains nascent across these markets. A key barrier is the lack of scalable, industry-relevant use cases that clearly demonstrate ROI. Before telecommunication companies can accelerate enterprise integration, they must develop compelling applications tailored to specific industry contexts and operational challenges. These applications must also work within local regulatory and competitive constraints.

This need is driving demand for professionals with deep vertical expertise. Roles such as Enterprise Solution Sales specialists and Business Strategy and Modeling experts are pivotal in translating 5G's technical potential into tangible business outcomes. Presales Solutions Architects (Industry Verticals) are especially critical. They customise 5G solutions to meet the unique needs of different sectors, ensuring applications are grounded in industry demands rather than generic technology demonstrations.

 CASE STUDY Cross-Sector 5G Use Case Comparison 			
	 Manufacturing	 Oil and Gas	 Logistics
Sector Needs	High precision manufacturing, automation and production efficiency	Operational safety, environmental monitoring and infrastructure reliability	Real-time logistics coordination, automated warehouse operations and efficient inventory management
Primary Application of 5G Private Network	- AI-enabled quality inspection - Autonomous material handling systems - Smart factory integration	- Real-time asset monitoring - Environmental sensing - IoT-enabled safety systems	5G-powered AGVs - AI-enabled video surveillance and infrared sensors - IoT and digital twin integration
Key Outcomes	Significant improvements in production speed, accuracy and process optimisation	Enhanced operational safety, reduced downtime and strengthened regulatory compliance	Improved operational efficiency, enhanced security and optimised inventory accuracy

Note: While Clarion and PETRONAS are based in Malaysia, a High Progress market, they have been included in this case study as their use cases offer high relevance for Intermediate markets.

The importance of contextual expertise becomes evident when examining successful implementations across various industries. In manufacturing, 5G enables predictive maintenance and automated quality control through real-time sensor networks. The oil and gas industry leverages 5G for remote monitoring of offshore platforms and pipeline integrity management. Meanwhile, logistics companies utilise 5G for real-time supply chain visibility.

While these applications share core 5G technologies such as ultra-low latency, massive connectivity and edge computing, their value propositions differ significantly. Implementation approaches and success metrics vary based on each industry's operational realities.

This targeted approach proves particularly relevant for markets such as the Philippines and Indonesia, given their varied economic profiles. Indonesia's manufacturing base and natural resource industries require different 5G applications than the Philippines' business process outsourcing and logistics sectors. Success depends on developing talent who understand not only 5G capabilities but also the specific value drivers, regulatory requirements and competitive dynamics within each vertical.

As these Intermediate markets build toward enterprise adoption, the focus remains on preparing essential groundwork. This includes strengthening digital infrastructure, fostering industry trust and developing a talent pipeline capable of supporting enterprise-scale deployment. Equally important is building foundational awareness among enterprises of 5G's capabilities and ROI potential. This requires proactive efforts by telecommunication companies to educate, engage and demonstrate real world value through practical use cases.

Investment in roles such as Solution Architecture and Product Analyst combined with industry-specific insight will prove essential for designing credible, commercially viable 5G solutions. These solutions must resonate with enterprises and unlock measurable value.

This foundation-building phase positions Intermediate markets to transition from experimentation to sustained enterprise integration. By establishing the expertise necessary to transform 5G from infrastructure investment into a driver of economic transformation, these markets can unlock the technology's full potential across key industries.

Early Stage Countries



In Early Stage countries, such as Brunei, Vietnam, Cambodia, Myanmar, Laos and Timor Leste, 5G talent development focuses on building foundational capabilities to support network deployment and infrastructure readiness.

Establishing Infrastructure as the Backbone of 5G

Infrastructure development remains the primary focus for Early Stage countries, where deployment is limited and coverage is largely confined to urban areas. This is particularly crucial for countries, such as Myanmar, Vietnam, Cambodia and Timor Leste, who are looking towards 5G roll-out. These markets present a unique opportunity to exchange experiences with High Progress and Intermediate countries, translating proven strategies into context-specific approaches that ensure early investments create a strong foundation for sustainable 5G growth.

The immediate priority lies in expanding passive infrastructure, from securing viable sites to laying fibre backhaul and preparing tower installations. These components create the physical footprint upon which 5G capabilities will be built. Alongside passive infrastructure development, establishing core active infrastructure including radios, antennas and transmission systems enables early network functionality. While advanced features such as network slicing may remain future considerations, early integration of active elements supports operational readiness and prepares the groundwork for scalable expansion in later stages.

As Early Stage countries build their 5G infrastructure, cybersecurity should be embedded as a core design principle rather than retrofitted later. The transition from 4G to 5G introduces a broader attack surface through increased connected devices, edge computing and virtualised network functions. This architectural shift increases complexity and exposure to cyber threats, making early security integration necessary for building resilient networks that can scale with infrastructure growth.



CASE STUDY

Laying Foundational Infrastructure in Vietnam



Vietnam's 5G rollout is accelerating but remains challenged by foundational infrastructure gaps. Operators such as MobiFone and VinaPhone face commercialisation delays due to limited network sharing and backhaul capacity. National efforts are now focused on:



- Expanding base stations
- Upgrading core networks
- Strengthening fibre connectivity

These developments are key to improving service quality, enabling digital transformation and driving demand for skilled infrastructure talent.

Executing this comprehensive infrastructure approach requires coordinated expertise across multiple domains. The Strategy and Planning skills cluster proves particularly valuable, where capabilities such as Infrastructure Strategy, Network Planning and Security Strategy enable policymakers and industry leaders to shape national 5G roadmaps, prioritise investments and sequence infrastructure rollout aligned with coverage targets and spectrum availability. This strategic foundation ensures scarce resources are allocated toward infrastructure that serves both immediate functionality and long-term economic objectives, with Infrastructure Project Managers translating these strategic capabilities into coordinated execution of timelines, budgets and resources.

The Design and Architecture skills cluster operationalises plans through technically sound and scalable network designs. In markets where legacy infrastructure may be limited, skills including Infrastructure Design, Network Design and Security Architecture support the creation of resilient, geographically adaptable network frameworks that are interoperable and energy-efficient while remaining prepared for future upgrades. The practical application of these design capabilities relies heavily on Site Acquisition Specialists who identify viable sites, navigate land use regulations and secure deployment permits, ensuring that technical designs can be successfully implemented in real-world environments.

Security implementation requires specialised talent, including 5G Cybersecurity Specialists, Security Operation Center (SOC) Analysts, Vulnerability Assessment Penetration Testing (VAPT) Engineers, Security Architects and DevOps Engineers who design secure frameworks, conduct continuous threat assessments and ensure new services are protected from deployment. These roles become particularly important in markets with limited legacy infrastructure, requiring creative problem-solving and efficient execution while embedding security considerations from the outset.

This coordinated approach to infrastructure development creates a clear pathway for sustainable expansion. By combining insights from more advanced markets with localised planning and technical delivery, Early Stage countries can move beyond isolated deployments toward national-scale rollouts. The integration of strategic planning, robust infrastructure development and security-first design position these markets for comprehensive digital transformation while building technical foundation needed for long-term 5G success.

Talent Availability and Readiness for 5G Deployment

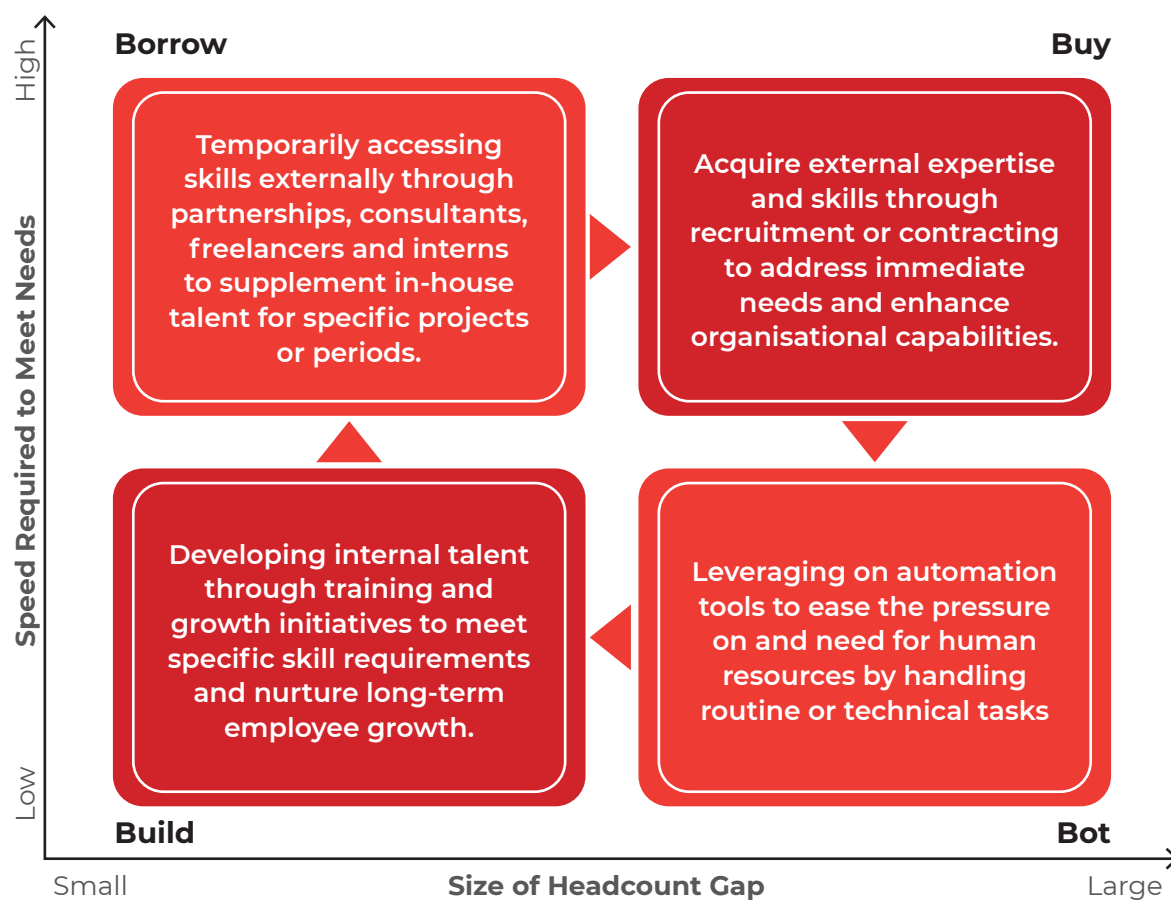
In Early Stage countries where 5G deployment remains predominantly on the horizon, talent development is entering a preparation phase. While 50 critical roles have been identified across the 5G ecosystem, their availability varies across markets. For many operators, regulatory milestones such as spectrum allocation are still pending, creating a window to plan for workforce readiness and foundational capability-building.

Two key patterns are emerging across these markets. First, infrastructure-related roles, such as Infrastructure Project Manager and Telecommunications Infrastructure Designer, benefit from continuity with past network generations. These roles can be upskilled to meet specific 5G demands, especially as operators decide between NSA and SA architectures. NSA models enable smoother transitions using existing 4G expertise, while SA offers opportunities to build specialised competencies from the outset. Second, several commercial and technical roles are positioned for evolution. Current Product Managers, for instance, who focus on delivering basic connectivity, can be upskilled to support more advanced offerings such as edge services, private networks or industry-specific platforms. Roles such as Platform Category Manager, Data Product Manager and IoT or Embedded Systems Engineers are gaining relevance as markets move toward B2B2X business models (business-to-business-to-consumer/enterprise approaches). These roles will be critical in turning 5G's technical potential into commercial value across sectors such as manufacturing, logistics and healthcare.

This phase presents an opportunity to adopt a more structured and forward-looking approach to workforce development. Given the complexity of 5G talent requirements and the varying timelines for deployment across Early Stage markets, a systematic framework becomes essential for strategic planning.

The Build, Buy, Borrow, Bot framework offers a blueprint to address talent gaps across both short- and long-term horizons. This framework allows countries and organisations to assess and pursue suitable combination of talent strategies. By aligning workforce strategies to speed and scale deployment needs, the framework enables countries to blend internal talent development with targeted recruitment, external partnerships and automation.

Build, Buy, Borrow, Bot Framework



Key Considerations

Speed Required to Meet Needs

- Prioritise roles by criticality (e.g., impact to business continuity)
- Assess the current market for the availability of needed skills
- Estimate the time required for new hires to reach full productivity

Size of Headcount Gap

- Determine the number of positions that need to be filled to maintain operations
- Consider the financial implications of large-scale hiring
- Evaluate the potential for internal promotions or transfers

Published by:

