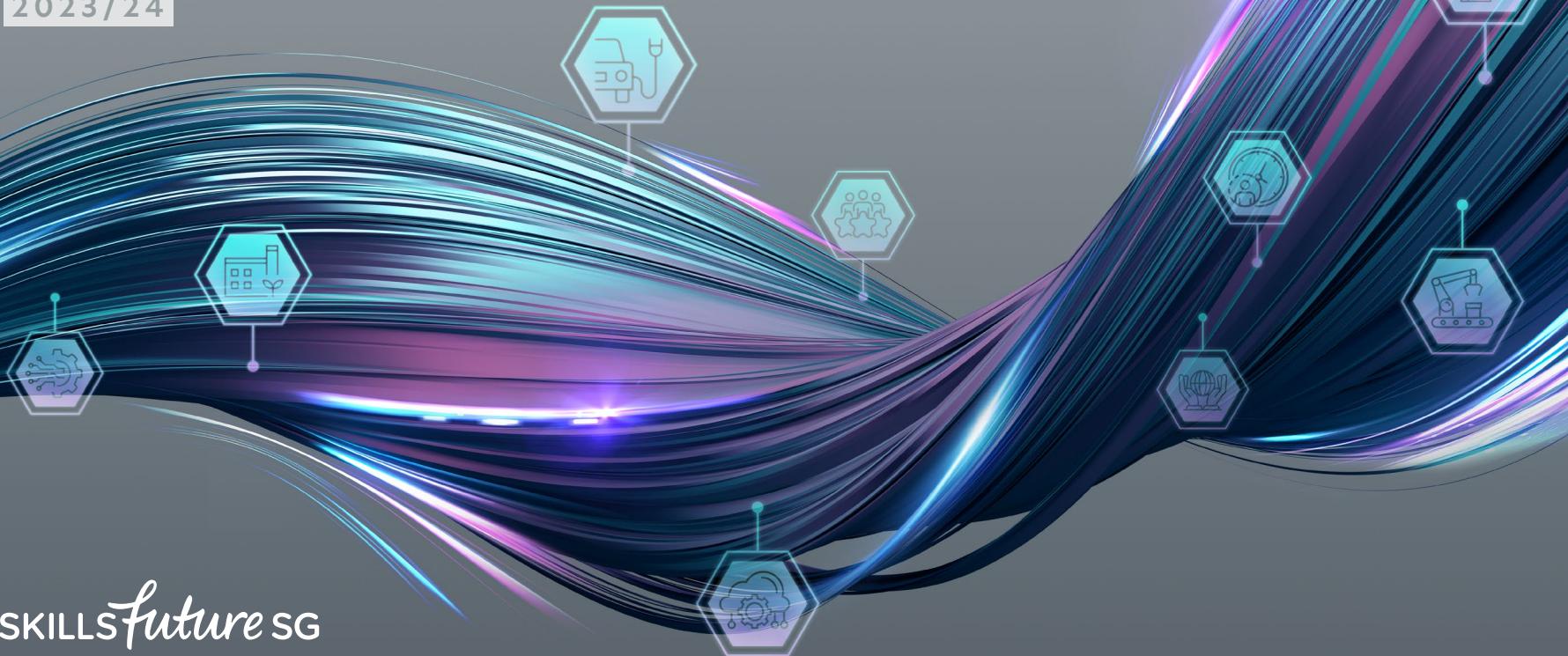


SKILLS DEMAND FOR THE FUTURE ECONOMY

2023/24



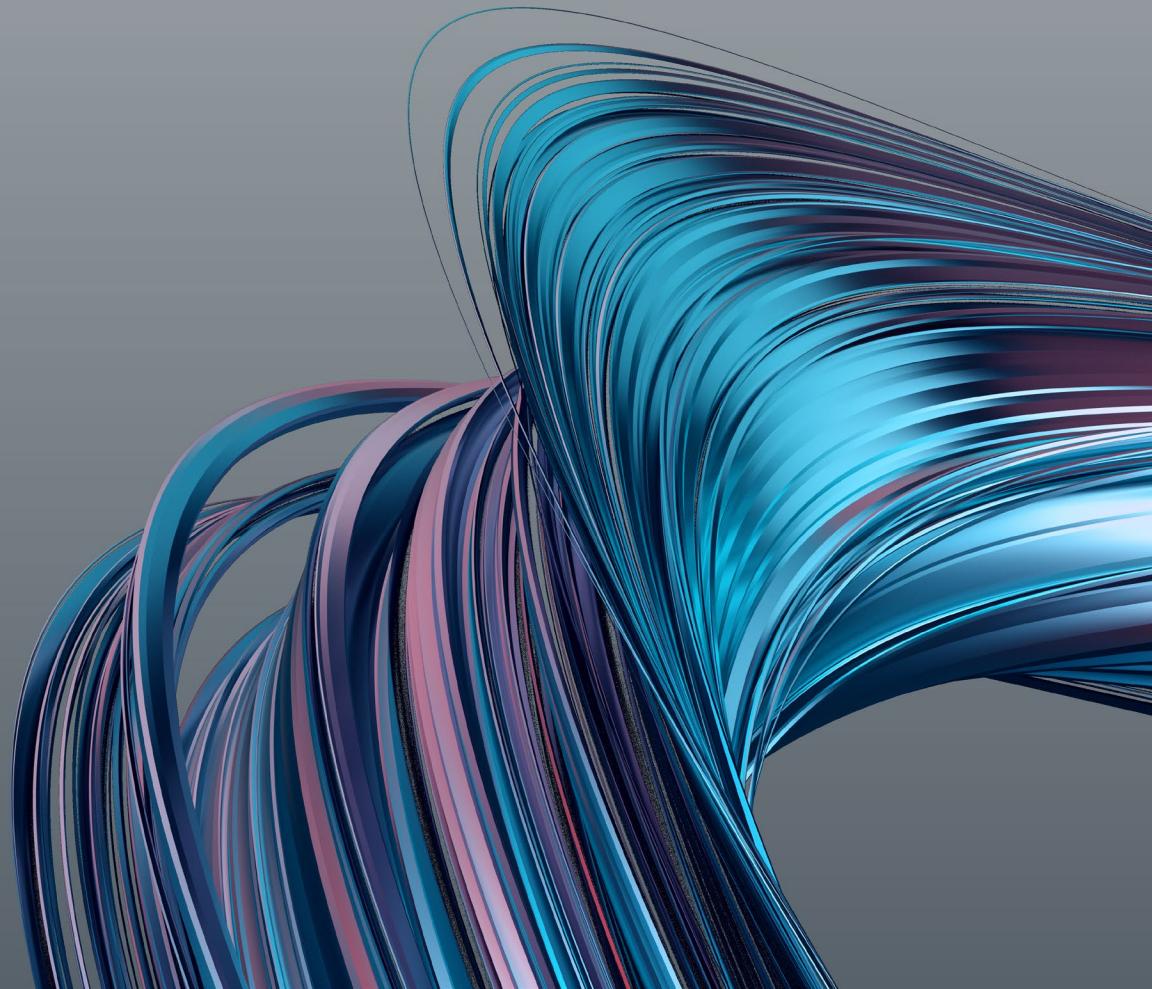
About SkillsFuture Singapore

SkillsFuture Singapore (SSG) drives and coordinates the implementation of the national SkillsFuture movement, promotes a culture of lifelong learning and strengthens the ecosystem of training and adult education in Singapore. Through a holistic suite of national SkillsFuture initiatives, SSG enables Singaporeans to take charge of their learning journey in their pursuit of skills mastery. SSG also works with key stakeholders to ensure that students and adults have access to high quality and industry-relevant training that meet the demands of different sectors of the economy for an innovative and productive workforce. For more information, visit <https://www.skillsfuture.gov.sg/>.

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Foreword

Mr Chan Chun Sing
Minister of Education
Singapore

Our operating environment is changing rapidly, and the way in which we approach skills training must also keep pace. Digital technology has progressed rapidly from the advent of the Internet to cloud technology to machine learning. ChatGPT and Large Language Models may dominate discussions today but be antiquated tomorrow given the velocity of digital advances. Geopolitics is increasingly affecting trade and supply chains. The speed at which climate change is happening underscores the urgency with which societies must step up on climate change mitigation and adaptation.

These developments will have a profound impact on businesses, nature of jobs, and what

it takes for our workers to stay relevant. In this dynamic environment, it is critical that we build up our understanding of the skills needed by our workers, so that we can respond and act early. This is why we launched the annual Skills Demand for the Future Economy report two years ago, to distil the global trends shaping jobs and skills, examine the skills demanded by employers, and spotlight in-demand and transferable skills.

With these skills insights, we hope to support Singaporeans in making purposeful training decisions to boost their employability and better seize new job opportunities. Training providers must be nimble in developing training programmes that can meet evolving needs of both industry and individuals. For example, the refreshed SkillsFuture Series courses launched in early 2023 is a response to the skills top-

ups demanded by the digital, green and care economies. Through this consolidation of enterprises' skills needs, we hope to work more closely with employers to strengthen our collective understanding of the skills environment and to use this yearly report as a guide to developing the skills of our workforce.

Our people are our greatest asset, and we will continue to support their growth through upskilling and reskilling. With a strong workforce, our businesses can continue to adapt and transform, and I have every confidence that Singapore will continue to stay competitive in an uncertain world. Thank you to all our partners who have provided valuable insight to the report, and I look forward to your continued contributions to the SkillsFuture Movement.

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Acknowledgements

What is in store for you?

Dr Gog Soon Joo
Chief Skills Officer
SkillsFuture Singapore

The 2023/24 edition of the Skills Demand for the Future Economy (SDFE) report starts with an analysis of how the skills required by the Singapore economy have changed over time (Chapter I). We also demonstrate how the same analysis can be scoped down, to examine such changes for specific types of jobs. The aim is to guide the reader to make informed choices about what to upskill in to either stay relevant at the current workplace or to pivot to job opportunities with growth potential.

In gist, Critical Core Skills have consistently remained important across all jobs and industries, while skills specific to the application of digital tools have seen the most dramatic changes. This is not surprising, as enterprises and workplaces transform their businesses and operating models to make use of the latest digital applications.

In Chapter II, the report updates on the priority skills for the Green, Digital and Care economies, as had been done

in previous editions. The chapter spotlights those priority skills in the three economies that have been rising in both demand and cross-sectoral transferability. Some of these skills are forecasted to continue growing in demand over the next two years.

This year's edition also introduces content that focuses on career mobility and planning. Chapter III features examples of multi-step pathways to attain desired job roles in the Care, Digital or Green economy. It also features Career Conversion Programmes and SkillsFuture Career Transition Programmes as options for those planning a career transition. There is also a section featuring research by the Institute for Adult Learning¹ on the career mobility of Singapore workers, which shows that individuals who are intentional in the forward planning of their careers (a 'Strong Career Decision-Making State') are more likely to achieve better career progression and wage outcomes.

Following from last year, the report provides updated resources and support for citizens, including advice from career planning experts such as career coaches from Workforce Singapore and Skills Ambassadors from SkillsFuture Singapore (Chapter IV). Employers and

workplaces play a critical role in supporting and directing employees to develop the right skills to help companies stay competitive and resilient. To this end, the report advises employers on the resources and support that they can tap on.

Supplementing the SDFE 2023/24 report, SkillsFuture Singapore has made available, for the first time, a series of datasets and dashboards for users to generate even more useful insights. We encourage partners to use the data and dashboards and give us feedback.

Lastly, I would like to thank all the partners who have contributed to this publication. I look forward to hearing from you.

Chapter 1

Changes to Skills Composition of Jobs in the Singapore Economy (2012-2022)

SkillsFuture Singapore (SSG) conducted a study using 11 years' worth of job posting data, to investigate the changes in skills required by Singapore's economy over time. The analysis provides insight into how employers' demand for skills needed of their workers has changed over the years; what skills are most in demand, what is becoming increasingly important and what is becoming less important. We call this changing portfolio of skills needed the "**skills composition**".

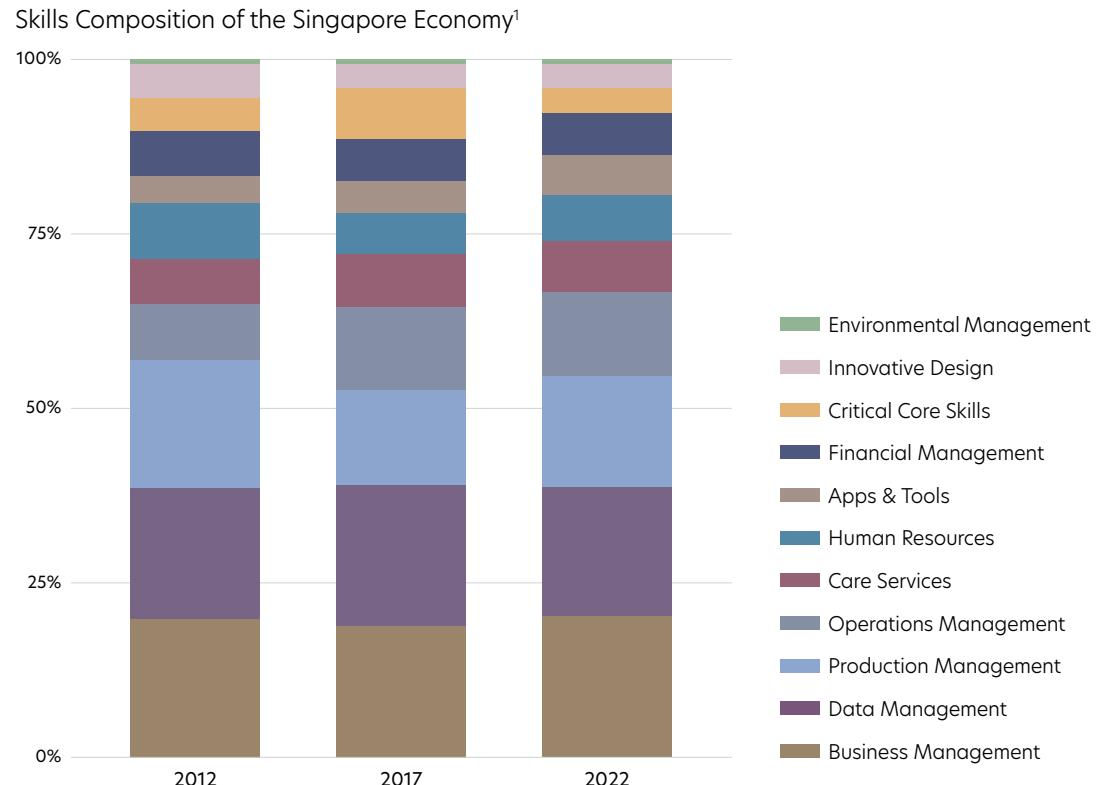
In this chapter, three job families were selected for analysis: hotel and food & beverage (F&B) managers, information technology (IT) infrastructure and cybersecurity professionals and engineers.



The bulk of the skills required by the Singapore economy are in the Business Management, Data Management, and Production Management clusters.

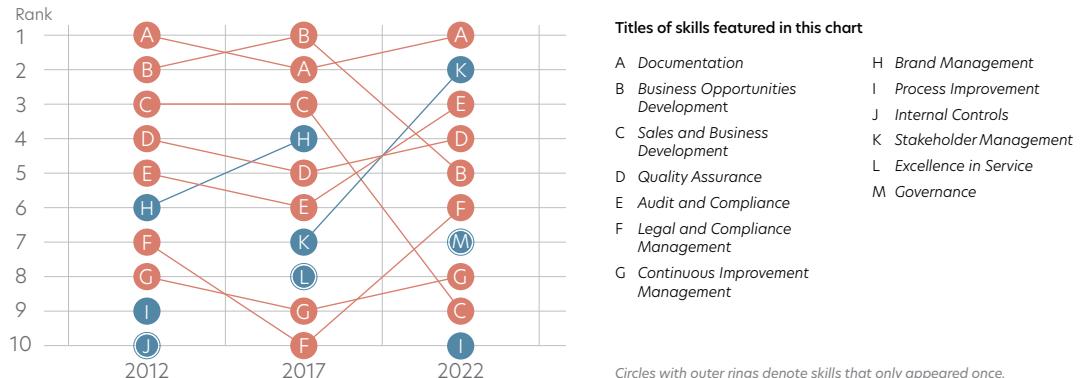
From 2012 to 2022, Business Management, Data Management, and Production Management accounted for the majority of the skills composition of the Singapore Economy. Operations Management increased in relative importance from 8% in 2012 to 12.2% in 2022, reflecting the rise of e-commerce and globalised supply chains. Care Services increased slightly in relative importance from 6.5% in 2012 to 7.6% in 2022, reflecting the increased need to cater to Singapore's aging population.

While the absolute demand for **Critical Core Skills (CCS)** increased in this period, its increase is lower than the other clusters. This resulted in a net decrease in relative importance from 4.8% in 2012 to 3.4% in 2022. Apps & Tools increased in relative importance from 4.0% in 2012 to 6.4% in 2022, reflecting the speed of digitalisation in Singapore.



The top 10 demanded skills in the Business Management cluster remained relatively consistent over the past decade. Stakeholder Management, Governance, and Process Improvement are skills that became more important in 2022.

Top Ten Demanded Skills in the Business Management Cluster



Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

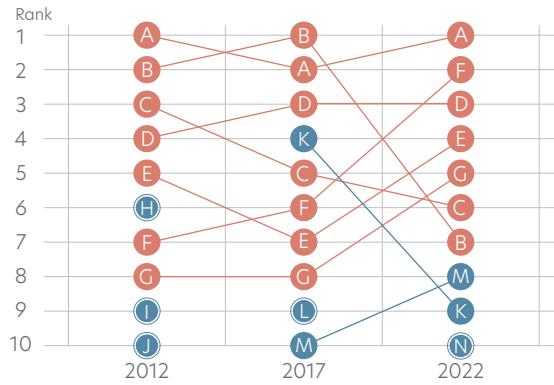
- **Documentation:** Write clear and concise reports
- **Audit and Compliance:** Develop compliance processes and audit strategies
- **Quality Assurance:** Develop and implement quality standards
- **Business Opportunities Development:** Identify new business opportunities
- **Legal and Compliance Management:** Manage compliance with regulations
- **Continuous Improvement Management:** Improve processes and procedures
- **Sales and Business Development:** Generate new business and grow existing accounts

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Stakeholder Management:** Manage stakeholder expectations
- **Governance:** Evaluate governance practices
- **Process Improvement:** Evaluate change and improvement processes

The top 10 demanded skills in the Data Management cluster remained relatively consistent over the past decade. *Customer Data Analysis, Data Protection Management and Artificial Intelligence Application* are skills that became more important in 2022.

Top Ten Demanded Skills in the Data Management Cluster



Titles of skills featured in this chart

A	<i>Programming and Coding</i>	H	<i>Market Research</i>
B	<i>Human Resource Digitalisation</i>	I	<i>Business Environment Analysis</i>
C	<i>Applications Support and Enhancement</i>	J	<i>Systems Integration</i>
D	<i>Applications Development</i>	K	<i>Data Protection Management</i>
E	<i>Engineering Problem Solving</i>	L	<i>Customer Data Analysis</i>
F	<i>Big Data Analytics</i>	M	<i>Database Administration</i>
G	<i>Automation Research and Implementation</i>	N	<i>Artificial Intelligence Application</i>

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

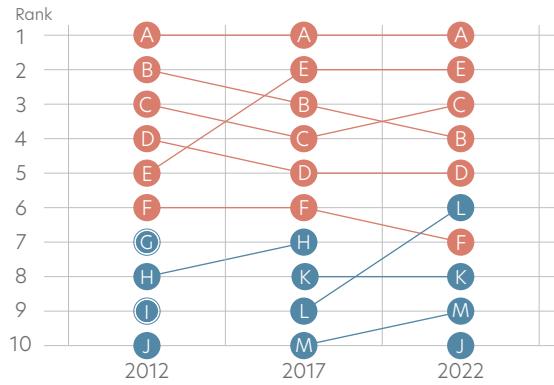
- **Programming and Coding:** Write code to create software programs
- **Big Data Analytics:** Analyse large datasets to find patterns and trends
- **Applications Development:** Develop applications from design specifications
- **Engineering Problem Solving:** Use root cause analysis to solve problems
- **Automation Research and Implementation:** Automate processes using equipment and information technology
- **Applications Support and Enhancement:** Provide technical support and enhancements to applications
- **Human Resource Digitalisation:** Innovate HR processes through digitalisation

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Customer Data Analysis:** Analyse customer data to understand customer behaviours
- **Data Protection Management:** Develop and implement data protection programmes
- **Artificial Intelligence Application:** Integrate artificial intelligence into engineering processes

The top 10 demanded skills in the Production Management cluster experienced some changes over the past decade. Standard Operating Procedures Development, Power Quality Management, and Mathematical Concepts Application are skills that became more important in 2022.

Top Ten Demanded Skills in the Production Management Cluster



Titles of skills featured in this chart

A	Quality Assurance	H	Quality Assurance and Audit
B	Mechanical Engineering Management	I	Process Control
C	Electrical Fundamentals Application	J	Operation Management
D	Civil and Structural Engineering Management	K	Power Quality Management
E	Continuous Improvement Management	L	Standard Operating Procedures Development
F	Preventive Maintenance Management	M	Mathematical Concepts Application
G	Electronic Fundamentals Application		
H			
I			
J			

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

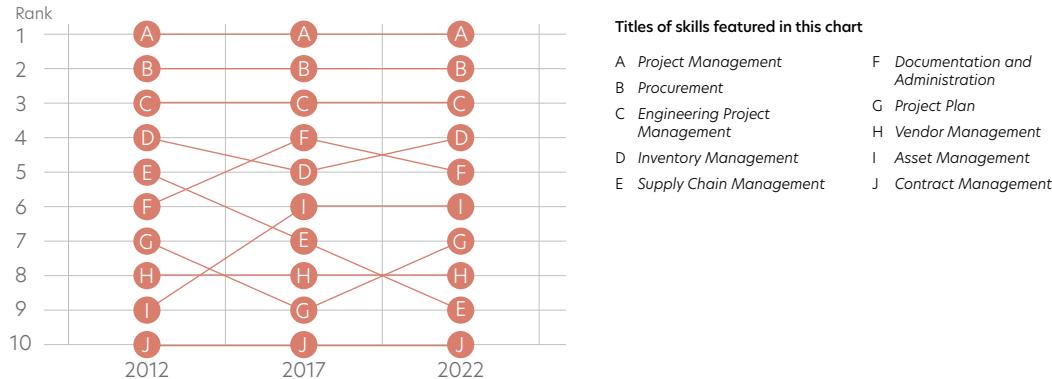
- **Quality Assurance:** Develop and implement quality standards
- **Continuous Improvement Management:** Improve processes and procedures
- **Electrical Fundamentals Application:** Apply electrical principles to aircraft systems
- **Mechanical Engineering Management:** Manage mechanical engineering projects
- **Civil and Structural Engineering Management:** Manage civil and structural engineering projects
- **Preventive Maintenance Management:** Develop and implement preventive maintenance plans

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Standard Operating Procedures Development:** Implement and enforce standard operating procedures
- **Power Quality Management:** Investigate electricity supply issues
- **Mathematical Concepts Application:** Apply math to solve engineering problems
- **Operation Management:** Manage manufacturing operations

The top 10 demanded skills in the Operations Management cluster did not change over the past decade, although there are changes in their ranking.

Top Ten Demanded Skills in the Operations Management Cluster



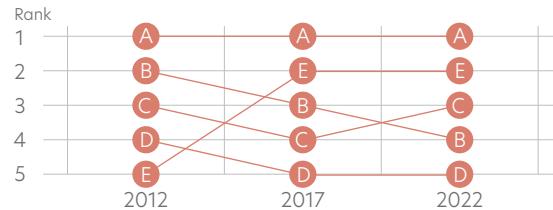
Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Project Management:** Manage projects, stakeholders, resources, budgets and risks
- **Procurement:** Develop and apply procurement processes, select vendors and assess risks
- **Engineering Project Management:** Manage engineering projects, set objectives, plans and timelines
- **Inventory Management:** Formulate and implement inventory strategies, ensuring equipment availability
- **Documentation and Administration:** Develop and maintain supply chain processes and manage supplies and demands
- **Asset Management:** Manage shipping documents, commence loading and unloading
- **Project Plan:** Develop project plans and manage project risks using tools
- **Vendor Management:** Manage vendor relationships and ensure performance as per contracts
- **Supply Chain Management:** Formulate and implement asset management policies and optimise asset performance
- **Contract Management:** Manage contract creation, execution, and analysis while minimising risks

The top five demanded Critical Core Skills did not change over the past decade, although there are changes in their ranking.

CCS are essential for the Singapore workforce to be competitive globally. In today's global economy, businesses need to be able to communicate effectively with clients and customers from all over the world. They also need to collaborate with colleagues from different cultures and backgrounds to solve problems in a fast-paced and ever-changing environment.

Top Five Demanded Critical Core Skills



Titles of skills featured in this chart

- A Communication
- B Creative Thinking
- C Problem Solving
- D Self Management
- E Collaboration

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Communication:** Share information effectively
- **Collaboration:** Work effectively with others
- **Problem Solving:** Identify and solve problems
- **Creative Thinking:** Generate new and innovative ideas
- **Self Management:** Manage one's personal effectiveness and holistic well-being

For organisations and individuals keen on developing CCS at organisational and/or personal levels, CCS Training Providers offer a wide range of courses that cater to various CCS learning needs. For more information, please scan the QR below.



<https://go.gov.sg/ccs-courses>

To find out your individual Critical Core Skills profile, please scan the QR below.



<https://go.gov.sg/ccs-profiling>

Industry Voice

Interview with training providers:

CLAIRE LIM

Head of Business Development, Capelle Consulting Pte Ltd

ANTHONY CHEW

Chief Core Skills Officer, NTUC LearningHub Pte Ltd

GRACE LAM

Director, Seraphcorp Institute Pte Ltd

Following an analysis conducted on job posting data from the past 11 years to identify the most demanded Critical Core Skills (CCS), SSG delved deeper with training partners (TPs) and career coaches to understand the importance of the top five CCS at the workplace.

Question (Q): Why are these five CCS consistently in demand over the past decade and why do employers value them?

Claire: Innovation and digitisation put organisations ahead of their peers and empower them to sustain market relevance. A combination of *Collaboration*, *Problem Solving* and *Creative Thinking* can raise organisations' resilience through co-developing innovative solutions for business problems.

Anthony: The business world is dynamic and complex. To stay competitive, organisations have to constantly review operating models and maintain their competitive edge to meet the ever-evolving shift in market demands. *Problem Solving* and *Creative Thinking* are key CCS employees must have to help organisations grow.

Grace: Employers recognised these CCS as essential future skills that prepare their organisations to adapt to change, remain relevant in the market and be up-to-date with changes in their operating environment.

Q: Are there specific CCS training requests from different sectors or job roles?

Claire: As the built environment sector increasingly digitises, having the right culture, relevant competencies and workable processes are key to ensuring success in this transformation. In addition, clients from all sectors recognised that CCS such as *Problem Solving* and *Self Management* help them build business resilience and display proactiveness in implementing change management.

Anthony: *Communication*, *Collaboration* and *Problem Solving* are sought after by the hotel sector. These skills enable employees to develop positive interactions and delight their guests, resulting in positive reviews and greater guest satisfaction.

Grace: The engineering profession is specifically interested in *Creative Thinking* and providing learners with *Problem Solving* tools, particularly for manufacturing processes. They also indicated an interest in Building Inclusivity to create a warm culture for their multi-national teams.

Q: How are CCS TPs supporting workplaces in developing these five CCS?

Claire: Our training intervention incorporates "Action Learning Projects", consisting of four key components: (1) a clear problem statement focusing on authentic issues faced; (2) a project sponsor; (3) identifying learners with the capacity and capability to learn; and (4) appoint and train learning coaches. This allows learners to apply the CCS to real-life projects in training and reflect on their learning points during group coaching sessions.

Anthony: Face-to-face is still clients' preferred training option to interact more effectively with the trainers. There is also a need to contextualise CCS training content to make it relevant to their workplace contexts.

Grace: Even before embarking on training, the workforce must be aware of the need for CCS and their skills gaps. Currently, there is very little awareness and low urgency in CCS training. Hence, we are raising awareness by sharing bite-sized CCS content over social media.

Industry Voice

Interview with experts:

TAN CHEE KEONG

Principal Career Coach, Workforce Singapore (WSG)

NIRMALA PALAYSAMY

Deputy Director, Public Service Division (PSD)

JEREMIAH WONG

Lead Career Developer, Avodah People Solutions Pte Ltd

JACQUELINE YEUNG

Career Developer, Avodah People Solutions Pte Ltd

ONG YI LING

Career Developer, Avodah People Solutions Pte Ltd

Question (Q): Why are these five CCS consistently in demand and why do employers value them?

Chee Keong: An employee's ability to manage time and work task effectively have always been important to employers. Now, employees need to go beyond that and learn how to manage their emotions and expectations as well. This will enable them to perform optimally in today's increasingly complex workplace.

Jacqueline: Employers want employees to be more self-directed and manage themselves, so that they can focus

on solving complex problems in complicated business environments. *Problem Solving* must be strengthened through a collaborative effort. Effective Communication can only be achieved when individuals understand how others receive information and work together.

Nirmala: With the work landscape and technology evolving so quickly, employers want their employees to have both technical skills and CCS, to be creative, innovative, able to communicate cross-culturally, write and present clearly, and appreciate and embrace cultural differences in collaborations.

Q: What are the CCS individuals need to plan their career trajectory better?

Jeremiah: *Self Management* is the key integrative factor to better career management. Individuals' career health depends on their agency and autonomy to 'want to do something' to either alleviate or advance their careers. External drivers may exert change, but whether it is sustainable and lasting will depend on the 'self'.

Nirmala: *Adaptability* and *resilience*. Career mobility requires individuals to adapt and transit to changing work environments, learn new skills quickly and bounce back from setbacks and failures. These skills give individuals

a positive attitude towards pursuing career goals. Networking skills are also critical for career mobility. Strong professional networks help individuals learn new skills, create job opportunities and gain insights to different industries and job functions.

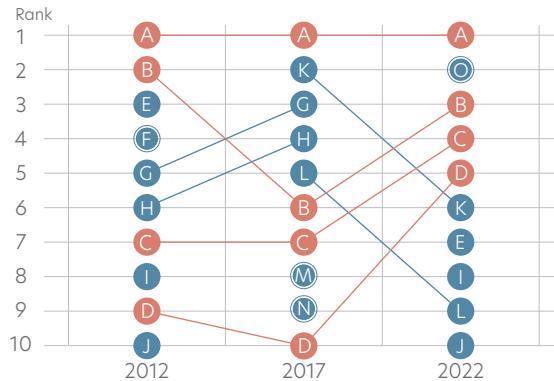
Q: What can individuals do to enhance their career management skills and aptitudes?

Chee Keong: Mastery of CCS, especially those that are consistently valued by employers, can help you better manage your career. Conduct an honest stocktake of where you stand in terms of these CCS and be pro-active about closing the gaps. For example, seek out team-based opportunities that require multi-disciplinary contributions so that you can learn how to better appreciate the collective outcome over individual inputs. This builds collaborative skills.

Yi Ling: Individuals can seek 360-degree feedback from their colleagues and decide on the most important CCS areas to work on. If any of these CCS are badly affecting their career health, they can consult career coaches for deeper self-awareness and customised intervention.

The top 10 demanded Apps & Tools² changed significantly over the past decade. There is a new set of in-demand programming languages, while customer management systems and drawing tools have risen in importance.

Top Ten Demanded Apps & Tools



Titles of skills featured in this chart

A Microsoft Office (Excel)	I CRM Systems
B Microsoft Office (PowerPoint)	J Visual Basic (VB)
C Java	K CSS2/CSS3
D SQL	L Job Control Language (JCL)
E AUTOCAD	M Moz (SEO)
F Enterprise Resource Planning System (ERP)	N PHP
G HTML4/HTML5	O Python
H Adobe Photoshop	

Circles with outer rings denote skills that only appeared once.

Apps & Tools that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Microsoft Office (Excel)**: Spreadsheet software
- **Microsoft Office (PowerPoint)**: Presentation software
- **Java**: Programming language
- **SQL**: Database language

Apps & Tools that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Python**: Programming language
- **CSS2/CSS3**: Style sheet language
- **AUTOCAD**: Computer-aided design (CAD) software used to create 2D and 3D drawings
- **CRM Systems**: Customer relationship management software
- **JavaScript**: Programming language
- **Visual Basic (VB)**: Programming language

² Apps and Tools in this analysis refer to digital and technology solutions programs, in software or app formats, that help people complete tasks more efficiently and effectively.

There is an increasing requirement for Data Management skills and the use of digital Apps & Tools for hotel and F&B managers.

In 2022, the hiring demand for hotel and F&B managers was at 8,367 job posts, which is moderate. The hiring demand is likely driven by the resumption of the tourism industry and growing need for hotel and F&B managers to oversee the operations of hotels, restaurants, and other food service establishments.

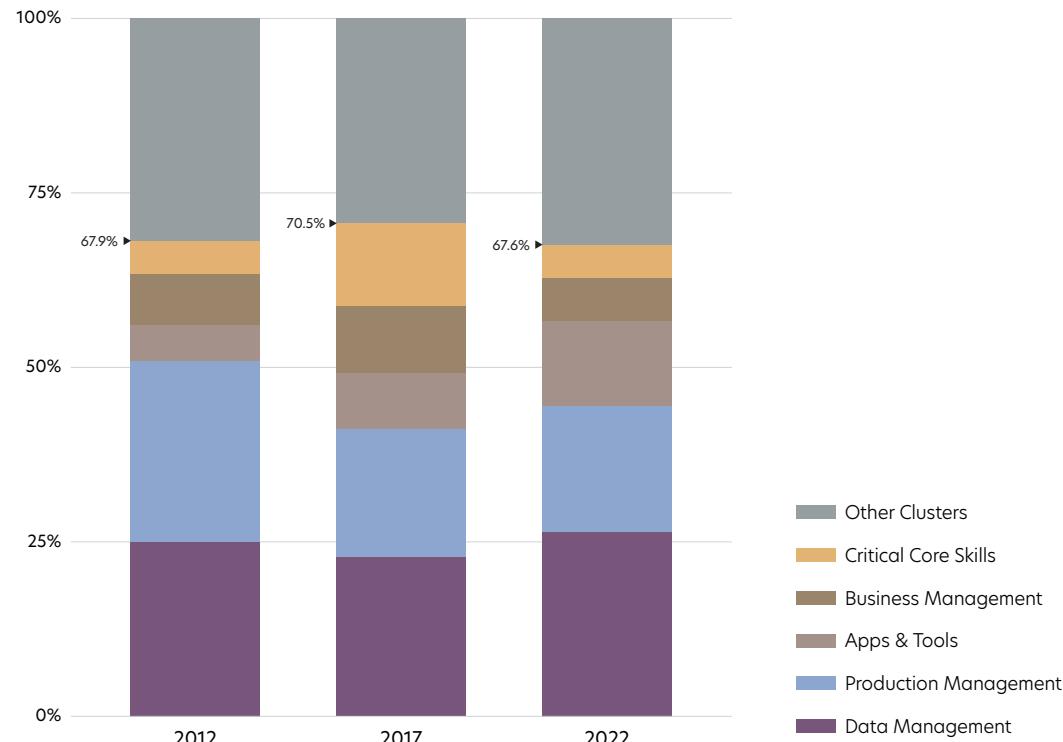
Examples of job roles in this job family include:

- Hotel operations/ lodging services managers
- Restaurant managers
- Catering managers

The total relative importance of the Data Management, Production Management, Apps & Tools, Business Management clusters and CCS remained almost unchanged from 67.9% in 2012 to 67.6% in 2022.

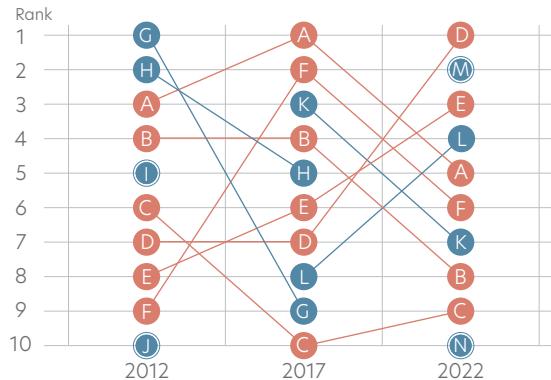
CCS increased in relative importance for this job family, from 4% in 2012 to 11.0% in 2017, but decreased to 4.4% in 2022. Overall, this cluster increased in relative importance for this job family. Amongst the top five demanded CCS for this job family, *Communication, Collaboration, Problem Solving and Creative Thinking* also appeared in the top five demanded skills for the Singapore economy.

Relative Importance of Selected Skill Clusters for Hotel and F&B Managers³



The top 10 demanded skills in the Data Management cluster experienced changes over the past decade. Critical Thinking, Customer Data Analysis, and Data Protection Management are skills that became more important in 2022.

Top Ten Demanded Skills in the Data Management Cluster for Hotel and F&B Managers



Titles of skills featured in this chart

A	Human Resource Digitalisation*	H	Engineering Problem Solving
B	Applications Support and Enhancement*	I	Data Engineering
C	Automation Research and Implementation*	J	Business Environment Analysis
D	Big Data Analytics*	K	Data Protection Management
E	Programming and Coding*	L	Customer Data Analysis*
F	Business Environment Analysis	M	Critical Thinking
G	Market Research	N	Financial Analysis

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Big Data Analytics**: Analyse large datasets to find patterns and trends
- **Programming and Coding**: Write code to create software programs
- **Human Resource Digitalisation**: Innovate HR processes through digitalisation
- **Business Environment Analysis**: Analyse data to understand the business landscapes and environments
- **Applications Support and Enhancement**: Provide technical support and enhancements to applications
- **Automation Research and Implementation**: Automate processes using equipment and information technologies

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

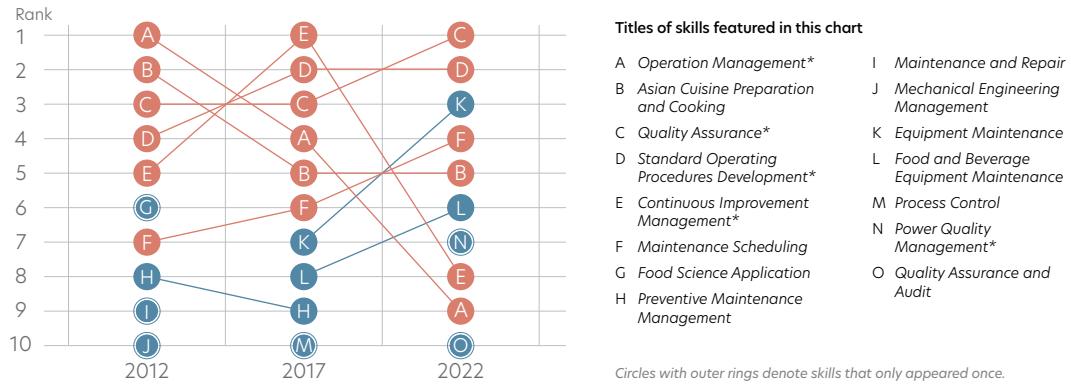
- **Critical Thinking**: Analyse issues, ideas, and reasoning from multiple perspectives
- **Customer Data Analysis**: Analyse customer data to understand customer behaviours
- **Data Protection Management**: Develop and implement data protection programs
- **Financial Analysis**: Analyse financial statements and data to understand the financial performances of organisations

The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Data Management cluster in the Singapore economy in 2022.

The top 10 demanded skills in the Production Management cluster experienced changes over the past decade. Equipment Maintenance, Power Quality Management, and Quality Assurance and Audit became more important in 2022.

Top Ten Demanded Skills in the Production Management Cluster for Hotel and F&B Managers



Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Quality Assurance**: Develop and implement quality standards
- **Standard Operating Procedures Development**: Implement and enforce standard operating procedures
- **Maintenance Scheduling**: Plan and manage maintenance schedules while following standards
- **Asian Cuisine Preparation and Cooking**: Prepare and present Asian cuisine dishes
- **Continuous Improvement Management**: Improve processes and procedures
- **Operation Management**: Manage manufacturing operations

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Equipment Maintenance**: Maintain tools and equipment and improve their performances
- **Food And Beverage Equipment Maintenance**: Maintain food and beverage tools and equipment and improve their performances
- **Power Quality Management**: Investigate electricity supply issues
- **Quality Assurance and Audit**: Carry out security audits

The top 10 demanded Apps & Tools changed significantly over the past decade. Apps & Tools related to programming languages became more important in 2022.

Top Ten Demanded Apps & Tools for Hotel and F&B Managers



Titles of skills featured in this chart

A	Microsoft Office (Excel)	L	Job Control Language
B	Java*	M	Process Control
C	SQL*	N	HTML4/HTML5
D	.NET	O	Microsoft Office (PowerPoint)*
E	Oracle WebLogic	P	JavaScript
F	COBOL	Q	Visual Basic (VB)*
G	IBM Db2	R	PLC Programming
H	J2EE	S	Python*
I	CRM Systems	T	Alfresco
J	Microsoft Office (Word)	K	CSS2/CSS3*

Circles with outer rings denote skills that only appeared once.

Apps & Tools that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Microsoft Office (Excel)**: Spreadsheet software

Apps & Tools that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **CSS2/CSS3**: Style sheet language
- **Moz (SEO)**: Search engine optimisation tool
- **Visual Basic (VB)**: Programming language
- **Microsoft Office (PowerPoint)**: Presentation software
- **Microsoft Office (Word)**: Word processing software
- **Python**: Programming language
- **Alfresco**: Information management software for Windows and UNIX
- **SQL**: Database language
- **Java**: Programming language

The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Apps & Tools cluster in the Singapore economy in 2022.

Profile Story

KUNG TEONG WAH

general manager in a hotel and F&B company

Hospitality and F&B: Industries rooted in tradition, but rapidly evolving with digitalisation

Having worked his way from the kitchen as an executive chef into the boardroom as the general manager, Kung Teong Wah developed his career in the hospitality and F&B sectors. His responsibilities are massive, managing a hotel with 346 rooms, two restaurants, a cocktail bar, and a large banquet.

The evolution of hospitality, F&B and essential skills

Over the years, Teong Wah has seen the hotel and F&B sectors evolve alongside the proliferation of digital technologies and data-driven insights.

Teong Wah elaborates, "When speaking with hotel owners from an older generation, we talk about things the industry traditionally looks at, like service quality and occupancy rates. In contrast, hotel owners in their 30s want to know about digitalisation strategies, using data to drive channel revenue through marketing, and more. Having the experience and digital fluency to connect with hotel owners of both generations is a big advantage."

Speaking about the skills that hospitality and F&B professionals need in the years ahead, Teong Wah highlights *Developing People, Creative Thinking, Problem Solving, and Change Management* as essential for management personnel. He then lists *Communications, Customer Orientations, Learning Agility, and Digital Fluency* as necessary skills for staff to be competitive in a digitalised economy.

Roadmaps for digitalisation and upskilling

In Teong Wah's opinion, the keys to building successful hotel and F&B outlets lie in roadmaps. Specifically, digital roadmaps for the hotels' technology investments, and skills roadmaps for staff to improve their skills and salary.

"In a modern hotel, a digital roadmap helps plan the investments to make in the hotel's technologies, possibly over the next 10 years. It'll also ensure that all the technologies in the hotel are properly integrated, so work can flow seamlessly.

"For instance, we make innovative use of robots to deliver items such as amenities, towels and ordering of in-room dining to guests' rooms and this is only possible with end-to-end integration of our hotel room tablets, doorbells, guest room management system, elevators, and more.

Failing to plan this entire chain properly could lead to bad technology investments that may hold us back for the next decade."

Teong Wah also recognises that low salaries and 'unsexy' job roles like 'waiters' are key reasons why his industries lose their best talents. His solution is pragmatic, "We focus on capacity building and job redesign, especially with our front-end staff, so they can take on bigger job roles of higher value and are more fulfilling. We incentivise them to learn new skills, take on more responsibilities and reward them with the higher salaries that their expanded roles deserve."

Thriving in a rapidly evolving environment

Sharing his thoughts on staying relevant in an environment that is continuously changing, Teong Wah reflects, "The days of lifetime employment in one career are behind us. Today, we can embrace technology and use it to our advantage.

"The good news is that we live in a country with an incredibly comprehensive training ecosystem. Take advantage of it and use your SkillsFuture Credit to stay relevant; in the career you have today, and the one you could be in tomorrow."



Demand for skill in the Business Management and Operations Management clusters, as well as the utilisation of digital Apps & Tools, is rising among IT infrastructure and cybersecurity professionals

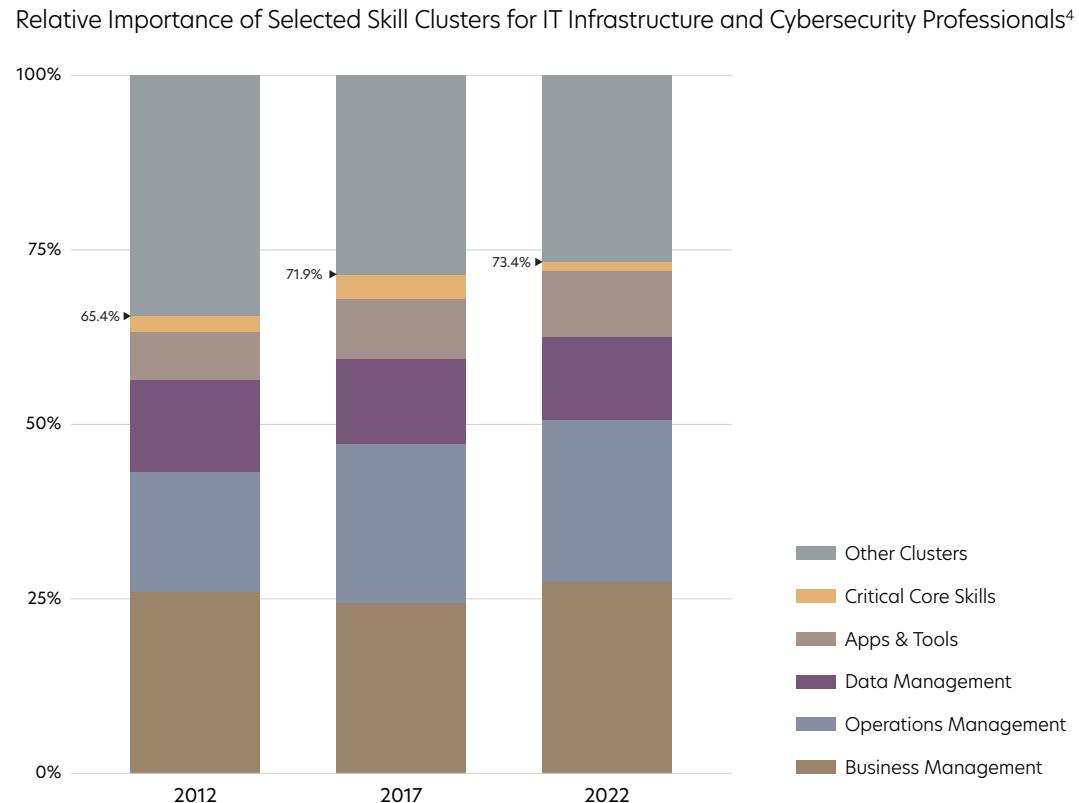
In 2022, the hiring demand for infrastructure and cybersecurity professionals reached 84,307 job posts, which is extremely high. Increased business digitisation and the growing need to protect critical data from cyberattacks drives this hiring demand.

Examples of job roles in this job family include:

- Data centre engineers
- Cloud specialists
- Cyber risk specialists

The total relative importance of Business Management, Operations Management, Data Management, Apps & Tools clusters and CCS increased significantly from 65.4% in 2012 to 73.4% in 2022.

CCS increased in relative importance for this job family, from 1.6% in 2012 to 3.3% in 2017 but decreased to 1.1% in 2022. Among the top five demanded CCS for this job family, *Communication, Problem Solving, Collaboration, Creative Thinking, and Self Management* also appeared in the top five demanded for the Singapore economy.

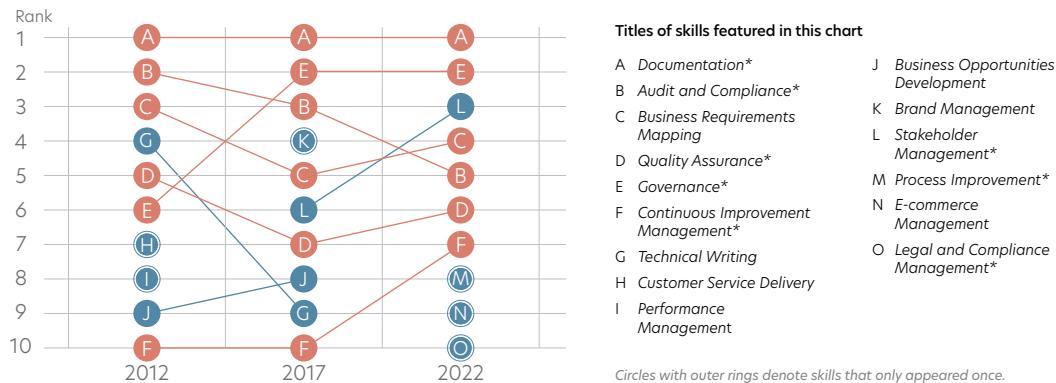


⁴ Based on Singapore Standard Occupational Classification (SSOC) code 252: 'Database, network, infrastructure and cybersecurity professionals'.



The top 10 demanded skills in the Business Management cluster experienced changes over the past decade. Stakeholder Management, Process Improvement, and E-commerce Management became more important in 2022.

Top Ten Demanded Skills in the Business Management Cluster for IT Infrastructure and Cybersecurity Professionals



Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Documentation:** Write clear and concise reports
- **Governance:** Evaluate governance practices
- **Business Requirements Mapping:** Map business requirements to processes, identify gaps, and evaluate solutions
- **Audit and Compliance:** Develop compliance processes and audit strategies
- **Quality Assurance:** Develop and implement quality standards
- **Continuous Improvement Management:** Improve processes and procedures

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Stakeholder Management:** Manage stakeholder expectations
- **Process Improvement:** Evaluate change and improvement processes
- **E-commerce Management:** Develop, manage, and execute e-commerce strategies aligned to organisation objectives
- **Legal and Compliance Management:** Manage compliance with regulations

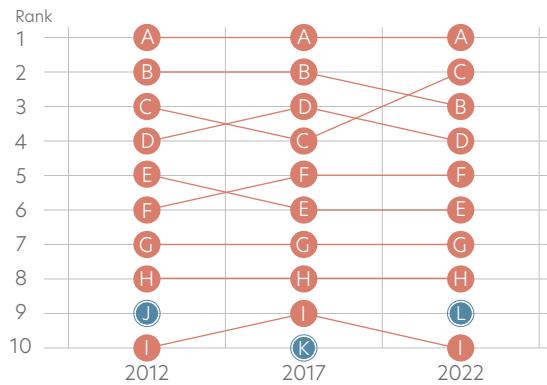
The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Business Management cluster in the Singapore economy in 2022.



The top 10 demanded skills in the Operations Management cluster remained relatively consistent over the past decade. *Project Timeline* is a skill that became more important in 2022.

Top Ten Demanded Skills in the Operations Management Cluster for IT Infrastructure and Cybersecurity Professionals



Titles of skills featured in this chart

A	Project Management*	G	Project Plan*
B	Engineering Project Management*	H	Inventory Management*
C	Documentation and Administration*	I	Warehouse Administration
D	Procurement*	J	Supply Chain Management
E	Vendor Management*	K	Contract Management
F	Asset Management*	L	Project Timeline

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Project Management:** Manage projects, stakeholders, resources, budgets, and risks
- **Documentation and Administration:** Develop and maintain supply chain processes, managing supplies and demands
- **Engineering Project Management:** Manage engineering projects, set objectives, plans, and timelines
- **Procurement:** Develop and apply procurement processes, select vendors, and assess risks
- **Asset Management:** Formulate and implement asset management policies and optimise asset performance.

- **Vendor Management:** Manage vendor relationships and ensure performance as per contracts
- **Project Plan:** Develop project plans and manage project risks using tools
- **Inventory Management:** Formulate and implement inventory strategies, ensuring equipment availability
- **Warehouse Administration:** Schedule warehouse tasks, maintain records, and coordinate with stakeholders

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Project Timeline:** Determine project requirements and develop timelines to ensure timely project delivery

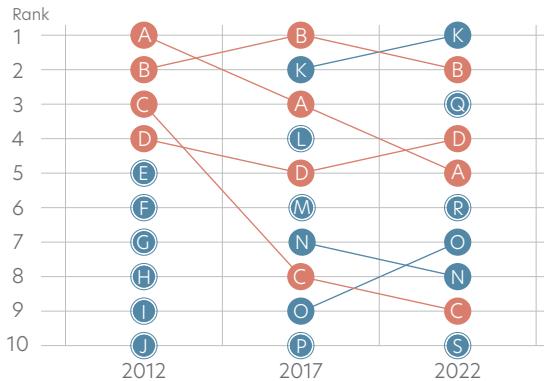
The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Operations Management cluster in the Singapore economy in 2022.



The top 10 demanded Apps & Tools changed significantly over the past decade. Apps & Tools that are related to the management, protection, and productisation of data became more important in 2022.

Top Ten Demanded Apps & Tools for IT Infrastructure and Cybersecurity Professionals



Titles of skills featured in this chart

A	Microsoft Office (Excel)*	J	Perl
B	SQL*	K	Python*
C	Active Directory	L	CSS2/CSS3
D	Java*	M	HTML4/HTML5
E	Enterprise Resource Planning System (ERP)	N	Hadoop
F	Oracle Database	O	Apache Spark
G	Visual Basic (VB)	P	JavaScript
H	AIX	Q	Microsoft Azure Proactive
I	Microsoft Office (PowerPoint)	R	Tableau
J		S	Kubernetes

Circles with outer rings denote skills that only appeared once.

Apps & Tools that are consistently in the top 10 list in 2012, 2017 and 2022:

- **SQL**: Database language
- **Java**: Programming language
- **Microsoft Office (Excel)**: Spreadsheet software
- **Active Directory**: Directory service that helps organisations manage users, computers, and other resources in a central location

Apps & Tools that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Python**: Programming language
- **Microsoft Azure Proactive**: Cloud-based service that helps organisations to identify and remediate potential security threats
- **Tableau**: Data visualisation tool
- **Apache Spark**: Unified analytics engine
- **Hadoop**: Open-source software framework that is used for distributed storage and processing of large datasets
- **Kubernetes**: Open-source container orchestration system for automating deployment, scaling, and management of containerised applications

The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Apps & Tools cluster in the Singapore economy in 2022.



Industry Voice



RAJAT MAHESHWARI

Vice President,
Cyber and Intelligence (Asia-Pacific)
Mastercard

As the world becomes more digitally connected, the need to protect the digital space becomes more critical. According to the World Economic Forum's Global Cybersecurity Outlook 2023⁵, 93% of cybersecurity experts and 86% of business leaders believe global geopolitical instability is likely to lead to a critical cyberattack in the next two years. Further, business leaders acknowledge the lack of skilled cybersecurity talent as a threat to business and society. Sectors such as energy and utilities reported a 25% gap in critical skills.

This is compounded by the ballooning of cybercrime which according to recent estimates⁶, has a worldwide

cost of US\$6 trillion, accounting for 1% of the global GDP; this estimated cost will rise by US\$4.5 trillion in the next few years. The harsh reality for organisations is that data breach or fraud is no longer a question of 'if' but 'when'. This has led to the term 'cyber resilience', which speaks to an organisation's ability to continue to deliver outcomes despite cyberattacks.

When we look at the cause of cyberattacks and the needs of organisations, three areas stand out. The first is that around 60% of data breaches are caused by third parties, such as an external vendor in its supply chain. This is known as third-party risk. This means that though an organisation may have good cyber hygiene, if it does not ensure its third parties have good cyber hygiene, bad actors can exploit these vulnerabilities to gain access. As such, there is a growing need for cybersecurity professionals to have *Cyber Risk Management* skills, especially in the area of third-party risk management. This includes close coordination with finance and procurement to ensure third parties that are onboarded do not introduce vulnerabilities.

The second area is to stem cybersecurity skills shortage in key areas such as cyber threat intelligence (CTI). CTI is the practice of continuously detecting vulnerabilities and potential threats that bad actors may try to exploit. Given the dearth of talent in this field, Mastercard is working with the Nanyang Technology University (NTU) to put together a comprehensive program to grow the CTI talent pipeline that can serve Singapore and ASEAN region.

The third area gaining attention is the application of artificial intelligence (AI) to cybersecurity and trusted AI which aims to ensure AI is free of bias. This is a key area that Singapore could build focus on given its reputation as a trusted business hub.

The three areas highlight the need to develop a talent pipeline in cybersecurity that can meet evolving needs to secure the digital ecosystem.

5 World Economic Forum - "Global Cybersecurity Outlook 2023"

6 PurpleSec website - "Cyber Security Statistics, The Ultimate List Of Stats Data, & Trends For 2023"



Engineers are increasingly required to possess Business Management skills and utilise digital Apps & Tools.

In 2022, the hiring demand for engineers reached 134,767 job posts, which is extremely high. New areas of growth in engineering, which includes 4.0 and sustainable engineering, drives this hiring demand.

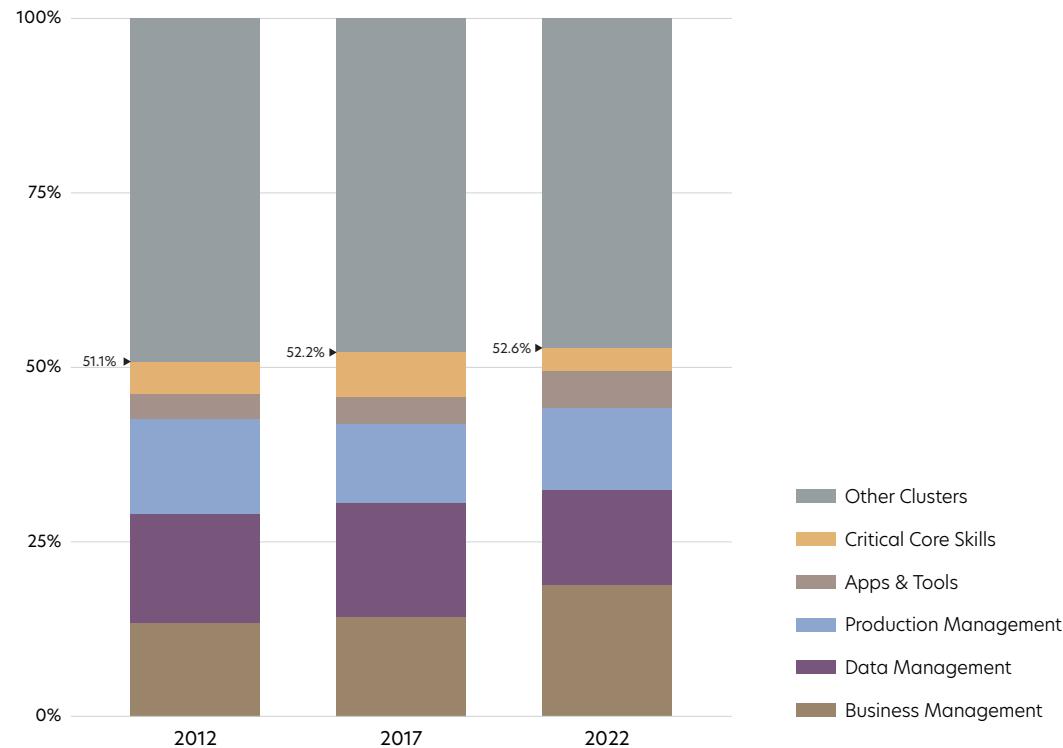
Examples of job roles in this job family include:

- Manufacturing engineers
- Environment engineers
- Quantity surveyors

The total relative importance of Business Management, Data Management, Production Management, Apps & Tools clusters and CCS increased from 51.1% in 2012 to 52.6% in 2022.

CCS increased in relative importance for this job family, from 4.1% in 2012 to 5.8% in 2017 but decreased to 3% in 2022. Amongst the top five demanded CCS for this job family, *Communication, Problem Solving, Collaboration, Creative Thinking, and Self Management* also appeared in the top five demanded for the Singapore economy.

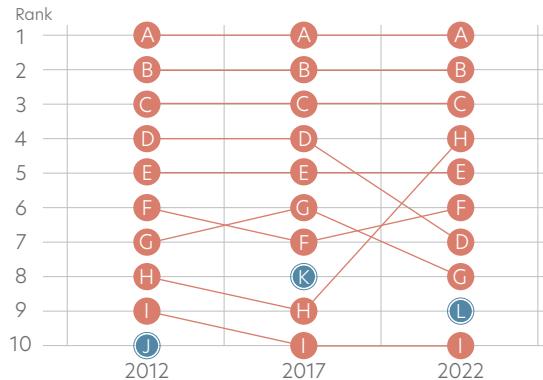
Relative Importance of Selected Skill Clusters for Engineers⁷



⁷ Based on Singapore Standard Occupational Classification (SSOC) code 214: 'Engineering professionals I'

The top 10 demanded skills in the Business Management cluster remained relatively consistent over the past decade. Stakeholder Management became more important in 2022.

Top Ten Demanded Skills in the Business Management Cluster for Engineers



Titles of skills featured in this chart

A Documentation*	H Legal and Compliance Management*
B Quality Assurance*	I Process Development Management
C Continuous Improvement Management*	J Internal Audit Function Management
D Quality Assurance and Audit	K Brand Management
E Audit and Compliance*	L Stakeholder Management*
F Process Engineering Design	
G Process Improvement*	

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Documentation:** Write clear and concise reports
- **Quality Assurance:** Develop and implement quality standards
- **Continuous Improvement Management:** Improve processes and procedures
- **Legal and Compliance Management:** Manage compliance with regulations
- **Audit and Compliance:** Develop compliance processes and audit strategy
- **Process Engineering Design:** Apply process design principles, standards, control, and safety for new and existing plants
- **Quality Assurance and Audit:** Methodological approaches to carry out security audits

- **Process Improvement:** Evaluate change and improvement processes

- **Process Development Management:** Manage process development for new or altered raw materials, catalysts, or products

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

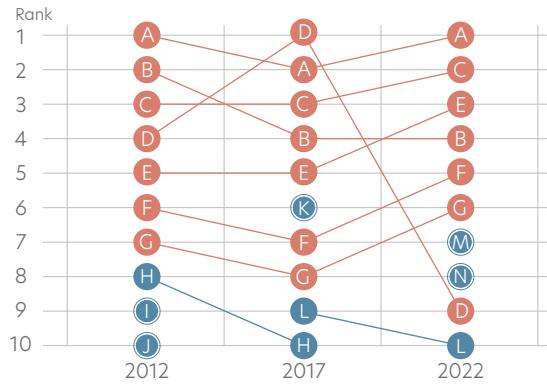
- **Stakeholder Management:** Manage stakeholder expectations

The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Business Management cluster in the Singapore economy in 2022.

The top 10 demanded skills in the Data Management cluster experienced changes over the past decade. Artificial Intelligence Application, Continuous Integration and Continuous Deployment, and Customer Data Analysis became more important in 2022.

Top Ten Demanded Skills in the Data Management Cluster for Engineers



Titles of skills featured in this chart

A	<i>Engineering Problem Solving*</i>	H	<i>Systems Integration</i>
B	<i>Applications Support and Enhancement*</i>	I	<i>Naval Architecture Calculations</i>
C	<i>Programming and Coding*</i>	J	<i>Automation Process Control</i>
D	<i>Human Resource Digitalisation*</i>	K	<i>Data Protection Management</i>
E	<i>Automation Research and Implementation*</i>	L	<i>Customer Data Analysis*</i>
F	<i>Big Data Analytics*</i>	M	<i>Artificial Intelligence Application*</i>
G	<i>Applications Development*</i>	N	<i>Continuous Integration and Continuous Deployment</i>

Circles with outer rings denote skills that only appeared once.

Skills that are consistently in the top 10 list in 2012, 2017 and 2022:

- **Engineering Problem Solving:** Use root cause analysis to solve problems
- **Programming and Coding:** Write code to create software programs
- **Automation Research and Implementation:** Automate processes using equipment and information technology
- **Applications Support and Enhancement:** Provide technical support and enhancements to applications
- **Big Data Analytics:** Analyse large datasets to find patterns and trends

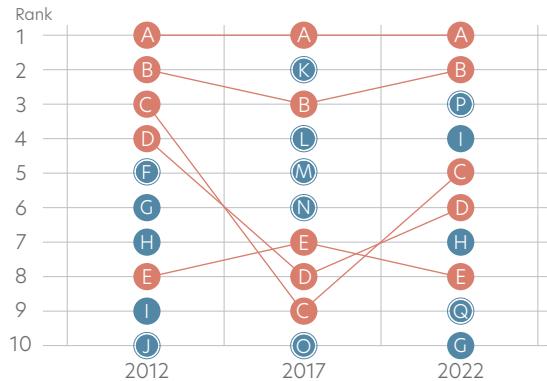
- **Applications Development:** Develop applications from design specifications
- **Human Resource Digitalisation:** Innovate HR processes through digitalisation

Skills that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Artificial Intelligence Application:** Integrate artificial intelligence into engineering processes
- **Continuous Integration and Continuous Deployment:** Automate code changes, testing, and deployment
- **Customer Data Analysis:** Analyse customer data to understand customer behaviours

The top 10 demanded Apps & Tools experienced changes over the past decade. Apps & Tools related to automation and engineering process analyses became more important in 2022.

Top Ten Demanded Skills in the Apps & Tools Cluster for Engineers



Titles of Apps & Tools featured in this chart

A	AUTOCAD*	J	Enterprise Resource Planning System (ERP)
B	Microsoft Office (Excel)*	K	CSS2/CSS3
C	SolidWorks	L	HTML4/HTML5
D	PLC Programming	M	Job Control Language (JCL)
E	Visual Basic (VB)*	N	Moz (SEO)
F	Microsoft Project	O	JSON
G	Microsoft Office (PowerPoint)*	P	Python*
H	C++	Q	Kubernetes
I	Java*		

Circles with outer rings denote skills that only appeared once.

Apps & Tools that are consistently in the top 10 list in 2012, 2017 and 2022:

- **AUTOCAD**: CAD software used to create 2D and 3D drawings
- **Microsoft Office (Excel)**: Spreadsheet software
- **SolidWorks**: CAD software used to create 3D models of physical objects
- **PLC Programming**: Programming language for industrial control systems
- **Visual Basic (VB)**: Programming language

Apps & Tools that appeared in 2022 but did not consistently appear in the top 10 list in 2012 and 2017:

- **Python**: Programming language
- **Java**: Programming language
- **C++**: Programming language
- **Kubernetes**: Open-source container orchestration system for automating deployment, scaling, and management of containerised applications
- **Microsoft Office (PowerPoint)**: Presentation software

The complete list of skills covered, with full descriptions, is provided at the end of the chapter.

* Denotes skills that also appear in the top 10 demanded skills in the Apps & Tools cluster in the Singapore economy in 2022.

Industry Voice



SIM CHER WHEE

Vice President,
Global Talent Acquisition,
Mobility and Immigration,
Micron Technology

Micron Technology is a world leader in innovative memory solutions that transform how the world uses information. Our company has been instrumental to the world's most significant technology advancements, delivering optimal memory and storage systems for a broad range of applications. Having worked in the semiconductor industry for over 30 years, I have witnessed how the industry constantly evolves. While we see the memory and storage industry growing exponentially with all the demand for data, our need for highly skilled talents grows at an accelerated rate too.

The way engineers approach engineering challenges has changed. Looking back a decade ago, *Problem Solving*

skills were more focused on the diagnostic journey where engineers focus on data collection and analysis to make data "digestible". Fast forward to today, with greater systems integration, artificial intelligence (AI) and automation, data is made much more available. The remedy journey on how to draw insights and recommend solutions using *Data Storytelling and Visualisation* has become more important for engineers.

Other than problem-solving, engineers need to have *Critical Thinking*, *Transdisciplinary Thinking* and effective *Communication* skills, which are Critical Core Skills essential for them to thrive at work. Engineers also need to have a growth-oriented mindset and continue to acquire skills to stay relevant and competitive. Regardless of job roles and scopes, employees need to develop T-shaped skills which include deep technical skill sets, complemented by experience, **transferable skills**, and an enthusiasm to learn and collaborate with others.

Inevitably, the advancement of technology will lead to changes in how we work as machine learning and AI

used become more advanced. While some might express concern that technology, such as AI will replace most of the roles in the near future and eventually make humans redundant, I strongly believe that utilisation of AI amplifies the human potential and creates opportunities that we previously could not achieve. Micron is a great example of where AI empowers individuals. Tapping on big data and even machine learning, for example, generative AI, engineers can now do less manual and repetitive tasks, focus more on creative solutions and complex decision-making. We are embedding these skills as part of what we call the "citizen data scientist model" to train our engineers with these new AI skills.

Last but not least, inclusion is the foundation of a thriving workplace, leading us to innovation. According to McKinsey research, diverse and inclusive companies are 35% more likely to be better performing. It is crucial to exemplify the collective effort to nurture talents and uplift the community with diverse semiconductor and engineering industry opportunities.

The analysis of skills compositions help us understand changes in the Singapore economy's skills landscape. The three job families featured in this chapter showed greater changes at work that required augmentation of work activities with digital and technology Apps & Tools, and smaller changes in the respective job family's domain skills. This observation is unsurprising as Singapore's economy has been adopting digital solutions to enhance productivity.

For those who wish to explore further for other types of jobs, you can go to this link:
<https://go.gov.sg/sdfe2023ch1>



Descriptions for Clusters

Skill Cluster	Skill Description
Apps & Tools	Digital and technology solutions programs, in software or app formats, that help people complete tasks more efficiently and effectively
Business Management	Skills needed to plan, manage, and implement a business
Care Services	Skills needed to help people meet their basic needs, such as nutrition, healthcare, and mental wellness
Critical Core Skills	A unique set of 16 core skills identified by Singapore employers as the most critical to thrive in the future economy
Data Management	Skills needed to collect, analyse, and interpret data
Environmental Management	Skills needed to sustain and develop the environment
Financial Management	Skills needed to account, budget, and invest financial resources
Human Resources	Skills needed to recruit, train, reward, and retain employees in an organisation
Innovative Design	Skills needed to apply design principles to create new and innovative designs
Operations Management	Skills needed to plan, organise, and manage resources
Production Management	Skills needed to design, build, and maintain physical structures, machines, and products

Business Management Cluster

Skill Title	Skill Description
<i>Audit and Compliance</i>	Develop compliance processes and audit strategy for the organisation to review adherence to statutory regulatory and standards
<i>Brand Management</i>	Co-create the organisation's projected brand and reputation with the customer, consider customer's perspectives and the organisation's desired image and priorities
<i>Business Opportunities Development</i>	Identify new business opportunities to better meet the needs of existing markets and bring benefits to the organisation
<i>Business Requirements Mapping</i>	Map business requirements to existing processes to identify gaps or opportunities for possible solutions and evaluate impact of solutions against requirements to propose adjustments as needed
<i>Continuous Improvement Management</i>	Apply continuous improvement plans to optimise cost, task efficiency and effectiveness of processes and procedures
<i>Customer Service Delivery</i>	Anticipate customer needs and provide quality customer services as ambassadors of the airports
<i>Documentation</i>	Write clear, concise and readable reports supported by facts and evidence
<i>E-commerce Management</i>	Develop, manage and execute e-commerce strategies and activities according to organisational objectives
<i>Excellence in Service</i>	Create strategies to foster positive customer and/or patient experiences and deliver service excellence throughout the engagement lifecycle
<i>Governance</i>	Evaluate and improve governance practices in the organisation
<i>Internal Audit Function Management</i>	Develop and manage the internal audit function

Business Management Cluster

Skill Title	Skill Description
<i>Internal Controls</i>	Evaluate effectiveness and efficiency of internal controls in the organisation
<i>Legal and Compliance Management</i>	Manage the adherence to applicable legislations and compliance standards
<i>Performance Management</i>	Measure and manage business performance
<i>Process Development Management</i>	Manage process development for new or significantly altered raw materials, catalysts or products including early stage piloting, trial runs and full-scale production
<i>Process Engineering Design</i>	Apply process design principles, engineering standards, control and safety strategies for the development of new and existing process plants
<i>Process Improvement</i>	Evaluate strategic and longer-term impacts of change and improvement processes, as well as communicate to employees improvement plans, goals and changes to operational procedures
<i>Quality Assurance</i>	Develop, implement and monitor practice of clear quality expectations and standards aligned to the organisation's values and business objectives
<i>Quality Assurance and Audit</i>	Methodological approaches to carry out security audits
<i>Sales and Business Development</i>	Manage business development efforts to generate new business or upsell and increase business with existing accounts
<i>Stakeholder Management</i>	Manage stakeholder expectations to ensure continuous levels of engagement by identifying and addressing needs, setting service standards and resolving issues in accordance with organisational procedures
<i>Technical Writing</i>	Apply technical writing approaches to communicate complex information and enable actions in pursuit of defined project goals

Data Management Cluster

Skill Title	Skill Description
Applications Development	Develop applications based on the design specifications; encompassing coding, testing, debugging, documenting and reviewing and/or refining it across the application development stages in accordance with defined standards for development and security
Applications Support and Enhancement	Provide ongoing technical support and improvements to users of applications
Artificial Intelligence Application	Apply algorithmic, statistical and engineering knowledge to integrate artificial intelligence into engineering processes
Automation Process Control	Apply automation process control to monitor performance metrics and quality of manufacturing outputs to determine the optimal settings as well as productivity improvement strategies
Automation Research and Implementation	Manage equipment and information technologies and integrate into organisation operations or processes to achieve organisation desired outcomes
Big Data Analytics	Analyse and validate significant volumes of data to discover and quantify patterns and trends to improve business operations
Business Environment Analysis	Analyse data pertaining to the business landscape and environment, including competitor-analysis, trends and developments in laws and regulations and the impact on the business
Continuous Integration and Continuous Deployment	Manage the planning, building, testing and integration of codes, and deployment of software changes and updates into a live environment
Critical Thinking	Examine, manage and connect issues and ideas from multiple perspectives to identify reasoning in a variety of fields with differing assumptions, contents and methods
Customer Data Analysis	Devise frameworks for customer data analysis to develop an understanding of customer knowledge and behaviour from various customer touchpoints

Data Management Cluster

Skill Title	Skill Description
<i>Data Engineering</i>	Develop and implement efficient and stable processes to collect, store, extract, transform, load and integrate data at various stages in the data pipeline
<i>Data Protection Management</i>	Develop and implement a Data Protection Management Programme to comply with the Personal Data Protection Act 2012
<i>Database Administration</i>	Perform Installation, coordination and upgrading of databases and database servers, performance monitoring and troubleshooting
<i>Engineering Problem Solving</i>	Apply the eight disciplines methodology for systematic problem solving including root cause analysis, failure mode effect and analysis, containment actions, and corrective actions and preventive actions in accordance with organisational systems and processes
<i>Financial Analysis</i>	Analyse the financial statements and data to provide insights about the financial performance and position of the organisation over time
<i>Human Resource Digitalisation</i>	Innovate human resource (HR) processes and practices through digitalisation by evaluating its impact on the delivery of HR services
<i>Market Research</i>	Conduct market research to identify opportunities for enhancing product suites, services and revenue opportunities for the organisation
<i>Naval Architecture Calculations</i>	Apply mathematical and physics calculations to specify capacity, trim and stability details, and ensure seaworthiness of ships, rigs and/or conversions
<i>Programming and Coding</i>	Develop technical capabilities to understand, design and write instructions to be processed by computers as software programmes to achieve desired outcomes
<i>Systems Integration</i>	Realise the system-of-interest by progressively combining system elements in accordance with design requirements and the integration strategy

Operations Management Cluster

Skill Title	Skill Description
Asset Management	Formulate and implement the organisation's asset management policies to optimise asset life-cycles and performance
Contract Management	Manage contract creation, execution and analysis to maximise financial and operational performance and minimise risks
Documentation and Administration	Manage and maintain shipping documents (e.g. cargo import and export documents, shipping permits, bills of lading, booking lists, shipping permits and delivery orders) which are necessary to commence the loading and unloading operations
Engineering Project Management	Manage engineering projects and work areas by setting objectives, project plans, methodologies and timelines to ensure successful outcomes
Inventory Management	Formulate and implement inventory management strategies targeted at ensuring availability of equipment, tools and materials for engineering projects for the purpose of construction, operations and maintenance works
Procurement	Develop and apply procurement processes related to the solicitation of technology services through external providers
Project Management	Execute projects by managing stakeholder engagement, resources, budgets and resolving problems
Project Plan	Develop project plans and manage project risks using appropriate project management tools
Project Timeline	Determine project requirements and develop timelines to ensure timely project delivery
Supply Chain Management	Develop and maintain supply chain processes, comprising feedstock, production, storage, and export, to ensure supply and demand are managed in an integrated manner and in full alignment with production availability, downtime, plant turnarounds and market conditions
Vendor Management	Manage vendor relationships by ensuring performance as per contracts, operations within standards established by the organisation such as adherence to safety, security, and compliance standards
Warehouse Administration	Execute warehouse task scheduling, record maintenance and information coordination with internal and external stakeholders

Production Management Cluster

Skill Title	Skill Description
<i>Asian Cuisine Preparation and Cooking</i>	Prepare and present standard and complex Asian cuisine dishes
<i>Civil and Structural Engineering Management</i>	Manage the design, technical specification, selection, modification and troubleshooting of civil structures and systems to provide civil and structural engineering discipline support to construction, maintenance and project teams
<i>Electrical Fundamentals Application</i>	Apply and use electrical fundamentals for maintenance, repair, overhaul or manufacturing of aircraft electrical and power generation systems
<i>Electronic Fundamentals Application</i>	Apply and use principles of electronics for maintenance, repair, overhaul or manufacturing of aircraft electronics and related systems
<i>Equipment Maintenance</i>	Maintain tools and equipment to meet operation requirements as well as propose strategies for tools and equipment performance improvement
<i>Food and Beverage Equipment Maintenance</i>	Maintain tools and equipment to meet operation requirements and propose strategies for tools and equipment performance improvement
<i>Food Science Application</i>	Apply food science principles food preparation
<i>Maintenance and Repair</i>	Manage and oversee shipboard maintenance and repairs

Production Management Cluster

Skill Title	Skill Description
Maintenance Scheduling	Plan and manage maintenance schedules in accordance with the organisational standards and Original Equipment Manufacturer's recommendations
Mathematical Concepts Application	Apply mathematical concepts to solve engineering problems
Mechanical Engineering Management	Manage the design, technical specification, selection, modification and troubleshooting of mechanical equipment, structures and systems so as to provide mechanical engineering discipline support to construction, operations, maintenance and project teams
Operation Management	Manage the manufacturing operations' standard operating procedures (SOPs) to ensure consistent results of each manufacturing process as well as define and standardise the exact steps to perform specific tasks
Power Quality Management	Investigate electricity supply quality issues to identify root causes and provide advice to consumers on mitigation solutions
Preventive Maintenance Management	Develop and implement preventive maintenance workflows, procedures and practices to optimise plant equipment availability and reliability
Process Control	Apply process control to monitor and optimise process plant performance and quality of production output
Standard Operating Procedures Development	Implement and develop standard operating procedures (SOPs) and enforce compliance with SOPs

Apps & Tools Cluster

Skill Title	Skill Description
.NET	Developer platform with tools and libraries for building any type of app
Active Directory	Directory service for Windows domain networks
Adobe Photoshop	Raster graphics editor for Windows and macOS
AIX	Proprietary UNIX operating system from IBM
Alfresco	Information management software for Windows and UNIX
Apache Spark	Unified analytics engine for large-scale data processing
AUTOCAD	CAD software used by millions worldwide to create precise 2D and 3D drawings and models
C++	General-purpose programming language with object-oriented, generic, and functional features
COBOL	Compiled English-like computer programming language designed for business use
CRM Systems	Technology for managing all your company's relationships and interactions with customers and potential customers
CSS2/CSS3	Style sheet language for describing the presentation of web documents
Enterprise Resource Planning System (ERP)	Integrated management of main business processes, often in real time and mediated by software and technology
Hadoop	Collection of open-source software utilities for using a network of computers to solve problems involving massive amounts of data and computation

Apps & Tools Cluster

Skill Title	Skill Description
HTML4/HTML5	Markup language used for structuring and presenting content on the world wide web
IBM Db2	Family of data management products, including database servers, developed by IBM
J2EE	Computing platform for development and deployment of portable code for embedded and mobile devices
Java	High-level, class-based, object-oriented programming language designed to have as few implementation dependencies as possible
JavaScript	Programming language that is one of the core technologies of the world wide web, alongside HTML and CSS
Job Control Language (JCL)	Scripting language used on IBM mainframe operating systems to instruct the system on how to run a batch job or start a subsystem
JSON	Open standard file format and data interchange format that uses human-readable text to store and transmit data objects consisting of attribute-value pairs and arrays
Kubernetes	Open-source container orchestration system for automating deployment, scaling, and management of containerised applications.
Microsoft Azure Proactive	Cloud-based service that helps organisations to identify and remediate potential security threats
Microsoft Office (Excel)	Spreadsheet software with calculation, graphing, and pivot table features
Microsoft Office (PowerPoint)	Presentation software for creating and delivering slideshows
Microsoft Office (Word)	Word processing software for creating and editing text documents
Microsoft Project	Project management software for developing schedules, assigning resources, and tracking progress

Apps & Tools Cluster

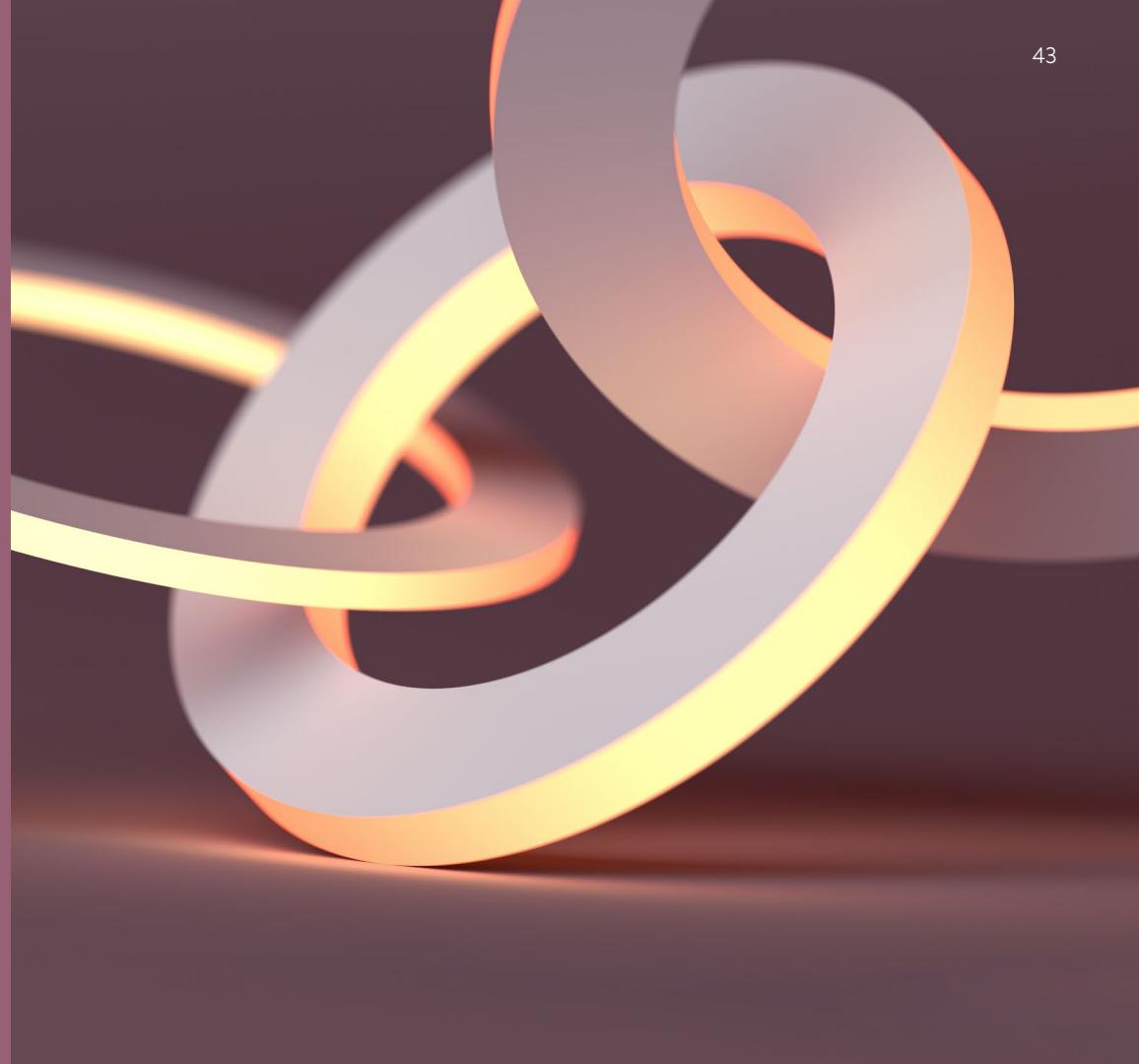
Skill Title	Skill Description
Moz (SEO)	Link explorer tool for exploring the backlink profile of any site
Oracle Database	Multi-model database management system for online transaction processing (OLTP), data warehousing (DW), and mixed workloads
Oracle Weblogic	Java EE application server for developing, deploying, and managing Java applications
Perl	High-level, general-purpose, interpreted, dynamic programming language
PHP	General-purpose scripting language geared toward web development
PLC Programming	Designing and implementing control applications for industrial realtime applications
Python	Programming language
SolidWorks	Solid modeling computer-aided design and computer-aided engineering application
SQL	Domain-specific language used for managing data in relational database management systems
Tableau	Data visualisation tool
Visual Basic (VB)	Multi-paradigm, object-oriented programming language implemented on .NET, Mono, and the .NET Framework

Chapter 2

Priority Skills in the Three Economies: Green, Digital and Care

Having looked at the overall skills composition of the Singapore economy, this chapter spotlights the three economies – Care, Digital and Green, which had also been featured in our previous reports.

This chapter builds on what we reported in 2022 and updates the **priority skills** for these three economies. In addition, the chapter also features the movement trends for selected priority skills, forecasting the skills that may continue to grow in the near term.



Green Economy

Climate change and sustainability will increasingly be at the top of the agenda for both public and private sectors. As a signatory of the Paris Agreement in 2016, Singapore has pledged to meet the goals to reduce carbon emissions by 2050¹ with progressive efforts such as the Singapore Green Plan (SGP) 2030².

The **Green Economy** has seen rapid developments in the sustainability space. Examples of climate mitigation efforts include: (i) the well-established Green Mark certifications for energy-efficient and sustainable buildings³; (ii) rapid deployment of solar energy systems and floating solar farms to enable Singapore's clean

energy transition⁴; (iii) progressive adoption and deployment of electric vehicles and charging stations for private owners and public transport fleets⁵; and (iv) beginning financial year 2025, mandatory climate-related disclosure (CRD) requirements for listed firms which will be progressively implemented beginning financial year 2025.⁶

Further efforts in the Green Economy are underway through sectoral development, including the Sustainable Sentosa Framework⁷, alternative fuel bunkering for the maritime sector⁸, and sustainable aviation fuel and carbon offsetting in the aviation sector⁹. Various

government agencies are also focusing on efforts in climate adaptation, such as (i) coastal protection and improved flood responses through the use of technologies¹⁰; and (ii) digitised climate modelling to predict long-term weather¹¹ and sea-level patterns impacting Singapore¹².

Together, these efforts aim to meet the SGP 2030 goals and beyond. The local workforce must be equipped with sector- and function-specific green skills needed in emerging sectors, and transferable green skills applicable across sectors and job roles.

¹ Singapore and International Efforts on Climate Action

² Singapore Green Plan 2023

³ Green Mark Certification Scheme

⁴ Energy Market Authority website - "Solar"

⁵ Land Transport Authority website - "Our EV Vision"

⁶ Accounting and Corporate Regulatory Authority (ACRA) website - "Singapore's Sustainability Reporting Advisory Committee Recommends Mandatory Climate Reporting for Listed and Large Non-Listed Companies"

⁷ Sustainable Sentosa Framework

⁸ Maritime Port Authority of Singapore media release - "Singapore Sets Out to Drive Transformation in Bunkering"

⁹ Neste website - "Neste celebrates the opening of the Singapore expansion and establishes a sustainable aviation fuel (SAF) supply chain to Changi Airport"

¹⁰ Public Utilities Board's (PUB) sustainability framework

¹¹ Meteorological Service Singapore - "Weather Predictions"

¹² Ministry of Sustainability and the Environment website - "Climate Change"



Priority Skills in the Green Economy – 2019 to 2022



HIGH DEMAND GROWTH



MODERATE TRANSFERABILITY

No. of skills: **10**

These skills tend to be more niche and in emerging sectors.

Examples of skills:
Urban Farming Business Development and Management

Carbon Markets and Decarbonisation Strategies
Sustainability Risk Management



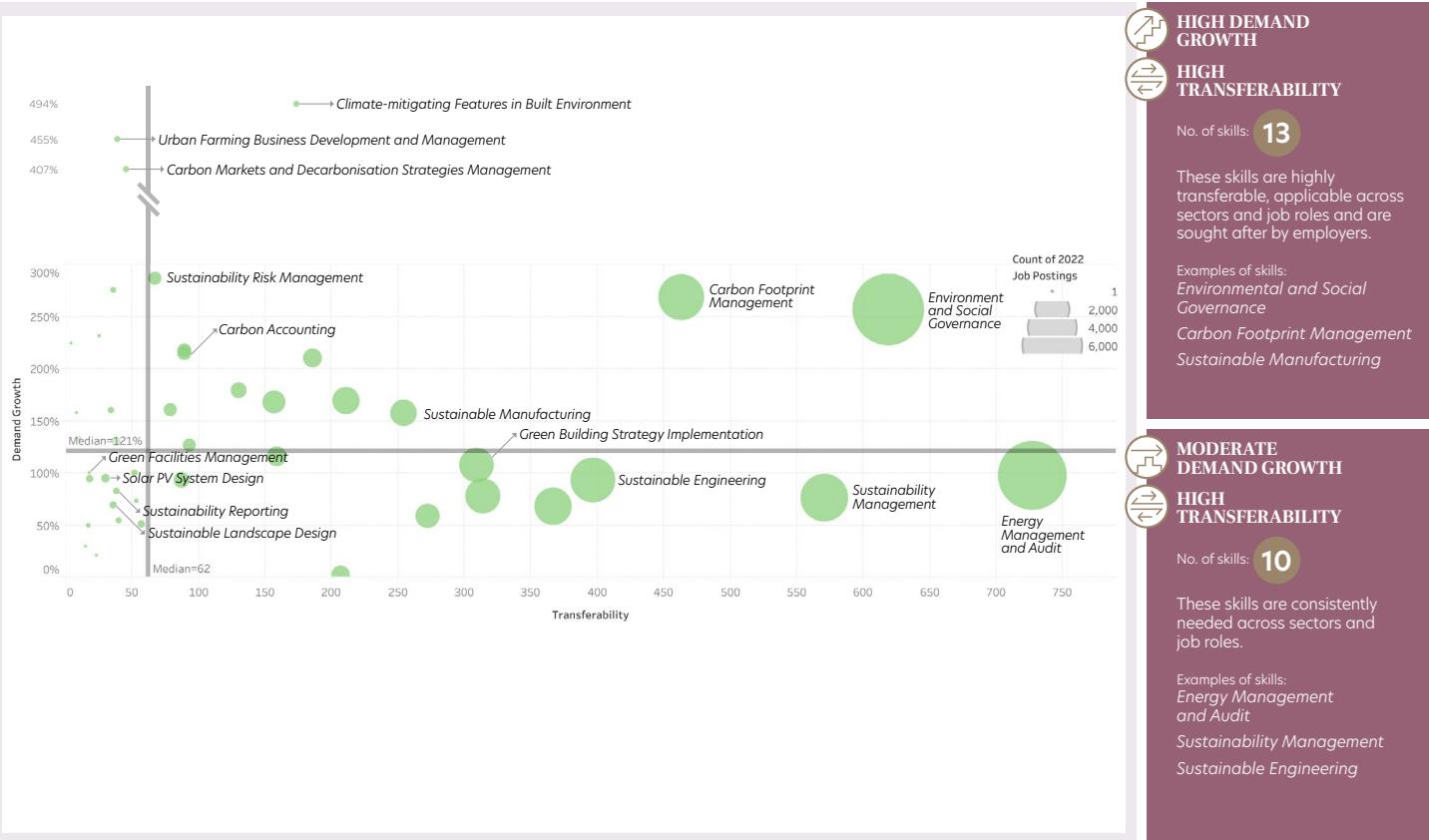
MODERATE DEMAND GROWTH



No. of skills: **13**

These skills tend to be in niche, emerging areas and/or are already well-established.

Examples of skills:
Sustainability Reporting
Solar Photovoltaic System Designs
Sustainable Landscape Design



HIGH DEMAND GROWTH

No. of skills: **13**

These skills are highly transferable, applicable across sectors and job roles and are sought after by employers.

Examples of skills:
Environmental and Social Governance
Carbon Footprint Management
Sustainable Manufacturing



MODERATE DEMAND GROWTH



No. of skills: **10**

These skills are consistently needed across sectors and job roles.

Examples of skills:
Energy Management and Audit
Sustainability Management
Sustainable Engineering



Insight #1 – Green skills growth has been consistent in the last two years, with high demand in emerging areas like agrifood, sustainable finance and carbon management.

Cross-sector and cross-functional skills continue to see high **transferability** with moderate to high **demand growth** from 2019 to 2022. These skills are consistently sought after by employers across job roles and sectors. Examples of these skills include *Environment and Social Governance, Carbon Footprint Management and Energy Management and Audit*.

Skills in emerging areas such as agrifood, sustainable finance and carbon management experienced high demand growth in the past two years. The emergence of the Green Economy created a demand for professionals with the skills needed in green financial structuring, carbon management and carbon services. Furthermore, efforts are ongoing to build up a technology-enabled agrifood sector and workforce to meet Singapore's 30-by-30 food security target¹³ progressively.

Green skills supporting the urban green environment show moderate demand growth and transferability across sectors. Examples of these skills include *Green Building Strategy Implementation and Green Facilities Management*. Since the inception of the Building and Construction Authority's (BCA) Green Mark Scheme in 2005¹⁴, the built environment sector has accelerated the push for greater sustainability outcomes through smart building technologies, resource conservation, enhancing buildings' resilience to climate change and healthier urban environments. Concomitantly, skills such as *Climate-mitigating Features in Built Environment* are being sought after with enhanced emphasis in the latest Green Mark 2021¹⁵.

¹³ Singapore Green Plan 2023 website - "Resilient Future"

¹⁴ Green Mark Certification Scheme

¹⁵ Green Mark 2021



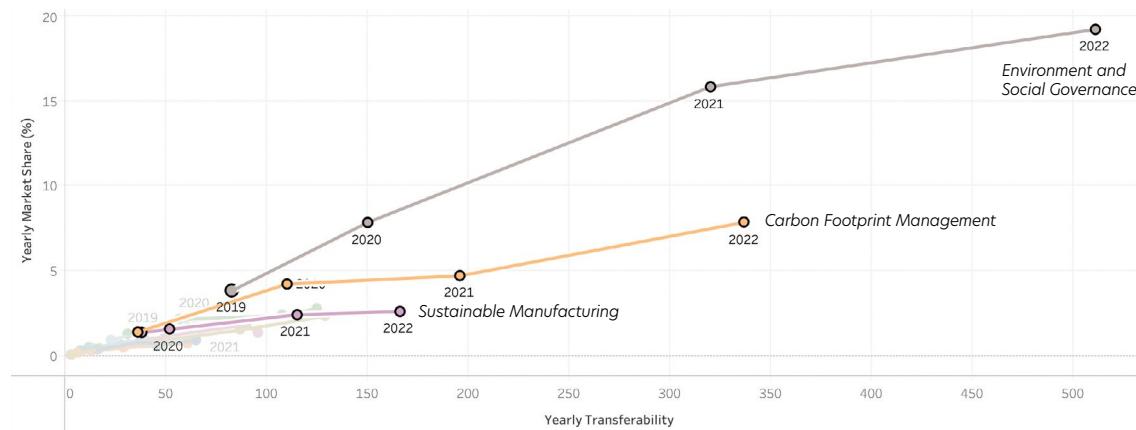
Insight #2 – Three highly transferable green skills across sectors and job roles are seeing high growth momentum.

Environmental and Social Governance (ESG), Carbon Footprint Management and Sustainable Manufacturing are the fastest-growing skills in the Green Economy.

ESG is the most transferable skill and is required by more than 500 unique job roles in 2022. Individuals possessing this skill can support their organisations by incorporating ESG principles within compliance, business operations and service and product offerings. Job roles that need this skill include internal auditors, business valuation managers and product managers.

Carbon Footprint Management and Sustainable Manufacturing are skills related to implementing and managing sustainability strategies and ESG goals within business operations, products and service offerings. Examples of job roles requiring these skills are energy engineers, compliance advisory managers, operations and maintenance managers and engineering procurement managers.

Movement of Skills in the Green Economy with High Demand Growth and Transferability





Insight #3 – Compliance requirements pushed the demand for skills in sustainable finance, carbon management, decarbonisation and sustainability risk management.

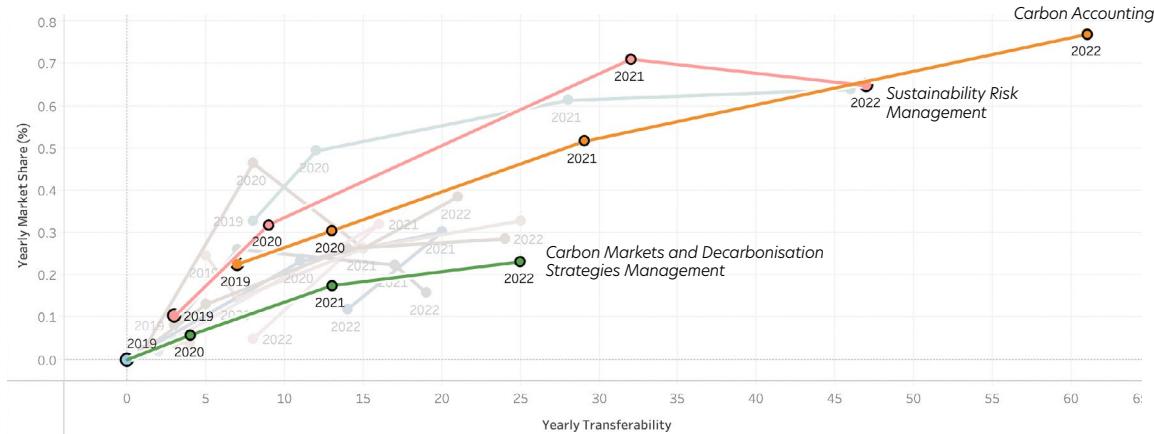
From 2025, climate-related disclosures (CRD) requirements will be progressively implemented for listed firms¹⁶. It is foreseen that skills related to sustainable finance and carbon management will be increasingly sought-after by employers and present good skills investment opportunities for individuals.

Carbon Accounting, Carbon Markets and Decarbonisation Strategies Management and Sustainability Risk Management are examples of such skills. They are required in job roles such as finance managers, compliance advisory managers and risk analysts.

As operations in environment, health and safety (EHS), process engineering, marine and maintenance transit to more sustainable practices, these skills are required in technical and engineering job roles like EHS specialists, marine engineers, marine consultants and operations and maintenance managers.

¹⁶ ACRA website – “Singapore’s Sustainability Reporting Advisory Committee Recommends Mandatory Climate Reporting for Listed and Large Non-Listed Companies”

Movement of Skills in the Green Economy with High Demand Growth



* These three skills are found in the high demand and high transferability quadrant (top-right) of the Green Economy skills scatterplot.

Industry Voice

**EVAN LAW**

Assistant Chief Executive,
Accountancy Sector Development Group
Accounting and Corporate
Regulatory Authority (ACRA)

As we stand at the intersection of climate change and corporate accountability, businesses must not only embrace sustainable practices but also be transparent about their environmental impacts.

Sustainability development is one of our key national agenda under the Singapore Green Plan 2030. Earlier this year, ACRA and the Singapore Exchange Regulation (SGX RegCo) launched a public consultation on the recommendations by the Sustainability Reporting Advisory Committee (SRAC) to advance climate reporting

in Singapore¹⁷. As we embark on this journey, Singapore will need to build a strong talent pool of sustainability reporting professionals across businesses and professional services firms.

A 2022 study showed that sustainability reporting is among the top professional services that large corporates and small and medium enterprises (SMEs) are requesting from accounting practices in Singapore¹⁸. This rising demand for sustainability reporting presents new opportunities for accounting and finance professionals in Singapore. With the proposed adoption of mandatory reporting as recommended by the SRAC, the number of accounting entities and workforce providing sustainability-related services are expected to triple by 2025¹⁹.

Accounting professionals will play a crucial role in reporting on businesses' sustainability performance to stakeholders, with existing job scopes expected to

expand to include sustainability-related responsibilities such as assurance. This would mean that new skills in green financing, *Sustainability Risk Management*, carbon markets and credit need to be acquired to take on the enlarged role²⁰. New job roles such as ESG specialists²¹ and ESG managers²² are also expected to emerge and support businesses to implement and review their sustainability agenda.

In line with this, a dedicated working group under the Green Skills Committee, led by ACRA and Enterprise Singapore, has been set-up to develop a skills plan for sustainability reporting and assurance. In addition, ACRA is also committed to support and work with professional bodies and industry stakeholders on capability and capacity building efforts to equip professionals with the requisite sustainability reporting and assurance skill sets, thus enabling businesses and individuals to reap opportunities in the Green Economy.

17 ACRA website - "Public Consultation on Turning Climate Ambition into Action in Singapore"

18 ACCA and Singapore Accountancy Commission. (2022). Market Demand for Professional Accountancy Services in Singapore: FY2021-2024.

19 Accounting and Corporate Regulatory Authority. (2023). AE Census 2022

20 Institute of Singapore Chartered Accountants, Singapore Management University, Singapore Accountancy Commission, Ernst & Young. (2022). Sustainability: Jobs and Skills for the Accountancy Profession.

21 WSG website - "Manpower study of Singapore-based accounting practices"

22 WSG website - "Study on in-house Finance and Accounting functions"

Profile Story

ELANGO ANGAYAR KANNI

assistant vice president of finance and human resources at a nutrition and supplements company

The science of sustainability planning

Kanni Elango is not only the AVP of Finance and HR at her workplace, she is also an advocate for sustainable practices, both at home where she encourages recycling with her family, and at work where she develops production plans and sustainability reports that reduce wastage for her company.

From day-to-day management to future planning

Before stepping into her current role, Kanni was doing managerial finance for the organisation. According to her, it was a role that "involved managing day-to-day situations". Of her present role, Kanni says, "Now, my work also involves research and planning. There's more forward-thinking because of the emphasis on production control and waste reduction, which lies at the heart of the company's sustainability efforts."

Benefits of planning with sustainability in mind

Elaborating, Kanni tells us, "Since 2018, our company has been placing a greater emphasis on sustainability. During this time, we developed and implemented our company logistics plan, or CLP. This plan details when we order supplies, how much we order, how packaging is done, and other aspects of the production chain."

The benefits of comprehensive production planning is already paying off. Since implementing their CLP, wastage has been reduced by 15%, making the new process better for the environment, and healthier for their balance sheet.

Acquiring key sustainability skills

Planning these processes and preparing sustainability reports does require specific sets of skills; expertise that Kanni needed to acquire for the role.

To acquire these skills, Kanni's employer enrolled her in the Career Conversion Programme (CCP) for Sustainability Professionals funded by Workforce Singapore (WSG). Kanni also embarked on a mix of self-learning and company-sponsored training. Among the courses she

attended were a SkillsFuture Singapore (SSG) funded course to pick up the HR-related skills needed for her present role, and an ISO Audit Report course where she learnt how to prepare internal audits.

Her colleagues have been helpful too, often sharing related news articles, brochures, and other sustainability-related resources with her.

Kanni highlights *Sustainability Reporting*, *Sustainability Risk Management*, *Sustainability Management*, and *Carbon Footprint Management* as the top skills needed in her role.

Advice for moving into a sustainability-focused role

What would Kanni say to fellow mid-career professionals thinking of making a change? She advises, "If you feel like you're getting bored of the same work and are slowing down as a result, change could be just what you need! Welcome change, charge yourself up, and give 100% to your role and you'll have a fulfilling career."



Profile Story

TANYA SNG

director of climate change and sustainability services at a global professional services partnership

What determines a career path: Your qualifications or your passions?

Tanya Sng has always had a soft spot for environmental, social, and governance (ESG) issues - whether it is protecting our environment, helping children, or other ESG-related matters.

Having studied accounting and law in university, Tanya decided that finance would be the area she was best qualified for and joined the financial firm, Ernst & Young (EY), immediately after graduation.

Moving into a sustainability-focused role

After beginning her career as a financial auditor, Tanya transitioned to transactions advisory and internal finance roles with the firm, before deciding to shift her career direction. "While financial roles seemed like a natural choice with my qualifications," Tanya shared, "I've always been interested in the social aspects of what organisations do."

With this in mind, Tanya took on her current role as a director with EY's climate change and sustainability services team. In this position, she advises EY's clients on matters that are near and dear to her heart, including climate change and sustainability-related matters, such as clients' sustainability frameworks, ESG reporting and decarbonisation efforts.

An essential suite of skills for the green economy

Tanya points to Carbon Footprint Management, Environment and Social Governance, Sustainability Management, Sustainability Reporting, Sustainability Risk Management, Energy Management and Audit, Carbon Accounting, as well as Carbon Markets and Decarbonisation Strategies Management as a complementary set of skills that she believes are crucial for professionals in her position.

Tanya explains how these skills enable professionals like her to properly advise clients on sustainability reporting. "Having a skills gap could mean that you're not aware of certain regulations - and this could result in our clients not setting proper baselines and monitoring standards, which could impact them negatively. As consultants in the Green Economy, we must have the skills and knowledge to offer advice covering all the bases."

The various paths to acquiring skills

Tanya takes a multi-pronged approach to learning, and is thankful for the support provided by her employer. "Within EY, there's a comprehensive learning curriculum that's curated by the learning and development (L&D) department." She explains, "We can take up self-paced learning via e-learning modules, or sign up for relevant courses and accreditations."

With her mindset of constant improvement driving her, Tanya has already acquired several key accreditations to build her capabilities. These include the GARP Sustainability and Climate Risk (SCR) certificate, GRI Certified Sustainability Professional, and the IFRS Foundation Fundamentals of Sustainability Accounting (FSA) Credential.

Before leaping into a new career

Sharing her thoughts with other professionals looking to make a passion-based career switch, Tanya says, "First, gain clarity into whether your desired role really encompasses what you envisioned. Network with individuals already in the role, ask them about the pros and cons of the career, the key skills needed, and more.

"Once you've decided to make the move, be proactive in building up your knowledge and skills to prepare yourself for success in your new role!"

Digital Economy

Singapore has made significant strides in leveraging technology for growth and innovation, committing to the **Digital Economy** through strategic partnerships and initiatives aimed at exploring the potential of technologies such as artificial intelligence (AI) and business digitalisation. This has enabled Singapore to rank among the top five global economies in the International Institute for Management Development (IMD) World Digital Competitiveness Ranking 2022²³.

The Digital Economy, which includes the Infocomm Technology (ICT) sector and digitalisation efforts in other industries, accounted for 17% of Singapore's GDP

in 2022²⁴. This is expected to reach around US\$30 billion in 2025, driven by e-commerce and digital finance services²⁵. To ensure continued growth, Singapore must build a trusted, interconnected, and inclusive Digital Economy through the enhancement of hard and soft infrastructure, such as robust networks for faster connectivity and secured digital transaction²⁵.

However, the scarcity of digital talent and high adoption costs pose challenges for Small and Medium Enterprises. To address this, the government aims to increase the number of digitally skilled workers by 55%, from the present 2.2 million in the workforce²⁶.

Singapore's exploration of technologies has the potential to drive innovation and create significant economic value. For instance, while generative AI is still in its early days, the use of this nascent technology is already widespread and its impact on productivity could add trillions of dollars in value to the global economy²⁷.

Businesses should, therefore, continue to leverage on data and AI related skills to push for business innovation and digital transformation.

²³ International Institute for Management Development (IMD) World Digital Competitiveness Ranking

²⁴ Straits Times - "Cyber security, connectivity needed to tap potential of digital economy: DPM Wong"

²⁵ 7th edition of the e-Economy SEA report by Google, Temasek and Bain & Company

²⁶ Today Online - "Singapore needs another 1.2 million workers trained in digital skills by 2025"

²⁷ McKinsey Aug 1 Report, The State of AI in 2023: Generative AI's breakout year.



Priority Skills in the Digital Economy - 2019 to 2022

**HIGH DEMAND GROWTH****MODERATE TRANSFERABILITY**No. of skills: **53**

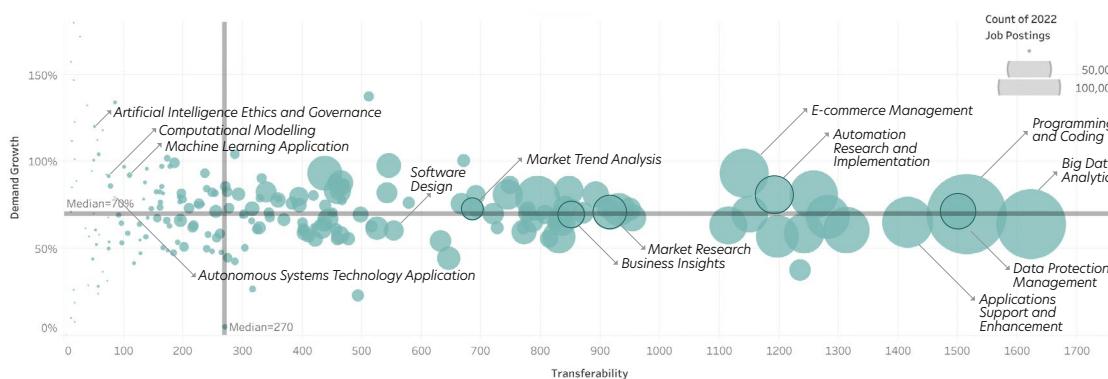
These skills tend to be highly technical and/or in relatively new functional areas but are not required across many job roles.

Examples of skills:
*Workflow Digitalisation
Marketing Campaign Management*

**MODERATE DEMAND GROWTH**No. of skills: **54**

These skills may have plateaued in demand and consolidated within several job roles.

Examples of skills:
*Network Configuration
IT Asset Management*

No. of skills: **48**

These skills see relatively high demand growth and are required across many job roles.

Examples of skills:
*Artificial Intelligence Application
E-commerce Management*

**MODERATE DEMAND GROWTH**No. of skills: **58**

Despite moderate demand growth, these skills are required across many job roles.

Examples of skills:
*Programming and Coding
Big Data Analytics*



Insight #1 - Digital transformation and emerging technology are leading the trend toward businesses leveraging data and AI for business innovation.

Tech-lite job roles, such as marketing executives, data analysts and sales executives, require skills that enable businesses to respond quickly to market changes and customer needs. *Market Research*, *Market Trend Analysis*, *Data Protection Management*, and *Business Insights* are among the skills with high demand growth and have high transferability.

For **tech-heavy** job roles, such as software engineers, data engineers and DevOps engineers, skills such as *Software Design*, *Programming and Coding*, and *Big Data Analytics* are becoming increasingly crucial. These skills see steady demand growth and high transferability for businesses to leverage data and technology to deliver personalised and relevant customer experiences.

Emerging technology-related skills with high demand growth but moderate transferability, such as *Machine Learning Application*, *Autonomous Systems Technology Application*, *Artificial Intelligence Ethics and Governance*, and *Computational Modelling*, are associated with megatrends of AI and automation. Tech-heavy job roles, such as AI engineers and data scientists, need to keep up with the latest trends in data and AI to remain relevant and effective in their roles. As these technologies continue to evolve and become more prevalent in business and society, the demand for these skills will likely continue to grow.



Insight #2 - Three skills continue to trend high in transferability with steady demand growth.

Programming and Coding is crucial in developing software applications and websites and automating work tasks. *Programming and coding* is a required skill for software engineering managers, associate software engineers, software developers and mobile and application-related job roles that require this skill.

Big Data Analytics is becoming increasingly important to businesses for data-driven decisions to improve business-related outcomes. Data specialised job roles, such as data analysts, data engineers, and data centre engineers are in high demand as businesses leverage the power of big data to gain insights. Other non-data specialised job roles, such as e-commerce managers, audit managers, and business analysts are also in demand. Professionals in job roles harness big data's potential to personalise products and services with the aim of meeting customer needs better.

Application Support and Enhancement is critical for job roles such as systems support engineers, applications support engineers, and product engineers. This skill is essential in providing transformative solutions and digital infrastructure such as the Internet, big data, and AI.

Movement of Skills in the Digital Economy with High Transferability





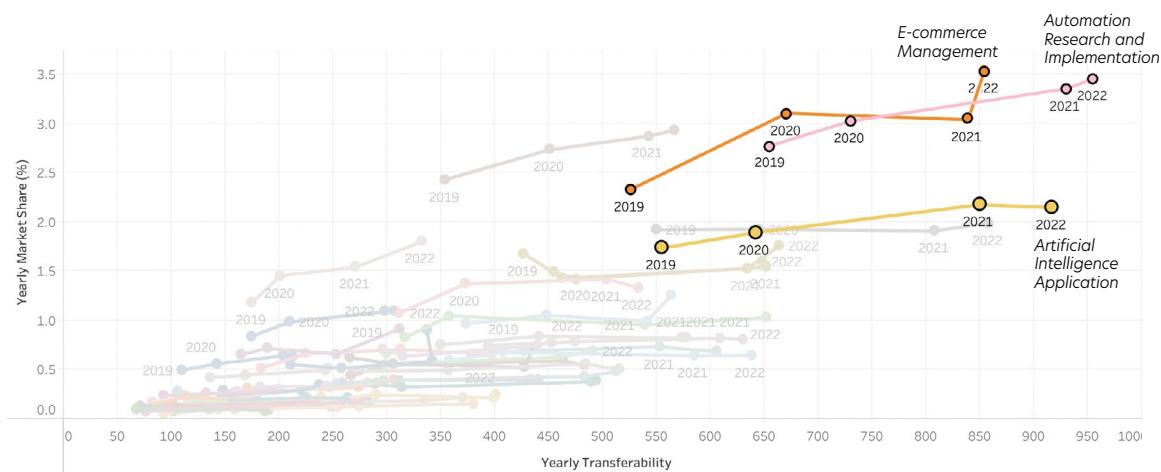
Insight #3 – There is a general surge in demand and transferability for Automation Research and Implementation, E-commerce Management, and Artificial Intelligence Application across business functions and sectors.

E-commerce Management creates new opportunities for businesses and transforms the way they operate. Job roles in online sales, such as e-commerce executives and online sale channel managers, are crucial to support the e-commerce function. In the last two years, more retail job roles, such as merchandising associates and retail managers have grown in their need for this skill as more retailers harness the potential of omnichannel strategies.

Automation Research and Implementation enables productivity improvement by streamlining processes, reducing errors and fostering innovation. DevOps engineers and cloud specialists are examples of job roles that have consistently supported businesses in their drive for automation and digitalisation. Furthermore, specialised job roles, such as automation and orchestration engineers, automation technicians and digital transformation managers are seeing greater demand from employers.

Artificial Intelligence Application is transforming business operations and outcomes by improving efficiency and enhancing decision-making capabilities. The introduction of generative AI to allow machines to create new content in various forms has further enhanced AI capabilities to transform businesses. Job roles, such as data scientists and AI engineers, use this skill to leverage AI technologies to drive productivity. As general-purpose AI applications become increasingly widespread, tech-lite job roles such as innovation managers, portfolio management analysts, and financial planners are also increasingly using this technology.

Movement of Skills in the Digital Economy with High Demand Growth and Transferability



Industry Voice

**BENJAMIN MAH**

Co-Chairman,
SGTech Talent Committee

We stand on the brink of a technological generative AI revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has witness termed as a Kairos season.

In Singapore, as well as globally, the generative AI market is burgeoning at an unprecedented rate. Experts predict that by 2025, the global AI market will exceed \$190 billion, with generative AI playing a pivotal role in this surge. Singapore, recognised as a technological hub, is positioned to harness this potential, with the government pushing for innovation and the private sector eagerly adopting generative AI solutions.

Small and Medium Enterprises (SMEs) in Singapore are starting to embrace generative AI technologies to improve their operations. Customer service managers use generative AI to automate responses, enhance customer interaction, and reduce the time to resolve customer issues. For marketing managers, generative AI provides data-driven insights, creates personalised marketing campaigns, and generates creative content, thereby boosting marketing efficiency and effectiveness. Besides these two functions, there are increasingly more use cases across various business functions on the use of generative AI to complement their work. To be successful, they should possess a blend of AI knowledge and business acumen.

In addition, generative AI unicorns like Anthropic and Cohere are increasing their employee strength to continually build and enhance generative AI capabilities. Some of these roles include software engineers and AI/ML research scientists. Software engineers design, code, and debug the software infrastructure that powers these generative models. AI/ML research scientists are tasked

with running experiments, improving the models, and developing new algorithms.

Deep tech organisations such as GovTech and IBM are recruiting a wide range of professionals, including software developers, AI/ML engineers, data engineers, data scientists, and business analysts.

The incorporation of generative AI-related skills is not just a necessity; it's a strategic move to accelerate business growth. By harnessing the power of AI-generated content and solutions, companies can streamline processes, enhance customer experiences, and make data-driven decisions. Moreover, this transformation doesn't just impact external operations, it also holds the key to upskilling the workforce. Employees equipped with generative AI skills can contribute to the development and implementation of AI-driven strategies, ensuring a symbiotic relationship between technology and human expertise.

Profile Story

CAROL WONG

data advocate at a local tech consultancy firm

Journeying from a sunset industry to future tech

After 29 years of telling stories through her work in the publishing industry, Carol Wong transitioned to a dramatically different career - albeit one that also involves telling stories.

As a data advocate at JJ Innovation, Carol Wong is, in her own words, a 'data storyteller'. Now, instead of being in an industry that collects words into sentences to tell imaginative tales, she collects data and makes sense of it, then helps her clients to visualise all the useful ways they can use this data to improve their organisation.

A learning mindset, and a successful transition

Carol's journey into the Digital Economy has been fast-tracked by her willingness to learn, and enabled by the proactive use of her SkillsFuture Credit. During the COVID-19 pandemic, Carol took on several digital courses,

including Advanced Management Spreadsheet, Basic Data Analytics, and Google Data Analytics Professional Certification courses.

More crucial to her successful career switch, she also enrolled in the Junior Data Engineer track of the SkillsFuture Career Transition Programme. The 15-week bootcamp equipped her with key digital skills like the Python programming language, and Carol was fortunate that her cohort also received bonus lessons on machine learning and artificial intelligence (AI) as her instructor wanted to shed more light on these upcoming technologies. Through the programme, Carol also got to connect with JJ Innovation, who loved her drive for professional development and hired her.

Developing the skills for a digital career

When asked about the most important skills for professionals in her field, Carol named *Artificial Intelligence Application*, *Artificial Intelligence Ethics and Governance*, *Big Data Analytics*, *Business Insights*, *Machine Learning*, and *Information Collection* as the skills that digital professionals (and especially data advocates) should prioritise.

However, Carol notes that technical skills are only one part of the equation. "Soft skills are also important for digital professionals," she says. Elaborating, Carol tells us, "In tech, it's important to have a growth mindset, be able to accept setbacks, and have the skills to communicate with both team members and external stakeholders. This includes voicing your opinion when you hear something you don't agree with, because it's an important part of the process."

Thriving in a supportive environment

Carol also credits her workplace, and the mentors she's had along her journey, for her seamless transition into the digital space. "The company gives us the resources we need to succeed, like scholarships for pursuing Google and Microsoft certifications, to become proficient in using relevant tools.

"Also, I've met some amazing mentors. From career advisors in the tech industry to my 'tech buddy' at the bootcamp, and my boss at work - these digital professionals have guided me at every turn, and I appreciate every one of them."



Profile Story

CHUA KIAT LEONG

software engineer at a digital solutions company

From F&B entrepreneur to software engineer: Essential skills for transitioning

Any career transition is challenging, but moving from food and beverage (F&B) business owner to software engineer can be a leap too far for most people. For Chua Kiat Leong, however, it was a challenge he willingly jumped into.

The journey from F&B to software engineering

In 2019, Kiat Leong stepped into the bold world of entrepreneurship when he set up an F&B business that offered delicious, customisable salad bowls to health-conscious diners. When the COVID-19 pandemic hit the F&B industry badly, Kiat Leong decided it was time to refocus his efforts into an area that piqued his interest while he was in university – technology.

Recalling how he enjoyed problem solving and the satisfaction of debugging issues and enhancing features

in one computing class he took in university, Kiat Leong signed up for a 9-month SGUnited Java Developer Course in 2021 and set his sights on taking on a tech role – which he eventually landed as a software engineer with CrimsonLogic.

"The company was open to hiring people without experience, and promised mentorship as well. It was everything I could hope for, so I was excited to give it a shot," Kiat Leong says, explaining his decision to take on this role.

Key digital skills

Identifying the skills he uses most as a software engineer, Kiat Leong pointed to *Applications Support And Enhancement, Programming and Coding, Software Design, and Software Testing* – all skills that SkillsFuture Singapore (SSG) has identified as key digital skills, and covered in the SGUnited Java Developer Course he enrolled in.

Diving deeper, Kiat Leong explains, "A big part of my job involves understanding how clients use their applications, recognising the enhancements they need, and being able

to create these add-ons. The other side is identifying issues that clients are having with programs, and solving these issues for them. That's why in my role, the most used set of technical skills is *Application Support and Enhancement*.

"With that said, as I need to speak with clients, people-facing skills are also important. This is where my F&B experience has been useful, as I used to speak with customers, vendors and suppliers every day."

Kiat Leong also credits his team for making his career switch a smooth one. "My managers and colleagues have guided me along and taught me how things are done. Being new to the field, I've asked many questions, and they've always been open with answering my queries and being a part of my learning journey."

Leaping into the Digital Economy

Reaching out to other Singaporeans interested to enter the Digital Economy, Kiat Leong has this to share. "If this is a space you're really interested in, go for courses to learn the necessary skills, then make the jump! It may be tough at the start, but keep learning and the results will pay off in the end."

Care Economy

The **Care Economy** is a vibrant field that is continuously innovating ways to care for, support and empower citizens to reach their full potential.

Singapore's diverse and ageing population poses an ongoing demand growth for care services. With one in four citizens expected to reach 65 and above by 2030²⁸, the government has taken steps to address the need for various care services to promote preventive health measures, including proactive initiatives such as Healthier SG.

Health technology continues to be a key enabler in expanding care services through virtual consultation

and ward management and enabling coordinated care provision supported by the National Electronic Health Record.

Education services are an integral part of the Care Economy. Singapore adopts a holistic approach to developing its citizens, beginning with early childhood education and continuing through lifelong learning. Measures supporting the vulnerable, such as KidSTART and the Enabling Masterplan 2030, ensure accessibility to quality education and create meaningful employment opportunities for all population segments. This approach cultivates a resilient and versatile workforce as the foundation of

a competitive and inclusive economy.

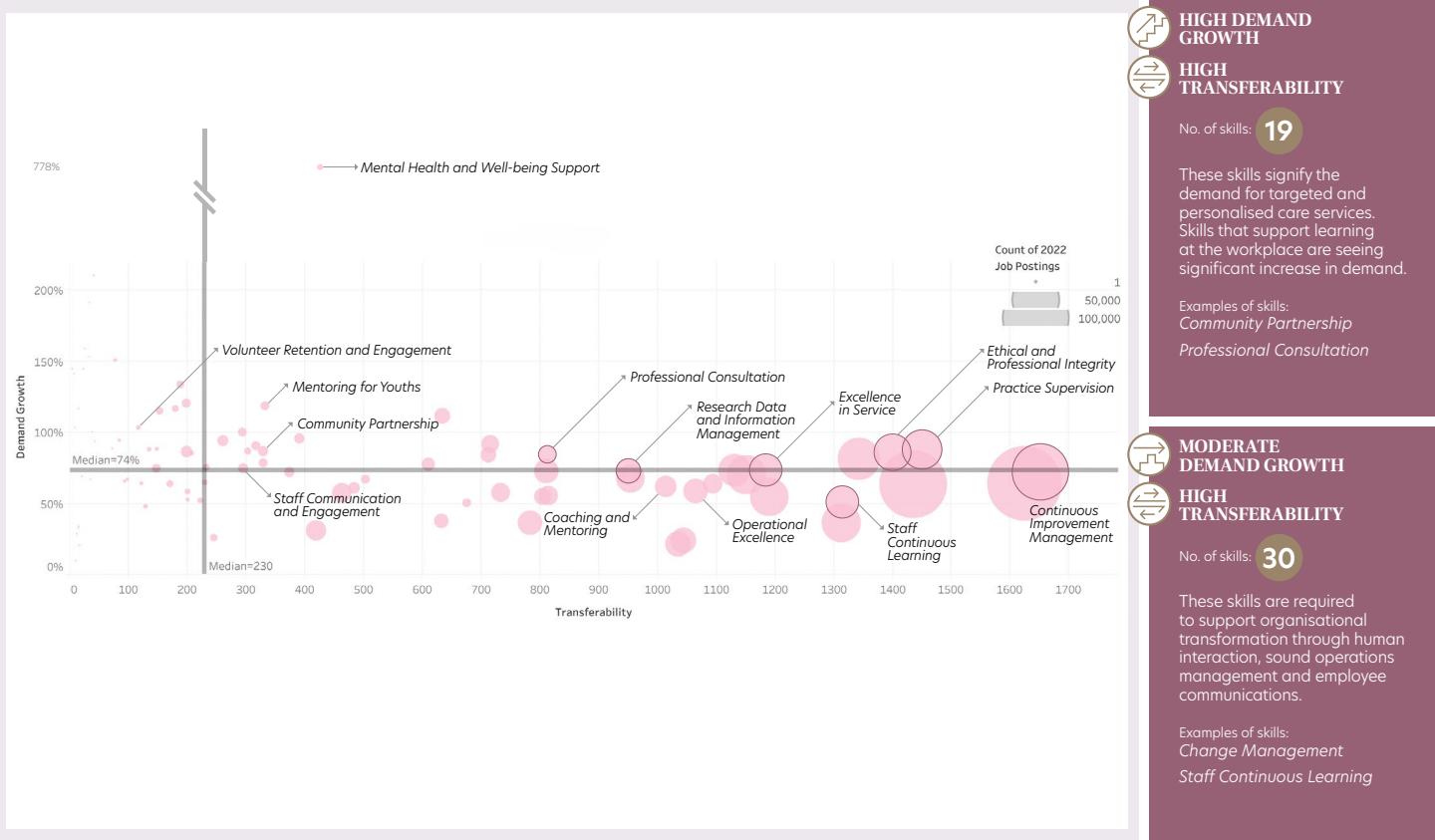
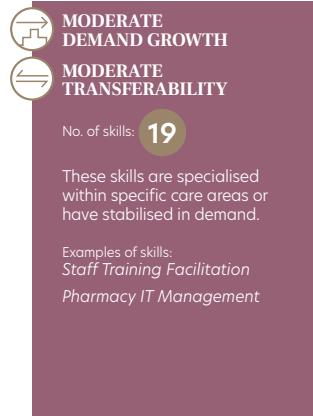
Employers play a major role in adopting a skills-based talent development and management approach to address skills competitiveness. The ongoing innovation initiated by the stakeholders within the lifelong learning ecosystem will continue to strengthen the responsiveness and scalability of Singapore's reskilling and upskilling efforts.

As the Care Economy transforms, care professionals will correspondingly embrace new work practices, augment their work with technologies, and maintain their learning agility to acquire new skills.

²⁸ Population Brief 2022, jointly published by National Population and Talent Division, Strategy Group, Prime Minister's Office, Singapore Department of Statistics, Ministry of Home Affairs, Immigration & Checkpoints Authority and Ministry of Manpower



Priority Skills in the Care Economy - 2019 to 2022



Insight #1 - Ongoing demand for care services spur demand for skills that support holistic care provision and innovative business models.

Skills that foster collaboration, such as *Community Partnership* and *Professional Consultation*, have experienced high demand and are required by various job roles such as medical social workers, early intervention educators, and psychologists.

Singapore's labour market remains tight, and volunteers remain a vital augmented resource in segments of the Care Economy, particularly in areas such as befriending seniors and mentoring youths. These social support services have led to a surge in demand for skills such as *Volunteer Retention and Engagement* and *Mentoring for Youth*. *Staff Communication and Engagement*, as

well as *Coaching and Mentoring* skills, also remain important to hiring many job roles to ensure staff are aligned with the organisations' transformation journey and skilled accordingly.

With ongoing changes in the Care Economy, employers recognise that innovating business models would require them to keep abreast with best practices, use technology to harness services, and involve staff in ideation. Skills experiencing high growth and sought after in many job roles include *Business Opportunities Development*, *Research Data Collection and Management* and *Operational Excellence*.



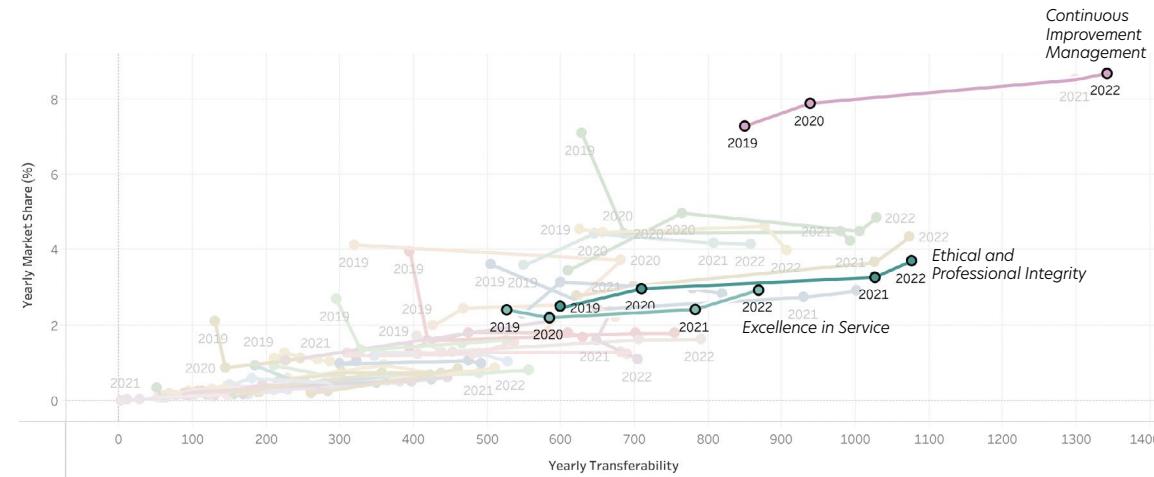
Insight #2 - Employers continue to demand skills that enhance service experience and service delivery value chains.

Continuous Improvement Management is essential to enhance service quality and respond to changing business environments. Staff members require this skill at all levels to identify issues, brainstorm workable solutions, and implement change. Various job roles in care services provision require this skill, from frontliners such as staff nurses and operation executives, to middle-office enablers, such as facilities managers.

Ethical and Professional Integrity is a vital skill in the Care Economy as it builds trust, upholds moral principles, maintains confidentiality and promotes patient/client autonomy. As care providers work with various partners to provide holistic care, it is vital to manage shared data carefully. Many job roles require this skill, including teacher aides, centre managers, policy officers and researchers.

Care service recipients are often vulnerable and expect individualised care tailored to their needs. *Excellence in Service* ensures that care providers can deliver responsive services to the needs of the individuals and their families. Many job roles, such as healthcare assistants, patient service executives and allied health professionals require this skill.

Movement of Skills in the Care Economy with High Transferability





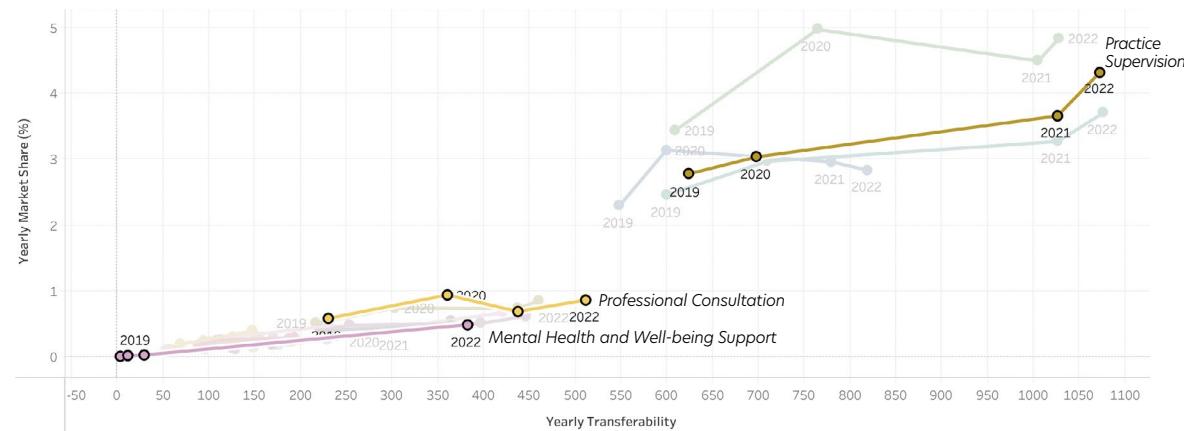
Insight #3 - Demand for care skills is increasing because professionals within and beyond the Care Economy require them to achieve collective care outcomes.

Practice Supervision provides a structured and supportive process for professionals to reflect on their practice, identify areas for improvement, and develop new skills and competencies. This skill is not only needed by care professionals in healthcare, social service and early childhood sectors, but is increasingly in demand by employers for researchers, site supervisors, and sous chefs.

Professional Consultation enables interdisciplinary teams comprising medical and social service professionals to work together to address client's physical, emotional, and social needs. Job roles requiring this skill include care staff, occupational therapists, nurse managers, and social service workers.

With increasing recognition for the impact of mental health on employee well-being and productivity and organisations' overall success, employers are looking to *Mental Health and Well-being Support* to promote good mental health practices at the workplace. Job roles requiring this skill include business leaders, like a head of department or director, to lead in this effort, especially in high-stress environments.

Movement of Skills in the Care Economy with High Demand Growth and Transferability



Industry Voice



LYNETTE ONG
Chief Operating Officer,
Tan Tock Seng Hospital

Today, about 1 in 5 citizens is 65 years and above. By 2030, it would be almost 1 in 4 citizens over 65²⁹. This is a familiar narrative, and indeed, we are on the travellator to be a super-aged society. While Singapore is building more healthcare facilities in anticipation of expected healthcare needs, it is imperative that we make a parallel and timely pivot in care models for a more sustainable healthcare system which would otherwise burden future generations.

Healthier SG was launched recently, shifting emphasis from acute care to preventive care. It calls for healthcare institutions to go beyond the familiar operating models, by collaborating with one another and with community and social care partners, to encourage healthy individuals to stay healthy and for discharged patients to be cared for comfortably at home and in their community.

What does this mean in terms of priority skills for the Care Economy? It calls for healthcare professionals to develop *Community Partnership* skills to establish and foster partnerships with community stakeholders, through a culture of collaboration, to develop mutually beneficial programmes for residents, patients, and their caregivers. *Operational Excellence* and service design are critical to designing a user-centred healthcare experience that yields effectiveness and efficiency. Tan Tock Seng Hospital's (TTSH) Integrated Care Hub (ICH) is designed to facilitate rehabilitation at every moment, such as allowing eligible patients to self-administer medications, to easing the transition from discharge to home and community.

Digitalisation is a key enabler for easier access to care and services in patients' homes through remote monitoring technologies, robotics, and artificial intelligence (AI). The Mobile Inpatient Care at Home (MIC@Home) enables patients to receive hospital-type care in the comfort of their homes through teleconsultations and home visits by healthcare professionals until they are deemed fit for discharge. *Practice Supervision* is another required skill for healthcare professionals to scale the use of digitalisation

in a safe and ethical way. Our medical 3D printing centre, which started operations in 2020 with the printing of jigs or custom tools to aid in surgery, has since honed its capabilities to print custom-made prostheses, such as prosthetic noses for cancer survivors.

A multi-generational workplace is becoming common in the healthcare industry as well. *Staff Engagement and Communication* is an essential skill to manage the dynamics of a multi-generational workforce, and bring out the best in our people to serve the mission we have. One of TTSH's workforce transformation strategies is to build a competent and future-ready workforce through annual competency and training framework reviews and learning needs analysis for all staff.

The skill, *Effective Client Communication*, is expected to grow in demand in the healthcare sector, especially as we advocate for residents, patients, and their caregivers to take charge of their healthcare needs. This requires healthcare professionals to understand 'what matters' to our 'clients', for an effective nudging to adopt a healthy lifestyle and follow through of treatment plans.



Profile Story

CHUA WAN TING

hospitality and environmental services executive at a local hospital

Spreadsheets and schedules: A life in finance to a career in operations

After 12 years in finance, Chua Wan Ting was comfortable in her role and doing well in her career at Tan Tock Seng Hospital (TTSH). But, this curious lady wanted to explore 'the other side' – specifically, the other side of the spreadsheets and budgets she received from her colleagues in the operations department.

A curiosity that led to a career switch

Wan Ting wanted to experience what the hospital was like outside of the finance office, where communications typically revolved around emails and phone calls. In the office, decisions were always made with numbers in mind, and Wan Ting wanted to see – with her own eyes – how the budgets she looked at every day, were being used for the betterment of the hospital and its patients.

When opportunity knocked and Wan Ting learnt about an available position in TTSH's Hospitality & Environmental Services department, she leapt at the chance and to her delight, was brought into the team as an executive.

Essential skills in the care economy

"In this position, *Inter-professional Collaboration* and *Continuous Improvement Management* are incredibly important." Wan Ting shares.

"In an operations role at a hospital, the main part of our job is working with outsourced vendors and end users. It's our responsibility to create a scope of work, working closely with users to determine the amount of manpower needed, and make sure everything stays within budget." Continuing, Wan Ting details, "That's why *Continuous Improvement Management* is key. We must know how to keep improving productivity and optimising the resources we have. This way, we can serve patients better, without necessarily increasing costs."

Wan Ting places '*Inter-professional Collaboration*' at the top of her list of 'must have skills' – especially for operations

professionals in the Care Economy. Explaining her decision, Wan Ting elaborates, "Building good relationships with people is the key to getting things done. In a hospital, we often have to make last-minute ad-hoc requests, and getting vendors to agree to these requests can be tricky."

"But, if you've managed to develop rapport with them, they will be more willing to help when you reach out to them – and they'll be happier while doing so, too!"

Finding joy in a new role

11 months into her new career, Wan Ting is delighted with all the learning opportunities she has received – primarily through on-the-job training and looking to her colleagues as role models, which involves observing how they communicate with people, solve problems and improve processes.

To others who are considering a mid-career switch, Wan Ting shares her heartfelt advice. "Be open to giving it a try! Just think about building good relationships, having a positive and resilient mindset, and embracing lifelong learning – and you'll do well."



Profile Story

JUMAHAT BIN LEMAN

therapy assistant at a local healthcare provider

Turning inspiration into action: Taking on a new challenge after 50

When Jumahat bin Leman's mother suffered a stroke, he witnessed how life could be turned upside down due to physical limitations. Every day, he saw his mum unable to do basic tasks like walking, and this significantly impacted the quality of her life.

Thankfully, she attended physiotherapy sessions regularly and month after month, Jumahat saw consistent improvements in her physical abilities. He explains, "After all the physiotherapy sessions, she recovered well enough to be independent. Most importantly, she's been able to do all the things she loves like shopping, going to market, cooking, and more."

The next thing Jumahat tells us, explains his biggest motivation for making a brave late-career switch. "I knew then, that this (helping a patient with rehabilitation) was something I wanted to pass on to someone else."

From promoting furniture to promoting recovery

Over the following years, Jumahat kept that thought at the back of his mind as he took care of his biggest financial responsibility - paying off his housing loan, which he eventually did. Following his 50th birthday, and after over a decade of success handling graphics communications at IKEA, the creative professional thought to himself, "It's time."

Considering his options, Jumahat decided to enrol in a Rehab Support Course as it offered an accelerated pathway into healthcare. The four-month course was followed by a three-week attachment to Ren Ci hospital. Thereafter, he officially took on the role of therapy assistant at Jurong Community Hospital and will transfer to Woodlands Health in 2024 when the fully integrated acute and community hospital opens.

Nurturing skills for the Care Economy

Jumahat credits the Rehab Support Course for instilling in him most of the skills needed for his new career in healthcare. Specifically, he names *Change Management*, *Continuous Improvement Management*, *Effective Client Communications*, *Ethical and Professional Integrity*, *Excellence in Service*, and *Operational Excellence* as essential skills that he picked up from the course.

Additionally, Jumahat has also upskilled in several other areas, thanks to training provided by Woodlands Health. These include *Staff Communication and Engagement*, *Staff Continuous Learning*, and *Staff Training Facilitation*. Jumahat explains, "These skills enable therapy assistants to communicate clearly with patients, therapists, and one another - so we can work more effectively and better help patients."

Heartfelt advice for aspiring care professionals

For individuals who hear the calling of the Care Economy, Jumahat shares some words of encouragement.

"The first step to a smooth career switch is planning your finances. When you first switch, your pay may not be the same as before, so set your expectations accordingly. Get the support of your family, as they will be very important during this period. Most importantly, be open about learning new things, immersing yourself in a new environment, and meeting new people!"

Skills Forecast

The previous sections of this chapter tracked the changes in demand and transferability for priority skills in the three economies to share insights into skills that have seen fast growth and other skills that are emerging. This section features prediction modelling³⁰ to forecast the trajectory of priority skills over the next two years and identify skills more likely to continue upward in demand and transferability.

A total of 24 skills were identified with demand and transferability forecasted to grow³¹. All of the skills reside in the Digital and Care Economies, and **Industry 4.0**, among others. No prominent skills from the Green Economy came through this analysis, as green trends are reasonably recent, with many skills being nascent and only starting to emerge.

Skills Forecasted to Grow in Demand and Transferability in the Near Term



³⁰ This is SSG's first trial at forecasting skills, employing Meta's Prophet model to create a proof-of-concept (POC) with the intention of employing a more robust model in future. For more details, refer to Methodology Chapter.

³¹ The 24 skills identified met the analysis criteria to (i) be a good fit with the prediction model and (ii) have kept within the prediction accuracy error margin.

Which skills will continue to grow?

- What the experts say

“

Effective Client Communication is expected to grow in demand in the healthcare sector, especially as we advocate for residents, patients, and their caregivers to take charge of their healthcare needs. This requires healthcare professionals to understand ‘what matters’ to our ‘clients’, for an effective nudging to adopt a healthy lifestyle and follow-through of treatment plans.

”

Lynette Ong

Chief Operating Officer,
Tan Tock Seng Hospital

“

Embracing new digital skills training today is not just an investment, it's a business commitment in the new digital and care economy. Businesses must strive to stay ahead to do well, to understand tomorrow's customers to do better today, for the future belongs to those who prepare for it now.

”

Benjamin Mah

Co-Chairman Talent Committee,
SGTech

A gentle plea to readers

SSG has employed data science in this section to identify skills that may exhibit increased demand and transferability in the near future. This analysis is coupled with qualitative insights by industry experts to validate these skills.

Looking ahead with this forecast is done in good faith and with every intent to help readers make informed judgments. As with all predictions, we may be wrong, especially as we are doing this for the first time. SSG welcomes interested and keen partners to jointly enhance our prediction modelling and improve our collective wisdom on jobs and skills. To share your ideas, please get in touch with us at JSInsights@ssg.gov.sg.

Green Economy

Skill Title	Skill Description
Carbon Accounting	Report, monitor and reduce emissions using accounting and reporting practices prescribed by the relevant governing body to ensure all transactions meet regulatory requirements
Carbon Footprint Management	Quantify and reduce the organisational carbon footprint
Carbon Markets and Decarbonisation Strategies Management	Lead organisation's strategy and policies in response to current and projected carbon policy, market developments and decarbonisation strategies, and provide support for the organisation and clients in their efforts to decarbonise and become net-zero
Climate-mitigating Features in Built Environment	Research, develop, and implement climate-mitigating features in built environment, and incorporate sustainable and green building design concepts, sustainably sourced building materials, and energy-efficient building technologies to achieve near-to or net-zero energy buildings
Energy Management and Audit	Perform energy audits to optimise the energy performance of energy consuming systems and manage energy consumption
Environmental and Social Governance	Understand the latest industry and/or client standards regarding Environment and Social Governance (ESG) and undertake ESG research activities
Green Building Strategy Implementation	Develop environmental sustainability plans throughout the building lifecycle through the development, implementation and review of sustainability strategies to enhance environmental performance
Green Facilities Management	Manage facility operations and maintenance to minimise environmental impact and operational costs efficiently

Green Economy

Skill Title	Skill Description
<i>Solar Photovoltaic System Designs</i>	Oversee design of solar Photovoltaic (PV) systems according to project requirements and site constraints
<i>Sustainability Management</i>	Plan, develop and roll out of an organisation-wide sustainability strategy
<i>Sustainability Reporting</i>	Lead development of organisation's sustainability reporting and accounting policies and processes in line with regulatory requirements and international best practices
<i>Sustainability Risk Management</i>	Develop frameworks, strategies and policies for managing sustainability risks for the organisation to minimise and mitigate risks and impact to the organisation
<i>Sustainable Engineering</i>	Design, construct and operate engineering systems and assets to optimise energy management and enhance environmental performance
<i>Sustainable Landscape Design</i>	Incorporate considerations for sustainability, safety and maintainability in the design of landscapes
<i>Sustainable Manufacturing</i>	Manage efficient use of energy and other utility resources to promote sustainable manufacturing operations
<i>Urban Farming Business Development and Management</i>	Apply knowledge of urban farming techniques to formulate competitive agribusiness strategies, incorporating agrotechnology innovations and sustainable farm-to-market business practices and value-chain

Digital Economy

Skill Title	Skill Description
<i>Application Support and Enhancement</i>	Provide ongoing technical support and improvements to users of applications
<i>Artificial Intelligence Application</i>	Apply algorithmic, statistical and engineering knowledge to integrate artificial intelligence into engineering processes
<i>Artificial Intelligence Ethics and Governance</i>	Establish and drive Artificial Intelligence Ethics and Governance frameworks to ensure compliance, manage risks and commercial benefits in product design
<i>Automation Research and Implementation</i>	Manage equipment and information technologies and integrate into organisation operations or processes to achieve organisation's desired outcomes
<i>Autonomous Systems Technology Application</i>	Integrate autonomous systems and technologies in operational workflows, including processes, maintenance, logistics and plant surveillance, to enhance productivity and precision, and reduce reliance on manual tasks
<i>Big Data Analytics</i>	Analyse and validate significant volumes of data to discover and quantify patterns and trends to improve business operations
<i>Business Insights</i>	Define and operationalise business metrics and hypotheses to enable data analytics and business insight generation to inform business and strategy
<i>Business Requirements Mapping</i>	Map business requirements to existing processes to identify gaps or opportunities for possible solutions and evaluate impact of solutions against requirements to propose adjustments as needed
<i>Computational Modelling</i>	Develop, select and apply algorithms and advanced computational methods to enable systems or software agents to learn, improve, adapt and produce desired outcomes or tasks

Digital Economy

Skill Title	Skill Description
Data Protection Management	Develop and implement a Data Protection Management Programme to comply with the Personal Data Protection Act 2012
E-commerce Management	Develop, manage, and execute e-commerce strategies and activities according to organisational objectives
Embedded Systems Programming	Program an embedded system using permitted programming interfaces provided by the system to support creation of devices that do not operate on traditional operating systems
Information Collection	Gather and measure data on topics targeted to answer relevant questions
IT Asset Management	Manage, optimise and protect the organisation's IT assets
Machine Learning Application	Apply machine learning knowledge and algorithms, optimise the models learned into project execution and maintenance processes
Market Research	Conduct market research to identify opportunities for enhancing product suites, services and revenue opportunities for the organisation
Market Trend Analysis	Devise the framework, and manage and conduct the situational analysis process to uncover market trends and industry developments to identify new opportunities
Marketing Campaign Management	Develop evaluation strategies for marketing campaign effectiveness and analyse data to provide recommendations for improvements in future marketing campaigns

Digital Economy

Skill Title	Skill Description
Network Configuration	Configure network hardware and software components according to organisational guidelines and technical requirements
Product Development	Evaluate consumer and market trends to determine value proposition, cost-effectiveness and profitability of proposed products in different markets
Programming and Coding	Develop technical capabilities to understand, design and write instructions to be processed by computers as software programmes to achieve desired outcomes
Qualitative Analysis	Formulate research questions and hypotheses, identify qualitative data sources for analysis of securities and provide investment recommendations based on analysis
Sales Channel Management	Develop and implement a strategy to manage the channels and channel partners through which products and/or services are sold
Software Design	Create and refine the overall plan for the design of software, including the design of functional specifications
Software Testing	Assess and test the overall effectiveness and performance of an application, involving the setting up of suitable testing conditions, definition of test cases and/or technical criteria
System Configuration Management	Establish consistency in performance, functional, and physical attributes throughout system lifecycles
Workflow Digitalisation	Apply digitalisation to enhance efficiency and effectiveness of operational workflows, processes and practices

Care Economy

Skill Title	Skill Description
<i>Business Opportunities Development</i>	Identify new business opportunities to better meet the needs of existing markets and bring benefits to the organisation
<i>Change Management</i>	Initiate and facilitate organisational changes and business transformation initiatives
<i>Coaching and Mentoring</i>	Develop and implement coaching and mentoring approaches to address learner developmental needs
<i>Community Partnership</i>	Establish and foster partnerships with community stakeholders through a culture of collaboration to develop mutually beneficial programmes for children and families
<i>Continuous Improvement Management</i>	Apply continuous improvement processes to optimise operating cost, task efficiency and effectiveness in production, services and processes
<i>Effective Client Communication</i>	Demonstrate effective communicative skills when communicating with clients and caregivers
<i>Ethical and Professional Integrity</i>	Understand the professional conduct, ethics and values and comply with the relevant legislation to uphold the integrity and reputation of the profession
<i>Excellence in Service</i>	Create strategies to foster positive customer and/or patient experiences and deliver service excellence throughout the engagement lifecycle
<i>Human Resource Practice Implementation</i>	Implement of human resource (HR) practices by integrating local and international requirements, guidelines and best practices
<i>Learning Mode Design</i>	Assess, design and integrate suitable learning modes to drive desired learning experiences
<i>Mental Health and Well-being Support</i>	Promote awareness of common mental health conditions and provide support to person with mental health issues, including guiding towards appropriate professional help

Care Economy

Skill Title	Skill Description
<i>Mentoring for Youth</i>	Provide guidance to youths to facilitate their holistic development
<i>Operational Excellence</i>	Analyse the effectiveness of human resource (HR) operations, programmes and initiatives, and recommend improvement actions
<i>Pharmacy Information Technology Management</i>	Maintain and enhance pharmacy information technology systems and workflows to ensure optimum performance
<i>Practice Supervision</i>	Provide professional supervision to supervisees to develop their practice capabilities and competencies
<i>Professional Consultation</i>	Provide guidance or professional assistance in response to requests from clients, other professionals, external organisations and the general public
<i>Research Data Collection and Management</i>	Collect research data and manage research databases, including extracting required data and managing data storage
<i>Staff Communication and Engagement</i>	Drive staff communication and engagement to achieve the Centre's goals
<i>Staff Continuous Learning</i>	Manage staff's continuous learning activities to maximise staff's potential and capabilities to contribute to the Centre and Cluster
<i>Staff Training Facilitation</i>	Identify training needs and develop training roadmaps to improve employees' skills and capabilities. Coordinate staff training and evaluate effectiveness of programmes
<i>Volunteer Retention and Engagement</i>	Conduct volunteer engagement and develop strategies to engage and retain volunteers

Industry 4.0

Skill Title	Skill Description
<i>Equipment and Systems Testing</i>	Execute equipment and systems testing procedures to ensure continuity of operations and meet standards of performance
<i>Material Management (Planning, Sourcing, Use, Disposal)</i>	Establish plans, organisation procedures and controls of flow of materials from the point of origin to the point of consumption and disposal
<i>Process Development Management</i>	Manage process development for new or significantly altered raw materials, catalysts or products including early stage piloting, trial runs and full-scale production
<i>Process Engineering Design</i>	Apply process design principles, engineering standards, and control and safety strategies for the development of new and existing process plants
<i>Quality Systems</i>	Apply quality considerations and practices in port operations to satisfy customer expectations
<i>Technical Writing</i>	Apply technical writing approaches to communicate complex information and enable actions in pursuit of defined project goals
<i>Workplace Safety and Health Management in Chemical, Process, Pharmaceutical Industries and Laboratories</i>	Manage the operational issues associated with the control and put in place appropriate risk control measures in the chemical, process, pharmaceutical industries and laboratories industry

The skills featured in this chapter are non-exhaustive.
To see the full list of priority skills, please visit this link:
<https://go.gov.sg/sdfedata2023>



Please visit these links for information on suggested courses



Green Economy courses:
<https://go.gov.sg/green-econ-courses>



Digital Economy courses:
<https://go.gov.sg/digital-econ-courses>



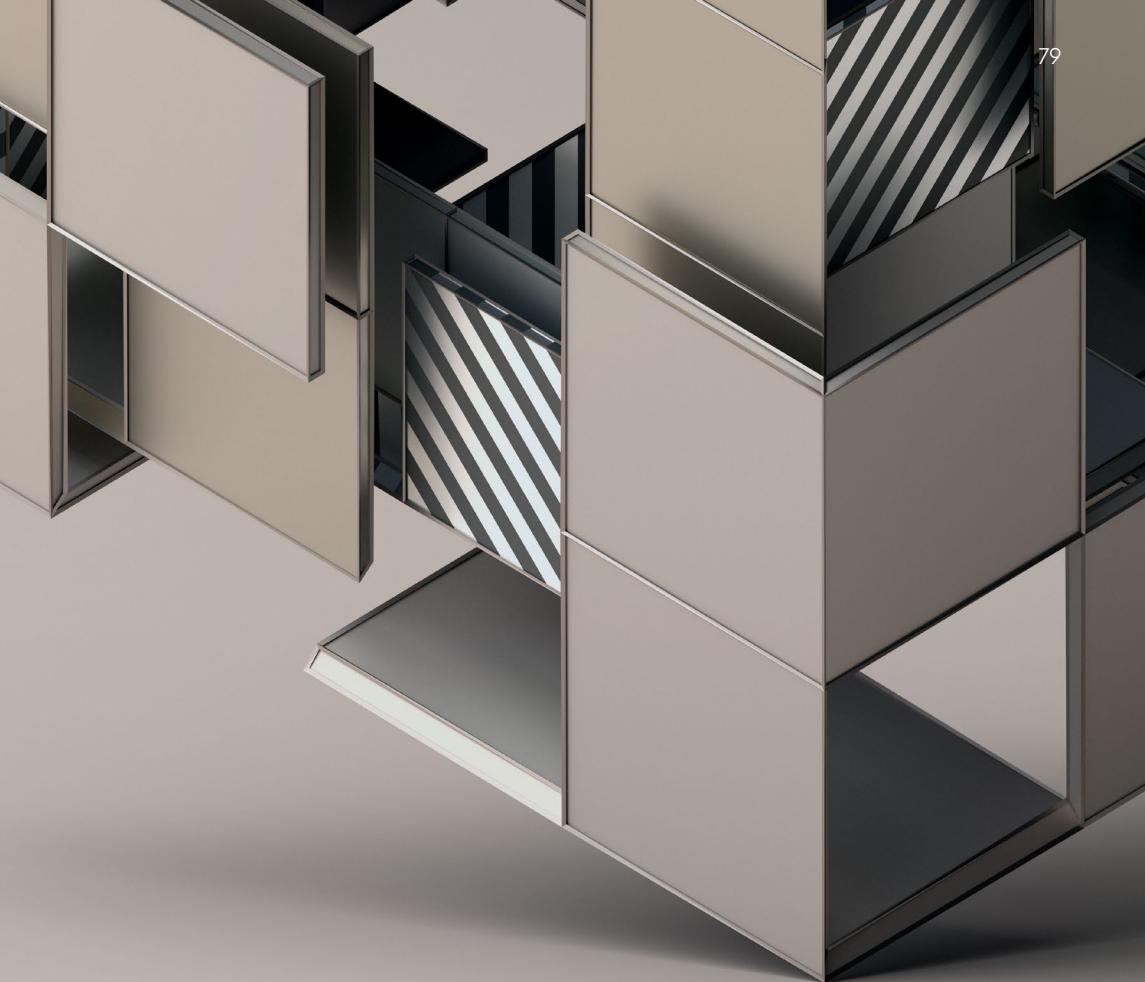
Care Economy courses:
<https://go.gov.sg/care-econ-courses>

Chapter 3

Career Mobility Planning: A Multi-step Approach

While good jobs are associated with the Green, Care and Digital Economies, specific jobs can be more attainable if the individual adopts a multi-step approach to enhance career mobility, bringing oneself first into a job adjacent to these desired good jobs.

This chapter examines six in-demand jobs within these three economies, and how viable multi-step paths might pan out.



Opportunities available for career transitioners

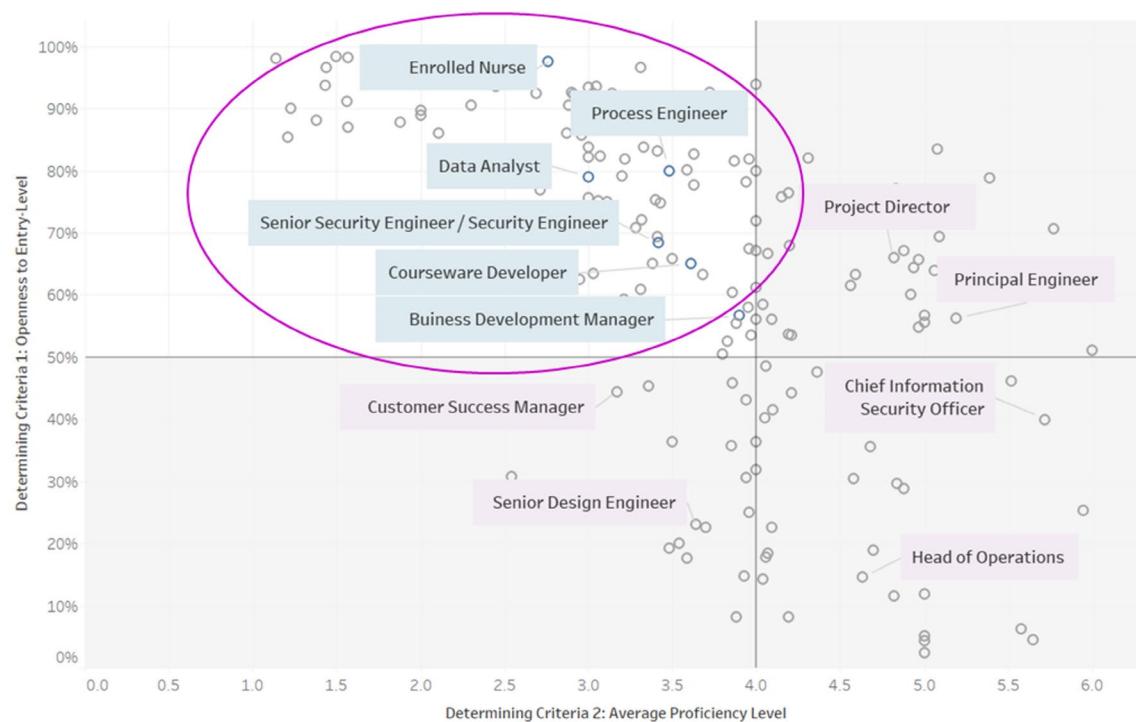
These six **growth job roles** account for 74% of the job postings from 2019 to 2022¹. These roles are better suited for career transitioners compared to other job roles because:

- They offer more entry-level positions² to serve as starting points for transitioners;
- The required technical skills for these job roles are easier to attain; and
- They offer career progression opportunities, entry to expert roles and potential diversification to adjacent roles.

Nonetheless, career transitioners are still expected to upskill/reskill and gain relevant technical know-how, to be considered eligible for such roles.

Individuals who are clear and focused on their career directions can opt for targeted pathways which facilitate direct placement in job roles like Career Conversion Programmes (CCP) and SkillsFuture Career Transition Programmes (SCTP). Individuals still exploring several career options can opt for alternative pathways like stackable full qualifications.

Identifying Variable Roles for Career Transition



1 Source: SalaryBoard

2 More than 50% of the job postings for these job roles are deemed as entry-level. In turn, entry-level jobs are identified when they indicate that applicants require only three years or less as the minimum relevant experience.

Reskilling pathways to kickstart the career transition journey

There are multiple approaches that individuals can undertake to fulfil their career moves. Individuals can either upskill or reskill to move into growth job roles. Depending on the reskilling or upskilling options, the skills top-up required may vary, but the ones with higher skills top-up may offer more significant benefits in the long run. The options presented in this chapter are inexhaustive, and the actual pathways taken by individuals may vary depending on their specific circumstances.

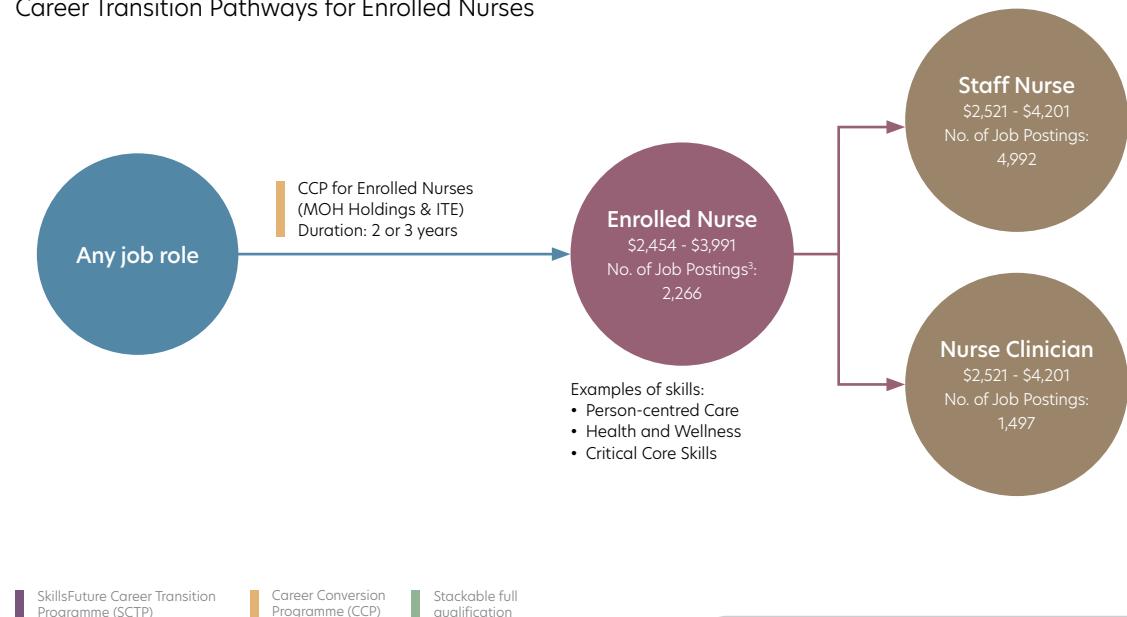
1. Enrolled Nurse

Enrolled nurses provide basic nursing care and patient education under the supervision and direction of registered nurses. They operate in various settings such as acute care, primary care, community hospitals, integrated care and long-term care facilities. They typically require skills in *Person-centred Care, Health and Wellness* and **Critical Core Skills**.

This diagram shows an example of a multi-step approach to reskill into an enrolled nurse from any job role using stackable full qualifications or targeted placement programmes like CCP.

This diagram also shows examples of job roles that enrolled nurses can progress to in future with career mobility planning. There are options to enter nursing roles via the polytechnic or autonomous university.

Career Transition Pathways for Enrolled Nurses



- 3 Examples of skills listed are Critical Core Skills and Emerging Domains, which are clusters of skills. Not every skill within a listed emerging domain will be relevant for a growth role.
- 4 Salary ranges shown for the corresponding job roles are based on the minimum and maximum remuneration rates advertised in job postings in 2022.
- 5 The numbers of job postings shown in this diagram are derived from the total number of job postings for the corresponding job roles in 2022.

Please visit this link for information on more programmes that can help with transitions into these new roles:
<https://go.gov.sg/cmp1>



Reskilling pathways to kickstart the career transition journey

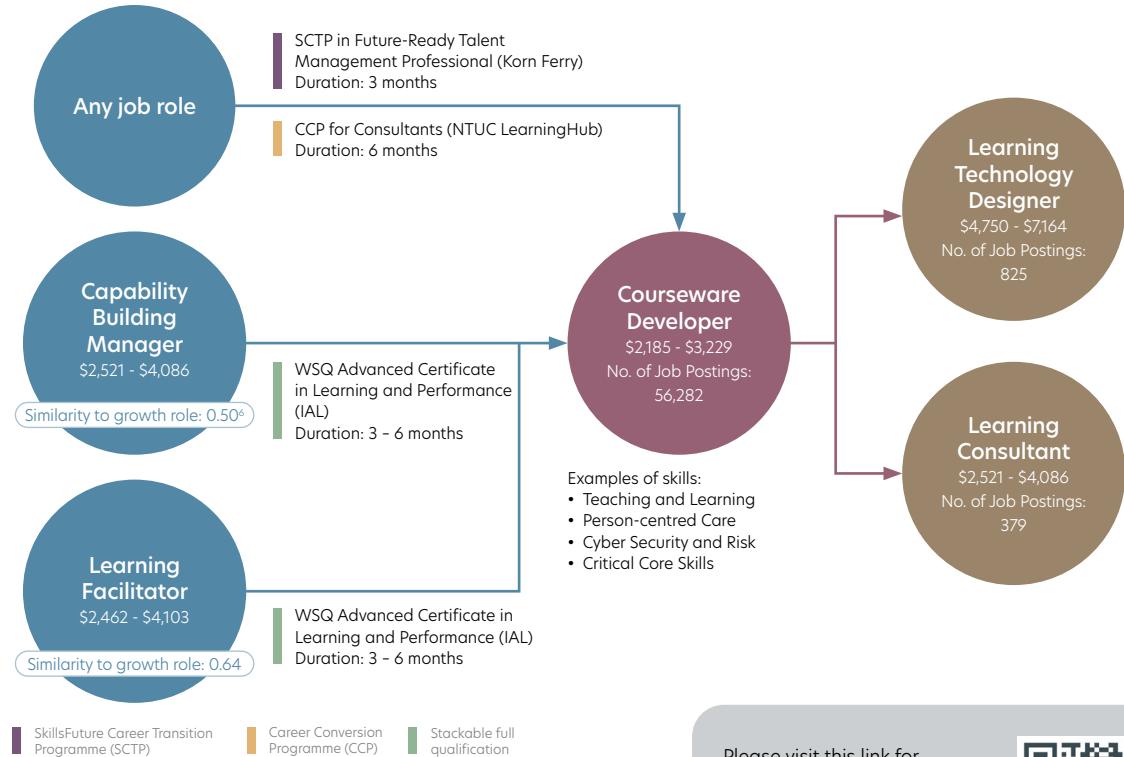
2. Courseware Developer

Courseware developers conduct research and develop learning materials, courseware based on curriculum objectives, and assessment of learning needs. They typically require skills in *Teaching and Learning, Person-centred Care, Cyber Security and Risk, and Critical Core Skills*.

This diagram shows an example of a multi-step approach to reskill into a courseware developer from **adjacent job roles** like capability building managers or learning facilitators, using stackable full qualification pathways. Targeted placement programmes like SCTP or CCP can also facilitate this career transition from any job role.

The diagram also shows examples of job roles that courseware developers can progress to in future with career mobility planning.

Career Transition Pathways for Courseware Developers



⁶ The adjacent job roles featured have a similarity score of at least 0.50 to the growth job role. 50% is deemed to reflect reasonable similarity between two job roles. A job role similarity score of less than 50% reflects bold moves that may require more effort to make a successful transition.

Please visit this link for information on more programmes that can help with transitions into these new roles:
<https://go.gov.sg/cmp2>



Reskilling pathways to kickstart the career transition journey

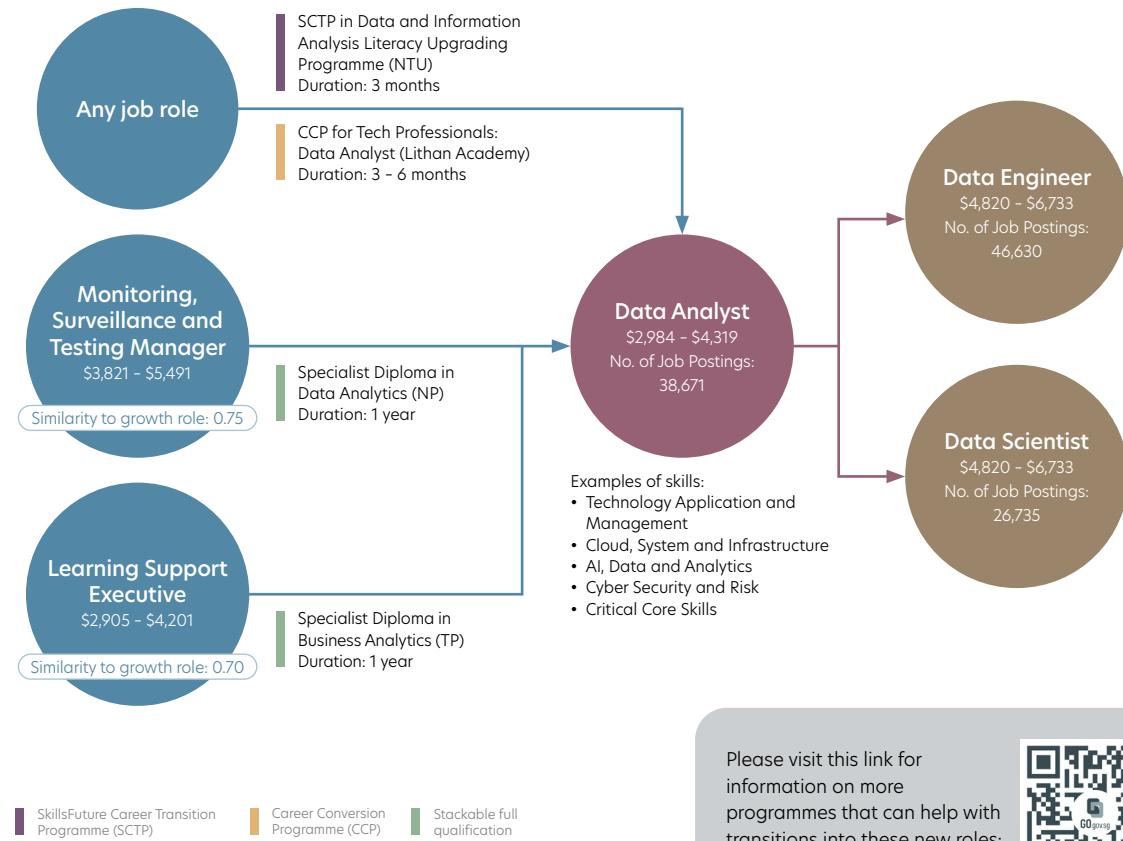
3. Data Analyst

Data analysts perform basic data preparation and analyse data to support business. They use apps and tools to generate reports and dashboards, clean and prepare data and analytical solutions according to business requirements. They typically require skills in *Technology Application and Management, Cloud, System and Infrastructure, AI, Data and Analytics, Cyber Security and Risk* and Critical Core Skills.

This diagram shows an example of a multi-step approach to reskill into a data analyst from adjacent roles like monitoring, surveillance and testing managers or learning support executives, using stackable full qualification pathways. Targeted placement programmes like SCTP or CCP can also facilitate this career transition from any job role.

The diagram also shows examples of job roles that data analysts can progress to in future with career mobility planning.

Career Transition Pathways for Data Analysts



Please visit this link for information on more programmes that can help with transitions into these new roles:
<https://go.gov.sg/cmp3>



Reskilling pathways to kickstart the career transition journey

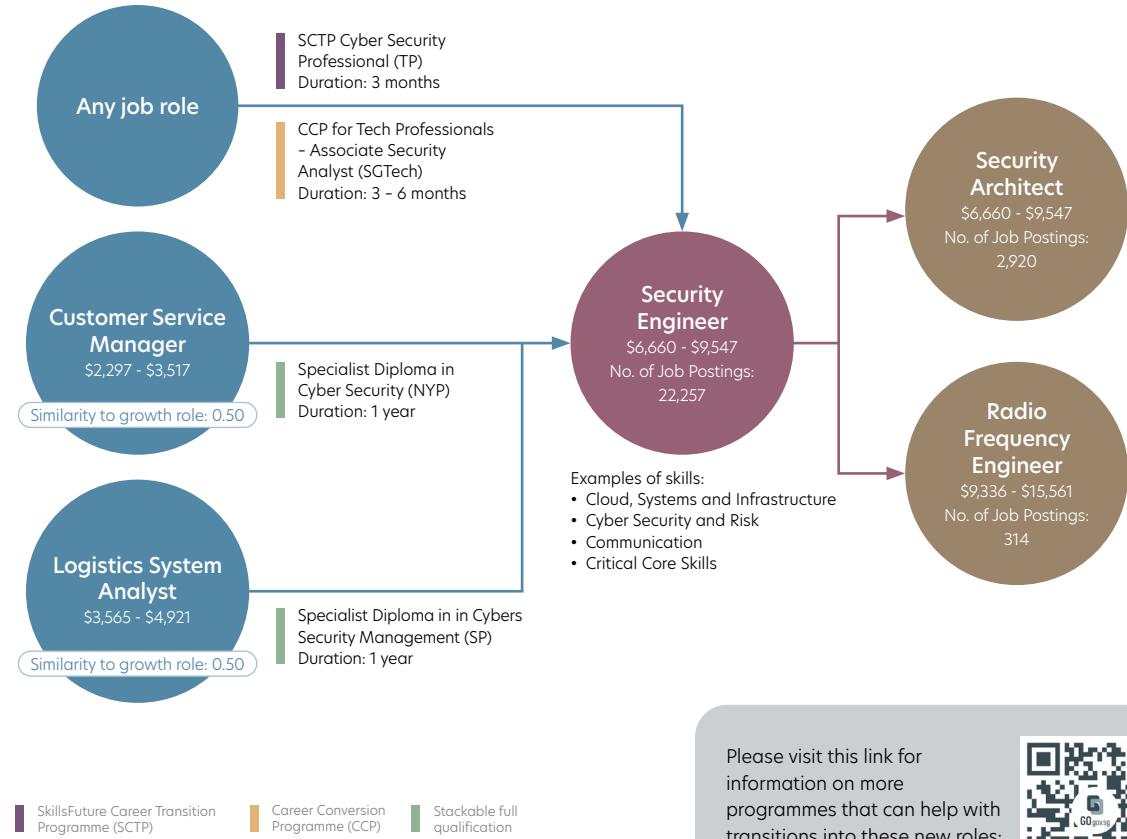
4. Security Engineer

Security engineers design, develop and implement secure system architectures and embed security principles into system architecture designs to mitigate the risks presented by new technologies and business practices. They typically require skills in *Cloud, Systems and Infrastructure Cyber Security and, Risk and Critical Core Skills*.

This diagram shows an example of a multi-step approach to reskill into a senior security engineer from adjacent roles like customer service managers or logistics system analysts using stackable full qualification pathways. Targeted placement programmes like SCTP or CCP can also facilitate this career transition from any job role.

The diagram also shows examples of job roles that senior security engineers can progress to in future with career mobility planning.

Career Transition Pathways for Security Engineers



Please visit this link for information on more programmes that can help with transitions into these new roles:
<https://go.gov.sg/cmp4>



Reskilling pathways to kickstart the career transition journey

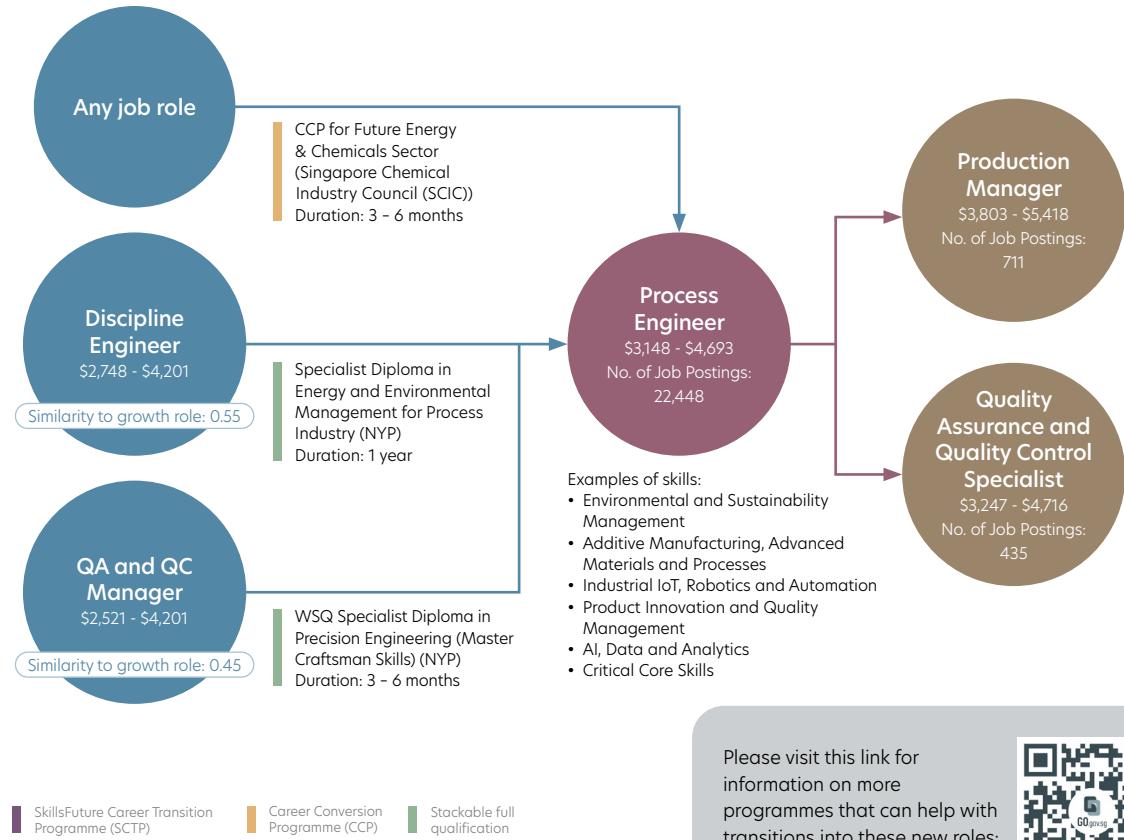
5. Process Engineer

Process engineers provide technical support to optimise process capability, efficiency, yield and quality in compliance with the organisation's system requirements, such as Workplace Safety and Health (WSH), Environmental Management System (EMS), and Process Safety Management (PSM). Depending on organisational needs, they may also specialise in process control, process optimisation or process engineering projects. They typically require skills in *Environmental and Sustainability Management, Additive Manufacturing, Advanced Materials and Processes, Industrial IoT, Robotics and Automation, Product Innovation and Quality Management, AI, Data and Analytics, and Critical Core Skills*.

This diagram shows an example of a multi-step approach to reskill into a process engineer from adjacent roles like discipline engineers or laboratory chemists using stackable full qualification pathways. Targeted placement programmes like CCP can also facilitate this career transition from any job role.

The diagram also shows examples of job roles that process engineers can progress to in future with career mobility planning.

Career Transition Pathways for Process Engineers



Reskilling pathways to kickstart the career transition journey

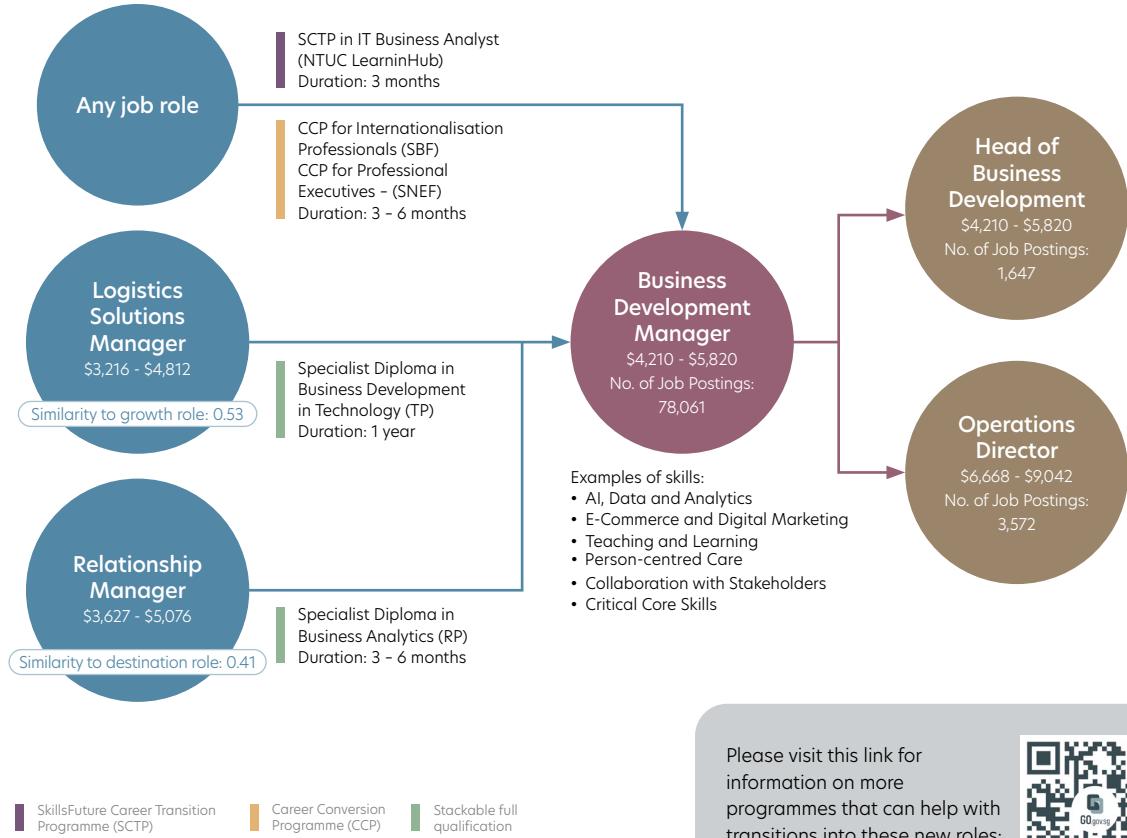
6. Business Development Manager

Business development managers assume the responsibility of supporting their organisations' business development strategies, expanding current business portfolios, and overseeing the running of sales and marketing activities. They maintain extensive knowledge of current market conditions to identify competitors and market trends. They typically require skills in *AI, Data and Analytics, E-Commerce and Digital Marketing, Teaching and Learning, Person-centred Care, Collaboration with Stakeholders and Critical Core Skills*.

This diagram shows an example of a multi-step approach to reskill into a business development manager from adjacent roles like logistics solutions managers or relationship managers using stackable full qualification pathways. Targeted placement programmes like CCP can also facilitate this career transition from any job role.

The diagram also shows examples of job roles that business development managers can progress to in future with career mobility planning.

Career Transition Pathways for Business Development Managers



Please visit this link for information on more programmes that can help with transitions into these new roles:
<https://go.gov.sg/cmp6>



Profile Story

As SkillsFuture Singapore (SSG) transformed internally to focus on data-driven insights and publications such as this, several of our officers went through similar career transition experiences to adapt to this new direction and become data professionals. Two of them share their experiences here.

ALEX SEO

data scientist with SkillsFuture Singapore

My journey in becoming a data scientist

"I appreciated the chance to embark on a targeted learning journey through a six-month Specialist Diploma in Business and Big Data Analytics at Nanyang Polytechnic. This course helped me gain *Data Engineering*, *Data Ethics*, *Data Visualisation* and *Business Needs Analysis* skills. Outside the classroom, I realised the importance of having a flexible learning mindset and learning on the job from various sources such as mentors and online platforms. This ability to integrate insights from different

sources and apply them creatively to craft effective solutions matters to me.

"I agree with the timeless wisdom that "Change is the only constant." This idea is especially true in uncertain times when change accelerates rapidly. In these situations, adapting and learning quickly is essential. It is about staying abreast of the ever-changing environment and remaining relevant. I believe that the real worth of learning is in its application and implementation. Becoming a data scientist is not just about gaining knowledge for its own sake but using it to improve things important to us."

DARRYL LEONG

jobs skills analyst with Skillsfuture Singapore

My journey in becoming a jobs skills analyst

"As a Jobs Skills Analyst, I use *Big Data Analytics* to analyse labour market intelligence and produce jobs-skills insights

that inform stakeholders' decision-making. However, communication is vital when discussing my research and findings with other government organisations, businesses, training providers and the public. I also need to tailor my messages to cater to their level of understanding and empathise with their perspectives to ensure effective communication. In this aspect of my role, I leveraged my skills in *Communication*, *Learning Agility* and *Self Management*, and my experiences engaging stakeholders from my previous job role.

"Technology is advancing faster than ever, as are the changes to the economy and industry. The knowledge and skills one has now will become outdated sooner. Therefore, to stay relevant or competitive, I urge everyone to keep their skills and experiences current and aligned with industry trends."

Profile Story

HAZEL XIE YI FANG

cloud software engineer at a products and technology MNC

Teacher to student: A story of lifelong learning and chasing a dream career

After graduating from the National Institute of Education (NIE) with a Bachelor of Arts (Education), Hazel Xie dedicated the next few years of her life to teaching geography. While she enjoyed working in education, Hazel's first love has always been technology – so when she got the opportunity to work at an urban farming company, she jumped at it!

Levelling up a career, one skill at a time

Excited by the new skills she was picking up, but not quite satisfied with her pace of advancement, Hazel decided to accelerate her progress by learning tech skills on her own.

This search for knowledge led her to Workforce Singapore's (WSG) Career Conversion Programme (CCP), where she picked up the expertise needed to land a role as a software engineer. From there, Hazel studied the technology landscape and recognised that the cloud would be a big part of every organisation's future. She

then took up AWS Cloud Solution Architect and Google Cloud Solutions Architect certifications in her own time.

Opportunity came knocking again when Hazel was asked if she would be interested in a role as a cloud software engineer with her present employer. The firm, impressed by Hazel's proactiveness and ability to pick up tech skills on her own, was confident that she would learn the skills needed to excel in this role. Without a moment's hesitation, Hazel – once again – leapt towards the opportunity.

Today, the cloud software engineer codes programs for her colleagues across the organisation and ensures seamless deployment of these programs to the cloud for various business functions to get work done more easily and efficiently than before.

Essential digital skills

Hazel highlights *Workflow Digitalisation*, *Programming and Coding*, and *Software Design* as the most important skills for someone in her role.

Hazel explains, "Workflow Digitalisation enables us to take applications that were once run on local servers and data centres, put them onto a cloud infrastructure and make them more widely accessible. It simplifies

troubleshooting and improves the speed at which we can create and run programs.

"Meanwhile, a good understanding of *Software Design* allows us to design solutions that are purpose-built to suit our business needs. Finally, *Programming and Coding* enables us to write code that ensures these solutions work exactly as intended. This is very important for both our consumer products, and the programs we use internally."

Advice for transitioning into technology

Although Hazel's move into the Digital Economy looked seamless, she's had to overcome her fair share of hurdles – the biggest one, being the need to rethink her mindset on learning.

"As a teacher, I realised that many students were used to being spoon-fed the 'correct answers', then memorising everything. That's how many of us approach learning. But with programming and coding, it's never just about finding 'the correct answer'. You must be comfortable with failing, making mistakes, and knowing that this is part of the process!"

"That's because, in a real-world tech workspace, you'll always need to find the answers for yourself. And this is what makes it truly rewarding."

Industry Voice



DR RUBY TOH

Principal Researcher/Senior Lecturer,
Singapore University of Social Sciences,
Institute for Adult Learning

Recent research by the Institute for Adult Learning (IAL) on labour mobility of tertiary educated workers in Singapore (those with Polytechnic diplomas and above) highlighted four mobility archetypes with different levels of career progression and transitions between jobs: those who achieve strong career progression (with respect to income and designation) through fewer (Stable Achievers) rather than more moves (Adroit Achievers), and those who experience comparatively weak career progression regardless of whether the transitions are frequent (Explorers) or not (Early Careerists/Plodders). Labour mobility here refers to transitions between jobs, occupations and/or industries. It encompasses career

mobility, which examines the sequence of transitions in job roles within and between organisations throughout one's working life. Such transitions may be voluntary or involuntary, temporary or permanent, that may or may not involve a change (increase or decrease) in income and job designation.

The research spotlighted the importance of developing and maintaining strong career decision-making readiness and career self-management capability as critical to achieving successful career outcomes. Career decision-making readiness reflects one's capability to make appropriate career choices while taking into account the complexity of various external influences such as family, social, economic, and organisational factors. In contrast, career self-management is a dynamic process of developing, implementing and monitoring one's career goals and strategies. Other factors that are significantly associated with mobility are age, gender, race, marital status, having dependents, education, upgrading, income, job designation, occupation, industry, type of company,

employment terms, union membership, experience in internship and apprenticeship, and the availability of government support - CCP, SCTP, career guidance, online portal (MyCF, MySF).

To support career progression and job transitions, it is pertinent that individuals hone their career management skills and regularly upgrade and update their skills and knowledge over their career, including one's domain knowledge as well as Critical Core Skills that can facilitate job transition (skills related to *Communication, Collaboration, Influencing, Problem Solving, and Digital Fluency*). Seeking career advisory support to improve career decision-making readiness may also be helpful for Early Careerists, Plodders and Explorers. Employers are strongly encouraged to support the skills and career development of the multi-generation workforce to reap the benefits of a skilled workforce and the demographic premium of an ageing population.

Industry Voice

Descriptions of Labour Mobility Archetypes from IAL's Study

Career Progression ↑

Stable Achiever (SA)

SAs attain career success with few job transitions. They have comparatively low LMI but high career progression (above 75th percentile). The income increase over the career is a median of 7.3 times the first drawn pay, with the top percentile earning 50 times the first drawn pay.

SAs have strong career decision-making states and career self-management skills. They comprised 16.5% of the respondents.

Adroit Achiever (AA)

AAs attain career success with several adroit moves in their career. Their LMI is above the median worker, and their career progression ranks above 75th percentile of respondents. After two or more job transitions, they multiply their earnings by a median of 6-fold, with the top percentile earning 60.7 times the first drawn pay.

AAs have strong career decision-making states and career self-management skills, exhibit clarity, confidence and satisfaction in their career directions, and take appropriate actions to achieve their career goals while maintaining well-being through networking and ensuring that their skills and knowledge remain relevant for the workplace. They comprised 8.5% of the respondents.

Early Careerist/Plodder (EC/P)

Plodders do not transit between jobs much and tend to remain in the same job throughout their careers, achieving less career success than Achievers. Early Careerists similarly make few job transitions in their short career runways, having recently entered the labour force. The income increase over the career is a median of 2.4 times the first drawn pay and 9 times for the top percentile.

One in four of the EC/Ps were 'frozen' in their career decision-making states, not knowing that what to do about their career. Their career self-management skills were among the weakest among the respondents. They comprised 33.6% of the respondents.

Explorer (E)

Es make several transitions between different jobs but these moves result in less successful career progression outcomes than Achievers.

Their career decision-making state is among the weakest of the four archetypes, with one in three exhibiting poor clarity about their career goals. Their income increase over the career is a median of 1.7 times the first pay after 2 or more job transitions, and 5.2 times the starting pay for the top percentile. They comprised 41.4% of the respondents.

Labour Mobility Index (LMI) →

This chapter highlights some examples of the multi-step approach, demonstrating thoughtful evaluation of career moves that provide future career progression. With this approach, individuals can deepen their skills to access in-demand job roles and/or consider diversification into adjacent job roles. Individuals making career transitions may consider stackable modules that lead to full qualifications or targeted placement programmes, like Career Conversion Programmes – Place-and-Train or SkillsFuture Career Transition Programmes – Train-and-Place. Individuals are encouraged to approach SkillsFuture Singapore's (SSG) and Workforce Singapore's (WSG) networks of Skills Ambassadors and Career Coaches to discuss their career aspirations and plans.

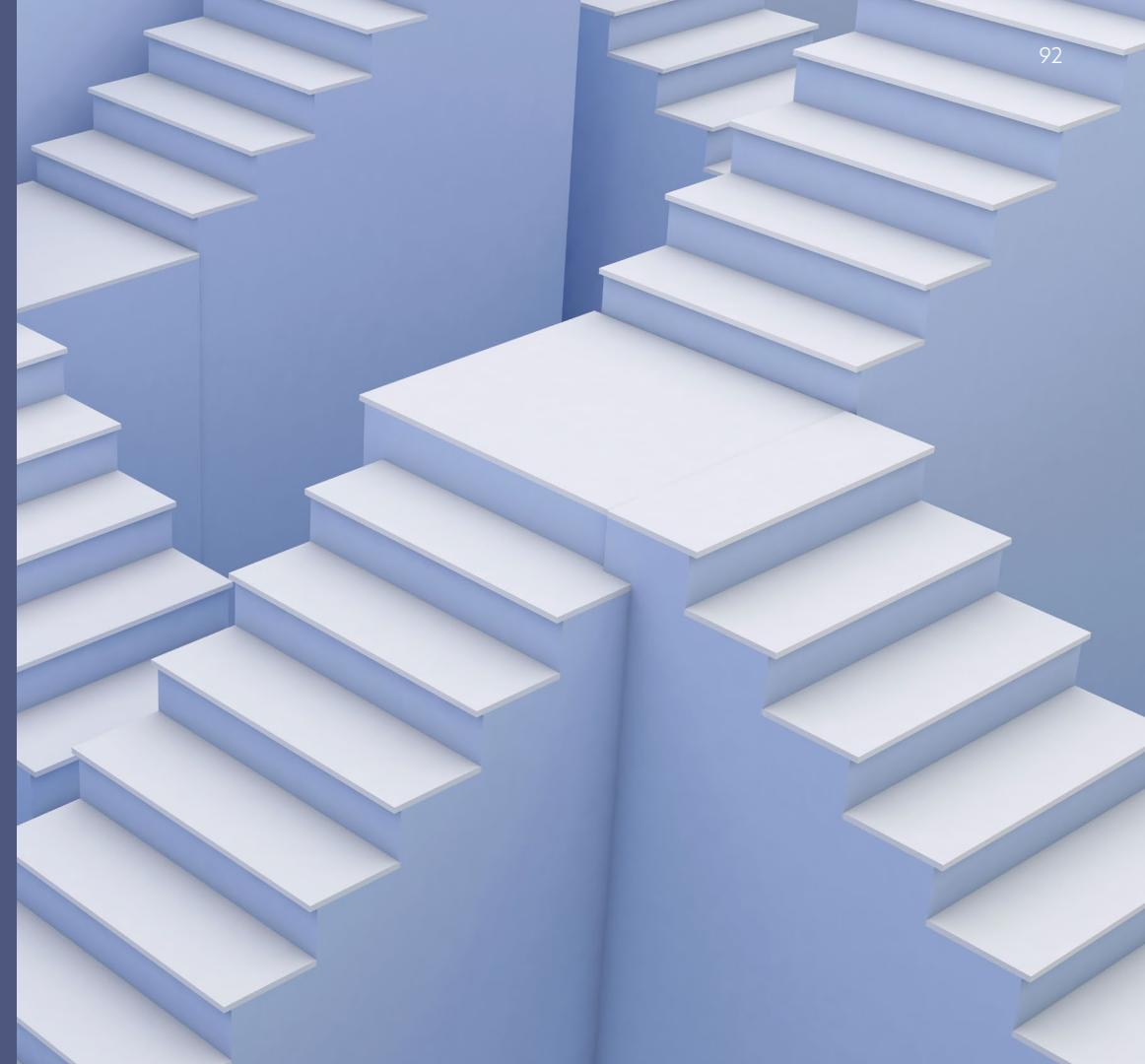
Career mobility has benefits for both organisations and employees. Employers play a crucial role in recognising the skills that individual workers offer the organisations and creating opportunities for career mobility internally. By doing so, employers will be better able to tap these workers' full potential.

The skills featured in this chapter are non-exhaustive. To see the full list of priority skills, please visit this link: <https://go.gov.sg/sdfedata2023>



Chapter 4

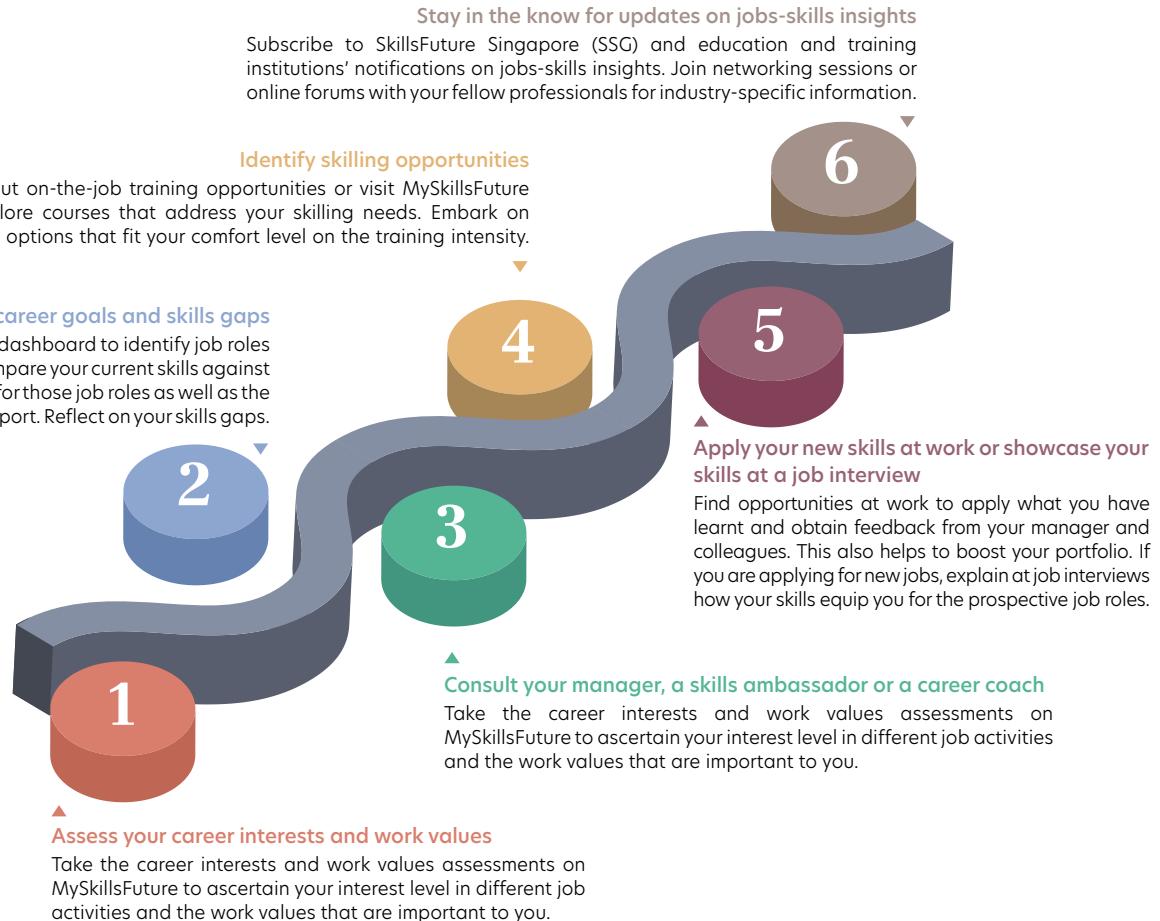
Charting Your Skills Development Journey



Embarking on a career and skills development journey is a continuous process

The preceding chapters present experts' views, as well as insights gained using data-driven techniques on labour market information to help readers understand the available opportunities, aligned to their personal interests, ambitions and work values.

Here are some useful tips as you consider how to plan ahead for your own career and skills development journey. Having done so, you may wish to explore the range of training opportunities and courses available for upskilling, including the plethora of courses subsidised by SkillsFuture Singapore (SSG), Workforce Singapore (WSG), Infocomm Media Development Authority (IMDA), Monetary Authority of Singapore (MAS) and other agencies.



Industry Voice



DR RAMESH TARANI

Skills Ambassador,
SkillsFuture Singapore

In a rapidly evolving business environment, continuous upskilling and reskilling are essential for capitalising on opportunities. Through my conversations with various clients, I observed that there is often a lack of proactive action in acquiring the right knowledge and skills among many individuals.

In my experience, it is concerning to witness individuals who acquire new skill sets without clear career goals. It is comparable to playing football without goal posts or participating in a marathon without an end point.

Personally, I believe that the first step to effectively grow in your career is to discover your own career aspirations and understand the in-demand skills required for the role that you are interested in.

To facilitate self-discovery, the Realistic, Investigative, Artistic, Social, Enterprising, Conventional (RIASEC) self-assessment tool can aid you in identifying careers aligned with your personality. Additionally, the Skills Framework offers valuable insights into various industries, occupations, and in-demand skills. Whether you are transitioning between fields or aspiring to progress in your current career, a comprehensive grasp of the requisite skills for your chosen path provides a sense of clarity and purpose and focuses your learning and development journey to directly align with your career objectives. The right skill sets will render you a more compelling candidate when pursuing fresh opportunities or advancements. To identify your skills gaps, you can also engage in a guided conversation with a Skills Ambassador, to empower yourself with the knowledge to make informed decisions and take targeted actions.

Among the mid-careerists that I have consulted, one client shared that she was retrenched as an operations executive and felt overwhelmed with the multitude of career options to explore. Through RIASEC and the consultation session with me, she identified new roles in industries which might be a good fit for her, and the

essential skills required. After assessing her existing transferable skills, she gained a greater understanding of the required skills and training for her career transition. It was gratifying to learn that months later, she returned and shared her accomplishment of successfully transitioning to become a patient service associate.

In addition to assisting individuals gain clarity on their career goals and exploring training options, Skills Ambassadors can also provide support by recommending suitable courses and introducing various initiatives that align with one's career aspirations.

Therefore, regardless of which stage of career you are in, I encourage you to reach out to our team of Skills Ambassadors and discover how you can progress in your career.

Lastly, I understand that navigating career crossroads can be daunting, as fear of change and the desire to stay within our comfort zone often hold us back. But when you find what's right for you, it becomes easier to excel in whatever field you choose.

Industry Voice



ANGELINE CHIANG

Principal Career Coach,
Workforce Singapore

Career change can involve changing roles, functions, departments, industries, or even starting one's own business. Regardless, a career change requires careful preparation, such as identifying one's transferable skills, researching potential careers, upskilling to acquire new skills, networking with people in the desired fields. One may start off by conducting a self-reflection on what triggered the desire for a career change. For instance, are you seeking greater job satisfaction or career growth or meaningful work?

You should also think about your career motivators – the values or priorities that drive you at work. For example, if you have a flair for creative writing and value social interactions, you might find fulfilment as a writer in an organisation that emphasises teamwork. In addition, consider what work activities energises you at work. Are there any specific tasks that drain you? Understanding

your career motivators can pinpoint career opportunities that gives you better job satisfaction.

Understanding your career motivators and the impetus behind your career transition would define your career goals. The next step is then to conduct systematic industry research and identify positions that match your career motivators. Determine qualifications or skills required and work towards attaining them. Leverage existing/new networks connecting with professionals in your desired industries to gain valuable insights or opportunities, attend industry workshops/events, and utilise networking platforms like LinkedIn.

My client, Alex, expressed job dissatisfaction as a Technical Executive as his role did not align with his career motivators which are fellowship and helping others. Recognising this, he identified social services as a sector he would like to transit into. Through my career guidance, Alex gained career clarity and formulated a career plan. Recognising his limited experience, Alex identified roles where his transferable skills in customer service and operations would be valued. With a well-defined career plan, Alex successfully switched into the social service sector, where he is now more satisfied.

It is important to stay resilient and keep an open mindset. Remember, you don't have to navigate the challenges alone. Workforce Singapore (WSG)'s Careers Connect and NTUC e2i's Career Centre offer personalised career advisory and guidance to help you navigate your career change. You can also tap onto digital resources such as theCareersFinder feature on MyCareersFuture portal for personalised upskilling and career recommendations and Workipedia by MyCareersFuture for career-related resources.

Additionally, there are various programmes such as SGUnited Mid-Career Pathway Programmes and WSG's Career Conversion Programmes (CCPs) to support your transition. With SGUnited Mid-Career Pathway Programmes, you can gain industry-relevant skills and experience through full-time attachments and convert to full-time employment. With close to 100 WSG's CCPs, you have numerous options to reskill and switch careers to align with your career transition.

Despite the challenges that a career change presents, your journey can be enriching. By diligently crafting and following through a career plan, you not only can realise your professional aspirations but also discover fulfilment in your new path.

Resources to support skills and career development

SSG and WSG offer a range of resources, tools, programmes and initiatives to help you explore career opportunities, identify and acquire the necessary skills to increase employability, improve job performance and adapt to job content changes.

Here are some specially curated resources to build a viable, long-term professional development career and skills strategy.

Jobs-and-Skills Insights Resources

Make use of our resources to keep abreast of trends impacting jobs and skills in Singapore.



SkillsFuture Jobs-Skills Insights

Publications that spotlight high-tempo jobs and skills changes within specific sectors or economies.

<https://www.skillsfuture.gov.sg/jobs-skills/sfjsi>



Jobs-Skills Insights Webinars

Industry professionals come together to discuss the emerging trends and their impacts to jobs and skills.

<https://go.gov.sg/jsi-webinar>

Contact us at JSInsights@ssg.gov.sg to be added to our eDM contact list for webinars.

Jobs-Skills Insights on SSG portals

Articles that focus on key trends and insights about jobs and skills, at sectoral and workforce-segment levels.



for Individuals

<https://go.gov.sg/guex0q>



for Enterprises

<https://go.gov.sg/3u6sh3>



for Training Providers

<https://go.gov.sg/znfhhu>



Singapore Skills Frameworks

Provide key sector information, occupations/ job roles, and the required existing and emerging skills.

<https://www.skillsfuture.gov.sg/skills-framework>



Jobs-Skills Dashboard

Provides job posting data on job roles such as hiring demand, wage range, top hiring companies, industries and top demanded skills.

<https://go.gov.sg/sdfe-dashboard>

Jobs-Skills Insights Commentaries

Follow SkillsFuture Singapore on the following platforms:



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More Resources for Individuals

Self-help career and skills tools



RIASEC Profiling Tool

An assessment tool to determine your personality strengths, and work values to identify suitable career options.
<https://go.gov.sg/riasec-profiling>



Critical Core Skills Profiling Tool (enhanced)

An assessment tool to determine your strengths and gaps in critical core skills.
<https://go.gov.sg/ccs-profiling>



Skills Passport

A one-stop repository to view and manage your skills, certificates and licenses.
<https://go.gov.sg/spsprt>



Career Grit

Provides an easy-to-use platform to access comprehensive career resources.
<https://go.gov.sg/c-grit>

Career and skills development services



Career Advisory and Coaching

Register for guidance from WSG Career Coaches with personalised career advisory and coaching services.
<https://go.gov.sg/cac>



Skills and Training Advisory (STA) Services

Register for guidance from SSG Skills Ambassadors on skills and training to achieve your career goals.
<https://go.gov.sg/skills-advisory>

Training programmes and support



WSG Career Conversion Programmes (CCP)

Targeted at mid-career individuals, to undergo skills conversion and switch to new jobs or sectors.
<https://go.gov.sg/cpp>



SkillsFuture Career Transition Programme (SCTP)

A train-and-place programme which supports mid-career individuals in acquiring industry-relevant skills to improve employability and pivot to new sectors or job roles.
<https://go.gov.sg/sctp-home>



SkillsFuture Series

A curated list of short, industry-relevant training programmes that focuses on emerging and in-demand skills in our economic growth pillars.
www.skillsfuture.gov.sg/series



SkillsFuture Credit

Used on top of existing SSG course fee subsidies to pay for a wide range of approved skills-related courses.
<https://go.gov.sg/sf-cred>



Courses for Critical Core Skills

A set of 16 transferable soft skills and competencies critical for employability and aids acquiring of technical skills required to perform in job roles, adapt to changes and seize career development opportunities.
<https://go.gov.sg/ccs-courses>

More Resources for Enterprises

Partnerships to strengthen capabilities



SkillsFuture Queen Bees

Industry leaders who champion skills development, by providing skills advisory and guide organisations to identify and acquire the skills needed for business transformation.

<https://go.gov.sg/sfqueenbee>



Jobs-Skills Integrators

Intermediaries who work with industry, training and employment facilitation partners to optimise training provision and job matching services for companies and individuals.

<https://go.gov.sg/jxit>



National Centre of Excellence for Workplace (NACE)

Equip companies, particularly SMEs, with the capabilities to train and develop their workers.

<https://www.skillsfuture.gov.sg/nace>

Training programmes



SkillsFuture Work-Study Programmes

Include facilitated learning, on-the-job training and work-based projects, to allow deepening of skill sets at the workplace.

<https://www.skillsfuture.gov.sg/workstudy>



SkillsFuture Career Transition Programme (SCTP)

A train-and-place programme which supports mid-career individuals in acquiring industry-relevant skills to improve employability and pivot to new sectors or job roles.

<https://go.gov.sg/sctp-home>



SkillsFuture Series

A curated list of short, industry-relevant training programmes that focuses on emerging and in-demand skills in our economic growth pillars.

<https://www.skillsfuture.gov.sg/series>



WSG Career Conversion Programmes

Targeted at mid-career individuals, to undergo skills conversion and switch to new jobs or sectors.

<https://go.gov.sg/2zb901>



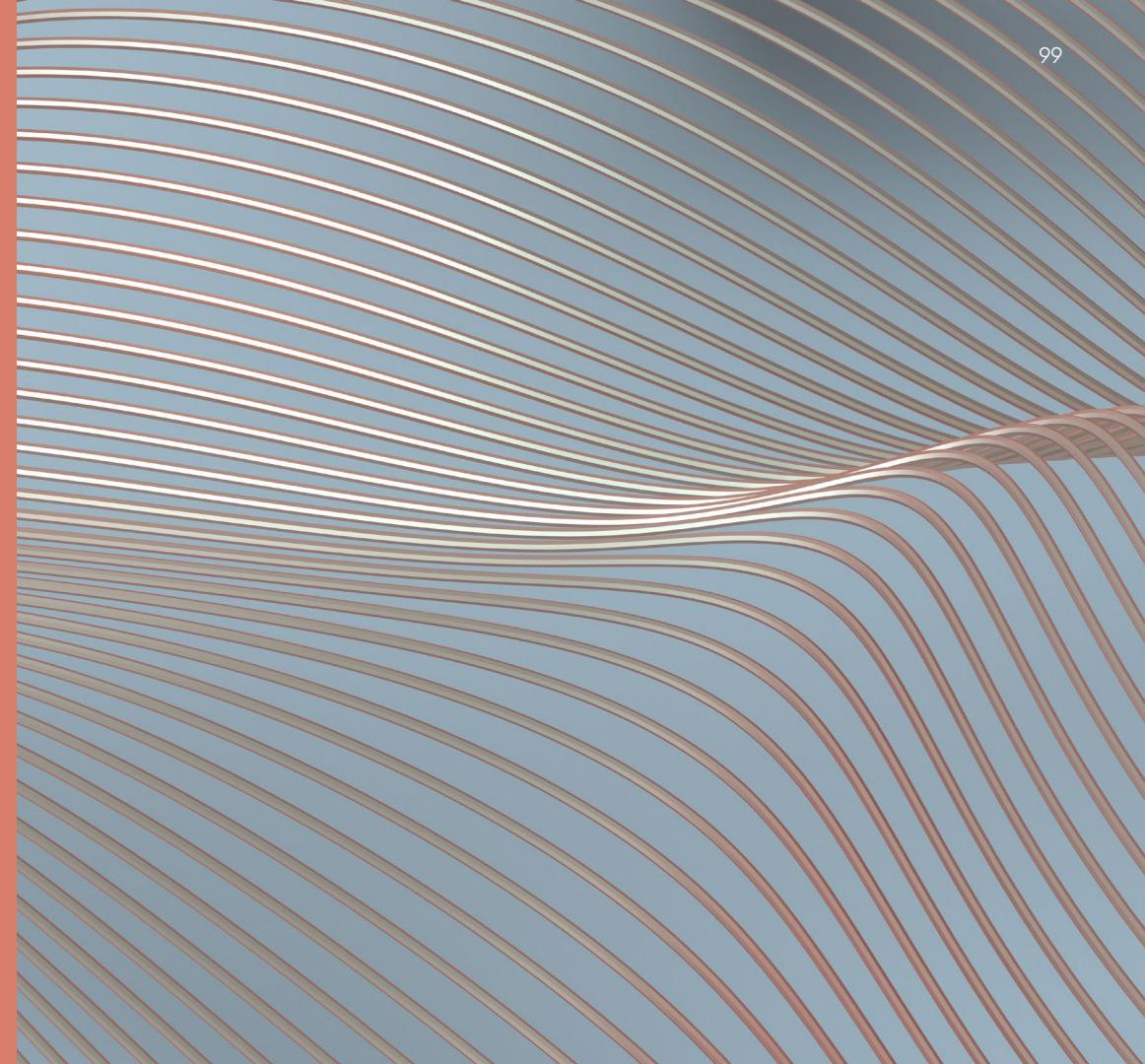
Courses for Critical Core Skills

A set of 16 transferable soft skills and competencies that enable employees to remain nimble and agile to support business transformation.

<https://go.gov.sg/ccs-courses>

Chapter 5

Methodology



Analysis methodologies applied in Chapter 1: Changes to Skills Composition of Jobs in the Singapore Economy (2012-2022)

A. Tagging job posting data (2012-2022) to Singapore Standard Occupational Classification (SSOC)

Job posting data was tagged to the latest SSOC 2020, and at SSOC level 3 to distinguish between different types of job roles while avoiding overly granular analysis.

B. Tagging job posting data (2012-2022) to the Singapore Skills Taxonomy (SST) and Apps & Tools

The SST is a hierarchical classification system that is used to define, categorise, and organise skills according to their corresponding knowledge and abilities. The primary purpose of the SST is to systematically define, organise and communicate the most relevant clusters of in-demand skills needed and to provide clarity and structure around the skills required for the workplace. For analysis, we used SST level 1 which has 10 clusters to help readers quickly understand the landscape of skills. Beyond skills, **Apps & Tools** are also critical enablers to perform work. SSG has identified about 900 Apps & Tools from job posting data. The 10 SST level 1 clusters and the Apps & Tools cluster constitute the 11 clusters in our analysis.

C. Performing data analysis

Each cluster was normalised by dividing the total count of skills or Apps & Tools that belong to the cluster based on job postings in a given year, by the total count of skills or Apps & Tools from all 11 clusters based on job postings in the same year. The result is each cluster represented as a share that indicates its relative importance for a given type of job (SSOC), or its relative importance in Singapore's economy. The hiring demand is calculated by grouping the job postings related to a given type of job.

In this chapter, data from three years (2012, 2017, and 2022) was highlighted to show the changes in skills by comparing the beginning year of the data, the middle year of the data before COVID-19, and the end year of the data during the COVID-19 recovery. The top 10 demanded skills or Apps & Tools for each cluster were analysed across the three years to show how individual skills have become more important or less important over time.

The 11 clusters are: Business Management, Production Management, Innovative Design, Data Management, Human Resources, Care Services, Operations Management, Financial Management, Environmental Management, Critical Core Skills, and Apps & Tools.

Analysis methodologies applied in Chapter 2 ‘Priority Skills in the Three Economies: Green, Digital and Care

A. Definition of priority skills

Priority skills refer to skills that citizens can prioritise to gain access and thrive in specific sectors. These skills were derived from SSG's National Jobs-Skills Intelligence engine and validated with expert input from industry, academia and sector agencies. In the various charts within this chapter, SSG chose to spotlight skills whose demand grew in recent years, rather than just skills with a large, existing demand. The spotlighted skills are more likely to see shortages now and in the near future.

B. Measurement of demand growth and transferability of priority skills

Demand growth for a given priority skill refers to the growth in employers' demand for the skill as reflected in job postings over four calendar years. Growth in employers' demand for a given priority skill is then computed as the **compound annual growth rate (CAGR)** of job postings that mentioned the skill. If two priority skills, 'S1' and 'S2', are mentioned in a single job posting, the job posting will be counted twice, once under 'S1' and once under 'S2' to compute the respective CAGR. If a priority skill is mentioned more than once in a single job posting, the job posting will only be counted once under that priority skill to compute the CAGR. In this report, demand growth is calculated using CAGR based on job postings from 2019 to 2022.

$$\text{Demand Growth}_{\text{CAGR}} = \left(\frac{\text{Number of job postings in 2022}}{\text{Number of job postings in 2019}} \right)^{\left(\frac{1}{3} \right)} - 1$$

Transferability for a given priority skill refers to the number of unique job roles that require the skill. SSG spotlighted highly transferable skills as, all things being equal, these skills would contribute the most to an individual's career versatility. A job role is deemed to require a skill when job postings for that job role mention the skill. In computing the number of unique job roles, a job role is counted only once even when there are multiple job postings for the job role. In this segment, transferability is aggregated based on job postings from 2019 to 2022.

$$\text{Transferability} = \sum_{i=1}^n \text{Unique job role}_{(2019-2022)}$$

Analysis methodologies applied in Chapter 2 ‘Priority Skills in the Three Economies: Green, Digital and Care’

C. Measurement of yearly market share and yearly transferability

Yearly Market Share of a given priority skill refers to the relative demand of the skill as compared to the entire demand of all the skills for its respective economy. This allows us to determine how valuable a skill is as compared to the other skills within the economy.

$$\text{Yearly Market Share} = \left(\frac{\text{Number of job postings that mentioned a given skill}}{\text{Total number of job postings for all skills within the economy}} \right)$$

Yearly Transferability of a given priority skill refers to the number of unique job roles that require the skill that year. In this segment, transferability is calculated year by year based on job postings from 2019 to 2022.

$$\text{Yearly Transferability} = \sum \text{Unique job role}_{(\text{year})}$$

D. Forecasting skills' demand and transferability growth

A time series regression with univariate forecasting using Meta’s Prophet model was used on 11 years of job posting data to predict a skills’ future demand and transferability. Only skills that are within acceptable R²¹ and **Symmetric Mean Average Percentage Error (SMAPE)**² values are featured in the chapter as they are within model fit and prediction accuracy thresholds.

¹ R² refers to the coefficient of determination which indicates how well the data points fit with the model.

² SMAPE is an accuracy measure based on relative errors that informs how close a forecasted value matches the actual value.

Analysis methodologies applied in Chapter 3 ‘Career Mobility Planning: a Multi-step Approach’

A. Identification of growth job roles suitable for career transition

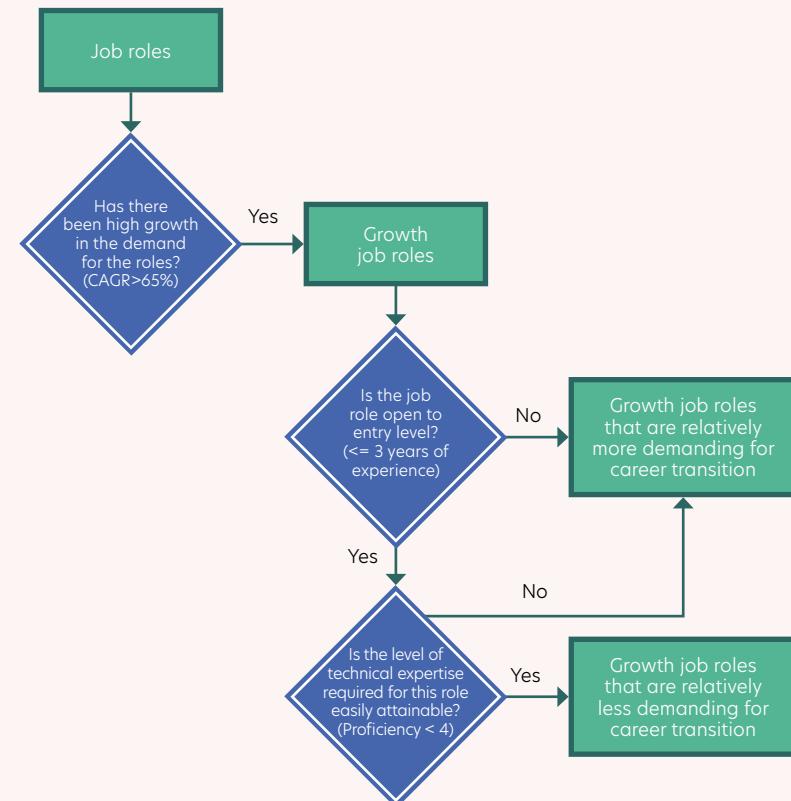
Growth job roles are job roles that are increasingly in-demand or have seen high demand growth between 2019 to 2022. The compound annual growth rate (CAGR)³ is used to calculate the demand growth of job posting numbers for each job role. Using the CAGR of all job postings from 2019 to 2022 as a baseline (65%), job roles with an average CAGR of 65% and above were deemed to reflect a reasonable growth and demand.

These in-demand, high-growth job roles are then filtered through a two-step approach to assess:

1. Job roles that have more entry level positions suitable for career transitioners – these are job roles where more than 50% of the job postings analysed indicate applicants with three years of experience or less as the minimum years of experience needed and;
2. Job roles that have required proficiency levels of technical skills which are more attainable – these are defined as job roles with an average skill proficiency level below 4.0 which indicates that the level of technical skills required are relatively easy to attain for career transitioners.

This figure shows the methodology and process flow that was applied to job posting data to derive the growth job roles that are more accessible for career transitioners to move into.

Process flow to identify accessible growth job roles



³ CAGR is the average annual growth rate over a specified period of time longer than one year. It represents one of the most accurate ways to calculate anything that can rise or fall in value over time.

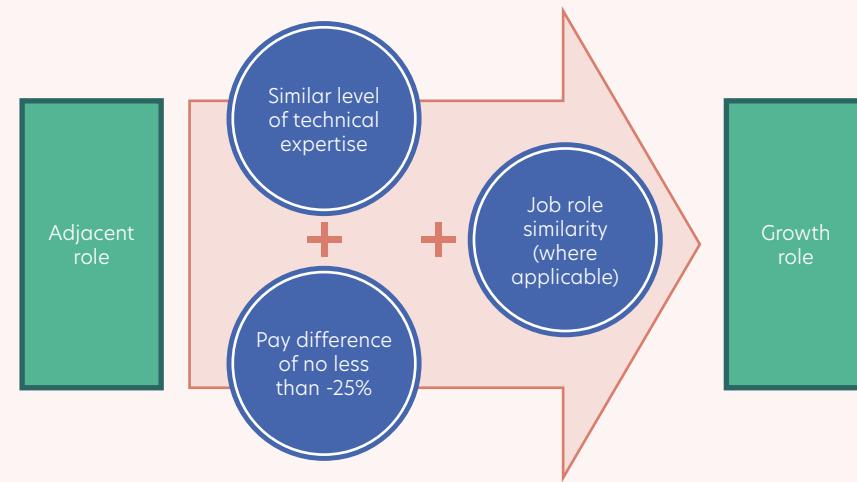
Analysis methodologies applied in Chapter 3 ‘Career Mobility Planning: a Multi-step Approach’

B. Identification of adjacent job roles and growth job roles that one can progress into

Adjacent job roles are job roles that may have a relatively smoother transition into growth job roles for career transition.

These roles were shortlisted using the SSG's jobs-skills adjacency algorithm, with the following three-step approach:

1. Determine job roles with a similar level of technical expertise where the average proficiency level difference is within +/- 1
2. Identify job roles with a percentage difference in minimum wage compared to the growth role higher than -25% (where applicable)
3. Identify job roles with a similarity score of at least 0.5. Job role similarity of 0.5 and above is deemed to reflect reasonable similarity between two job roles (i.e.: destination job role is adjacent). A job role similarity of less than 0.5 reflects bold moves that may require more effort to move into the growth job role.



Skill Cluster	Skill Description
Adjacent job role(s)	One or more job role(s) with high job role similarity as compared to the job role in question, and may entail a relatively smoother job transition
Apps & Tools	Digital and technology solutions programs, in software or app formats, that help people complete tasks more efficiently and effectively
Care Economy	An economy that is based on a professional cluster of jobs and skills focused on providing the care and support services involved in the nurturing and teaching of current and future populations
Compound annual growth rate (CAGR)	The average annual growth rate over a specified period of time longer than one year. It represents one of the most accurate ways to calculate anything that can rise or fall in value over time
Critical Core Skills	A unique set of 16 core skills identified by Singapore employers as the most critical to thrive in the future economy
Demand growth	Demand growth for a given priority skill refers to the growth in employers' demand for the skill as reflected in job postings over four calendar years
Digital Economy	An economy that is based on digital computing technologies, based on interconnecting people, organisations and machines through the Internet, mobile technology, and the Internet-of-Things (IoT)
Green Economy	An economy that strives to achieve environmental, economic and social outcomes to take care of the environment and use limited resources as efficiently and sustainably as possible
Growth job role	A job that is increasingly in-demand or has seen high demand growth over the period of analysis (between 2019 to 2022)
Industry 4.0	The exploitation of technological advancements, particularly in the digital space, to make step improvements in process efficiency, sustainability, and product or service quality
Job family	Used in SSG's research on changes to skill compositions, a job family is a job grouping related by common job roles. Job roles in a job family require similar knowledge, skills, and abilities; and have a continuum of knowledge, skills, and abilities

Skill Cluster	Skill Description
Priority skills	Skills that citizens can prioritise to gain access and thrive in specific sectors. These skills were derived from SSG's National Jobs-Skills Intelligence engine and validated with expert input from industry, academia and sector agencies
Singapore Skills Taxonomy (SST)	The SST is SSG's hierarchical classification system that is used to define, categorise, and organise skills according to their corresponding knowledge and abilities
Skills composition	The changing portfolio of skills needed in jobs over time
Skill demand growth	Demand growth that captures the relative scale of the increase in demand for that skill
Symmetric mean absolute percentage error (SMAPE)	An accuracy measure based on relative errors that informs how close a forecasted value matches the actual value
Tech-heavy	Tech-heavy roles are specialised roles responsible for the development, implementation and maintenance of more complex technological solutions and applications
Tech-lite	Tech-lite roles are job roles that involve the use of foundational digital solutions at work
Transferability	Transferability for a given priority skill refers to the number of unique job roles that require the skill
Yearly market share	The yearly market share of a given priority skill refers to that skill's relative demand, as compared to the entire demand of all the skills for its respective economy
Yearly transferability	Yearly Transferability of a given priority skill refers to the number of unique job roles that require the skill that year

Chapter 1 - Changes to Skills Composition of Jobs in the Singapore Economy (2012-2022)

Green

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Chapter 2 - Priority Skills in the Three Economies: Green, Digital and Care

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Chapter 2 - Priority Skills in the Three Economies: Green, Digital and Care

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