



ASEAN 5G SKILLS FRAMEWORK



Recognised at the WSIS Prizes 2026
Winner Project
WSIS Action Line C1



ASEAN 5G

SKILLS FRAMEWORK

PUBLISHED BY



MALAYSIAN COMMUNICATIONS AND MULTIMEDIA COMMISSION

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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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Preface

by the Chairman of the Malaysian Communications and Multimedia Commission (MCMC)

ASEAN's digital future will be defined not only by the technologies we embrace, but by our collective ability to develop the talent that will innovate, secure, and maximise their potential. As 5G accelerates digital transformation across industries, governments and communities, the region must ensure that its workforce possesses the capabilities needed not only to adapt to change, but to lead it.

The ASEAN 5G Skills Framework was developed in response to this shared regional priority. Spearheaded by the Malaysian Communications and Multimedia Commission (MCMC) under the Ministry of Communications Malaysia, the Framework reflects the collective aspirations of ASEAN Member States to strengthen digital capabilities and build a future-ready workforce. Its development was made possible through close collaboration among ASEAN Member States, industry leaders, regional experts and partners, with support from the ASEAN ICT Fund. The Framework's endorsement at the ASEAN Digital Ministers' Meeting in Hanoi, Vietnam in January 2026 underscores ASEAN's shared commitment to preparing our people for the opportunities and challenges of the 5G era.

By providing a common regional reference for priority job roles, competencies and emerging skills, the Framework establishes a practical foundation for greater regional coordination. It supports policymakers and regulators in aligning workforce development strategies, enables industry to anticipate evolving talent requirements, and guides academia and training institutions in designing programmes that remain relevant to the needs of a rapidly evolving digital economy. The Framework's recognition as a Winner Project under WSIS Action Line C1 at the WSIS Prizes 2026 further affirms the value of this collaborative ASEAN initiative and demonstrates the impact that can be achieved through regional cooperation, shared expertise and a common vision.

The publication of this Framework marks an important milestone, but it is only the beginning. Its true value will be realised through sustained implementation, continuous refinement and its translation into meaningful policies, programmes and partnerships that empower individuals and strengthen national and regional capabilities. Achieving this will require the continued commitment of governments, regulators, industry, academia and training providers across ASEAN.

On behalf of the Malaysian Communications and Multimedia Commission, I extend my sincere appreciation to all ASEAN Member States, partners, experts and stakeholders whose dedication and collaboration made this Framework possible. Their contributions exemplify the spirit of ASEAN cooperation that has been instrumental in bringing this initiative to fruition.

By investing in our people, strengthening regional collaboration and aligning our efforts, we can build a skilled and resilient workforce that will enable ASEAN to innovate with confidence, respond effectively to technological change, and fully realise the transformative potential of 5G for the benefit of our economies and communities.

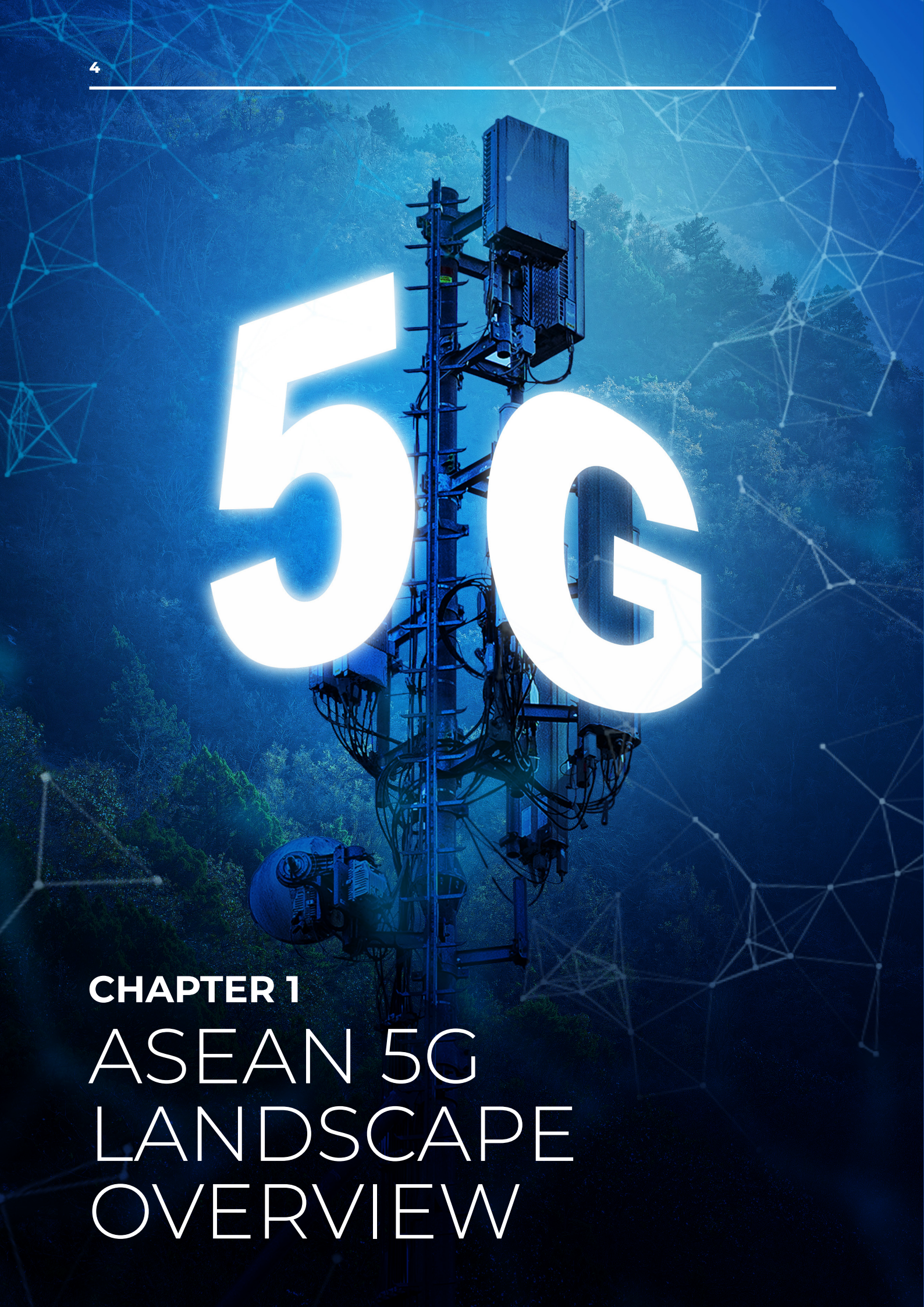
“ Building ASEAN’s capabilities
today for a smarter, more
connected tomorrow ”

Tan Sri Mohamad Salim bin Fateh Din

Chairman

Malaysian Communications and Multimedia Commission (MCMC)





5G

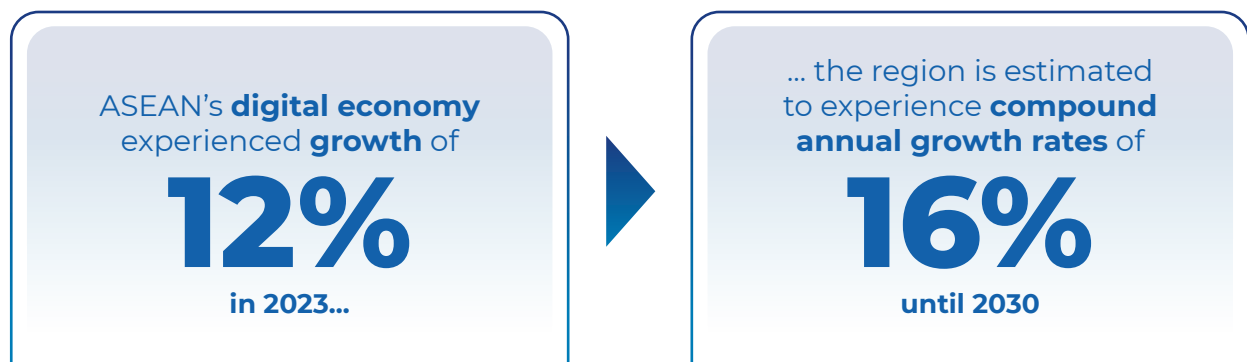
CHAPTER 1
ASEAN 5G
LANDSCAPE
OVERVIEW

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)

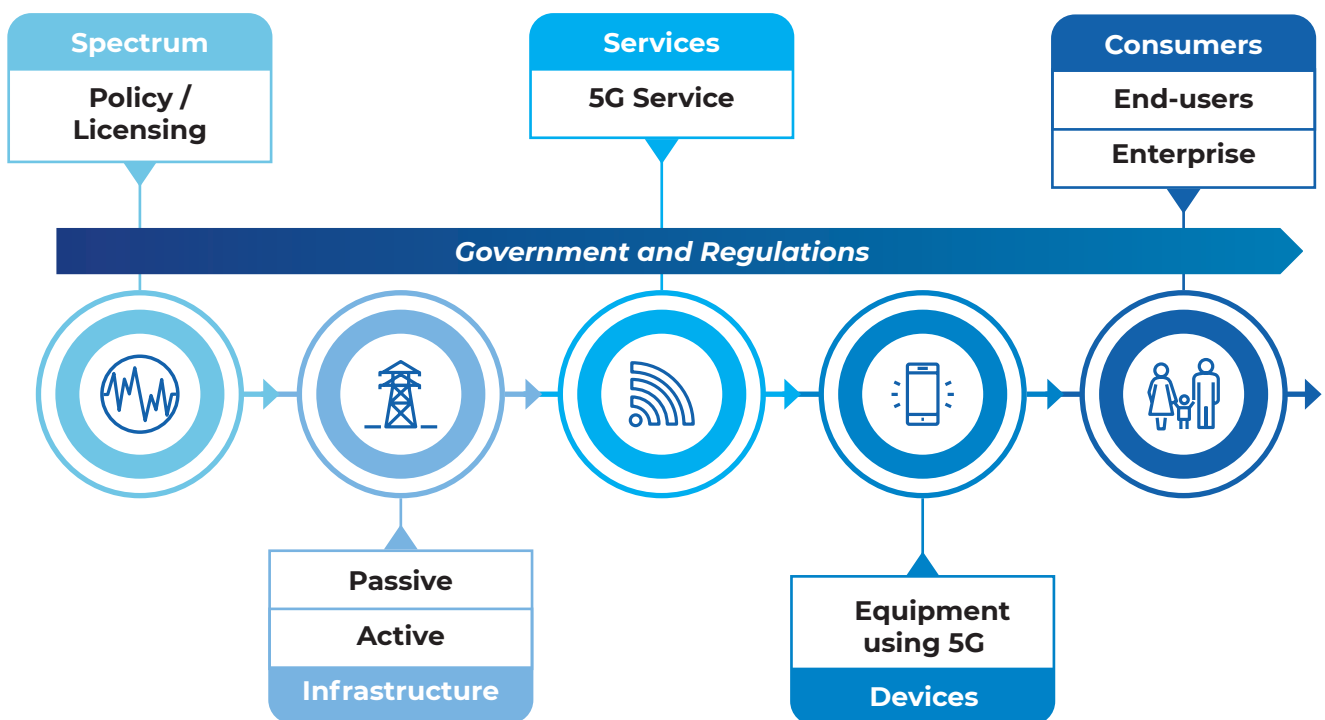
Provides reliable, scalable connectivity for high density of connected devices, with minimal human intervention

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



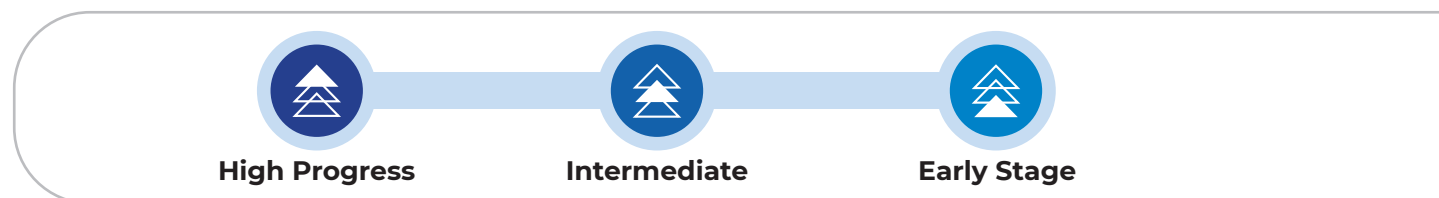
This report is structured on the core components of the 5G value chain – spectrum, infrastructure, services devices and consumers, with government and regulations playing an overarching role. While there are adjacent domains that are highly relevant and in some cases critical, to 5G success, they have 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/Trial ◑ 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



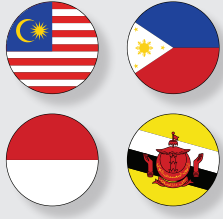
Market Dynamics



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



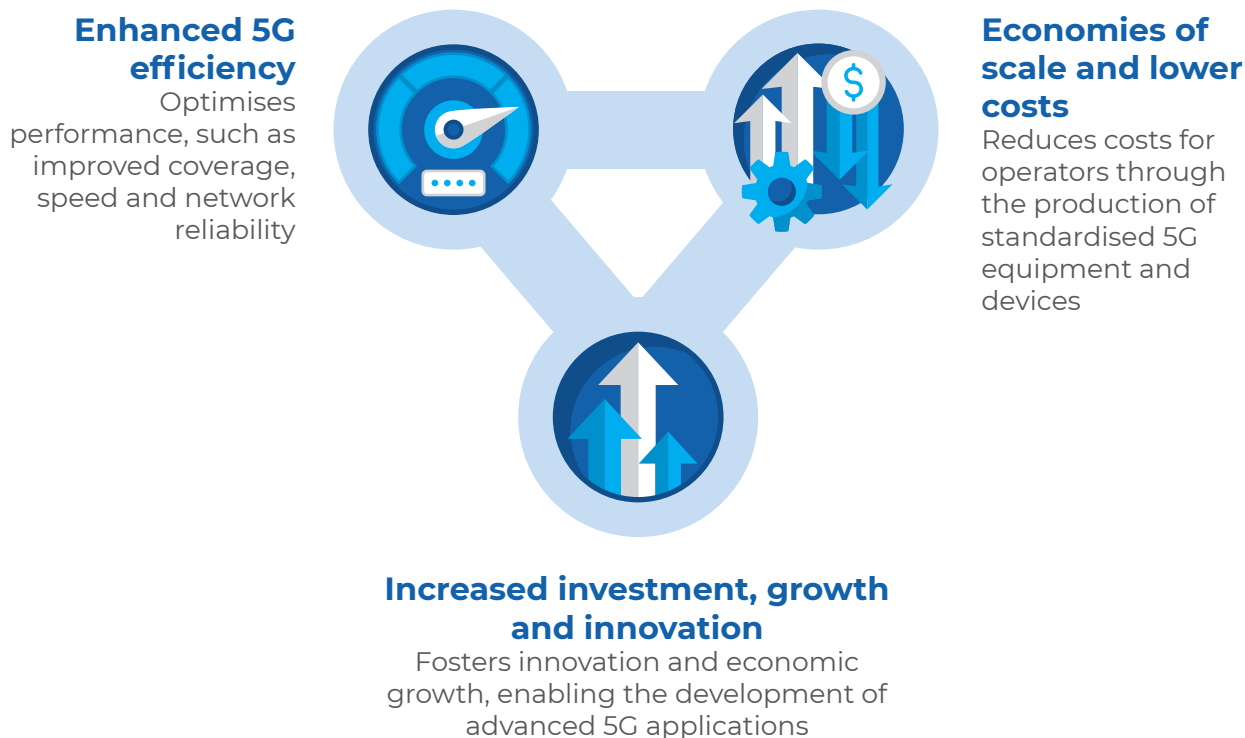
Governance complexity – Without strong coordination, there is risk of network fragmentation and inefficiencies

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



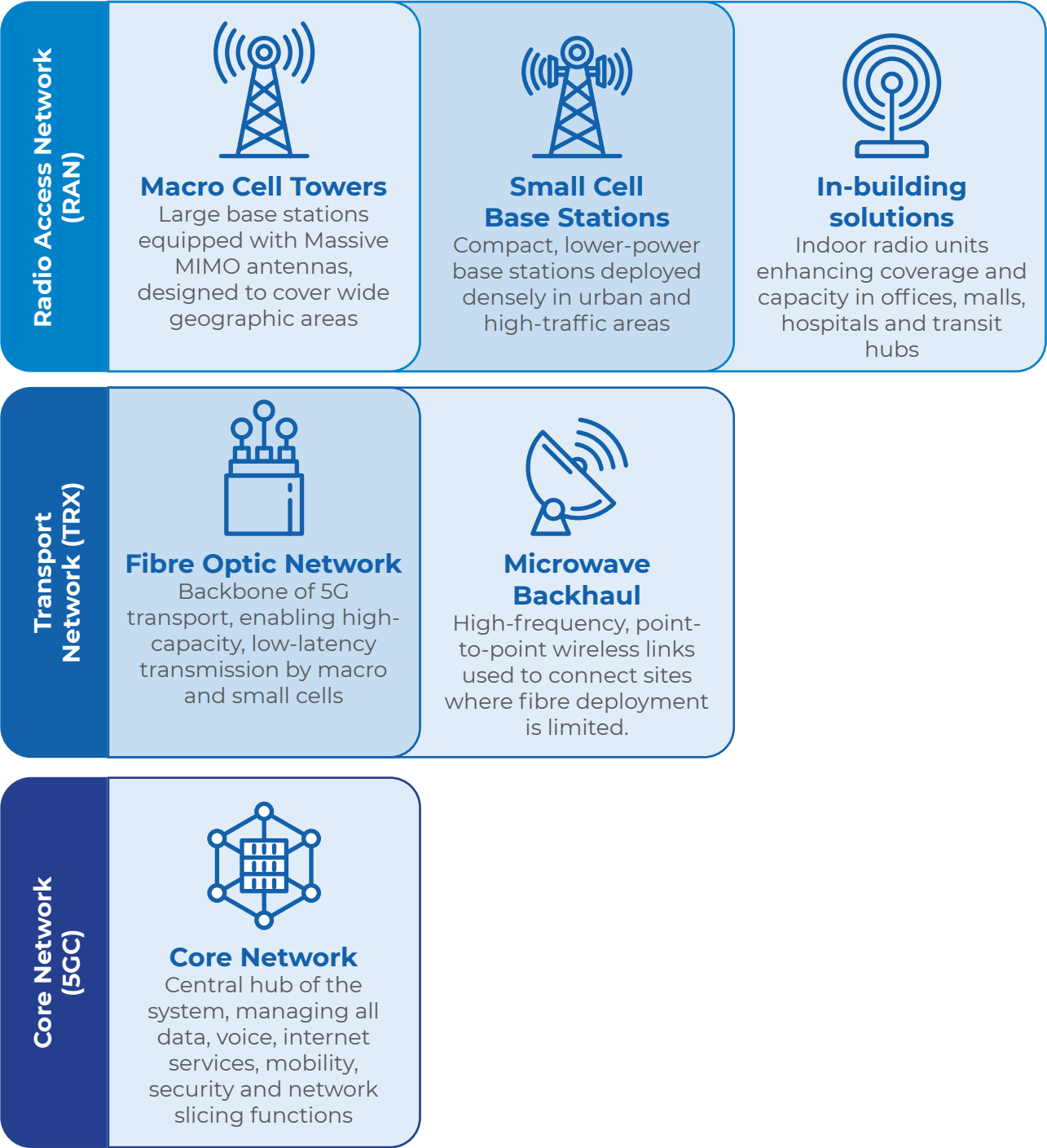
Capacity building and training

- 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

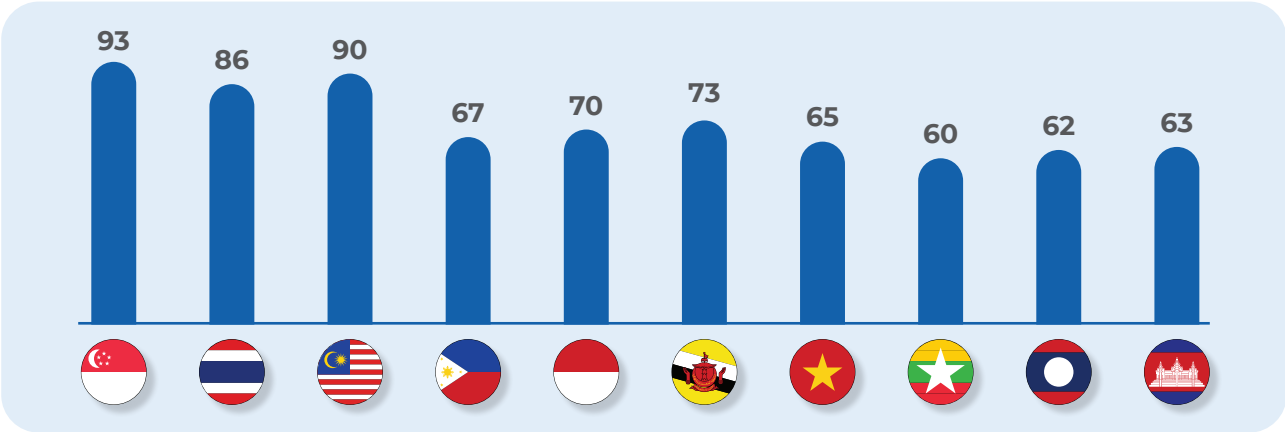


ASEAN member states show varying 5G network readiness, shaped by economic landscapes, population distributions and national priorities.

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



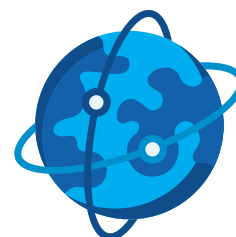
Cost Efficiency

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:

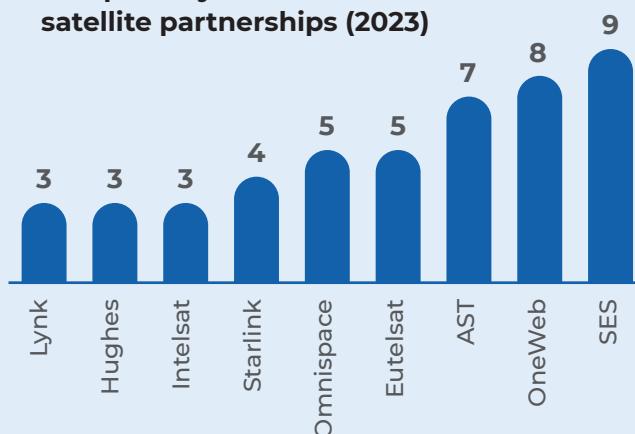
Small cells, low-cost equipment and satellite-based solutions offer more flexible alternatives that can overcome geographic barriers cost-effectively, allowing for adaptable deployment in difficult environments.



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



KOMINFO

Telkomsel

PT Telkom Indonesia



ERICSSON

Qualcomm

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...

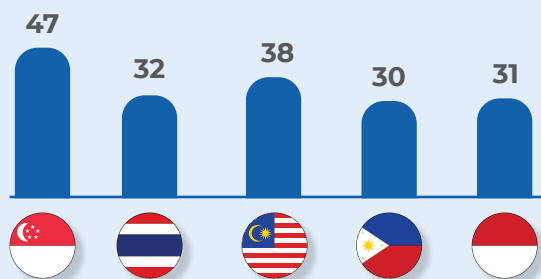
- Faster speeds
- Lower latency
- New digital experiences



For enterprises...

- Enhanced connectivity
- Automation
- Cross-industry innovation

Services



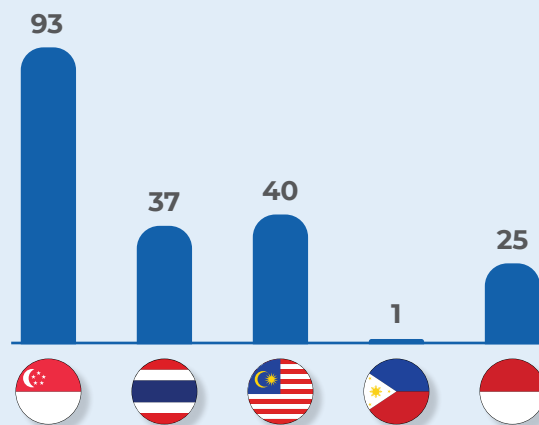
Note: Chart focuses on 5 countries with most advanced 5G current state based on data availability

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:

			
High-Speed Data	Cloud Gaming	Immersive Media	Connected Devices
Enhanced browsing, video conferencing and online gaming experiences	Offers experience of console gaming without expensive hardware	4K/8K streaming, AR/VR applications for entertainment and education	Wearables, Smart devices and IoT-enabled home systems

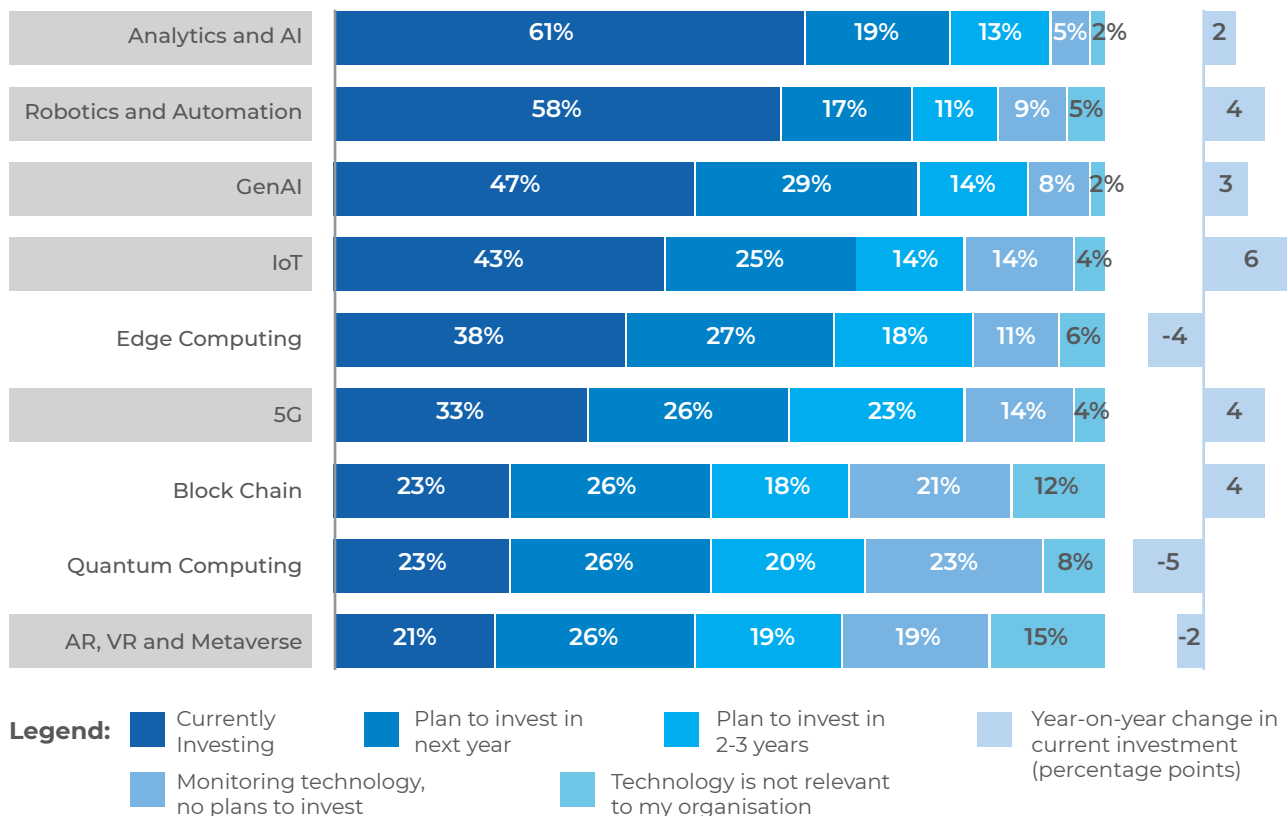
Enterprise Technology Transformation

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.

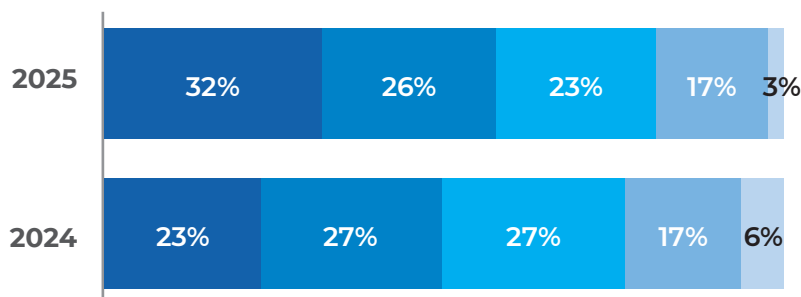
Global Technology Investment by Enterprises



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

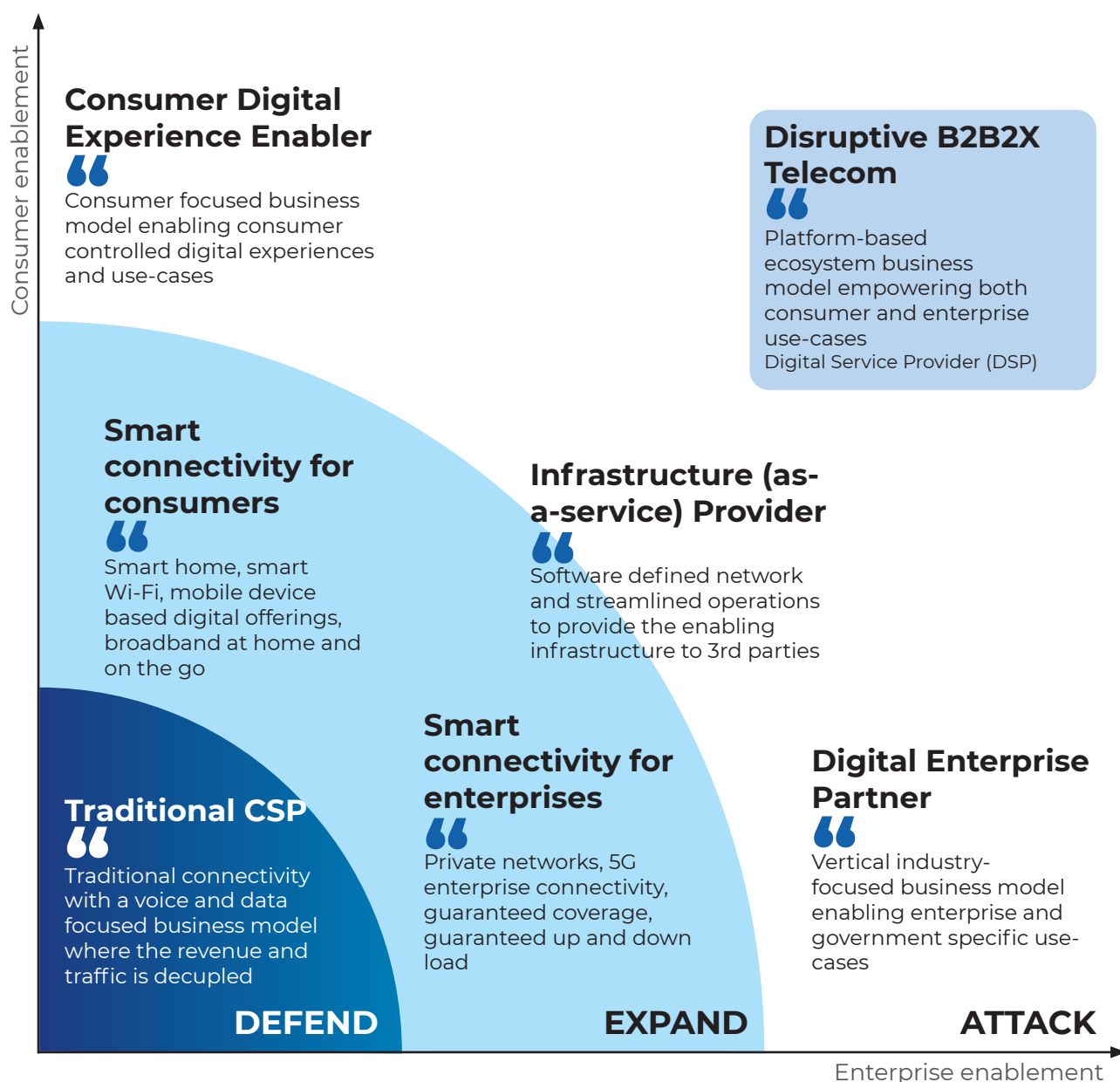
Upskilling for 5G deployment is crucial to equipping the workforce with the skills needed to effectively adopt and leverage 5G as industries increasingly embrace innovations such as 5G, AI and IoT.

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



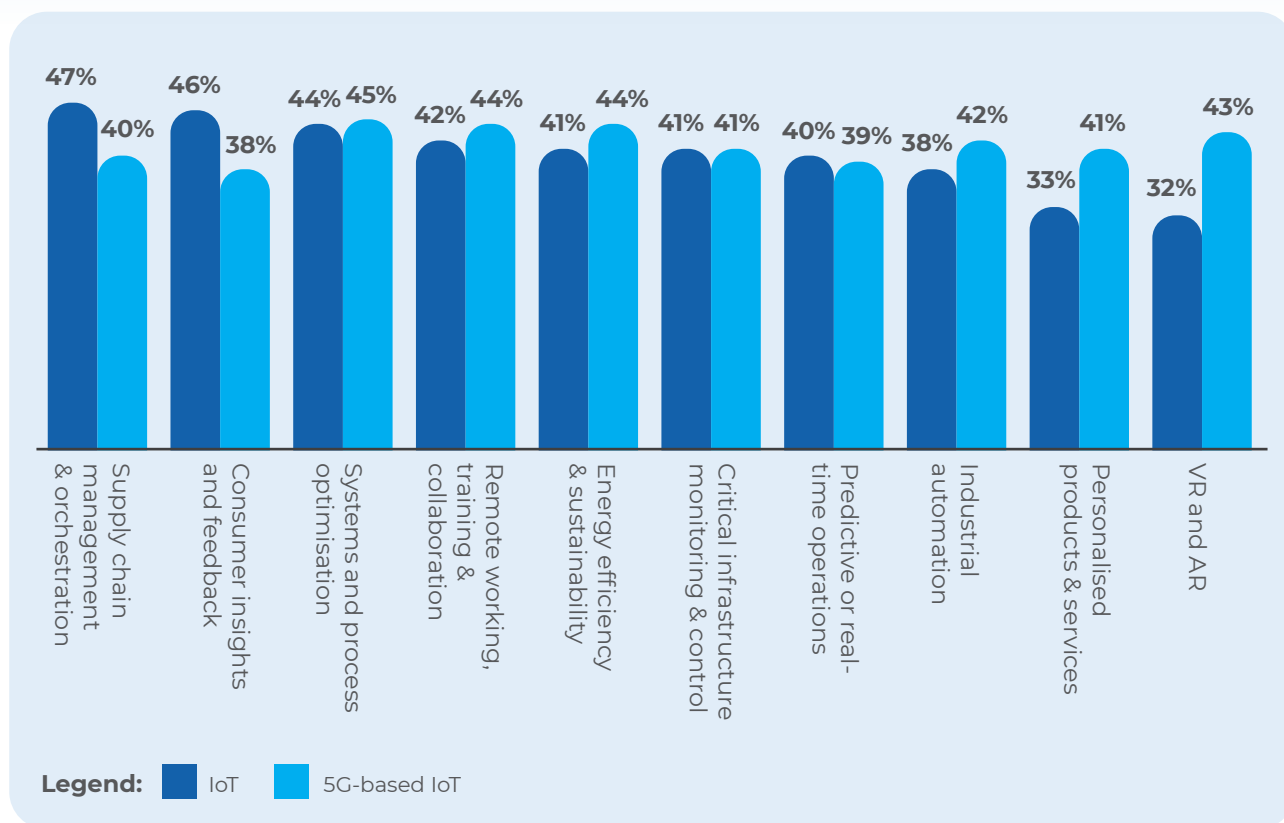
TREND 2

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 Cnnergz 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 Cnnergz 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

HYUNDAI
MOTOR GROUP

Singtel

- 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**

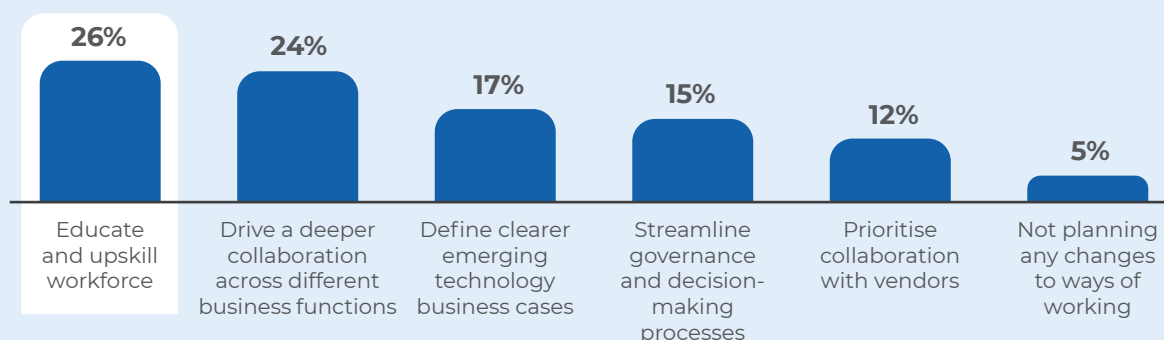
As 5G revolutionises connectivity and enables the expansion of technologies, the ASEAN workforce will continue to experience shifts in job roles, skills and overall workforce dynamics. The scale and speed at which 5G will impact enterprises will necessitate new approaches to talent development and workforce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

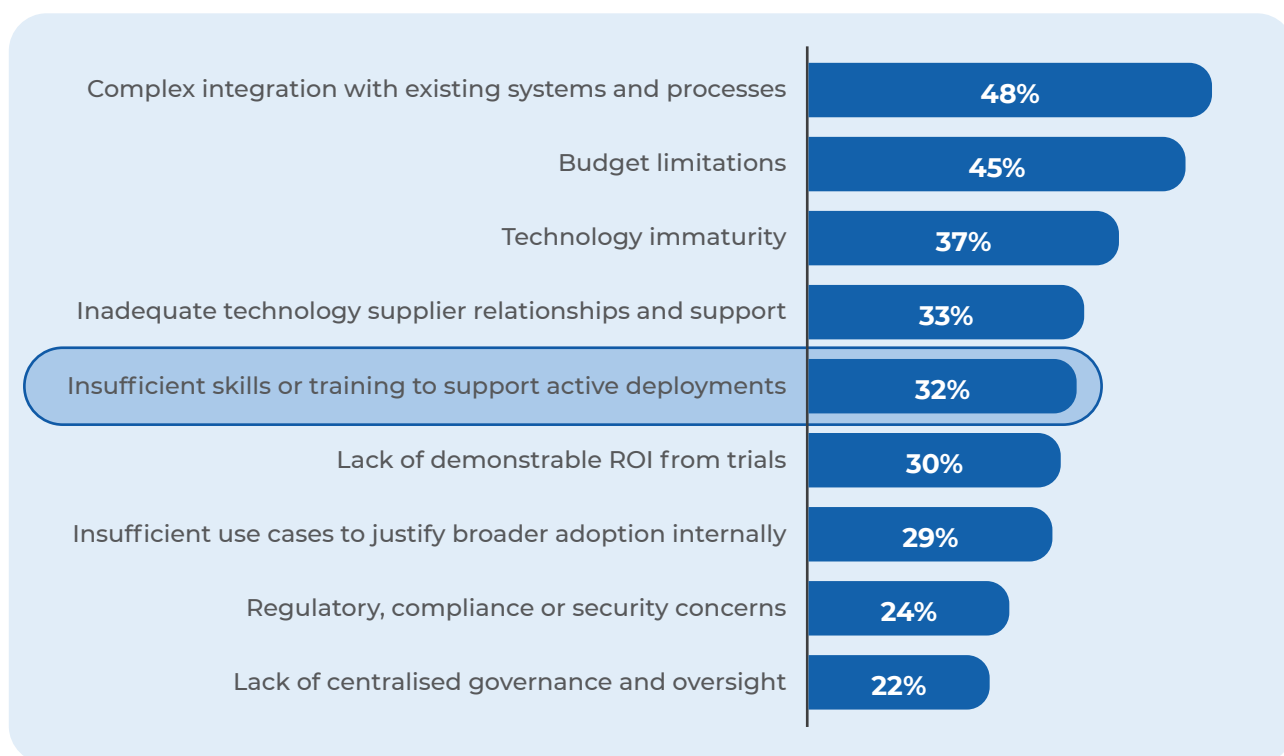
**TREND 5**

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

Power Skills

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.

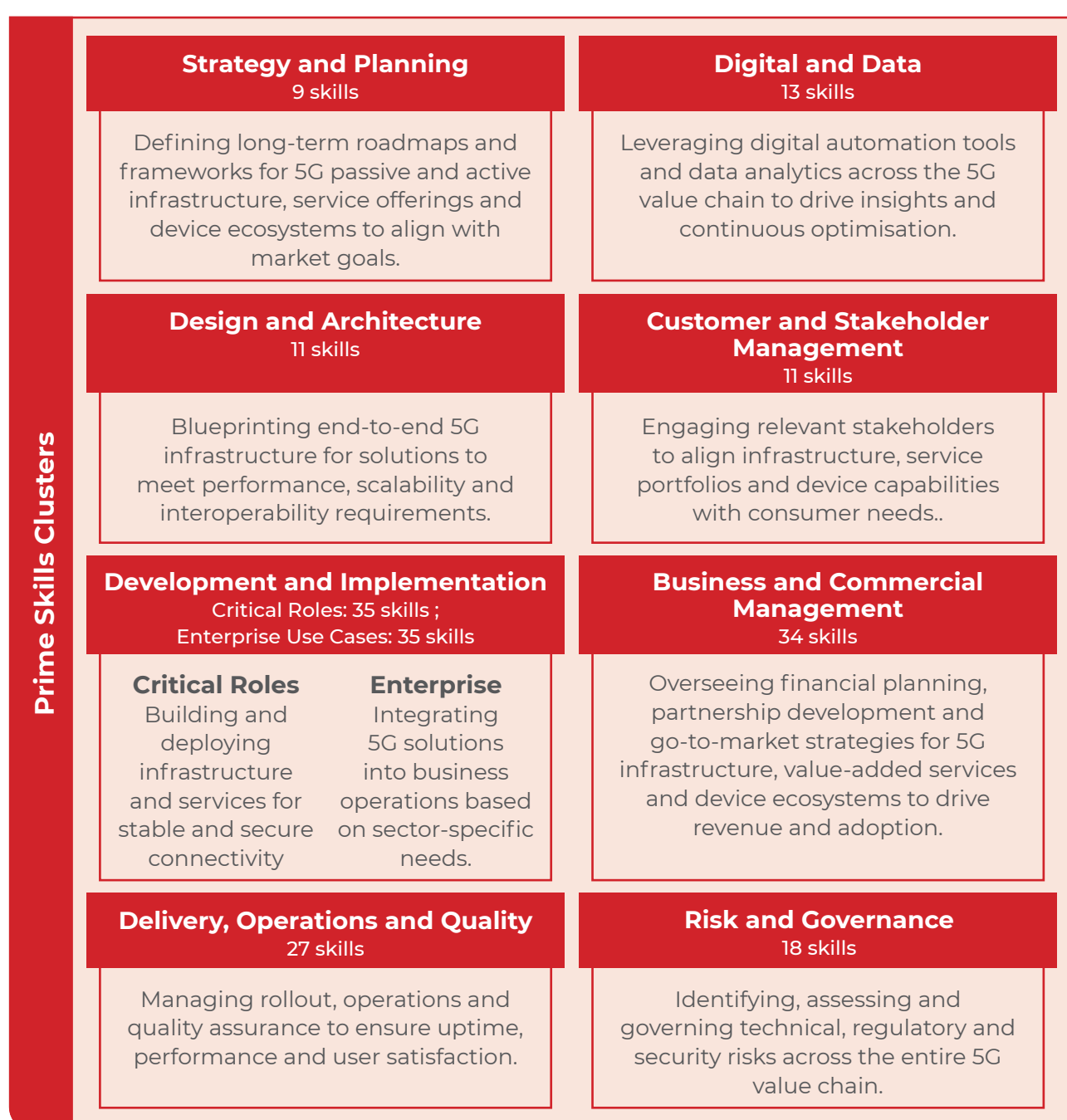
Aligned to the power skills within this framework,
79% of employers consider **Leadership** to be the most in-demand power skill

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.

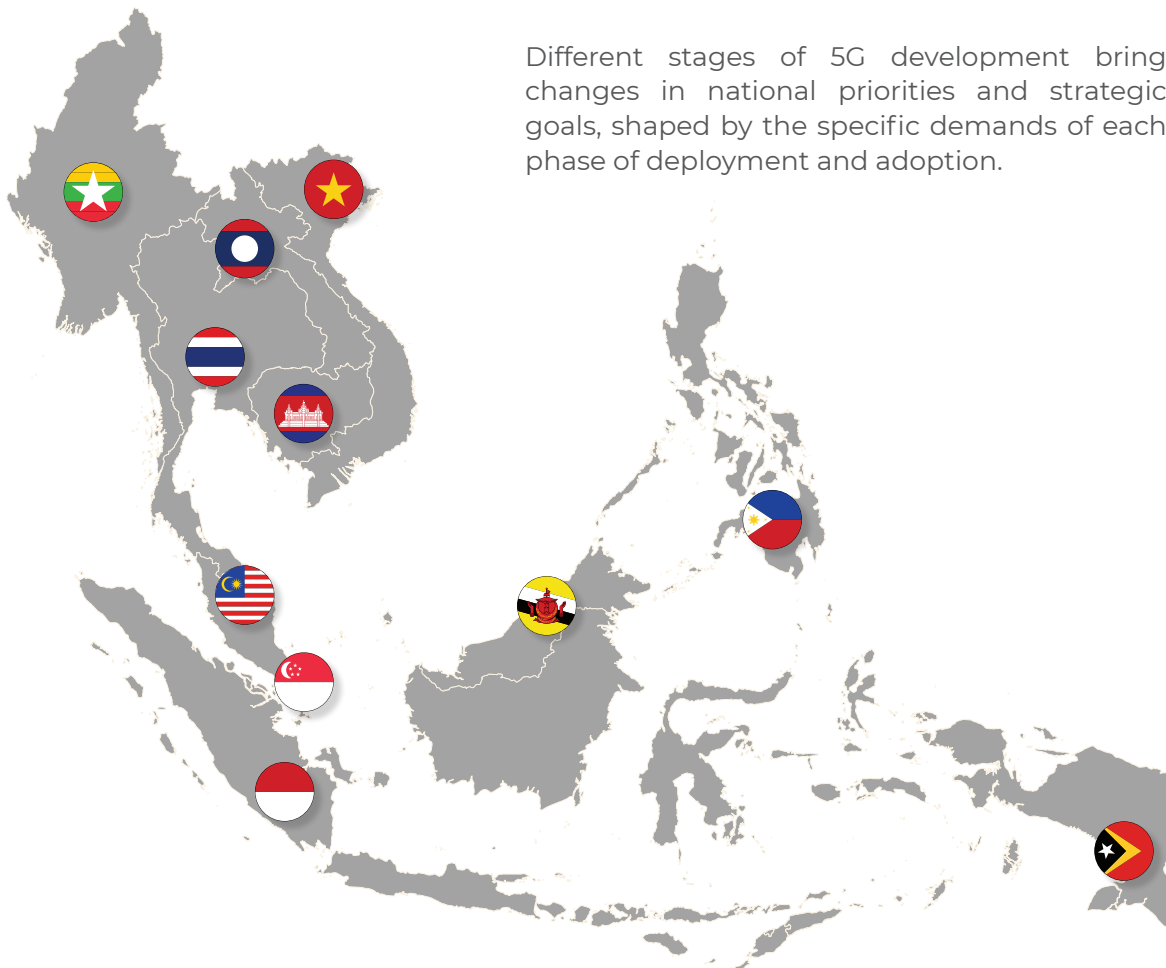
A total of 193 prime skills were identified and grouped into eight skill clusters:



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			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	
	50	Devices				
	1		Emphasis on data processing capabilities within enterprises to fully leverage 5G's potential			
		Consumers (Enterprises)				
	5					

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.

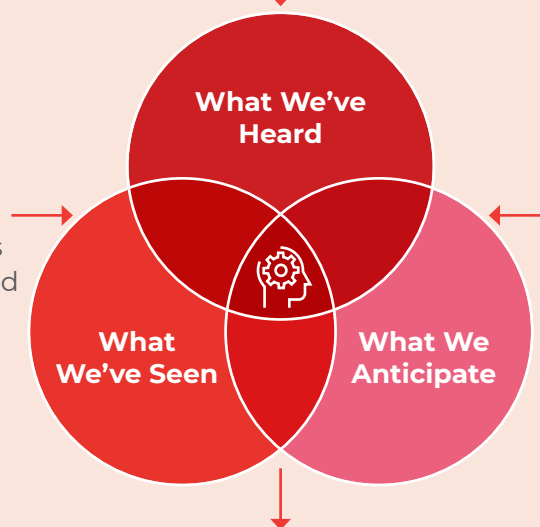


ROLE SPOTLIGHT

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

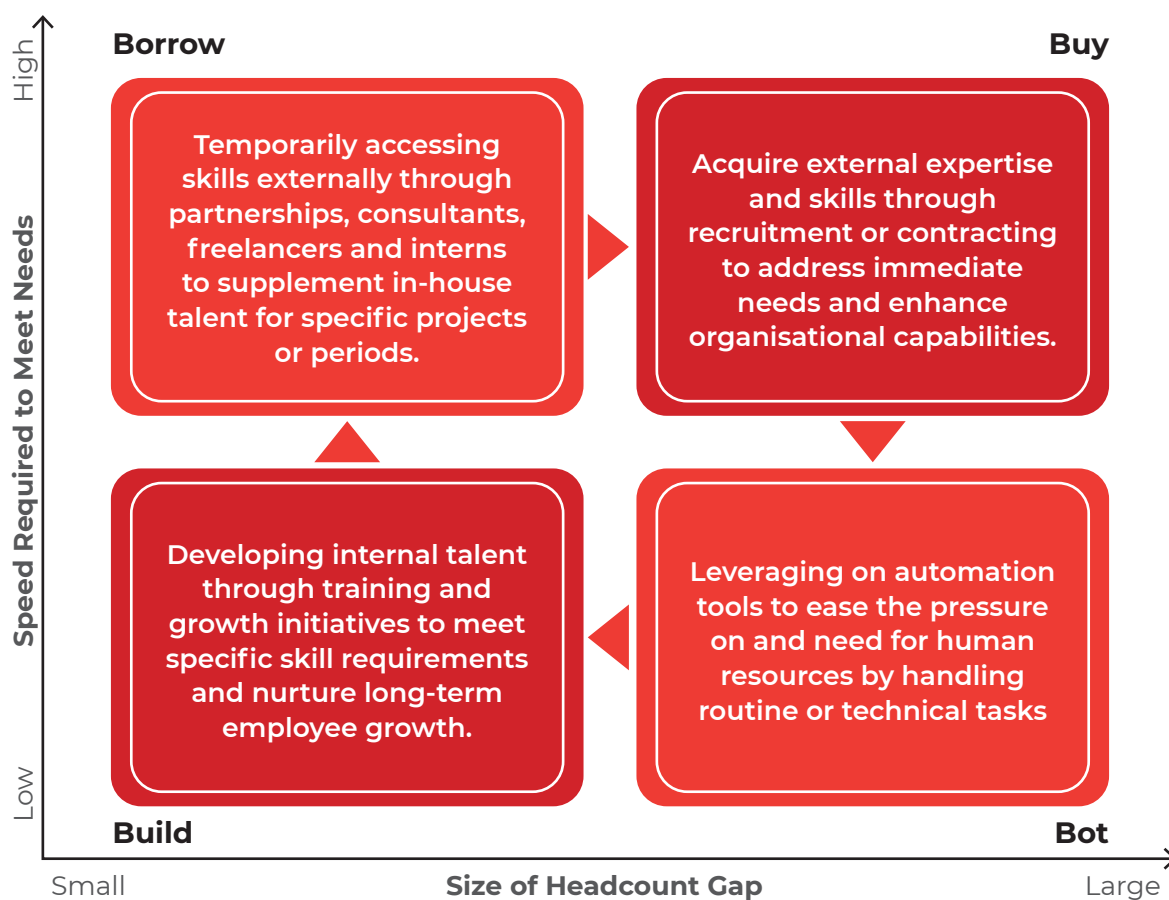
In Early Stage countries where 5G deployment remains predominantly on the horizon, talent development is entering a preparation phase. While 50 critical roles have been identified across the 5G ecosystem, their availability varies across markets. For many operators, regulatory milestones such as spectrum 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



CHAPTER 3

SKILL GAP ANALYSIS

Skill Gaps across the ASEAN Landscape

Identifying skill gaps can help define future focus areas and guide workforce priorities across ASEAN

As ASEAN looks towards scaling 5G provisioning and adoption, many skills expected to become increasingly important as organisations take on more active roles across the 5G ecosystem.

A skill gap refers to...

Capabilities that organisations are likely to require to fulfil their responsibilities effectively over the next three to five years, but which may not yet be developed to the necessary level. This does not imply that the skills are entirely absent, nor that they are required immediately. Rather, the analysis highlights areas where further development may be beneficial in anticipation of evolving demands.

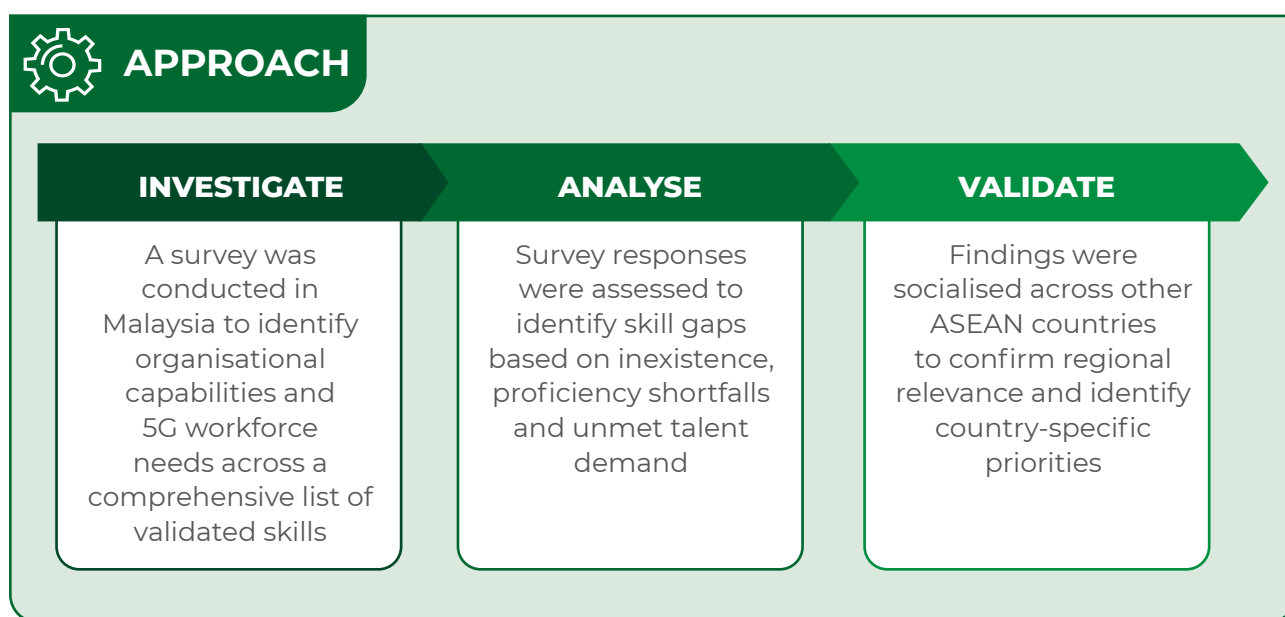
While the findings may not capture the full variation across all organisation types—such as differences in scale, sector or digital maturity—they offer a valuable reference point for guiding workforce planning and talent development efforts. By highlighting common trends, these insights can support organisations in aligning their talent strategies with national 5G priorities and broader digital transformation goals.

Identifying Skill Gaps in the 5G Ecosystem

While 5G is no longer a new technology, its rollout and integration continue to progress at different speeds across ASEAN. As discussed in previous chapters, countries are at varying stages of development, shaping the types of roles and skills required, with each country prioritising capabilities that align with its current objectives and market conditions.

The analysis has identified a range of skill gaps spanning both technical and functional domains, which present clear opportunities for industry players and enterprises to enhance their existing workforce. By proactively addressing these development needs, enterprises can better position themselves to support 5G implementation and adoption, further supporting national and sectoral digital ambitions.

The skill gaps identified span both foundational and advanced areas. While relevant across all ASEAN countries, the emphasis on specific skills differs depending on each country's 5G readiness and current priorities. This highlights the difference in regional needs whilst pointing to shared opportunities for developing a future-ready workforce, especially the 50 critical roles amongst the industry players and personnel involved in 5G use cases in the enterprises.



This collaborative approach ensured that the final set of identified skill gaps reflects both shared regional needs and the unique developmental contexts of individual ASEAN member states.

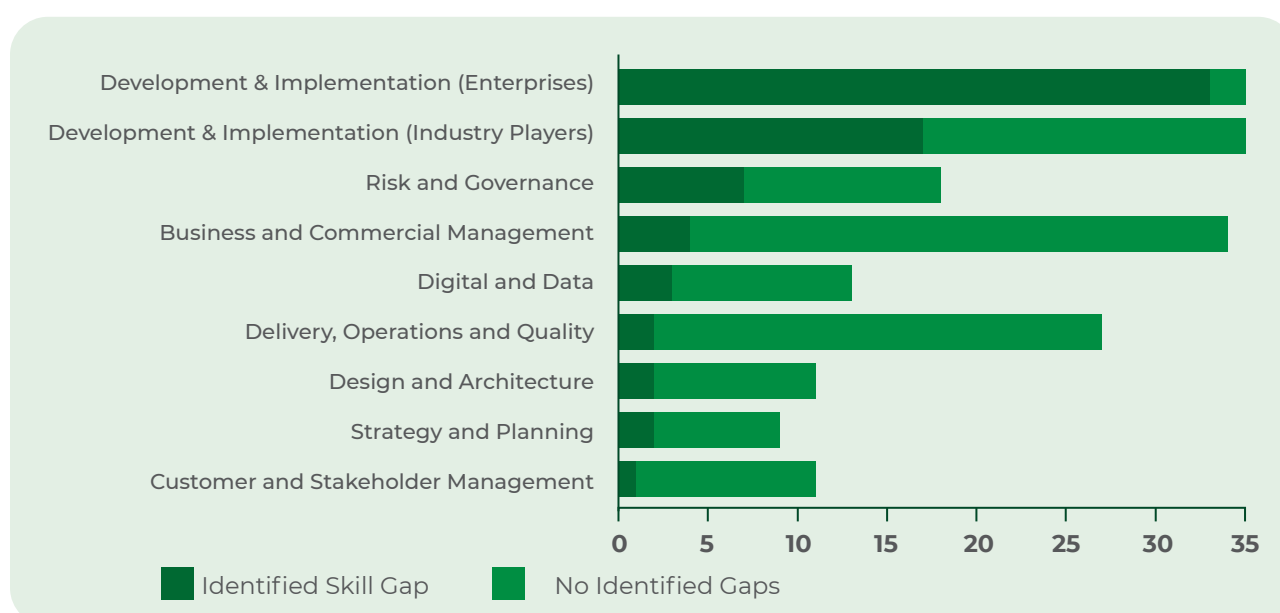
The findings also reveal strengths already present in the region. In many areas, baseline capabilities are well established, particularly in infrastructure-related roles, providing a solid foundation for further development. These skills are increasingly being complemented by emerging competencies in areas like AI, cloud computing and edge technologies, reflecting a shift toward more integrated service delivery.

The identified gaps serve as a roadmap rather than a sign of deficit. They help pinpoint where to focus development efforts, whether updating existing competencies or building new ones in anticipation of future demand. This positions ASEAN to meet immediate rollout requirements while effectively leveraging 5G capabilities across sectors.

Skill Gaps Findings Overview

Distribution of Gaps across Skill Clusters

A review of capability gaps across the identified clusters reveals an uneven landscape of readiness across ASEAN, largely driven by differences in existing telecommunications infrastructure maturity and historical investment patterns. Whilst some capabilities, particularly in Delivery, Operations and Quality and Customer and Stakeholder Management, appear relatively well-established due to established mobile network operations, others show clear gaps in areas that demand strategic or highly specialised expertise such as skills that have had limited development time given 5G's recent emergence. Clusters tied to technical deployment, data innovation and governance continue to reflect pressing talent needs, reinforcing the importance of strategic investment in both foundational and emerging skills to ensure sustainable 5G growth.



Growing gaps are also evident in clusters such as Risk and Governance, Strategy and Planning and Digital and Data. These gaps stem from 5G's intersection with rapidly evolving regulatory frameworks, cybersecurity requirements and data privacy legislation that traditional telecommunications training has not fully addressed. The increasing complexity and intelligence of 5G systems demand sophisticated understanding of multi-layered governance structures, foresight for technology convergence and advanced data management capabilities that many enterprises are still developing.

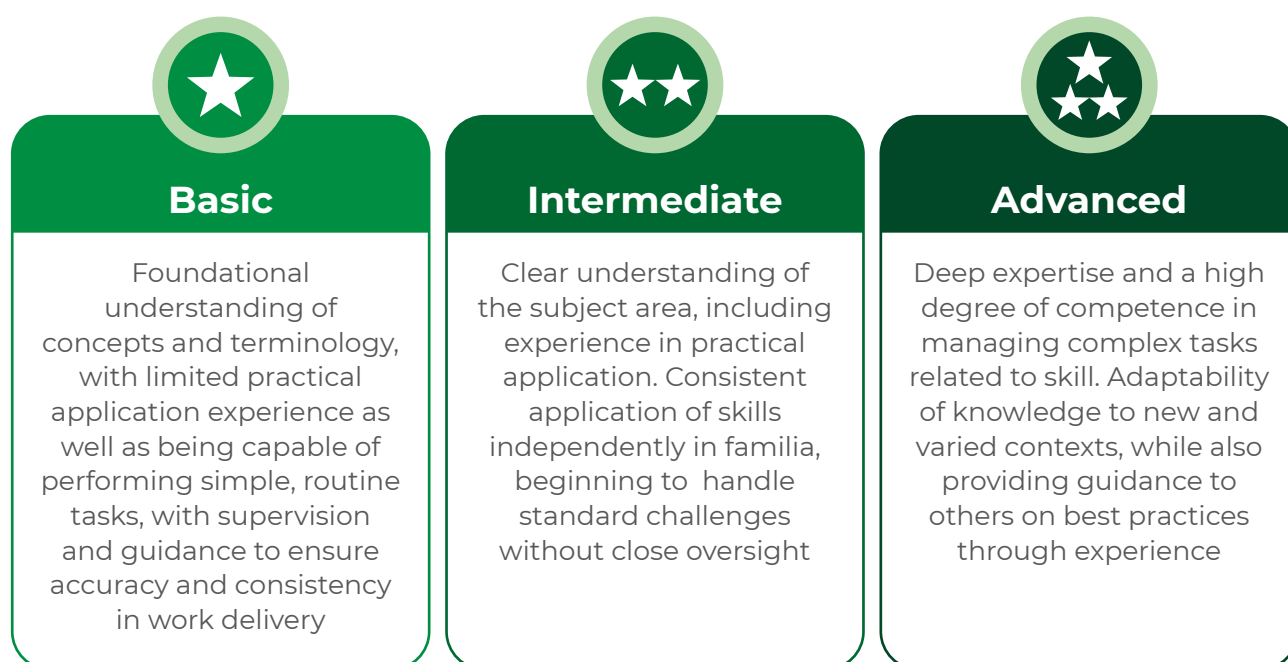
In contrast, clusters including Business and Commercial Management and Customer and Stakeholder Management appear relatively mature, building on decades of experience in mobile services commercialisation and customer relationship management. However, the shift toward B2B2X business models introduces new complexity, requiring technical teams to develop commercial acumen and commercial teams to understand technical capabilities, a cross-functional skill set that traditional organisations have not fostered.

Overall, the gaps span enabling infrastructure, advanced service development and governance, indicating that enterprises must build capabilities not just to support rollout, but to sustain and evolve with 5G's advancement. This reinforces the need for a holistic approach to workforce development that addresses both immediate deployment requirements and longer-term strategic capabilities.

Assessing Proficiency Needs across Skill Gaps

Following the examination of skill gap distribution across clusters, this analysis focuses on the depth of these gaps. Specifically, the proficiency levels at which these skills are currently inadequate. A skill gap does not signify complete absence of capability, but rather indicates that existing proficiency levels are insufficient to meet 5G deployment requirements.

The diagram below defines each proficiency level: Basic (foundational knowledge), Intermediate (practical application) and Advanced (specialised expertise). These definitions provide the framework for interpreting the subsequent findings.



5G Implementation Skill Gaps and Proficiency Requirements

Proficiency level at which the skill is required			
	★ Basic	★★ Intermediate	★★★ Advanced
Industry Players	- Agile Software Development - Cloud Computing - AI Applications - AI Application in Product Development - Edge Computing - Applications Integration - Business Innovation - Continuous Integration and Continuous Deployment - Embedded Systems Interface Design - Software Testing - Solution Architecture - Network Virtualisation - Embedded Systems Programming	- Computational Modelling - Embedded Systems Integration - Emerging Technology Synthesis - Organisational Analysis - Test Planning - Real-time / Embedded Systems Development - Edge Computing - Security Monitoring - Risk Governance - Risk Management - Risk Modelling and Validation - Failure Analysis - IT Governance - Network Slicing - Stakeholder Management - Sustainability Management - Business Opportunities Development - Data Governance - Data Security	- Data Collection and Analytics - Network Security - Security Strategy - Threat Analysis and Defence - Cyber Risk Management - Data Engineering - Database Design

The assessment of proficiency gaps across ASEAN industry players reveals distinct patterns by skill level. This analysis, validated via multiple stakeholder engagement sessions, identifies both the specific skills required and the depth of capability necessary for effective 5G implementation across infrastructure, services and devices.

Basic-level gaps represent fundamental skills absent from the current workforce. These include Agile Software Development and Business Innovation methodologies and integration of emerging technologies such as AI Application and Edge Computing. While many of these capabilities predate 5G deployment, they have become critical due to 5G's technical demands and accelerated innovation cycles. The prevalence of these gaps indicates that numerous industry players remain in the initial stages of building capacity in areas like data center expansion and AI-related skills, which are key investment priorities for telecommunication companies driven by 5G growth.

Intermediate-level gaps identify skills that exist at foundational levels but require enhanced application capabilities. Key areas include Embedded Systems Integration, Real-time/Embedded Systems Development and Data Governance. These competencies are increasingly vital as 5G enables more sophisticated and responsive solutions. The concentration of Intermediate requirements reflects the industry's transition towards customised solution development, where enterprises manage technical challenges with greater autonomy.

Advanced-level gaps occur where working knowledge exists but specialised expertise remains insufficient. This category includes advanced Network Security protocols, comprehensive Cyber Risk Management and sophisticated data capabilities. These gaps underscore industry expectations that players will assume leadership roles in securing connected ecosystems as networks evolve into platforms supporting mission-critical enterprise services.

Enterprise 5G Readiness Skill Gaps and Proficiency Requirements

Proficiency level at which the skill is required			
	Basic	Intermediate	Advanced
Enterprises	• Solution Architecture • Robotics Programming and Automation • Network Performance Optimisation • Embedded Systems and IoT Integration • Embedded Systems and IoT Device Engineering • Edge Computing and Real-Time Data Processing • Data Visualisation • Data Analytics and Monitoring • Cybersecurity for Operational Technology • Cybersecurity and Industrial Systems • Autonomous Vehicle and Robotics Engineering • Autonomous Drone Technology • AI and Predictive Maintenance • AI and ML • AI and Data Analytics • AI and Automation • 5G Network Engineering • IoT and Sensor Integration	• Warehouse Automation and Robotic Systems • QoS Management • Network Segmentation • Network Security and Access Control • Infotainment System Development • Industrial Automation and Robotics • Embedded Systems Engineering • Digital Twin and Simulation Modelling • Data Engineering • Computer Vision • Cloud Computing and Dashboard Development • Cloud and Mobile Robot Integration • Cloud and ERP Integration • AR Development	• Cybersecurity for Data Management

The enterprise landscape presents a distinct proficiency gap profile that builds on the broader industry patterns. Enterprise proficiency gaps mirror the broader pattern of nascent 5G adoption, with the majority concentrated at basic levels. Critical skills including Solution Architecture, IoT and Sensor Integration, Cybersecurity for Industrial Systems and a range of AI applications are only beginning to penetrate enterprise workforces, despite being essential for progressing beyond pilot implementations to full-scale deployment.

Intermediate-level gaps are evident in skills such as Industrial Automation and Robotics, Cloud and Enterprise Resource Planning (ERP) Integration and Digital Twin and Simulation Modelling capabilities. While enterprises have initiated experimentation in these domains, they lack the consistency required for scalable implementation. The identification of advanced-level gaps in Cybersecurity for Data Management demonstrates emerging but limited specialisation in areas fundamental to data protection and business resilience.

These findings highlight the need for enterprises to establish foundational capabilities now while preparing to develop deeper proficiency in automation, intelligence and integration technologies. Building these competencies systematically will be essential for enterprises to effectively implement 5G solutions at scale.

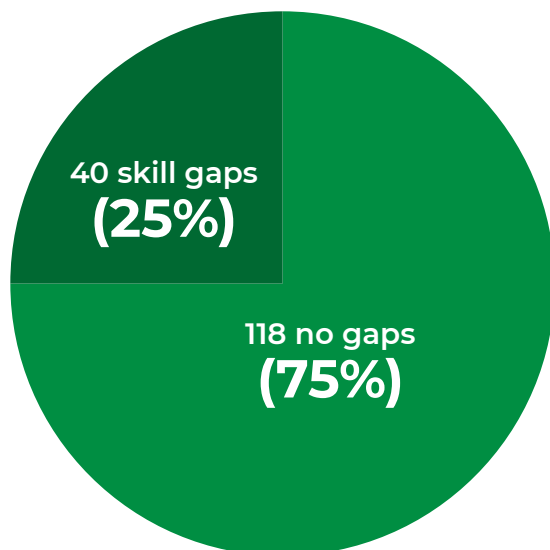
Skill Gaps by Industry Players

Industry players will need to address key skill gaps to enable successful 5G deployment and integration



As ASEAN countries advance through distinct phases of 5G deployment, their telecommunications workforce faces a nuanced challenge: building specialised capabilities that align with each nation's strategic priorities rather than pursuing generic skill development. Industry players are central to this transition, as their expertise determines both network performance and whether 5G delivers tangible value to enterprises and consumers.

Industry Player Skill Gap Identification



- Identified Skill Gap
- No Gaps

Analysis shows that focused development is needed in approximately one in four industry skills, indicating that many foundational capabilities are already in place across ASEAN's telecommunications workforce. The skill gaps that do exist are closely tied to each country's stage of 5G deployment and specific growth priorities. This highlights the importance of targeted reskilling and upskilling to ensure the workforce can adapt to evolving demands and support sustained advancement in 5G implementation.

This pattern exemplifies that ASEAN is experiencing strategic skill evolution driven by clear development priorities. Countries are systematically building expertise when and where it matters most for their next phase of progress. High Progress markets are prioritising network optimisation and commercial innovation. Intermediate countries are balancing infrastructure expansion with early service development. Early Stage countries are focused on building governance frameworks and foundational technical capabilities.

Two fundamental drivers explain this strategic skills development. Traditional telecommunications roles require upgrading to meet 5G's elevated technical standards and performance demands. Simultaneously, technologies that are now central to 5G applications, particularly AI, IoT and embedded systems, demand distinct expertise that many organisations are still developing internally.

The strategic implications extend beyond individual country readiness. As nations progress through deployment stages, their skill requirements will shift predictably, creating systematic opportunities for regional knowledge transfer and coordinated capability building. Long-term success depends not only on closing current gaps but also on building adaptive capacity for continuous technological advancement.

Skill Gap Identification by Value Chain and Maturity Level

Industry Players	
Infrastructure	Services and Devices
Skills that enable effective planning, deployment, management and scaling of 5G networks	Skills that enable development of new products and services that leverage 5G
Identified Skill Gaps	• AI Applications • AI Application in Product Development • Agile Software Development • Edge Computing • Network Virtualisation • Network Security
	• AI Applications • AI in Product Development • Agile Software Development • Edge Computing • Continuous Integration and Continuous Deployment • Emerging Technology Synthesis • Applications Integration • Embedded Systems Integration • Business Innovation • Business Opportunities Development
	• Embedded Systems Interface Design • Embedded Systems Programming • Real-time / Embedded Systems Development • Computational Modelling • Cyber Risk Management
• Threat Analysis and Defence • Security Monitoring • Failure Analysis • Risk Modelling and Validation • Security Strategy • Data Collection and Analytics • Software Testing • Solution Architecture • Cloud Computing	• Data Engineering • Data Governance • Organisational Analysis • Test Planning • Database Design • Data Security
• Network Slicing • IT Governance • Stakeholder Management • Sustainability Management	

Current Stage of 5G Deployment:



High Progress



Intermediate



Early Stage

High Progress Countries



High Progress countries reveal a complex workforce challenge: transitioning from infrastructure-focused engineering excellence to hybrid technical-commercial expertise that can monetise mature network investments. With coverage exceeding 90%, these markets have moved beyond deployment challenges to focus on extracting returns from existing 5G infrastructure.

Network optimisation represents their most immediate technical frontier. AI-driven automation, particularly in self-organising and self-healing network functions, requires professionals who can seamlessly integrate traditional network engineering with machine learning applications. While operators recognise capabilities such as AI Application and AI Application in Product Development, as essential for maintaining service reliability while reducing operational costs, building this specialised talent pipeline presents an opportunity for regional skill development initiatives.

Network Virtualisation and Edge Computing present additional technical requirements. These markets are implementing complex, distributed architectures that require expertise in containerisation orchestration and real-time processing optimisation. Managing latency-sensitive applications across distributed edge nodes requires specialised capabilities that represent a growth area for professional development, creating opportunities for targeted training programmes.

Intermediate Countries



The Philippines and Indonesia are managing a dual development agenda: building technical depth while deployment continues at scale. This creates workforce development opportunities as these markets expand coverage beyond urban centres and develop expertise needed to secure and optimise their growing networks.

Infrastructure development needs are centered around Network Security, Network Analytics and Solution Architecture - skills that become important as 5G scales across diverse environments and enterprise dependencies grow. Building adequate expertise in Failure Analysis and Risk Modelling represents a priority area as network complexity increases.

In parallel, these countries are building foundations for advanced service delivery. Developing capacity in Real-time/Embedded Systems Development will enable support for intelligent, 5G-enabled devices that enterprises are beginning to demand. This technical development area connects with building capabilities in Business Opportunities Development and Computational Modelling, upstream skills needed for identifying viable service markets and designing solutions that meet specific enterprise requirements.

This pattern shows markets navigating an important transition: completing infrastructure buildout while preparing for service differentiation. Unlike High Progress countries that can focus primarily on optimisation and innovation, Intermediate markets are strengthening foundational network operations alongside early commercial development capabilities.

Countries that manage this dual requirement effectively through building solid operational expertise while cultivating analytical and development capabilities will be well-positioned to compete on service quality.

Early Stage Countries



Early Stage countries approach 5G from a position of strategic opportunity rather than operational urgency. With many markets still finalising spectrum allocation and national deployment strategies, their skill gaps reflect deliberate preparation for future requirements rather than immediate operational needs.

Infrastructure-related gaps highlight a shift toward modern, cloud-enabled network architectures. The emergence of skills like Cloud Computing and Network Slicing suggests that the workforce is beginning to prepare for 5G-ready infrastructure, laying the groundwork for more flexible and virtualised networks over time. Gaps in Information Technology (IT) Governance, Stakeholder Management and Data Governance highlight the importance of cross-functional coordination and structured policy frameworks which are particularly relevant as 5G deployment requires unprecedented collaboration across public and private sectors.

The emphasis on Sustainability Management reflects growing recognition that long-term operational and environmental planning must be integrated into network design from the outset, a strategic advantage over countries retrofitting legacy infrastructure.

Service and device capabilities reveal forward-looking data infrastructure priorities. Skills in Data Engineering, Database Design and Data Security will become essential for harnessing the volume and complexity of data that 5G enables. Capabilities in Cyber Risk Management, Test Planning and Organisational Analysis highlight the importance of ensuring that 5G-enabled solutions are secure, well-integrated and enterprise-ready from deployment.

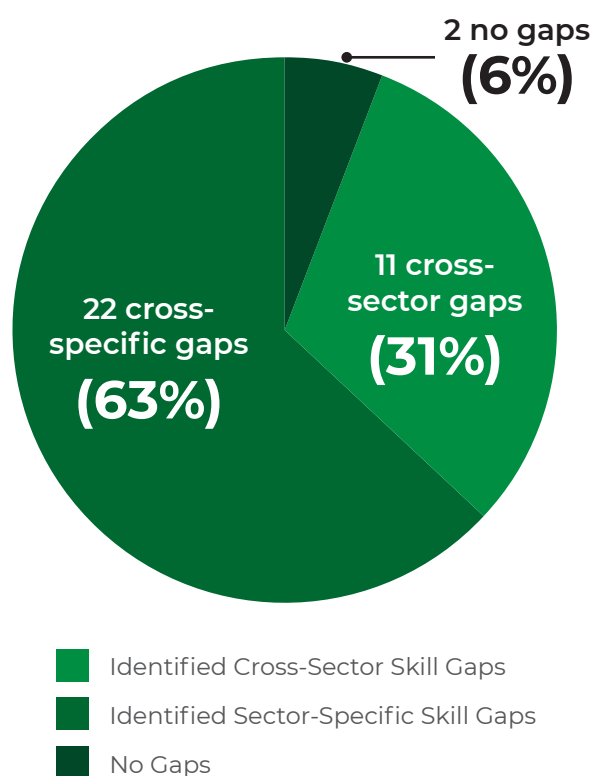
Early Stage countries are leveraging their position to build a future-proof foundation for 5G. These skill gaps reflect intentional, forward-looking planning, emphasising the development of adaptable, secure and sustainable infrastructure, governance and talent ecosystems. This strategic posture enables them to capitalise on 5G as a transformative enabler of digital growth, positioning their economies to adopt next-generation technologies with greater agility and resilience when deployment accelerates.

Skill Gaps by Enterprises

Enterprises will need to address key skill gaps to enable successful 5G adoption and realise its full potential

As ASEAN countries progress in their 5G journeys, enterprises face a critical shift: developing the capabilities needed to translate 5G's technical potential into meaningful business outcomes. Rather than treating 5G as just a connectivity upgrade, forward-looking organisations must align adoption efforts with sector-specific use cases, workforce readiness and innovation agendas to realise its full value.

Enterprise Skill Gap Identification



The adoption of 5G technology within ASEAN enterprises requires a blend of technical capabilities that encompass both general competencies and specialised sector expertise. This dual requirement reflects 5G's function as both foundational infrastructure technology and an enabler of industry-specific applications.

Analysis of enterprise 5G implementations identifies 35 skills necessary for effective development and deployment, with 33 representing current skill gaps across ASEAN. These gaps indicate areas where workforce development could support organisations seeking to implement 5G solutions for operational improvements and competitive positioning.

Cross-Sectoral Skill Requirements

Enterprise Skill Gaps			
Applies to all sectors	Foundational skills to design and integrate 5G networks for end-to-end enterprise solutions	• 5G Network Engineering	• Solution Architecture
	Skills to enable real-time, autonomous and connected enterprise systems through 5G-powered edge intelligence and device integration	• Autonomous Drone Technology • Autonomous Vehicle and Robotics Engineering • Computer Vision	• Edge Computing and Real-Time Data Processing • Embedded Systems and IoT Device Engineering • IoT and Sensor Integration
	Skills to enable the collection, protection and interpretation of real-time data flows	• Data Visualisation • Data Engineering	• Cybersecurity for Data Management

11 of the 35 identified Development and Implementation skill gaps are cross-sectoral, forming the technical foundation for enterprise 5G applications. These skills address fundamental network architecture, data management and system integration challenges that all sectors encounter when implementing 5G solutions.

5G Network Engineering and Solution Architecture represents the primary technical requirement, encompassing network design, deployment protocols and integration with existing enterprise systems. These capabilities support reliable connectivity and operational continuity across different industry contexts.

The integration of 5G with emerging technologies requires capabilities in Autonomous Drone Technology, Edge Computing, Real-time Data Processing and IoT Sensor Integration. These capabilities leverage 5G's low latency and high bandwidth to enable responsive operational systems, from automated quality control to predictive maintenance protocols.

Enterprise dependence on real-time data streams requires capabilities in Data Visualisation, Data Engineering and Cybersecurity for Data Management. These skills enable organisations to process the increased data volumes that 5G connectivity generates whilst maintaining appropriate security and compliance standards.

Sector-Specific Skill Requirements

Sector-focused skill development reflects the operational demands and priorities that influence how different sectors implement 5G technology. These specialised competencies address sector-specific challenges that emerge from each industries unique operating environment and 5G use cases.

Sector -Specific	Manufacturing	Oil and Gas	Transport	Logistics	Power and Utilities
	Skills to enable real-time data flows, protect integrated systems and drive automation through smart robotics and IoT technologies	Skills to enable secure, reliable network performance and manage segmented, prioritised connectivity for critical operations	Skills to enable intelligent transportation systems that can anticipate maintenance needs and adapt to real-time conditions	Skills to enable real-time visualisation, process simulation and automation through robot technologies	Skills to enable real-time environmental monitoring and analyse data for actionable insights through cloud-based dashboards
	• Cloud and ERP Integration • Cloud and Mobile Robot Integration • Cybersecurity and Industrial Systems • Cybersecurity for Operational Technology • Embedded Systems and IoT Integration • Industrial Automation and Robotics • Robotics Programming and Automation	• Network Performance Optimisation • Network Security and Access Control • Network Segmentation • QoS Management	• AI and Machine Learning • AI and Predictive Maintenance • Infotainment System Development	• AR Development • Digital Twin and Simulation Modelling • Warehouse Automation and Robotic Systems	• AI and Automation • AI and Data Analytics • Cloud Computing and Dashboard Development • Data Analytics and Monitoring • Embedded Systems Engineering

Manufacturing enterprises operating high-volume, precision production environments require skills that support real-time system integration and security. Cloud and ERP Integration enables seamless data flow between 5G-connected production systems and business platforms, whilst Cybersecurity for Industrial Systems addresses the expanded attack surface created by connected manufacturing equipment. Robotics Programming and Automation supports the dynamic reconfiguration capabilities that 5G's low latency enables in automated production lines.

Oil and gas operations in remote, mission-critical environments necessitate advanced network management capabilities to ensure reliable connectivity across challenging geographical conditions. Network Performance Optimisation maintains consistent 5G performance in isolated locations, whilst Network Security and Access Control protects sensitive operational data transmitted across extended networks. Network Segmentation enables the creation of isolated network zones required for different operational functions, supporting the robust connectivity that remote monitoring and control systems demand.

Power and utility companies managing distributed energy assets require skills that transform vast sensor networks into actionable operational intelligence. AI and Data Analytics processes the increased data volumes from 5G-connected grid sensors to support predictive maintenance and demand forecasting. This capability builds upon but extends the cross-sectoral Real-time Data Processing skills by applying sector-specific algorithms for energy management. Cloud Computing and Dashboard Development centralises monitoring across geographically distributed assets, whilst Data Analytics and Monitoring transforms raw sensor data into grid management insights.

Logistics operations managing complex, dynamic supply chains leverage 5G's enhanced capabilities for immersive operational technologies. AR Development utilises 5G's low latency to support real-time warehouse operations and remote maintenance procedures, whilst Digital Twin and Simulation Modelling creates virtual representations of supply chain networks that require 5G's high bandwidth for continuous data synchronisation.

Transport enterprises implementing AI-driven operational systems require skills that leverage 5G's ability to support distributed AI processing. AI and ML capabilities enable real-time route optimisation and capacity management across transport networks, whilst AI and Predictive Maintenance supports proactive fleet management through continuous monitoring of vehicle systems enabled by 5G connectivity.

Prioritising Skills towards 5G Implementation and Adoption

Upskilling efforts will need to be targeted, meeting immediate needs while creating lasting impact for both talent and organisations

Following the analysis of skill gaps across industry players and enterprises, it is equally important to understand which skills are considered a priority in the context of 5G rollout and adoption. Skill gaps indicate where capabilities are still developing, but do not always align with what organisations see that support their future. In many High Progress countries, priority skills are skills that often already exists, reflecting a need to strengthen and scale existing capabilities, rather than develop entirely new skill sets.

To reflect this, key stakeholders have identified the high priority skills for upskilling or hiring. These responses were then mapped against critical roles (for Industry Players) and use cases (for Enterprises) to highlight which skills are most frequently linked to future 5G implementation efforts.

This approach offers a clearer view of where organisations are placing emphasis and can serve as a reference for other ASEAN countries navigating their own upskilling strategies.

Priority Skills for Industry Players

A total of 29 skills were identified as priority across industry players, of which five were also flagged as skill gaps. These five warrant attention, representing capabilities deemed essential for 5G success yet currently absent from the workforce. While other priority skills may already exist within organisations, identifying them as gaps indicates urgent requirements for focused upskilling or recruitment.

Industry Players	
Infrastructure	Services and Devices
1. Infrastructure Development (16) 2. Infrastructure Deployment (14) 3. AI Applications (13) 4. Infrastructure Design (9) 5. Infrastructure Support (7) 6. Cloud Computing (6) 7. System Integration (6) 8. Process Automation (5) 9. Regulatory Compliance (4) 10. Risk Management (4) 11. Network Planning (4) 12. Contract Management (3) 13. Information Security (3) 14. Network Design (3) 15. Big Data Analytics (2) 16. Infrastructure Strategy (1) 17. Network Orchestration and Automation (1) 18. Project Management (1)	1. Solution Architecture (6) 2. Product Design and Development (5) 3. Data Modelling and Design (5) 4. Security Architecture (3) 5. Applications Development (2) 6. Applications Integration (2) 7. AI Management (2) 8. Organisational Analysis (2) 9. Business Opportunities Development (1) 10. Customer Experience Design (1) 11. Strategy Implementation (1)

Legend: **XXX** - Skills with gap XX - Number of roles mapped to the skill

A total of 18 priority skills were identified for infrastructure functions and mapped across 24 critical roles. Skills such as Infrastructure Development (16 roles), Infrastructure Deployment (14 roles) and AI Applications (13 roles) appear most frequently, reflecting their broad relevance in supporting 5G infrastructure expansion and optimisation.

The number of role mappings indicates broad relevance rather than relative importance. For example, across both planning and deployment functions. Conversely, less frequently mapped skills like Network Orchestration and Automation, Infrastructure Strategy and Project Management may reflect more specialised or leadership-level competencies relevant to a narrower set of roles.

Of the 18 priority skills, AI Applications and Cloud Computing emerged as both priorities and gaps. This suggests immediate areas of focus, particularly as industry players look to operationalise virtualised infrastructure and intelligent networks capable of self-optimisation and adaptive scaling.

For services and devices, 11 priority skills were identified and mapped across 26 critical roles. The relatively small number of skills and fewer mappings per skill reflect the specialised nature of these roles, which often focus on targeted solution development or integration functions. This results in a narrower set of skills being relevant to each role, emphasising the need for highly specific expertise rather than broad capabilities.

The most frequently mapped skills were Solution Architecture (6 roles), Product Design and Development (5 roles) and Data Modelling and Design (5 roles), each playing a central role in the creation and delivery of differentiated service offerings in the 5G landscape.

Several of these, Applications Integration, Organisational Analysis and Business Opportunities Development also appeared as skill gaps. These reveal requirements for competencies that support service integration within enterprise environments, internal alignment across teams and the discovery of new commercial models enabled by 5G.

Priority Skills for Enterprises

A total of 8 skills were identified as priority across enterprises, of which 6 were also flagged as skill gaps. This substantial overlap underscores that most enterprise priorities correspond to areas requiring active development. While remaining priority skills may already exist within organisations, the prevalence of gaps points to upskilling and recruitment needs.

Enterprises

1. **Cybersecurity for Data Management (6)**
2. Service Engineering (5)
3. **Data Engineering (4)**
4. **Solution Architecture (4)**
5. Product Knowledge (2)
6. **Data Analytics and Monitoring (2)**
7. **Digital Twin and Simulation Modelling (1)**
8. **Network Security and Access Control (1)**

Legend: **XXX** - Skills with gap XX - Number of use cases mapped to the skill

Eight priority skills were identified across enterprise use cases, each mapped to several sector-specific applications. The most frequently mapped were Cybersecurity for Data Management (6 use cases), Service Engineering (5 use cases), Data Engineering (4 use cases) and Solution Architecture (4 use cases), demonstrating their relevance across multiple enterprise needs, particularly in building secure, intelligent and scalable solutions on top of 5G infrastructure.

Skills like Cybersecurity for Data Management, Data Engineering and Digital Twin and Simulation Modelling present as both priorities and gaps, indicating areas where deeper technical capabilities are still needed to fully unlock the value of 5G.

While these skills may appear sector-specific based on current use cases, they offer potential for cross-sector learning and adaptation. For example, the way Service Engineering is applied in manufacturing may differ from how it is used in healthcare or logistics, but the underlying competencies could become widely transferable as 5G adoption matures. As use cases diversify, today's sector-focused skills may become tomorrow's industry-agnostic essentials.

Upskilling Priorities in Relation to the Current State of 5G Across ASEAN

The infographic below maps priority 5G-related skills against two dimensions: impact and urgency. A skills impact reflects the number of critical roles or use cases it supports; the higher the impact, the more widespread the effect of targeted upskilling. Urgency distinguishes between skills that are widely acknowledged as priorities and those that are also identified as gaps, indicating more immediate attention is needed.



High Progress Countries



High Progress countries have established 5G infrastructure and are advancing toward service enablement and ecosystem integration. Industry players focus on optimising networks, scaling advanced features such as network slicing and automation and enabling industry-specific solutions. Workforce development must prioritise capabilities in intelligent network operations, service orchestration and integration of AI, cloud and edge technologies.

While some enterprises have begun embedding 5G into operations, others remain in exploratory phases. Strengthening enterprise capabilities in Data Engineering and Security and Solution Design will support 5G commercialisation and improve infrastructure investment returns. This dual approach will accelerate innovation cycles and drive cross-sector adoption.

Intermediate Countries



Intermediate countries are scaling 5G infrastructure while exploring service-level applications. Industry players work to expand coverage, upgrade legacy systems and integrate automation for improved efficiency. This requires deepening skills in Infrastructure Strategy, Systems Integration and Process Automation.

Enterprises face constraints including limited technical expertise and unclear business cases. Workforce development must therefore target both infrastructure delivery and the ability to translate 5G into operational value. Success will enable countries to generate tangible sectoral benefits through improved logistics and smarter urban infrastructure.

Early Stage Countries



Early Stage countries focus on foundational 5G maturity through spectrum allocation, policy enablement and initial infrastructure rollout. Industry players often pilot deployments but may face constraints in technical readiness, vendor capacity or project management expertise. The priority is building essential capabilities in infrastructure deployment, regulatory compliance and support services ensuring quality and reliability.

Enterprise 5G adoption remains limited due to low awareness of use cases and required workforce capabilities. However, investing in fundamental digital and security skills creates a platform for future innovation. This approach ensures coordinated, secure expansion when infrastructure becomes fully operational.

CHAPTER 4

RECOMMENDATIONS



Accelerating 5G Progress in ASEAN

In the era of rapid digital transformation, advancing ASEAN's 5G capabilities is vital for connectivity and innovation

The region stands at a critical juncture in its digital transformation journey. However, the pace and scale of 5G implementation remains uneven across member states due to differing policies, infrastructure conditions and market readiness challenges.

To unlock the full potential of 5G, coordinated action is needed across two focus areas:

FOCUS AREAS



5G Setup, Deployment and Adoption

Effective 5G deployment requires policy and regulatory foundations, supported by investment in infrastructure, services and devices. Enterprise adoption then translates network capabilities into productivity and innovation. Balanced progress across these areas is vital for 5G growth



5G Workforce Development

As the 5G ecosystem expands, demand for talent across technical, operational and business functions grows and diversifies. Investing in future-ready skills will equip ASEAN to enhance 5G implementation and drive continuous technological advancement



APPROACH

Key stakeholders across ASEAN, including industry players, enterprises, academia and associations were engaged to identify challenges and opportunities within the regional 5G landscape. These engagements centered on forward-looking suggestions based on successes in other markets regionally and globally, resulting in actionable themes and context-relevant recommendations to accelerate 5G implementation and workforce development

Within the two focus areas, key themes emerged from these stakeholder engagements.



5G Setup, Deployment and Adoption

5G readiness through spectrum allocation

Support efficient 5G deployment through optimisation of spectrum availability and implementation of flexible sharing models

Enterprise adoption driving commercialisation

Support enterprise adoption of 5G by showcasing use cases, translating them to market-ready solutions and developing business cases to deliver 5G services



5G Workforce Development

Building the 5G and next generation talent pipeline

Align education pathways and early talent development with evolving industry needs to prepare a future-ready workforce for 5G and beyond

Expanding access to relevant 5G training

Ensure flexible, modular learning opportunities are widely available for all skill levels and sectors by fostering collaboration among key stakeholders

5G Setup, Deployment and Adoption

5G goes beyond technological upgrades, it is a coordinated effort across various stages of development, shaping a country's ability to realise its full benefits

For ASEAN, the ability to fully tap into the value of 5G means recognising and addressing the interconnected phases of setup, deployment and adoption. Each plays a distinct role in accelerating digital transformation.

The setup phase lays the foundation by establishing the regulatory and policy conditions for 5G to scale effectively. This includes harmonising spectrum allocation, aligning national roadmaps and creating frameworks that enable innovation while ensuring fair competition and investor confidence. Without this groundwork, implementation risks becoming delayed, fragmented or commercially unviable.

The deployment phase focuses on building physical and digital infrastructure, ensuring coverage, interoperability and access to 5G-ready devices and services. Alignment with national priorities is critical to maximise cost efficiency and bridge connectivity gaps, particularly in rural and underserved communities.

The adoption phase represents the integration of 5G into enterprise operations, where the most tangible economic value is realised. However, it often faces barriers such as limited technical capabilities, uncertain ROI, high ecosystem costs and uneven enterprise demand. Countries may need to align efforts, pool use cases and build economies of scale to reduce adoption costs and make 5G commercially viable. Targeted measures that demonstrate business value and provide hands-on support can accelerate uptake across industries.

By effectively addressing each phase, ASEAN can create a robust, resilient and inclusive 5G ecosystem that drives innovation and economic growth while extending digital connectivity benefits throughout the region.

5G readiness through spectrum allocation

Building on this stage approach, spectrum management emerges as a critical enabler across all phases of 5G implementation. When effectively planned and governed, spectrum policy can provide the foundation for timely rollout, investment certainty and the development of advanced services across the region.

Across ASEAN, efforts to advance 5G deployment reflect a strong commitment to digital transformation, but progress is shaped by diverse national contexts. Many countries are actively working to modernise their spectrum frameworks while balancing a range of competing priorities, including managing existing spectrum commitments, ensuring fair industry participation, maintaining affordability for consumers and coordinating policy across a wide set of stakeholders. In some markets, legacy services are still being phased out, while others face regulatory, financial or geographical constraints that influence the pace and sequencing of spectrum reform. As a result, each ASEAN member state will need to chart its own path in addressing these challenges, aligned with national conditions and development priorities.

Despite these efforts, spectrum management remains a central bottleneck to faster and more uniform 5G deployment across the region. In many cases, existing allocations were designed for earlier generations of mobile networks, leaving key bands underutilised, locked into legacy systems or fragmented into blocks that are inefficient for 5G use. This creates a patchwork of spectrum availability that raises deployment costs, delays network rollout and limits access to advanced mobile services for both enterprises and consumers. Without clear and timely allocation frameworks, operators face uncertainty in network planning, slowing investment in base stations, backhaul infrastructure and other critical components.

The desired outcome is clear: spectrum frameworks must provide both certainty and flexibility. Certainty enables operators and investors to plan long-term network build-outs with confidence, while flexibility ensures that scarce spectrum resources are used efficiently and can adapt to evolving demand and technological change.

International experience offers valuable lessons. In Europe, regulators have developed clear multi-year roadmaps for the release and reallocation of spectrum bands, allowing industry players to prepare investments well in advance. Finland's regulator, Traficom, released a transparent timeline for 5G spectrum auctions that provided certainty to operators while ensuring spectrum would not remain unused. This approach provided investors with greater confidence and accelerated the rollout of services, with Finland emerging as a leader in 5G penetration within Europe.

These examples suggest that ASEAN regulators can adopt more adaptive and transparent approaches. By ensuring that spectrum is allocated in a timely, predictable and efficient manner, governments can create the conditions for operators to expand coverage, reduce costs and bring the benefits of 5G more broadly to citizens and businesses alike.

To accelerate 5G implementation across ASEAN, individual countries must first optimise their spectrum availability and allocation. Targeted policy actions can unlock capacity, reduce costs and provide a clear path for enterprises and industry players to scale 5G applications.

Release and Reallocate Spectrum Bands for Broader 5G Deployment

Strategic spectrum release and reallocation presents a significant opportunity to accelerate 5G implementation across ASEAN. Countries at different development stages can optimise their spectrum management approaches. Access to mid-band spectrum, particularly the 3.5 GHz band, enables optimal balance between coverage and capacity requirements. Timely spectrum access reduces costs, provides planning certainty and enhances operators' ability to secure financing and develop comprehensive service offerings.

Countries can leverage opportunities based on their development stage:

Early Stage countries can identify underutilised spectrum and publish clear release roadmaps that provide certainty for operators and investors.

Intermediate countries may have released some priority bands but still require allocation of remaining frequencies to support full network coverage and advanced use cases. Flexible spectrum policies, such as spectrum sharing or secondary markets, can maximise utilisation and reduce idle resources. Clear and predictable release schedules enable operators to coordinate procurement and plan applications that leverage low-latency and high-throughput capabilities.

High Progress countries already operating advanced networks offer examples of effective spectrum management. Singapore has implemented a detailed 5G spectrum roadmap, including timelines for mid- and high-band releases and clear allocation rules. This approach allowed operators to plan rollout in advance, accelerating commercial launch and enabling rapid adoption of new services. By providing transparency on future spectrum availability, the roadmap enabled both investors and industry players to align capital expenditure, network expansion and technology upgrades with regulatory milestones.

Effective spectrum management creates positive momentum including accelerated network rollout, optimised infrastructure investment and expanded enterprise application opportunities. Clear spectrum policies with forward-looking roadmaps provide operators and investors with regulatory certainty that enables strategic network planning and efficient capital allocation, establishing a strong foundation for scalable 5G implementation and digital economy growth across the region.

Implementing Spectrum Sharing for National Efficiency and Regional Cohesion

Spectrum sharing offers governments a strategic way to maximise scarce spectrum resources while advancing regional alignment. Unlike traditional allocation models that grant exclusive rights to operators and often leave large portions underused, sharing arrangements enable multiple users to access the same frequencies under defined rules of prioritisation, time or geography.

This allows more efficient 5G implementation by directing spectrum to where it generates the greatest value, industrial hubs, urban centres or underserved rural areas. For countries at different stages, sharing provides tailored benefits. Early Stage and Intermediate countries can pilot 5G applications without committing to immediate nationwide allocations. High Progress countries can use it as an optimisation tool, giving industries and enterprises flexible spectrum access for high-value use cases without requiring costly new releases.

At a regional level, spectrum sharing opens opportunities for harmonisation. Cross-border fragmentation occurs when neighbouring countries assign different frequency bands, technical standards or usage rules. This misalignment can cause interference in border regions, create connectivity gaps along trade corridors and complicate operations for enterprises whose services span multiple jurisdictions.

Spectrum sharing helps mitigate these risks by introducing common rules for interference management, prioritisation and access. This ensures spectrum can be used consistently across borders, reduces service disruptions and enables seamless connectivity for transport and logistics systems. An ASEAN-level technical taskforce could formalise these rules, laying the foundation for coordinated sharing practices. Such alignment would strengthen regional supply chains, reduce inefficiencies and unlock new opportunities for cross-border collaboration.

Spectrum sharing becomes both a national tool for efficiency and a regional lever for cohesion. By combining optimisation within borders with harmonisation across them, ASEAN can ensure spectrum resources are fully leveraged to accelerate 5G adoption, drive innovation and support integrated growth across the region.



CASE STUDY

Spectrum Sharing in the European Union



The European Union introduced Licensed Shared Access (LSA) to improve spectrum efficiency, enabling multiple users to share frequencies under agreed rules while safeguarding priority access. In December 2025, a decision harmonising 3.8–4.2 GHz for shared local-area wireless broadband, resulting in:

- Optimised national efficiency by enabling shared use of underutilised frequencies, expanding access to 5G while safeguarding priority services
- Reduced cross-border fragmentation by introducing EU-wide standards for harmonised spectrum allocation and coordinated border use, minimising interference and enabling seamless connectivity across member states

Enterprise adoption driving commercialisation

Enterprise adoption of 5G is critical to realising its economic and societal benefits. While ASEAN countries have advanced in network rollout, uptake remains uneven, with many organisations facing knowledge gaps, unclear business cases and limited exposure to practical applications. Converting 5G capabilities into market-ready solutions enables enterprises to see tangible benefits, strengthens the innovation ecosystem and accelerates cross-sector adoption.

High Progress countries can lead in creating and documenting practical applications, but successful use cases are not confined to advanced markets. Intermediate countries such as the Philippines and Indonesia and Early Stage countries like Vietnam, have also developed innovative applications showcasing 5G's potential in diverse contexts. Intermediate markets can draw on insights from High Progress peers and comparable use cases to design pilots and business cases, while Early Stage countries can learn from this broader set of outcomes to prepare for enterprise adoption.

Three recommendations have been identified to outline opportunities for regional progress.

Document, Showcase and Develop a Business Case for 5G Use Cases

Converting use cases into quantified business cases and sharing this knowledge across sectors is crucial for accelerating enterprise adoption. While countries have developed 5G applications, adoption barriers persist due to unclear return on investment and limited enterprise understanding of practical opportunities.

Systematic documentation and dissemination enables businesses to comprehend 5G's potential while fostering innovative applications. In practice, the level of detail shared will vary, as business cases are often commercially sensitive and require appropriate governance. To address this, countries should appoint a lead government agency or national telecommunication company to coordinate use case documentation and showcasing. From this, countries can contribute based on their development stage: High Progress countries should develop consolidated case studies that highlight business impact and implementation insights, enabling regional knowledge sharing. Intermediate countries can leverage shared knowledge to develop sector-specific pilots while contributing their own insights. Early Stage countries can utilise documented cases to identify opportunities and build enterprise awareness. This collaborative approach enables businesses to envision applications, reduce risks and adapt proven models, accelerating enterprise adoption across ASEAN.



CASE STUDY

Mobile 5G Joint Innovation Center



This facility functions as both a large-scale test lab and exhibition hub to bridge the gap between concept and commercial rollout, supporting cross-sector 5G applications.

- Showcases over 200 live demonstrations across sectors, from 5G-enabled robotic arms and remote medical diagnostics to autonomous port operations
- Enables enterprises, policymakers and technology partners to interact with real-world implementations, providing greater understanding of opportunities and potential for applying 5G at enterprise level

Develop Government Incentives to Support and Encourage Adoption

Government incentives are vital to move enterprise 5G adoption beyond pilots toward commercial rollout in ASEAN. While initiatives are mostly industry-led, targeted support can reduce risk and investment barriers through tax breaks, regulatory facilitation and infrastructure access. At the same time, a growing base of use cases across ASEAN has already progressed from pilot to deployment, demonstrating the technical feasibility and operational value of 5G. These use cases can be leveraged as reference models to build confidence among enterprises and accelerate adoption. However, care is needed to ensure that early successes do not create expectations of sustained government support as a prerequisite for commercialisation. Support frameworks should therefore be positioned as catalytic and time-bound, with a clear emphasis on transitioning use cases toward commercially viable and self-sustaining models.

ASEAN models demonstrate effective approaches that can be adapted for 5G implementation:

Singapore's 5G Innovation Programme co-funds up to 70% of qualifying costs for enterprise projects with commercialisation potential. Indonesia offers super-deductions of up to 300% for research and development (R&D) activities and 200% for vocational training, applicable to 5G solution development and workforce upskilling. Vietnam's Digital Technology Industry Law provides newly established companies with full Corporate Income Tax exemption for two years, followed by 50% reduction for four years, plus access to state investment funds and expansion grants.

These examples illustrate the range of available incentive mechanisms for encouraging enterprise 5G adoption. Regional coordination opportunities exist through common frameworks for enterprise trial funding, regulatory sandboxes and training recognition, which would harmonise demand signals and reduce market fragmentation.

Combining national incentive schemes with regional alignment enables governments to support enterprise adoption scaling, capability building and commercialisation opportunities across ASEAN markets.

Drive Investments in Pilot Projects to Transform Research and Development (R&D) Outputs into Deployable Solutions

Pilot projects validate R&D outputs by demonstrating technical feasibility, quantifying productivity gains and building enterprise confidence. They provide measurable outcomes for accurate ROI estimation and test usability in real operations, addressing concerns about 5G's adoption and viability.

Countries can contribute based on their capabilities:

High Progress countries should lead by launching multi-site, cross-sector pilots that demonstrate interoperability, regulatory compliance and measurable business impact including productivity gains and operational efficiencies. Intermediate countries can adapt these proven models to local contexts through sector-focused pilots that address identified enterprise pain points while generating their own performance metrics. Early Stage countries can establish partnerships with regional leaders to observe pilot outcomes, analyse demonstrated benefits and develop implementation frameworks for future rollout.

Strategic pilot implementation across ASEAN enables systematic validation of 5G capabilities, provides enterprises with tangible evidence of commercial benefits and creates a foundation for scaling successful solutions across regional markets.

5G Workforce Development

A skilled and adaptable workforce is essential to unlocking 5G's full potential and driving sustainable growth

Equally critical to 5G Progress is the need to build a skilled and adaptable workforce that can support rollout, integration and innovation across all sectors of the economy. As 5G technologies evolve and underpin more advanced applications, workforce strategies must move beyond traditional telecom-focused training to encompass a wider mix of capabilities, ranging from cybersecurity to AI integration and business transformation strategy. This shift requires not only specialised technical skills, but also hybrid skill sets that allow workers to bridge technology and business needs effectively.

Workforce development is both a prerequisite and an enabler of 5G value creation. Technology providers and infrastructure partners require talent capable of designing, deploying and managing next-generation networks, while also integrating 5G with emerging technologies such as AI, IoT and cloud services. The speed at which industries can scale their 5G solutions will depend heavily on the availability of this expertise. In more advanced ASEAN economies, where 5G infrastructure is already well underway, efforts are shifting toward building the skills needed to drive greater enterprise adoption. This includes upskilling cross-functional teams and developing sector-specific expertise to support meaningful integration of 5G across industries.

This industry demand for skilled talent directly connects to enterprise challenges. For enterprises, the key challenge lies in building the internal capability to adopt and apply 5G technologies effectively. This includes developing a basic understanding of 5G's potential, identifying relevant use cases and building confidence in its business value. Many organisations may lack the technical knowledge or strategic insight needed to explore how 5G can enhance their operations, improve efficiency or open new revenue streams. Supporting enterprise readiness will require broader access to skills development opportunities, awareness-raising initiatives and practical guidance that helps businesses translate 5G capabilities into actionable outcomes.

Building the 5G and next generation talent pipeline

The rollout of 5G across ASEAN presents a unique opportunity to develop a highly skilled workforce, capable of driving innovation and adoption of advanced technologies. Much of this opportunity lies in academia, where curricula and training programs can be adapted to meet the evolving needs of the 5G industry. By equipping students with practical skills, applied knowledge and exposure to real-world 5G environments before they enter the workforce, countries can ensure that graduates are ready to add value from day one. By addressing this need to strengthen the current educational foundation, ASEAN is positioned to accelerate 5G deployment, support enterprise adoption and unlock broader economic and technological potential for the region.

Therefore, there is a clear need to build a 5G and next-generation talent pipeline. This entails aligning education pathways and early talent development with evolving industry requirements, ensuring that students and early-career professionals are prepared for the demands of emerging technologies. A strong talent pipeline not only supports network deployments and operations, but also fuels innovation, drives adoption and strengthens regional competitiveness.

Develop programs that supports 5G and future generation technology applications

To ensure graduates are equipped to meet the evolving demands of next-generation networks, institutions should develop specialised programs focused on 5G and related emerging technologies. These may include foundational modules, lab-based projects or vocational training, interdisciplinary courses or capstone assignments that introduce students to network concepts, deployment practices and evolving technology applications. This recommendation emphasises the creation of structured learning experiences that build both technical understanding and practical skills, ensuring graduates develop the knowledge and adaptability necessary to participate meaningfully in 5G initiatives.

The structure and content of these programs should reflect the maturity of each market's ecosystem while maintaining a focus on skill development and applied learning. High Progress markets can incorporate comprehensive project-based learning, research collaborations and simulation of complex network scenarios to cultivate advanced problem-solving and innovation capabilities. For Intermediate countries, curricula can emphasise hands-on labs, incremental technology applications and integration exercises that strengthen practical skills and readiness for broader network deployment. Early Stage markets should focus on foundational concepts, structured exercises and guided technical projects that introduce students to the 5G ecosystem and develop core competencies for future learning. Across all stages, this approach ensures that students progressively build the technical expertise and applied understanding necessary to support 5G initiatives as the ecosystem evolves.

Consult and collaborate with industry stakeholders to align academic programs to 5G industry needs

Consulting and collaborating with industry stakeholders ensures that academic learning pathways remain aligned with current and future industry requirements. By embedding real market needs into curriculum design, universities can better equip students with skills that match employer expectations, closing the gap between graduation and job readiness. This collaboration may take the form of co-designed courses, updated learning materials, guest lectures from practitioners or the integration of practical industry scenarios into classroom learning. These efforts ensure that graduates enter the workforce with relevant expertise and the agility to adapt to such technologies.

This recommendation applies to all stages of 5G maturity, though the academic focus will differ for each stage. High Progress markets can integrate advanced, industry co-developed modules into degree programs, covering areas such as private 5G networks, IoT, edge computing and cross-functional applications that bridge telecommunications with other sectors. Intermediate markets can prioritise a mixed curriculum, reinforcing competencies in network deployment and optimisation while gradually introducing advanced technology content. Early Stage markets may emphasise embedding foundational concepts into core courses, alongside practical components that prepare students for initial deployment, operational management and market adoption roles. Together, these efforts can create a steady pipeline of graduates with industry-aligned skills who are ready to support 5G implementation and innovation directly, strengthening the talent base that will drive growth in the telecom and digital sectors.



CASE STUDY

Huawei ICT Academy



The Huawei ICT Academy is a global partnership program between Huawei and universities, designed to integrate industry-standard Information and Communication Technologies (ICT) knowledge, including 5G-related skills, into academic curricula.

- Provide educators with up-to-date 5G training and access to Huawei-developed course materials, labs and certification programs
- Equip students with industry-recognised skills and certifications that align with current and emerging industry demands

In December 2025, the Huawei ICT Academy has over 3500 university partnerships and 1.8 million students trained. By integrating Huawei's technical expertise into university programs, the ICT Academy equips graduates with the skills needed to drive advanced technology deployment, strengthening the talent pipeline and enabling a smooth transition into in-demand ICT roles.

Offer internships and placements to expand learning opportunities

Internships and placements enhance classroom learning by giving students hands-on experience in real-world 5G environments. This experiential learning bridges the gap between theory and industry practice, helping students develop practical technical and soft skills while understanding workflows, project timelines and collaborative problem-solving. These opportunities prepare graduates to perform successfully in network deployment, optimisation and innovation.

This recommendation can be implemented in all markets, with the design and focus of internships and placements adapted to the specific stage of ecosystem development. High Progress markets can embed students within innovation-driven environments, enabling them to support advanced integration initiatives, participate in trials of emerging applications and engage with cross-sector use cases that extend the capabilities of 5G. Intermediate markets may provide a balanced combination of field-based experience and operational engagement, offering opportunities to support network rollouts, address deployment challenges and gain insight into the logistical and regulatory considerations of expanding coverage. Early Stage markets should emphasise building foundational competencies, where students are introduced to equipment handling, basic network configuration and core operational processes, while fostering interest in further technical specialisation. This graduated approach ensures that, irrespective of market maturity, internships and placements deliver a progressive sequence of skills and experiences that prepare graduates to add value as national ecosystems evolve.



CASE STUDY

Ericsson's 5G Elite Trainee Program



Ericsson's 5G Elite Trainee Program in Northeast Asia is a highly immersive, two-year graduate initiative. Trainees rotate through key departments, including Project Management, Product Management and Sales, gaining exposure to pre-sales, design and customer delivery for 5G projects.

- Cultivate cross-functional expertise by rotating through diverse roles, equipping trainees with holistic understanding of 5G ecosystems
- Bridge theory and practice by involving trainees directly in real-world, customer-facing 5G initiatives

Expanding access to relevant 5G training

The previous theme focused on the development of the 5G talent pipeline, looking primarily at the next generation of professionals entering the workforce through universities, vocational institutions and early-career programs. While nurturing future talent remains essential, the workforce of today also requires attention. Many of the skills necessary for 5G deployment and adoption are not entirely new competencies but rather extensions and refinements of existing roles. Cybersecurity, for instance, has historically concentrated on safeguarding networks and systems, but with 5G, professionals must contend with a more complex threat landscape created by network slicing, edge computing and the proliferation of connected devices. Likewise, network engineers are now expected to manage ultra-reliable low latency communications, dense device connectivity and energy-efficient spectrum usage, while application developers need to design solutions capable of handling higher bandwidth requirements across a variety of industries.

These changes underline that workforce development in the 5G era is a continuous process. Upskilling and reskilling are not one-off efforts but an ongoing requirement that evolves alongside technology. Across ASEAN, the current state of training varies depending on each country's position along the 5G maturity curve. Advanced member states have implemented structured training programs, often supported by strong industry partnerships and dedicated training institutions. Intermediate countries are in the process of establishing sector-specific initiatives while rolling out network infrastructure and Early Stage countries usually rely on existing ICT frameworks to develop workforce capabilities.

This landscape presents both challenges and opportunities. While disparities exist in resources, infrastructure and program sophistication, cross-border collaboration offers a mechanism for sharing lessons, harmonising approaches where feasible and optimising the use of limited resources. Expanding access to relevant 5G training represents an opportunity not just to fill gaps, but to enhance the effectiveness of existing initiatives and create a coordinated approach to workforce development that benefits the entire region.

Expanding access to relevant 5G training is therefore defined as ensuring that flexible and modular learning opportunities are widely available for all skill levels and sectors. It is not limited to technical knowledge alone, but includes industry applications, policy understanding and the ability to innovate within the 5G ecosystem. Central to this approach is collaboration among government agencies, academic institutions and industry stakeholders to ensure that the workforce can continuously adapt to evolving technological requirements and market conditions.

Establishing Centres of Excellence across ASEAN for 5G Advancement

A key recommendation is the establishment of national Centres of Excellence (CoE) in each ASEAN member state. These multi-domain hubs provide training, research and practical experimentation across technical skills, sector-specific applications, policy and regulatory frameworks and innovation support for enterprises and startups. While focused on 5G, they would remain adaptable to emerging technologies such as 6G, ensuring long-term relevance.

The CoEs would serve dual purposes. At the national level, they deliver structured opportunities for upskilling, offering training programs tailored to the needs of technicians, engineers, policy makers and industry specialists. Demonstration environments within the centres allow participants to engage with live networks, explore practical use cases and apply theoretical knowledge in controlled settings.

At the regional level, CoEs form a network across ASEAN, facilitating the sharing of curricula, training resources and lessons learned. Advanced countries could serve as initial pilots, testing governance structures, program content and collaboration mechanisms. Meanwhile, Intermediate and Early Stage countries could adapt these lessons to their own national conditions, scaling programs in line with local capacity and priorities.

Within each centre, engagement with multiple stakeholders would be essential. Industry partners could provide insight into current and emerging skills requirements, offer real-world problem statements and support practical learning through internships or project work. Academic institutions would contribute research expertise and curriculum development, ensuring that training content remains evidence-based and pedagogically sound. Government agencies could provide guidance on regulatory compliance, public sector use cases and funding mechanisms. Together, these actors would ensure that each CoE functions as a hub for coordinated and sustainable workforce development.



CASE STUDY

5G Barcelona – A Model for CoE



5GBarcelona is a pioneering initiative transforming Barcelona into a real-world testbed for 5G technologies. Launched by a consortium including the government, Mobile World Capital Barcelona, the i2CAT Foundation, the Telecommunications Technology Centre of Catalonia, Atos and the Polytechnic University of Catalonia, this project aims to establish Barcelona as Southern Europe's leading digital innovation hub.

- **Unified Ecosystem:** 5GBarcelona fosters a partnership-driven environment by bringing together public institutions, private companies and academic entities to co-create and test 5G solutions
- **Real-World Testing:** The initiative provides a platform for validating 5G technologies in real urban settings, enabling the development of applications in sectors such as health, industry, entertainment and energy

While there are no formal 5G-related Centres of Excellence currently established in ASEAN, initiatives like 5GBarcelona highlight valuable lessons and present an opportunity for the region to learn from such models when shaping its own future hubs.

Developing a Collaborative Platform to Drive Talent Initiatives

Complementing the CoEs, ASEAN would benefit from a collaborative platform to facilitate ongoing interaction between government, industry and academia. Stakeholder engagements have revealed that workforce development initiatives rarely operate in isolation. Most programs naturally intersect, with actions by one party influencing outcomes for another. Academic institutions can adjust curricula to align with industry requirements, while industry partners provide feedback on the effectiveness of training and offer opportunities for practical application. Government agencies contribute oversight, regulatory guidance and strategic direction.

Despite this interdependence, structured collaboration is often limited, which can result in redundancy or misalignment between programs. A collaborative platform would provide a framework to coordinate these efforts systematically. The platform could initially operate through national-level pilots, with lessons gradually harmonised across the region. It would support the sharing of training materials, assessment tools and program outcomes, while also hosting discussion forums, workshops and working groups to foster joint problem-solving. Importantly, the platform would facilitate continuous updating of curricula and learning modules, reflecting technological advances, evolving industry practices and emerging skill requirements.



CASE STUDY

UK Digital Skills Council – A Talent Platform



The UK Digital Skills Council is a national, cross-sector body established to coordinate digital talent development across all four nations of the UK (United Kingdom). It brings together representatives from government, industry leaders, education providers and training organisations to align on national priorities, reduce duplication and ensure digital skill programs are future-ready.

By acting as a collaborative platform, the Council enables:



Shared Vision and Goals

Agreeing on priority skills areas and target outcomes across all UK nations



Resource Pooling

Combining funding, infrastructure and expertise across the UK

The Council's work ensures that talent strategies are connected across industries and regions, creating a more agile and competitive workforce capable of meeting the UK's evolving digital economy needs. Its UK-wide remit offers a strong model for ASEAN, showing how a collaborative platform can harmonise workforce development initiatives across diverse national contexts.

Expanding access to relevant 5G training addresses the immediate needs of the current workforce while building on the talent pipeline developed through universities and early-career initiatives. Centres of Excellence provide structured, multi-domain hubs for training, research and applied experimentation, while a collaborative platform ensures that stakeholders remain coordinated and responsive to emerging requirements. Together, these mechanisms support sustainable, adaptable workforce development, enabling ASEAN member states to maintain and evolve their 5G capabilities over time and providing a foundation for the workforce to respond to future technological developments.

CHAPTER 5

MOVING FORWARD



The Future Outlook of Skilling Priorities

Future pathways for 5G upskilling in ASEAN will need to be aligned to deployment maturity to guide skilling priorities

ASEAN member states are progressing through 5G deployment at different rates, resulting in varying workforce capability requirements. As countries advance through different stages of 5G maturity, the skills needed to support infrastructure development, adoption and innovation will continue to evolve.

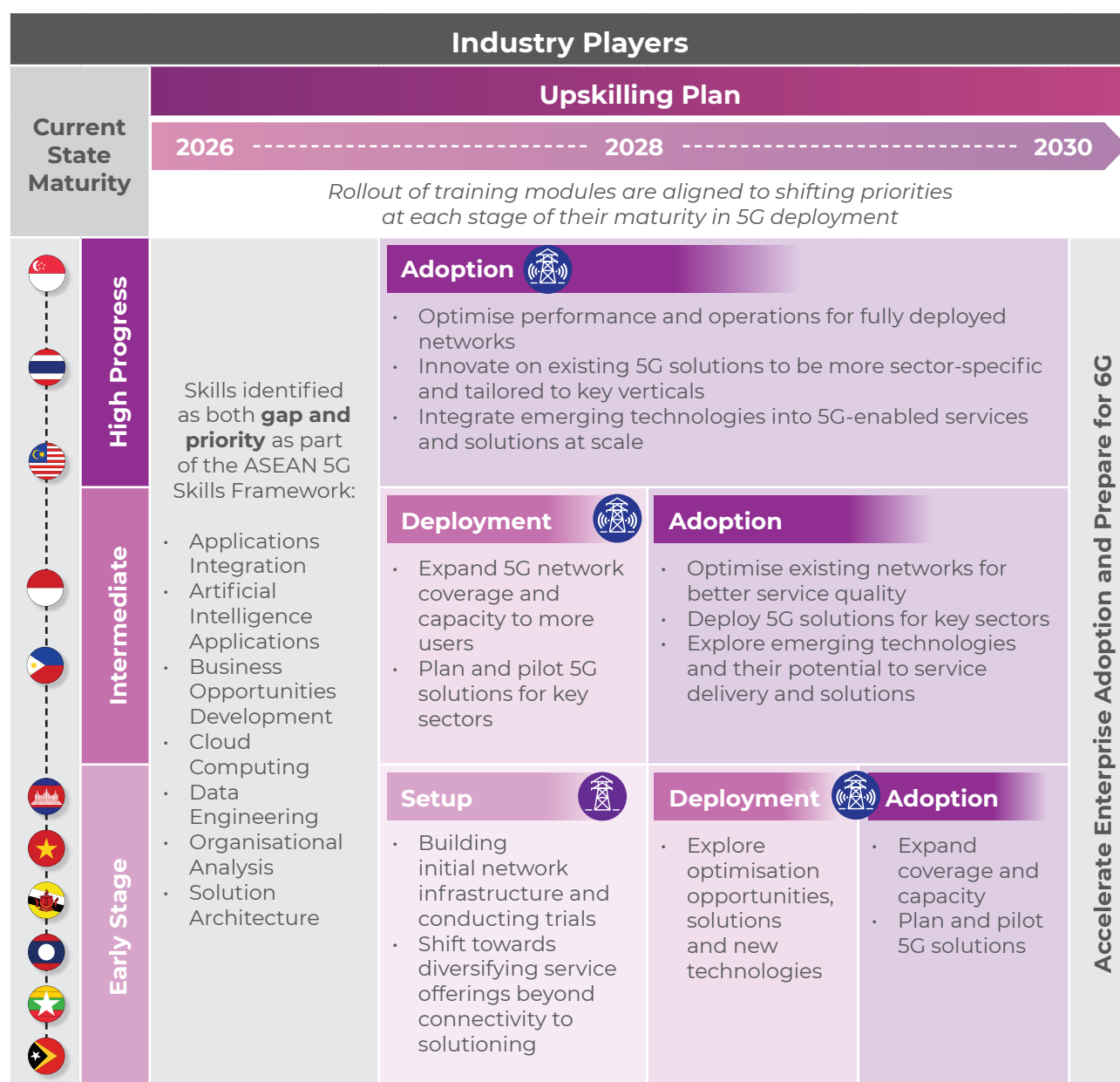
To support sustainable workforce development, skilling priorities should consider both the future workforce, individuals preparing to enter the labour market, and the current workforce, individuals already participating in the workforce who require upskilling or reskilling to meet evolving 5G demands.

While both groups require targeted interventions, the focus of skilling efforts will vary according to a country's stage of 5G maturity. Countries in earlier stages may prioritise foundational capabilities and talent pipeline development, while more mature markets may focus on specialised skills, advanced use cases and innovation-driven capabilities.

This chapter outlines how skilling priorities evolve across different stages of 5G maturity, providing a structured view of workforce development needs across both workforce segments.

ASEAN 5G Maturity-Based Skilling Roadmap for Industry Players Over the Next 5 Years

The roadmap provides guidance for ASEAN's 5G workforce development from 2026 to 2030, designed primarily for industry players while serving as a reference for training providers, academia and governments shaping skilling initiatives



Anticipated Progress:  5G Rollout Started  5G Rollout Completed

The roadmap outlines how ASEAN countries progress across different stages of 5G maturity, from initial setup to deployment and eventual adoption. It shows how workforce priorities change as countries build, expand, and operationalise their 5G capabilities over time.

The priority skills listed in the roadmap are drawn from the ASEAN 5G Skills Framework presented in Chapter 3. These skills were identified as both high impact and currently underdeveloped based on engagement with industry players. They represent areas where capability gaps are most evident across the region. However, these skills are not uniformly required by all countries. Their relevance depends on the 5G maturity and immediate priorities of a country. Countries should therefore interpret these skills in the context of their own development journey. The sections below outlines how focus areas, roles and skills differ across early, intermediate and advanced stages, and how these translate into practical workforce development priorities.

For early-stage countries, the immediate focus is on establishing core network infrastructure and enabling basic deployment readiness. This includes activities such as infrastructure planning, site preparation and early-stage trials, along with limited exploratory use cases beyond connectivity. At this stage, the existing workforce is typically limited in both scale and experience. As a result, there is a stronger emphasis on building foundational capabilities while developing new talent pipelines, including the education and training of students. Skilling efforts are focused on enabling initial deployment activities and preparing the workforce for the next stage of expansion, with priority roles concentrated in infrastructure-related functions.

By focusing on these areas, early-stage countries can build the base capabilities required to support wider network rollout and more advanced use cases over time.

Early Stage: Immediate Skilling Priorities		Example Skills	Example Critical Roles
Setup	Establish initial 5G network infrastructure through planning, site readiness and early-stage trials	- Infrastructure Design - Infrastructure Development	- Infrastructure Project Manager - Telecommunications Infrastructure Designer
	Build baseline readiness for network rollout (e.g. spectrum allocation, site preparation, ecosystem alignment)	- Regulatory Compliance - Radio Frequency Engineering	- Site Acquisition Specialist - Radio Frequency Planning Engineer
	Initiate exploratory 5G use cases beyond connectivity on a limited basis	- Edge Computing - Emerging Technology Monitoring	- IoT Solutions Architect 5G Solutions Architect

Note: The roles and skills presented are indicative examples for each priority area. A comprehensive list of identified roles and skills is provided in the appendix

As countries move into the deployment stage, focus expands across both infrastructure and services. In addition to scaling network coverage and capacity, there is increasing emphasis on piloting and launching 5G-enabled solutions across key sectors. This stage typically reflects a wide range of progress, requiring capabilities across multiple parts of the value chain. Workforce needs become broader, with most critical roles becoming relevant, spanning network deployment, solution development and early-stage service operations.

Upskilling priorities at this stage focus on enabling both infrastructure expansion and solution execution. This requires a mix of foundational and more advanced capabilities, as countries transition from building networks to using them to deliver tangible outcomes.

Deployment Stage: Immediate Skilling Priorities		Example Skills	Example Critical Roles
Deployment	Expand 5G network coverage and capacity to wider population and areas	- Infrastructure Deployment - Network Configuration	- Transmission Engineer 5G Wireless Network Engineer
	Plan and pilot 5G solutions for key sectors	- Prototype Development and Validation - System Integration	- Presales Solution Architect (Industry Vertical) - IoT Systems Engineer
	Launch early-stage 5G services and use cases for operational use	- Continuous Integration and Continuous Deployment - Applications Support	- Application Engineer - Software Engineer
	Introduce emerging technologies into live environments on a limited scale	- Network Orchestration and Automation - Process Automation	- Automation, AI and Orchestration Engineer - DevOps Engineer

Note: The roles and skills presented are indicative examples for each priority area. A comprehensive list of identified roles and skills is provided in the appendix

For countries at the adoption stage, priorities shift towards optimising network performance and scaling enterprise use cases. With infrastructure largely established, the focus moves to advanced service delivery, sector-specific solutions and the integration of emerging technologies into live environments. At this stage, the workforce is more established, and the emphasis shifts from building new talent to strengthening and specialising existing capabilities.

Upskilling efforts are focused on deepening expertise in areas such as optimisation, product development, service integration and innovation. These capabilities support continued commercialisation and enable countries to extract long-term value from 5G investments.

Adoption Stage: Immediate Skilling Priorities		Example Skills	Example Critical Roles
Adoption	Optimise performance and efficiency of fully established 5G networks	• Network Optimisation • Network Administration and Maintenance	• Optimisation Engineer • Operations Centre Support Engineer
	Scale deployment of 5G solutions across key sectors	• Product Management • Sales Strategy	• Product Manager (Industry Vertical) • Enterprise Solution Sales
	Tailor and refine solutions to specific industry needs	• Market Trend Analysis • Customer Behaviour Analysis	• Business Strategy and Modelling • Customer and Market Insights Analyst
	Innovate on existing 5G solutions to be more sector-specific and tailored to key verticals	• Product Design and Development • Product Performance Management	• Product Engineer • NaaS Product Developer
	Integrate emerging technologies into 5G-enabled services and solutions at scale	• DevSecOps • Security Architecture	• Cloud Applications Engineer • Security Architect

Note: The roles and skills presented are indicative examples for each priority area. A comprehensive list of identified roles and skills is provided in the appendix

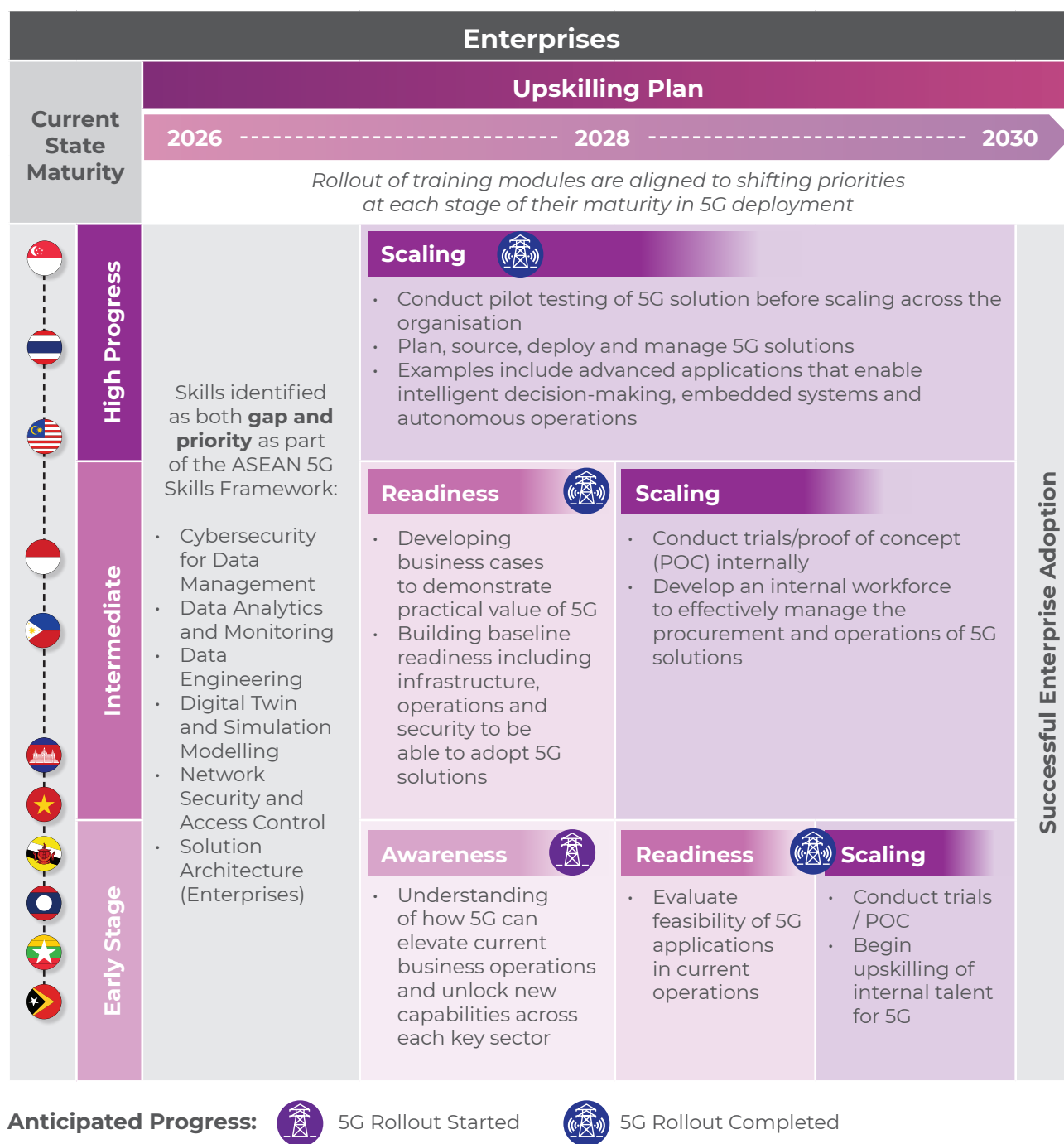
The priority roles and skills presented in this section highlight the workforce requirements most relevant to each stage of 5G progress. While the specific focus areas will vary by country context, stakeholders should determine their country's current maturity stage and then reference the role profiles in Chapter 4, the associated skills and proficiency requirements in Chapter 3, and the comprehensive role-to-skill mappings provided in the appendix. Together, these components enable countries to identify the full set of workforce requirements and translate the roadmap into workforce development priorities aligned to their specific 5G deployment journey.

Across all stages, workforce development includes both the creation of new talent and the development of the existing workforce. However, the emphasis evolves over time. Early-stage countries focus on building foundational capabilities and developing talent pipelines, including preparing students and new entrants for emerging 5G roles. Deployment-stage countries broaden capabilities across the value chain, while more advanced countries focus on deepening specialised skills and continuously upskilling and reskilling an experienced workforce. This may also include early exposure to frontier capabilities such as quantum-safe security and advanced computing, where these become relevant to future network resilience and enterprise-grade 5G (or newer generation) services

As ASEAN countries advance along this maturity journey, workforce development priorities will continue to shift. Foundational and intermediate programmes will gradually give way to more advanced and specialised training as 5G ecosystems mature. This progression provides countries with a structured approach to building the capabilities needed to support inclusive and sustainable 5G growth.

ASEAN 5G Maturity-Based Skilling Roadmap for Enterprises Over the Next 5 Years

For enterprises across ASEAN, the skilling roadmap is designed to align workforce development with the stage of 5G deployment in their respective countries. The intention is to help enterprises anticipate when and how to build capabilities, ensuring that skills development keeps pace with business opportunities.



The enterprise roadmap shows how organisations progress in their adoption of 5G, from initial awareness through to scaling solutions across their operations. It reflects how capabilities develop over time as enterprises move from exploring potential use cases to deploying and optimising 5G-enabled solutions. The priority skills identified reflect key capability gaps observed across enterprise use cases, based on the ASEAN 5G Skills Framework. These skills are heavily centred on data, security, solution design and system integration, which are required to support 5G adoption across different industries. However, these skills are not uniformly required by all enterprises. Their relevance depends on each organisation's stage of adoption and the maturity of its 5G use cases.

At an early stage, enterprises are still figuring out where 5G fits within their operations. The immediate focus is on understanding how it can improve existing processes and identifying practical use cases within their sector. This usually involves evaluating feasibility and exploring how 5G can be applied in a controlled environment. Upskilling at this stage is light and targeted. The priority is to build basic awareness across business and technical teams while enabling small-scale experimentation. In practice, this takes the form of internal trials, feasibility assessments and early proofs of concept, with a small group of personnel beginning to develop hands-on exposure to 5G applications.

As enterprises gain clarity on use cases, attention shifts towards preparing the organisation for adoption. This includes developing business cases, piloting selected use cases and building organisational readiness across infrastructure, operations and security. At this stage, the emphasis is not just on testing solutions, but on ensuring the organisation is ready to adopt and support them at scale. Organisations start putting in place the systems, processes and people needed to move beyond experimentation. Trials and proofs of concept become more structured, and there is a stronger focus on building internal teams that can support procurement, deployment and early-stage operations of 5G solutions.

For more advanced enterprises, the challenge moves beyond 5G adoption and towards a structured understanding and approach to scale effectively. The focus moves to embedding 5G solutions into core operations and expanding their use across functions and business units. Capability development here is driven by actual deployment. Teams gain experience through managing live systems, integrating solutions into existing processes and refining performance over time. Upskilling is less about awareness and more about deepening expertise, particularly in areas linked to optimisation, integration and advanced applications that deliver sustained business value.

While the roadmap highlights priority skills for enterprise adoption of 5G, these do not imply that all organisations must develop these capabilities in-house. Unlike industry players, which are directly responsible for building and delivering 5G solutions, enterprises will engage with these capabilities to different degrees depending on their role and scale in the value chain.

As explored in the use cases in earlier chapters, some organisations may choose to rely on external providers for the design and deployment of 5G solutions, while others may build selected capabilities internally by upskilling existing employees and developing in-house expertise to support more advanced or customised applications. As a result, the relevance of each skill depends on how deeply the enterprise is involved in the implementation and operation of its 5G use cases.

The table below outlines how enterprise focus and capability needs evolve across different stages of adoption, along with selected examples of skills that support these activities..

Enterprise Upskilling Priorities		Example Skills
Awareness	Identify where 5G is relevant and explore how it can improve operations; assess use cases and feasibility through early experimentation	• Data Analytics and Monitoring • Market Trend Analysis
Readiness	Develop business cases and build organisational readiness for 5G adoption, including feasibility validation, piloting use cases, and developing internal capabilities across infrastructure, operations and security	• Network Security and Access Control • System Integration
Scaling	Deploy and scale 5G solutions across operations; integrate with existing systems and continuously improve performance and outcomes	• Cybersecurity for Data Management • Process Automation

Similar to the roadmap for industry players, the skills highlighted in this section represent the priority capabilities associated with each stage of enterprise 5G adoption. However, capability requirements will vary based on an organisation's role in the value chain, operating model and intended use cases. Stakeholders should therefore use their stage of 5G adoption as a starting point and reference the role profiles in Chapter 4, the associated skills and proficiency requirements in Chapter 3, and the role-to-skill mappings in the appendix to identify the capabilities most relevant to their context.

Not all enterprises will need to develop end-to-end technical expertise, particularly where capabilities such as infrastructure deployment, system integration or solution design are outsourced to industry providers. However, all enterprises will require a baseline level of understanding to effectively adopt and utilise 5G solutions, including the ability to define requirements, evaluate vendors and ensure deployed solutions meet operational needs. As organisations mature in their adoption journey, some may also need to develop internal capabilities to operate, maintain and optimise 5G-enabled solutions.

Consequently, enterprise upskilling is less about replicating the full range of capabilities found within industry players and more about building the knowledge and expertise needed to support the adoption, operation and continuous improvement of 5G-enabled use cases.

Upskilling Opportunities for ASEAN Workforce

Understanding current upskilling opportunities in ASEAN provides context to address workforce development challenges and informs the roadmap outlined in this chapter

While 5G deployment is advancing across ASEAN, workforce development remains a critical enabler in translating technical capabilities into practical outcomes. Addressing current skill gaps will require targeted training to support infrastructure rollout, service delivery, enterprise adoption and the development of 5G-enabled solutions.

As outlined in the previous section, priority upskilling areas have been identified for both industry players and enterprises across different stages of 5G adoption. These areas highlight where capability development is most critical in the near term, based on identified skill gaps and input from industry stakeholders. Training efforts should therefore focus on the 50 critical roles and associated skills identified in this framework, particularly in areas where regional demand is highest and capability gaps are most pronounced.

Workforce development in the ASEAN context should address both future and current talent pools. For future talent, the focus is on preparing university and Technical and Vocational Education and Training (TVET) students with foundational 5G knowledge and industry-relevant skills before they enter the workforce through curriculum-based learning pathways. For the current workforce, the focus is on upskilling and reskilling employees by building on existing capabilities to adapt to evolving job requirements, adopt new technologies and support the deployment, operation and scaling of 5G-enabled solutions.

As countries progress in their 5G adoption journey, skilling priorities and delivery approaches will differ by maturity. Early-stage markets are likely to emphasise foundational awareness and entry-level capability building, while more advanced markets will require specialised training to support the integration of 5G into enterprise operations, solution development and continuous technology enhancement. This reinforces the need for lifelong learning pathways that allow workers to acquire new competencies and remain adaptable in an increasingly digital economy.

To support both future and current workforce development, ASEAN countries can leverage a range of learning approaches. Curriculum-based programmes remain important for building the future talent pipeline, while structured training courses and certification programmes help existing workers develop role-specific capabilities aligned to the 50 critical roles identified in this framework. These approaches can be supplemented by digital learning platforms that provide scalable access to training, and practical environments such as test beds that enable hands-on application of skills. Together, these mechanisms support workforce development across different roles, capability levels and stages of 5G maturity.

Curriculum

Curriculum remains one of the most effective mechanisms for developing future 5G talent, providing students with the foundational knowledge and technical competencies needed to enter the workforce and adapt to evolving technologies. However, keeping curricula aligned with industry needs remains a challenge, particularly in rapidly evolving areas such as 5G where technological developments and industry requirements can progress faster than curriculum review cycles. Stakeholders consulted during industry engagements also highlighted that graduates often require additional exposure to real-world deployment environments and industry practices as they transition into the workforce.

As such, universities, colleges and TVET institutions should strengthen collaboration with industry players through curriculum reviews, internships, industry-led projects and knowledge-sharing initiatives. These partnerships help ensure that learning content remains relevant, practical and aligned with current workforce needs, while equipping graduates with skills that remain applicable as technologies continue to evolve.



CASE STUDY

Polteknaker and Huawei Partnership



In 2026, Indonesia's Polytechnic of Manpower (Polteknaker) partnered with Huawei to strengthen the alignment between vocational education and industry needs. The collaboration includes curriculum alignment, practical training facilities, industry-led lectures, internships and competency development initiatives. By involving industry directly in the learning process, the partnership aims to ensure students are equipped with skills that reflect current workforce requirements and technological developments

Anticipated Outcomes:

Students will gain greater exposure to industry practices through curriculum alignment, practical training, industry-led learning activities and internship opportunities, helping to strengthen workforce readiness

Training Courses and Programmes

Structured training programmes provide a formal pathway for developing 5G talent through instructor-led courses, certification tracks and tailored curricula. These initiatives are often developed in collaboration between governments, regulators, industry partners and academic institutions, allowing stakeholders to share expertise and ensure relevance to market needs. By establishing clear learning objectives and recognised credentials, such programmes strengthen workforce competency and demonstrate a long-term commitment to cultivating a future-ready talent pool. Several ASEAN member states, including Singapore, Malaysia, Thailand, Indonesia, the Philippines, Brunei and Cambodia, have established such programmes, showcasing the region’s early progress in institutionalising structured pathways for 5G skills development.



CASE STUDY

MCMC and IMDA



Both Malaysia and Singapore have government-led initiatives, through Malaysian Communications and Multimedia Commission (MCMC) and Infocomm Media Development Authority (IMDA) that drive 5G training. While sharing the same objective, they take differing approaches in programme design and delivery, offering insights into the diversity of capacity-building models in ASEAN.

	MCMC	IMDA
Program Focus	Foundational trainings to introduce learners to 5G concepts	Trainings of varying complexity to address wide range of industry upskilling needs
Training Delivery	Traditional curriculum structure (e.g., face-to-face, practical site visits)	Blended structure (e.g., face-to-face, on-the-job, digital learning platform)
Training Development	Developed in-house by MCMC	Developed primarily through partnerships with industry, academia and government

Digital Learning Platforms

Digital learning platforms expand access to 5G knowledge beyond physical classrooms, offering flexible, self-paced learning opportunities across a comprehensive range of modules, from foundational network concepts to advanced technical specialisations including network slicing, edge computing, AI and IoT integration, and 5G security protocols. These platforms leverage diverse learning modalities such as interactive simulations, virtual laboratory environments and emerging AR/VR training experiences that allow learners to practice complex network configurations in risk-free digital environments. Current platforms span government initiatives, international organisation programs and private vendor academies, with examples including telecommunications operators' internal training systems that have expanded public access and specialised 5G certification programs tailored to ASEAN's priority sectors such as manufacturing automation and smart logistics applications.

The regional accessibility of these platforms across ASEAN's diverse linguistic and geographic landscape presents both opportunities and considerations for scalable workforce development. While all ASEAN countries currently have access to 5G-related learning platforms, maximising their effectiveness requires addressing language localisation needs and ensuring reliable connectivity for learners in rural areas where traditional fiber infrastructure remains limited. These platforms increasingly incorporate AI-powered personalised learning paths that adapt to individual skill levels and career objectives, while maintaining currency with rapidly evolving 5G standards through regular content updates and industry partnerships. As the 5G ecosystem matures, enhanced cross-border collaboration between member states through shared digital learning infrastructures offers significant potential for standardising skill development, promoting knowledge exchange and creating regionally recognised certification frameworks that support workforce mobility across ASEAN markets while strengthening the region's collective 5G capabilities.



CASE STUDY

ASEAN University Network



The ASEAN University Network (AUN) is a regional platform that brings together leading universities across Southeast Asia to promote academic cooperation, curriculum alignment and human capital development. Through structured networks and collaborative programmes, AUN enables member institutions to share resources, align academic standards and collectively respond to evolving regional skills needs. In recent years, AUN has expanded its activities to include digital and technology-enabled learning, supporting online collaboration, blended delivery and shared digital learning initiatives that strengthen cross-border education and digital skills development.

- Enables academic collaboration through joint programmes, shared curricula and cross-border learning initiatives
- Strengthens institutional quality and capacity via aligned academic standards and support for digital and blended learning
- Expands access to skills development through digital learning and regional knowledge exchange

Testbeds and Innovation Hubs

Hands-on experience is critical for building 5G expertise, with testbeds and innovation hubs providing controlled environments where learners and practitioners can experiment with real 5G infrastructure, including standalone networks, private deployments and edge computing architectures. These facilities enable participants to work with 5G network setups while testing enterprise applications such as industrial IoT, autonomous vehicle communications and augmented reality solutions. Beyond basic connectivity testing, these environments support experimentation with latency-critical applications and integration challenges. Several ASEAN member states, including Singapore, Malaysia, Thailand, Brunei and Vietnam, have established such facilities focusing on manufacturing, smart cities and rural connectivity applications.

The collaborative ecosystem fostered by these testbeds extends beyond traditional academic-industry partnerships to address ASEAN's regional challenges through locally relevant 5G use cases, from precision agriculture to port automation systems. Many testbeds incorporate multi-tenancy capabilities that allow organisations to share infrastructure costs while maintaining security isolation, making 5G experimentation accessible to smaller enterprises and startups. As these innovation hubs mature, they function as regional knowledge exchange networks, facilitating collaboration between ASEAN member states through shared research initiatives. This regional coordination approach accelerates individual country capabilities while positioning ASEAN as a cohesive testing ground for scalable 5G innovations that support digital transformation and build a skilled workforce.



CASE STUDY

5G Ecosystem Innovation Center



The Thailand 5G Ecosystem Innovation Center, launched by DEPA in partnership with Huawei, is a national testbed and collaborative hub under the Thailand 4.0 strategy. It provides a platform for developing and trialling 5G-enabled applications across industries, supporting local innovation, digital skills and enterprise transformation.

- Drive experimentation across sectors through 5G-enabled pilots
- Support SMEs and startups in adopting 5G, cloud, AI and IoT solutions to enhance competitiveness

The success of ASEAN's 5G transformation ultimately depends on the region's ability to build and sustain a skilled workforce. Through a combination of structured training programmes, digital learning platforms and hands-on innovation hubs, ASEAN countries can address their diverse capacity-building needs while fostering regional collaboration. This includes developing the future workforce by equipping students and new entrants with relevant 5G capabilities, while also enabling the current workforce to upskill and reskill in response to evolving industry demands. As 5G adoption accelerates, continued investment in workforce development will be essential to ensure the region not only keeps pace with technological advancement but also maximises the economic and societal benefits that 5G can deliver across all member states.



CHAPTER 6

CONCLUSION

5G is an essential component in ASEAN's next wave of economic transformation, extending beyond connectivity upgrades to enable fundamental changes in how enterprises operate, innovate and compete. Ultra-high-speed networks, low latency and massive connectivity capabilities create new opportunities for organisations across the region, particularly for small and medium enterprises that form the backbone of ASEAN economies. Enterprises integrating 5G capabilities are positioned to capture growth opportunities, strengthen operational resilience and expand participation in regional and global value chains.

Regional progress remains encouraging yet uneven. High Progress countries have advanced in deployment and enterprise adoption through proactive strategies and investments. Intermediate countries are in the midst of rolling-out while addressing infrastructure and spectrum challenges. Early Stage countries continue network deployment and policy preparation. These variations highlight opportunities for shared learning and underscore the need for ASEAN-wide coordination.

Realising 5G's enterprise potential requires balancing technical infrastructure development with workforce capability building. Both dimensions are equally critical for successful deployment and adoption. Technical expertise in engineering, data science, cybersecurity and solution development is essential for harnessing 5G's capabilities. Addressing regional skills gaps is critical to preventing uneven adoption, missed enterprise transformation opportunities and widening competitiveness disparities across ASEAN member states.



ASEAN 5G Landscape

Unlocking 5G's potential in ASEAN depends on addressing key trends: shifting business models, emerging technologies, private networks, enterprise adoption and workforce upskilling, to unlock its full value



Critical Roles and Skills for the ASEAN 5G Workforce

Workforce roles across the 5G value chain require continuous skills development, from foundational readiness in early markets to advanced technical-commercial expertise in mature ones



Analysis of Skills Gaps and Skill Priorities

5G skill gaps differ across countries, reflecting the progression from building initial capabilities to strengthening operations and developing more specialised expertise as markets mature



Recommendations to Accelerate 5G across ASEAN

ASEAN to strengthen the enabling environment through spectrum readiness and enterprise adoption incentives, while investing in a skilled 5G talent pipeline and expanding access to advanced training

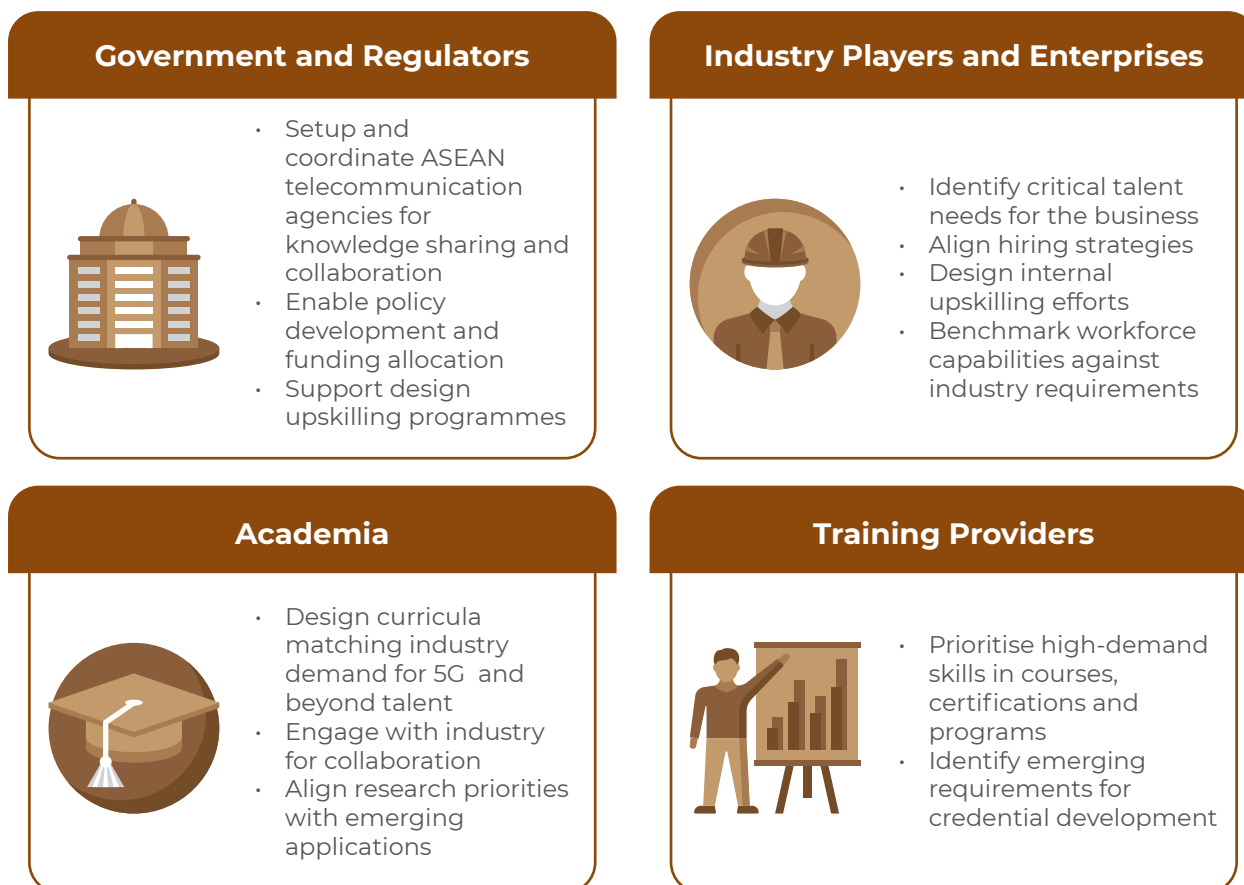


Capacity Building Approaches

ASEAN's 5G workforce strategy should combine continuous, industry-aligned training, enterprise-led upskilling and cross-sector partnerships to build a future-ready talent pipeline

Applicability of the Skills Framework on Stakeholder Groups

Building on the key findings, the skills framework serves as a comprehensive reference tool for multiple stakeholder groups across the 5G ecosystem. The framework translates insights into actionable guidance that supports strategic decision-making and coordinated capacity building efforts throughout the region, enabling each stakeholder to address the specific workforce challenges and opportunities highlighted in this study.



The path forward requires sustained collaboration between governments, industry, academia and training providers to bridge existing skill gaps and prepare for future technological evolution.

The successful deployment and adoption of 5G across ASEAN ultimately depends on the region's ability to develop a skilled workforce capable of realising this technology's transformative potential, starting with the 50 critical roles across the 5G value chain. This skills framework provides a foundation for coordinated action, offering stakeholders a common reference point for addressing workforce development challenges while capitalising on emerging opportunities.

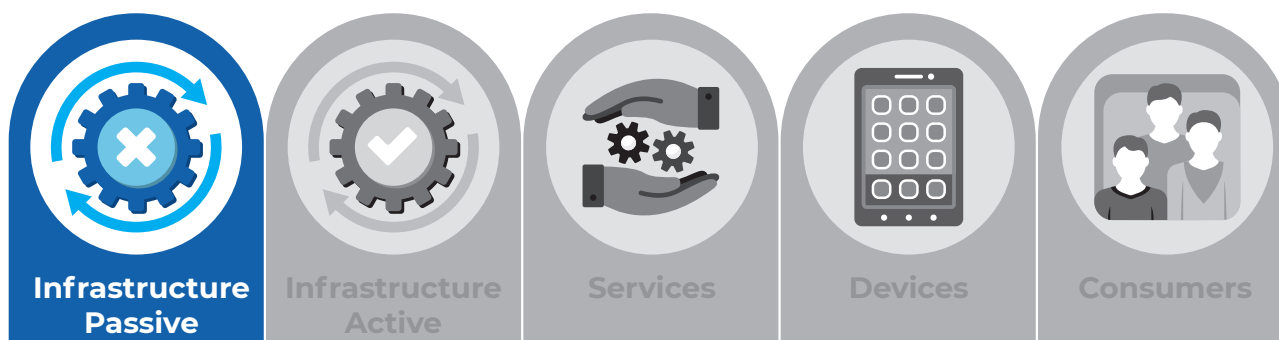
As ASEAN member states continue their 5G journeys at various stages of development, each country will approach the deployment at their pace. Thus, capacity building efforts will differ and will be according to their country specific contexts. Key will be ASEAN collaboration in the regional knowledge sharing and coordination. By aligning workforce development with enterprise needs across priority sectors, ASEAN can ensure that 5G deployment translates into measurable economic benefits and competitive advantages.

Through implementation supported by this framework, ASEAN is positioned to build a workforce that not only supports current 5G deployment objectives but also drives continued innovation in the digital economy.

APPENDICES



Critical Roles



Role

Infrastructure Project Manager

Job Purpose

Manages the planning, execution and delivery of telecommunications infrastructure projects

Job Description

1. Plan, coordinate and oversee the execution of telecommunications infrastructure projects, including network expansions, upgrades and new installations.
2. Develop detailed project plans, schedules and budgets, ensuring resources are allocated effectively and milestones are met.
3. Collaborate with engineers, contractors and vendors to ensure technical specifications and quality standards are adhered to throughout the project lifecycle.
4. Manage project risks and issues, implementing mitigation strategies and contingency plans as necessary.
5. Serve as the primary point of contact for project stakeholders, providing regular updates on progress, changes and outcomes.
6. Ensure compliance with industry regulations, safety standards and environmental guidelines for telecommunications projects.
7. Monitor and control project costs, scope and timelines to avoid overruns and ensure successful delivery.
8. Document project processes, decisions and lessons learned to inform future projects and best practices.
9. Lead the handover and transition of completed infrastructure to operational teams for ongoing management and maintenance.

Prime Skills

Risk Management

Stakeholder Management

Sustainability Management

Budgeting

Health Safety Environment (HSE)

Contract Management

Crisis Management

Infrastructure Deployment

Infrastructure Support

Process Automation

Project Management

Quality Assurance

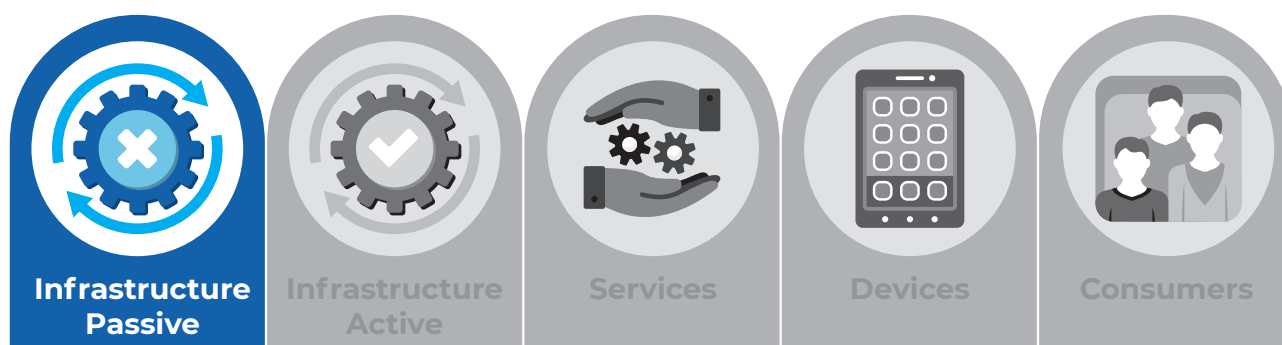
Regulatory Compliance

Resourcing

Supplier Management

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Site Acquisition Specialist****Job Purpose**

Secures and negotiates locations for telecommunications infrastructure deployment

Job Description

1. Identify and evaluate potential sites for telecommunications infrastructure, such as cell towers, antennas and related equipment.
2. Negotiate lease agreements, easements and right-of-way permissions with property owners, landlords and government entities.
3. Coordinate with legal, engineering and construction teams to ensure site acquisition complies with zoning laws, regulatory requirements and technical specifications.
4. Manage the due diligence process, including site visits, environmental assessments and title searches.
5. Liaise with local authorities and community stakeholders to obtain necessary permits and approvals for site development.
6. Collaborate with project managers to integrate site acquisition timelines and milestones into overall project plans.
7. Maintain accurate records of site acquisition activities, including contracts, correspondence and documentation of negotiations.
8. Resolve site acquisition challenges, such as legal disputes, permitting delays or community opposition.
9. Stay current with industry trends, property market conditions and changes in telecommunications regulations that may impact site acquisition.
10. Provide expertise and support to the organisation on matters related to real estate, land use and site development for telecommunications purposes with project managers, engineers and other technicians to ensure timely and efficient completion of projects.

Prime Skills

Stakeholder Management

Contract Management

Infrastructure Deployment

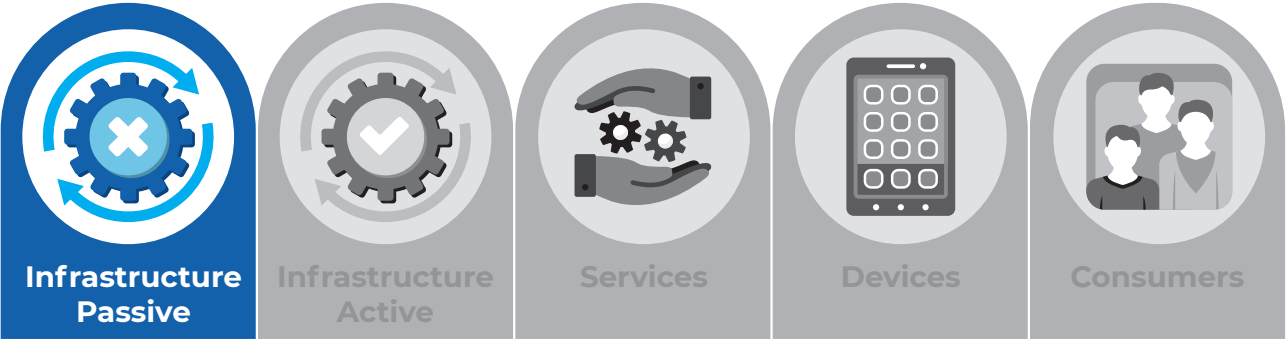
Infrastructure Development

Regulatory Compliance

Safety Assessment

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)



Role	Telecommunications Infrastructure Designer
Job Purpose	Plan, design and analyse telecom infrastructure to support fibre optic and wireless network deployments

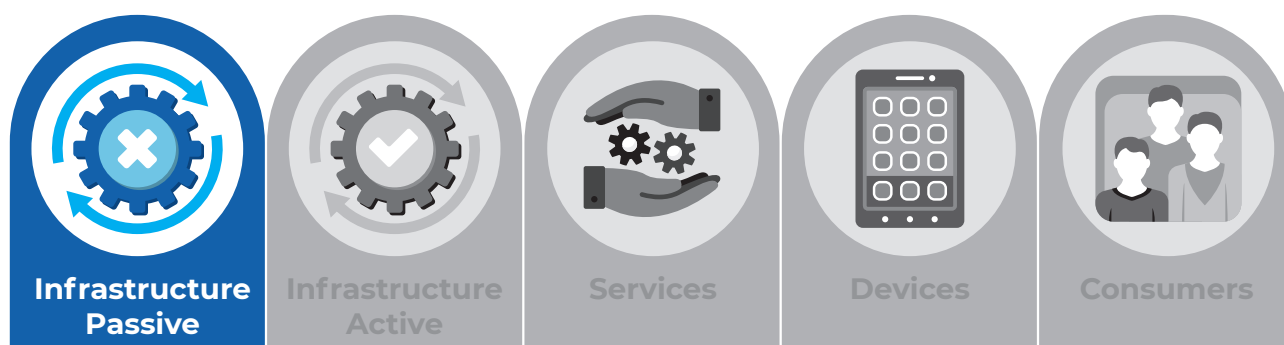
Job Description

1. Design pole-related infrastructure for fibre optic and wireless networks
2. Use tools like Automated Computer-Aided Design, SPIDAcad, Power Line Systems – Computer Aided Design and Drafting and Geographic Information System for telecom designs
3. Create structural models for Gigabit Passive Optical Network/Fibre to the Premises, copper, coax and small cell networks
4. Conduct site visits for data collection and field measurements
5. Analyse material properties, dimensions and environmental factors
6. Coordinate project activities from planning to completion
7. Prepare clear documentation and design packages for clients and crews
8. Collaborate with senior analysts and field teams for seamless delivery
9. Communicate effectively with team members and stakeholders
10. Continuously learn and contribute to R&D and process improvements

Prime Skills

Stakeholder Management	Data Collection and Analytics	AI in Product Development
Budgeting	Infrastructure Design	Infrastructure Development
Process Automation	Product Management	Product Requirements
Prototyping	Structural Knowledge	

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Fibre Optic Technician****Job Purpose**

Installs, tests and maintains fibre optic cables and systems to ensure efficient network connectivity

Job Description

1. Install, terminate and test fibre optic cables and systems in various environments, including residential, commercial and industrial locations.
2. Read and interpret blueprints, diagrams and specifications to ensure proper installation of fibre optic systems.
3. Perform splicing of fibre optic cables using fusion or mechanical techniques and ensure minimal signal loss.
4. Conduct thorough testing and troubleshooting of fibre optic networks to identify and resolve issues such as signal degradation or breaks.
5. Maintain and repair existing fibre optic infrastructure, including cleaning connectors, replacing damaged components and upgrading systems.
6. Use specialised equipment such as optical time-domain reflectometers, power meters and light source tools to measure fibre optic signal strength and quality.
7. Provide technical support and guidance to customers, explaining the capabilities and maintenance of fibre optic systems.
8. Document all installation and repair activities, including test results and site conditions.
9. Adhere to industry standards and safety regulations while performing fibre optic work.
10. Collaborate with project managers, engineers and other technicians to ensure timely and efficient completion of projects.

Prime Skills

Health Safety Environment
(HSE)

Quality Assurance

System Installation /
Decommissioning

Fibre Splicing

Safety Assessment

Testing

Infrastructure Deployment

System Integration

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Radio Frequency Planning Engineer****Job Purpose**

Designs and optimises RF networks using modeling tools, field tests and traffic analysis to maximise coverage and capacity

Job Description

1. Develop RF network plans, including frequency planning, cell site location and antenna configuration, to meet coverage and capacity requirements.
2. Utilise RF planning tools and software to model and predict network performance.
3. Analyse network traffic data, coverage maps and field test results to optimise network design.
4. Coordinate with cross-functional teams to integrate RF planning with other network development activities.
5. Prepare and maintain documentation for RF network design and planning processes.
6. Conduct site surveys and field tests to validate RF plans and troubleshoot issues.
7. Collaborate with other engineers and technicians to implement RF network enhancements.
8. Monitor and analyse network Key Performance Indicator (KPI)s to ensure network quality and performance standards are met.
9. Stay informed about new RF technologies, industry trends and regulatory changes that may impact network planning.
10. Provide technical support and guidance to junior engineers and other team members.

Prime Skills

Network Security

AI Application

Infrastructure Deployment

Infrastructure Design

Infrastructure Development

Infrastructure Strategy

Network Configuration

Network Design

Network Planning

Quality Assurance

Quality Standards

RF Engineering

System Design

Systems Integration

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Network Architect****Job Purpose**

Design and optimise network infrastructure to align with business goals, enhance performance and ensure security

Job Description

1. Design and develop a high-level network infrastructure blueprint that aligns with the organisation's business goals and technology strategy.
2. Evaluate current network systems and propose enhancements to improve performance, scalability and security.
3. Lead the planning and implementation of network solutions, including hardware selection, software configuration and integration with existing systems.
4. Collaborate with IT management and stakeholders to understand business requirements and translate them into technical network specifications.
5. Create detailed network documentation, including diagrams, standards and operational guidelines.
6. Oversee the testing and deployment of new network architectures, ensuring minimal disruption to business operations.
7. Stay abreast of emerging network technologies and industry trends to guide future network investments and innovations.
8. Provide technical leadership and mentorship to network engineers and support staff.
9. Manage relationships with vendors, service providers and external consultants to ensure high-quality products and services.
10. Lead network security initiatives, assessing risks and implementing measures to protect the organisation's data and systems.

Prime Skills

Network Security

AI Application

Emerging Technology
Monitoring

Infrastructure Deployment

Infrastructure Development

Infrastructure Design

Network Administration
and Maintenance

Network Configuration

Network Optimisation

Quality Assurance

Strategy Planning

Security Architecture

System Design

Threat Intelligence and
Detection

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Optimisation Engineer****Job Purpose**

Designs, analyses and optimises RF systems for efficient communication and signal integrity

Job Description

1. Design and develop RF systems and components such as antennas, transmitters, receivers and amplifiers.
2. Perform complex RF engineering tasks including simulation, modeling and analysis to optimise system performance.
3. Conduct field tests and measurements to evaluate signal strength, coverage and interference issues.
4. Collaborate with cross-functional teams to integrate RF systems into telecommunications and other electronic products.
5. Troubleshoot and resolve RF-related issues during product development and post-deployment.
6. Prepare technical documentation, including design specifications, test procedures and operational manuals.
7. Stay abreast of the latest RF technologies, industry trends and regulatory changes.
8. Provide technical guidance and support to junior engineers and technical staff.
9. Manage RF projects, ensuring they meet technical requirements, deadlines and budget constraints.
10. Participate in professional development opportunities to maintain expertise in RF engineering and related fields.

Prime Skills

Failure Analysis

Network Security

AI Application

Edge Computing

Infrastructure Support

Infrastructure Development

Infrastructure Deployment

Network Administration
and Maintenance

Network Configuration

Network Optimisation

Network Planning

Quality Assurance

RF Engineering

Regulatory Compliance

Test Planning

Testing

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Systems Engineer****Job Purpose**

Define and develop product and feature requirements, conduct system and performance analyses and engage with customers on 4G/5G call processing and air interface technologies

Job Description

1. Responsible for developing product requirements, feature requirements, systems and performance analysis and conducting deep-dive customer sessions on 5G Call processing-related features and air interface technologies.
2. Analysing the customer requirements, converting them into system requirements and capturing detailed design for the development team for product features.
3. Responsible for leading all technical discussions on products/scheduler-related features with several customer vertical organisations, including 5G RAN Development groups and RAN performance
4. Author technical proposals, Technical research and white papers, design documents, Operator network design, Request for Information/Request for Proposal and Patent filings.
5. Aid in product and feature performance analysis, evaluation of new product and software releases and third-party product evaluation to build product synergies.
6. Accountable for leading field integration testing efforts of all 5G key features with customers, including test plan development, reviewing test plan with customers, driving cross-functional teams to execution, review of test results, issue identification, analysis and quality proofing until software acceptance is achieved.
7. Responsible for Tier3 support, analysing and troubleshooting scheduler related issues reported from customer labs, field sites and production network.
8. Review and provide recommendations to improve Long-term Evolution (LTE) RAN network performance by evaluating and trending key KPIs, performing trials and providing optimisation guidelines

Prime Skills

AI Application

Contract Management

Network Administration
and MaintenanceInfrastructure
Development

Infrastructure Support

Infrastructure Deployment

Network Configuration

Network Optimisation

Quality Assurance

System Integration

Test Planning

Testing

Troubleshooting

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****5G Wireless Network Engineer****Job Purpose**

Researches and optimises the security and performance of 5G network implementations

Job Description

1. Research and assess the security measures implemented in 5G networks
2. Contribute to the development and optimisation of secure and efficient 5G solutions.
3. Collaborate with multidisciplinary teams to ensure the proper integration of security solutions into 5G networks.
4. Develop technical documentation and reports related to network and cybersecurity evaluations.
5. Participate in innovation initiatives and knowledge-sharing activities on 5G technology and security.

Prime Skills

Security Monitoring

Network Security

AI Application

Infrastructure Deployment

Infrastructure Development

Information Security

Security Assessment and Testing

Security Architecture

Security Administration

Security Education and Awareness

Security Programme Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Transmission Engineer****Job Purpose**

Designs, plans and optimises networks for high-performance and cost-effective deployment

Job Description

1. Design and develop fibre optic network architectures, including backbone, distribution and access networks.
2. Perform detailed calculations to determine the most efficient and cost-effective fibre routes.
3. Prepare technical drawings, schematics and documentation for fibre optic network installations.
4. Coordinate with cross-functional teams, including field technicians and project managers, to ensure successful deployment of fibre networks.
5. Conduct site surveys to assess the environment and plan fibre layout in accordance with physical and regulatory constraints.
6. Oversee the testing and commissioning of fibre optic systems, ensuring compliance with industry standards and performance criteria.
7. Troubleshoot complex network issues and provide technical support for resolution of fibre-related problems.
8. Manage fibre optic projects from conception through to completion, including budgeting, resource allocation and timeline management.
9. Stay abreast of emerging fibre optic technologies and industry developments to incorporate best practices into network design.
10. Liaise with vendors and suppliers to select appropriate fibre optic materials and equipment for projects.

Prime Skills

Network Security

Budgeting

Infrastructure Deployment

Infrastructure Development

Infrastructure Design

Infrastructure Support

Internet Protocol (IP)

Network Configuration

Resourcing

Strategy Planning

Supplier Management

Test Planning

Testing

Troubleshooting

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)



Role	NOC Engineer
Job Purpose	Manages network performance, troubleshooting and system improvements in the NOC

Job Description

1. Monitor and maintain the NOC infrastructure to ensure optimal network performance and availability.
2. Troubleshoot and resolve complex network issues, escalating to higher-level support or engineering teams as necessary.
3. Implement and manage network monitoring tools and systems to proactively detect and address potential problems.
4. Coordinate with IT and network teams to execute network changes, updates and maintenance activities.
5. Analyse network data and generate reports on performance metrics, incident trends and capacity planning.
6. Develop and maintain NOC documentation, including network diagrams, procedures and incident logs.
7. Participate in the design and enhancement of NOC processes and workflows to improve efficiency and response times.
8. Provide technical support and guidance to NOC technicians and other staff members.
9. Stay current with emerging network technologies and industry best practices to recommend improvements to the NOC environment.

Prime Skills

Stakeholder Management	Data Collection and Analytics	Network Security
AI Application	Infrastructure Support	Network Administration and Maintenance
Network Configuration	System Integration	Troubleshooting
Quality Assurance		

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Cloud Core Network Engineer****Job Purpose**

Design, implement and analyse Core Network areas

Job Description

1. Responsible to plan, implement, integrate, migrate and perform acceptance test for Core network areas including Circuit-Switched, Packet-Switched/Evolved Packet Core, IP Multimedia Subsystem, Voice over LTE, Voice over WiFi, Voice over BB, Home Location Register, Signal Transfer Point, Policy and Charging Rules Function, Network Functions Virtualisation, IoT.
2. To analyse network performance, resolve complex network problem and optimise network architecture.
3. As technical point of contact for engineering team, customer and vendor.
4. To engage directly with marketing team, project team and customer for the purpose of promoting and delivering strategic services.

Prime Skills

AI Application

Cloud Computing

Infrastructure Deployment

Infrastructure Development

Infrastructure Design

Network Design

Network Configuration

Network Optimisation

Network Planning

Testing

Troubleshooting

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Cloud Security Architect****Job Purpose**

Design and implement secure cloud architectures for various cloud platforms

Job Description

1. Develop and enforce security policies and procedures for cloud environments.
2. Conduct security assessments and audits of cloud infrastructure and applications.
3. Collaborate with IT and development teams to integrate security into cloud-based projects and deployments.
4. Monitor and respond to security incidents and threats in the cloud environment.
5. Provide guidance and training on cloud security best practices to internal teams.
6. Conduct detailed risk assessments of cloud environments, including the evaluation of security controls for third-party services and implement risk mitigation strategies based on threat modeling and vulnerability analysis.
7. Stay updated with emerging security threats, technologies and trends to continuously improve cloud security strategies and architecture.

Prime Skills

Risk Management

Risk Modelling and Validation

Risk Governance

Security Monitoring

AI Application

Cloud Computing

Cyber and Data Breach Incident Management

DevSecOps

Infrastructure Deployment

Infrastructure Design

Infrastructure Development

Security Administration

Threat Intelligence and Detection

Security Architecture

Security Assessment and Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Cloud Infrastructure Engineer****Job Purpose**

Design and implement secure cloud architectures for various cloud platforms

Job Description

1. Determine user requirements and design specifications for cloud based (Amazon Web Services, Digital Ocean,) Infrastructure as a Service (IaaS) systems
2. Design and maintain operating system backup solutions for system recovery and disaster recovery
3. Develop business applications on cloud-based services, with a special emphasis on OpenStack utilising leading edge technologies and frameworks
4. Develop and manage the Cloud core systems in IT Services
5. Be involved in the build and extend of our cloud services that span IaaS across the global data centres public cloud providers
6. Interface with business units, architects, project managers and subject matter experts to understand and evaluate/translate business requirements into technical solutions
7. Be a technical expert to help internal customers & teams to consume standard cloud services
8. Participate and assist in setting the long-term direction, roadmaps and standards for technical solutions, ensuring they align to the overall enterprise architecture
9. Help to engineer solutions that provide infrastructure as code for re-use
10. Provide systems and application administration for multiple cloud, hosted and Linux systems

Prime Skills

Cloud Computing

AI Management

Cyber Risk Management

Data Engineering

Data Modelling and Design

Database Design

Disaster Recovery
Management

Information Security

Infrastructure Design

Quality Standards

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Cloud Applications Engineer****Job Purpose**

Design, deploy and configure solutions in the cloud

Job Description

1. Working with customer to understand their current state from infra, applications, database, Application Programming Interface (API)s to allow you to come out with future state of cloud environment
2. Hands on to delivery in implementation owning the architecture design and planning.
3. To craft cloud strategy, conduct cloud migration assessment, present the outcome
4. Design and automate cloud operations, develop infrastructure automation scripts and participates in the continuous improvement of cloud solutions.
5. Participate in the specification, setup and run POCs and demonstrations of cloud solutions.

Prime Skills

Risk Governance

Risk Management

Risk Modelling and Validation

Security Monitoring

Software Testing

Solution Architecture

Agile Software Development

Cloud Computing

AI Management

Cyber and Data Breach Incident Management

DevSecOps

Infrastructure Deployment

Infrastructure Development

Infrastructure Strategy

Process Automation

Quality Assurance

Security Administration

Security Assessment and Testing

Software Configuration

Software Design

Threat Intelligence and Detection

Test Planning

Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****SOC VAPT Manager****Job Purpose**

Identify, assess and mitigate security vulnerabilities through penetration testing and risk analysis

Job Description

1. Assist in the development of cyber security standards, policies and best practices
2. Conduct reviews and assessment of existing security policies, procedures, standards and exceptions
3. Assist in establishing certification-based policies for maintaining compliance to cyber security standards
4. Provide inputs on security penetration testing in the development of software and applications
5. Review software designs, source codes and deployment to address cyber security issues
6. Perform on-site security assessments of infrastructure components and computer systems
7. Carry out scoping activities to identify systems components which require testing
8. Identify emerging security and risk management trends, issues and alerts in VAPT activities
9. Define and translate requirements into test plans, scenarios, scripts or procedures
10. Conduct VAPT, black box and code reviews and reverse engineering

Prime Skills

Security Monitoring

Risk Governance

Risk Management

Network Security

Threat Analysis and Defence

Cyber and Data Breach Incident Management

DevSecOps

Infrastructure Development

Infrastructure Support

Penetration Testing

Security Programme Management

Security Administration

Security Assessment and Testing

Security Governance

Threat Intelligence and Detection

Security Architecture

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****5G Cybersecurity Specialist****Job Purpose**

Design, implement and manage robust cybersecurity measures across the 5G ecosystem

Job Description

1. Design and implement cybersecurity measures for 5G networks
2. Monitor and respond to emerging 5G threats and vulnerabilities
3. Conduct risk assessments and threat modeling for RAN, Core and Transport
4. Ensure compliance with national standards
5. Perform penetration testing and vulnerability scans on 5G infrastructure
6. Develop and lead incident response plans for 5G security events
7. Collaborate with engineers to embed security in 5G architecture
8. Evaluate and implement encryption and authentication protocols
9. Create and enforce 5G security policies and best practices
10. Deliver cybersecurity training and track evolving 5G threat trends

Prime Skills

Network Security

Security Strategy

AI Application

Cyber and Data Breach
Incident ManagementEmerging Technology
MonitoringInfrastructure
Development

Infrastructure Design

Penetration Testing

Regulatory Compliance

Cyber Risk Management

Security Architecture

Security Governance

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****4G/5G Core Network Engineer****Job Purpose**

Develops, integrates and troubleshoots core network functionalities for 4G and 5G

Job Description

1. Develop, deploy and optimise 4G Voice over LTE, 5G Network Core & roaming functionality
2. Integrate and configure network systems and simulation tools with back-end 4G, 5G network elements.
3. Provide technical systems engineering support to assist with Evolved NodeB, Next Generation NodeB 4G/5G network core deployments.
4. Analyse Evolved Packet Core network performance and investigate the root cause(s) of performance degradations.
5. Perform on demand analysis of specific core network issues (new performance degradation, customer complaints, etc.).
6. Develop and integrate health and signal spectrum analysis monitoring and automation.
7. Buildout lab for RAN and radio technologies, integration with evolved packet core to perform testing in different scenarios.
8. Carry out demonstration project design, setup and presentation.
9. Collect Wireshark traces identify/troubleshoot root cause(s) of core network issues

Prime Skills

Network Virtualisation

AI Application

Cloud Computing

Infrastructure Deployment

Network Design

Infrastructure Design

Infrastructure Development

Network Optimisation

Process Automation

System Design

System Integration

Security Programme Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Inbuilding DAS Technician****Job Purpose**

Designs, plans and deploys DAS solutions

Job Description

1. Design, implement and maintain DAS to enhance wireless communication coverage and capacity within various environments
2. Interpret iBwave files
3. Prepare detailed documentation, including system designs, installation plans, as-built drawings and technical reports
4. Stay updated with industry trends, standards and regulations related to DAS engineering and wireless communication
5. Ensure compliance with local building codes, safety regulations and relevant wireless communication standards
6. Collaborate with regulatory bodies or third-party organisations to obtain necessary permits or certifications for DAS installations

Prime Skills

AI Application

Infrastructure Deployment

Infrastructure
Development

Infrastructure Design

System Integration

System Design

Test Planning

Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Automation, AI and Orchestration Engineer****Job Purpose**

Enhance the efficiency and reliability of network infrastructure through the development and deployment of software and automation and orchestration tools

Job Description

1. Design, develop and implement automation workflows to streamline network operations and processes
2. Collaborate with network engineering teams to identify opportunities for automation, ensuring alignment with business objectives and network architecture standards.
3. Perform rigorous testing of automation scripts and tools in a lab environment before deployment in production to ensure reliability and efficiency.
4. Manage and maintain the network automation infrastructure, including version control systems and automation servers, to ensure high availability and performance.
5. Develop custom scripts to automate data collection for network performance monitoring and generate reports for analysis by the network operations team.
6. Orchestrate the provisioning-related activities involved in the fulfilment of customer orders or service control requests
7. Implement security practices within automation workflows to safeguard network data and infrastructure from unauthorised access or breaches.
8. Troubleshoot and resolve issues within automated processes, applying debugging tools and techniques to ensure minimal disruption to network services.
9. Document automation processes, including code comments, user manuals and operational procedures, to ensure knowledge transfer and adherence to best practices within the team.

Prime Skills

Network Slicing

Data Collection and Analytics

AI Application

Infrastructure Deployment

Infrastructure Support

Network Analytics

Infrastructure Development

Network Optimisation

Network Orchestration and Automation

Network Design

Network Support

Process Automation

Network Planning

System Design

Troubleshooting

Quality Assurance

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Centre Architect****Job Purpose**

Design and develop advanced data centre infrastructures, integrating telecommunications systems and hyperscale architectures to deliver scalable, high-performance and resilient solutions

Job Description

1. Lead the design and development of data centre infrastructures, including the integration of telecommunications systems and hyperscale architectures.
2. Collaborate with internal teams and external stakeholders to understand project requirements and objectives.
3. Conduct thorough analysis and evaluation of project specifications, site conditions and technical constraints to inform design decisions.
4. Develop comprehensive architectural plans, schematics and specifications for data centre projects, ensuring alignment with industry best practices and standards.
5. Utilise your expertise in telecommunications systems to design robust network connectivity solutions that meet the data transfer and communication needs of the data centre environment.
6. Incorporate hyperscale technologies and methodologies into the architectural design, optimising for scalability, efficiency and performance.

Prime Skills

Solution Architecture

Sustainability Management

Data Collection and Analytics

Big Data Analytics

Budgeting

Data Engineering

Emerging Technology Monitoring

IT Strategy

Prototyping

Quality Assurance

Quality Standards

System Design

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Centre Network Engineer****Job Purpose**

Design, implement, secure and optimise complex network infrastructures that support data centre operations and enterprise connectivity

Job Description

1. Establish networking environment by designing network configuration, directing, implementing network infrastructure, defining, documenting and enforcing standards.
2. Improve network performance by monitoring, troubleshooting and reviewing network problems and outages and collaborating with Network Service partners and Business Unit to recommend and inspire changes for network optimisation.
3. Secures network infrastructure by defining and establishing policies, in conjunction with the Security and other partner teams.
4. Plan and coordinate the implementation of network technologies, solutions and automations in support of defined requirements generated by internal customers, industry directions and growth demands.
5. Plan and facilitate highly complex network and automation upgrades and migration activities.
6. Perform analysis and diagnosis of highly complex network and automation problems.
7. Generates operational documentation including detailed test plan for highly complex networks.
8. Assist with deployment and strategy of tools and related Network Management Systems. Help with developing tools set to manage and maintain enterprise network
9. Produce method of procedures that demonstrate understanding of changes proposed and how the change will be driven with minimal service impact.

Prime Skills

IT Governance

Network Slicing

Data Collection and Analytics

Cloud Computing

Big Data Analytics

Capacity Management

Data Engineering

IT Standards

Network Configuration

Testing

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Centre Security Specialist****Job Purpose**

Coordinate and support day-to-day security operations within assigned data centres to ensure alignment with established security policies, standards and procedures

Job Description

1. Coordinate the day-to-day security activities for your assigned data centre(s) under the guidance of an experienced manager
2. Assess vendor compliance, based on the established work order, track service deliverables and escalate corrective actions to a senior team member as needed.
3. Provide support to all vendors within the data centre
4. Conduct inspections, audits and reviews in your area of responsibility and ensure compliance with AWS security standards and policies.
5. Lead the media security requirements within the data centre
6. Participate in regular meetings with vendors, data centre operations and other partner teams to accomplish operational consistency.
7. Effectively communicate with partner teams when providing awareness of security policies and procedures.
8. Troubleshooting Security Devices in conjunction with the local Security System Integrator

Prime Skills

IT Governance

Security Monitoring

Network Security

Security Strategy

Threat Analysis and Defence

Cyber and Data Breach Incident Management

Cyber Risk Management

DevSecOps

Information Security

Security Administration

Security Architecture

Penetration Testing

Security Programme Management

Security Assessment and Testing

Security Governance

Threat Intelligence and Detection

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Centre Critical Facilities Engineer****Job Purpose**

Performs and oversees preventive and corrective maintenance, switching operations and emergency response in compliance with regulations and internal standards

Job Description

1. Ensure the proper functioning, upkeep and preventive maintenance of electrical systems in compliance with Energy Commission regulations.
2. Perform switching operations on high and low voltage electrical systems.
3. Handle preventive and corrective maintenance tasks on critical facility systems.
4. Resolve advanced incidents and develop new procedures to improve team operations and system support.
5. Manage complex Building Management System alarms requiring independent action and initiative.
6. Implement energy efficiency measures and identify opportunities for optimisation in facility operations.
7. Oversee and inspect the operation and maintenance of fire suppression and life-safety systems.
8. Assist in the development of project scopes for life-cycle maintenance, end-of-life infrastructure projects and critical replacements.
9. Support the approval and tracking of vendor maintenance work, ensuring compliance with standard operating procedures.
10. Manage site logs, respond to incidents, identify Single Points of Failure, collaborate to resolve issues and recommend infrastructure improvements.

Prime Skills

Failure Analysis

Risk Management

Risk Modelling and Validation

Sustainability Management

Crisis Management

Disaster Recovery Management

Safety Assessment

Systems Installation / Decommissioning

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Centre Operations Engineer****Job Purpose**

Oversees data centre reliability, disaster recovery and operational efficiency

Job Description

1. Oversee the execution of disaster recovery drills and exercises and simulate incidents to diagnose and resolve escalated data centre-related incidents
2. Develop disaster recovery plans for data centre operations
3. Oversee resolution of data centre-related incidents involving vendors and analyse incidents to determine patterns and propose recommendations to prevent future occurrences
4. Optimise the interfaces between the IT equipment and data centre
5. Identify best practices in data centre operations and management for adoption and recommend enhancements to improve availability and performance
6. Conduct short- and long-term planning to meet organisation's requirements and business needs
7. Conduct technical feasibility studies to determine viability, cost, time required and compatibility with organisational needs and requirements
8. Manage the development of service-level objectives and targets
9. Monitor service level objectives to ensure that requirements are met or exceeded

Prime Skills

Data Governance

Data Security

Data Engineering

AI Application

Data Modelling and Design

Data Protection

Disaster Recovery Management

Incident Management

Testing

Vendor Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****DevSecOps Engineer****Job Purpose**

Secures the software development lifecycle by integrating security into telecom applications

Job Description

1. Implement and manage security measures across the software development lifecycle in telecommunications
2. Analyse and respond to security threats and vulnerabilities in telecommunications systems
3. Automate security processes and integrate security tools into the business pipeline
4. Ensure secure and compliant deployment of telecommunications applications and infrastructure
5. Incorporate security management and privacy requirements into telecommunications hardware, software and applications
6. Collaborate with development, operations and security teams to enhance the security posture of telecommunications systems

Prime Skills

Data Security

Cyber Risk Management

AI Application

DevSecOps

Penetration Testing

Process Automation

Security Administration

Security Architecture

Security Governance

Security Programme Management

Security Strategy

Threat Analysis and Defence

Threat Intelligence and Detection

Regulatory Compliance

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Security Architect****Job Purpose**

Design and implement security frameworks to ensure compliance, resilience and protection of IT infrastructure

Job Description

1. Define the alignment of security governance with enterprise architecture governance and oversee the translation of the security architecture to solutions
2. Ensure compliance with enterprise and IT security policies and industry regulations
3. Contribute to the alignment of security governance with enterprise architecture governance
4. Analyse, evaluate and develop secure solutions based on approved security architectures
5. Ensure adequate security solutions are in place throughout all IT systems and platforms
6. Analyse cost versus benefits, risks, impact and technology priorities and identify and propose variances to the architecture to accommodate project needs
7. Analyse the current architecture to identify weaknesses and develop opportunities for improvement
8. Assist in post-implementation and continuous improvement efforts to enhance performance and provide increased functionality
9. Ensure compatibility with existing solutions, infrastructure, services and strategic requirements
10. Participate in ecosystem strategy development, environment analysis and opportunity identification

Prime Skills

Data Security

AI Application

Continuous Integration
and Continuous
Deployment

Cyber Risk Management

Data Collection and
Analytics

Enterprise Architecture

Network Security

Regulatory Compliance

Security Architecture

Security Governance

Security Monitoring

Security Programme
Management

Software Security

Threat Analysis and
DefenceThreat Intelligence and
Detection

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****IoT Solutions Architect****Job Purpose**

Design and implement comprehensive, scalable and secure IoT (Internet of Things) solutions for businesses

Job Description

1. Develop and implement end-to-end IoT solutions that are scalable, reliable and secure.
2. Collaborate with clients and stakeholders to understand business requirements and design IoT
3. Architectures that leverage device, edge and cloud technologies.
4. Collaborate with project managers and software developers to ensure IoT solutions are delivered on time and within budget.
5. Work with technical teams to troubleshoot and resolve issues related to IoT solutions.
6. Stay up-to-date with emerging trends and technologies in IoT, device, edge and cloud.
7. Build IoT Practice Team, Frameworks, Standard Methodologies & Solutions that can be reused for multiple customer across industrial segments

Prime Skills

Embedded Systems
Programming

Edge Computing

Embedded Systems
Integration

Emerging Technology
Synthesis

AI Application

AI in Product
Development

Embedded Systems
Interface Design

Data Collection and
Analytics

Emerging Technology
Monitoring

Networking Protocols

Requirements Definition
and Management

Solution Architecture

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****IoT Systems Engineer****Job Purpose**

Design, implement, maintain and optimise IoT (Internet of Things) systems and solutions

Job Description

1. Develops, creates and modifies general computer applications software or specialised utility programs.
2. Analyses user needs and develops software solutions. Designs software or customises software for client use with the aim of optimising operational efficiency.
3. Modifies existing software to correct errors, allow it to adapt to new hardware or to improve its performance.
4. Analyses user needs and software requirements to determine feasibility of design within time and cost constraints.
5. Experience in IoT product design and development with hands on experience for Multimedia and AI/ML software
6. Familiarity with IoT reference platforms and customisation of platforms for end use case
7. Familiarity with open-source architectures and software development
8. Stores, retrieves and manipulates data for analysis of system capabilities and requirements.
9. Designs, develops and modifies software systems, using scientific analysis and mathematical models to predict and measure outcome and consequences of design

Prime Skills

Computational Modelling

AI Application

AI in Product Development

Agile Software Development

AI Management

Application Integration

Data Modelling and Design

Product Design and Development

Software Configuration

Software Design

Software Testing

System Integration

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****IoT Software Engineer****Job Purpose**

Design, build and implement software solutions for Internet of Things (IoT) devices and systems

Job Description

1. Developing software systems for collecting, storing and analysing data generated by IoT devices to extract meaningful insights.
2. Implementing secure and efficient communication protocols to enable IoT devices to interact with each other and with cloud services.
3. Ensuring the security and privacy of data transmitted and processed by IoT devices to protect against cyber threats.
4. Testing IoT software systems, identifying and resolving issues and optimising performance.
5. Integrating IoT solutions into existing infrastructure or other IoT ecosystems to create comprehensive, interconnected systems.

Prime Skills

Data Security

Database Design

AI in Product Development

Data Modelling and Design

Firmware Development

Testing

Embedded Systems Programming

Embedded Systems Integration

Embedded Systems Interface Design

Data Management

Networking Protocols

Real-time/Embedded Systems Development

AI Application

Data Collection and Analytics

Device Integration

System Integration

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Business Strategy and Modelling****Job Purpose**

Drive strategic growth beyond core business by providing robust modelling, analysis and strategic insights across high-priority initiatives

Job Description

1. Responsible to drive priority strategic projects to generate new revenue sources (beyond core), including the management of the entire end-to-end process:
2. Evaluation of new business ideas / proposals
3. Exploration with external parties – strategic external partnership opportunities
4. Development of entire concept until early execution
5. To lead key work streams under 5G projects, which includes 5G-related mergers and acquisition (e.g. Spectrum Sharing Agreements), 5G wholesale operations, 5G dual network transition and 5G use case development. This will include stakeholder engagement across all levels
6. To support and drive performance management, this includes analysis of performance indicators of business lines and where necessary, identifying initiatives to improve topline performance and overall cost structure (Operational Efficiency, structural cost initiatives)
7. To develop long term (3-5year) strategic direction, which includes leading workshops and discussions across various strategic topics. Also responsible for further developing and executing key strategic projects / initiatives resulting from Board of Directors discussions

Prime Skills

Emerging Technology Synthesis

Organisational Analysis

AI Application

Business Innovation

Continuous Integration and Continuous Deployment

Business Development

Business Needs Analysis

Business Process Testing

Continuous Improvement and Process Re-engineering

Business Process Improvement

Change Implementation Planning and Management

Demand and Supply Analysis

Continuity Management

Data Modelling and Design

Emerging Technology Monitoring

Data Storytelling and Visualisation

Market Research

Market Trend Analysis

IT Strategy

Strategy Implementation

Strategy Planning

Stakeholder Management

Revenue Analysis

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Customer & Market Insights Analyst****Job Purpose**

Analyses B2B customer data and behaviors to drive strategic decisions in telecommunications

Job Description

1. Analyse business-to-business (B2B) customer data specific to the telecommunications industry, including usage patterns, service preferences and satisfaction levels.
2. Utilise advanced analytics and statistical methods to segment customers and predict behaviors such as churn, upsell opportunities and service adoption.
3. Collaborate with cross-functional teams, including marketing, sales and product development, to leverage customer insights for targeted campaigns and product enhancements.
4. Monitor and assess the impact of telecommunications market trends on customer behavior and expectations.
5. Develop and maintain dynamic reports and dashboards that provide actionable insights into customer demographics, behaviors and lifecycle stages.
6. Conduct customer journey mapping to identify key touchpoints and opportunities for improving the customer experience.
7. Design and implement customer surveys, focus groups and other research initiatives to gather qualitative insights.
8. Provide data-driven recommendations to inform customer retention strategies and loyalty programs.
9. Communicate complex analytical findings to non-technical stakeholders in a clear and compelling manner.
10. Support the creation of personalised customer communications and offers based on data-driven segmentation and profiling.

Prime Skills

AI Application

Customer Behaviour
AnalysisCustomer Experience
Management

Customer Profiling

Data Storytelling and
VisualisationEmerging Technology
Monitoring

Market Trend Analysis

Market Research

Predictive Modelling

Product Management

Product Performance
ManagementRequirements Definition
and Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Presales Solution Architect (Industry Vertical)****Job Purpose**

Deliver tailored ICT solutions to customers across various industry verticals

Job Description

1. Responsible in providing Information and Communication Technology (ICT) solutions for customers from various industry verticals. Have basic knowledge of the ICT fields, for example, products & solution such as Network (Router/Switch/WIFI), IT (storage/server) etc.
2. Gain insights into the market and customers and formulate sales strategies.
3. Understand customer's need and providing solutions for projects.
4. Able to achieve sales target, sustain revenue growth and provide recommendations to enhance account growth and revenue potential.
5. Participate in planning and executing key industry marketing activities and communicate with high level customers about solution opportunities.
6. Develop and manage high-value relationships with key customer.
7. Engage the improvement of the competitiveness of the solutions, collect customer demand, work with partners to continuously optimise and promote.

Prime Skills

AI Application

AI in Product Development

Applications Development

Customer Relationship Management

Marketing Strategy

Market Trend Analysis

Market Research

Product Design and Development

Prototyping

Quality Assurance

Sales Strategy

Solution Architecture

Stakeholder Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****5G Solutions Architect****Job Purpose**

Design, implement and optimise end-to-end solutions that leverage 5G technology to meet the business needs of clients

Job Description

1. Design end-to-end architectural roadmaps for enterprise architecture (EA), in accordance with enterprise strategies and EA processes
2. Analyse client requirements and collaborating with R&D divisions to provide ongoing support.
3. Apply advanced skills, extensive technical expertise and full industry knowledge.
4. Develop innovative solutions to complex problems
5. Knowledge of 5G core network specifications, solutions and operations, Multi-Access Edge Computing implementation and usage, Open RAN, network protocols, procedures, implementation and call flows.

Prime Skills

Edge Computing

AI Application

AI in Product Development

AI Management

Enterprise Architecture

Network Design

Networking Protocols

Solution Architecture

Requirements Definition and Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Enterprise Solution Sales****Job Purpose**

Target sales of 5G system integration solutions in enterprise segments

Job Description

1. Sell 5G solutions in enterprise segments and system integration services comprising network, compute, storage and security stack, Wi-Fi solutions and smart city solutions
2. Identify and develop potential clients in enterprise segments
3. Articulate appropriate solution offerings and provide effective value proposition to clients
4. Understand unique business needs and challenges of each client and provide tailored solutions
5. Develop and execute strategic sales plans

Prime Skills

Business Opportunities Development

AI Application

Account Management

Customer Acquisition and Retention Management

Customer Experience Management

Customer Profiling

Customer Relationship Management

Market Profiling

Product Advisory

Sales Strategy

Sales Target Management

Selling

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)



Role	Operations Centre Support Engineer
Job Purpose	Ensure stable operations and performance monitoring of IT systems, providing support and resolutions for incidents and disruptions

Job Description

1. Conduct scheduled tests on systems and monitor performance to ensure stable operations
2. Oversee monitoring activities to maintain system stability and resolve downtime or malfunctions
3. Develop and monitor service-level objectives to ensure they meet or exceed requirements
4. Create client satisfaction metrics and service procedures, proposing recommendations for improvement
5. Install software and hardware equipment for users, conducting user acceptance tests on new setups
6. Carry out feasibility studies for implementing new solutions and ensuring integration compatibility
7. Evaluate past incidents, prepare reports and document findings for senior stakeholders
8. Classify incidents for escalation, provide support and recommendations to affected teams
9. Analyse technical incidents and provide third-line support to resolve issues effectively
10. Ensure seamless integration and continued operation of systems to minimise disruptions

Prime Skills

Incident Management

System Integration

Service Level Management

Stakeholder Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Network-as-a-Service (NaaS) Product Developer****Job Purpose**

Develop and implement innovative Network-as-a-Solution (NaaS) products

Job Description

1. Responsible for developing Network product portals and software solutions
2. Partnering with stakeholder organisations to define and align on product roadmaps, priority and delivery dates
3. Working with the product and delivery teams to collaboratively drive new solutions, proof of concepts and help drive the architectural direction of the solution.
4. Being a recognised technology leader in the network product portfolio and drive a technology lead path to grow revenue by implementing NaaS solutions
5. Acting as a cross functional technology leader in driving build vs buy decision for product development and product launches
6. Identifying new opportunities for integrating network services to enhance and differentiate product offerings
7. Developing and owning Solution architecture, ensures user stories are written and acceptance criteria are met and demo the working features internally and externally.
8. Collaborating with stakeholders and development teams (internal and external) to ensure successful implementation of new or enhanced functionality for the product.

Prime Skills

API Management

AI Application

Customer Profiling

Market Profiling

Market Trend Analysis

Product Branding

Product Design and Development

Network Integration

Software Design

Regulatory Compliance

Solution Architecture

Stakeholder Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****DevOps Engineer****Job Purpose**

Develop, automate and manage software deployment, integration and monitoring to improve system reliability and scalability

Job Description

1. Build IT solutions to meet business requirements and develop reusable components for scalability
2. Develop automation frameworks for deployment, management and monitoring of software applications
3. Set up and maintain test environments for manual and automated testing while ensuring quality assurance
4. Develop and maintain program codes, logic and integration with other applications and platforms
5. Translate business and technical requirements into test cases, test scenarios and scripts
6. Perform automated, load and security vulnerability testing to enhance system performance and security
7. Evaluate and improve existing applications through gap analysis, troubleshooting and performance optimisation
8. Deploy new modules, upgrades and fixes to production while ensuring smooth knowledge transfer
9. Automate security and risk management processes, integrating security protocols into system infrastructure
10. Develop requirements, methods and procedures for routine maintenance and continuous integration

Prime Skills

Cyber Risk Management

Test Planning

Agile Software Development

AI Application

Applications Integration

Applications Development

Applications Support and Enhancement

Process Automation

Quality Assurance

Security Monitoring

Software Testing

Solution Architecture

System Integration

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****SysOps Engineer****Job Purpose**

Manages cloud infrastructure solutions, operations, automation and performance optimisation

Job Description

1. Configure network infrastructure environment for software development and prototyping and conduct pre-deployment testing of systems to ensure reliability of solutions
2. Identify and resolve deployment issues and address gaps in performance or availability based on identified metrics
3. Perform regular tuning of network infrastructure services and resolve service operation issues and prevent recurrence using automation
4. Conduct measurement and monitoring of overall performance, system health, system availability and latency
5. Configure cloud platforms and applications in alignment with organisational cyber security policies
6. Execute procedures to ensure data protection and encryption and monitor compliance of data management and retention processes
7. Identify opportunities to enhance operational workflows, systems and processes through automated deployment
8. Conduct capacity planning for cloud infrastructure and systems performance analysis and develop tools and scripts to automate deployments and optimise performance
9. Design and write code for scalable, robust systems using cloud architecture
10. Develop processes and standards for system or application reliability in areas of availability, performance, latency, capacity, emergency response, capacity planning, security and monitoring

Prime Skills

Data Security

Agile Software
Development

AI Application

Configuration
Management

Data Management

Data Protection

Infrastructure
Development

Network Support

Network Optimisation

Process Automation

Prototyping

Software Configuration

Software Security

Software Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Software Engineer****Job Purpose**

Develop and maintain high-quality software solutions by designing, testing and optimising code for performance and security

Job Description

1. Recommend approaches that balance security, stability and performance needs while providing technical guidance on solutions
2. Translate user requirements into technical specifications and formulate software requirement specifications
3. Design test environments, specify test cases and identify stakeholders for testing activities
4. Analyse defect arrival rate and failure intensity data to improve software reliability
5. Develop and use simulations, prototypes and static analysis to evaluate software design quality
6. Design software components, modules and high-level system architecture while performing trade-off analysis
7. Establish project coding standards, review and approve coding practices and identify security risks
8. Perform threat modeling, attack surface analysis and define security requirements for new and modified systems
9. Lead code reviews, perform refactoring and oversee software release building, verification and implementation
10. Maintain software configuration management processes, tools, audit reports and documentation of approved changes

Prime Skills

Test Planning

AI Application

AI in Product Development

Agile Software Development

Configuration Management

Data Collection and Analytics

Data Management

Failure Analysis

Porting/Software Configuration

Product Management

Product Performance Management

Security Architecture

Software Configuration

Software Design

Software Testing

Threat Intelligence and Detection

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****NaaS Product Manager****Job Purpose**

Manage API-driven network service products from concept to launch and continuous improvement

Job Description

1. Own and manage network service API products from concept to launch to continuous improvement.
2. Define product vision, roadmap and KPIs, ensuring alignment with business strategy and market needs.
3. Drive end-to-end execution, including defining release scope, collaborating with engineering and managing the go-to-market strategy.
4. Own and prioritise the product backlog, ensuring alignment with business and technology goals.
5. Partner with cross-functional teams (business development, marketing, sales, engineering) to define and execute launch plans.
6. Ensure compliance with security, data privacy and regulatory requirements in API and network services.
7. Establish a robust Voice of Customer feedback loop to inform product decisions.
8. Continuously track product performance using dashboards and analytics tools.
9. Develop and execute adoption strategies for API monetisation and customer growth.

Prime Skills

AI Application

API Management

Customer Behaviour
Analysis

Customer Profiling

Market Profiling

Market Trend Analysis

Product Branding

Product Performance
Management

Product Management

Regulatory Compliance

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Platform Category Manager****Job Purpose**

Define and execute strategies for internal platform products, ensuring they align with long-term business and product goals

Job Description

1. Define and maintain platform product strategy: Develop and communicate a clear vision for internal platforms that supports long-term product and business goals.
2. Own and prioritise the platform product roadmap: Manage a backlog of platform features, enhancements and infrastructure investments.
3. Partner with engineering leadership: Work closely with platform, infrastructure and DevOps teams to scope and deliver technical capabilities.
4. Understand internal team needs: Regularly gather feedback from product, design, engineering and data teams to identify pain points and opportunities for platform improvements.
5. Drive platform adoption: Develop and execute strategies to promote the use of platform tools and services across all product teams.
6. Track and report platform metrics: Establish objectives and key results to measure platform reliability, product adoption, developer productivity and the impact of platform investments.
7. Manage platform risks and technical debt: Proactively identify and address technical risks, infrastructure bottlenecks and scaling challenges.
8. Collaborate on product architecture decisions: Provide input on architectural decisions to ensure new product features align with platform capabilities.

Prime Skills

Organisational Analysis

AI Application

Change Implementation
Planning and Management

Configuration Tracking

Market Profiling

Market Trend Analysis

Product Design and
Development

Product Management

Technology Risk
Management

User Research

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Product Manager (Industry Vertical)****Job Purpose**

Lead the strategy, development and delivery of enterprise products tailored to key industry verticals

Job Description

1. Define and execute the product strategy and roadmap for solutions tailored to key industry verticals
2. Lead the end-to-end lifecycle of industry-specific enterprise products, from concept through development, launch and iteration.
3. Collaborate closely with cross-functional teams including go-to-market, user-interface/user-experience, engineering, research and operations to ensure successful product delivery.
4. Identify key customer challenges and business opportunities within each vertical to guide product features and priorities.
5. Drive the creation of scalable, impactful solutions that improve customer experience and deliver measurable business outcomes.
6. Ensure alignment between product vision and execution by coordinating across architecture, infrastructure and operational functions.

Prime Skills

AI Application

Customer Experience Design

Customer Relationship Management

Market Trend Analysis

Product Management

Product Performance Management

Product Requirements

Service Level Management

Solution Architecture

Stakeholder Management

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Data Product Manager****Job Purpose**

Drive the roadmap for data products, ensuring they meet the needs of both internal and external data users

Job Description

1. Owning and driving the product roadmap for various data products supporting internal and external data users.
2. Managing and collaborating with various stakeholders to implement product enhancements that fulfill user and business requirements.
3. Prioritising users' requests and delivering high-quality Product Requirements Documents with clear goals, scopes, user scenarios, analytics frameworks and data logic to meet users' needs.
4. Collaborating with other product teams, engineering teams and project managers to drive feature releases while ensuring quality, speed and sustainability.
5. Promoting and driving usage and sales of data products across regional and local data users through initiatives such as conducting sharing and training sessions and creating and maintaining user guides.
6. Serving as the data domain expert for customer portfolio.

Prime Skills

Data Governance

Data Security

Data Engineering

AI Application

Data Modelling and Design

Market Trend Analysis

Market Trend Analysis

Product Management

Product Requirements

Revenue Analysis

Sales Support

Sales Strategy

Sales Target Management

Stakeholder Management

Strategy Planning

User Research

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Security Product Manager****Job Purpose**

Drive strategy, development and lifecycle management of security products and solutions

Job Description

1. Development of pre-sales & pre-implementation processes, training, technical discovery and other tools
2. Communicate the value proposition of the products to the sales team and develop the sales tools
3. Be the expert in the portfolio's current technical and operational approaches (systems, tools, processes) while navigating new development initiatives through the process to launch
4. Evaluate and determine technologies/platforms and commercial models already in network to understand how they can be leveraged
5. Execute the product life cycle from strategic planning (e.g. getting buy in from management), through customer/field requirements gathering
6. Leads the on-going product development strategy, from initial business case and definition to final production, with products and services delivered on schedule, on-budget and with high quality
7. Develop and implement a lifecycle service plan for each new product/solution offering that enables Customer Service Centres to cost effectively provide services to its clients throughout the product/solution's lifecycle with global effectiveness
8. Design outbound marketing activities, identifying customers for case studies, creating marketing materials for use by the sales force, educating the sales force and working with the public relations team to handle press contacts

Prime Skills

Data Security

AI Application

Emerging Technology
Monitoring

Marketing

Network Security

Product Management

Product Performance
Management

Sales Strategy

Sales Support

Sales Target Management

Software Security

Strategy Planning

Threat Analysis and
Defence

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Applications Support Engineer****Job Purpose**

Ensures software reliability and user support through testing, maintenance and troubleshooting

Job Description

1. Specify test cases for the selected testing technique and design the test environment and test case scenarios
2. Design software test plan and criteria for regression testing
3. Lead software operational training and software diagnostics and real-time debugging and/or troubleshooting
4. Develop software transition plans and identify stakeholders for transition and operational requirements
5. Develop software activation and check-out procedures and determine the impact of software changes on the operational environment
6. Develop maintenance plans including timelines and resources needed and oversee the maintenance of technical documentation of technical architecture, code changes, issue resolutions, etc.
7. Provide high-level maintenance and update of an existing software and/or platform to improve functionality and process flow and monitoring of security measures, proper registration of passwords and other access procedures
8. Conduct technical impact analysis and problem identification and implement software maintenance processes and plans
9. Develop plans to make corrective, adaptive and perfective changes to software

Prime Skills

Test Planning

AI Application

AI in Product Development

Continuous Integration and Continuous Deployment

Application Support

Customer Experience Management

Process Improvement and Optimisation

Software Maintenance

Software Testing

System Software

Testing

User Experience Evaluation

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Product Analyst****Job Purpose**

Analyse market trends and user needs to provide data-driven insights for product development and decision-making

Job Description

1. Articulate stakeholder needs to guide product decision-making and identify requirements through customer journeys and user stories
2. Analyse market data, surveys and interviews to gather insights on consumer needs and determine product-market fit
3. Develop research roadmaps and strategies across product stages, from conceptualisation to post-launch review
4. Design qualitative and quantitative research methods, including usability testing, A/B testing and heuristic evaluations
5. Develop a User Research Practice Framework for data collection, benchmarking and evaluation of best practices
6. Collaborate with designers, engineers and product managers to integrate research findings into product development
7. Design and conduct User Acceptance Testing to validate product functionality and usability before launch
8. Analyse test data, validate findings and document testing processes to ensure quality control and compliance
9. Develop data tracking requirements and analyse large datasets to identify trends, correlations and actionable insights
10. Create data reports, visualisation tools and dashboards to support decision-making through storytelling and analytics

Prime Skills

AI Application

Customer Behaviour
AnalysisCustomer Experience
ManagementData Collection and
Analytics

Market Research

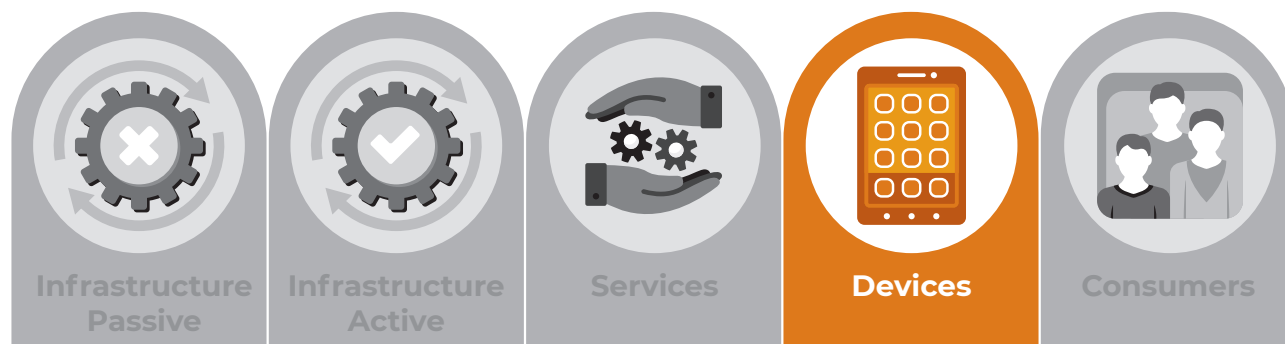
Product Advisory

Product Performance
Management

Testing

User Experience Evaluation

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Product Engineer****Job Purpose**

Designs products and coordinates the production process for those products

Job Description

1. Execute New Product Introduction, customise customer technical documentation, ensure compliance with safety regulations and implement engineering changes
2. Using industry knowledge to come up with unique product ideas
3. Coordinating with the product development team to finalise product ideas
4. Testing product prototypes to adjust design flaws
5. Evaluating the product prototype to identify potential safety hazards
6. Consulting with shipping managers and logisticians to determine cost-effective manufacturing procedures and materials
7. Overseeing the start of the manufacturing process to ensure productivity and safety

Prime Skills

AI Application

AI in Product Development

Product Design and Development

Product Management

Product Performance Management

Product Requirements

Quality Assurance

Stakeholder Management

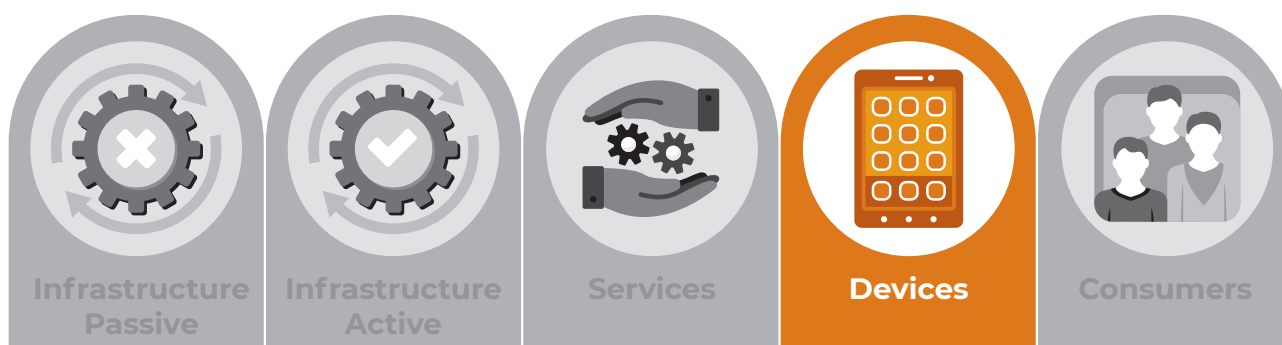
Testing

Troubleshooting

User Interface and User Experience Design

User Testing and Usability Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Embedded Systems Engineer****Job Purpose**

Design, develop and optimise software-hardware integration for embedded systems to ensure performance, stability and security

Job Description

1. Test and validate software and hardware interactions from prototype to manufacturing release
2. Diagnose and rectify technical problems in embedded software and evaluate failed system scenarios
3. Evaluate software resilience against reverse engineering
4. Participate in hardware design and security architecture reviews
5. Lead the design of specific modules for development of software for embedded systems and create software tools for tests and automation
6. Formulate specifications on delivery platforms for embedded systems
7. Identify system-level traceability requirements and tools
8. Perform requirements analysis and determine user requirements based on business needs
9. Support software quality assurance to optimise input/output performance
10. Analyse and enhance efficiency, stability and scalability of system and resources
11. Writing the software that runs on IoT devices, enabling them to gather data, communicate with other devices and perform actions based on collected information

Prime Skills

Embedded Systems Programming

Embedded Systems Integration

AI Application

Embedded Systems Interface Design

Real-time/Embedded Systems Development

Data Collection and Analytics

Failure Analysis

Hardware Design

Process Automation

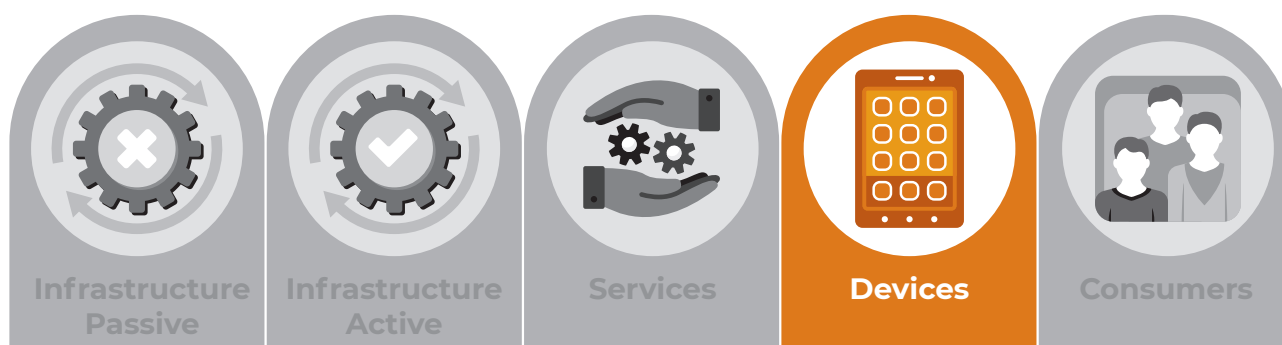
Quality Assurance

Software Design

System Integration

Testing

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

**Role****Equipment Engineer****Job Purpose**

Design, enhance and maintain mechanical, computer or electrical devices

Job Description

1. Lead and manage the end-to-end process of transferring product lines, including planning, execution and validation.
2. Work closely with the overseas team to understand equipment specifications, process requirements and operational best practices.
3. Oversee the preventive and corrective maintenance of all the capacitor equipment and testing systems.
4. Ensure the proper functioning of machinery by performing regular maintenance, troubleshooting issues and identify opportunities for efficiency improvements in the machine process, in mechanisation, automation and machine calibration.
5. Analyse equipment performance data, track critical metrics (Root Cause Analysis, Overall Equipment Effectiveness, Mean Time to Repair, Mean Time Between Failures), to improve efficiency and reliability.
6. Ensure that all the equipment's meet the industry regulations, workplace safety standards and environmental guidelines, conducting inspections and audits.
7. Maintain accurate records of equipment performance, maintenance schedules and service reports.
8. Manage relationships with equipment manufacturers, spare part suppliers and service providers.
9. Work closely with cross-functional teams including production, quality and process to optimise equipment performance.

Prime Skills

AI Application

AI in Product
DevelopmentCustomer Relationship
ManagementEquipment Performance
MonitoringEquipment Maintenance
and Repair

IT Standards

Process Automation

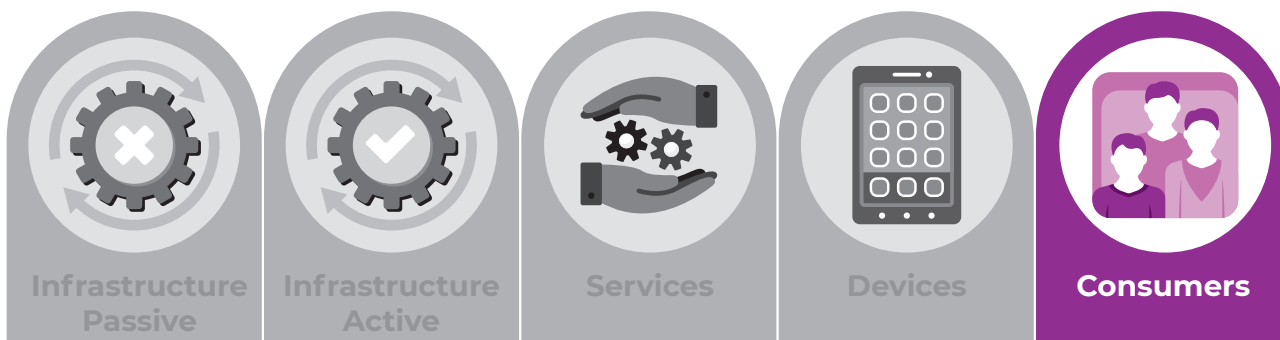
Quality Assurance

Supplier Management

Troubleshooting

Note: Power Skills are applicable across all Critical Roles (Refer to 'Skills' section for detailed view of skills and skill definitions)

Use Cases



Sector

Manufacturing

Use Case

First 5G-enabled Advanced Manufacturing

Objective

To digitally enhance manufacturing approaches by improving efficiency, accuracy and operational agility

5G Application

1. 5G-enabled smart scanners capture material information upon scanning and automatically updates cloud-based Enterprise Resource Planning (ERP) system
2. 5G-enabled smart racks automatically pick materials, ensuring accuracy while updating the ERP on a real-time basis
3. 5G-enabled X-ray counter ensures accuracy and speed while updating the ERP on a real-time basis
4. 5G-enabled automated mobile robots (AMR) automate movement throughout the factory
5. 5G private network has seamless mobility, low latency, high-capacity Quality of Service (QoS) controlled bandwidth with a highly resilient design suitable for mission-critical deployments

Prime Skills

Industrial Automation & Robotics

Cloud & ERP Integration

Cybersecurity for Data Management

5G Network Engineering

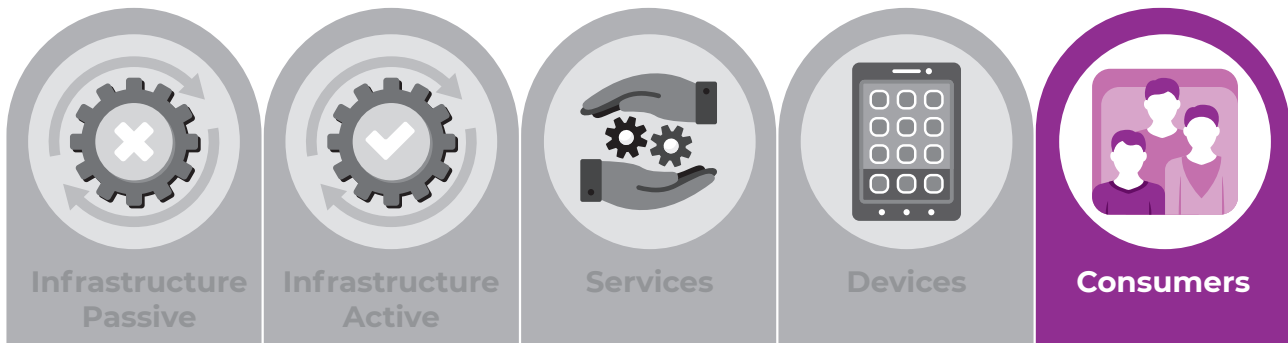
Cybersecurity for Operational Technology

Data Visualisation

Embedded Systems & IoT Device Engineering

Solution Architecture

Service Engineering



Sector	Manufacturing
Use Case	World's First 5G-enabled Built-To-Order Electric Vehicle Factory
Objective	To automate transport operations of vehicle manufacturing material across the factory

5G Application

1. 5G-enabled robots deployed across factory floor to simultaneously transport material required for vehicle manufacturing to manufacturing cells
2. 5G private network for a cloud-based centralised mobile robot management solution

Prime Skills

Cloud & Mobile Robot Integration

Cybersecurity for Data Management

5G Network Engineering

Cybersecurity for Industrial Systems

Data Visualisation

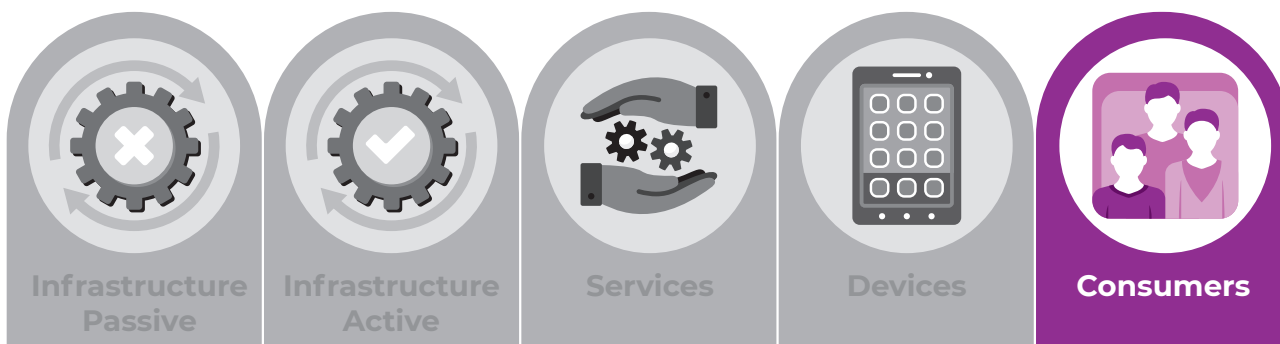
Embedded Systems & IoT Integration

Robotics Programming & Automation

Solution Architecture

Service Engineering

Product Knowledge

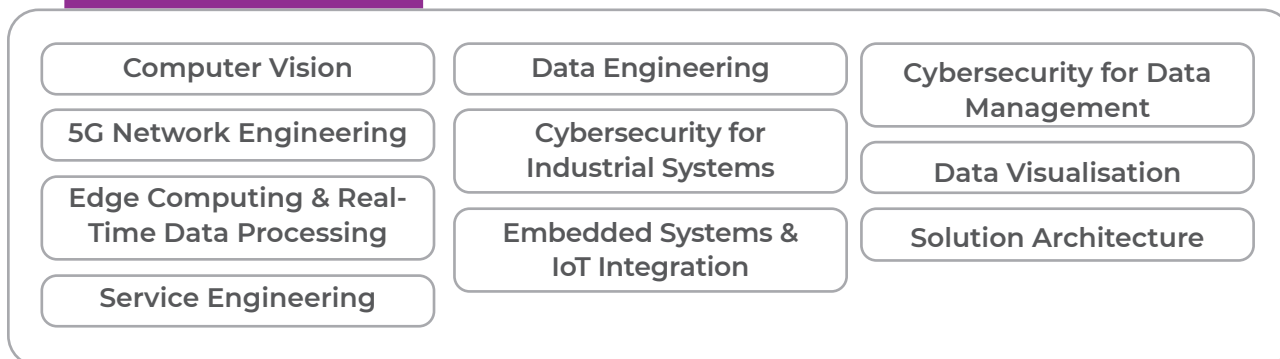


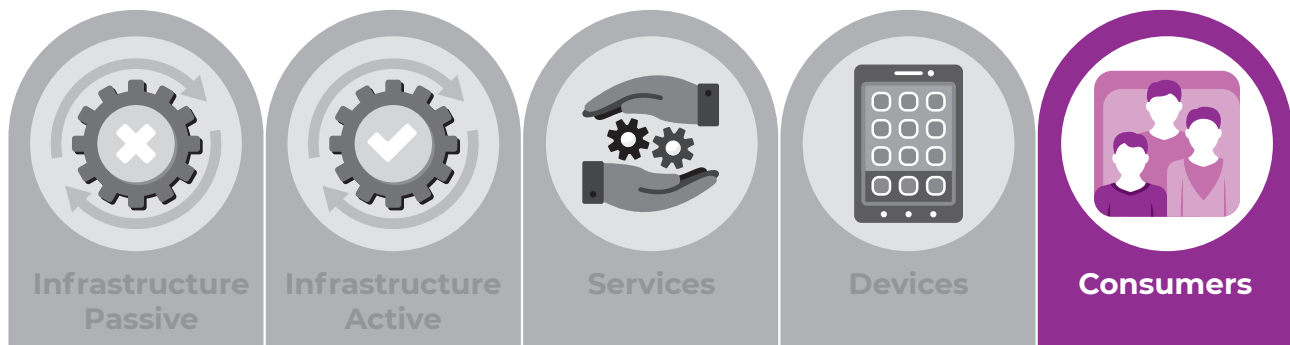
Sector	Manufacturing
Use Case	First Overseas 5G Factory
Objective	To establish a smart factory fully connected by a 5G private network

5G Application

1. 5G private network allows for wide connectivity and low latency
2. 5G AI inspection system to identify shapes of manufacturing parts and locate positions of manufacturing parts through laser sensors

Prime Skills





Sector	Oil and Gas
Use Case	First in Malaysia to Adopt 5G Private Network for Enterprise Use
Objective	To advance the reliability and sustainability of energy supplies amid energy transition

5G Application

1. 5G private network allows segregation from public networks, a 99.9% network availability, enhanced security features to limit access to network, greater control over network operations and maintenance, high upload throughput and a wider coverage for transmission

Prime Skills

Data Engineering

QoS Management

Data Visualisation

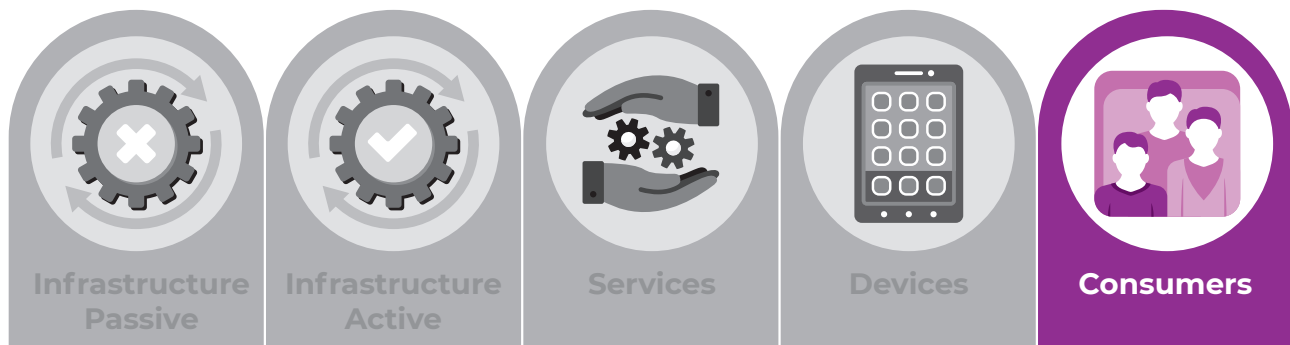
Product Knowledge

Network Security &
Access ControlCybersecurity for Data
ManagementNetwork Performance
Optimisation

Network Segmentation

5G Network Engineering

Solution Architecture



Sector	Transport
Use Case	5G Inbuilding Airport Coverage
Objective	To improve the operational efficiency of KLIA and KLIA2 and deliver better value to customers

5G Application

1. Autonomous buggy for passenger transport
2. 5G-AI driven delivery robot for delivery of goods and luggage
3. IoT devices, smart sensors and advanced digital solutions to enhance operational efficiency and passenger convenience

Prime Skills

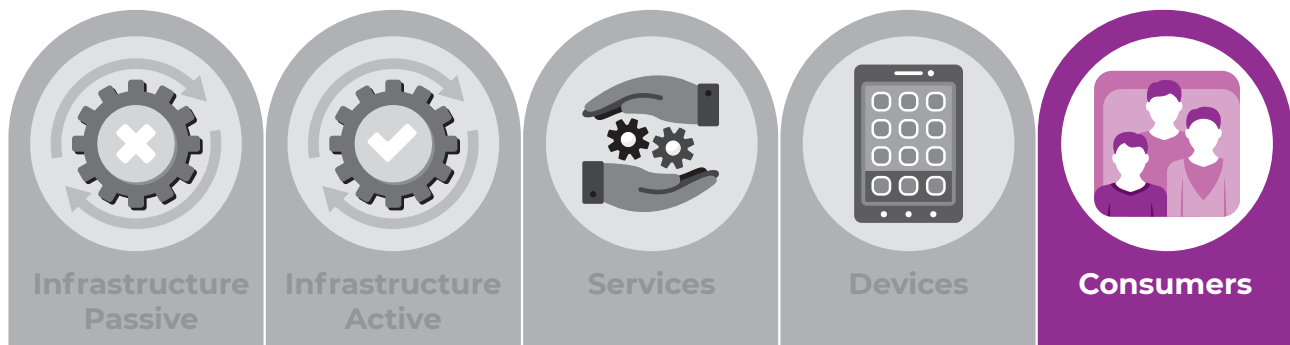
5G Network Engineering

AI & Machine Learning

Autonomous Vehicle &
Robotics Engineering

Embedded Systems & IoT
Device Engineering

IoT & Sensor Integration



Sector	Transport
Use Case	Autonomous Bus Demonstration
Objective	To improve road safety by enabling real-time communication between vehicles and control centres, allowing better response times to potential hazards

5G Application

1. 5G-enabled sensors, cameras and Light Detection and Ranging to collect real-time information in the physical world
2. AI algorithms to make decisions about navigation, obstacle avoidance and route planning;
3. Infotainment systems to enhance passenger experience
4. 5G-enabled CCTVs to monitor on-board safety

Prime Skills

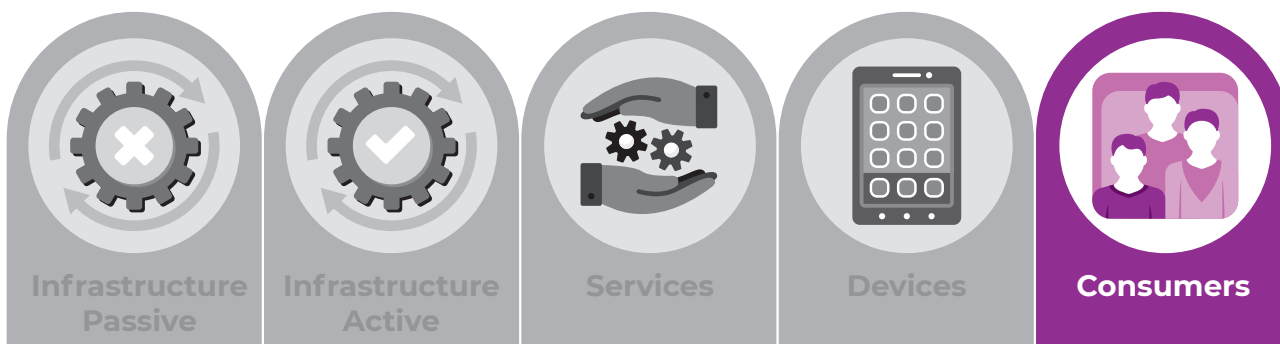
Computer Vision

Infotainment System
Development

5G Network Engineering

AI & Machine Learning

IoT & Sensor Integration

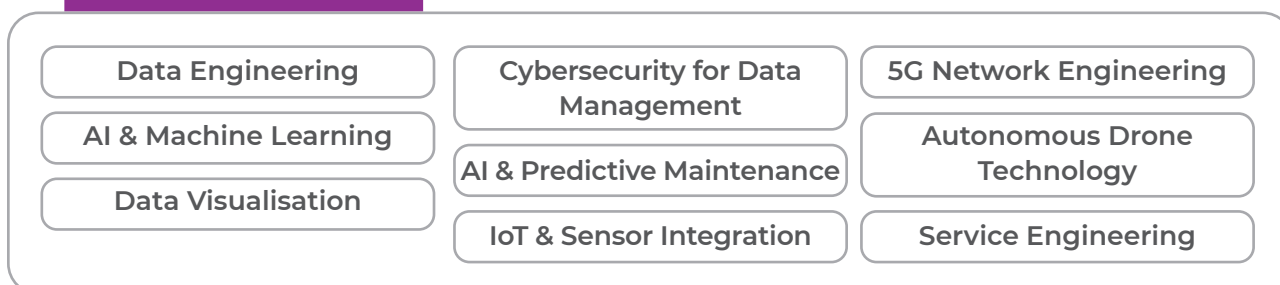


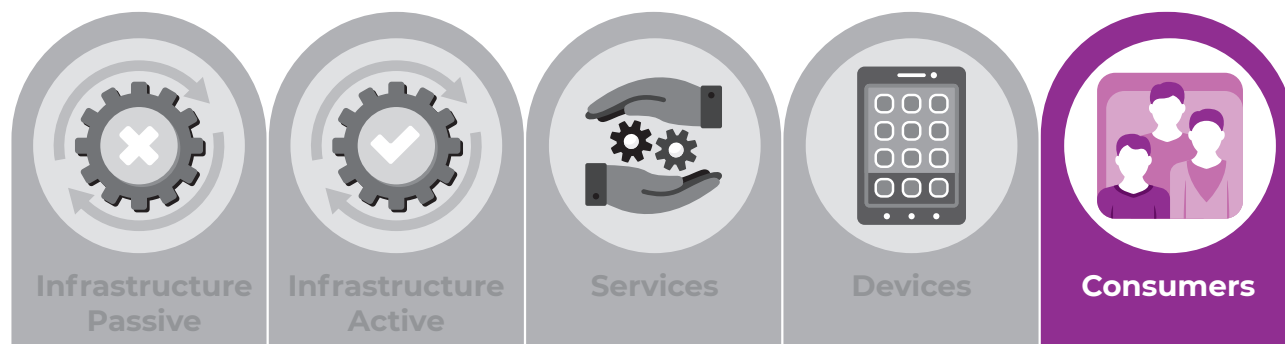
Sector	Transport
Use Case	Maritime 5G Coverage
Objective	To enhance maritime safety, efficiency and sustainability by enabling real-time data sharing between vessels, port operations and maritime authorities

5G Application

1. AI-driven management systems using real-time data to enhance fleet management, asset tracking and predictive maintenance.
2. Autonomous vessels and robotic hull cleaning, along with other maritime technologies, serving as testbeds for innovation
3. Drones for remote inspections, deliveries and incident response at sea
4. Just-in-Time Platform for optimising vessel scheduling, voyage speed and coordination of marine services

Prime Skills





Sector	Logistics
Use Case	First 5G-powered AI Autonomous Inventory Management System
Objective	To build an innovative digital ecosystem by co-creating new synergies between different industries, implementing more innovative solutions that will fuel their efficiency and growth

5G Application

1. 5G-enabled autonomous drones to carry out daily inventory management
2. 5G-enabled autonomous stock-taking solutions to enable efficient stock counting operations
3. Computer vision technologies to run processes independently and without human error

Prime Skills

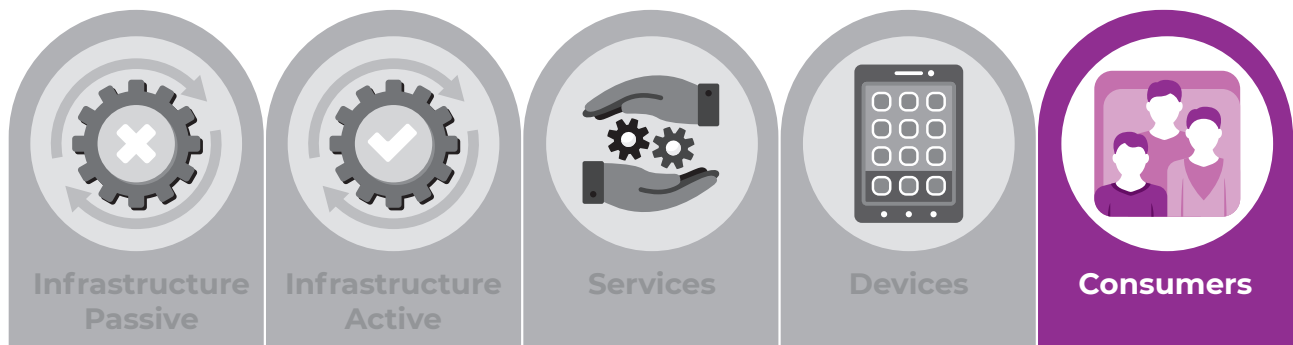
Computer Vision

Warehouse Automation
& Robotics Systems

5G Network Engineering

Autonomous Drone
Technology

IoT & Sensor Integration



Sector	Logistics
Use Case	5G Smart Warehouse Transformation in Indonesia
Objective	To enhance operational efficiency and accuracy through automation and advanced industrial solutions

5G Application

1. Hybrid 5G network to provide high-speed, low-latency connectivity
2. Digital Twin Warehouse Simulation for real-time monitoring
3. AGVs for intelligent material transfer
4. AI-powered Closed-Circuit Television (CCTV) for enhanced security

Prime Skills

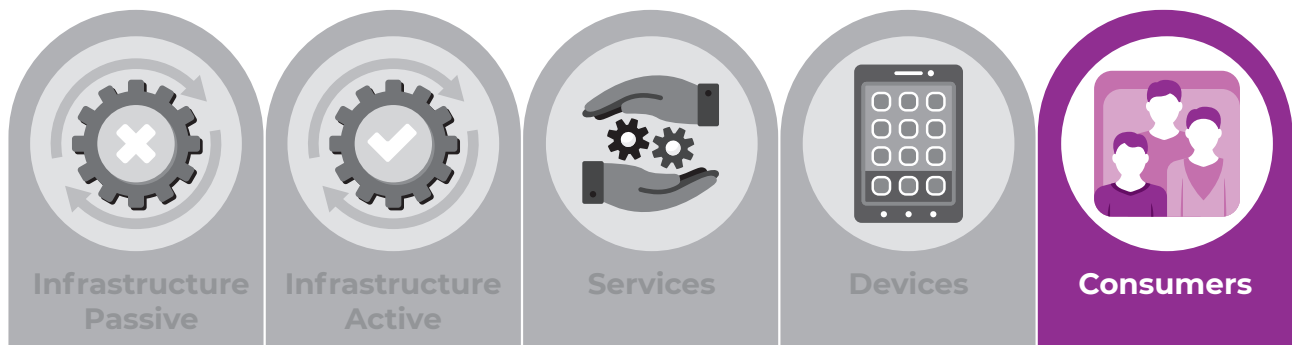
Computer Vision

Digital Twin &
Simulation Modelling

5G Network Engineering

Autonomous Vehicle &
Robotics Engineering

IoT & Sensor Integration



Sector	Logistics
Use Case	5G-enabled Shipment Tracking
Objective	To enhance logistical processes by using near real-time data analytics to predict and track shipping goods

5G Application

1. Real-time data about shipments to enable predictive planning
2. Environmental sensors to provide continuous monitoring and proactive interventions for shipments worldwide

Prime Skills

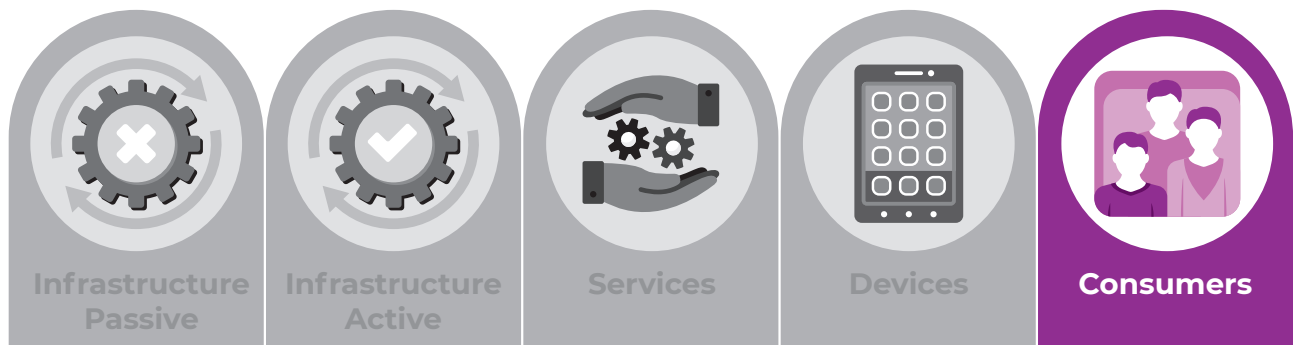
AI & Predictive
Maintenance

Cybersecurity for
Operational Technology

Data Analytics &
Monitoring

Edge Computing & Real-
Time Data Processing

IoT & Sensor Integration



Sector	Logistics
Use Case	5G Warehouse
Objective	To explore 5G's potential to unlock the power of the connected devices required for cutting-edge automation, inventory management and analytics

5G Application

1. Augmented Reality (AR) Vision Picking to test using custom augmented reality goggles to select items for shipping
2. 5G-enabled drones to conduct inventory counts

Prime Skills

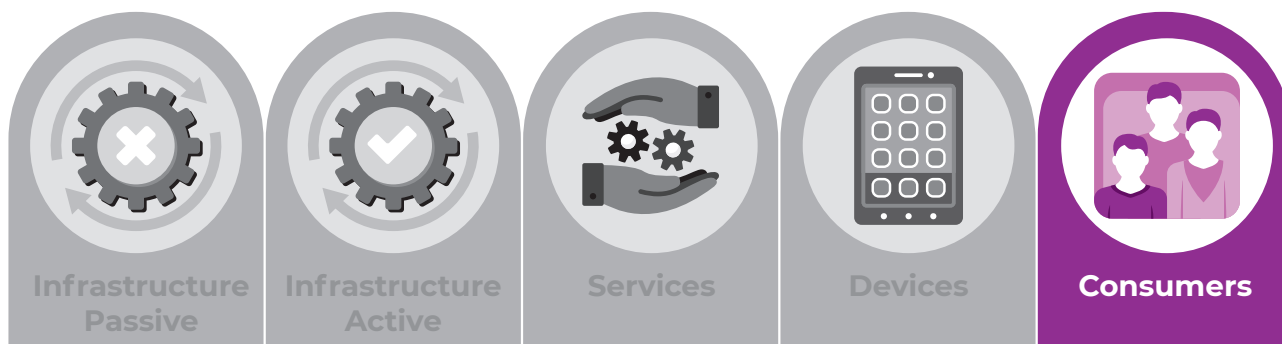
AR Development

Computer Vision

5G Network Engineering

Autonomous Drone
Technology

IoT & Sensor Integration



Sector	Power and Utilities
Use Case	Smart Nation Sensor Platform
Objective	To gain situational awareness of what's happening in urban spaces in Singapore

5G Application

1. 5G-enabled smart sensors to collect real-time information from the physical world
2. 5G-enabled technologies to translate the collected sensor data into intuitive insights
3. Smart meters – Request for Information for 5G

Prime Skills

Cloud Computing &
Dashboard Development

5G Network Engineering

Edge Computing & Real-
Time Data Processing

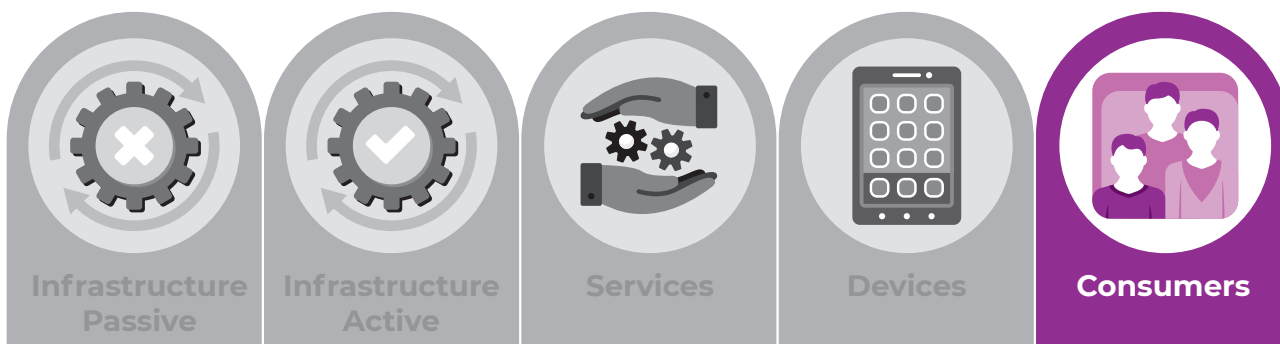
Data Engineering

AI and Data Analytics

IoT & Sensor Integration

Cybersecurity for Data
Management

Data Visualisation



Sector	Power and Utilities
Use Case	Punggol Northshore Smart Homes
Objective	To enhance the planning, design and maintenance of HDB estates to bring about a more livable, efficient, sustainable and safe living environment

5G Application

1. Smart distribution boards and smart sockets to help residents monitor their energy consumption
2. Smart lighting at common areas that adjust lighting levels based on human traffic patterns

Prime Skills

Embedded Systems Engineering

Data Engineering

Cloud Computing & Dashboard Development

AI & Automation

Data Analytics & Monitoring

Data Visualisation

IoT & Sensor Integration

Skills

Prime Skill Cluster: Strategy and Planning

Skill	Skill Definition
Emerging Technology Monitoring	Identify and assess emerging technologies to evaluate potential impact on business performance, costs and sustainability
Infrastructure Strategy	Develop a forward-looking IT infrastructure strategy that optimises performance, aligns investments and supports long-term operational goals and transformation
IT Strategy	Formulate and communicate IT strategies and action plans that respond to evolving business needs and drive long-term value through effective transformation and investment alignment
Network Planning	Develop and maintain network strategies and infrastructure to support organisational communication needs and service level agreements
Organisational Analysis	Assess internal capabilities and external factors to identify strategic improvements for enhanced organisational performance
Requirements Definition and Management	Manage requirements throughout solution lifecycles, balancing stakeholder needs with technical and regulatory constraints
Resourcing	Manage workforce resources, providing expert guidance on hiring and engaging employees, consultants and contractors
Security Strategy	Define and implement the organisation's security strategy to ensure enterprise-wide protection of information and assets
Strategy Implementation	Execute and implement operational and tactical-level action plans in alignment with the organisation's business strategies

Prime Skill Cluster: Design and Architecture

Skill	Skill Definition
Embedded Systems Integration	Implement control systems to perform pre-defined tasks and also real-time monitoring for the real world
Embedded Systems Interface Design	Design and set up networked sensor interfaces to enable real-time transmission of information to central locations
Enterprise Architecture	Translate business strategy into structural and operational plans by reviewing market trends, prioritising initiatives and aligning enterprise capabilities to support strategic evolution
Hardware Design	Design and specify computing and communication equipment for integration into IT infrastructure, ensuring compatibility and sustainability
Infrastructure Design	Establish infrastructure design principles to address connectivity, capacity, access and security needs and translate these into technical specifications aligned to business requirements
Network Design	Design comprehensive network architectures and policies to meet business needs across all communication channels
Security Architecture	Design security architectures and controls to embed protection into technology and mitigate emerging technological and commercial risks
Software Design	Design software architecture based on business needs, ensuring functional integration across components
Solution Architecture	Design and refine a solution blueprint to guide development of IT solutions to meet business needs
Structural Knowledge	Knowledge about the structure and materials needed to be used in the design of the products
System Design	Design systems that align with user needs, existing architectures and performance standards

Prime Skill Cluster: Development and Implementation (Roles)

Skill	Skill Definition
Agile Software Development	Plan and implement Agile methodologies to drive adaptive, iterative software development, ensuring continuous evolution and seamless application delivery to end users
Applications Development	Develop and refine applications through coding, testing, debugging and documentation, ensuring compliance with development and security standards and integrating advanced technologies
Applications Integration	Develop and implement integration plans to connect disparate applications, utilising middleware to optimise connectivity and performance across target environments
Artificial Intelligence (AI) in Product Development	Apply AI and machine learning in product design, development and lifecycle management for improved functionality and decision-making
Health Safety Environment (HSE)	Provides insights into safety requirements and behaviours to ensure workplace safety, minimising risks and complying with environmental and safety regulations.
Change Implementation Planning and Management	Deploy and integrate digital capabilities in line with operational needs and business processes
Cloud Computing	Implement cloud solutions to enhance business performance and security of IT systems
Computational Modelling	Develop and apply algorithms and computational methods to enable systems or software agents to learn, improve and achieve desired outcomes, while interpreting data and using data modelling techniques to address specific issues
Configuration Tracking	Track and manage software project changes systematically to ensure all revisions are accounted for, safeguarding assets against unauthorised alterations or misuse
Continuous Integration and Continuous Deployment	Manage the planning, building, testing and integration of code, ensuring the seamless deployment of software changes and updates into a live environment

Prime Skill Cluster: Development and Implementation (Roles)

Skill	Skill Definition
Data Engineering	Develop and implement efficient and stable data pipeline processes to collect, store, extract, transform, load and integrate data from diverse sources, preparing it in a structured manner for accessible analysis aligned with business requirements
Device Integration	Coordination with device companies to make a service possible
Edge Computing	Design and manage edge computing systems for processing data closer to source (e.g., IoT devices, local servers)
Embedded Systems Programming	Programme embedded systems using authorised interfaces to support device functionality independent of traditional operating systems
Failure Analysis	Examine physical and electrical defects to verify root causes of failure and identify failure modes
Fibre Splicing	Ability to join optical fibre cable using fusion or mechanical methods
Firmware Development	Develop and maintain low-level software for embedded systems and hardware control, ensuring efficient and correct operation
Infrastructure Deployment	Deploy, maintain and decommission infrastructure components according to defined plans and safety standards, including site preparation, system testing and issue resolution
Infrastructure Development	Develop and implement strategies and design for IT infrastructure to support the business needs of an organisation in a way that is future ready, secure and cost-effective
Internet protocol (IP)	Ability to work with the protocols and technologies that manage data transmission over networks.
Network Configuration	Configure network hardware and software to meet organisational and technical requirements, ensuring stable, secure and reliable network operations
Network Orchestration and Automation	Automate network service delivery across traditional and virtualised environments to improve efficiency and minimise manual intervention

Prime Skill Cluster: Development and Implementation (Roles)

Skill	Skill Definition
Network Security	Design secure network systems incorporating protection, detection and response mechanisms to uphold infrastructure integrity
Network Slicing	Implement logically partitioned networks to deliver tailored services aligned with service level agreements
Networking Protocols	Apply and troubleshoot network protocols to optimise communications between devices and systems
Prototyping	Oversee, design and build a preliminary model or version enabling the development of the complete system, process, product or service
Radio Frequency (RF) Engineering	Design, deploy and maintain radio frequency infrastructure to support wireless communication and IT systems
Real-time/ Embedded Systems Development	Develop embedded and real-time software systems for integration into devices with safety, security and reliability constraints
Software Configuration	Configure and deploy software using automation tools, adjusting based on system testing outcomes
Software Security	Safeguard software applications and networks by identifying vulnerabilities and defending against cyber threats
Software Testing	Plan and execute application testing to validate performance against technical criteria
System Integration	Implement integration solutions to facilitate integration and optimise inter-operability of ICT systems and their interfaces
Test Planning	Define test strategies to verify compliance with design and performance specifications throughout product lifecycles
User Testing and Usability Testing	Conduct and manage user tests to evaluate design feasibility and user-friendliness

Prime Skill Cluster: Development and Implementation (Use Cases)

Skill	Skill Definition
5G Network Engineering	Design, implement, optimise and manage 5G wireless networks to deliver high-speed, low-latency and highly reliable connectivity.
AI and Automation	Integrate AI technologies with building management systems (BMS) to enhance energy efficiency, security and comfort
AI and Data Analytics	Apply machine learning, data science and AI techniques to analyse large datasets generated by sensors, drones and other monitoring devices used in farming
AI and Machine Learning	Apply AI to design and implement intelligent systems capable of performing tasks independently, without human intervention
AI and Predictive Maintenance	Apply machine learning, data analysis and AI models to predict equipment failures before they happen, reducing downtime and optimising maintenance schedules
Augmented Reality (AR) Development	Create interactive experiences that combine real-world environments with computer-generated content, enabling users to interact with both simultaneously
Autonomous Drone Technology	Use unmanned aerial vehicles (UAVs) equipped with advanced sensors and cameras to collect data from remote locations
Autonomous Vehicle and Robotics Engineering	Develop and deploy self-driving vehicles and robotic systems that can navigate and operate independently
Cloud and Enterprise Resource Planning (ERP) Integration	Integrate cloud computing technologies with ERP systems to enable seamless real-time data exchange and management
Cloud and Mobile Robot Integration	Leverage cloud computing to manage fleets of mobile robots in a centralised environment
Cloud Computing and Dashboard Development	Use cloud technologies to provide a centralised platform for monitoring and visualising key metrics and analytics through dashboards
Computer Vision	Apply algorithms and neural networks to enable machines to recognise objects, analyse scenes and perform tasks such as image classification, face recognition and motion detection

Prime Skill Cluster: Development and Implementation (Use Cases)

Skill	Skill Definition
Cybersecurity and Industrial Systems	Protect the hardware and software that support industrial operations, including manufacturing plants
Cybersecurity for Data Management	Manage and protect data systems to ensure security, privacy and compliance with cybersecurity requirements
Cybersecurity for Operational Technology	Protect critical systems and infrastructure that manage physical processes, such as industrial control systems (ICS), SCADA systems and networked devices
Data Analytics and Monitoring	Use data to track and optimise energy consumption, efficiency and sustainability efforts
Data Engineering	Design, construct and maintain data pipelines and infrastructure to support data collection and analysis at scale
Data Visualisation	Analysing collected data and demonstrated effectively to provide intended outcome, clear insights and support informed decision-making
Digital Twin and Simulation Modelling	Build sophisticated digital models that can be used to simulate scenarios, monitor systems and make data-driven decisions
Edge Computing and Real-Time Data Processing	Process and analyse data at or near the source of data generation (the "edge") rather than relying on centralised cloud infrastructure
Embedded Systems and IoT Device Engineering	Design, develop and implement embedded systems that integrate with IoT (Internet of Things) devices to collect, process and communicate data
Embedded Systems and IoT Integration	Connect and integrate embedded systems with IoT networks to facilitate communication, data exchange and control between devices (e.g. sensors)
Embedded Systems Engineering	Design and develop physical components that make up embedded systems, such as microcontrollers, processors, sensors and actuators
Industrial Automation and Robotics	Integrate automated systems and robotic technologies into industrial operations to optimise manufacturing processes, improve efficiency and enhance precision

Prime Skill Cluster: Development and Implementation (Use Cases)

Skill	Skill Definition
Infotainment System Development	Design and build embedded systems that provide entertainment, information and connectivity to users in vehicles or other devices
IoT and Sensor Integration	Design, implement and manage interconnected systems that gather and transmit data from various types of sensors to an IoT network for analysis and action
Network Performance Optimisation	Use various tools and techniques, such as network analysis, bandwidth management and congestion control, to ensure optimal performance for all network devices and users
Network Security and Access Control	Manage and enforce security protocols and policies to safeguard network infrastructure and ensure that only authorised users and devices can access network resources
Network Segmentation	Divide a large network into smaller, isolated sub-networks (segments) to improve security, performance and management
Product Knowledge	Provide Level 1 support by applying knowledge of the product to troubleshoot issues and assist end users effectively (specifically 5G native infrastructure)
QoS Management	Configure and optimise network resources to ensure efficient and prioritised traffic flow, particularly for time-sensitive applications like VoIP, video streaming and real-time communications
Robotics Programming and Automation	Develop and program of robots to perform specific tasks within automated systems
Service Engineering	Develop and manage technical services and support processes to ensure the reliable delivery and performance of systems, often involving design, testing and maintenance
Solution Architecture	Oversee end-to-end implementation and integration of complex systems and solutions, ensuring alignment with business requirements and technical feasibility
Warehouse Automation and Robotic Systems	Implement robotic systems and automation technologies within warehouses to streamline material handling, storage and distribution processes

Prime Skill Cluster: Delivery, Operations and Quality

Skill	Skill Definition
Application Support	Provide application support and maintenance, resolving user issues, monitoring performance and delivering enhancements
Applications Support and Enhancement	Provide continuous technical support and improvements, offering guidance on installation, resolving application issues and implementing changes to enhance functionality and user experience
Artificial Intelligence (AI) Applications	Integrate AI into engineering processes using algorithmic and statistical approaches to enhance maintenance operations
Capacity Management	Plan, design and manage IT service capacity to meet current and future needs, using cost-efficient methods and demand modelling techniques
Configuration Management	Control and maintain configuration items and documentation to ensure traceability and compliance throughout the system lifecycle
Cyber and Data Breach Incident Management	Detect and report cyber and data-related incidents, identify affected systems and trigger alerts for prompt resolution
Equipment Maintenance and Repair	Troubleshoot, repair and maintain mechanical machinery to ensure operational efficiency
Equipment Performance Monitoring	Analyse, benchmark and optimise equipment performance using data-driven techniques
Incident Management	Coordinate and process incident responses, manage help requests, track resolution progress and ensure timely service restoration
Infrastructure Support	Deliver end-user support by diagnosing and resolving technical issues, advising on upgrades and producing user documentation and training to minimise disruptions
Network Administration and Maintenance	Monitor and maintain network performance, identify and resolve issues and support users through proactive communication and training
Network Analytics	Ability to analyse and interpret network data to uncover patterns, optimise performance and support decision-making across digital, social or physical networks.
Network Optimisation	Continuously improve network reliability and performance through iterative enhancements and monitoring

Prime Skill Cluster: Delivery, Operations and Quality

Skill	Skill Definition
Network Support	Provide network maintenance and user support, including performance monitoring, issue resolution, user guidance and system modifications
Porting/Software Configuration	Configure software products to operate within specific platforms or IT environments
Quality Assurance	Conduct quality assurance audits, analyse results and initiate improvements to maintain high standards across products, services and processes
Security Administration	Administer and update security mechanisms to safeguard enterprise assets, including patch management and access control
Security Education and Awareness	Promote organisational security awareness through training, guidance and communication strategies
Software Maintenance	Maintain and enhance legacy software systems for performance, security and compatibility improvements
System Software	Install and support system software, ensuring smooth operation of core platforms and utilities
Systems Installation/Decommissioning	Install and test IT hardware, software and cabling, resolving issues and maintaining accurate configuration records
Testing	Plan and execute software testing to validate functionality, security and performance, while managing risk and compliance
Threat Analysis and Defence	Enable and conduct analysis of malicious threats to understand behaviour and develop mitigation strategies
Threat Intelligence and Detection	Monitor cyber intelligence to anticipate threats through proactive behavioural analysis
Troubleshooting	Identify, analyse and resolve technical problems and issues in systems, software and devices to minimise disruption to operations and prevent recurrences
User Experience Evaluation	Validate systems and services through iterative testing to ensure usability, satisfaction and compliance with user needs
User Research	Conduct user research to uncover behaviours and needs, informing inclusive and accessible design for systems, products and services

Prime Skill Cluster: Digital and Data

Skill	Skill Definition
Application Programming Interface (API) Management	Design, deploy, monitor and maintain different software applications or systems by leveraging Application Programming Interfaces (APIs)
Artificial Intelligence (AI) Management	Leverage AI to analyse data, enhance customer experience, automate tasks and improve decision-making, while upholding ethical standards aligned with industry best practices
Big Data Analytics	Utilise advanced techniques to process, analyse and interpret extensive and complex datasets to produce actionable insights and recommendations to support decision-making
Data Collection and Analytics	Gather, extract and analyse data to identify trends and patterns, produce statistical information and derive meaningful insights to support decision-making
Data Management	Ensure data quality, integrity, security and accessibility through effective data governance and management practices
Data Modelling and Design	Model data relationships and requirements to support system development, integration and retrieval processes
Data Protection	Develop, implement and monitor measures and controls to safeguard the confidentiality, integrity and availability of data against unauthorised access, corruption, loss and misuse
Data Security	Protect digital data throughout its lifecycle by enforcing cybersecurity practices to maintain confidentiality, integrity and availability
Data Storytelling and Visualisation	Utilise narrative techniques and data visualisation tools to effectively communicate the insights derived from data analysis in a thoughtful and engaging manner
Database Design	Design and manage data storage structures to support enterprise information and analytics needs
DevSecOps	Integrate security measures into software development and IT operations throughout the system development lifecycle to ensure secure and reliable deployment
Predictive Modelling	Utilise statistical algorithms and machine learning techniques to develop forecasts and predict future outcomes based on historical and current data to support decision-making
Process Automation	Streamline and automate business processes to improve efficiency, reduce costs, conserve resources, optimise investments and increase productivity

Prime Skill Cluster: Customer and Stakeholder Management

Skill	Skill Definition
Account Management	Manage and maintain relationships with specific customers or set of accounts, including in-depth customer engagement as well as provision of quality solutions and services to address customers' needs efficiently
Contract Management	Formalise contracts and service level agreements with providers, managing supplier performance and resolving contractual issues to maintain vendor relationships
Customer Acquisition and Retention Management	Develop customer acquisition and retention strategies and execute targeted initiatives and campaigns to drive sales conversion and maximise customer satisfaction
Customer Experience Design	Understand, design and consistently deliver satisfying customer experience that meets or exceeds expectations at every touchpoint throughout the customer journey
Customer Profiling	Utilise data to segment customer base to create a targeted and personalised marketing strategy and portfolio, based on the understanding of customer's needs, behaviour and preferences
Customer Relationship Management	Manage customer interactions and relationships throughout customer lifecycle with the goal of improving business relationships with customers, assisting in customer retention and driving sales growth
Service Level Management	Plan, monitor and manage service provisions for the achievement of agreed service level targets
Stakeholder Management	Manage stakeholder expectations and needs by aligning those with requirements and objectives of the organisation
Supplier Management	Manage supplier relationships and performance across multiple vendors, ensuring alignment with sourcing strategies, risk mitigation and service quality
User Interface and User Experience Design	Design and develop visually compelling, user-friendly, intuitive and interactive digital experiences to elevate user usability, accessibility and satisfaction
Vendor Management	Manage vendor relationships to ensure compliance with contracts and organisational standards

Prime Skill Cluster: Business and Commercial Management

Skill	Skill Definition
Budgeting	Prepare organisational budgets by forecasting, allocating resources and setting financial policies to support both short- and long-term business plans
Business Development	Identify and establish strategic business opportunities, leveraging market research to generate leads, engage with industries and promote IT products and services
Business Innovation	Identify and evaluate digitisation opportunities and innovations in ICT to establish new services or businesses bridging the physical and digital worlds
Business Needs Analysis	Scope and gather business requirements through analysis, clarifying solutions and programs and building a compelling business case to demonstrate the potential impact on the business
Business Opportunities Development	Identify and evaluate potential business opportunities and formulate strategies to capitalise on the identified prospects to support growth and ensure the sustainability of the business
Business Process Improvement	Drive business transformation through innovative process design, technology adoption and evaluation of new models and benefits
Business Process Testing	Design and conduct usability testing to evaluate and improve business processes and system interfaces
Continuous Improvement and Process Re-engineering	Analyse existing processes, identify inefficiencies and implement strategic enhancements to optimise workflows and achieve higher efficiency, productivity and quality outcomes
Crisis Management	Develop and implement crisis management plans within the broader context of business continuity management to prepare for disruptive events
Customer Behaviour Analysis	Devise tools and approaches for customer behaviour analysis, performing detailed analysis on customer data to derive actionable insights
Customer Experience Management	Develop and implement a cohesive end-to-end customer journey strategy to engage a diverse population of customers with evolving demands and buying patterns

Prime Skill Cluster: Business and Commercial Management

Skill	Skill Definition
Demand and Supply Analysis	Segment the markets, select the targeting strategies and tactics, profile the target segments and develop the positioning strategies and implementation activities
Disaster Recovery Management	Develop and implement internal IT disaster recovery policies and processes to enable prompt restoration of critical systems and evaluate the effectiveness of incident responses
Emerging Technology Synthesis	Monitor and assess emerging technology trends by gathering structured data, conducting cost-benefit analyses and evaluating relevance and value to the business
Market Profiling	Segment the markets, select the targeting strategies and tactics, profile the target segments and develop the positioning strategies and implementation activities
Market Research	Conduct marketing and digital research to uncover customer and competitor trends, evaluate campaign effectiveness and derive insights to optimise marketing efforts
Market Trend Analysis	Design and oversee situational analyses to identify market trends, industry developments and emerging opportunities
Marketing	Conduct market research and analysis to support business development, drive marketing campaigns and generate customer enquiries
Marketing Strategy	Define and communicate an organisational marketing strategy, incorporating critical industry trends, customer segmentation and market dynamics
Process Improvement and Optimisation	Establish critical processes to achieve operational efficiency in line with organisational procedures
Product Advisory	Convey detailed and specialised product knowledge, while keeping abreast of emerging product knowledge to advise customers on making informed decisions
Product Branding	Create a distinctive and compelling brand identity, including its visual elements, messaging and positioning, to establish a strong and memorable presence in the market
Product Design and Development	Ideate, create and launch new products or enhance existing ones, ensuring alignment with customer needs and organisational objectives

Prime Skill Cluster: Business and Commercial Management

Skill	Skill Definition
Product Management	Develop and manage a product roadmap from ideation to market exit, evaluating performance against strategic goals
Product Performance Management	Assess, monitor and improve the performance of products or services to ensure they meet the intended goals
Product Requirements	Gather and manage user and stakeholder requirements to align product/service design with business goals
Project Management	Plan, manage and control IT programmes, aligning resources and timelines to meet performance expectations and business objectives
Revenue Analysis	Systematic examination of an organisation's income streams by dissecting revenue sources, patterns and trends to provide a comprehensive understanding of financial health
Sales Strategy	Formulate a comprehensive sales strategy and targets, incorporating market potential, trends and internal capabilities, with regular reviews to enhance outcomes
Sales Support	Deliver technical advice and support to sales teams, partners and customers, aiding sales efforts and fulfilling post-sales obligations
Sales Target Management	Evaluate and monitor sales target and performance to plan and initiate actions to achieve excellence in sales delivery
Selling	Identify and qualify sales opportunities, manage bids and oversee the execution and monitoring of product and service sales
Strategy Planning	Develop strategies and policies informed by analysis of internal and external influence
Sustainability Management	Develop, implement and monitor sustainability strategies by assessing resource use and identifying efficiency improvements

Prime Skill Cluster: Risk and Governance

Skill	Skill Definition
Continuity Management	Plan and coordinate IT service continuity to safeguard critical systems and ensure availability, integrity and confidentiality
Cyber Risk Management	Develop cyber risk assessment techniques to identify security weaknesses, demonstrate associated business risks and implement treatment strategies to ensure appropriate protection and alignment with security frameworks
Data Governance	Develop and implement organisational guidelines, laws and regulations for data handling across its lifecycle, including advising on proper data practices and resolving breaches in complex or ambiguous contexts
Information Security	Implements controls and strategies to ensure information systems are secure, compliant and resilient
IT Governance	Establish and oversee IT infrastructure, systems and services, including policies to ensure regulatory compliance, accountability and alignment with business strategies
IT Standards	Develop and review standard operating procedures and service expectations to ensure consistency, efficiency and adherence to IT quality standards
Penetration Testing	Conduct penetration testing to expose vulnerabilities and assess the effectiveness of security controls
Quality Standards	Establish and communicate clear quality standards aligned with business goals for internal and client-facing IT services
Regulatory Compliance	Develop, enforce and implement regulatory compliance activities to ensure compliance with legislative and regulatory requirements
Risk Governance	Establish, implement and oversee structured processes, policies and strategies within an organisation to identify, assess and manage risks effectively, ensuring compliance, transparency, oversight and sustainable decision-making

Prime Skill Cluster: Risk and Governance

Skill	Skill Definition
Risk Management	Identify, evaluate and manage risks by developing and implementing risk management strategies, frameworks, policies, procedures and practices
Risk Modelling and Validation	Quantify and value risks to assess the organisation's exposure to risk and make better decisions about how to manage risks
Safety Assessment	Assess software systems for compliance with safety standards, evaluating risks and ensuring appropriate engineering methods
Security Assessment and Testing	Conduct threat modelling and penetration testing to identify system vulnerabilities and assess data protection capabilities
Security Governance	Develop and publish corporate security policies and frameworks to protect against operational risks and threats
Security Monitoring	Design, develop and utilise security monitoring tools and platforms to detect security threats and vulnerabilities, conduct real-time analysis of security alerts and determine prompt remedial actions
Security Programme Management	Plan and manage innovative security solutions, products and services to address evolving cyber challenges
Technology Risk Management	Identify, assess and mitigate potential technology risks associated with the various uses and integration of technology by the organisation to uphold security, integrity and continuity of operations

Power Skill Cluster: Innovation and Delivery

Skill	Skill Definition
Adaptability and Resiliency	Navigate through the unexpected, respond positively to evolving challenges and recover from setbacks with flexibility and resilience
Business Acumen	Handle various business situations and make decisions by applying both general and organisation-specific knowledge
Change Management	Support business and people impacted by change to ensure the change is seamlessly and successfully adopted
Critical Thinking	Analyse, interpret and draw conclusions from information to solve problems and make decisions
Digital Fluency	Understand and effectively utilise various digital platforms and tools, such as online collaboration tools and application of AI capabilities, to solve problems and drive efficiency
Innovative Thinking	Generate and be receptive to new and unconventional ideas or concepts to resolve challenges
Learning Agility	Learn new concepts and apply the acquired knowledge to execute various tasks quickly and effectively
Problem-Solving	Recognise, analyse and define problems to evaluate options for solutions and decide on the most appropriate course of action
Strategic Thinking	Assess current initiatives with broader organisational objectives to make decisions toward long-term success
Sustainability Awareness	Understand principles of sustainable development and the implications of Environmental, Social and Governance (ESG) on the organisation

Power Skill Cluster: Social Intelligence

Skill	Skill Definition
Coaching and Mentoring	Guide and support others to elevate their performance and foster their development and growth
Collaboration	Engage and rally others to contribute towards a common purpose and work effectively with them
Communication	Interact effectively with others and engage in meaningful conversations to foster positive relationships and build mutual understanding, rapport and trust
Conflict Management	Address and resolve disagreements in a way that promotes understanding and achieves mutually beneficial solutions
Empathy	Understand the emotions, feelings and perspectives of others to establish an impactful connection and meaningful engagement
Influencing and Negotiating	Persuade and convince others of ideas, proposals and solutions that work best mutually
Leadership	Inspire, motivate and guide teams, helping to implement initiatives successfully while fostering a positive work culture
Positive Mindset	Maintaining a positive attitude to succeed and drive innovation through continuous change and technological disruption

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Abbreviations

4G	4th Generation
5G	5th Generation
5GA	5G Advanced
5GC	Core Network
ACU	ASEAN Cyber University
AGV	Automated Guided Vehicles
AI	Artificial Intelligence
AMR	Autonomous Mobile Robot
APAC	Asia Pacific
API	Application Programming Interface
AR	Augmented Reality
ARPU	Average Revenue per User
ASEAN	Association of Southeast Asian Nations
B2B	Business-to-Business
B2B2X	Business-to-Business-to-Customer
BAKTI	Telecommunication Accessibility Agency
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CCTV	Closed-Circuit Television
COE	Centre of Excellence
CSP	Communications Service Provider
DAS	Distributed Antenna System

DEPA	Digital Economy Promotion Agency
DNB	Digital Nasional Berhad
EA	Enterprise Architecture
eMBB	Enhanced Mobile Broadband
ERP	Enterprise Resource Planning
ESG	Environmental, Social and Governance
FWA	Fixed Wireless Access
GDP	Gross Domestic Product
GenAI	Generative Artificial Intelligence
GHz	Gigahertz
GSMA	Global System for Mobile Communications Association
HSE	Health Safety Environment
IaaS	Infrastructure-as-a-Service
ICT	Information and Communication Technology
IMDA	Infocomm Media Development Authority
IoT	Internet of Things
IP	Internet Protocol
IT	Information Technology
ITU	International Telecommunication Union
KOMINFO	Indonesian Ministry of Communications and Informatics
KPI	Key Performance Indicator
LEO	Low Earth Orbit

LNG	Liquified Natural Gas
LSA	Licensed Shared Access
LTE	Long-Term Evolution
MCMC	Malaysian Communications and Multimedia Commission
MDES	Ministry of Digital Economy and Society
ML	Machine Learning
mMTC	Massive Machine-Type Communications
MNO	Mobile Network Operator
MSME	Micro, Small and Medium-Sized Enterprise
NaaS	Network-as-a-Service
NOC	Network Operations Centre
NSA	Non-Standalone
OPEX	Operating Expenses
PETRONAS	Petroleum Nasional Berhad
POC	Proof of Concept
QoS	Quality of Service
R&D	Research and Development
RAN	Radio Access Network
RedCap	Reduced Capability
RF	Radio Frequency
RGTSU	Regasification Terminal Sungai Udang
ROI	Return on Investment
SA	Standalone

SaaS	Software-as-a-Service
SOC	Security Operations Centre
SWN	Single Wholesale Network
TEU	Twenty-Foot Equivalent Unit
THB	Thai Baht
TNB	Tenaga Nasional Berhad
TRX	Transport Network
UK	United Kingdom
URLLC	Ultra-Reliable Low Latency Communications
USD	US Dollar
VAPT	Vulnerability Assessment Penetration Testing
VR	Virtual Reality
XaaS	Everything-as-a-Service

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