MINISTRY OF HUMAN RESOURCES

TalentCorp
GROUP OF COMPANIES

Impact Study of Artificial Intelligence, Digital, and Green Economy on the Malaysian Workforce Volume 2

Sector:
Information and Communications Technology

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Preface by the Group Chief Executive Officer of TalentCorp

As Malaysia stands on the threshold of a transformative era, we find ourselves driven by the accelerating forces of Artificial Intelligence (AI), Digital, and Green Economy. These global trends are reshaping industries, redefining the future of work, and challenging us to navigate both the opportunities for job creation and the realities of evolving role redundancies.

With a median age of 31, Malaysia leads a youthful ASEAN region where the median age is just 30. This demographic advantage presents a unique opportunity—a vibrant, dynamic workforce ready to harness the opportunities of a Digital and Green Economy. Yet, it also poses challenges. Youth unemployment and underemployment remain persistent issues across ASEAN, with Malaysia facing a youth unemployment rate of 11% and 36.3% of tertiary-educated employees grappling with skill-related underemployment. These figures demand immediate action. Reskilling and upskilling are not just important—they are imperative as the landscape of jobs continues to evolve.

At TalentCorp, we are honoured to serve as a strategic think tank under the Ministry of Human Resources' (KESUMA) mandate. This critical role allows us to leverage our networks and initiatives, providing data-driven insights that strengthen the government's intelligence capacity and support national policy development, advocacy, and long-term strategic planning.

One of our foremost initiatives in this capacity is the **Impact Study of AI, Digital, and Green Economy on the Malaysian Workforce**. This study is designed to offer key guidance to policymakers and industries, equipping them with the knowledge to prepare the workforce for upcoming shifts. It highlights essential reskilling and upskilling programmes to assist Malaysians affected by job displacement, ensuring they transition smoothly into new roles, fostering sustainable growth, and ensuring no one is left behind.

Through insights gleaned from this study, TalentCorp's MyMAHIR Future Skills Talent Council (FSTC)—an industry-led body dedicated to addressing skills needs—will drive efforts to close critical skills gaps. MyMAHIR's collaboration with industry leaders enables us to identify priority competencies and shape training programmes to meet the evolving demands of their sectors. Aligned with the MADANI Economy framework's focus on lifelong learning and guided by best practices from the International Labour Organization (ILO), TalentCorp will continue working closely with key ministries, agencies, and industry players to develop forward-looking curricula that meet the workforce needs of the future.

As Malaysia navigates this new landscape, the findings from this study will serve as an indispensable resource—providing policymakers, industries, and the workforce with the insights and tools required to stay competitive and resilient in an ever-evolving global economy.

On behalf of TalentCorp, I extend our deepest gratitude to our industry partners, colleagues, and experts for their invaluable contributions to this study. Together, we have crafted a comprehensive and impactful report that will serve as a guide for Malaysia's future of work, ensuring that we are prepared for the challenges and opportunities ahead.

Thomas Mathew
Group Chief Executive Officer
Talent Corporation Malaysia Berhad

“As Malaysia navigates this new landscape, the findings from this study will serve as an indispensable resource— providing policymakers, industries, and the workforce with the insights and tools required to stay competitive and resilient in an ever-evolving global economy.”

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Group Chief Executive Officer
Talent Corporation Malaysia Berhad

Executive Summary

The world has firmly entered the digital era, with technological advancements emerging at a fast pace and shaping every part of daily life. This trend is clearly evident in Malaysia, a middle-income, developing economy where mobile phone subscriptions reached 140 for every 100 people in 2022,[1] putting technology at the fingertips of the population. In this context, digital has long been recognised as a gateway to accelerating socio-economic growth in the country. Malaysia's focus on digital has only increased further as it has put in place economic reforms to establish itself as a regional leader in the modern age.

In line with the growing implications of digital advancements on society and the economy, this report covers a study on the impact of Artificial Intelligence (AI), Digital, and Green Economy on the Information and Communications Technology (ICT) sector, which contributed 23% to Malaysia's Gross Domestic Product (GDP) in 2022 and employed over a quarter of a million workers.[2]

These workers must now rapidly upskill in line with the developments in AI. The need for this upskilling is shown by market trends including growth in AI-assisted software development and a shortage of a skilled ICT workforce, whereas AI is expected to create 97 million jobs by 2025, with a 58% increase in roles which need AI skills.[3] Additionally, emerging technologies such as Gen AI and Manufacturing 4.0 are raising competitiveness for companies and workers. Further trends impacting the ICT workforce include the ability for AI tools to reduce manual work, providing opportunities for the workforce to take on more complex work.

This study has identified **159 critical roles**, of which **156** are **established positions** integral to maintaining industry standards and operational efficiency. An additional three (3) emerging roles, which were derived from the macrotrends, were identified due to the advancements and innovations within the sector. The emerging roles are prompt engineer, which was identified from the emergence of conversational AI and chatbots; AI auditor, required due to the need for robust cybersecurity; and AI ethicist; a role that has emerged to address the ethical risks related to the rapid rise of AI.

Driven by strong global ICT spending as well as supportive government policies, the country has developed a healthy ICT export market worth RM35.2 billion in 2022, while its imports of RM33.6 billion demonstrate robust domestic demand for ICT services.

Beyond the numbers, in recent years Malaysia has sharpened its focus on the ICT sector. Identifying the long-term growth prospects of AI and Digital, the country sees opportunities to become a leader of the digital age, which it can leverage to contribute to the country's continued socio-economic development.

In line with this, the Malaysia Digital Economy Blueprint 2021-2030 has identified a target for the country to become a digital hub in ASEAN by 2025. Further to this, the AI sector has shown significant potential to transform various industries in Malaysia. Of note, public services such as healthcare and education present key areas which could benefit from more innovation and efficiency through AI. The Malaysia Digital Economy Blueprint has thus also put in place measures to strengthen the AI ecosystem and support the development of AI startups.

Following analysis of the critical and emerging ICT roles, **nine (9) Initiatives** were identified to be implemented across the talent stakeholders' ecosystem. Specific roles were recommended for government, industry players, academia, and training providers to ensure the ICT sector workforce evolves higher up the value chain in line with digital trends.

GOVERNMENT	**IN1** Provide Funding and Incentives **IN2** Develop Policy and Regulations that are Supportive of Adoption of AI and Digital by the Sector **IN3** Continuous Development of National Talent to Address the Talent Gap
INDUSTRY PLAYERS	**IN4** Collaborate Between Government and Industry Players **IN5** Improve Work Environment and Organisation
ACADEMIA	**IN6** Develop Industry-Relevant Curriculum **IN7** Promote Micro-Credential Courses (also applicable to Training Providers)
TRAINING PROVIDERS	**IN8** Develop Training Content Needed by the Sector **IN9** Consult Industry Experts for the Specialised Needs of the Sector

1. World Bank, Mobile Cellular Subscription (Per 100 People) - Malaysia, <https://data.worldbank.org/indicator/IT.CEL.SETS.P2?locations=MY&skipRedirection=true&view=map>
2. Malaysian Investment Development Authority (MIDA), ICT contributes 23.2% to GDP, <https://www.mida.gov.my/mida-news/ict-contributes-23-2-to-gdp/>
3. Forbes, *The Future of Work: Embracing AI's Job Creation Potential*, 12 March 2024, <https://www.forbes.com/sites/forbestechcouncil/2024/03/12/the-future-of-work-embracing-ais-job-creation-potential/>

Chapter 1:

Introduction of the Study

Introduction of the Study

Purpose of the Study

The increasing focus and adoption of AI, Digital, and Green Economy call for a transformative shift in global operating models and workforce, supported by the digitally enabled drive beyond Industrial Revolution 4.0. The study aims to help government, industry players, academia, training providers, and the public to prepare for future workforce demands. The output of this study will contribute to the Malaysia National Skills Registry (MyNSR), a skills taxonomy that will be integrated into the MyMAHIR platform. This platform offers comprehensive insights into industry trends, job roles, required skills, career pathways, and available training programmes across all sectors.

These research and studies cover several sectors, namely Information and Communications Technology (ICT); Food Manufacturing and Services; Pharmaceutical Manufacturing; Medical Devices; Aerospace; Electrical and Electronics; Wholesale and Retail Trade; Energy and Power; Chemical; and Global Business Services.

AI will increasingly impact the nature of work and the broader societal progress

Majority of industry players in Malaysia are conscious about AI and the benefits it brings to organisations. While some have leveraged AI to carry out tasks, many organisations have yet to fully embrace AI as it remains difficult for organisations to justify the expense and effort required to implement AI due to the uncertainty of Return on Investment (ROI). Organisations are also wrestling with how to address AI throughout their operations – not just from a technology perspective but also from the human perspective in terms of roles and skills readiness.

This is also consistent with an inaugural Cisco AI Readiness Index in 2023 where 86% of organisations worldwide are not fully ready to integrate AI into their businesses. Malaysia's AI Readiness tracks that of the Global level, standing at 87% with only 13% considered as "pacesetters".

With the rise of AI, the Malaysian government has launched the National AI Talent Roadmap 2024–2033 to cultivate a skilled workforce to unlock the potential of AI across various sectors. Adding to this momentum, tech giant Microsoft Corp announced a significant investment of RM10.5 billion in Malaysia's cloud and AI infrastructure. Additionally, global tech firms Google and ByteDance will invest RM9.4 billion and approximately RM10 billion to establish data centres and transform Malaysia into a regional AI hub.

Malaysia's digital transformation is key to enhance national competitiveness, empower industries and local enterprises to progress towards high-value added activities

Digital transformation has been a strategic imperative across many organisations for many years. By continuing to embrace digital technologies, Malaysia can significantly elevate the capabilities of its industries and local enterprises. This technological advancement is not just about automating existing processes to enhance productivity, but also about enabling a shift towards higher value activities.

Digital economy is one of Malaysia's key economic pillars, contributing 22.6% to the country's gross domestic product (GDP).[4] This number is set to rise to 25.5% by 2025. To remain relevant and resilient, the Malaysia Digital Economy Blueprint overseen by MyDIGITAL outlines the efforts and initiatives taken to transform Malaysia into a high-income nation that is focused on digitalisation and a regional pioneer in the digital economy.

Malaysia is also making significant strides in Green Economy

When it comes to Green Economy, most organisations in Malaysia today are still driven by compliance to regulations. However, there has been growing awareness and willingness to drive the Environmental, Social and Governance (ESG) agenda at the forefront with concerted efforts from the government, private sector, and public. While progress is being made, ongoing commitment and collaboration across all industries are necessary to ensure a sustainable future for the country.

This is in line with the Twelfth Malaysia Plan (2021–2025) that outlines the nation's aspiration to achieve net-zero greenhouse gas (GHG) emissions as early as 2050. Complementing this, the National Energy Policy (2022–2040) sets the foundation for transforming the energy landscape towards sustainability. In line with these objectives, the Malaysian Government has also developed the National Energy Transition Roadmap (NETR) to accelerate the shift from a traditional fossil fuel-based economy to a high-value Green Economy. Malaysia's efforts are reflected in its leading position in the World Economic Forum Energy Transition Index, ranking 1st in ASEAN and 35th globally.[5]

It is imperative to future-proof Malaysia's workforce for the impact of AI, Digital, and Green Economy

This study aims to provide transformative and strategic inputs to complement the rapid growth of these areas. It will examine how these trends as a whole will reshape Malaysia's workforce in the upcoming three (3) to five (5) years and assess the impact of current and future trends of AI, Digital, and Green Economy; its implications for current and future job roles and skills; the nation's capacity to cater to future workforce demands and needs; and lastly, policy recommendations that the policy makers and agencies, industry players, academia and training providers as a whole can do in spurring the industry forward amidst flexible changes ahead.

This report will provide an overview of the ICT sector, including its related sub-segments, the key trends and developments relating to AI, Digital, and Green Economy.

More importantly, it will highlight the roles impacted as well as the skills needed to be future-ready for the ICT sector. These findings are based on engagements with industry associations and key players as well as regulators and government agencies.

The report concludes with Recommended Initiatives for four (4) key stakeholder groups, namely: Government, Industry Players, Academia, and Training Providers.

> **"Microsoft's investments in digital infrastructure and skilling will help Malaysian businesses, communities, and developers apply the latest technology to drive inclusive economic growth and innovation across the country."**
>
> ***Satya Nadella, CEO of Microsoft***

4. Vanessa Gomes, *Catalysing Malaysia's Digital Economy*, September 2022, https://mdec.my/esg-mdcap/content-hub/catalysing-malaysia-digital-economy
5. MIDA, *Malaysia ranked first place in S-E Asia in WEF energy transition index*, July 2030, <https://www.mida.gov.my/mida-news/malaysia-ranked-first-place-in-s-e-asia-in-wef-energy-transition-index/>

Chapter 2:
Approach and Methodology

Approach

A six-pronged approach entailed a blend of qualitative and quantitative research techniques that generated insights and met the objectives desired from this study. The study's outcomes reflect what is happening in each industry today and what is expected of each sector in the next three (3) to five (5) years.

Research Techniques

The qualitative and quantitative research techniques were as follows:

Research Methodology

The study focused on three (3) key trends shaping today's workforce: AI, Digital, and Green Economy. Their definition is outlined below:

01 Artificial Intelligence
Development and use of machine learning models capable of performing tasks that would have required human intelligence (deep learning, computer vision, Natural Language Processing (NLP), reinforcement learning, supervised and unsupervised learning).[6]

02 Digital
Activities and transactions driven by the public and various organisations to produce, adapt and innovate digital technologies and services for enhanced productivity and quality of life (big data analytics, cloud, Internet of Things (IoT), and robotic process automation).[7]

03 Green Economy
Employment growth and income driven by investment in low-carbon, resource-efficient, and socially inclusive economic activities, infrastructure, and assets.[8]

To effectively analyse how the key trends impact existing roles, four (4) key parameters have been defined in the assessment process, as stated below:

AI & Digital

1. **Opportunity to automate data-driven or low-creativity activities that are repetitive or rule-based via AI or other technology tools.**

2. **Human intervention is required despite some or most activities being automated or digitalised, as:**
   - Strategic thinking and problem-solving are vital to making decisions
   - Creative thinking is needed to generate new ideas or ways of working
   - Outcomes need to be communicated or socialised and regulated
   - High importance is placed on human emotions or physical involvement in performing the activity
   - Typically performed by a critical role that holds accountability or a role requiring certification

Green Economy

1. **Impact of the environment on jobs that depend on limited natural resources and produce outputs that are polluting or may pollute the environment.**

2. **Opportunity to diversify, requiring new skills to implement the organisation's Environmental, Social, and Governance (ESG) agenda, which includes:**
   - Environment: Areas for improvement in environmental sustainability
   - Social: Diversity, equity, inclusivity, ethics, and community engagement
   - Governance: Risk management, compliance, reporting, and corporate culture

6. World Economic Forum
7. Malaysia Digital Economy Corporation (MDEC)
8. United Nations Environment Programme (UNEP)

Based on the parameters above, the impact assessment of AI, Digital, and Green Economy on roles will result in one of the following outcomes:

HIGH

Roles at risk of convergence or displacement

Need to pivot to adjacent role and reskill

MEDIUM

Roles still relevant

Need to evolve and upskill to deliver beyond what would traditionally be expected

LOW

Roles not severely impacted

Require ongoing self-improvement to stay relevant

The impact assessment results inform individuals and organisations about the levels of risk faced by job roles in the industry. This information can aid in strategising career development and workforce planning, ensuring relevance amidst advancements in the three (3) key trends.

Key Stakeholders Engaged in the Study

Recognising the importance of on-the-ground perspectives, the impact study gathered insights from key stakeholders across the country, including Government, Industry Players, Academia, and Training Providers. The contributions from these four (4) groups enriched and fine-tuned the study's findings.

Stakeholders and their Contributions to the Study

Stakeholder Groups	Government Entities responsible for enforcing industry regulations and ensuring compliance with standards	Associations Organisations facilitating networking, advocacy, and knowledge exchange among industry players	Industry Players Companies actively involved in producing and distributing goods or services within the industry	Training Providers National and state-specific institutions that offer courses to develop skills and knowledge in various fields
Key Contributions	• Share inputs on industry trends • Validate high-level impact assessments • Recommend initiatives	• Identify selected industry players • Share inputs on industry trends • Validate high-level impact assessments • Recommend initiatives	• Validate industry trends • Validate detailed impact assessments • Identify future roles and skills requirement • Provide a view of capacity demand and number of highly impacted workforce • Recommend initiatives	• Recommend training providers and suitable programmes mapped to skills • Suggest new training programmes to close existing and future gaps • Recommend initiatives

Stakeholders' Selection Criteria

Selecting the right stakeholders ensures the impact study benefits from diverse perspectives and relevant expertise. The four (4) criteria used to identify stakeholders for engagement are:

01

HOLISTIC SECTOR COVERAGE

Comprehensive coverage of industry players across all sub-sectors and the entire value chain

02

STRONG BRAND PRESENCE

Widespread visibility and influence within the sector

03

SIZEABLE EMPLOYMENT COVERAGE

Comprehensive coverage and employee counts across all roles included in the assessment

04

SIGNIFICANT TURNOVER

Ensure a diverse mix of industry players, including large firms with high turnover

The study was conducted from April to September 2024, consulting **34** experts from **19** organisations during a workshop, followed by **five (5)** separate engagements with industry stakeholders.

Key Facts and Figures of Impact Study Stakeholder Engagements

In-Depth Interviews

Regulators : 3

Validation Workshops

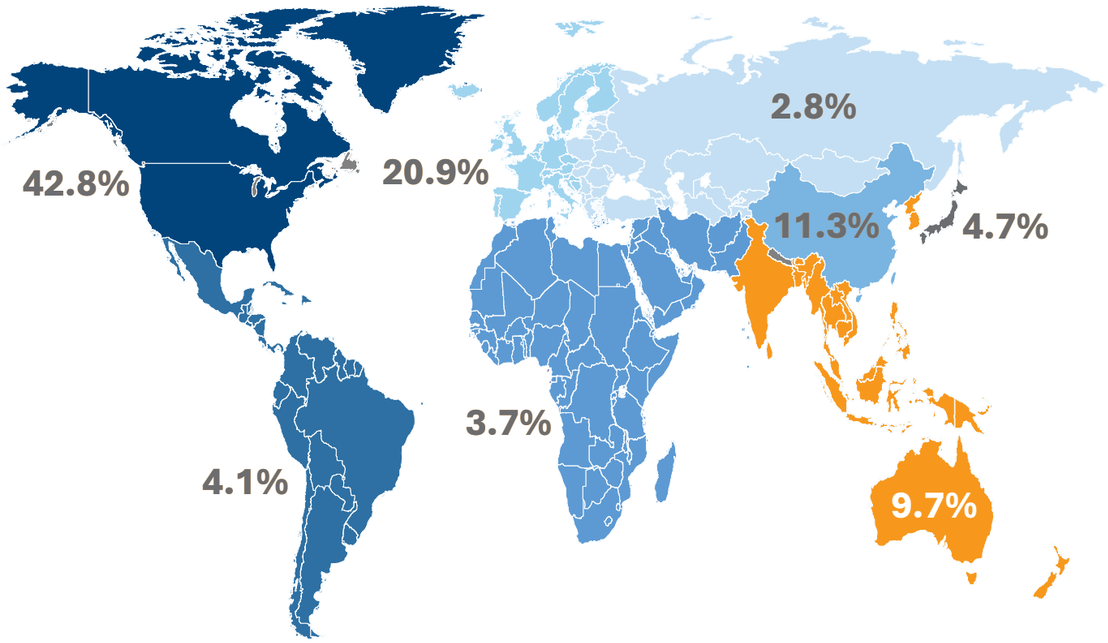
Associations : 2

Industry Players : 14

Chapter 3:
Sector Overview

The ICT sector, both globally and in Malaysia, is advancing with AI, Digital, and Green Economy practices. These advancements are creating a skills gap, as new expertise is increasingly in demand, potentially leading to job displacement. However, they also present opportunities for those who upskill and adapt. This chapter examines the ICT sector from both global and Malaysian perspectives, exploring how macro trends at both levels influence the sector.

Overview of Global Trends in the ICT Sector



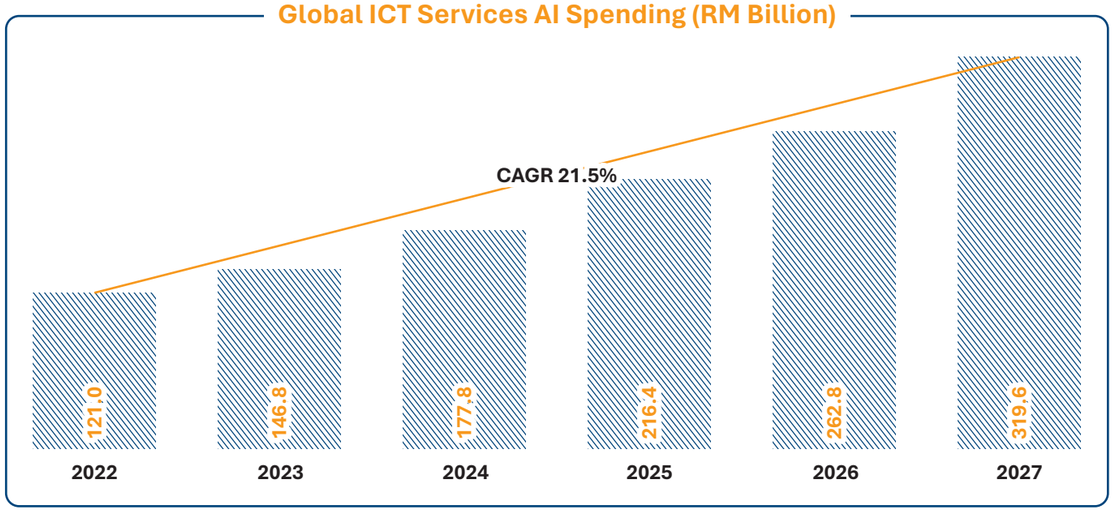
Global ICT spending trends show continued growth with a focus on digital enterprise transformation, while Malaysia is also showing consistent growth. The United States, Western Europe and China account for almost 74.5% of global ICT spending.[9]

The data suggests that while the bulk of IT spending remains concentrated in traditional tech hubs, other regions are increasingly investing in IT as they recognise the importance of digital infrastructure for economic growth. As these emerging markets continue to develop, the global IT spending landscape is expected to show a gradual shift, with these regions playing a larger role.

The global IT spending landscape in 2023 was concentrated in North America and Western Europe, with Greater China and the Asia-Pacific region as significant contributors. Emerging markets, while currently contributing smaller shares, represent areas of potential growth. The overall trend indicates that while developed regions will continue to lead, the global distribution of IT spending may become more balanced as emerging economies ramp up their investments in technology.

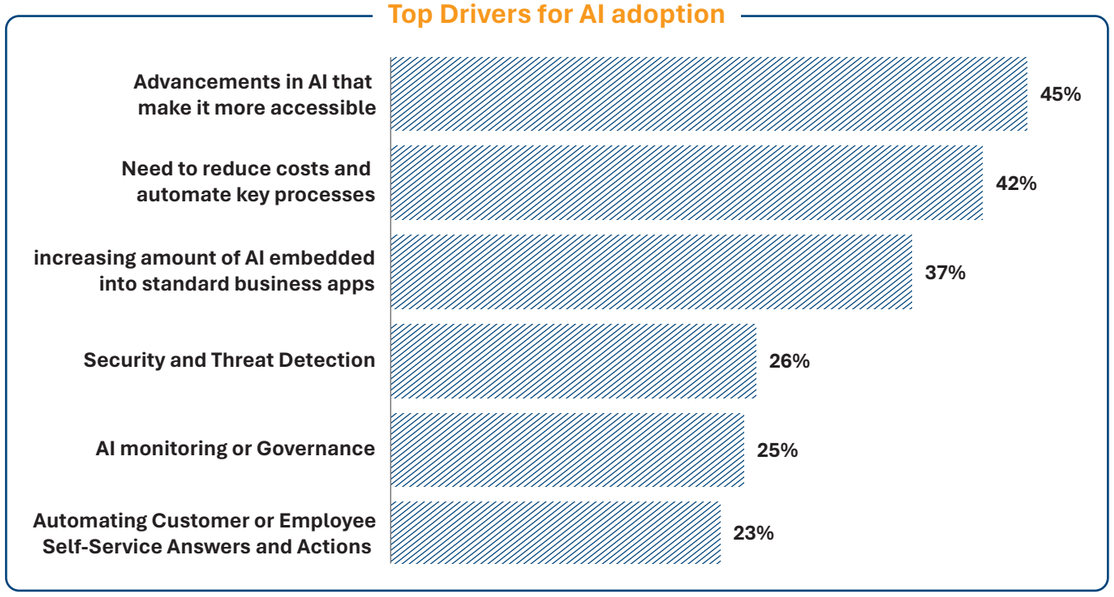
9. IDC Blackbook, IDC Customer Insight

Global AI Trend: Global ICT Services AI Spending to Reach USD77 billion (RM339.6 billion) by 2027, driven by Technological Advancements, Cost Efficiency, and Enhanced Security.



Global ICT services AI spending was USD29 billion (RM121 billion) in 2022, with a projected Compound Annual Growth Rate (CAGR) of 21.5%. By 2027, AI spending in the ICT services sector is expected to reach USD77.1 billion (RM319.6 billion). Between 2024 and 2027, the IDC forecasts that spending on digital infrastructure for Generative AI (GenAI) will grow from USD18 billion (RM79.4 billion) to more than USD48 billion (RM211.7 billion).[10]

The expansion shows the expected high adoption of AI where AI and AI-related applications roles and skills, including ICT, will be in high demand. The upward trend in AI expenditure highlights an accelerating investment rate, demonstrating the sector's increasing focus on leveraging AI for enhanced capabilities and competitive advantage. The forecast for spending on digital infrastructure for Generative AI also shows the rapid expansion and growing importance of AI technologies in the global market.



10. IDC Blackbook, IDC Customer Insight

IBM's Global AI Adoption Index - Enterprise Report showed that advancements in AI technology was the top factor for AI adoption (45% of respondents), underscoring the importance of technological progress in making AI more accessible and appealing. Another 42% of respondents emphasised AI's role in reducing costs and automating processes as a leading driver for adopting AI, reflecting its value in enhancing operational efficiency and cost-effectiveness. AI's integration into products and services, along with its role in security and threat detection were also key drivers of its adoption, showcasing the varied factors behind its growing use.

37% of respondents viewed AI integration into products and services as a major driver for adoption, while 26% saw AI's role in security and threat detection as crucial. These were followed by the importance of AI monitoring and governance (25%) and self-service automation (23%) as key reasons for AI adoption.[11]

AI & GenAI Upskilling Strategies

Businesses are rapidly adopting AI and GenAI for IT training, with around 70% of IT service providers actively investing in training their workforce in AI technologies.

Internal Academies and Learning Hubs

Wipro has developed a training curriculum for employees to learn AI, Machine Learning (ML), and GenAI, and has committed USD1 billion (RM4.38 billion) to advance AI capabilities over the next three (3) years.[12]

Partnerships with Educational Institutions

In March 2024, Wipro partnered with Indian Institute of Science (IISc) to provide AI education for its employees, with plans to train 220,000 staff in AI and GenAI.[13]

Adopting GenAI tools

Enterprises are increasingly adopting AI and GenAI-embedded tools and platforms, accelerating IT training more rapidly than anticipated.

11. Morning Consult and IBM, *IBM Global Ai Adoption Index – Enterprise Report*, November 2023
12. Wipro, *Wipro Launches Wipro ai360, Commits to Investing $1 Billion in AI Over the Next Three Years*, 12 July 2023, <https://www.wipro.com/newsroom/press-releases/2023/wipro-launches-wipro-ai360-commits-to-investing-1-billion-in-ai-over-the-next-three-years/>
13. Wipro, *Wipro Collaborates with Indian Institute of Science for Online Master's Program in AI*, 28 March 2024, <https://www.wipro.com/newsroom/press-releases/2024/wipro-collaborates-with-indian-institute-of-science-for-online-masters-program-in-ai/>

Overview of the Malaysian Trends in the ICT Sector

The ICT sector (including e-commerce), contributed 23%, or RM412.3 billion, to GDP in 2022.[14] Projections suggest that the contribution to GDP will reach 25.5% by 2025.[15] The ICT Services Gross Value Added (GVAICT) is approximately RM102.1 billion, with a 41.9% share.

Malaysia's ICT sector has seen strong growth in exports, which expanded 22.8% from 2021 to RM35.2 billion in 2022. This was driven by global trends, rising ICT demand and supportive government policies. Imports also grew, rising 19.5% from 2021 to RM33.6 billion in 2022, reflecting the expanding domestic digital economy.

According to the Labour Force Survey 2023, total employed persons in Information and Communication was 268,100 persons.[16]

Sub-sectors

This study focuses on two (2) sub-sectors in ICT, namely Software and IT Services as well as Telecommunication. The sub-sectors covered under Software and IT services include cybersecurity; operations and support; infrastructure; product development; data; strategy and governance; and software and applications. Meanwhile, Telecommunication was categorised as a sub-sector on its own.

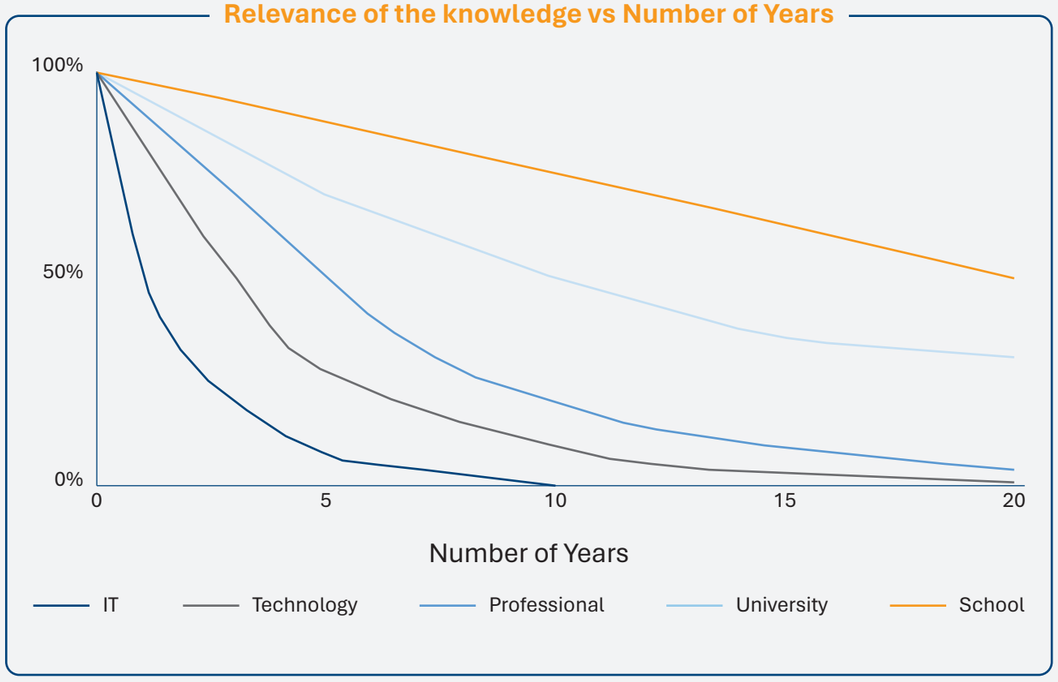
14. Malaysian Investment Development Authority (MIDA), ICT contributes 23.2% to GDP, <https://www.mida.gov.my/mida-news/ict-contributes-23-2-to-gdp/>
15. 12th Malaysia Plan
16. Department of Statistics Malaysia (DOSM), *Information and Communication Satellite Account 2022*, Labour Force Survey 2023

Impacts of AI, Digital, and Green Economy on the ICT Sector

A Challenges and Opportunities

Challenges

The sector faces several challenges, including the fast pace of technology which makes the rate of knowledge obsolescence high, impacting the relevance of a university graduate's certificate quickly over time. Therefore, ICT workers will need to continuously upskill to ensure they remain relevant in the ICT workplace. The rapid adoption of AI puts further pressure on the workforce to continuously upskill and reskill to achieve longevity in the rapidly changing ICT job market.



> **"Reshaping Malaysia's talent brand is crucial for future-proofing the workforce. A robust and forward-looking talent brand will attract the right skills and investment, ensuring Malaysia's workforce remains relevant and in demand for years to come."**
>
> ***Dr. Jasmine Begum, Regional Director of Legal, Corporate & Government Affairs, Microsoft ASEAN***

Opportunities

Malaysia's recent drive to develop its data centre capabilities has seen the country show strong potential to become Southeast Asia's data powerhouse. From 2021 to March 2024, the country has attracted RM76 million worth of approved data centre-related investments from RM114.7 various foreign direct investments (FDIs) approved by the Ministry of Investment, Trade and Industry via its agency the Malaysian Investment Development Authority (MIDA). This created over 2,325 high value job opportunities in specialised fields.[17]

The expansion of data centres in the country has been contributed by global hyper-scalers and colocation providers, whose clients need computing resources for AI development and deployment. This, in turn, is expected to catalyse Malaysia's ICT sector further, driving demand for ICT workers for the set-up and operations of the data centres, while providing Malaysia with access to world class infrastructure and applications. Moreover, the establishment of the data centre and cloud services ecosystem could also increase the number of industry suppliers in the country.[18]

By 2025, the country targets to earn RM3.6 billion in revenue from data centres, from RM2.09 billion in 2022.[19]

In recent years significant investments have been made by:	
Google	RM9.4 billion committed investment in May 2024 to house its first Google data centre and Google Cloud region in Malaysia, which is expected to support 26,500 jobs across various sectors and have an economic impact of about RM15.04 billion.[20]
Amazon Web Services	Plans to invest RM25.5 billion in Malaysia by 2037 through the AWS Region, consisting of three (3) availability zones (clusters of data centres).[21]
ByteDance Systems	TikTok's parent company is planning to spend RM10 billion to expand its data centre footprint in Malaysia on a regional AI hub.[22]
Bridge Data Centre	Bridge Data Centres (BDC), a leading data centre solutions provider in Asia Pacific, announced an expansion of its hyperscale data centre campus at MRANTI Park Kuala Lumpur.[23]
Malaysia YTL Data Centre	YTL Malaysia invested RM1.5 billion into Johor Malaysia as their Sea Data Centre, the first phase of the 500MW YTL Green Data Centre Park.[24]
NextDC	Australia's NEXTDC Ltd plans to invest RM3 billion over the next five (5) to ten years to develop Kuala Lumpur 1 (KL1), a Tier IV-certified data centre in Petaling Jaya, aiming to create substantial employment opportunities.

17. OpenGov Asia, *Malaysia's Data Centre Industry Poised for Growth*, 10 August 2024, < https://www.opengovasia.com/2024/08/10/malaysias-data-centre-industry-poised-for-growth/>
18. The Malaysian Reserve, *Data centres in our backyard: Pros and cons*, 14 August 2024, <https://themalaysianreserve.com/2024/08/14/data-centres-in-our-backyard-pros-and-cons-2/>
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23. MRANTI, *Bridge Data Centres Expand Footprint At MRANTI Park*, 23 June 2023, <https://mranti.my/news/bridge-data-centres-expand-footprint-at-mranti-park>
24. MIDA, *YTL Data Centers and Sea Break Ground with the RM1.5bil First Phase of the 500MW YTL Green Data Center Park in Johor*, 25 August 2022, <https://www.mida.gov.my/media-release/ytl-data-centers-and-sea-break-ground-with-the-rm1-5bil-first-phase-of-the-500mw-ytl-green-data-center-park-in-johor/>

B Impacts of AI, Digital, and Green Economy

Artificial Intelligence

AI Trends

Malaysia's AI landscape is experiencing a boom, with both government and businesses actively embracing the technology. AI-Based customer services chatbots are being used for customer inquiries, 24/7 support and personalised customer experiences. AI is also used for analysing data collected through networks, helping optimise network performance, identify potential issues and improve overall efficiency, while AI-Based solutions are also proving valuable to detect and respond to cyber threats more effectively, crucial for protecting data and infrastructure in the ICT sector.

AI Impact

AI in Malaysia has led to job creation in high-value roles, enhanced business efficiency, increased investments in data centres, and fostered innovation and startups across various industries.

Job Creation in High-Value Roles	AI is driving demand for specialised roles in the ICT sector, including data scientists, AI engineers, and cybersecurity experts, leading to the creation of high-value jobs and new career opportunities.
Enhanced Business Efficiency	AI technologies are helping businesses in Malaysia optimise their operations by automating routine tasks, improving decision-making through data analytics, and personalising customer experiences, leading to increased productivity and competitiveness.
Growth in Data Centre Investments	The rise of AI has significantly contributed to the growth of data centre investments in Malaysia, as companies require robust infrastructure to support AI applications, big data processing, and cloud computing services.
Innovation and Startups	AI is fostering a vibrant innovation ecosystem in Malaysia, with startups and established companies alike developing AI-driven solutions across various industries, from healthcare and finance to manufacturing and logistics.

Digital

Digital Trends

The ICT sector in Malaysia is experiencing a surge in digital trend adoption, driven by government initiatives, technological advancements, and increasing consumer demand. Among uses of digital has been in developing and implementing smart city initiatives leveraging IoT sensors and data analytics to optimise traffic management, waste management and resource utilisation in urban areas. Big data and analytics are also being utilised for insights into customer behaviour, network performance, and market trends, allowing informed decision-making, personalised marketing strategies and improved operational efficiency.

Digital Impact

The digitisation and automation of processes within the ICT sector have led to increased efficiency and productivity. These advancements have driven innovation, improved risk management, and enhanced public services and healthcare through detailed data analytics.

Enhanced Efficiency and Productivity	Digital tools and automation have streamlined processes and operations, leading to increased efficiency and productivity in the ICT sector. This includes improved data management, faster communication, and more effective project management.
Digital Transformation of Businesses	Many traditional businesses have undergone digital transformation to stay relevant and competitive. This shift includes adopting digital marketing strategies, e-commerce platforms, and advanced data analytics to better understand and engage with customers.
Big Data Analytics	In Malaysia's ICT sector, digitalisation and big data analytics significantly enhance decision-making by providing actionable insights, boost operational efficiency through data-driven automation, and enable personalised customer experiences. These advancements foster innovation and competitive advantage, improve risk management, and enhance public services and healthcare by leveraging detailed data analytics.

Green Economy

Green Economy Trends

The trend of adopting Green Economy practices in Malaysia's ICT sector is characterised by a significant shift towards energy efficiency, with companies increasingly incorporating energy-efficient technologies and sustainable practices. There is a growing demand for green ICT solutions that optimise resource use and minimise environmental impact. Regulatory compliance and policy influence are also driving companies to adhere to environmental standards, while investment in green technologies is on the rise, reflecting a commitment to long-term sustainability and new business opportunities. Overall, these trends indicate a strong move towards integrating sustainability into the core operations of the ICT sector.

Green Economy Impact

The ICT sector in Malaysia is actively pursuing strategies to mitigate its environmental impact. This includes adopting energy-efficient practices, integrating renewable energy sources, addressing e-waste management, and harnessing advanced technologies like AI and data analytics to optimise operational processes and reduce environmental impact.

Enhanced Energy Efficiency and Reduced Carbon Footprint	The ICT sector is adopting energy-efficient practices and renewable energy sources to lower its carbon footprint. Innovations such as free cooling systems in data centres and cloud migration reduce the reliance on physical hardware, which helps in cutting down overall energy consumption and GHG emissions.
Improved Resource Management and Waste Reduction	The focus on responsible e-waste management and refurbishment of IT equipment in Malaysia aims to minimise electronic waste. Additionally, smart grid technologies are being implemented to better integrate renewable energy sources into the grid, promoting sustainability and reducing waste in energy consumption.
Optimised Operations through Advanced Technologies	By leveraging AI and data analytics, Malaysia's ICT sector enhances operational efficiency. This includes optimising data centre operations, improving network management, and using advanced analytics for urban systems such as traffic and waste management, leading to better resource utilisation and environmental impact reduction.

Green ICT

In line with growing emphasis on green solutions, ICT services firms are now focusing on developing and adopting environmentally sustainable computing. This includes reducing energy use in data centres and optimising resources in rolling out IT systems while maintaining performance levels. These efforts are applied throughout the IT operations value chain, from design to disposal, to ensure environmentally-friendly solutions.

Key Benefits of Green IT[25]

- Reduce waste and emissions, contributing to a healthier planet.
- Promotes the use of energy-efficient technology that can reduce costs.
- Enables compliance with laws and regulations.
- Improves brand perception with customers and partners.
- Supports the recruitment and retention of employees.
- Spurs innovative solutions to environmental issues.

- Green IT is a practice that focuses on creating and using environmentally sustainable computing solutions within IT organisations.
- As the demand for cloud and online services continues to rise, IT firms are placing greater emphasis on Green IT to reduce energy consumption in data centres and deploy IT systems that use fewer resources while maintaining high performance.
- It aims to mitigate the environmental impact of IT operations by designing, manufacturing, operating, and disposing of PCs and computer-related products in an environmentally responsible manner.

25. TechTarget, *Definition: Green IT (Green Information Technology)*, <https://www.techtarget.com/searchcio/definition/green-IT-green-information-technology#:~:text=Green%20IT%20aims%20to%20minimize,in%20an%20environmentally%20friendly%20manner.>

Case Studies of Green IT Goals in ICT Services Firm[26]

- **Microsoft** has set a goal to become carbon negative by 2030, aiming to remove more carbon from the environment than it emits.
- **NTT Data** aims to cut CO2 emissions by 90% by 2040, compared to 2013 levels.
- **Accenture** seeks to achieve net zero by 2025 and gender parity by 2025.
- **Adobe** aims to achieve 100% renewable electricity by 2025, versus its 56% renewable electricity consumption in Financial Year 2021.
- **Google** aims to operate on 100% carbon-free energy by 2030 and has achieved carbon neutrality for its global operations since 2007.
- **Amazon** targets being carbon neutral by 2040 and has committed to investing USD2 billion (RM8.75 billion) in clean energy projects by 2025.

ICT Services Firms and Sustainable Innovation: Leveraging Green IT

The demand for ICT continues to grow in today's digital age, driven by the increasing reliance on cloud computing, online services and digital transformation initiatives. However, this growth also brings with it significant environmental challenges, particularly related to energy consumption and electronic waste. To address these challenges, many ICT services firms are turning to Green IT—a practice focused on creating and using computing technologies in an environmentally sustainable manner.

Understanding Green IT

Green IT refers to the initiatives and strategies that ICT firms adopt to minimise their environmental footprint. The primary goals of Green IT include reducing energy consumption, minimising waste and ensuring the environmentally responsible disposal of electronic equipment.

Key Aspects of Green IT

Energy Efficiency	ICT firms are focused on reducing the energy required to run their data centres and IT operations. This involves optimising infrastructure, adopting energy-efficient hardware and using software that minimises power usage.
Sustainable Resource Use	Green IT encourages the use of renewable resources such as solar or wind energy to power IT operations. It also promotes the recycling and reuse of electronic components to reduce the need for new raw materials.
Compliance with Environmental Regulations	As governments worldwide impose stricter regulations on emissions and electronic waste, Green IT helps organisations comply with these laws, thereby avoiding penalties and enhancing their reputation.

26. EY Knowledge, Company Reports

Benefits of Green IT

The challenge of addressing environmental problems can spur innovation within the organisation. Green IT encourages the development of new technologies and processes that not only solve sustainability issues but also improve overall efficiency.

Embracing Green IT provides numerous advantages for ICT firms, both from an environmental and a business perspective:

Reduction in Waste and Toxic Materials	ICT firms are focused on reducing the energy required to run their data centres and IT operations. This involves optimising infrastructure, adopting energy-efficient hardware and using software that minimises power usage.
Encourages Use of Renewable Energy	Green IT encourages the use of renewable resources such as solar or wind energy to power IT operations. It also promotes the recycling and reuse of electronic components to reduce the need for new raw materials.
Enables Compliance with Regulations	As governments worldwide impose stricter regulations on emissions and electronic waste, Green IT helps organisations comply with these laws, thereby avoiding penalties and enhancing their reputation.
Improves Brand Perception and Attracts Talent	Companies that invest in sustainability are often viewed more favourably by consumers and employees alike. Green IT practices can improve brand perception, making it easier to attract and retain customers and top talent who value corporate responsibility.

Real-World Examples of Green IT Goals

Many leading ICT services firms have set ambitious targets to reduce their environmental impact, showcasing the industry's commitment to sustainability. Some examples include:

Microsoft	The tech giant has set a goal to become carbon negative by 2030, meaning it will remove more carbon from the environment than it emits. Microsoft is also investing in innovative technologies and processes to achieve this goal, including carbon capture and storage (CCS).
NTT Data	This company is aiming to reduce its CO2 emissions by 90% by 2040, compared to 2013 levels. This target reflects a long-term commitment to reducing the company's carbon footprint and contributing to global climate goals.
Google	Google has set a goal to operate on 100% carbon-free energy by 2030. The company has already achieved carbon neutrality for its global operations since 2007 and continues to invest in clean energy projects around the world.
Amazon	Amazon aims to be carbon neutral by 2040 and has committed USD2 billion to clean energy projects by 2025. This investment will support the development of new renewable energy sources and help Amazon achieve its ambitious sustainability goals.

More than just a trend, Green IT is a necessary shift towards sustainable innovation that aligns with global efforts to combat climate change. ICT services firms are at the forefront of this movement, leveraging Green IT to reduce their environmental impact, comply with regulations and drive business success. By setting and pursuing ambitious sustainability goals, these companies are not only protecting the planet but also ensuring their long-term viability in an increasingly eco-conscious market. This comprehensive approach to Green IT illustrates the critical role that ICT services firms play in the global sustainability movement and sets a blueprint for other industries to follow.

State of Trends Adoption

The adoption of AI in Malaysia is rapidly reshaping the ICT sector in numerous impactful ways. Coupled with this, the increasing embrace of Digital technologies is driving significant transformations in service delivery and operational efficiency. At the same time, Green Economy is exerting a strong influence on the ICT sector, placing a greater emphasis on sustainability and efforts to minimise its environmental footprint.[27]

Artificial Intelligence

Job Creation in High-Value Roles:
Axiata, one of Malaysia's leading telecommunications companies, has invested in AI-driven initiatives to optimise network operations and enhance customer service. This has led to the creation of specialised roles such as data scientists, AI engineers, and machine learning experts within the company, showcasing the direct impact of AI on high-value job creation.

Enhanced Business Efficiency:
AirAsia has implemented AI and machine learning to optimise its operations, particularly in revenue management and customer service. The airline uses AI for dynamic pricing, predictive maintenance, and personalised marketing, which has significantly improved operational efficiency and customer experience, demonstrating the efficiency gains AI can provide.

Growth in Data Centre Investments:
Google's establishment of a Google Cloud Region in Malaysia supports AI and big data applications, reflecting the growing need for data centres to handle AI projects.

Innovation and Startups:
Favoriot, a Malaysian ICT company, integrates AI with IoT to drive digital transformation across industries such as smart cities, agriculture, and healthcare, fostering Malaysia's innovation ecosystem.

Digital

Enhanced Efficiency and Productivity:
Telekom Malaysia has implemented advanced network management systems and automation tools to enhance its operational efficiency. The adoption of Network Functions Virtualisation (NFV) and Software-Defined Networking (SDN) has streamlined network operations and reduced costs.

Digital Transformation of Businesses:
Digi Telecommunications has facilitated digital transformation in Malaysia by providing AI-powered customer experience solutions, business automation tools, and IoT applications, enabling traditional businesses to optimise operations and enhance customer engagement.

Big Data Analytics:
TM One, the enterprise arm of Telekom Malaysia, utilises big data analytics to optimise network performance, enhance customer insights, and drive business decisions, thereby improving service delivery and customer satisfaction.

Green Economy

Enhanced Energy Efficiency and Reduced Carbon Footprint:
YTL Communications, Cyberjaya Data Centre, TM Cloud, and Microsoft Malaysia have put in place energy-efficient data centres with free cooling systems, cloud migration to reduce on-premise hardware, and use cloud solutions to minimise energy consumption and carbon emissions.

Improved Resource Management and Waste Reduction:
Maxis and Tenaga Nasional Berhad (TNB) have responsible e-waste management, equipment refurbishment, and investment in smart grid technologies are being used to better integrate renewable energy and reduce waste.

Optimised Operations through Advanced Technologies:
Huawei Malaysia and Xperanti use AI and data analytics for optimising data center operations, network management, and urban systems like traffic and waste management, leading to more efficient resource use.

27. Stakeholder Engagements

Chapter 4:
Key Findings

Overview of Roles and Skills

The study focuses on eight (8) key domains within the ICT sector, providing a comprehensive framework for understanding the impact of AI, Digital, and Green Economy trends on the workforce. These domains cover critical areas such as Cybersecurity, Data and AI, and Infrastructure, among others. Roles and skills within these domains are consolidated and assessed to determine how they are affected by the three key trends.

8 Key Domains in the ICT Sector

Cybersecurity

- Protects digital assets and systems from cyber threats through security protocols, encryption, and threat management.

Data and AI

- Utilises data analytics and AI to drive insights, automation, and decision-making.

Infrastructure

- Builds and maintains the foundational hardware, networks, and systems that support digital operations.

Operations & Support

- Ensures smooth IT operations and provides technical support for systems, software, and users.

Product Development

- Designs and develops innovative technology products to meet user needs and market demand

Software and Applications

- Develops and maintains software applications that solve specific problems or enhance user experiences

Strategy and Governance

- Guides organisational IT strategy, ensuring alignment with business goals through governance frameworks and policies.

Telecommunications

- Manages communication networks and services, enabling data transmission, connectivity, and collaboration across distances.

Consolidated Job Clusters, Roles, and Skills in ICT

8 Job Clusters

Cybersecurity (13 Job Roles)	**Product Development** (21 Job Roles)	**Software and Applications** (16 Job Roles)	**Telecommunications** (45 Job Roles)
Operations and Support (15 Job Roles)	**Infrastructure** (11 Job Roles)	**Strategy and Governance** (25 Job Roles)	**Data and Artificial Intelligence** (10 Job Roles)

156 Job Roles

18 Skills Clusters

(Categorised into 16 specific skill clusters and 2 basic skill clusters)

Specific Skills

Agile and Continuous Improvement (2 skill)	**Business Development and Strategy** (3 skills)	**Business Operation Management** (1 skill)	**Customer, Vendor, and Stakeholder Management** (4 skills)
General Business Management (5 skills)	**Data Development and Implementation** (12 skills)	**Health, Safety, and Environment (HSE)** (9 skills)	**Product and Services** (6 skill)
Quality Management (7 skills)	**Project and Process Management** (2 skills)	**Risk Management, Compliance, and Governance** (23 skills)	**Research and Development** (1 skill)
Software Development and Implementation (23 skills)	**Supply Chain and Logistics Management** (1 skill)	**Technical Design and Architecture)** (16 skills)	**Technology Management** (9 skills)

Basic Skills

Innovation and Delivery (10 skills)	**Social Intelligence** (6 skills)

140 Skills

Which comprises 124 Specific Skills and 16 Basic Skills

Job Clusters and Roles

The roles in the ICT sector involve analytical, administrative, monitoring, and support functions, many of which could potentially be replaced or automated by AI and Digital. These roles are integral to the competencies of the ICT sector, with many employees already using digital tools in their daily tasks. Green Economy significantly impacts roles within the infrastructure; product development; and operations and support clusters, as sustainability best practices must be adhered to in these sectors.

Job Clusters	Roles
Cybersecurity	1. Associate Security Analyst 2. Cyber Risk Analyst 3. Chief Information Security Officer 4. Incident Investigation Manager 5. Forensics Investigation Manager 6. Forensics Investigator 7. Security Operations Analyst 8. Security Architect 9. Cyber Risk Manager 10. Incident Investigator 11. Sr. Security Engineer/ Security Engineer 12. Vulnerability Assessment and Penetration Testing Analyst 13. Vulnerability Assessment and Penetration Testing Manager
Operations and Support	1. Applications Support Engineer 2. Associate Data Centre Operations Engineer 3. Associate Applications Support Engineer 4. Associate Systems Support Engineer 5. Associate Database Support Engineer 6. Associate Operations Centre Support Eng. 7. Database Support Engineer 8. Data Centre Operations Engineer 9. Chief Information Officer 10. Infrastructure Support Engineer 11. Operations and Support Manager 12. Head of Operations and Support 13. Associate Infrastructure Support Engineer 14. Operations Centre Support Engineer 15. Systems Support Engineer
Infrastructure	1. Associate Network Engineer 2. Network Engineer 3. Automation and Orchestration Engineer 4. Cloud Developer 5. Cloud Administrator 6. Cloud Analyst 7. Infrastructure Architect 8. Cloud Development & Operations Engineer 9. Head of Infrastructure 10. Infrastructure Engineer 11. Infrastructure Engineering Manager
Product Development	1. Senior Front-End Developer 2. Software Architect 3. Quality Assurance Manager 4. Head of Software Engineering 5. Product Manager 6. Chief Product Officer 7. Back-End Developer 8. Product Risk Analyst 9. Lead Product Analyst 10. Front-End Developer 11. Quality Engineer 12. Software Engineering Manager 13. Quality Assurance Engineer 14. Chief Technology Officer 15. Head of Product 16. Lead Product Designer 17. Product Security Engineer 18. Quality Engineering Manager 19. Senior Back-End Developer 20. Full Stack Developer 21. Senior Full Stack Developer
Data and Artificial Intelligence	1. Sr. Data Engineer 2. AI/ Machine Learning Engineer 3. Business Intelligence Director 4. Business Intelligence Manager 5. Chief Data Officer/ Chief AI Officer 6. Data Analyst/ Assoc. Data Engineer 7. Data Architect 8. Data Engineer 9. Head of Data Science and Artificial Intelligence 10. Data Scientist/ AI Scientist
Strategy and Governance	1. Associate Business Analyst 2. Head of Quality 3. Senior Product Manager 4. Data Protection Executive 5. Programme Director 6. Associate UX Designer 7. Data Protection Officer 8. IT Audit Manager 9. Solutions Architect 10. Programme Manager 11. Head of Product 12. Enterprise Architect 13. IT Auditor 14. Project Manager/ Scrum Master 15. Quality Assurance Engineer 16. Group Data Protection Officer 17. Business Architect 18. Lead UX Designer 19. UX Designer 20. Quality Engineering Manager 21. Chief Technology Officer 22. Head of IT Audit 23. Product Manager 24. Quality Assurance Manager 25. Quality Engineer
Software and Applications	1. RPA Programme Manager 2. Associate Embedded Systems Engineer 3. Embedded Systems Engineering Manager 4. Associate Software Engineer 5. Head of Software Engineering 6. Software Architect 7. Software Engineer 8. Associate UI Designer 9. Lead UI Designer 10. UI Designer 11. Automation Tester 12. Performance Tester 13. DevOps Engineer 14. RPA Developer 15. RPA Engineer 16. Embedded Systems Engineer

Job Clusters	Roles
Telecommunications	1. RF Engineer 2. Telecom Infrastructure Manager 3. Tower Technician 4. Telecom Fiber Director 5. Lead Telecom Engineer 6. OSS Analyst 7. Associate Radio Frequency Engineer 8. Fiber Optic Network Manager 9. Senior Tower Technician 10. Cable Installer 11. Telecom RF Director 12. Telecom Engineer 13. Fiber Optic Technician 14. Network Architect 15. OSS Architect 16. RF Manager 17. DevSecOps Engineer 18. Network Engineer 19. OSS Engineer 20. RF Planning Engineer 21. Compliance Officer 22. Fiber Splicer 23. Telecom Installer 24. Site Acquisition Specialist 25. Radio Frequency Engineer 26. RF Technician 27. Customer Experience Manager 28. Infrastructure Project Manager 29. NOC Engineer 30. Telecom Fiber Director 31. Site Reliability Engineer 32. NOC Manager 33. Radio Frequency Specialist 34. Senior Fiber Optic Technician 35. Customer Insights Analyst 36. Junior Network Engineer 37. Tower Crew Lead 38. Senior RF Engineer 39. Tower Operations Manager 40. Regulatory Affairs Manager 41. Senior Network Engineer 42. NOC Technician 43. Telecommunications Engineering Technician 44. Fiber Optic Engineer 45. Junior RF Engineer

Skills Clusters and Skills

Skills Category	Skills Clusters
BASIC SKILLS Essential skills required for a person to be fit for a job	**Innovation and Delivery** • Digital and AI Fluency • Critical Thinking • Innovative Thinking • Learning Agility • Business Acumen • Sustainability Awareness • Planning and Organising • Adaptability and Resiliency • Change Management • Cognitive Skills
	Social Intelligence • Communication • Teamwork and Collaboration • Coaching and Mentoring • Conflict Management • Empathy • Influencing and Negotiation

Skills Category	Skills Clusters
SPECIFIC SKILLS Skills relating to a specific task or situation. It involves both understanding and proficiency in such specific activity that involves methods, processes, procedures, or techniques	**Data Development and Implementation** • Data Engineering • Pattern Recognition Systems • Text Analytics and Processing • Data Visualisation • Big Data Analytics • Data Storyboarding • Data Validation • Data Sharing • Database Administration • Data Migration • Data Strategy • Data Science
	Quality Management • Test Planning • Quality Assurance Management • Failure Analysis • Process Validation • IT Audit • Quality Standards • Internal Controls in Product Development
	Technical Design and Architecture • Data Design • Security Architecture • User Interface Design • User Experience Design • Enterprise Architecture • Solution Architecture • Infrastructure Design • Systems Design • Embedded Systems Integration • Embedded Systems Interface Design • Narrative Design in Product Development • Intelligent Reasoning • Self-Learning Systems • Infrastructure Deployment • Radio Frequency Engineering • Network Security
	Business Development and Strategy • Business Performance Management • Business Opportunities Development • Systems Thinking
	Agile and Continuous Improvement • Continuous Improvement • Process Re-Engineering
	Business Development and Strategy • Budget Management • Business Networking • Resource Management • Cost Management • Partnership Management

Skills Clusters and Skills (Continue)

Skills Category	Skills Clusters	
SPECIFIC SKILLS Skills relating to a specific task or situation. It involves both understanding and proficiency in such specific activity that involves methods, processes, procedures, or techniques	**Business Operation Management**	
	• Data Centre Facilities Management	
	Project and Process Management	
	• Project Management	• Project Feasibility Assessment
	Research and Development	
	• Research and Information Synthesis	
	Software Development and Implementation	
	• Software Design • Applications Development • Applications Integration • Configuration Tracking • Software Configuration • Software Testing • Cloud Computing • Computational Modelling • Computer Vision Technology • System Integration and Configuration • Control System Programming • Network Configuration and Troubleshooting	• Security Assessment and Testing • Security Programme Management • Agile Software Development • User Testing and Usability Testing • Network Slicing • Continuous Integration and Continuous Deployment • Artificial Intelligence Applications • Quality Engineering • Embedded Systems Programming • Structured Query Language (SQL) • Data Warehouse Solutions
	Customer, Vendor, and Stakeholder Management	
	• Technical Sales Support • Service Level Management	• Stakeholder Management • Vendor Management
	Health, Safety, and Environment (HSE)	
	• Sustainability Management • Eco-Friendly Site Selection • Sustainable Facilities Management • Green Business Innovation • Sustainable Business Practices	• Eco-Design Principles • Waste Management • Sustainable Sourcing • Security Awareness
	Risk Management, Compliance and Governance	
	• Business Risk Management • Business Continuity Management • Crisis and Disaster Recovery Management • Data Governance • Data Ethics • IT Governance • IT Standards • Cyber Risk Management • Security Governance • Data Protection Management • Artificial Intelligence Ethics and Governance • Applications Support and Enhancement	• Cyber and Data Breach Incident Management • Security Administration • Cyber Forensics • Threat Analysis and Defence • Threat Intelligence and Detection • Risk Governance • Regulatory Compliance • Secure Coding • Product Risk Analytics • Product Risk Assessment • Security Strategy
	Supply Chain and Logistics Management	
	• Procurement Management	
	Technology Management	
	• Portfolio Management • IT Asset Management • System Performance Management • IT Strategy • Infrastructure Strategy	• Emerging Technology Synthesis • Artificial Intelligence Application in Product Development • Machine Learning Models • Platform Knowledge and Deployment
	Products and Services	
	• Product Management • Demand and Supply Analysis • Infrastructure Support • Network Administration and Maintenance	• Design Concepts Generation • Automation Management in Product Development

In-Demand Skills

The in-demand skills in the ICT sector include:

Areas	Skills
AI & DIGITAL	• Systems Design • Network Security • Network Administration and Maintenance • Emerging Technology Synthesis • Cyber and Data Breach Incident Management • Infrastructure Deployment
GREEN ECONOMY	• Eco-Design Principles • Green Business Management • Sustainable Business Practices • Waste Management

Below are the non-exhaustive skills relevant to the ICT sector:

Business Networking	Project Management	Stakeholder Management
Continuous Improvement	Business Risk Management	Product Management
Business Performance Management	Quality Assurance Management	Service Level Management

Role and Skills Analysis by Impact Level

The ICT impact study identified 159 critical roles, of which 156 are established positions integral to maintaining industry standards and operational efficiency. Additionally, three (3) emerging roles were identified based on trending advancements and innovations within the sector.

The following provides an overview of the impact assessment on the 156 existing roles across the ICT sector:

Impact Assessment on 159 Roles in the ICT Sector

	High	Medium	Low	Emerging
AI/Digital	• **High opportunity** to **automate** • **Low human intervention**	• **High opportunity** to **automate** • **High human intervention**	• **Low opportunity** to **automate** • **High or low human intervention**	
Green Economy	• **Job no longer required** due to impact to environment • **May or may not** have **opportunity to diversify**	• **Job still required** despite impact to environment • **Opportunity to diversify exist**	• **Job still required** despite impact to environment • **No opportunity to diversify**	New job positions created due to technological advancements, sector trends, and societal changes help organisations drive innovation, adopt sustainable practices, and stay competitive and compliant with evolving regulations and market demands.
Outcome	**Roles facing convergence or displacement** Need to pivot to adjacent role and reskill	**Roles are evolving** Need to upskill to deliver beyond what would traditionally be expected	**Roles not severely impacted** Need to continue improving to keep self relevant	
	14 Roles	51 Roles	91 Roles	3 Roles
Proportion of Roles	9%	33%	58%	

Overview of Roles by Impact Level

The impact study focuses on roles that are heavily influenced by advancements in AI, Digital, and Green Economy, aiming to identify viable career paths and necessary skills essential for the Malaysian workforce. It also highlights emerging roles that are driven by these trends to help bolster the sector's competitive advantage and future resilience.

HIGH

14 Roles

1. Incident Investigator
2. Associate Security Analyst
3. Security Operations Analyst
4. Data Analyst / Associate Data Engineer
5. Cloud Administrator
6. Associate UI Designer
7. Cloud Analyst
8. Applications Support Engineer
9. Associate Applications Support Engineer
10. Associate Operations Centre Support Engineer
11. Associate Systems Support Engineer
12. OSS Analyst
13. NOC Technician
14. Customer Insights Analyst

MEDIUM

51 Roles

1. Cyber Risk Analyst
2. Cyber Risk Manager
3. Forensics Investigator
4. Incident Investigation Manager
5. Vulnerability Assessment and Penetration Testing Analyst
6. Vulnerability Assessment and Penetration Testing Manager
7. Data Engineer
8. Infrastructure Architect
9. Infrastructure Engineer
10. Infrastructure Engineering Manager
11. Associate Network Engineer
12. Lead Product Analyst
13. Lead Product Designer
14. Product Security Engineer
15. Quality Assurance Engineer
16. Quality Assurance Manager
17. Quality Engineer
18. Quality Engineering Manager
19. Back-End Developer
20. Front-End Developer
21. Senior Back-End Developer
22. Senior Front-End Developer
23. Lead UI Designer
24. UI Designer
25. Performance Tester
26. Associate Data Centre Operations Engineer
27. Data Centre Operations Engineer
28. Infrastructure Support Engineer
29. Head of Operations and Support
30. Operations and Support Manager
31. DevOps Engineer
32. IT Audit Manager
33. Associate Infrastructure Support Engineer
34. Operations Centre Support Engineer
35. Systems Support Engineer
36. IT Auditor
37. Quality Assurance Engineer
38. Quality Assurance Manager
39. Quality Engineer
40. Quality Engineering Manager
41. Associate Radio Frequency Engineer
42. Junior Network Engineer
43. Network Engineer
44. Telecom Engineer
45. Senior Network Engineer
46. RF Engineer
47. Senior RF Engineer
48. RF Planning Engineer
49. OSS Engineer
50. NOC Engineer
51. Customer Experience Manager

LOW

91 Roles

1. Chief Information Security Officer
2. Forensics Investigation Manager
3. Security Architect
4. Senior Security Engineer / Security Engineer
5. Artificial Intelligence / Machine Learning Engineer
6. Data Scientist / Artificial Intelligence Scientist
7. Business Intelligence Director
8. Business Intelligence Manager
9. Data Architect
10. Senior Data Engineer
11. Chief Data Officer / Chief Artificial Intelligence Officer
12. Head of Data Science and Artificial Intelligence
13. Head of Infrastructure
14. Automation and Orchestration Engineer
15. Network Engineer
16. Cloud Developer
17. Cloud Development and Operations Engineer
18. Associate Database Support Engineer
19. Database Support Engineer
20. Chief Information Officer
21. Chief Product Officer
22. Chief Technology Officer
23. Head of Product
24. Head of Software Engineering
25. Product Manager
26. Product Risk Analyst
27. Full Stack Developer
28. Senior Full Stack Developer
29. Software Architect
30. Software Engineering Manager
31. Associate Embedded Systems Engineer
32. Embedded Systems Engineer
33. Embedded Systems Engineering Manager
34. Associate Software Engineer
35. Software Engineer
36. Head of Software Engineering
37. Software Architect
38. RPA Developer
39. Automation Tester
40. RPA Engineer
41. RPA Programme Manager
42. Associate Business Analyst
43. Business Architect
44. Data Protection Executive
45. Data Protection Officer
46. Group Data Protection Officer
47. Enterprise Architect
48. Head of IT Audit
49. Programme Director
50. Programme Manager
51. Project Manager / Scrum Master
52. Solutions Architect
53. Associate UX Designer
54. Lead UX Designer
55. UX Designer
56. Head of Quality
57. Senior Product Manager
58. Head of Product
59. Chief Technology Officer
60. Product Manager
61. Radio Frequency Engineer
62. Telecommunication Engineering Technician
63. Lead Telecom Engineer
64. Network Architect
65. Telecom Infrastructure Manager
66. RF Technician
67. Junior RF Engineer
68. Radio Frequency Specialist
69. RF Manager
70. Telecom RF Director
71. Tower Technician
72. Telecom Installer
73. Senior Tower Technician
74. Tower Crew Lead
75. Tower Operations Manager
76. Telecom Tower Director
77. Fiber Optic Technician
78. Cable Installer
79. Fiber Splicer
80. Senior Fiber Optic Technician
81. Fiber Optic Engineer
82. Fiber Optic Network Manager
83. Telecom Fiber Director
84. OSS Architect
85. NOC Manager
86. Regulatory Affairs Manager
87. Compliance Officer
88. Infrastructure Project Manager
89. Site Acquisition Specialist
90. DevSecOps Engineer
91. Site Reliability Engineer

EMERGING

3 Roles

1. Prompt Engineer
2. AI Auditor
3. AI Ethicist

Highly Impacted Roles and Career Pathways

Analysis of the shifts in demand trends and advancements in automation technology showed that highly impacted roles can transition into other roles that are currently in high demand.

The adoption of AI, automation, and digitalisation in the ICT sector streamlines operations, optimises resource usage, and enhances efficiency across various domains, including threat detection, anomaly identification, and pattern recognition to name a few. AI also improves incident detection and analysis, enabling faster issue resolution, and provides valuable insights for market trend analysis, customer behaviour prediction, and personalised marketing strategies. Furthermore, AI optimises software development processes, enhances data analytics capabilities, and supports the integration of machine learning algorithms, driving innovation and competitiveness in the sector.

In the context of digitalisation, digital tools streamline incident investigation, security operations and data analysis processes. This enables automation of tasks in cloud development, infrastructure management and database operations. Digital tools also improve efficiency in incident response, business development and software engineering. As a result, digital tools provide opportunities to enhance installation management, tower inspection and cable installation processes. Furthermore, digital tools facilitate data manipulation, Operational Support Systems (OSS) analysis, Network Operations Centre (NOC) operations, and customer insights analysis. Digital tools can also optimise operational effectiveness, improve communication, and support agile adaptation to digital transformations in various roles.

Meanwhile, in the aspect of Green Economy, roles in the management and IT operations play a critical role in reducing energy consumption and optimising resource use, aligning with the green economy's emphasis on efficiency. Roles in business development influence organisational strategies to promote the adoption of eco-friendly technologies and practices in ICT business operations. While roles such as data analysis and customer insights ensure that operations are conducted with minimal environmental impact.

"Highly impacted roles indicate a need for enhanced training efforts to prepare for AI and Digital advancements. The focus should be on acquiring new skills, rather than assuming that entire job roles will disappear."

Dr. Andrew Lau, Director of Strategic Programs, Microsoft Malaysia

Case Studies for Highly impacted Roles

Roles	Impact and Case Studies
Incident Investigator	AI is significantly automating the detection and analysis of security incidents, leading to a considerable reduction in the demand for traditional incident investigation tasks. As a result, investigators are now expected to upskill in areas like AI integration, advanced threat intelligence, and strategic security management. With AI taking over routine tasks, incident investigators might need to look for career threat analysis, or cybersecurity strategy development. The role's transformation underscores the necessity for continuous learning and adaptation to new technological advancements within the digital economy. • **IBM** automates initial triage of security alerts using AI, requiring incident investigators to shift focus towards strategic threat mitigation and AI system management.[28] • **Symantec** utilises AI-driven threat intelligence platforms, pushing investigators to enhance their expertise in advanced data interpretation and AI tool management.[29] • **CrowdStrike** leverages AI for real-time threat detection, necessitating investigators to develop skills in managing AI-driven systems and focusing on proactive threat hunting.[30] • **FireEye** implements advanced data analytics and AI for forensic investigations, prompting investigators to upskill in AI technologies and consider roles in cybersecurity strategy and policy formulation.[31]

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31. Steven M Miller and Lipika Bhattacharya, *Cybersecurity at FireEye: Human+AI*, 2021

Roles	Impact and Case Studies
Associate Security Analyst	The role is highly impacted by advancements in AI, necessitating continuous learning and upskilling to remain relevant in the digital economy. The automation of many of the routine tasks traditionally performed by Associate Security Analysts, such as monitoring and analysing security alerts means the analysts are now expected to enhance their skills in AI-driven security technologies, advanced threat detection techniques, and strategic security planning. This transformation allows analysts to focus on more complex threat analysis, proactive threat hunting, and developing comprehensive security measures. • **Cisco** uses AI to automate the analysis of security alerts and network traffic, freeing up analysts to work on more sophisticated threat investigations and strategic security initiatives.[32] • **Palo Alto Networks** employs AI-based threat detection systems that reduce the workload on analysts by automatically identifying and prioritising potential threats.[33] • **Fortinet** utilises machine learning to enhance the accuracy of threat detection, enabling analysts to focus on developing and implementing advanced security protocols.[34] • **Check Point** implements AI-driven cybersecurity tools that assist analysts in identifying complex threats and improving response times.[35]
Security Operations Analyst	Due to the high impact of AI in this role, Security Operations Analysts may need to explore upskilling opportunities or alternative career paths within cybersecurity. The automation of routine monitoring and initial response tasks allow Security Operations Analysts to focus on more complex incident analysis and threat hunting. Analysts are expected to upskill in AI technologies, machine learning for security, and advanced threat intelligence. The role's transformation emphasises the need for continuous improvement in strategic decision-making and the implementation of proactive security measures. • **IBM** uses AI to automate security event monitoring and prioritisation, enabling analysts to concentrate on deeper investigation and mitigation of sophisticated threats.[36] • **Splunk** employs AI-driven analytics to provide real-time threat detection and response, requiring analysts to develop skills in managing and interpreting[37] AI-generated data.

Roles	Impact and Case Studies
	• **McAfee** utilises machine learning to identify patterns and anomalies in network traffic, aiding analysts in focusing on critical threat analysis and strategic security initiatives.[38] • **Trend Micro** implements AI for automating threat detection and response processes, allowing analysts to dedicate more time to developing and executing advanced security strategies.[39]
Data Analyst / Associate Data Engineer	Automation allows Data Analysts and Associate Data Engineers to focus on more complex analytical tasks and strategic data management. Professionals in these roles are now expected to enhance their skills in AI integration, machine learning, and advanced data analytics. The transformation necessitates a shift towards strategic decision-making, developing predictive models, and driving data-driven business insights. The significant impact of AI suggests that Data Analysts and Associate Data Engineers may need to consider upskilling or exploring new career opportunities in related fields. • **Google** utilises AI to automate data preprocessing and cleaning, enabling data professionals to focus on building advanced machine learning models and extracting meaningful insights from large datasets. • **Microsoft** employs AI-driven analytics tools that[40] streamline data integration and analysis processes, requiring data analysts to develop skills in managing AI systems and interpreting complex analytical results.[41] • **Amazon** implements machine learning algorithms to automate the analysis of customer data, allowing data engineers to concentrate on optimising data pipelines and enhancing the efficiency of data processing workflows.[42] • **Facebook** uses AI to perform real-time data analysis and visualisation, pushing data professionals to focus on strategic decision-making and developing predictive analytics models.[43]

32. Cisco, *Cisco Redefines Cybersecurity Defense with Powerful, Portfolio-Wide Artificial Intelligence Capabilities*, 5 December 2022, <https://investor.cisco.com/news/news-details/2023/Cisco-Redefines-Cybersecurity-Defense-with-Powerful-Portfolio-Wide-Artificial-Intelligence-Capabilities/default.aspx#:~:text.>
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43. Pickl.AI, *Decoding Your Posts: How Facebook Uses Data Analytics*, 27 February 2024, <https://medium.com/@deepanshi.pal/decoding-your-posts-how-facebook-uses-data-analytics-3cba71dc82e8>

Roles	Impact and Case Studies
Cloud Administrator	AI and digital advancements are transforming the role of Cloud Administrators by introducing automated tools for managing cloud resources, optimising costs and ensuring security compliance. Cloud Administrators are required to upskill in areas such as AI-driven cloud management platforms, container orchestration, and infrastructure as code (IaC) to efficiently manage cloud environments. They must also become proficient in analysing cloud usage data to make informed decisions about scaling and optimising services. The role is evolving to include a deeper understanding of machine learning models that can predict usage patterns and automate resource allocation. • **AWS's Lambda** allows Cloud Administrators to automate tasks and manage serverless applications, requiring them to understand event-driven architectures and real-time scaling.[44] • **Google Cloud** provides AI-powered recommendations for cost management and performance optimisation, pushing Cloud Administrators to learn how to integrate and act on these insights.[45] • **Microsoft's Azure AI** automates security compliance checks and threat detection, necessitating Cloud Administrators to be skilled in configuring and managing AI-based security tools.[46] • **IBM Cloud** enables the implementation of AI-infused cloud management tools that help in predictive analytics for maintenance and resource deployment, requiring administrators to be adept at interpreting AI-generated reports and recommendations.[47]
Associate UI Designer	AI is revolutionising the field of UI design by automating repetitive tasks such as asset creation, colour scheme generation and layout adjustments, allowing designers to focus on more creative and user experience (UX) driven tasks. Associate UI Designers are expected to upskill in AI-powered design tools and platforms that can rapidly prototype and test user interfaces. As a result, these designers will need to develop an understanding of user behaviour analytics powered by AI to create more intuitive and personalised user experiences. The role is increasingly requiring knowledge of machine learning to predict user preferences and to create adaptive UI elements that change dynamically based on user interactions. • **Adobe XD** incorporates AI with features such as auto-animate and repeat grid, enabling UI designers to quickly prototype and iterate designs. This requires a proficiency in utilising AI-enhanced design workflows.[48]

44. AWS, *Operating Lambda: Understanding event-driven architecture – Part 1*, 11 January 2021, <https://aws.amazon.com/blogs/compute/operating-lambda-understanding-event-driven-architecture-part-1/>
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48. Dexigner, *Adobe XD Announces New AI Integrations*, 17 March 2019, <https://www.dexigner.com/news/31948>

Roles	Impact and Case Studies
	• **Sketch** uses AI to offer suggestions for design improvements and to automate the design handoff process, driving designers to learn how to collaborate effectively with AI systems.[49] • **Figma** leverages AI for collaborative design and real-time feedback, requiring Associate UI Designers to be skilled in using AI to enhance teamwork and streamline design processes.[50] • **InVision** applies AI to transform static screens into interactive prototypes, challenging designers to understand how to integrate AI into the storytelling aspect of design to create compelling user journeys.[5`]
Cloud Analyst	AI provides advanced analytics for cloud resource utilisation, cost optimisation and performance monitoring, impacting Cloud Analysts by requiring them to upskill in AI-driven analytics and machine learning to predict trends, identify anomalies and make data-driven recommendations for cloud infrastructure management. Cloud Analysts will need to become adept at using AI tools for real-time analysis of cloud services, enabling proactive measures for efficiency and security. The role is also expanding to include strategic planning based on predictive analytics, requiring Cloud Analysts to understand how to leverage AI for long-term cloud strategy and governance. • **Splunk** offers AI-powered monitoring and analytics for cloud services, which necessitates Cloud Analysts to interpret complex data patterns and automate incident responses.[52] • **Datadog** utilises machine learning to provide predictive alerts and capacity planning insights, pushing Cloud Analysts to develop skills in configuring and responding to AI-generated forecasts.[53] • **Google Cloud's Operations Suite** (formerly Stackdriver) integrates AI for intelligent monitoring, logging and diagnostics, requiring Cloud Analysts to be proficient in managing and deriving insights from AI-based tools.[54] • **Microsoft Azure's AI** includes predictive analytics and anomaly detection for cloud operations, challenging Cloud Analysts to understand and implement AI-driven strategies for maintaining optimal cloud performance.[55]

49. Sketch, *Sketch and AI*, 30 September 2024, <https://www.sketch.com/blog/sketch-and-ai/>
50. Figma, *Meet Figma AI: Empowering designers with intelligent tools*, <https://www.figma.com/blog/introducing-figma-ai/>
51. Invision, <https://invision.ai/>
52. Splunk, *Log Monitoring with AI: What Makes Monitoring Intelligent?*, <https://www.splunk.com/en_us/blog/learn/log-monitoring.html>
53. Datadog, *Machine Learning*, <https://www.datadoghq.com/solutions/machine-learning/>
54. Tech Target Network, *Google Cloud operations (formerly Stackdriver)*, <https://www.techtarget.com/searchcloudcomputing/definition/Google-Stackdriver#:~:text>
55. Microsoft, *AI Anomaly Detector*, <https://azure.microsoft.com/en-us/products/ai-services/ai-anomaly-detector>

Roles	Impact and Case Studies
Applications Support Engineer / Associate Applications Support Engineer	AI is transforming the role of Applications Support Engineers by automating the diagnosis and resolution of common application issues, which allows them to concentrate on more complex problems and user support. These professionals are expected to upskill in AI-powered monitoring tools, automated troubleshooting systems and predictive maintenance technologies. This requires these professionals to become proficient in interpreting insights from AI-driven analytics to improve application performance and user satisfaction. The role is evolving to include a focus on enhancing user experience through personalised support and predictive interventions, using AI to anticipate and resolve issues before they impact users. • **ServiceNow** uses AI to automate incident categorisation and routing, enabling Applications Support Engineers to focus on high-priority issues and complex problem-solving.[56] • **IBM Watson** offers AI-powered cognitive services that can assist in analysing and responding to user queries, requiring engineers to integrate and manage AI interactions within the support framework.[57] • **Dynatrace** uses AI for full-stack monitoring and automatic problem resolution, pushing Applications Support Engineers to adapt to AI-centric operations and maintenance protocols.[58] • **New Relic** provides AI-driven analytics and alerting systems, challenging support engineers to leverage AI for proactive application health monitoring and performance optimisation.[59]
Associate Operations Centre Support Engineer	AI is enhancing the role of Operations Centre Support Engineers by automating network monitoring, incident detection, and response protocols, allowing them to focus on more strategic operations tasks. These professionals are required to upskill in AI-driven network management tools, cybersecurity solutions and automated response systems to maintain and optimise IT infrastructure. These support engineers will need to become adept at using AI for predictive analytics to foresee potential system disruptions and to plan preventive measures. The role now includes a significant focus on AI-powered anomaly detection and the ability to coordinate with AI systems for rapid incident resolution and continuous system improvement. • **Cisco's AI Network Analytics** helps in automating network optimisation and troubleshooting, necessitating Operations Centre Support Engineers to be skilled in interpreting AI-generated insights and recommendations.[60] • **Splunk IT Service Intelligence (ITSI)** utilises AI for IT operations (AIOps) to predict and prevent problems before they occur, driving engineers to adapt to AI-led operational workflows.[61]

56. ITSMgroup, *Machine Learning in ServiceNow for incident category automation*, 17 June 2024, <https://www.itsmgroup.com/en/news/detail/servicenow-machine-learning-incident-category-automation#>
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58. Dynatrace, *AI powered, full stack, automated — Monitoring redefined*, <dynatrace.com>
59. New Relic AI, <https://newrelic.com/platform/new-relic-ai>
60. Cisco, *Cisco AI Network Analytics Overview*, 2019
61. Splunk IT Service Intelligence (ITSI) , <https://www.splunk.com/en_us/products/it-service-intelligence.html>

Roles	Impact and Case Studies
	• **Hewlett Packard Enterprise's** AI-driven operations offer predictive analytics for data centres, requiring support engineers to manage and act on AI-based forecasts for system health and maintenance.[62] • **Moogsoft AIOps** provides AI for real-time incident detection and resolution, challenging support engineers to integrate AI into their incident management processes and to collaborate with AI for operational efficiency.[63]
Associate Systems Support Engineer	AI is reshaping the role of Systems Support Engineers by introducing automated system health checks, predictive maintenance, and self-healing systems, reducing the time spent on routine maintenance tasks. These professionals are expected to upskill in AI-based diagnostic tools, automated patching software and intelligent alerting systems to efficiently manage and support IT systems. This requires proficiency in leveraging AI for capacity planning, resource optimisation and to ensure high availability and reliability of IT services. The role is increasingly requiring knowledge of AI-driven security measures to proactively identify and mitigate threats, as well as to automate compliance reporting. • **IBM's Watson AIOps** uses AI to automate IT operations, enabling Systems Support Engineers to focus on complex system integration and optimisation tasks.[64] • **VMware's vRealize AI Cloud** provides AI-powered workload optimisation, pushing Systems Support Engineers to develop skills in managing dynamic and self-optimising IT environments.[65] • **Nutanix's AIOps** offers machine learning-driven insights for infrastructure management, requiring engineers to interpret and act on AI-generated recommendations for system improvements.[66] • **SolarWinds' AI** capabilities include intelligent alerts and automated incident management, challenging support engineers to integrate AI into their daily workflows for enhanced system support and uptime.[67]

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63. DevOps Community, *What is Moogsoft and use cases of Moogsoft?*, 2 February 2024, <https://www.devopsschool.com/blog/what-is-moogsoft-and-use-cases-of-moogsoft/>
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Roles	Impact and Case Studies
OSS Analyst	AI is enabling automating network configuration, service provisioning and fault management processes, allowing OSS Analysts to focus on higher-level analysis and optimisation of network operations. OSS Analysts will need to upskill in AI-driven network analytics, automated service fulfillment systems and predictive fault isolation techniques to enhance operational efficiency. They must be able to use AI to analyse vast amounts of network data to predict service degradation and to preemptively address issues before they affect customers. The role is also evolving to include a strategic focus on using AI to drive network automation, service innovation and to support the transition to next-generation network technologies. • **Ericsson's Expert Analytics** utilises AI to provide real-time network insights, enabling OSS Analysts to proactively manage network performance and customer experience.[68] • **Nokia's Cognitive Analytics for Customer Insight** offers AI-powered analytics to optimise network operations, pushing OSS Analysts to develop skills in leveraging AI for customer-centric network management.[69] • **Huawei's AI-based Network Operations** integrates AI for automated network optimisation and predictive maintenance, requiring OSS Analysts to manage and interpret AI-driven operational insights.[70] • **Ciena's Blue Planet Analytics** provides AI-driven assurance and analytics, challenging OSS Analysts to utilise AI for dynamic network and service management.[71]
NOC Technician	AI is transforming the role of NOC Technicians by automating network monitoring, alerting and initial troubleshooting steps, which allows them to concentrate on more complex network issues and optimisation. NOC Technicians will need to upskill in AI-powered tools for real-time network analytics, automated incident response and predictive maintenance to ensure network health and performance. They will also be expected to interpret AI-generated insights for network traffic patterns, anomaly detection and security threat identification, while the role is also expanding to include collaboration with AI systems for rapid incident resolution, capacity planning and to support the deployment of new network technologies. • **Zabbix** provides AI-powered network monitoring solutions, enabling NOC Technicians to quickly identify and respond to network anomalies and performance issues.[72] • **NetBrain** uses automated network mapping and diagnosis, requiring NOC Technicians to adapt to AI-assisted troubleshooting and network optimisation techniques.[73]

68. Ericsson, <https://www.ericsson.com/en/portfolio/cloud-software-and-services/business-and-operations-support-systems/data-and-analytics/expert-analytics>
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Roles	Impact and Case Studies
	• **ThousandEyes**, a segment of Cisco, offers AI-driven network intelligence for optimising digital experience, requiring NOC Technicians to leverage AI for enhanced visibility and proactive problem-solving.[74] • **SolarWinds AI** integrates machine learning to enhance network performance monitoring and management, challenging NOC Technicians to use AI for predictive planning and anomaly detection.[75]
Customer Insights Analyst	AI is significantly enhancing the role of Customer Insights Analysts by automating data collection and analysis, enabling the extraction of deeper insights into customer behaviour and preferences. These professionals are required to upskill in AI-powered analytics platforms, customer data platforms (CDPs) and machine learning algorithms to predict customer trends and personalise marketing efforts. They must become adept at using AI to segment customers, predict customer lifetime value and identify opportunities for customer engagement and retention. The role is increasingly focused on leveraging AI to turn vast amounts of unstructured data into actionable insights that drive business strategy and customer experience improvements. • **Salesforce Einstein Analytics** provides AI-driven insights for CRM, enabling Customer Insights Analysts to predict customer behaviour and optimise marketing campaigns.[76] • **Adobe Analytics** uses AI and machine learning to offer advanced analysis of customer data, requiring analysts to develop skills in interpreting complex data sets for strategic decision-making.[77] • **IBM Watson Customer Experience Analytics** employs AI to deliver a comprehensive view of the customer journey, requiring analysts to leverage AI for enhanced customer experience mapping and optimisation.[78] • **Google Analytics** integrates AI for predictive analytics and audience insights, challenging Customer Insights Analysts to use AI for real-time decision-making and to uncover new customer segments.[79]

74. CISCO ThousandEyes, <https://www.thousandeyes.com/product/platform>
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78. IBM, IBM Watson to watsonx, <https://www.ibm.com/watson>
79. Hostinger, Best AI Use Cases With Google Analytics 4 for 2024, 2 May 2024 <https://www.hostinger.my/tutorials/ga4-ai>

Highly Impacted Roles Career Pathways

Roles

Incident Investigator

Key Responsibilities:
Oversees and optimises the analysis and resolution of security incidents, preparing detailed reports and recommending corrective actions

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **IT Audit**
   Developing IT audit skills enhances the ability to identify security gaps and ensure compliance with regulations, which is crucial for effective risk management. This expertise also cultivates critical thinking and strategic oversight, valuable in a variety of roles focused on organisational integrity.

2. **Network Security**
   Gaining knowledge in network security deepens the understanding of infrastructure vulnerabilities, making it easier to adopt proactive risk management strategies. This skill set is particularly relevant in roles aimed at safeguarding digital assets and ensuring robust security measures.

3. **Systems Design**
   Understanding systems design allows for a comprehensive analysis of how various components interact within larger systems. This insight is beneficial across different roles as it supports operational efficiency, effective problem-solving, and streamlined processes.

GREEN SKILLS

1. **Eco-Design Principles**
   Knowledge of eco-design principles fosters an appreciation for sustainability and their integration into organisational processes. This ability to think holistically is advantageous in roles that require balancing technological advancement with environmental and social responsibilities.

Possible Roles for Transition Within the Sector

Product Security Engineer

Forensics Investigator

Cyber Risk Analyst

Network Engineer

Possible Roles for Transition into Other Sectors

Cybersecurity Analyst
Sector:
Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Associate Security Analyst

Key Responsibilities:
Supports security systems operations, monitoring, and maintenance, while analysing and resolving security-related issues

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **IT Audit**
   Developing IT audit skills enhances the ability to evaluate security controls and ensure compliance with regulatory standards, which is vital for identifying vulnerabilities in security systems. This expertise fosters critical thinking and a strategic approach to improving security operations across various roles.

2. **Network Security**
   Gaining knowledge in threat intelligence and detection equips an analyst with the skills to proactively identify and respond to emerging threats, improving overall security posture. This capability is essential for roles that focus on maintaining robust defenses against evolving cyber threats.

3. **Systems Design**
   Understanding cyber risk management allows for the identification and assessment of potential risks, enabling informed decision-making regarding security measures. This skill is particularly valuable in roles that require balancing risk with operational needs and resource allocation.

Possible Roles for Transition Within the Sector

Product Security Engineer

Forensics Investigator

Possible Roles for Transition into Other Sectors

Cybersecurity Analyst
Sector:
Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles	Examples of Additional Skills Required and Analysis		Possible Roles for Transition Within the Sector	Possible Roles for Transition into Other Sectors
	AI / DIGITAL SKILLS	GREEN SKILLS		
Security Operations Analyst **Key Responsibilities:** Performs real-time security log analysis, identifies and mitigates security risks, and recommends process improvements	1. **Cyber Forensics** Developing cyber forensics skills enhances the ability to investigate security incidents and analyse evidence, which is crucial for understanding the root causes of breaches. This expertise supports effective incident response and strengthens overall security measures in various roles. 2. **Security Programme Management** Gaining knowledge in security programme management equips an analyst with the skills to oversee security initiatives and ensure alignment with organisational goals. This capability is crucial for roles focused on optimising security processes and improving risk management strategies. 3. **Network Configuration & Troubleshooting** Understanding network configuration and troubleshooting allows for effective analysis of security-related network issues, enabling swift identification and mitigation of risks. This skill is important in roles that require maintaining secure and efficient network operations.	1. **Eco-Design Principles** Familiarity with eco-design principles encourages the integration of sustainability into security operations, promoting a balance between technological advancement and environmental responsibility. This approach is beneficial in roles that aim to enhance operational efficiency while minimising ecological impact.	 Cyber Risk Analyst  Product Security Engineer  Network Engineer	 Cybersecurity Analyst Sector: Global Business Services  Information Security Manager Sector: Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Examples of Additional Skills Required and Analysis

Possible Roles for Transition Within the Sector

Data Analyst / Associate Data Engineer

Key Responsibilities:
Integrates data analysis with business strategy, supports key projects, and communicates findings effectively

AI / DIGITAL SKILLS

1. **Big Data Analytics**
   Acquiring skills in big data analytics enhances the ability to process and analyse vast datasets, providing valuable insights that drive informed business decisions. This expertise is essential for roles focused on leveraging data to optimise strategies and improve project outcomes.
2. **Software Design**
   Gaining proficiency in software design fosters a strong understanding of how to build scalable and efficient data solutions, ensuring seamless integration with existing systems. This capability is particularly important in roles that require collaboration with development teams to enhance data processing and analysis.
3. **Data Ethics**
   Developing knowledge of data ethics promotes responsible data use and compliance with privacy regulations, which is vital for maintaining trust and transparency in data-driven initiatives. This understanding is crucial in roles that involve managing sensitive information and ensuring ethical considerations are integrated into data practices.

Possible Roles for Transition Within the Sector

Business Intelligence Manager

Full Stack Developer

Senior Data Engineer

Possible Roles for Transition into Other Sectors

Data Scientist
Sector:
Global Business Services

Applications Support Engineer

Key Responsibilities:
Operates and maintains specific software applications, interacts with users, and provides support and onboarding

AI / DIGITAL SKILLS

1. **AI Application in Product Development**
   Gaining expertise in the application of AI within product development enhances the ability to leverage innovative technologies to improve software functionalities and user experiences. This knowledge is invaluable for roles focused on integrating advanced solutions to meet user needs effectively.
2. **Emerging Technology Synthesis**
   Understanding emerging technology synthesis allows for the identification and integration of new tools and methodologies, fostering a proactive approach to software support and enhancements. This capability is essential for roles that require staying ahead of technological trends and optimising application performance.
3. **Software Design**
   Proficiency in software design equips an engineer with the skills to create user-friendly applications that align with organisational requirements, ensuring efficient operation and maintenance. This expertise is important in roles that involve collaboration with developers to enhance application functionality and support user onboarding.

Possible Roles for Transition Within the Sector

Product Manager

Associate Software Engineer

Possible Roles for Transition into Other Sectors

Technical Support Specialist
Sector:
Global Business Services

Systems Administrator
Sector:
Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Associate Applications Support Engineer

Key Responsibilities:
Provides support and maintenance for specific software applications, and assists with application development and testing

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Data Engineering**
   Developing skills in data engineering enhances the ability to manage and manipulate data flows, ensuring that software applications operate efficiently and effectively. This expertise is crucial for roles that require supporting data-driven functionalities and improving application performance.

2. **Software Design**
   Gaining proficiency in software design fosters a solid understanding of creating intuitive applications that meet user needs and enhance functionality. This knowledge is vital in roles that involve collaborating with development teams to optimise application features and usability.

3. **Applications Integration**
   Understanding applications integration enables the seamless connection of various software systems, facilitating improved workflows and data sharing. This skill is essential for roles that focus on enhancing operational efficiency through effective application interactions.

GREEN SKILLS

1. **Eco Design Principles**
   Familiarity with eco-design principles encourages the implementation of sustainability in application development and maintenance, promoting environmental responsibility. This perspective is beneficial for roles that seek to balance technological advancement with ecological considerations.

2. **Sustainable Business Practices**
   Acquiring knowledge of sustainable business practices enhances the ability to contribute to organisational goals that prioritise ethical and environmentally friendly approaches. This understanding is valuable in roles that require aligning application support with broader sustainability initiatives.

Possible Roles for Transition Within the Sector

Associate Embedded Systems Engineer

Associate Software Engineer

Full Stack Developer

DevOps Engineer

Automation & Orchestration Engineer

Possible Roles for Transition into Other Sectors

Technical Support Specialist
Sector:
Global Business Services

Systems Administrator
Sector:
Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Associate Operations Centre Support Engineer

Key Responsibilities:
Monitors and identifies incidents in hardware and software components, and analyses and resolves system issues in collaboration with teams

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Solution Architecture**
   Gaining expertise in solution architecture enhances the ability to design and implement robust systems that effectively address operational challenges. This knowledge is crucial for roles focused on ensuring seamless integration and functionality across hardware and software components.

2. **Applications Support & Enhancement**
   Developing skills in applications support and enhancement enables a deeper understanding of how to optimise software performance and resolve user issues efficiently. This expertise is particularly valuable in roles that require collaboration with teams to improve system reliability and user satisfaction.

3. **Network Administration and Maintenance**
   Understanding network administration and maintenance equips an engineer with the ability to manage and troubleshoot network components effectively, ensuring system stability. This skill is essential for roles that focus on maintaining operational continuity and enhancing overall system performance.

GREEN SKILLS

1. **Sustainability Management**
   This skill Familiarity with sustainability management promotes the integration of eco-friendly practices into operational processes, aligning technical support with broader organisational goals. This perspective is important in roles that aim to balance operational efficiency with environmental responsibility.

Possible Roles for Transition Within the Sector

- DevOps Engineer
- Automation & Orchestration Engineer
- Data Centre Operations Engineer
- Database Support Engineer
- Infrastructure Engineer
- Operations & Support Manager

Possible Roles for Transition into Other Sectors

- **Technical Support Specialist**
  Sector:
  Global Business Services
- **Systems Administrator**
  Sector:
  Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Associate Systems Support Engineer

Key Responsibilities:
Performs routine systems administration tasks, ensures system uptime, provides on-call support, and collaborates effectively in a team environment

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Database Administration**
Obtaining expertise in database administration enhances the ability to manage and optimise databases, which is essential for roles focused on maintaining data integrity and improving system performance. This skill is valuable across positions that require efficient handling of large datasets and ensuring data availability.

2. **Data Centre Facilities Management**
Knowledge in data centre facilities management equips an engineer to oversee physical infrastructure, ensuring operational efficiency and minimising downtime. This capability is transferable to roles where managing both digital and physical assets is crucial for seamless system operations.

3. **Infrastructure Design**
Developing skills in infrastructure design allows for creating scalable, efficient system architectures that support organisational needs. This expertise is relevant to roles that involve building and optimising IT infrastructures for improved performance and reliability.

GREEN SKILLS

1. **Green Business Innovation**
Familiarity with green business innovation encourages the adoption of sustainable practices in system operations, aligning with modern environmental and business trends. This skill is increasingly important in roles that emphasise corporate responsibility and sustainable growth.

2. **Eco-Design Principles**
Understanding eco-design principles promotes the development of environmentally responsible system designs, reducing ecological impact while maintaining performance. This skill is useful in roles focused on creating sustainable and efficient technological solutions.

3. **Sustainability Management**
Gaining insights into sustainability management enables the implementation of eco-friendly practices in IT operations, supporting long-term environmental goals. This capability is applicable across roles where balancing operational efficiency with sustainability is a priority.

Possible Roles for Transition Within the Sector

- Associate Database Support Engineer
- Associate Data Centre Operations Engineer
- Database Support Engineer
- DevOps Engineer
- Infrastructure Engineer
- Operations & Support Manager

Possible Roles for Transition into Other Sectors

- **Technical Support Specialist**
  Sector:
  Global Business Services
- **Systems Administrator**
  Sector:
  Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles

Customer Insights Analyst

Key Responsibilities:
Analyse customer data and feedback to uncover trends and insights, provide actionable recommendations and support strategies to enhance customer experience and satisfaction

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Intelligent Reasoning**
   Developing skills in intelligent reasoning enhances the ability to interpret complex customer data and derive meaningful insights that drive strategic decision-making. This expertise is crucial for roles that focus on understanding consumer behavior and improving customer experiences.

2. **Advanced Technology Integration**
   Understanding advanced technology integration equips an analyst with the ability to utilise innovative tools and methodologies for data analysis, improving the quality and efficiency of insights. This capability is particularly valuable in roles that aim to stay ahead of industry trends and enhance customer engagement strategies.

GREEN SKILLS

1. **Sustainable Business Practices**
   Familiarity with sustainable business practices promotes the incorporation of ethical considerations into customer strategies, aligning business goals with consumer values. This perspective is beneficial in roles that seek to enhance brand loyalty through responsible practices.

2. **Consumer Sustainability Education**
   Gaining knowledge in consumer sustainability education enables the ability to inform customers about sustainable choices and practices, fostering a more environmentally conscious consumer base. This understanding is important for roles that focus on enhancing customer experiences through responsible and informed decision-making.

Possible Roles for Transition Within the Sector

Data Scientist / Artificial Intelligence Scientist

Possible Roles for Transition into Other Sectors

Customer Relationship Management (CRM) Specialist
Sector:
Global Business Services

Customer Service Trainer
Sector:
Global Business Services

Manager, Customer Experience
Sector:
Wholesale and Retail Trade

Highly Impacted Roles Career Pathways

(Continue)

Roles

NOC Technician

Key Responsibilities:
Monitor and manage network operations from a network operations centre (NOC), troubleshoot and resolve technical issues, and ensure continuous network performance and reliability.

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Software Configuration**
   Developing skills in software configuration enhances the ability to customise and optimise applications within network operations, ensuring they function effectively. This expertise is valuable for transitioning to roles that require a deep understanding of software environments and their impact on network performance.

2. **IT Asset Management**
   Gaining knowledge in IT asset management supports the efficient tracking and maintenance of hardware and software resources, which is crucial for operational effectiveness. This skill is applicable across various roles focused on optimising resource utilisation and minimising downtime.

3. **Radio Frequency Engineering**
   Understanding radio frequency engineering provides insights into managing wireless communication systems, enabling improved network connectivity and performance. This knowledge is beneficial for roles that involve troubleshooting and enhancing wireless technologies within network operations.

GREEN SKILLS

1. **Green IT Practices**
   Familiarity with green IT practices promotes the adoption of environmentally friendly technologies and processes, aligning with sustainability initiatives in IT. This perspective adds value to roles focused on creating efficient and responsible technology solutions that minimise ecological impact.

Possible Roles for Transition Within the Sector

- Automation & Orchestration Engineer
- Systems Support Engineer
- Telecommunication Engineering Technician

Possible Roles for Transition into Other Sectors

- **Technical Support Specialist**
  Sector:
  Global Business Services
- **Network Administrator**
  Sector:
  Global Business Services

Highly Impacted Roles Career Pathways

(Continue)

Roles	Examples of Additional Skills Required and Analysis		Possible Roles for Transition Within the Sector
	AI / DIGITAL SKILLS	GREEN SKILLS	
OSS Analyst **Key Responsibilities:** Analyse and evaluate the performance and functionality of Operational Support Systems (OSS) within the telecommunications network. Gather and document requirements for OSS enhancements or new implementations, based on business needs and feedback from network operations.	1. **AI** can help with data analysis and system monitoring, but strategic analysis and recommendations require human expertise. 2. **Routine analytical tasks** can be automated, but comprehensive system evaluations and strategic improvements need human involvement.	1. **This role supports sustainability** by analysing and optimising OSS systems for energy efficiency and minimal environmental impact.	OSS Engineer Automation and Orchestration Engineer Data Scientist / Artificial Intelligence Scientist

Highly Impacted Roles Career Pathways

(Continue)

Roles	Examples of Additional Skills Required and Analysis		Possible Roles for Transition into Other Sectors
	AI / DIGITAL SKILLS	GREEN SKILLS	
Associate UI Designer **Key Responsibilities:** Assists in UI design and conducts usability testing and adopts a broad perspective in UI development	1. **Data Mining** Developing data mining skills enhances the ability to extract valuable insights from user data, which can inform more effective UI design decisions. This expertise is beneficial across roles that prioritise data-driven approaches to improve user experience. 2. **Data Modelling & Design** Gaining knowledge in data modeling and design provides a structured approach to organising and representing information, ensuring intuitive and user-friendly interfaces. This skill is applicable in various roles that require a clear understanding of how data interacts with design elements. 3. **Advanced Technology Integration** Mastering advanced technology integration enables the incorporation of innovative tools and platforms into UI development, enhancing user interactions. This proficiency is valuable across roles focused on leveraging technology to create seamless user experiences.	1. **Sustainable Business Practices** Understanding sustainable business practices encourages the implementation of ethical and responsible design strategies, which are increasingly relevant in today's market. This perspective adds value to various roles by aligning design efforts with broader corporate sustainability goals. 2. **Green Product Design** Familiarity with green product design promotes the integration of environmentally friendly principles into UI development, fostering sustainable choices. This knowledge is significant for roles that seek to create impactful and responsible user experiences while addressing ecological concerns.	 **Associate / Assistant, E-Commerce** Sector: Wholesale and Retail Trade  **Manager, Customer Experience** Sector: Wholesale and Retail Trade

Highly Impacted Roles Career Pathways

(Continue)

Roles

Cloud Administrator

Key Responsibilities:
Coordinates with the IT department to develop and support cloud, Windows, or Unix infrastructure, providing technical assistance on Windows and cloud-based systems, and resolving operational matters

Examples of Additional Skills Required and Analysis

AI / DIGITAL SKILLS

1. **Continuous Integration and Continuous Deployment**
   Mastering continuous integration and continuous deployment (CI/CD) streamlines software delivery and enhances system reliability, valuable in various IT roles. This proficiency promotes a proactive approach to managing changes and deployments.

2. **Solution Architecture**
   Developing expertise in solution architecture provides a framework for designing effective technological solutions, applicable across numerous IT positions. This skill aligns systems with business objectives, fostering strategic thinking.

3. **Network Configuration and Troubleshooting**
   Gaining knowledge in network configuration and troubleshooting equips an administrator with essential problem-solving skills for effective network management. This expertise is transferable to roles that require a solid understanding of network operations.

GREEN SKILLS

1. **Green Business Innovation**
   Acquiring skills in green business innovation encourages sustainable practices, increasingly relevant in environmentally conscious organisations. This perspective fosters responsible decision-making and supports organisational sustainability goals.

2. **Eco-Design Principles**
   Understanding eco-design principles facilitates the integration of sustainability into technology solutions, benefiting roles focused on responsible development. This knowledge helps create products that minimise environmental impact.

3. **Sustainable Business Practices**
   Developing insight into sustainable business practices enhances the implementation of ethical strategies within technology operations. This skill is relevant for roles that balance operational efficiency with social responsibility.

Possible Roles for Transition Within the Sector

Cloud Development & Operations Engineer

Infrastructure Engineer

Network Engineer

Senior Data Engineer

Highly Impacted Roles Career Pathways

(Continue)

Roles	Examples of Additional Skills Required and Analysis		Possible Roles for Transition Within the Sector
	AI / DIGITAL SKILLS	GREEN SKILLS	
Cloud Analyst **Key Responsibilities:** Monitors and investigates the operational status of cloud systems, while understanding security, risk, compliance, and regulatory policies	1. **Data Engineering** Cultivating data engineering skills enhances the ability to manage and analyse data, vital for informed decision-making in various roles. This proficiency supports the development of robust cloud solutions applicable in future positions. 2. **Infrastructure Deployment** Developing expertise in infrastructure deployment deepens the understanding of setting up and maintaining technology resources, relevant across numerous IT roles. This skill ensures systems are reliable and efficient, aligning well with operational responsibilities. 3. **Network Administration and Maintenance** Gaining knowledge in network administration and maintenance improves troubleshooting capabilities and promotes a proactive approach to ensuring connectivity. This expertise is transferable to roles requiring solid management of complex systems.	1. **Green Business Innovation** Acquiring skills in green business innovation fosters the ability to implement sustainable practices within various operational frameworks, which is increasingly valuable in today's eco-conscious job market. 2. **Eco-Friendly Site Selection** Understanding eco-friendly site selection promotes informed decision-making regarding resource placement, contributing to environmentally responsible practices in various operational roles. This knowledge is beneficial for enhancing project outcomes while addressing sustainability concerns. 3. **Waste Management** Developing expertise in waste management supports the implementation of efficient resource use and waste reduction strategies, which are relevant in many operational contexts. This skill not only aligns with sustainability goals but also improves overall efficiency, making it advantageous for various roles focused on operational excellence.	 Senior Data Engineer  Network Engineer  Infrastructure Engineer  Cloud Development & Operations Engineer

Projected Number of Highly Impacted Employees

Based on the TalentCorp Demand Model Projection,[80] the workforce in ICT's core business is expected to be approximately 296,579 **by 2029**. It is estimated that around **9%** of these employees, approximately **20,167 may face job risks within the next three (3) to five (5) years** as a result of roles significantly affected according to assessments by industry experts.

Summary of Highly Impacted Roles

Cybersecurity	Data	Infrastructure	Software and Applications	Operations and Support
• Incident Investigator • Associate Security Analyst • Security Operations Analyst	• Data Analyst / Associate Data Engineer	• Cloud Analyst	• Applications Support Engineer • Associate Applications Support Engineer	• Associate Operations Centre Support Engineer • Associate Systems Support Engineer

Telecommunications		
• OSS Analyst	• NOC Technician	• Customer Insights Analyst

Findings

In summary, many of these roles involve routine tasks such as monitoring, data analysis, and system maintenance. With the rapid development of AI and digital tools, these tasks are increasingly automated. As a result, organisations are shifting their focus toward roles that require advanced skills in strategy, decision-making, and creative problem-solving, such as cybersecurity strategists, data scientists, and cloud architects.

AI and digital tools are being integrated across various domains, such as cybersecurity, data management, infrastructure, and telecommunications. For instance, AI tools can automate security monitoring, anomaly detection, data analytics, and system performance checks. This cross-domain integration leads to unified, streamlined processes that require fewer specialised roles like Cloud Analysts, OSS Analysts, and NOC Technicians. Instead of having separate teams for each function, a single AI-driven platform can handle multiple tasks simultaneously, reducing the need for dedicated personnel and consolidating roles into broader, multi-disciplinary positions.

Advanced predictive capabilities of AI tools now allow for real-time insights and proactive issue management. AI systems can predict customer churn, recommend design changes, or flag system vulnerabilities, decreasing the need for constant human oversight. As AI tools continue to evolve, they will handle more sophisticated tasks autonomously, further reducing the reliance on manual intervention and making such roles increasingly redundant.

Employers with these roles in their organisation will need to plan for talent reskilling and pivoting strategies within or across sectors.

80. Department of Statistics Malaysia; TalentCorp Demand Model Projection

Medium and Low Impacted Roles

Medium Impacted Roles Analysis

As technology enables automation of repetitive tasks, ICT professionals are thus enabled to take on new or higher-value activities, with the opportunities for medium impacted roles in AI, digital and green economy.

AI will reshape job functions, necessitating new skill sets while preserving the importance of human qualities in roles demanding empathy, creativity, and complex decision-making. Jobs reliant on repetitive data processing and predictable workflows are undergoing significant transformation. However, roles requiring complex human interaction, emotional intelligence, and nuanced decision-making are less likely to be fully automated. Human expertise will remain crucial in navigating ambiguous situations and providing personalised services. The same can be said on the digitalisation of medium impacted roles. Digitalisation and automation of repetitive tasks enhances efficiency and accuracy within roles that require precise and timely decision-making based on data insights. With routine operations automated, these professionals can dedicate more time and energy to strategic initiatives such as proactive risk management, innovative investigation techniques, and optimising infrastructure design.

The roles of Green Economy such as cybersecurity, data engineering, and infrastructure management indirectly contribute to environmental sustainability. These roles enhance operational efficiency through practices that minimise energy consumption and waste generation, aligning with green economy principles. Their influence lies in integrating sustainable strategies into technological advancements and operational frameworks, thus shaping medium-level impacts on environmental sustainability

Job Clusters	Medium Impacted Roles	Skills
Cybersecurity	• Cyber Risk Analyst	**Specific Skills** • Cyber Risk Management • IT Audit • IT Governance **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Cyber Risk Manager	**Specific Skills** • Security Awareness • Security Governance • Security Programme Management **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Medium Impacted Roles	Skills
Cybersecurity	• Forensics Investigator	**Specific Skills** • Emerging Technology Synthesis • Failure Analytics • Network Security **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• Incident Investigation Manager	**Specific Skills** • System Performance Management • Threat Analytics and Defence • Threat Intelligence and Detection **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
	• Vulnerability Assessment and Penetration Testing Analyst	**Specific Skills** • Network Security • Security Assessment and Testing • Security Strategy **Basic Skills** • Conflict Management • Cognitive Skills • Influencing and Negotiation
	• Vulnerability Assessment and Penetration Testing Manager	**Specific Skills** • Security Governance • Security Strategy • Stakeholder Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Empathy
Data and Artificial Intelligence	• Data Engineer	**Specific Skills** • Security Governance • Security Strategy • Stakeholder Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Empathy

Job Clusters	Medium Impacted Roles	Skills
Infrastructure	• Infrastructure Architect	**Specific Skills** • Eco-Friendly Site Selection • Emerging Technology Synthesis • Security Architect **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Infrastructure Engineer	**Specific Skills** • Applications Integration • Configuration Tracking • Eco-Design Principles **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Infrastructure Engineering Manager	**Specific Skills** • Infrastructure Design • IT Asset Management • IT Audit **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Associate Network Engineer	**Specific Skills** • IT Asset Management • Network Administration and Maintenance • Network Configuration and Troubleshooting **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
Product Development	• Lead Product Analyst	**Specific Skills** • Data Storyboarding • Automation Management in Product Development • Big Data Analytics **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Medium Impacted Roles	Skills
Product Development	• Lead Product Designer	**Specific Skills** • Demand and Supply Analytics • Design Concepts Generation • Emerging Technology Synthesis **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• Product Security Engineer	**Specific Skills** • Cyber Risk Management • IT Audit • IT Governance **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
	• Quality Assurance Engineer	**Specific Skills** • Quality Engineering • Quality Standards • Software Design **Basic Skills** • Conflict Management • Cognititive Skills • Influencing and Negotiation
	• Quality Assurance Manager	**Specific Skills** • Stakeholder Management • System Performance Management • Test Planning **Basic Skills** • Digital and AI Fluency • Critical Thinking • Empathy
	• Quality Engineer	**Specific Skills** • Failure Analytics • Process Validation • Product Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency

Job Clusters	Medium Impacted Roles	Skills
Product Development	• Quality Engineering Manager	**Specific Skills** • Quality Assurance Management • Quality Engineering • Quality Standards **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Back-End Developer	**Specific Skills** • Agile Software Development • Applications Integration • Applications Support and Enhancement **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Front-End Developer	**Specific Skills** • System Performance Management • Test Planning • Data Design **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Senior Back-End Developer	**Specific Skills** • Applications Support and Enhancement • Cloud Computing • Software Configuration **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Senior Front-End Developer	**Specific Skills** • Agile Software Development • Applications Development • Applications Integration **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Medium Impacted Roles	Skills
Software and Applications	• Lead UI Designer	**Specific Skills** • Solution Architecture • Stakeholder Management • System Performance Management **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• UI Designer	**Specific Skills** • User Experience Design • User Interface Design • User Testing and Usability Testing **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
	• Performance Tester	**Specific Skills** • Infrastructure Deployment • Quality Assurance Management • Software Testing **Basic Skills** • Conflict Management • Cognititive Skills • Influencing and Negotiation
	• DevOps Engineer	**Specific Skills** • Applications Integration • Cloud Computing • Configuration Tracking **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
Operations and Support	• Associate Data Centre Operations Engineer	**Specific Skills** • Data Centre Facilities Management • Infrastructure Support • IT Asset Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Empathy

Job Clusters	Medium Impacted Roles	Skills
Operations and Support	• Data Centre Operations Engineer	**Specific Skills** • ICT Disaster Recovery Management • Infrastructure Support • IT Asset Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Infrastructure Support Engineer	**Specific Skills** • Infrastructure Deployment • Infrastructure Support • Network Administration and Maintenance **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Head of Operations and Support	**Specific Skills** • Procurement • Quality Standards • Resource Management **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Operations and Support Manager	**Specific Skills** • Data Centre Facilities Management • Database Administration • Project Management **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Associate Infrastructure Support Engineer	**Specific Skills** • Infrastructure Support • Network Administration and Maintenance • Network Configuration and Troubleshooting **Basic Skills** • Digital and AI Fluency • Critical Thinking • Empathy

Job Clusters	Medium Impacted Roles	Skills
Operations and Support	• Operations Centre Support Engineer	**Specific Skills** • Business Continuity Management • Configuration Tracking • Continuous Improvement **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Systems Support Engineer	**Specific Skills** • Security Administration • Security Programme Management • Service Level Management **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
Strategy and Governance	• IT Audit Manager	**Specific Skills** • IT Audit • IT Governance • IT Standards **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• IT Auditor	**Specific Skills** • Business Performance Management • Business Risk Management • IT Audit **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
Product Development	• Quality Assurance Engineer	**Specific Skills** • Quality Engineering • Quality Standards • Software Testing **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking

Job Clusters	Medium Impacted Roles	Skills
Product Development	• Quality Assurance Manager	**Specific Skills** • Product Management • Project Management • Quality Engineering **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Quality Engineer	**Specific Skills** • Quality Standards • Software Design • Software Testing **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• Quality Engineering Manager	**Specific Skills** • Artificial Intelligence Ethics and Governance • Failure Analytics • Process Validation **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
Telecommunications	• Associate Radio Frequency Engineer	**Specific Skills** • Infrastructure Deployment • Infrastructure Support • IT Asset Management **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Junior Network Engineer	**Specific Skills** • Network Configuration and Troubleshooting • Network Security • Security Administration **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration

Job Clusters	Medium Impacted Roles	Skills
Telecommunications	• Network Engineer	**Specific Skills** • Configuration Tracking • Cyber and Data Breach Incident Management • Emerging Technology Synthesis **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Telecom Engineer	**Specific Skills** • Network Configuration and Troubleshooting • Network Security • Network Slicing **Basic Skills** • AI and Digital Fluency • Innovative Thinking • Learning Agility
	• Senior Network Engineer	**Specific Skills** • Network Security • Network Slicing • Pattern Recognition Systems **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• RF Engineer	**Specific Skills** • Business Networking • Network Security • Radio Frequency Engineering **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Senior RF Engineer	**Specific Skills** • Network Administration and Maintenance • Network Configuration and Troubleshooting • Network Security **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Medium Impacted Roles	Skills
Telecommunications	• RF Planning Engineer	**Specific Skills** • Infrastructure Deployment • Infrastructure Design • Infrastructure Support **Basic Skills** • AI and Digital Fluency • Innovative Thinking • Learning Agility
	• OSS Engineer	**Specific Skills** • Business Networking • Data Validation • System Integration **Basic Skills** • AI and Digital Fluency • Learning Agility • Innovative Thinking
	• Customer Experience Manager	**Specific Skills** • Big Data Analytics • Process Improvement and Optimisation • Research and Information Synthesis **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy

Low Impacted Roles Analysis

Roles less impacted by AI, digital and green economy opportunities will maintain significant human intervention, with limited change to the tasks performed and remaining highly strategic and creative.

While AI excels in automating tasks, analysing data, and providing insights through machine learning, its impact is limited in roles requiring complex decision-making, strategic planning, creativity, and deep business understanding. Human leadership is crucial for interpreting AI insights, making nuanced decisions, setting strategic directions and integrating AI effectively into organisational goals, ensuring innovation and holistic business success. Similarly, digital tools enhance specific operational tasks, yet roles requiring human judgment and strategic thinking heavily rely on human expertise to drive innovation and achieve holistic business objectives.

As technological and operational priorities emphasise security, efficiency, and performance ahead of direct environmental considerations, the impact of Green Economy on these roles are minimal. However, these roles indirectly support environmental sustainability by enhancing digital security, optimising resource use, and improving efficiency through AI and data-driven insights.

Job Clusters	Low Impacted Roles	Skills
Cybersecurity	• Chief Information Security Officer	**Specific Skills** • Cyber and Data Breach Incident Management • Cyber Forensics • Cyber Risk Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Forensics Investigation Manager	**Specific Skills** • Failure Analytics • Security Administration • Security Assessment and Testing **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Security Architect	**Specific Skills** • Security Architecture • Security Programme Management • Solution Architecture **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• Senior Security Engineer / Security Engineer	**Specific Skills** • Security Awareness • Security Programme Management • System Performance Management **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
Data and Artificial Intelligence	• Artificial Intelligence / Machine Learning Engineer	**Specific Skills** • Computer Vision Technology • Configuration Tracking • Data Design **Basic Skills** • Conflict Management • Empathy • Influencing and Negotiation
	• Data Scientist / Artificial Intelligence Scientist	**Specific Skills** • Data Design • Data Ethics • Text Analytics and Processing **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking
	• Business Intelligence Director	**Specific Skills** • Business Performance Management • Data Governance • Project Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Business Intelligence Manager	**Specific Skills** • Business Networking • Business Performance Management • Resource Management **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness

Job Clusters	Low Impacted Roles	Skills
Cybersecurity	• Data Architect	**Specific Skills** • Security Architect • Data Design • Data Engineering **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Senior Data Engineer	**Specific Skills** • Emerging Technology Synthesis • Project Management • Quality Standards **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Chief Data Officer / Chief Artificial Intelligence Officer	**Specific Skills** • Data Strategy • Emerging Technology Synthesis • Enterprise Architecture **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Head of Data Science and Artificial Intelligence	**Specific Skills** • Business Performance Management • Computer Vision Technology • Text Analytics and Processing **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
Infrastructure	• Head of Infrastructure	**Specific Skills** • Enterprise Architecture • Green Business Innovation • IT Strategy **Basic Skills** • Change Management • Sustainability Awareness • Communication

Job Clusters	Low Impacted Roles	Skills
Infrastructure	• Automation and Orchestration Engineer	**Specific Skills** • Network Configuration and Troubleshooting • Software Configuration • System Integration **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
	• Network Engineer	**Specific Skills** • Network Administration and Maintenance • Systems Design • Test Planning **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking
	• Cloud Developer	**Specific Skills** • Cloud Computing • Infrastructure Deployment • Infrastructure Design **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Cloud Development and Operations Engineer	**Specific Skills** • Applications Development • Applications Integration • Automation Management in Product Development **Basic Skills** • Conflict Management • Empathy • Influencing and Negotiation
Strategy and Governance	• Data Protection Executive	**Specific Skills** • Business Risk Management • Crisis and Disaster Recovery Management • IT Audit **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency

Job Clusters	Low Impacted Roles	Skills
Strategy and Governance	• Group Data Protection Officer	**Specific Skills** • Data Ethics • Data Governance • Data Protection Management **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Enterprise Architect	**Specific Skills** • System Performance Management • Enterprise Architecture • Solution Architecture **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Head of IT Audit	**Specific Skills** • Data Governance • IT Audit • IT Governance **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Project Manager / Scrum Master	**Specific Skills** • Project Management • Resource Management • Stakeholder Management **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Solutions Architect	**Specific Skills** • Agile Software Development • Applications Integration • Process Re-engineering **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking

Job Clusters	Low Impacted Roles	Skills
Strategy and Governance	• Associate Business Analyst	**Specific Skills** • Process Improvement and Optimisation • Project Management • Software Testing **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Business Architect	**Specific Skills** • Emerging Technology Synthesis • Continuous Improvement • Project Feasibility Assessment **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Programme Director	**Specific Skills** • Emerging Technology Synthesis • Partnership Management • Portfolio Management **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Programme Manager	**Specific Skills** • Project Management • Resource Management • Business Networking **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
	• Associate UX Designer	**Specific Skills** • User Experience Design • User Testing and Usability Testing • Research and Information Synthesis **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency

Job Clusters	Low Impacted Roles	Skills
Strategy and Governance	• Lead UX Designer	**Specific Skills** • Business Performance Management • Product Management • System Performance Management **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• UX Designer	**Specific Skills** • User Experience Design • User Interface Design • User Testing and Usability Testing **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Head of Product	**Specific Skills** • Quality Standards • Business Opportunities Development • Business Performance Management **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• Head of Quality	**Specific Skills** • Quality Assurance Management • Quality Engineering • Quality Standards **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Chief Technology Officer	**Specific Skills** • Artificial Intelligence Applications • Business Risk Management • System Performance Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking

Job Clusters	Low Impacted Roles	Skills
Strategy and Governance	• Product Manager	**Specific Skills** • Design Concepts Generation • Emerging Technology Synthesis • Portfolio Management • Product Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Senior Product Manager	**Specific Skills** • Business Networking • Business Opportunities Development • Business Performance Management **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
Product Development	• Chief Product Officer	**Specific Skills** • Automation Management in Product Development • Product Management • Quality Standards **Basic Skills** • Conflict Management • Empathy • Influencing and Negotiation
	• Chief Technology Officer	**Specific Skills** • Agile Software Development • Artificial Intelligence Applications • Continuous Integration and Continuous Deployment **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking
	• Head of Product	**Specific Skills** • Portfolio Management • Product Management • Research and Information Synthesis **Basic Skills** • Business Acumen • Change Management • Cognitive Skills

Job Clusters	Low Impacted Roles	Skills
Product Development	• Head of Software Engineering	**Specific Skills** • Project Management • Quality Standards • Systems Design **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Product Manager	**Specific Skills** • Portfolio Management • Product Management • Research and Information Synthesis **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Product Risk Analyst	**Specific Skills** • Internal Controls in Product Development • Product Risk Analytics • Product Risk Assessment **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Full Stack Developer	**Specific Skills** • Applications Support and Enhancement • Business Risk Management • Data Design **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Senior Full Stack Developer	**Specific Skills** • Software Configuration • Software Design • System Performance Management **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration

Job Clusters	Low Impacted Roles	Skills
Product Development	• Software Architect	**Specific Skills** • Agile Software Development • Applications Integration • Cloud Computing **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking
	• Software Engineering Manager	**Specific Skills** • Software Configuration • Software Design • Software Testing **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
Software and Applications	• Associate Embedded Systems Engineer	**Specific Skills** • Configuration Tracking • Control System Programming • Emerging Technology Synthesis **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Embedded Systems Engineer	**Specific Skills** • Embedded Systems Integration • Embedded Systems Interface Design • Software Configuration **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Embedded Systems Engineering Manager	**Specific Skills** • Applications Integration • Business Performance Management • Control System Programming **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Low Impacted Roles	Skills
Software and Applications	• Head of Software Engineering	**Specific Skills** • Stakeholder Management • System Performance Management • Software Testing **Basic Skills** • Change Management • Sustainability Awareness • Communication
	• Associate Software Engineer	**Specific Skills** • Software Configuration • Software Design • Software Testing **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking
	• Software Architect	**Specific Skills** • Software Design • Solution Architecture • System Performance Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Software Engineer	**Specific Skills** • Software Configuration • Software Design • Software Testing **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• RPA Developer	**Specific Skills** • Software Configuration • System Performance Management • Systems Design **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Low Impacted Roles	Skills
Product Development	• Automation Tester	**Specific Skills** • Quality Assurance Management • Software Testing • System Performance Management **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• RPA Engineer	**Specific Skills** • Software Configuration • System Performance Management • Systems Design **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• RPA Programme Manager	**Specific Skills** • Crisis and Disaster Recovery Management • Process Re-engineering • Project Management **Basic Skills** • Planning and Organising • Teamwork and Collaboration • Coaching and Mentoring
Operations and Support	• Associate Database Support Engineer	**Specific Skills** • Database Administration • Infrastructure Support • IT Asset Management **Basic Skills** • Business Acumen • Change Management • Sustainability Awareness
	• Database Support Engineer	**Specific Skills** • Infrastructure Support • IT Asset Management • IT Strategy **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen

Job Clusters	Low Impacted Roles	Skills
Operations and Support	• Chief Information Officer	**Specific Skills** • Enterprise Architecture • ICT Disaster Recovery Management • Infrastructure Strategy **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
Telecommunication	• Radio Frequency Engineer	**Specific Skills** • Process Improvement and Optimisation • Radio Frequency Engineering • Software Configuration **Basic Skills** • Innovative Thinking • Learning Agility • Adaptability and Resiliency
	• Telecommunication Engineering Technicians	**Specific Skills** • Embedded Systems Integration • Pattern Recognition Systems • Infrastructure Deployment **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Lead Telecom Engineer	**Specific Skills** • Network Slicing • Pattern Recognition Systems • Radio Frequency Engineering **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Network Architect	**Specific Skills** • Network Security • System Performance Management • Systems Design **Basic Skills** • Cognitive Skills • Digital and AI Fluency • Critical Thinking

Job Clusters	Low ImpactedRoles	Skills
Telecommunication	• Telecom Infrastructure Manager	**Specific Skills** • Network Administration and Maintenance • Business Networking • Infrastructure Deployment **Basic Skills** • Coaching and Mentoring • Conflict Management • Empathy
	• RF Technician	**Specific Skills** • Computational Modelling • Infrastructure Design • Infrastructure Support **Basic Skills** • Learning Agility • Adaptability and Resiliency • Business Acumen
	• Junior RF Engineer	**Specific Skills** • Network Configuration and Troubleshooting • Network Security • System Performance Management **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Radio Frequency Specialist	**Specific Skills** • Radio Frequency Engineering • Configuration Tracking • Control System Programming **Basic Skills** • Learning Agility • Innovative Thinking • Communication
	• RF Manager	**Specific Skills** • Crisis and Disaster Recovery Management • Security Architecture • IT Strategy **Basic Skills** • Communication • Planning and Organising • Critical Thinking

Job Clusters	Low Impacted Roles	Skills
Telecommunication	• Telecom RF Director	**Specific Skills** • System Performance Management • Infrastructure Design • Infrastructure Support **Basic Skills** • Digital and AI Fluency • Learning Agility • Innovative Thinking
	• Tower Technician	**Specific Skills** • Eco-Friendly Site Selection • Network Administration and Maintenance • Infrastructure Support **Basic Skills** • Learning Agility • Communication • Critical Thinking
	• Telecom Installer	**Specific Skills** • Radio Frequency Engineering • System Performance Management • Eco-Friendly Site Selection **Basic Skills** • Communication • Planning and Organising • Teamwork and Collaboration
	• Senior Tower Technician	**Specific Skills** • Network Configuration • Network Security • Radio Frequency Engineering **Basic Skills** • Digital and AI Fluency • Learning Agility • Communication
	• Tower Crew Lead	**Specific Skills** • Network Security • Radio Frequency Engineering • System Performance Management **Basic Skills** • Communication • Planning and Organising • Teamwork & Collaboration

Job Clusters	Low Impacted Roles	Skills
Telecommunication	• Tower Operations Manager	**Specific Skills** • Infrastructure Design • Green Business Innovation • Sustainable Business Practices **Basic Skills** • Business Acumen • Critical Thinking • Adaptability and Resiliency
	• Telecom Tower Director	**Specific Skills** • System Integration • System Performance Management • Green Business Innovation **Basic Skills** • Digital and AI Fluency • Critical Thinking • Innovative Thinking
	• Fiber Optic Technician	**Specific Skills** • Business Networking • Big Data Analytics • Infrastructure Deployment **Basic Skills** • Communication • Critical Thinking • Planning and Organising
	• Cable Installer	**Specific Skills** • Infrastructure Deployment • Network Configuration and Troubleshooting • System Integration **Basic Skills** • Critical Thinking • Planning and Organising • Teamwork & Collaboration
	• Fiber Splicer	**Specific Skills** • Data Migration • Infrastructure Support • Network Configuration and Troubleshooting **Basic Skills** • Digital and Ai Fluency • Learning Agility • Critical Thinking

Job Clusters	Low Impacted Roles	Skills
Telecommunication	• Senior Fiber Optic Technician	**Specific Skills** • Infrastructure Support • Network Configuration and Troubleshooting • Network Security **Basic Skills** • Critical Thinking • Collaboration • Adaptability and Resiliency
	• Fiber Optic Engineer	**Specific Skills** • Infrastructure Design • Network Configuration and Troubleshooting • Network Security **Basic Skills** • Adaptability and Resiliency • Business Acumen • Learning Agility
	• Fiber Optic Network Manager	**Specific Skills** • Network Administration and Maintenance • Security Architecture • Security Governance **Basic Skills** • Critical Thinking • Adaptability and Resiliency • Business Acumen
	• OSS Architect	**Specific Skills** • Big Data Analytics • Enterprise Architecture • Solution Architecture **Basic Skills** • nnovative Thinking • Learning Agility • Communication
	• NOC Manager	**Specific Skills** • Network Administration and Maintenance • System Integration • Network Security **Basic Skills** • Digital and AI Fluency • Planning and Organising • Communication

Job Clusters	Low Impacted Roles	Skills
Telecommunication	• Regulatory Affairs Manager	**Specific Skills** • IT Audit • Risk Governance • Quality Assurance Management **Basic Skills** • Critical Thinking • Communication • Planning and Organising
	• Compliance Officer	**Specific Skills** • Data Ethics • Data Governance • Data Protection Management **Basic Skills** • Adaptability and Resiliency • Business Acumen • Change Management
	• Infrastructure Project Manager	**Specific Skills** • Project Management • Crisis and Disaster Recovery Management • Vendor Management **Basic Skills** • Change Management • Influencing and Negotiation • Coaching and Mentoring
	• Site Acquisition Specialist	**Specific Skills** • Business Opportunities Development • Eco-Friendly Site Selection • Project Feasibility Assessment **Basic Skills** • Change Management • Business Acumen • Influencing and Negotiation
	• DevSecOps Engineer	**Specific Skills** • Machine Learning Models • Secure Coding • Structured Query Language (SQL) **Basic Skills** • Digital and AI Fluency • Innovative Thinking • Learning Agility

Job Clusters	Low Impacted Roles	Skills
Telecommunication	• Site Reliability Engineer	**Specific Skills** • Eco-Friendly Site Selection • Infrastructure Support • Process Improvement and Optimisation **Basic Skills** • Change Management • Influencing and Negotiation • Business Acumen

Projected Numbers of Medium and Low Impacted Employees

The impact study identified that approximately 91% (217,906) of the medium and low impacted employees require upskilling that are related to AI, Digital, and Green Economy. Based on assessment and industry feedback, a total of **140** basic and specific skills were identified for the ICT sector, in which **53%** are AI/Digital skills and **6%** are Green Economy skills.

For medium impacted roles, **33%** require upskilling to progress and perform beyond traditional expectations, while **58%** of roles designated as low impacted do not require mandatory upskilling. For low impacted roles, continuous self-improvement is advised to maintain relevance and make informed decisions, particularly to keep up with knowledge of emerging trends.

In-Demand Skills for AI, Digital, and Green Economy	Training Programmes Available

AI/ Digital Skills

AI/Digital skills that are essential for roles to adopt for business operations enhancements and overall workforce productivity improvements

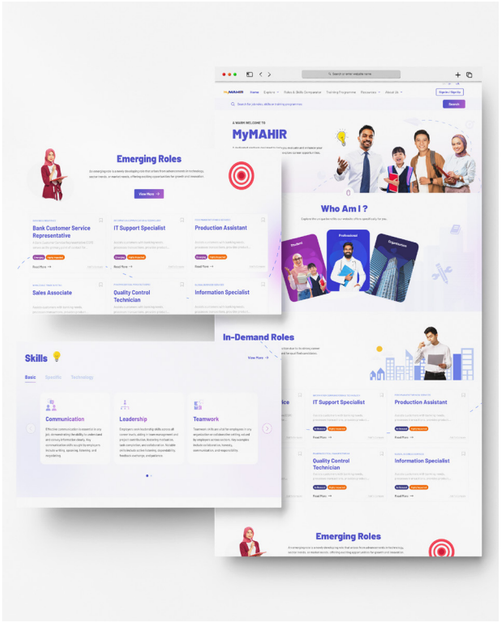
- Systems Design
- Network Security
- Network Administration and Maintenance
- Emerging Technology Synthesis
- Cyber and Data Breach Incident Management
- Infrastructure Deployment

Green Skills

Green skills that are needed for roles to integrate sustainability efforts and initiatives into business operations

- Eco-Design Principles
- Sustainable Sourcing
- Waste Management
- Sustainability Management
- Sustainable Facilities Management
- Eco-Friendly Site Selection
- Green Business Innovation
- Sustainable Business Practices

List of proposed training programmes is accessible on the **MyMAHIR platform**.



Emerging Roles

Global Presence of Emerging Roles in the ICT Sector

The emerging roles, Prompt Engineer, AI Auditor and AI Ethicist are becoming increasingly prominent in the ICT industry globally, including in countries like the US, UK, Germany, France, China, India and Singapore. The US boasts the most AI job postings, while China is heavily invested in AI research and development, aiming to be a global leader by 2030. Countries like the UK, France, and Germany are strong contenders. The UK leads in hiring growth for AI specialists, while France focuses on autonomous vehicles and Germany has a robust engineering background. Singapore fosters a data-driven environment, Canada offers government support for AI research, and Japan has a long history of robotics expertise.

Prompt Engineer

Prompt Engineers are essential in optimising AI-driven content generation and natural language processing applications. While the field is still evolving, there are early adopters in countries with strong AI research and development sectors. This includes the US, Canada, China, Singapore, and several European nations like Germany and the UK. Companies like OpenAI and Google are leveraging prompt engineering to fine-tune AI models for more accurate and relevant outputs. In China, the rapid development of AI applications in communication platforms and content creation, driven by tech giants like Baidu and Alibaba, is notable. This role is crucial for enhancing the efficiency and relevance of AI-generated content. In India, the rise of tech startups focusing on AI-driven solutions is increasing the demand for Prompt Engineers to improve local language processing and AI usability. This role will also support Malaysia's vision of becoming a leader in AI innovation and digital transformation by ensuring the quality and effectiveness of AI applications in various sectors.

AI Auditor

AI Auditors play a crucial role in ensuring the transparency and accountability of AI systems. The role of AI Auditor is another exciting emergence in the ICT industry, focusing on the responsible development and deployment of AI systems. AI Auditors are most in demand in countries with a strong focus on AI and where regulations are being developed. This includes the US, Canada, China, Singapore, and several European nations like Germany and the UK. Companies such as Siemens and SAP are investing significantly in AI governance to enhance trust and compliance. In the US, organisations like IBM and Microsoft employ AI Auditors to oversee ethical AI practices and mitigate biases in AI models. In India, with its growing tech industry, local companies like TCS and Infosys are increasingly employing AI Auditors to ensure compliance with global AI standards and regulations. In Malaysia, the demand for AI Auditors is predicted to be high due to the increasing focus on ethical AI practices and regulatory compliance. This role will also aid in building public trust in AI systems, which is essential for the growth of the ICT sector.

AI Ethicist

This role is critical in tech companies for developing and implementing ethical guidelines for AI development and deployment. AI ethicists are in demand in countries at the forefront of AI development and regulation. This includes the US, Canada, China, Singapore, and many European nations like Germany and the UK. Organisations like Facebook and Amazon are focusing on responsible AI practices to address ethical concerns and societal impacts. In the UK, the integration of AI ethics in policy-making and corporate governance is advancing, supported by institutions like the Alan Turing Institute and collaborations with tech firms. This role will support Malaysia's ICT industry by promoting ethical AI development and fostering trust in AI technologies, enhancing the country's capabilities in digital ethics and responsible innovation. In China, where AI adoption is widespread, AI Ethicists are crucial for guiding ethical AI use and addressing public concerns about privacy and surveillance.[81]

Malaysia's approach to AI ethics is still in the formative stages, with ongoing efforts to establish comprehensive guidelines. The rapid integration of AI technologies in various sectors has heightened the need for clear ethical policies to ensure responsible use and mitigate potential harms. While global frameworks exist, such as those from Institute of Electrical and Electronics Engineers (IEEE), Organisation for Economic Co-operation and Development (OECD), and the EU, Malaysia is developing its own standards, as seen in the AI Roadmap 2021-2025.

AI Ethicists are essential in shaping a responsible AI future by integrating ethical considerations into AI development. They help organisations navigate complex challenges, ensuring AI systems are fair, transparent, and aligned with human values. Their role includes promoting trust, compliance, and mitigating risks associated with AI, balancing innovation with social responsibility.

81. Harvard Business Review Charting the Emerging Geography of AI; Coursera; University of San Diego; MITSloan; European Commission

PIKOM recommends a "7 by 7" approach combining seven (7) key policies and characteristics to guide ethical AI development and usage:

POLICIES:	
Fairness	Prevent AI biases and promote inclusivity.
Reliability, Safety, and Control	Ensure AI systems are tested for safety and control.
Privacy & Security	Protect data through privacy-by-design.
Inclusiveness	Ensure AI benefits all stakeholders.
Accountability	Hold AI developers accountable for outcomes.
Transparency	Use explainable algorithms to foster trust.
Pursuit of Human Benefits	Prioritise human welfare over efficiency.

CHARACTERISTICS:	
Informed Consent	Obtain clear user consent for AI use.
Continuous Monitoring	Regular audits to ensure ethical compliance.
Collaboration and Openness	Promote open dialogue and cooperation.
Environmental Impact	Mitigate AI's environmental footprint.
Human Oversight	Incorporate human judgment in AI decisions.
Education and Awareness	Train stakeholders on ethical AI use.
Checks and Balances	Implement third-party reviews to uphold standards.

> **Addressing the ethical challenges posed by AI requires a concerted effort from all stakeholders to develop and implement holistic ethical policies that prioritise human well-being and societal values. By working together, we can harness the transformative potential of AI while mitigating its risks and ensuring a more ethical and responsible AI future. Lastly, the industry should develop the necessary mechanisms for self-regulation based on risk and governance and supported by an external review process.**

Woon Tai Hai, PIKOM Advisor

Demand Projection for Emerging Roles

The demand for emerging specialists is expected to increase as companies increasingly recognise the advantages of new technology and sustainable practices in a dynamic market environment. Based on the input collected from the industry players during the impact assessment workshop, analysis shows that the multinational corporations (MNCs) range from 1,500 to 10,000 employees, public listed companies (PLCs) range from 500 to 5,000 employees, and small and medium-sized enterprises (SMEs) range from 80 to 1,800 employees.

Based on a survey conducted during the study, the headcount of organisations based on company type ranges from

Multinational Corporations (MNCs):	Public Listed Companies (PLCs)	Small and Medium-Sized Enterprises (SMEs):
1,500 – 10,000	**500 – 5,000**	**80 – 1,800**

Projected Demand for Emerging Roles for each organisation in the next three (3) to five (5) years

	Multinational Corporations (MNCs)	Public Listed Companies (PLCs)	Small and Medium-Sized Enterprises (SMEs)
Prompt Engineer	1 - 25	1 – 25	1 - 25
AI Auditor	1 - 25	1 – 25	1 - 25
AI Ethicist	1 - 25	1 – 25	None

Findings

Prompt Engineer:
The analytics reveal that GLCs have a moderate demand for Prompt Engineers at 9.75%, reflecting their focus on AI initiatives and user interaction optimisation. In contrast, MNCs show minimal demand at 0.36% due to centralised AI operations, reducing the need for local roles. PLCs are in the early stages of adopting this position with a demand of 1.44%. Meanwhile, SMEs demonstrate a significant need at 9.29%, showcasing their proactive approach to implementing advanced technologies and improving operational efficiency through customised AI solutions.

AI Auditor:
All company types recognise the importance of AI Auditors, though demand varies. GLCs show moderate demand at 5.19%, while SMEs have significant interest at 9.29% and PLCs display minimal demand at 0.09%. MNCs exhibit low demand at 0.33%, reflecting early AI adoption stages. SMEs and PLCs can enhance compliance and governance through AI Auditors, while MNCs need more structured auditing processes to address operational complexity and uphold ethical standards in AI implementation.

AI Ethicist:
Demand for AI Ethicists is low across all sectors, with GLCs at 0.78%, PLCs at 1.08%, and MNCs at 0.04%, while SMEs show no demand, likely due to resource constraints. However, as organisations face ethical implications of AI, GLCs and PLCs should invest in AI Ethicist roles to strengthen governance frameworks. This investment can help build consumer trust, ensure responsible AI deployment, and contribute to long-term sustainability and brand loyalty in an evolving digital landscape.

Chapter 5:
Recommended Initiatives

Through the impact study assessment, nine (9) Recommended Initiatives have been identifed across the talent ecosystem to adapt to AI, Digital, and Green Economy trends within Malaysia's ICT sector. These plans aim to harness opportunities and address challenges posed by these transformative trends. Aligning with the needs and aspirations of each stakeholder group will foster innovation, promote skill development, and ensure the sustainable growth of the ICT sector. As shown in the table below, initiatives are grouped into four (4) categories based on the leading and enabling entities: **Government**, **Industry Players**, **Academia**, and **Training Providers**.

Summary of nine (9) Recommended Initiatives

Government

IN1
Provide Funding and Incentives

IN2
Develop Policy and Regulations that are Supportive of Adoption of AI and Digital by the Sector

IN3
Continuous Development of National Talent to Address the Talent Gap

Industry Players

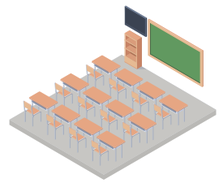
IN4
Collaborate Between Government and Industry Players

IN5
Improve Work Environment and Organisation

Academia

IN6
Develop Industry-Relevant Curriculum

IN7
Promote Micro-Credential Courses (also applicable to Training Providers)



Training Providers

IN8
Develop Training Content Needed by the Sector

IN9
Consult Industry Experts for the Specialised Needs of the Sector

Government

Three (3) initiatives were identified to be driven by the government, namely Funding and Incentives; Regulations, Policy and Initiatives; and Talent Development.

IN1 Provide Funding and Incentives

The strategy for this initiative leverages on government support to drive innovation and workforce development in Malaysia by enhancing funding for AI, digital and green economy.

Initiatives	Case Studies
IN1.1 **Government to increase funding, grants and tax breaks:** Increase in funding dedicated to research, development, and commercialisation will drive greater adoption and advancement of AI and green technologies in Malaysia. The funding will prioritise initiatives that foster strong collaboration between private sector and academia, ensuring that research efforts are aligned with the needs of ICT sector. Targeted funding stream can support the growth of AI and green technology ecosystems within Malaysia, creating opportunities for SMEs to engage in cutting-edge projects, thereby enhancing the nation's competitiveness and sustainability.	The **Agency for Science, Technology and Research (ASTAR)**[82] **in Singapore** is one example of the impact of effective government funding focused on industry collaboration in significantly advancing R&D in AI.
IN1.2 **Government through relevant human capital development agency to establish co-funding model:** Establish co-funding model to encourage greater private sector investment in upskilling and reskilling programmes Through sharing the financial responsibility, the model can lower the barriers for companies to invest in their workforce's development, particularly in high-demand areas like AI, digital technologies, and green economy Co-funding arrangements would also allow the government to strategically align training programmes with national economic priorities, ensuring that the Malaysian workforce remains competitive and adaptable in a rapidly evolving job market	**Singapore's National Research Foundation (NRF)**[83] is a prime example of a government body that significantly increased funding, grants, and tax incentives to boost research, development, and commercialisation in technology sectors, including AI and green technologies.

82. ASTAR, <https://www.a-star.edu.sg/>
83. Ministry of Electronics & Information Technology, Modified Special Incentive Package Scheme (M-SIPS), <https://www.meity.gov.in/esdm/incentive-schemes>

Benefits
Accelerated Technological Advancement and Adoption: Increased funding, grants, and tax breaks drive greater investment in research, development, and commercialisation of AI and green technologies. This accelerates technological advancement and adoption, enhancing Malaysia's innovation capabilities and sustainability efforts. **Enhanced Collaboration and Relevance:** Prioritising funding for initiatives that foster collaboration between the private sector and academia ensures that research is aligned with industry needs. This results in more relevant and impactful innovations, strengthening the connection between academic research and market demands. **Improved Workforce Development and Competitiveness:** Establishing a co-funding model encourages private sector investment in upskilling and reskilling programmes, particularly in high-demand areas. This lowers investment barriers for companies, aligns training with national economic priorities, and ensures that the Malaysian workforce remains competitive and adaptable in a rapidly evolving job market.

IN2 Develop Policy and Regulations that are Supportive of Adoption of AI and Digital by the Sector

This initiative will focus on developing policies and regulations that actively support the adoption of AI and digital technologies across various sectors, ensuring a conducive environment for innovation, competitiveness, and sustainable growth.

Initiatives	Case Studies
IN2.1 **Government to establish a central coordinating body for policy streamlining:** Establish a central coordinating body that includes representatives from key agencies, and industry associations such as PIKOM and select key industry players. This body would be responsible for streamlining policies and optimising resource allocation for AI, digital, and green economy initiatives. Additionally, it would facilitate regular industry roundtables and innovation hubs to encourage collaboration between industry players, academia, and government stakeholders. Alternatively, the initiative will leverage on existing FSTC as the coordinating body by enlarging its mandate to include streamlining policy.	**Singapore's National AI Strategy** established a multi-agency task force of government agencies (including the Singapore Economic Development Board and the InfoComm Media Development Authority), industry leaders and academia.[84]

84. Singapore's Ministry of Digital Development and Information, *AI Initiatives Launched to Uplift Singapore's Economic Potential*, 1 March 2024, <https://www.mddi.gov.sg/media-centre/press-releases/ai-initiatives-launched-to-uplift-sg-economic-potential/>

Initiatives	Case Studies
IN2.2 **Government to develop national AI foundation model:** Invest in the development of a national AI foundation model through a strategic partnership with the private sector. This initiative would leverage industry expertise and resources to create a robust AI framework that supports innovation and drives the nation's digital transformation.	China has set up the **'Beijing Academy of Artificial Intelligence' (BAAI)**,[85] a large-scale government-backed initiative to develop a national AI foundation model. This model is designed to be a public good accessible by companies and researchers to accelerate AI development in China.
IN2.3 **Government to improve and simplify training cost reimbursement process:** Advocate for streamlining and simplifying the training cost reimbursement process to reduce administrative burdens and enhance accessibility to training funds. An efficient and and user-friendly claims process will enable more companies to invest in employee development, thereby increasing the overall participation in training programmes.	**Singapore's SkillsFuture Credit** is a pre-loaded credit card that individuals can use to pay for government-approved training programmes.[86] This system simplifies the claims process and encourages participation in upskilling and reskilling initiatives.

Benefits
Enhanced Efficiency and Coordination: Establishing a central coordinating body streamlines policy implementation, improves coordination among agencies, and accelerates response to emerging challenges. **Unified Strategy and Global Competitiveness:** Developing a national AI foundation model creates a cohesive framework for AI development, sets standards, and boosts global competitiveness by attracting investment and talent. **Improved Access and Reduced Burden:** Simplifying the training cost reimbursement process increases accessibility to training programmes, reduces administrative burdens, and encourages investment in workforce development.

85. Beijing Academy of Artificial Intelligence, <https://www.baai.ac.cn/>
86. SkillsFuture, *SkillsFuture Credit*, <https://www.skillsfuture.gov.sg/initiatives/mid-career/credit>

IN3 Continuous Development of National Talent to Address the Talent Gap

This initiative seeks to address the talent gap by prioritising continuous development of national talent through ongoing education and professional growth initiatives. This involves creating targeted programmes that adapt to evolving industry needs, ensuring that the workforce remains skilled.

Initiatives	Case Studies
IN3.1 **Government and its relevant agencies to collaborate to attract and retain foreign technology talent:** Develop a comprehensive national strategy aimed at attracting and retaining foreign technology talent. This strategy should target specific skill sets that are in high demand within the ICT sector, ensuring that the industry remains competitive and well-equipped to meet future challenges.	The **Singapore** government has put in place a two-pronged approach to develop local talent while attracting foreign talent.[87]
IN3.2 **Government to promote and invest in integration of AI within TVET programmes:** To enhance TVET programmes, it is important to actively promote and invest in the integration of AI and digital technologies. This can be accomplished by updating curricula, providing targeted funding, fostering collaboration between the industry and academia, upskilling instructors, and establishing specialised AI-focused TVET initiatives. These efforts will ensure that graduates are equipped with the digital competencies necessary for success in modern workplaces.	**South Korea's 'Revitalising Vocational Education and Training (VET)'** initiative shows how governments can invest in and develop more impactful TVET programmes.[88]
IN3.3 **Government through its relevant agencies to lead public awareness campaigns in AI, digital (ICT) and green economy:** Initiate comprehensive public awareness campaigns that highlight high-impact job roles and promising career pathways in AI, digital, and green economy in the ICT sector. These campaigns should also provide information on available reskilling and upskilling programmes, empowering individuals to pursue opportunities in these rapidly growing fields	**Australia** introduced a 'Digital Careers Strategy' to raise awareness on careers in the digital sector.[89]
IN3.4 **Government to provide more autonomy to in revising syllabus according to constant change in sector demand:** Reform regulation in higher learning institutions with flexibility to revise and adapt its curricula including TVET, integrate AI, digital, and green economy as foundational courses is essential to preparing future ready workforce. By integrating AI, digital, and green economy fundamentals as core components across all programmes, institutions can ensure that students from various disciplines gain a strong foundational understanding of these critical areas.	**Germany's VET programmes** are regularly updated in collaboration with industry stakeholders. These programmes now include AI, automation, and green technology courses as essential components of the curriculum, ensuring that students acquire skills relevant to the digital and green economies.[90]

Benefits

Enhanced Workforce and Economic Growth:
Attracting and retaining foreign technology talent, along with integrating AI into TVET programmes, fosters a more skilled and innovative workforce, drives economic growth, and strengthens the local technology sector.

Improved Competitiveness and Innovation:
Investing in AI education and promoting technology adoption ensures that the workforce is equipped with future-ready skills, enhances industry competitiveness, and stimulates innovation and technological advancement.

Informed Public and Support for Policies:
Leading public awareness campaigns in AI, digital technologies, and green economy educates individuals and businesses, drives adoption and engagement, and builds support for relevant policies and investments.

87. Singapore Economic Development Board, <https://www.edb.gov.sg/en/why-singapore/world-class-talent.html>
88. OECD, *Education At A Glance: South Korea*, <https://www.oecd-ilibrary.org/korea_045cc436-en.pdf?itemId=%2Fcontent%2Fcomponent%2F045cc436-en&mimeType=pdf>
89. Tasmanian Government, *Tasmanian State Service: Digital Careers*, <https://www.digital.tas.gov.au/digital-careers>
90. German Federal Ministry of Education and Research, *The German Vocational Training System*, <https://www.bmbf.de/bmbf/en/education/the-german-vocational-training-system/the-german-vocational-training-system_node.html>

Industry Players

IN4 Collaborate Between Government and Industry Players

This initiative will focus on creating a synergistic partnership between government and industry players to jointly address ICT sector challenges, drive innovation, and shape policies that support sustainable growth and technological advancement. This collaboration leverages combined expertise to develop effective solutions and create a conducive environment for industry development.

Initiatives	Case Studies
IN4.1 **Associations such as PIKOM to encourage active participation in government-industry dialogues:** Engage actively in government-industry dialogues and consultations to influence the development of policies and regulations that promote the growth of the ICT sector By participating in these discussions, associations can provide valuable insights and feedback that shape sector's policies and regulations	The **Singapore Telecommunications Association (STA) and InfoComm Media Development Authority (IMDA)** have collaborated to address crucial elements of the regulatory framework update, focusing on spectrum allocation, infrastructure sharing and competition.[91]
IN4.2 **Industry players to increase collaboration with academia via TalentCorp's IAC:** The partnership can yield significant benefits for the ICT sector and drive innovations. Some of the possible collaborations are curriculum development, mentorship opportunities, guest lecturers from the industry and workshops and joint research projects.	The **Telecommunications Policy Forum (TPF) in Australia**, a collaborative forum brings together industry leaders, regulators, and consumer representatives.[92]
IN4.3 **Associations such as PIKOM to champion AI and digital adoption:** Associations like PIKOM to take a leading role in advocating for the widespread adoption of AI and digital technologies across ICT and relevant sectors such as ICT within GBS. These advancements will drive transformative changes that create new job opportunities and enhance overall industry competitiveness.	**TechUK**, a leading trade association in the UK, has successfully championed the adoption of AI and digital technologies across various sectors by advocating for policy reforms, promoting industry collaboration, and driving digital skills development, significantly enhancing industry competitiveness and creating new job opportunities.[93]

91. IMDA, <https://www.imda.gov.sg/regulations-and-licences/regulations/consultations>
92. Australia's Department of Infrastructure, Transport, *Regional Development, Communications and the Arts, International Involvement In Telecommunications and Internet Forums,* <https://www.infrastructure.gov.au/media-technology-communications/internet/international-involvement-internet-forums>
93. TechUK, <https://www.techuk.org/>

Benefits

Improved Policy and Strategic Alignment:
Encouraging active participation in government-industry dialogues ensures that industry players can influence and align policies with industry needs, leading to more effective and relevant regulations and support that benefit both sectors.

Enhanced Talent Development and Innovation:
Increasing collaboration with academia through initiatives like TalentCorp's IAC fosters the development of a skilled workforce, promotes research and innovation, and ensures that academic programmes are aligned with industry requirements and emerging trends.

Accelerated Technological Advancement and Competitiveness:
Championing AI and digital adoption through industry associations like PIKOM drives technological progress, enhances digital capabilities, and strengthens the overall competitiveness of the industry by promoting the integration of advanced technologies and practices.

IN5 Improve Work Environment and Organisation

This initiative will seek to create a synergistic partnership between government and industry players to jointly address ICT sector challenges, drive innovation, and shape policies that support sustainable growth and technological advancement. This collaboration leverages combined expertise to develop effective solutions and create a conducive environment for industry development.

Initiatives	Case Studies
IN5.1 **Employers' federation to drive offering of competitive salaries:** Deliver attractive salary and benefits packages to draw and retain top talent in the AI, digital and green economy related roles for the ICT sector. It is key to perform compensation benchmarks, develop performance and skill base incentives and recognition opportunities.	**Google** offers competitive salaries combined with generous stock options.[94] These equity-based incentives align employee interests with company success and incentivise long-term commitment.

94. Microsoft, Careers, <https://careers.microsoft.com/v2/global/en/benefits>

Initiatives	Case Studies
IN5.2 **Associations such as PIKOM to promote and drive integration of ESG principles:** A champion is needed to drive the integration of ESG principles across the ICT sector, advocating for these values to be embedded into core business operations. The principles may include eco-friendly practices, ethical governance, and inclusive workplaces, development of sustainable technology solutions that support both business objectives and social improvement	**Ericsson** aims to reduce their carbon footprint by 80% by 2030 through energy-efficient technologies, green infrastructure, and circular economy practices in their supply chain.[95] They foster diversity and inclusion, support global STEM education, and provide training and mentorship to develop future telecom talent. Additionally, the company upholds strong ethical standards, ensures operational transparency, and regularly reports on their sustainability progress, actively engaging with stakeholders.

Benefits

Attraction and Retention of Talent:
Competitive salaries help attract and retain top talent by making positions more appealing and ensuring employee satisfaction, which can lead to lower turnover and higher organisational stability.

Enhanced Corporate Reputation and Compliance:
Industry association-driven ESG adoption improves a company's reputation by demonstrating a commitment to sustainable and ethical practices, helping to attract socially conscious investors and customers while ensuring compliance with regulatory requirements.

Increased Employee Engagement and Productivity:
Competitive compensation and a focus on ESG initiatives contribute to higher employee morale and engagement, which can boost productivity, innovation, and overall organisational performance.

95. Ericsson, <https://www.ericsson.com/en/about-us>

Academia

IN6 Develop Industry-Relevant Curriculum

These initiatives will centre on the reforms and adjustments needed to ensure more emphasis on technology courses in the curriculum, equipping students with the skills required to tackle real-world challenges in STEM fields.

Initiatives	Case Studies
IN6.1 **Higher Learning Institutions to ensure tertiary education syllabus is industry driven:** Aligning the syllabus with emphasis on AI, digital and practical applications in higher education with emerging roles in the industry and adapting to changing talent and skill demands is crucial for preparing students for the workforce. Educational institutions should work closely with industry stakeholders to ensure that curricula reflect current and future industry needs.	The **Singapore University of Technology and Design (SUTD)** launched the 'AI for Industry' programme, a unique initiative designed to bridge the gap between academia and industry in AI education.[96]
IN6.2 **Higher Learning Institutions to expand on practical experiential learning:** Preparing graduates for the demands of the ICT sector, higher learning institutions should place a greater emphasis on practical experiential learning. This can be achieved by incorporating a variety of hands-on experiences into academic programmes, such as project-based learning, internships, and industry collaborations. Project-based learning approach allows students to work on real-world problems and develop solutions, thereby applying theoretical knowledge to practical scenarios. It fosters critical thinking, creativity, and teamwork, essential skills in the ICT field. In addition, internships with longer tenure, for example, six (6) months to one (1) year, with industry players provide students with opportunities to gain invaluable industry experience, build professional networks, and understand the day-to-day operations of ICT companies Industry collaborations with joint projects, guest lectures, and mentoring programmes enables students to gain insights into current industry trends and challenges.	The **University of Melbourne's** Master of Artificial Intelligence programme[97] addresses the demand for AI expertise by combining core techniques like machine learning and computer vision with practical experience through case studies, projects, and internships

Benefits

Attraction and Retention of Talent:
Competitive salaries help attract and retain top talent by making positions more appealing and ensuring employee satisfaction, which can lead to lower turnover and higher organisational stability.

96. Singapore's University of Technology and Design, <https://www.sutd.edu.sg/>
97. University of Melbourne, <https://study.unimelb.edu.au/find/courses/graduate/master-of-information-technology/>

Benefits

Enhanced Corporate Reputation and Compliance:
Industry association-driven ESG adoption improves a company's reputation by demonstrating a commitment to sustainable and ethical practices, helping to attract socially conscious investors and customers while ensuring compliance with regulatory requirements.

Increased Employee Engagement and Productivity:
Competitive compensation and a focus on ESG initiatives contribute to higher employee morale and engagement, which can boost productivity, innovation, and overall organisational performance.

IN7 Promote Micro-Credential Courses (also applicable to Training Providers)

Promoting micro-credential courses is essential for equipping experienced employees with specialised skills that meet current industry demands.

Initiatives	Case Studies
IN7.1 **Higher Learning Institutions to promote micro-credential courses:** Active promotion of micro-credential courses can address the growing demand for specialised skills in various fields in ICT. By offering these short, targeted courses, institutions can provide students and professionals with the opportunity to acquire specific competencies quickly and efficiently within AI, digital and green economy. Micro-credentials, which focus on practical skills and knowledge, enable learners to enhance their qualifications and stay competitive in a rapidly evolving job market.	The **Massachusetts Institute of Technology** offers a variety of micro-credentials in AI, cybersecurity, and data science through its online platform, edX.[98] These micro-credentials are developed in collaboration with industry.

Benefits

Enhanced Flexibility and Accessibility:
Micro-credentials offer flexible, modular, and cost-effective learning options that cater to both students and professionals, allowing them to acquire targeted skills and advance their careers without committing to full degree programmes.

Alignment with Industry Needs and Lifelong Learning:
They ensure that education stays relevant to current industry demands by rapidly adapting to emerging trends, and they support lifelong learning by providing continuous professional development opportunities.

Improved Employability and Recognition:
Micro-credentials help individuals showcase specific skills to employers, validate prior learning, and personalise their educational paths, thereby enhancing employability and career progression.

98. Singapore's University of Technology and Design, <https://www.sutd.edu.sg/>

Training Providers

IN8 Develop Training Content Needed by the Sector

Initiatives led by training providers will focus on developing training content that is aligned with the evolving needs of the sector, emphasising on the latest advancements in AI, digital technologies and green economy to bridge skill gaps.

Initiatives	Case Studies
IN8.1 **Training providers to develop high quality training programmes that are in demand by ICT:** Design, develop, and deliver comprehensive training programs that focus on reskilling and upskilling the workforce in critical areas i.e. AI, digital, and green technologies. These programmes should be tailored to meet the evolving demands of the ICT sector, equipping professionals with the advanced skills and knowledge in emerging technologies	**IMDA** initiated Point Working Groups with STA participation to address crucial elements of the regulatory framework update, focusing on spectrum allocation, infrastructure sharing, and competition.[99]
IN8.2 **Training providers to work with relevant government agencies to identify jobs and skills at risk due to automation:** Establish a strong collaboration with relevant government agencies to conduct comprehensive research on jobs and skills that are most vulnerable to automation. This involves identifying specific roles that may be impacted and understanding the competencies that will be in greater demand. The insights will be used to develop and implement targeted training programmes designed to equip employees with the critical skills needed to transition into new roles or adapt to evolving job requirements.	**Estonia's 'ProgeTiiger'** initiative promotes computational thinking and coding skills from a young age. This programme integrates these elements into primary and lower secondary education, fostering a strong foundation for further digital literacy development.[100]

99. IMDA, <https://www.imda.gov.sg/regulations-and-licences/regulations/consultations>
100. J. Angelo Racoma, *Estonia's Education Minister Kristina Kallas on the challenges and opportunities of AI in learning and empowerment [Q&A]*, 17 May 2024, <https://technode.global/2024/05/17/estonias-education-minister-kristina-kallas-on-the-challenges-and-opportunities-of-ai-in-learning-and-empowerment-qa/>

Initiatives	Case Studies
IN8.3 **Training providers to align the training course toward achieving certification:** Develop training programmes that are strategically aligned with recognised industry certifications, ensuring that trainees gain credentials that enhance their career progression opportunities, These programmes is designed to meet certification requirements and will provide practical, hands-on experience that prepares individuals for real-world challenges	The **Canadian Future Skills Centre (FSC)** tackles automation by working with industry to create innovative training programmes for future jobs.[101]

Benefits

Increased Relevance and Demand:
By developing high-quality training programmes that align with current industry demands in ICT, training providers ensure that their offerings are relevant and sought after. This increases the likelihood of their programmes being adopted by individuals and organisations looking to upskill or reskill their workforce.

Enhanced Career Support and Skill Adaptation:
Collaborating with government agencies to identify jobs and skills at risk due to automation allows training providers to tailor their programmes to address emerging skills gaps and help individuals adapt to changes in the job market. This proactive approach supports career transitions and helps mitigate the impact of automation on employment.

Improved Credibility and Value:
Aligning training courses toward achieving industry-recognised certifications enhances the credibility and value of the training programmes. Certification adds formal recognition of the skills acquired, which can improve job prospects and professional growth for participants, making the training more attractive and effective.

101. Future Skills Centre, <https://fsc-ccf.ca/>

IN9 Consult Industry Experts for the Specialised Needs of the Sector

This initiative will see industry experts with deep and niche expertise being tapped into to meet the ICT sector's specialised needs.

Initiatives	Case Studies
IN9.1 **Industry experts to train employees from the industry:** Freelance or independent industry experts with specialised knowledge in AI, Digital, and Green Economy can be appointed by training providers to deliver targeted courses and application skills in the ICT sector. These experts bring practical, cutting-edge insights and real-world experience. By leveraging their expertise, training providers can offer highly specialised content that addresses current industry needs and trends, ensuring that participants acquire the most up-to-date skills and knowledge.	**IBM's SkillsBuild** programme is a notable example of an industry-driven initiative to train employees and build a skilled workforce. Launched in 2020, the programme focuses on providing free digital skills training and certification to individuals and organisations to address the skills gap in technology and innovation sectors.[102]

Benefits

Skill Enhancement:
Employees gain access to up-to-date training and certifications that align with current industry standards and technological advancements, enhancing their technical skills and knowledge.

Bridging the Skills Gap:
By focusing on areas with high demand for skilled professionals, the programme helps bridge the skills gap and ensures that industry players have a pool of qualified candidates ready to meet their needs.

Increased Employability:
Participants benefit from improved employability through recognised certifications and career support services, while companies gain a competitive advantage by having a workforce with up-to-date skills in emerging technologies.

102. IBM SkillsBuild, <https://skillsbuild.org/>

Taking into account the Initiatives proposed, moving forward, these are the

Top 5 Initiatives

needed to kickstart the workforce transformation towards AI, Digital, and Green Economy to ensure their successful implementation

1 GOVERNMENT

Industry to leverage the tax funding and incentives applicable to AI, Digital, and Green Economy to upskill and reskill employees.

2 INDUSTRY PLAYERS

Collaboration between key stakeholders is key in addressing the challenges in advancing AI, Digital, and Green Economy, making sure that the policies and initiatives are tangible and realistic for implementation.

3 TRAINING PROVIDERS

Training providers to provide accessible and affordable training programmes for equipping the current workforce with the skills needed to succeed in the modern economy

4 TRAINING PROVIDERS

Skills development and talent cultivation to nurture and enhance individuals' abilities and competencies to meet personal, professional, and economic goals through education, training, and practical experiences

5 ACADEMIA

Integration of digital literacy and sustainability awareness into the education system and schools is a strategic approach to prepare students for the rapid changes in the industry

Conclusion

The impact study has shown **the implications on the ICT workforce** due to continued and rapid advancements in AI, Digital, and Green Economy.

159 key ICT roles were identified during the study, consisting of 156 established positions which are crucial to maintaining industry standards and operational efficiency; and **three (3) emerging roles which were highlighted due to the growing relevance** and need for the roles in tandem with the rise of AI. Of the 159 roles, the impacts range from low to medium to high, requiring holistic, cross-cutting, and targeted interventions to ensure ICT workers are sufficiently prepared to meet the industry's talent needs. requiring holistic, cross-cutting and targeted interventions to ensure ICT workers are sufficiently ready to meet the industry's talent needs. The study also **provided insights into the demand for the roles**, which will allow employees and employers alike to plan their career and talent development strategies accordingly.

To address these needs, **nine (9) initiatives have been identified for implementation across the talent ecosystem**. Government, industry players, academia, and training providers each have important roles to play in ensuring the necessary reforms, transitions, and interventions are in place to prepare the workforce for a future-ready sector and contribute to Malaysia's long-term socio-economic goals.

Moving forward, embarking on this journey of continuous adaptation and innovation will be vital in **preparing the ICT workforce for ongoing advancements in AI, Digital, and Green Economy**. To achieve this, **the MyMAHIR Future Skills Talent Council (FSTC)** will conduct regular needs assessments to identify **immediate and future workforce skills gaps, analyse talent demands by sector and educational level, propose strategies, determine essential sector-specific skills, and periodically update these skills in response to technological advancements** and evolving operating environments.

Key trends impacting existing roles:

- **Artificial Intelligence**
- **Digital**
- **Green Economy**

The study identified 156 job roles that will be highly impacted by these trends, along with 3 emerging roles, were highlighted due to the growing relevance.

9 Initiatives

have been identified for implementation across the talent ecosystem

MyMAHIR Future Skills Talent Council (FSTC) has been set up to prepare for these changes

Validation Workshop

Validation Workshop














Abbreviations

4IR	Fourth Industrial Revolution Policy
AI	Artificial Intelligence
AIOps	AI for IT operations
ASTAR	The Agency for Science, Technology and Research - Singapore
BAAI	Beijing Academy of Artificial Intelligence
BDC	Bridge Data Centres
CAGR	Compound Annual Growth Rate
CDP	Customer Data Platforms
CCNA	Cisco's Certified Network Associate
CEH	EC-Council Certified Ethical Hacker
DASP	Data Availability and Sharing - Australia
EC	European Commission
ESG	Environment, Social, and Governance
EU	European Union
FDI	Foreign Direct Investment
FSC	Canadian Future Skills Centre
FSTC	Future Skills Talent Council
FTRS	Financial Technology Regulatory Sandbox - Singapore
GDP	Gross Domestic Product
GenAI	Generative AI
GHG	Greenhouse Gas
GLCs	Government-Linked Companies
GVAICT	Gross Value Added from the ICT industry
IaC	Infrastructure as Code
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IISc	Indian Institute of Science
IMDA	Singapore InfoComm Media Development Authority
IR4.0	The Fourth Industrial Revolution
ITSI	Splunk IT Service Intelligence
MIT	The Massachusetts Institute of Technology, US
MNCs	Multinational Corporations
MSPs	Managed Service Providers
MyDIGITAL	Malaysia's Digital Economy Blueprint
MyNSR	Malaysia National Skills Registry
NETR	National Energy Transition Roadmap
NFV	Network Functions Virtualization
NIC	National Innovation Centre (NIC) - Vietnam
NLP	Natural Language Processing
NOC	Network Operations Centre
NRF	Singapore's National Research Foundation
NTU	Nanyang Technological University
OECD	Organisation for Economic Co-operation and Development
OSS	Operational Support Systems
PAI	The Partnership on AI
PLCs	Public Listed Companies
R&D	Research and Development
RMKe-12	Twelfth Malaysia Plan
ROI	Return on Investment
SDN	Software-Defined Networking
SMEs	Small and Medium-Sized Enterprises
STA	Singapore Telecommunications Association
SUTD	Singapore University of Technology and Design
TM	Telekom Malaysia
TNB	Tenaga Nasional Berhad
TPF	Telecommunications Policy Forum - Australia
TVET	Technical and Vocational Education and Training
UI	User Interface
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
US	United States
UX	User Experience
VET	Revitalising Vocational Education and Training - South Korea

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