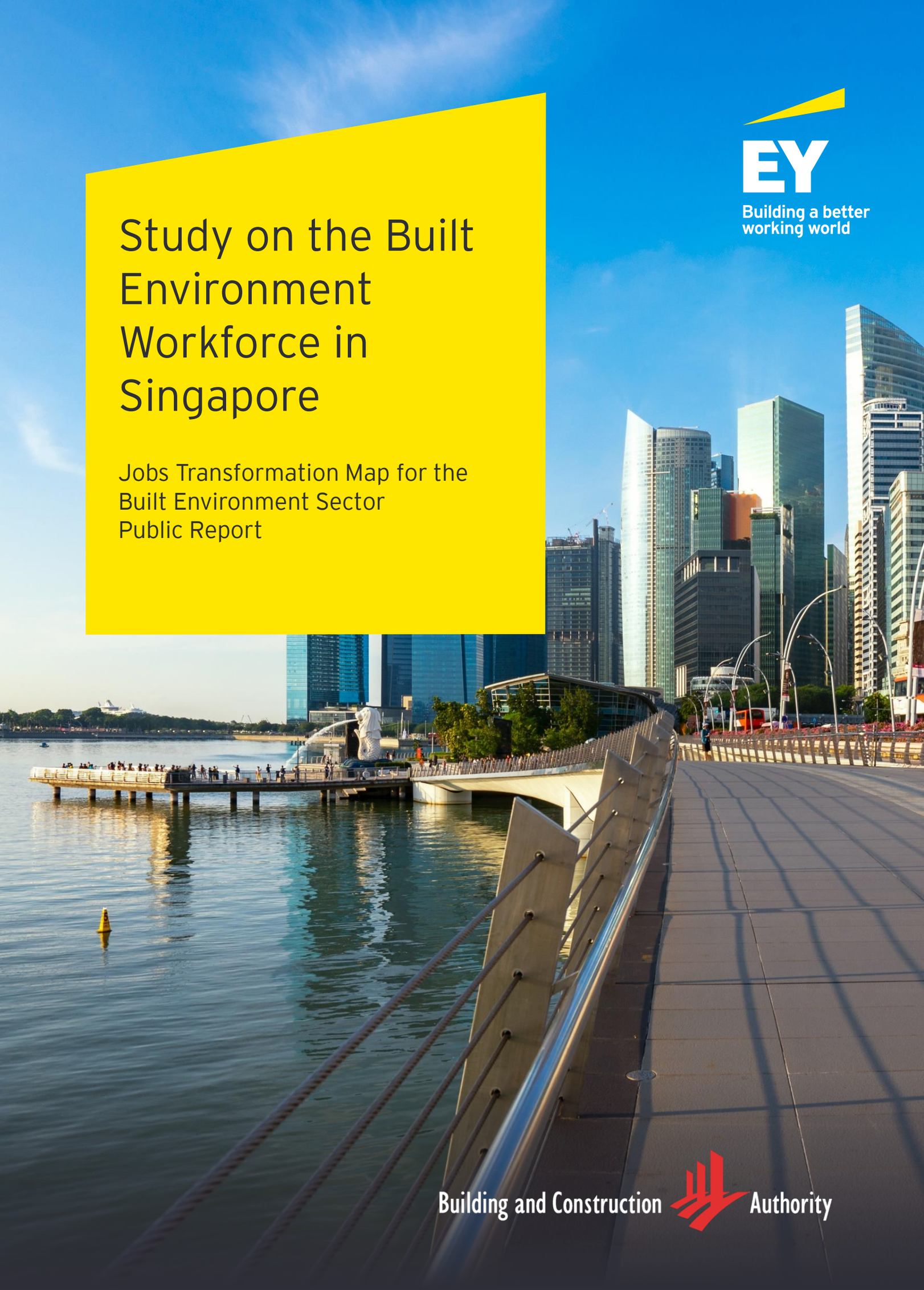

Study on the Built Environment Workforce in Singapore

Jobs Transformation Map for the Built Environment Sector Public Report

EY
Building a better working world

Building and Construction Authority

Preface

Ernst & Young Advisory Pte. Ltd. (EY) was commissioned by the Building and Construction Authority (BCA), in collaboration with Workforce Singapore (WSG), to conduct a Manpower Study and evaluate the impact of key trends on Singapore's Built Environment sector.

Megatrends and technology trends include (but are not limited to) workforce challenges, multi-skilling, Robots and Automation, and the COVID-19 pandemic which have and will continue to transform how the Built Environment sector functions today and in the future.

The study aimed to analyse the impact of industry transformation on the Built Environment workforce. Using the Skills Framework (SFw) for Built Environment as reference, the study sought to understand which job roles will be impacted and how job tasks and skills will change. Together with manpower analysis on cross mobility and synergies between occupations within the Built Environment sector and adjacent sectors, results of the study facilitate understanding of future demand and supply for existing job roles in the sector. Lastly, recommendations are put forth, to build a resilient and competitive workforce equipped with the right skills to thrive in a constantly evolving environment, in the long-term.

In partnership with...

Led by...

Abbreviations

Abbvn	Term	Abbvn	Term	Abbvn	Term
3D	3 Dimensional	DAOs	Decentralised autonomous organisations	IP	Intellectual Property
ACD	Architecture Consultancy & Design	DDM	Digital Delivery Management	ITE	Institute of Technical Education
ACES	Association of Consulting Engineers Singapore	DfM	Design for Maintainability	ITM	Industry Transformation Map
AFM	Aggregated Facilities Management	DfMA	Design for Manufacturing & Assembly	IWSP	Integrated Work Study Programme
AI	Artificial Intelligence	ECD	Engineering Consultancy & Design	JGI	Job Growth Incentive
BATU	Building Construction and Timber Industries Employees' Union	EVP	Employee Value Proposition	JTM	Jobs Transformation Map
BCA	Building and Construction Authority	EY	Ernst & Young Singapore	L&D	Learning and Development
BE	Built Environment	FM	Facilities Management	LQS	Local Qualifying Salary
BEST	Built Environment SkillsFuture Tripartite	FMP	Facility Management Professional	MET	Mass Engineered Timber
BETA	Built Environment Technology Adoption	GBIC 2.0	Green Buildings Innovation Cluster 2.0	ML	Machine Learning
BIM	Building Information Modeling	GDP	Gross Domestic Product	MLS	Mobile Laser Scanning
C&D	Construction and Demolition	FM	Facilities Management	MNC	Multinational Corporation
CAGR	Compound Annual Growth Rate	GES	Graduate Employment Survey	MND	Ministry of National Development
CCP	Career Conversion Programme	GIS	Geographical Information System	MOE	Ministry of Education
CET	Continuing Education Training	GMIS-EB 2.0	Green Mark Incentive Scheme for Existing Buildings 2.0	MOM	Ministry of Manpower
CFMC	Certified Facilities Management Company	HCDT	Human Capital Diagnostic tool	NP	Ngee Ann Polytechnic
CIC	Construction Industry Council	HR	Human Resources	NTU	Nanyang Technological University
CM	Construction Management	HRTTP	HR Tech Transformation Programme	NTUC	National Trade Union Congress
CMP	Construction Management (Production)	I/AFM	Integrated & Aggregated Facilities Management	NUS	National University of Singapore
COVID-19	Coronavirus Disease 2019	IDD	Integrated Digital Delivery	NYP	Nanyang Polytechnic
CTIL	Construction Technology Innovation Laboratory	IES	Institution of Engineers Singapore	OCSS	Off-site Construction Special Scheme
CVE	Civil Engineering	IHL	Institute of Higher Learning	OJT	On-the-job Training
CWRS	Construction Workers Registration System	IHRP	Institute of Human Resource Professionals	PET	Pre-Employment Training
D&C	Design & Construction	IoT	Internet of Things	PFAPS	Prefabrication Association of Singapore for Precast and Steel

Abbreviations

Abbvn	Term	Abbvn	Term	Abbvn	Term
PGF	Productivity Gateway Framework	RPA	Robotic Process Automation	SSG	SkillsFuture Singapore
PIP	Productivity Innovation Project	SCTP	SkillsFuture Career Transition Programme	SSIC	Singapore Standard Industrial Classification
PM	Project Management	SFM	Smart Facilities Management	SSOC	Singapore Standard Occupational Classification
PMET	Professional, Managerial, Executives and Technical	SFw	Skills Framework	SUSS	Singapore University of Social Sciences
Poly	Polytechnics	SGBC	Singapore Green Building Council	SUTD	Singapore University of Technology and Design
PPVC	Prefabricated Prefinished Volumetric Construction	SGBMP	Singapore Green Building Masterplan	TAC	Trade Associations & Chambers
PSG	Productivity Solutions Grant	SIA	Singapore Institute of Architects	TP	Temasek Polytechnic
PVC	Polyvinyl Chloride	SIE (BS)	Sustainable Infrastructure Engineering (Building Services)	UAV	Unmanned Aerial Vehicles
QA	Quality Assurance	SIFMA	Singapore International Facility Management Association	USE	Union of Security Employees
QC	Quality Control	SISV	Singapore Institute of Surveyors and Valuers	VDC	Virtual Design and Construction
QS	Quantity Surveying	SIT	Singapore Institute of Technology	VR/AR	Virtual Reality/Augmented Reality
RE	Real Estate	SLE	Super Low Energy	WSDip	Work-Study Diploma
REDAS	Real Estate Developers' Association of Singapore	SME	Small and Medium Enterprise	WSG	Workforce Singapore
ROI	Return on Investment	SP	Singapore Polytechnic		
RP	Republic Polytechnic	SPM	Society of Project Managers		

Notes on the Methodology and Findings

In this study, megatrends and technology trends are considered as the key drivers impacting jobs and skills in the Built Environment (BE) sector. While BE companies that are affected and/or adopt the identified technologies may expect the impact of jobs and skills to be as outlined in this report, there are certain factors that may overstate or understate this impact assessment. This study examines the Built Environment sector across 2 key clusters: (i) Design & Construction (D&C) and (ii) Facilities Management (FM). Findings across the study are targeted at the BE sector as a whole, but selected ones are specific to each cluster – and are marked out as so.

This study has been calibrated to provide a sector-wide view of technology trends, megatrends, and impact on job roles and skills by aggregating insights from multiple stakeholders of various clusters, stakeholder type, profiles and perspectives. The findings need to be interpreted by individual accounting practices and contextualised to their business operations and job roles respectively. There are also other considerations that should be taken into account during the conduct of this impact study, as outlined below.

Firstly, this study acknowledges that the **journey and timeline to transformation may vary** across companies.

- BE companies of different stakeholder types (i.e., Consultant, Builder, Developer and Facility Manager) operate on varying systems, size and scale of operations . The long-term nature of the operating models, business priorities, processes and the sector's contracting models also plays a part in influencing the pace that trends and technologies are reacted and/or adopted.
- The pace of transformation in the sector is acknowledged to be fragmented, and benefits from digital transformation can best be reaped if the sector moves holistically. Yet, certain BE companies may choose to transform along with or even beyond industry pace, while others may choose to be fast followers, or adopt a strict needs-based approach.
- Other factors beyond the control of BE companies may affect the transformation and adoption of trends and technologies across the value chain include, but are not limited to, regulatory requirements, clients' mindset and contractual flexibility, ease of accessibility or availability of solutions (technology or otherwise) for adoption across the value chain.

Secondly, this study also acknowledges **that the impact on jobs and skills experienced by BE companies may vary** depending on several factors.

A different pace of adoption of trends and technologies would result in varying impacts on jobs and skills that are experienced by BE companies. The study acknowledges that the Built Environment (BE) sector is a very diverse sector. With 2 broad clusters and 8 functional tracks at its core, the sector is also highly inter-linked with multiple stakeholders contributing to its success.

In this study, the extent of impact and time horizon has been calibrated for the sector, but individual companies have different business priorities and people strategies that may result in different outcomes. Hence, the potential outcomes for impacted jobs (e.g. major job redesign, moderate job redesign or minimal job redesign) may differ across various companies.

Thirdly, the historical trends and **future projections in the manpower study are triangulated by multiple factors.**

Megatrends identified from research, industry outreach and data collected from a sectoral Manpower Survey were overlaid with Singapore's gross domestic product (GDP) growth rates from Ministry of Trade and Industry (MTI) Economic Survey, Industry Transformation Map for Built Environment and Ministry of Manpower (MOM) Data.

While the actual manpower trends for the overall sector may be slightly varied, it is expected to display similar patterns.

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01

Executive Summary

Key Findings from the Study

The Built Environment sector is facing winds of change from evolving global and local trends, technological advances and prolonged manpower challenges. While these trends are likely to push the sector into the direction of becoming more productive, sustainable and less manpower reliant, the sector must proactively prepare and look to accelerate the necessary changes in order to achieve this future state for the sector.

In this study, 5 megatrends and 12 technology trends were examined to identify the impact on the sector's overall landscape, jobs and skills. The study identifies several key findings that are applicable across both clusters in the sector:

Key workforce findings

Workforce issues continue to be a challenge for the sector, exacerbated by an ageing workforce and low talent inflow. Megatrends such as COVID-19 and Workforce Challenges also contribute to the projected reduction in talent, and how the sector may face supply challenges in the future. This is compounded by **the sector remaining unattractive to attracting new talent and retaining existing talent**, with the workplace environment and current HR practices not mature or competitive enough against competing sectors for talent.

The sector is therefore pushed to find solutions by exploring new technologies and digital solutions, and adopting the necessary skills and technologies to augment gaps and remain competitive.

Key job role findings

Based on the inputs from the sector, across 48 job roles, **1 job role has been identified as being highly impacted** – thus expected to experience a high degree of change in job tasks and requires major job redesign. **34 job roles will experience a medium degree of change** in job tasks and require moderate redesign.

13 job roles have also been identified to be emerging in the sector as an outcome of digitalisation and sustainability-related trends – such as architectural technologist and facility management data analyst.

For further details on the job role findings, see Section 4.

Key Findings from the Study (cont'd)

Key skill findings

Overall, it has been observed that for the sector, **core technical skills remain in demand** i.e. Technical Drawing, Engineering Design and Management, Building Management. However, skills are also in-demand across 5 other categories: (A) **Digital skills** in lieu of the acknowledged need for greater technology adoption; (B) **Compliance skills** to manage project risks and continue adherence to sector's regulations; (C) **Sustainability skills** in response to evolving trends on sustainable construction/buildings and driven by regulatory needs; (D) **Management skills** to facilitate change and skills development, in support of industry transformation; and (E) Critical Core Skills such as Communication, Transdisciplinary Thinking and Digital Fluency have been highlighted by the sector as in-demand, complementing core technical skills, as it creates an agile and resilient workforce.

For further details on the impact to jobs and skills, see Section 4.

Key recommendations

In discussions with participants, it was found that alongside the expected impact of megatrends and technology trends on the sector, 5 common narratives were articulated that formed the basis of the recommendations for this study:

Firstly, **there is a need to accelerate adoption of technology to enable greater efficiency and productivity**. While there is general industry awareness of the need to accelerate adoption of technology, actual adoption remains slow across the sector. Greater efforts to accelerate technology adoption are needed – especially as a lever to enable higher efficiency and productivity through supporting existing job holders in current job tasks. With higher efficiency and productivity, the effects of the existing manpower gaps may be mitigated, as job roles are redesigned, and current employees can upskill to meet productivity demand more easily.

Secondly, **industry leaders will be looked towards and need to lead the way for the entire value chain to adopt and implement ITM skills***. With ITM skills having been identified as key drivers of the sector's transformation, a conducive ecosystem to facilitate better adoption of the ITM skills across the whole sector is critical to reap the benefits. ITM skills needs to be adopted at the same pace for the entire value chain to fully realise its benefits.

Thirdly, **jobs must be redesigned to mitigate potential unmet future demand, and drive upskilling and multiskilling**. As technology adoption is accelerated, job roles must be examined for potential redesign, to better fit changing processes enabled by technology and to ensure business needs continue to be met.

Job redesign can also potentially mitigate unmet future demand that arises from an ageing workforce and the uncertain nature of foreign labour supply, which the sector is reliant upon, by expanding employees' skill sets to meet job needs.

A CONDUCIVE ECOSYSTEM IDEALLY COMPRISES:

- Larger companies with greater resourcing power can lead pilot initiatives to upskill the entire value chain. Efforts can be directed to both preparing fresh graduates and ensuring mature workers are equipped with the right skills to meet the sector's changing demands and digital transformation.
- Greater incentives for both individuals and companies for upskilling initiatives, providing appropriate and relevant learning curricula, and achieving buy-in in prioritising the upskilling and reskilling of the workforce.

* ITM skills are skills defined within the Industry Transformation Map.

Key Findings from the Study (cont'd)

Fourth, **the attractiveness of the BE sector needs to be enhanced by changing people culture and practices.** Building an attractive sector requires examining and improving HR practices across Compensation, Employee Value Proposition and Organisational Culture, to ensure the viability of the sector relative to others – especially for talent attraction and retention.

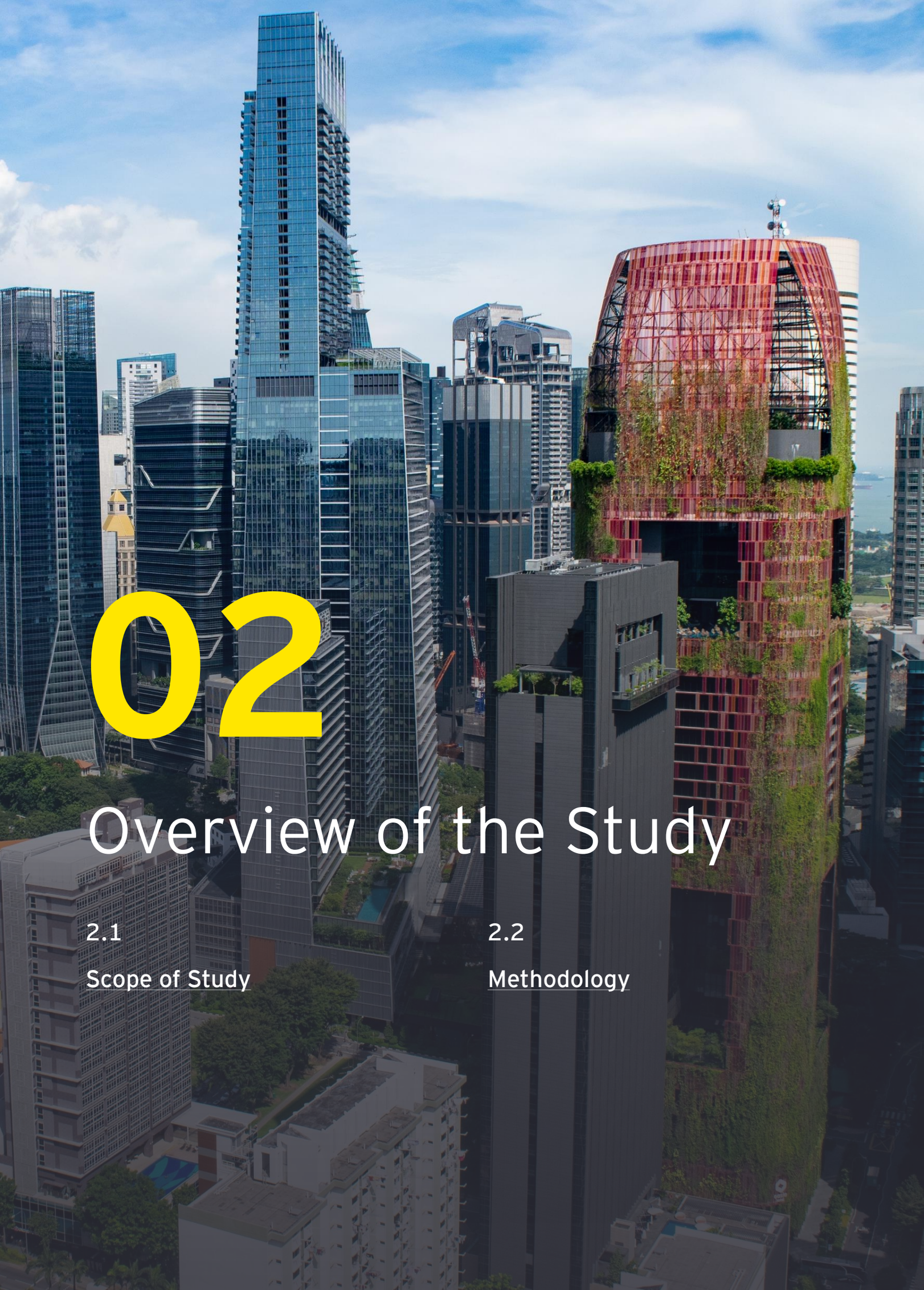
By enhancing people-centric levers, coupled with an accelerated drive for technology adoption, the sector has opportunities to reposition and brand themselves as essential and digitally-enabled, shifting away from traditional perceptions.

Finally, **the sector needs to increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce**. Early and meaningful engagement of the talent pipeline is critical in the talent attraction and retention process in the sector.

COMMITMENT AND COLLABORATION BY STAKEHOLDERS IN THE SECTOR TO DRIVE SUCH ENGAGEMENT IS REQUIRED, THROUGH:

- Implementation of processes and policies that reflect BE's modernization i.e. digital-centric processes, inclusive culture and leadership
- Building stronger partnerships between IHLs and companies to ensure alignment with industry needs, and better preparation in terms of expectations, skills, and experience
- Stronger sectoral branding experiences should be provided to students from a younger age, positioning the BE sector as a viable long-term career

For further details on the recommendations, see Section 6.



02

Overview of the Study

2.1

Scope of Study

2.2

Methodology

2.2 Methodology

Introduction

The study has been commissioned to explore the impact of industry transformation on the current BE sector workforce, with a focus on identifying and supporting the most impacted segments – to help the sector's stakeholders build capabilities to enhance or transform the sector's ability to attract, upgrade, and retain the current talent pipeline.

For the purpose of the study, the sector has been clustered into the Design & Construction Cluster and the Facilities Management Cluster. The study examines both clusters as a sector and individually, with findings and recommendations provided at minimally sectoral-level, and cluster-level where applicable.

The study focused on examining the following elements:

- Megatrends and technology Trends impacting the sector
- Impact on Job Roles within the Skills Framework for BE

Key objectives

Identify **key trends** (technology, megatrends and COVID-19) impacting the sector in the **short, medium and long-term**

Analyse and project the sector's **manpower demand and supply**

Conduct **local and global benchmarking** on manpower development efforts to identify **best practices** and recommendations to enhance sector's ability to **attract and retain local talent**

Identify **opportunities** in the BE sector (e.g., jobs that are in demand, emerging skills that are required)

Understand the **job roles at risk** and **adjacency of job roles to various sectors**

Provide **recommendations** to **strengthen the BE workforce** transformation efforts and **help talents stay relevant**

Megatrends

- COVID-19
- Multi-Skilling
- Sustainable Construction/ Buildings
- Value Chain Aggregation & Integration
- Workforce Challenges

Technology trends

- BIM Technology
- Blockchain
- Data Analytics and Artificial Intelligence
- Digital Twin
- Remote Monitoring
- Robotic Process Automation (RPA)
- Robots and Automation
- Virtual Reality/ Augmented Reality
- 5G, IoT & Smart Buildings
- 3D Printing
- Innovative Building Materials
- Modular Construction

2.1 Scope of Study

Functional Tracks and Job Roles in Scope

The study leveraged the Skills Framework for Built Environment (SFw for BE) to determine the functional tracks and job roles in scope for the sector. The definition of clusters, functional tracks and job roles in scope are as below:

CAREER MAP FOR BUILT ENVIRONMENT SECTOR

Design & Construction							Facilities Management
Architectural Consultancy and Design	Engineering Consultancy and Design	Quantity Surveying	Construction Management (Production)	Construction Management	Project Management	Digital Delivery Management	Facilities Management
Director / Managing Director / Chief Executive / General Manager							
Associate Director (Architecture)/ Principal Architectural Executive	Associate Director (Civil and Structural Engineering)/ Principal Civil and Structural Engineer	Associate Director (Mechanical Engineering/ Electrical Engineering)/ Principal Mechanical Engineer/ Principal Electrical Engineer	Associate Director (Quantity Surveying)/ Contracts Director	Factory Manager	Project Director (Construction)	Project Director (Project Management)	Chief Digital Officer	Associate Director (Facilities Management)
Senior Architect / Senior Architectural Executive	Senior Civil and Structural Engineer	Senior Mechanical Engineer/ Senior Electrical Engineer	Senior Quantity Surveyor/ Senior Contracts Manager/ Senior Cost Manager	Senior Production Manager	Senior Quality Assurance / Quality Control Manager / Senior Planner	Senior Project Manager (Construction)/ Project Manager (Construction)	Senior Project Manager	Lead (Digital Delivery)	Senior Facilities Manager
Architect / Architectural Executive	Civil and Structural Engineer	Mechanical Engineer/ Electrical Engineer	Quantity Surveyor/ Contracts Manager/ Cost Manager	Production Manager/ Assistant Production Manager	Quality Assurance/ Quality Control Manager / Quality Assurance/ Quality Control Engineer / Planner	Assistant Project Manager (Construction)/ Construction Manager	Project Manager	Specialist (Digital Delivery)	Facilities Manager/ Facilities Engineer
Architectural Associate / Architectural Assistant	Assistant Civil and Structural Engineer/ Technical Executive (Civil and Structural Engineering)	Assistant Mechanical Engineer/ Assistant Electrical Engineer/ Technical Executive (Mechanical Engineering/ Electrical Engineering)	Assistant Quantity Surveyor/ Assistant Cost Manager	Production Supervisor	Quality Assurance / Quality Control Supervisor	Engineer/ Assistant Engineer	Assistant Project Manager/ Project Management Executive	Assistant Specialist (Digital Delivery)	Technical Executive / Technical Officer	Building Executive/ Facilities Executive/ Property Executive / Building Officer/ Facilities Officer/ Property Officer
						Site Supervisor/ Trade Supervisor / Project Coordinator			Facilities Technician	Building Supervisor

Additional Materials Leveraged

Reference was also taken from:

- Built Environment ITM

to identify sector priorities and skills and competencies for the sector to adopt.

Note to this study

The following job roles are not in scope for this study:

- Corporate support roles in the functions Admin, Finance, Human Resources and Information Technology

2.2 Methodology

Overall Study Approach

The study adopted a four-step approach, and utilised various qualitative and quantitative research techniques to generate insights and meet the study objectives.

4-STEP APPROACH

1 Identify Local and Global Trends

Key trends affecting the sector were identified, as well as jobs, skills and workplace practices that will have significant impact on the BE sector.

2 Jobs and Skills Impact Analysis

To assess the impact of megatrends and technology trends on job roles, qualitative and quantitative methods were utilised to identify:

- Job roles that require job redesign
- Future skills required to perform the existing and evolving job roles
- Emerging job roles being created in the sector

3 Manpower Study

A quantitative manpower survey was conducted with companies and IHLs to understand the manpower demand and supply projections within the BE sector for up to the next 5 years.

4 Recommendations

Insights gathered from the qualitative and quantitative research were used to develop recommendations on strategies and measures to strengthen workforce transformation efforts for the next 3 to 5 years and beyond.

RESEARCH TECHNIQUES

Thought Leadership

- Thought leadership from EY and Government Agencies
- Academic publications and research papers

Industry Insights

- C-suite interviews with selected industry players
- Validation Sessions and Focus Group Discussions with industry players (including ESD companies) and IHLs
- Resource Team Engagements

Data Sources

- Data obtained from relevant government agencies
- Company Surveys released to the workforce within the BE sector on workforce demographics and projections
- IHL Surveys released to Institutes of Higher Learning on cohort size and graduation size of BE-related courses

Methodology

Assessment for Impact of Trends on Jobs and Skills

A key outcome of the study is to identify the impacted job roles and extent of impact on jobs and skills through a trends impact analysis.

To conduct the assessment of the impact, the following steps were taken:

TRENDS IMPACT ON JOBS AND SKILLS ANALYSIS

1

Identify Trends

Identified key megatrends and technology trends affecting the **sector, jobs, skills,** and **workplace practices** that will have significant impact on the BE sector

2

Validate Trends

Conducted **C-suite Interviews** with selected industry players to validate trends and **gather inputs for preliminary impact analysis** of jobs and skills

3

Develop Job Dashboards

Conducted **preliminary assessment** of **impact on jobs and skills**, and developed job dashboards that described the **future view of job tasks**, the **level of impact** on the job role, and the **time horizon of impact**

4

Validate Job Dashboards

Conducted **Validation Sessions** and **Focus Group Discussions** with industry representatives and IHLs to **validate assessment of impact on jobs and skills**

5

Refine Job Dashboards

Refined the job dashboards based on the **qualitative inputs** from Validation Sessions, Focus Group Discussion and Resource Team Consultations

6

Develop Jobs and Skills Impact Analysis

Consolidated findings to develop final analysis of impact on jobs and skills and **identified solutions** to manage the impact of megatrends and technology trends

Methodology

Stakeholder Engagement

To validate the study's findings and recommendations, key stakeholders across the sector were engaged to review and provide inputs in the course of the study.

TYPES OF STAKEHOLDERS ENGAGED

- 132 BE Industry Companies
- 16 Trade Association & Chambers, Unions
- 11 Institutes of Higher Learning
- 02 Professional Boards
- 09 Government Agencies

TYPES OF STAKEHOLDER ENGAGEMENTS

- 16 C-suite Interviews
- 22 Validation Sessions
- 01 Manpower Survey
- 01 IHL Survey
- 02 Focus Group Discussions
- 01 Resource Team Engagement
- 01 Industry Visioning Workshop

For further details of Methodology, see:

- Appendix: Details of Key Stakeholders Engaged
- Appendix: Details of Stakeholder Engagements

03

Trends Overview

3.1

Megatrends and Technology Trends

3.1 Megatrends and Technology Trends

Overview of Megatrends

MEGATRENDS

Megatrends refer to global shifts that changes and impacts the way the economy, business and people live or work.[1] The BE sector is no exception to being impacted by several megatrends. For the purposes of this study, 5 megatrends have been identified to be key trends that impacted the sector:

COVID-19

The global pandemic has had a greater supply-side impact through both manpower and supply chain disruptions, causing project delays and raising costs due to scarcity of resources.

As the world recovers from COVID-19, trends around digitalisation and remote working have increased in prominence, amidst concerns around sustained productivity and work-life balance.

MULTI-SKILLING

With the rise of digitalisation in the sector, professionals are increasingly required to possess cross-domain knowledge and cross-functional skills to stay relevant.

Key priorities include multi-skilling in the domains of digitalisation, finance and contract management as well as adjacent functions within and adjacent industries outside the BE sector, such as sustainability.

SUSTAINABLE CONSTRUCTION/ BUILDINGS

The persistent challenge of environmental sustainability and climate change globally has intensified focus on sustainable construction and buildings.

As part of the Singapore Green Building Masterplan, Singapore has proposed sustainability targets to be achieved by 2030. These include greening 80% of new and existing buildings, having 80% of new developments be Super Low Energy (SLE), and achieving 80% improvement in energy efficiency.

VALUE CHAIN AGGREGATION & INTEGRATION

The sector has observed a trend of clients seeking integrated services, along with the persistent need for improved efficiency and productivity.

The sector needs to align on technologies and skills across the functions and foster greater partnerships with different industry stakeholders to achieve better productivity and performance from an integrated and aggregated value chain.

WORKFORCE CHALLENGES

Workforce challenges have been long-standing in Singapore's BE sector as a result of little talent joining the sector, and talent leaving the sector.

Key factors for the small local talent pool include the unattractiveness of the sector due to low wages and harsh working conditions, as well as a mismatch between the skills and capabilities possessed by talent and those sought by employers.

3.1 Megatrends and Technology Trends

Overview of Megatrends

IMPACT OF MEGATRENDS

COVID-19

While COVID-19 is expected to be a passing trend, it is expected to have lasting ripple effects on the sector due to its impact via:

- **Disruption in supply chains, exacerbating workforce challenges** through tightened border controls and restrictions on talent movement – hence resulting in project delays and rising costs due to shortage in materials and manpower
- **Changing workforce demands** in the way we work through introduction and continued permutations of safe management measures – resulting in the **rise and prominence of hybrid workplace arrangements and costs associated with health and safety management**

Workforce Challenges

Challenges in attracting and retaining the right talents and capabilities exist in the sector due to viable and attractive opportunities from other talent-competing sectors. As an outcome of manpower supply disruptions, the sector needs to invest in the workforce to build resiliency and to prevent future labour disruptions.

Design & Construction	Facilities Management
Cluster's skills gap is estimated to be further exacerbated by the ageing population, where potential loss of knowledge and experience is likely to occur if no pipeline of future talent is established.	FM companies will need to look towards the adoption of digital solutions as an intervention to cater to the ageing demographic, redesign existing job roles to address tasks that grow increasing impractical due to physical limitations.

Multi-skilling

Multi-skilled professionals are increasingly sought after to provide expertise across domains (e.g. digitalisation, sustainability in construction methods/building operations). Professionals across the sector will increasingly see the need to learn skills across domains and functions (such as digital skills, green skills) to:

- Support various stages of the built environment lifecycle, such as efficient and sustainable design of buildings, coordination and management of construction operations, the planning and delivery of projects as well as the development and implementation of digital solutions. Relevant skills include (non-exhaustive): Building Information Modelling Application, Programming and Coding, Sustainable Engineering.
- Enhance productivity and sustainability in facilities operations management, and coordination of project tender and costs. Relevant skills include (non-exhaustive): Data Collection and Analysis, Environmental Sustainability Management, Green Building Strategy Implementation, Value Engineering.

3.1 Megatrends and Technology Trends

Overview of Megatrends

IMPACT OF MEGATRENDS (CONT'D)

Sustainable construction / buildings

There is growing interest in sustainability in construction and buildings. The growing trend of emphasis on carbon footprint of constructions and facilities operations will drive the need for relevant skills and/or emerging job roles.

Design & Construction

The use of sustainable materials and green technologies will become increasingly commonplace in the D&C space to reduce emissions, increase energy efficiency, and achieve overall cost savings.

Facilities Management

Innovations in the FM space help building owners achieve sustainability targets and companies move towards a zero-waste economy. This may involve early engagement in the value chain, working with the D&C cluster to understand how buildings are built to be energy-efficient and consequently reduce operational costs.

Value chain aggregation & integration

There is a growing need for greater collaboration and integration across the value chain and adjacent sectors, developing meaningful partnerships that add value to the sector beyond just capital optimisation.

Design & Construction

Closer collaboration from the start of the construction process between Developers, Designers, Builders and FM practitioners may be a key avenue for risk management.

Facilities Management

Closer upstream collaborations at design phase through Design for Maintainability (DfM) can reduce the maintenance load downstream. Wider collaborations with various service providers will also be increasingly prominent as the sector moves towards an integrated/aggregated FM model.

What does this mean for the sector?

The megatrends identified and their effects on the sector are not novel. Some of these trends are persistent in its impact on the sector, and whose impact may have been negatively compounded by COVID-19 over the last two years.

In lieu of these impacts, it is observed that efforts in the sector need to be centered around:

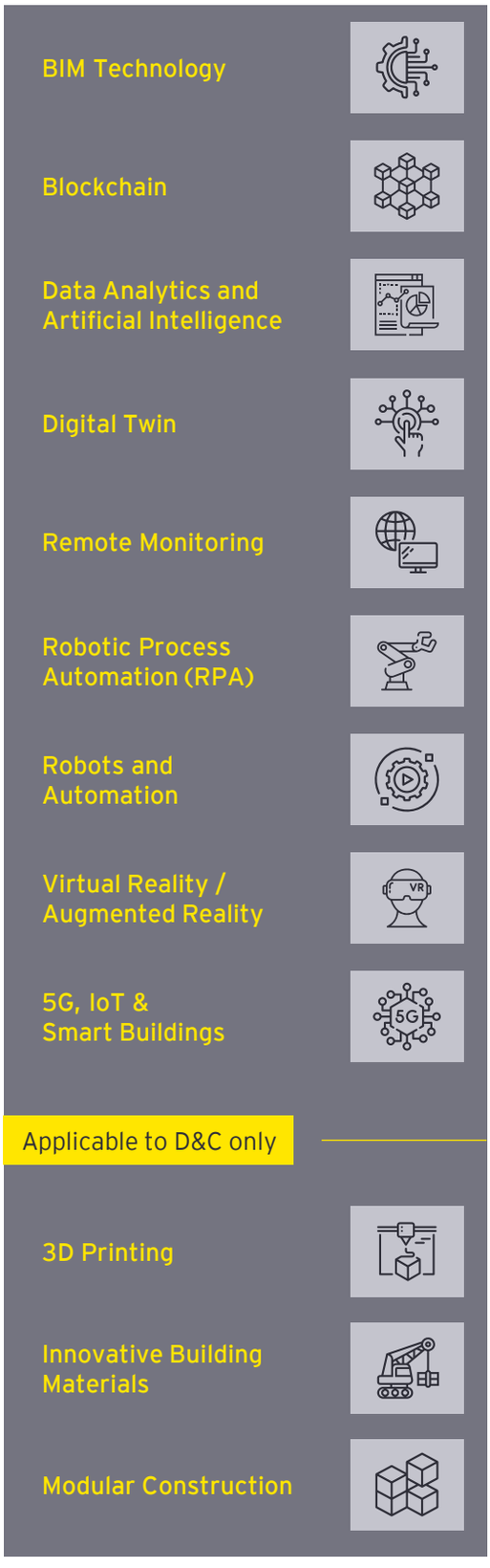
- Increasing and integrating technology adoption and streamlining processes, to augment existing and continued manpower gaps, and drive productivity for the sector
- Investing in employees' upskilling and reskilling to broaden skills across domains to build an agile and resilient workforce
- Building stronger partnerships across the sector to facilitate economies of scale and technology adoption and innovation, as the sector moves towards aggregation and integration

3.1 Megatrends and Technology Trends

Overview of Technology Trends

TECHNOLOGY TRENDS

12 technology trends have been identified in this study as having an impact on jobs and skills:



Digitalisation has been identified as a key lever to allow for the built environment sector to transform as a whole.[2] Despite the historical lag of adoption, the sector stands to gain "some of the biggest benefits from embracing new technologies"[3], with greater adoption observed as an outcome of COVID-19 and its accelerated push of technology adoption. Technology trends, and its consequent adoption, is critical for a sector that looks to achieve productivity growth – having only achieved a 1% growth globally over the last two decades against the world economy's 2.8%[4] – as well as to mitigate the rising challenges from megatrends.

In Singapore, efforts to prepare for digitalisation of the sector have been outlined in the Industry Transformation Maps (ITMs) launched in 2017[5] (D&C) and 2018[6] (FM), with greater emphasis on Integrated Digital Delivery and Smart Facilities Management.

This is also further underpinned by the BE Industry Transformation Map launched in 2022. Guided by the direction the sector looks towards in adopting technology, as the sector increases digitalisation of current processes, new technologies and skills are required to facilitate new methods of construction, building operations and maintenance, to generate cost and time savings while creating more value across the entire value chain.

- Ways that the aforementioned technologies impact the sector include:
  - Increasing use of BIM Technology as a common platform accessible by all stakeholders
  - Integration of Robotics Process Automation and Data Analytics & Artificial Intelligence to automate routine tasks
  - Use of Virtual Reality/ Augmented Reality with Remote Monitoring technology and Digital Twin models for enhanced user experiences
  - Incorporation of 5G, Internet of Things & Smart Buildings capabilities to build digitally enabled infrastructure
  - Use of Blockchain-enabled smart contracts for secure transactions
  - Use of Robots & Automation to decrease the load of physical tasks on talent
- These technologies would enable both cost and time savings for stakeholders, as mundane, routine tasks can be digitalised and automated, allowing talent to focus on higher-value job processes.

3.1 Megatrends and Technology Trends

Overview of Technology Trends

Of the 12 technology trends identified, 5 per cluster have been identified to (or are expected to) impact the sector in the short-term:

IMPACT OF TECHNOLOGY TRENDS

Design & Construction

BIM TECHNOLOGY

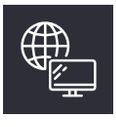
In the design and planning phase, BIM allows engineers to analyse and visualise the entire project, limiting waste and driving a just-in-time model. BIM provides insights for supply chain management and project installation, the former being increasingly important to manage COVID-19 supply chain disruptions.

DIGITAL TWIN

Digital Twin building simulations can be leveraged to conduct assessments of energy demand, indoor environmental quality, carbon emission and payment periods of energy management systems across the lifetime of an asset.

MODULAR CONSTRUCTION

Design and Construction professionals can apply Modular Construction to projects to mitigate construction challenges such as delivery speed, economic viability, quality and enhancing environmental sustainability.



REMOTE MONITORING

Remote Monitoring technologies can be leveraged to conduct field inspections and schedule reviews, to track project progress, quality, and security. Design & Construction professionals can leverage such technology to perform project coordination remotely.

5G, IoT & SMART BUILDINGS

In Design and Construction, the application of 5G, IoT & Smart Buildings includes real-time automation, monitoring tracking and surveillance, supply chain automation, enhanced video services, and hazard and maintenance sensing.

3.1 Megatrends and Technology Trends

Overview of Technology Trends (cont'd)

Of the 12 technology trends identified, 5 per cluster have been identified to (or are expected to) impact the sector in the short-term:

IMPACT OF TECHNOLOGY TRENDS (CONT'D)

Facilities Management

DATA ANALYTICS & AI

The data collected on the use of space, buildings and resources can be used to inform and drive asset management decisions and facilitate savings in operational costs. Data Analytics & AI can be applied to the classification of signals and patterns for real-time solutions, enabling the performance of preventive maintenance.

DIGITAL TWIN

Digital Twin serves as a single source for building managers to understand why and how buildings were engineered and designed, driving simplified maintenance. FM professionals can use Digital Twin to perform automated progress monitoring and predictive maintenance to support FM operations.

REMOTE MONITORING

Remote Monitoring tools (e.g. FM systems, security and surveillance cameras) can be leveraged by FM professionals to monitor facility activities in real-time and review facility incidents, e.g. security breaches. Thus, allowing for FM professionals to identify issues at earlier stages.

ROBOTS & AUTOMATION

Robotic devices can automate highly repetitive and manual tasks within buildings, such as cleaning, to increase productivity and save cost. FM professionals will increasingly be expected to leverage key data collected from such robots to optimise processes.

5G, IoT & SMART BUILDINGS

The integration of Sensors and Smart Building systems can enhance the management of building's facilities, allowing for data gathering that drives data-driven decisions to facilitate better efficiency and productivity.

3.1 Megatrends and Technology Trends

Overview of Technology Trends

What does this mean for the sector?

There is impetus for the BE sector as a whole to explore technology to address current challenges (e.g. labour shortage) as well as to overcome mid- to long-term challenges (e.g. ageing workforce, increased focus on sustainability).

The previous section presents the study's findings of the 5 technology trends per cluster that were identified by participants that the sector could look to adopting in the short-term, to address challenges identified and be competitive and current alongside the rate of change.

To allow for this change to be successful, considerations around the following areas must also be considered:

- Companies must be equipped with the right mindset to adopt and embrace technology, which may require investments both financially and from a change perspective by senior management.
- Industry stakeholders should consider building stronger partnerships across the sector to facilitate economies of scale and technology adoption and innovation, beginning from the Design phase until the Operations and Maintenance phase.

Design & Construction

The identified technology trends are targeted at driving productivity improvements for D&C through digitising and reducing manual labour interventions in the construction process – which has traditionally been a large cost factor for the cluster.

Facilities Management

To underpin the technology adoption efforts, FM companies can look towards anchoring their technology adoption strategy in alignment with:

- Smart FM – as technology underpins the adoption and implementation of Smart FM
- Design for Maintainability – the maintainability strategy should be considered in the technology integration process, and facilitate rather than hinder maintenance operations
- Integrated/Aggregated FM – leveraging technology as an enabler towards streamlining and aggregating processes

3.1 Megatrends and Technology Trends

Overview of Technology Trends

IMPACT ON TECHNOLOGY TRENDS BY INDUSTRY PLAYER TYPES

The study also acknowledges that technology trends have differential impact for different company stakeholder types. Players across the BE value chain will view adoption of technology at varying levels of benefits.

As part of the study, the following difference in impact of technology trends on the 4 key BE industry players were identified by participants:

IMPACT OF TECHNOLOGY TRENDS ON INDUSTRY PLAYERS

Developers

Developers were observed to be the key players in **driving adoption of technologies** due to their role in driving contracting terms across the value chain. They are, however, observed to be **less impacted by technologies**, as they do not typically require complex technologies to carry out their work.

Participants shared that **Developers are mostly focused on the return on investment of new technologies and** are more likely to adopt technology trends and drive adoption across the value chain if it aligns with their objectives of achieving quality, cost-savings and efficiencies.

Consultants

Consultants were regarded as more likely to **lead technology adoption in projects**, as they would have a **better grasp of industry trends** from working with global clients that have implemented technologies.

Participants shared that Consultants are often **keen to leverage technologies in projects**, but the degree of technology adoption may **depend on project size** i.e., larger ones may require and justify greater utilisation of technology.

Facility Managers

Participants shared that technology adoption may be more **prevalent in the FM space** with the shift towards **smart buildings**. The use of Smart FM enables FM to focus on higher-value tasks, although **clients' (i.e., Developers) must be willing to invest** in the necessary technological upgrades.

It was observed that FM companies may also look towards **partnerships with niche service providers**, such as IoT specialists, to **leverage technologies and build digital capabilities and expertise** within the FM space.

Builders

Builders were viewed as potential **leaders of technology adoption within the sector**, alongside Consultants.

Participants shared that Builders are likely to **benefit greatly from technology adoption** in terms of productivity gains, especially for manpower-related costs. However, the degree of technology adoption is confined to **tender bids and prices**, which limits the extent of which Builders are able to adopt and implement technology in the building process.

04

Jobs and Skills Overview

4.1

Impact on Job Roles

4.2

Impact on Skills

4.3

Emerging Job Roles

4.1 Impact on Job Roles

Overview of Job Role Impact Assessment

HOW IMPACT ON JOB ROLES WERE ASSESSED

- Impact on job roles was identified primarily from the factors of impact by megatrends, impact by technology trends and impact based on the expected time horizon.

Impact of megatrends

- Impact is defined as changes to the economic outlook, nature of business models, workforce, and job roles and skills in demand in the sector.
- Time horizon of a megatrend's impact is defined as the estimated period of time where the megatrend will or has facilitated such changes in the sector.

Impact of technology trends

- Impact is defined as changes to the nature, skills, competencies, composition, and number of jobs in the sector, and is expected to be adopted more widely and deeply.
- Time horizon of a technology trend's impact is defined as the estimated period of time where the technology has enabled such meaningful changes through the adoption of the technology across the sector.

The following definitions of impact were leveraged for the purposes of this study:

	Degree of change in job tasks	Expected outcomes
HIGH (H)	A **SIGNIFICANT proportion of the job tasks will be AUTOMATED** by technology and **HIGHLY IMPACTED** by megatrends.	The job role will be **"AT RISK"**. Job holders need to upskill or reskill with new skills to maintain their employability.
MEDIUM (M)	A **SMALL** proportion of the job tasks will be **AUGMENTED** by technology and **MODERATELY IMPACTED** by megatrends.	The job role will require **MODERATE JOB REDESIGN.** Job role will transform to take on additional duties beyond what is expected, with moderate upskilling or reskilling.
LOW (L)	The job tasks will remain **LARGELY UNCHANGED**, unaffected by technology and megatrends.	The job role will require **MINIMAL JOB REDESIGN.** Job role will continue to deliver outcomes, with minimal upskilling or reskilling required.

Assessed with a Time Horizon of Impact*:

Short-term	Medium-term	Long-term
Current to 2 years	2 to 5 years	**> 5 years**

**Time horizon of impact is independent across the degree of change in job tasks*

4.1 Impact on Job Roles

Overview of Job Role Impact Assessment

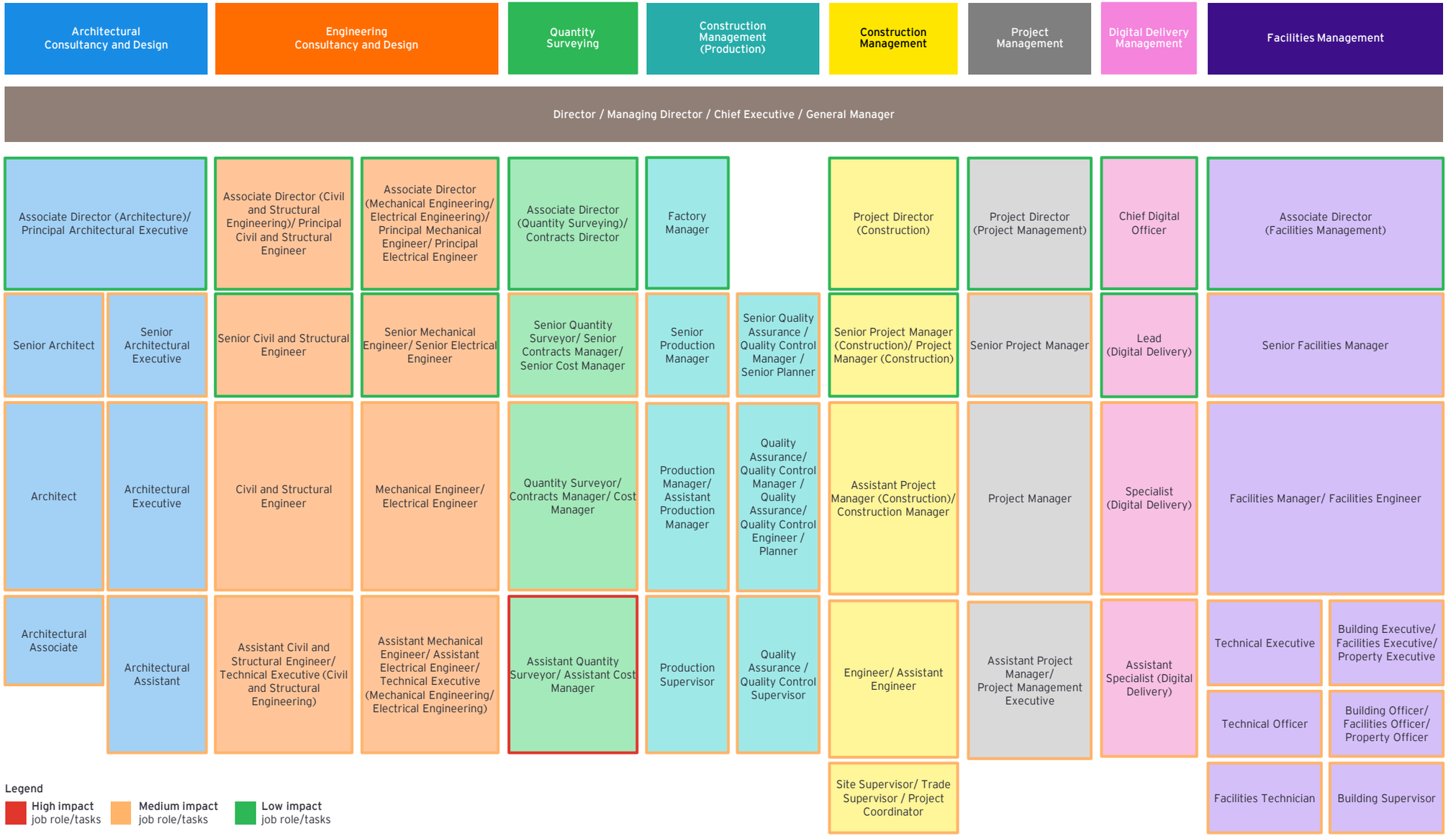
NOTES TO THE IMPACT ASSESSMENT OUTCOME

The impact analysis is based on the current version of the Skills Framework for Built Environment, published in 2020, which in its development process was designed to ensure job tasks are future-proofed in a similar time frame to this study. **Hence, given its future-oriented state, the level of deviation identified from the study for the current tasks against the future tasks may not present as significantly high impact.** However, the Skills Framework is a reference framework and may not necessarily be implemented by all organisations. **In using the findings from this section and the corresponding appendix, organisations are encouraged to examine their current state against the future state to identify the delta, and design interventions to address their gaps.**

4.1 Impact on job roles

Findings of Job Role Impact Assessment across the Skills Framework for the Built Environment

Click the relevant job roles to access more details



4.1 Impact on Job Roles

Findings of Job Role Impact Assessment across the Skills Framework for the Built Environment

OF THE 48 JOB ROLES IN THE BUILT ENVIRONMENT SECTOR...

1 job role

will experience a HIGH **degree of change** in job tasks, and job holders need to upskill or reskill with new skills to maintain their employability.

Impacted Job Role: Assistant Quantity Surveyor/Assistant Cost Manager

To address this impacted role, a Mobility Dashboard has been defined to explore potential lateral and vertical movements for incumbents in this job role.

Click the image below to begin:

34 job roles

will experience a **MEDIUM degree of change** and will require moderate job redesign. Job role will transform to take on additional duties beyond what is expected, with moderate upskilling or reskilling.

13 job roles

will experience a **LOW degree of change** and will require **minimal job redesign**. Job roles will continue to deliver outcomes, with minimal upskilling or reskilling required.

FINDINGS OF THE IMPACT ASSESSMENT

Across all the job roles, it was identified that the megatrends and the technology trends would have an impact on the job roles in changing the way that they work, hence requiring upskilling in both knowledge and abilities. For more senior job roles, the extent of upskilling would be more contained; vis-à-vis junior and mid-level job roles who would have to actively apply the skills.

The core tasks that the sector will have to do remains the same; the method of application may change – hence the overall identification of moderate impact and job redesign, rather than high impact and displacements. It is understood that the majority of job roles are going to be impacted to a medium degree of change, requiring moderate job redesign. As such, steps are encouraged to be taken to mitigate the impact of megatrends and technology trends on job roles.

The following pages detail high-level overviews of changes expected at the functional level, and the potential mitigating measures that can be taken to address this impact.

4.1 Impact on Job Roles

Findings of Job Role Impact Assessment at Functional Level

FUTURE OF THE FUNCTIONAL TRACKS

Architectural Consultancy And Design

- This function may be expected to **lead sector-wide change by driving the adoption of latest trends from the design phase.**
- In the short-term, **technology may augment existing architectural tasks**. Architectural professionals will need to focus on leveraging data insights to value-add to the design work, in generating designs that adhere to regulations and requirements in an increasingly efficient manner.
- Digital tools and platforms, e.g., BIM Technology, may grow increasingly to be used as a common platform for professionals in the value chain, integrating workflows across the entire process from design, modelling, coordination and documentation. This can **enable greater collaboration between architectural professionals and builders, easing the documentation and handover process.**

Engineering Consultancy And Design

- In the short-term, the **function may see a shift towards hybrid arrangements of site activities** i.e., mixture of onsite and offsite activities, enabled by the adoption of technologies that facilitate such arrangements. To meet future task demands, engineering professionals will need to **upskill in the effective operation of these technologies.**
- **Technology may enable greater automation and acceleration of engineering processes**. As a result, engineering professionals will need to **upskill to interpret and utilise data effectively in developing data-driven engineering designs** that adhere to regulatory requirements and **enhance the robustness of feasibility studies conducted.**

Quantity Surveying

- A **higher-than-average** proportion of tasks is expected to be automated by technology. To add value, the function as a whole may need to **place greater emphasis on advisory services to drive cost efficiency and competitiveness.**
- In the short-term, the trend of Sustainable Construction/Building is expected to see a significant rise in demand. As a result, quantity surveying professionals may see an increasing need to **acquire and apply relevant knowledge e.g., carbon costing to ensure holistic life-cycle costing of buildings.**
- With Blockchain potentially seeing an increased adoption in **tendering, contracting and procurement processes**, quantity surveying professionals will need familiarity with the technology to **perform smart contracting tasks in the long-term.**

Construction Management (Production)

- The function may see **greater emphasis placed on DfMA in the short-term**, as Modular Construction, Innovative Building Materials, and 3D Printing become **increasingly integrated into production processes.**
- Hybrid forms of work may see an increase in adoption amidst COVID-19. As a result, professionals in this track may need to **upskill in proficiencies with operating Remote Monitoring tools to conduct virtual and remote supervision** of factory works.
- **Production processes may be automated or accelerated** by technology. Professionals in this track may need to develop an understanding of and application of technology to effectively monitor and intervene in production where required.

4.1 Impact on Job Roles

Findings of Job Role Impact Assessment at Functional Level (cont'd)

FUTURE OF THE FUNCTIONAL TRACKS (CONT'D)

Construction Management

- Construction Management professionals may need to acquire proficiencies in adopting and operating relevant construction technologies – such as **familiarity with the application of robotic and automation technology to operate technology** that augments manpower and reduces repetitive, manual labour. Construction management professionals may also need to acquire proficiency in digital skills to operate digital tools and platforms that are applied in the construction process e.g., BIM, Remote Monitoring, **to drive process efficiency and perform hybrid site work.**
- This function will see the impact of the trend of **Value Chain Aggregation & Integration**, as it becomes **pivotal for efficiency** with increasingly complex building processes, **driving greater demand for interaction and close collaboration** amongst construction management professionals with other players in the sector in order to achieve project outcomes.

Project Management

- This function may see greater emphasis placed on **Value Chain Aggregation & Integration** in the short-term, where **shared digital platforms** will be increasingly adopted by project management professionals to **drive effective project management and coordination across the value chain.**
- With **Modular Construction** impacting the function in the short-term, project management professionals may need to **keep both off-site and on-site activities in mind to coordinate** project and construction processes effectively.

Digital Delivery Management

- Digital Delivery Management may see **greater emphasis placed on Integrated Digital Delivery (IDD)** in the short-term to **lead the digitalisation of the sector.**
- Digital delivery professionals will **need to continue to be at forefront of technology trends and digital solutions** in the market to drive the sector's digital transformation.
- Greater emphasis will be placed on the function to **lead implementation and troubleshooting of technology** for organisations and **support the training and development of other professionals in understanding and utilising the technologies effectively.**

Facilities Management

- Facilities Management is expected to **see greater emphasis placed on Smart FM in the short-term**, enabled by technologies e.g., 5G, IoT & Smart Buildings to automate and accelerate FM processes.
- The job roles in this function are expected to see an **overall moderate impact** on their tasks. Facilities management professionals will need to assume more of an **advisory role** by shifting focus to validate automated processes and interpret insights for recommendations.
- With the increasing importance of **Sustainable Buildings**, there is a need for facilities management professionals to **upskill** themselves in sustainability skills and knowledge to meet sector demands in the short-term.

4.1 Impact on Job Roles

Mitigating Measures for Job Role Impact

POTENTIAL MITIGATING STEPS FOR CONSIDERATION

To mitigate the impact on job roles, the sector should look to prioritise the upskilling / reskilling of workforce expected to see the highest impact first, to ensure:

- **High impact** roles acquire technological capabilities and higher-order thinking skills
- **Medium impact** roles upskill in awareness and application to leverage technology in their work
- **Low impact** roles develop greater awareness and knowledge of the applications and benefits of trends

The deepening of both horizontal and vertical skill sets **will also enable employees' mobility** across the BE sector.

The sector needs to overcome its general resistance to training.

Based on the study's findings, despite the sector's awareness to the benefits of upskilling, there is a general:

- **Lack of commitment to upskill** workforce, with limited support for training opportunities
- **Demotivation from employees** to attend training as salaries do not reflect competency levels

To address this, the sector should **facilitate a mindset shift**, especially for management roles to **see the value of upskilling talent**. The sector can look towards **accelerating the adoption of the SFw** to drive business and **achieve a common standard of competency and capability.**

This can be achieved by:

- Endorsing and applying the SFw in contracts to spur widespread adoption
- Setting wage trends to attract and retain talent with upskilled capabilities
- Additional support tied to SFw, CET, PET, and accreditation schemes by identifying relevant job competencies and proposing ways to tie credentials to salaries to better attract and retain upskilled talent

What does this mean for the sector?

To support impacted jobs, it is critical that the sector mitigates impact by upskilling/reskilling the workforce and address training resistance. The sector should look to:

- Leverage the **job redesign process** to facilitate the transition and transformation of impacted job roles
- Set up a **Centre of Excellence** for Continuous Education and Training to regulate and manage training for the sector
- Continue the development of **accreditation schemes and training frameworks** to guide industry and workforce in upskilling and/or reskilling
- Design and develop **PET and CET programmes**, with a view of continuous education
- Review **current salary practices and wage bands**, and design **sector salary guidelines** to guide compensation practices

4.2 Impact on Skills

Overview of Skills in Demand

Further to identifying the impact to job roles and how their roles and responsibilities might change, the study also examined skills that will grow in demand in the future. Assessment of skills in demand, and consequently the gap in skills, took reference from the Skills Framework for Built Environment (SFw for BE) – where skills have been identified for each job role.

Overall, it has been observed that **Core Technical skills remain in demand** i.e., Technical Drawing, Engineering Design and Management, Building Management. **In-demand skills are classified across 5 categories:**

Digital Skills

- Technical skills such as Programming and Coding have been highlighted as skills in-demand in lieu of the acknowledged need for greater technology adoption, but the study notes that **deep specialisation is not as requisite as opposed to agility in learning and utilising new technology.**

Compliance Skills

- Technical skills related to regulation compliance and adherence such as Regulatory Submission and Clearance, and Project Risk Management were identified as skills that continue to be in-demand, as amidst evolving trends and technologies, the sector recognises the need to be compliant to regulations and considers risk management as a key factor to manage going forward. This is further compounded by the potential novel complexities that may arise as technology is adopted and/or the changing operating models in the sector.

Sustainability Skills

- Technical skills such as Environmental Sustainability Management, Sustainable Engineering are also growing in-demand in response to evolving trends on sustainable construction/buildings, and driven by local regulatory needs.

Management Skills

- Technical skills such as People Management, Change Management will grow increasingly important as the sector looks to leverage these skill sets in driving industry transformation, such as upskilling and/or reskilling talent – which is a key resource in the sector – and driving adoption of technology through change and stakeholder management.

Critical Core Skills

- Skills such as Transdisciplinary Thinking and Communication have also been highlighted by the sector as in-demand as it facilitates the sector's ability to think critically and interact with others, complementing core technical skills to create an agile and resilient workforce. Due to the rapid pace of evolution for technology, skills such as **Digital Fluency are considered more relevant as compared to specialised skill sets as it drives the sector to stay relevant, and encourages rapid adoption and implementation of technology where necessary.**

4.2 Impact on Skills

Skills in Demand

This section provides an overview of the technical skills and competencies that are in-demand within the sector (i.e., the skill is already present in the sector today, but is in greater demand):

IN-DEMAND TECHNICAL SKILLS AND COMPETENCIES

Skills Category	Skills	D&C	FM
Core Technical Skills	Design for Maintainability	✓	✓
	Design for Manufacturing and Assembly	✓	
	Life Cycle Costing and Analysis	✓	
	Process Improvement and Optimisation	✓	
	Process Optimisation	✓	
	Value Engineering	✓	
Digital Skills	Analytics and Computational Modelling	✓	
	Application Support and Enhancement	✓	
	Applications Integration	✓	
	Artificial Intelligence Application	✓	
	Automated Process Design	✓	
	Building Information Modelling Application	✓	
	Common Data Environment Management	✓	
	Computational Design	✓	
	Construction Technology	✓	
	Data Collection and Analysis	✓	✓
	Emerging Technology Synthesis	✓	
	Integrated Digital Delivery Application	✓	
	Programming and Coding	✓	
	Robotic and Automation Technology Application	✓	✓
	Smart Facilities Management		✓
	Technology Application	✓	✓
	Technology Scanning	✓	✓
Compliance Skills	Contract Administration and Management	✓	✓
	Procurement Coordination and Policy Development	✓	
	Project Risk Management	✓	✓
	Regulatory Submission and Clearance	✓	
Sustainability Skills	Biophilic Design in Built Environment	✓	
	Green Building Strategy Implementation	✓	
	Green Facilities Management		✓

4.2 Impact on Skills

Skills in Demand / ITM Skills

IN-DEMAND TECHNICAL SKILLS AND COMPETENCIES (CONT'D)

Skills Category	Skills	D&C	FM
Management Skills	Change Management	✓	
	Critical Thinking	✓	✓
	Learning and Development	✓	
	People Management	✓	✓
	Stakeholder Management	✓	✓

ITM SKILLS

Of the skills in the Skills Framework, a sub-set of skills have been identified as Industry Transformation Map (ITM) Skills, and are clusters of skills that drive the transformation of the BE sector. They underpin wider sector transformational efforts and are tied to the Industry Transformation Maps launched by the Ministry of Trade and Industry Singapore.

The study sought to understand the rate of adoption of these ITM Skills in the BE sector, and key benefits and challenges faced by the sector in adopting these skills.

ITM SKILLS ADOPTION BY CLUSTER

Adoption of ITM Skills across both clusters was studied with the findings as follows, in order of highest to lowest adoption:

Design & Construction	
1	Design for Manufacturing and Assembly
2	Integrated Digital Delivery
3	Green Buildings
4	Design for Maintainability
5	Smart FM
6	Integrated & Aggregated FM

Facilities Management	
1	Smart FM
2	Green Buildings
3	Integrated & Aggregated FM
4	Design for Maintainability
5	Integrated Digital Delivery
6	Design for Manufacturing and Assembly

While Smart FM and Integrated & Aggregated FM are traditionally FM-adjacent skills, they were identified to be relevant ITM skills adopted by companies in the D&C cluster due to their relevance in downstream building operations and maintenance. Stakeholders in the cluster are required to be aware of these skills so as to design and build with them in mind.

While IDD and DfMA are traditionally DfMA-adjacent skills, they were identified to be relevant ITM skills adopted by companies in the FM cluster due to:

- IDD's relevance in Digital Asset Delivery & Management; and
- Awareness of DfMA processes for downstream operations and maintenance.

4.2 Impact on Skills

Emerging Skills / Findings on Sector Skills Gap

EMERGING TECHNICAL SKILLS AND COMPETENCIES

Alongside the study on skills in-demand and ITM Skills, additional skills and competencies were identified to be emerging (i.e., skill is not present in the sector today, but is emerging as a needed skill) as a result of the impact of megatrends and technology trends on the sector:

Core Technical Skills			
Coastal Engineering	Hydrodynamic and Flood Mitigation	Supply Chain Management	Tunnel Engineering Management

Sustainability Skills		
Design Sustainability and Ethics Management	Environmental Sustainability Management	Sustainable Engineering

KEY FINDINGS

For the skills in-demand, including ITM skills, and emerging skills, the following benefits and challenges have been identified:

BENEFITS

- Market Differentiation: Possession of in-demand (including ITM Skills) skills could serve as an **additional differentiator** between competing firms, as clients may be looking for specific skills and capabilities aligned to these skills.
  - International clients, in particular, may prefer to partner with and invest in firms with **similar priorities**, such as green buildings and sustainable construction methods.
  - ITM skills adoption allows the companies to secure more projects, enabling greater **efficiency and productivity** through **economies of scale and shared expertise.**
- Productivity: When adopted and utilised appropriately, companies have observed increased productivity in their processes through the digitalisation of processes (via IDD, Smart FM) and/or reduction of manual labour (via DfMA).
- Workforce Development: As companies upskill/reskill employees and ensure that they **evolve alongside technology and business needs**, this has a knock-on effect of **uplifting the sector as a whole** due to relevant upskilling and expertise, and can create better jobs through digitalizing the industry.

CHALLENGES

- Significant Financial and Time Investment: Adoption of skills has been determined to require significant investments in enablers (i.e., technology) to facilitate acquisition, and investments in employees' time to upskill/reskill them.
  - **Financial**: Companies have difficulty justifying and sharing costs with clients who are unwilling to pay for additional costs. For sub-contractors, they are further limited by financial constraints to invest, and limited ability to attract and retain talent with skills.
  - **Time**: Due to project timelines and constraints, companies may lack time or have high opportunity costs in sending employees for training, which drives slow adoption of skills. Despite new ways of working introduced from skills, employees may retain the mindset and preference to revert to old ways of working due to familiarity. There is a build-up time required to adapt to new practices.

4.2 Impact on Skills

Findings on Sector Skills Gap

KEY FINDINGS (CONT'D)

CHALLENGES (CONT'D)

- **Lack of Holistic Adoption**: The sector stands to reap benefits of adoption of in-demand/emerging skills only if the entire value chain adopts it i.e., IDD can enhance productivity if the entire value chain integrates digital in their delivery and leverages the benefits of digital in communications and handover. If the value chain does not adopt skills holistically, this delays the realisation of the benefits from skills adoption.

It is observed that there is a sector skills gap between skills in demand and skills currently possessed by the workforce. **The Skills Gap is a recognised concern for Industry Players**. Industry Players are concerned about the impact of megatrends and technology trends and recognise that training and development is a key lever to target in order to address this impact. This includes implementing people-centric measures i.e.,

- Equipping employees with the necessary skills in response to these trends; and
- Hiring talent with the necessary future-ready skills.

However, talent attraction and retention has been a key challenge for the sector. The skills gap is also estimated to be further exacerbated due to:

- Sector's ageing population – concerns have been shared that with a sector's workforce that trends towards a mature demographic, there will be potential loss of knowledge and experience if no pipeline of future talent is established.
- Rapid change of technology also impacts the rate of relevancy of skills – with future-ready skills potentially having a shorter half-life and consistent retraining may be required to maintain relevancy.

For further details on Skills in Demand, see Appendix: Skills in Demand/Emerging.

What does this mean for the sector?

Given the sector's need to respond to megatrends and technology trends, equipping the workforce with in-demand and future skills is a critical lever.

To close the skills gap, the sector should explore the following:

- Employers should commit to investing in employees' training and development to equip them with necessary skills by providing necessary resources and opportunities.
- Training and development programmes could be designed to target sector-wide upskilling and improvements, to ensure that the sector upskills and moves as a whole.
- Training programmes should also be designed to be adaptable and reactive to the sector's speed of change as a result of technology and megatrends (i.e., hybrid methods of delivery to minimise business disruptions, bite-sized modules).

4.3 Emerging Job Roles

Overview on Emerging Job Roles

Beyond impacting current jobs in the sector, megatrends and technology trends also impact the creation and evolution of new job roles within the sector. Through research and stakeholder engagements, 13 emerging job roles have been identified within the Built Environment sector, across 2 key categories:

Digital-related Roles

Digital job roles are likely to arise as the sector looks towards greater technology adoption and digitalisation, with job holders **specialising in digital skill sets required for the job role (e.g., Computational Design, Robotics)**, and may be responsible for identification and integration of digitalisation opportunities within the sector and across the value chain.

- **Technical skills and knowledge will still be needed** for these job roles, so as to effectively apply and integrate digitalisation opportunities into operations i.e. configuring digital systems for buildings, applying digital tools and platforms in architectural drawings.
- Job holders will be **expected to be specialists in their skill sets** i.e., Facility Management Data Analysts would be responsible for data gathering, processing and analysis for facility operation-related data.
- In the long-run, job roles across the sector would be **expected to have certain levels of competence in digital fluency**, such as the use of digital tools and platforms (e.g., BIM) and interpreting data visualisations. These specialists thus **act as centres of excellence** that support the overall sector's operations and delivering business outcomes.

In the short-term, some of these job roles may be filled by new entrants/mid-career entrants who possess strong digital expertise – but would require close collaboration and partnership with existing personnel who are technically strong so as to enable application to the work. In the long run, these job roles should ideally be anchored by individuals with an understanding of the BE sector and the associated technical knowledge and have the complementary digital skill sets to enhance the work delivered.

Sustainability

Sustainability job roles are likely to **emerge and evolve from traditional BE roles**, as **sustainability concepts are incorporated** across functional tracks, instead of building specialised sustainability teams.

- **Technical skills and knowledge will still be needed** for these job roles, with job holders applying sustainability concepts in the lifecycle of the overall value chain.
- However, new **sustainability integrator roles** may emerge, where the job holder **coordinates sustainability processes and initiatives** in projects.
- In the future, sustainability knowledge may become a **requirement across the sector**, as the workforce needs to embrace **sustainability as a mindset instead of a skill set**, thereby forming part of **every job role's core skill set**.

An alternative view held is that it may be better to **tap into the existing environmental and sustainability sector's capabilities through collaboration**, instead of building environmental and sustainability capabilities in-house, as companies **may struggle with the significant investment required** otherwise.

4.3 Emerging Job Roles

Overview on Emerging Job Roles (cont'd)

The general estimated time horizon for these emerging job roles to appear in the BE functional tracks is between 2 to 5 years – dependent on public and private sector factors i.e., legislative pressure and client demands.

Emerging job roles were observed in all BE functional tracks except Quantity Surveying (QS) and Digital Delivery Management (DDM).

- QS is unlikely to see new job roles. Instead, job holders will be enabled by digital tools such as automation and artificial intelligence, to achieve better efficiency and accuracy. Additional job scopes involving technology will be subsumed under junior QS roles to remain relevant.
- DDM is an emerging track that was identified as part of the Skills Framework, and it is unlikely to see new roles appearing; rather, there is more likely to be a change in the tasks and the technology adopted in the role.

4.3 Emerging Job Roles

List of Emerging Job Roles

Click each job role for more information

Below details the list of potential emerging job roles and estimated level of reskilling. To find out more about each job role, click the relevant box.

JOBS WITH MODERATE RESKILLING NEEDS

MODERATE LEVEL OF RESKILLING is required for existing BE job holders to take up the emerging job roles below. **Job holders will need to undergo training and continuous education.** For these job roles, reskilling roadmaps are available for job roles exhibiting overlap in Technical Skills and Competencies, indicating a possible transfer of talent.

Design & Construction

Short-term
- Architectural Technologist
- Climate-change Response Engineer
- Solar Engineer

Facilities Management

Short-term
- Facility Management Data Analyst
- Specialists (Digital FM/Engineering)
- Sustainability Facility Manager

JOBS WITH SIGNIFICANT RESKILLING NEEDS

SIGNIFICANT LEVEL OF RESKILLING is required for existing BE job roles to take up the emerging job roles below. **Further studies and qualifications are required**, and companies should **consider hiring talents from outside the Built Environment sector to fill these roles.**

Design & Construction

Medium-term
- Robotic Engineer

Short-term
- Environmental Sustainability Engineer
- Data Scientists/Engineer
- Computational Designer
- Digital Systems Engineer
- Metadata Project Manager

Facilities Management

Medium-term
- Energy and Sustainability Solutions Architect

For further information on Reskilling Roadmaps, see Appendix: Reskilling Roadmaps.

Estimated timeline of demand for emerging job roles:
Short-term: Current to 2 years | Medium-term: 2 to 5 years | Long-term: > 5 years

4.3 Emerging Job Roles

Considerations for Implementation of Emerging Job Roles

To meet the potential demand for these job roles:

- 6 out of 13 job roles can be filled by existing talents from within the BE sector, given moderate upskilling efforts to develop new skills; and
- Job roles that require higher levels of technical expertise can be possibly filled by talents from outside the Built Environment sector.

However, the following considerations should also be taken in the creation of these emerging job roles within organisations:

CONSIDERATIONS FOR EMERGING JOB ROLES

1

Emerging job roles will require new skill sets – which organisations will **need to potentially invest significant resources to obtain** through either upskilling or hiring of new talent. Organisations in the sector **need to ascertain the necessary and critical capabilities that they require**, and if these **emerging job roles are aligned to their strategies and priorities** before creating them.

2

Existing employee within the sector may already fulfilling some of these emerging job roles. In particular, roles created on a project or ad-hoc basis such as the Architectural Technologist and Sustainability Facility Manager may already be temporarily fulfilled by existing employees.

- An Architect can take over the Architectural Technologist's tasks of drafting structural designs and prototypes or developing technical software and solutions to potential future architectural challenges.
- A Facility Manager can take over the Sustainability Facility Manager's responsibilities of running company-wide sustainability initiatives or reviewing and evaluating system installation and performance outcomes.

In the circumstance that job redesign rather than job creation occurs, it is necessary for **companies to assess and determine the level of reskilling or upskilling needed** for employees to perform the responsibilities of the role.

FACTORS IMPACTING ADOPTION OF EMERGING JOB ROLES

Job roles may also be potentially easier or difficult to adopt depending on a number of factors. The study examined and identified Government and Industry-driven factors that would impact adoption.

GOVERNMENT

Legislative Pressure

Regulations put in place by the Government on mandated use and adoption of specific skills/technologies would create demand for the relevant job roles.

Targets

The presence of Government-defined targets such as the Singapore Green Building Masterplan, sector productivity target or digitalisation target would lead to the industry's response – potentially an increase in demand for related job roles that can enable achievement of targets.

(...continued next page)

4.3 Emerging Job Roles

Considerations for Implementation of Emerging Job Roles

FACTORS IMPACTING ADOPTION OF EMERGING JOB ROLES (CONT'D)

INDUSTRY

Client Demands

Clients and Building Owners can drive the demand for relevant, emerging job roles by including and catering for specific contractual requirements i.e., digitalisation, energy optimisation, including willingness to budget for additional contractual requirements. A signal in demand and higher fees would allow the industry to afford additional scope and/or specialized staff requested.

Drive to improve Productivity and reduce Operation Costs

As the industry re-examines business processes and operating models to identify productivity improvements and cost saving opportunities, the sector is likely to see increased adoption of technology, which in turn impacts adoption of new skill sets, and emerging job roles.

Industry players may look towards hiring individuals with relevant skill sets for technology implementation and operation, e.g.,:

- Individuals with an understanding of and expertise to leverage digital tools and gathered data to increase efficiency in construction project management
- Individuals with technical skills to plan and perform predictive maintenance, aided by technology and data availability, to optimise building and equipment performance
- Individuals with capabilities to manage changing contracting models i.e., move towards Outcome-Based Contracts, or if technology drives alternative contracting platforms e.g., Blockchain

05

Global Case Studies

5.1

Overview of Cities Selected

5.2

Key Learnings from Benchmark Cities

5.1 Overview of Cities Selected

Overview of Cities Selection Process

RESEARCH PROCESS

Shortlisting	Inputs from subject matter experts	Research and analysis
Cities around the world were identified and shortlisted for review and further input from Subject Matter Experts.	Subject Matter Experts were consulted for further insights and suitability as comparable cities for review, vis a vis to Singapore.	Key challenges and initiatives undertaken by each city were identified and serve as a basis for recommendations Singapore can potentially adopt.

Throughout this section, workforce related challenges faced within each city were identified across both Design & Construction and Facilities Management across 4 main pillars:

Productivity

Sustainability

Inclusivity

Workforce development

Initiatives taken at city or country level to address these workforce challenges have also been identified. Finally, relevant industry examples have been identified to illustrate use cases in each country.

Key Caveats to the Findings

- There will naturally be an overlap in initiatives between New York City and San Francisco, by virtue of them being two cities in the same country; as well as between Copenhagen, Frankfurt and Helsinki, by virtue of their countries being members of the European Union.

5.1 Overview of Cities Selected

Justification of Cities Selected

JUSTIFICATION FOR SELECTION OF BENCHMARK CITIES

In selecting the cities, the following indicators were reviewed:

Categories	Parameters
Economic Indicators	GDP revenue and contribution of BE sector
	Median wages of the sector's workforce
Demographic Indicators	Workforce size and sub-categories
Stakeholders	National sector regulators and governance
	Key industry partners (i.e., trade associations and unions)

Based on the above factors, the following cities and countries were selected as reference countries to research and identify leading practices that could be learned by Singapore:

Cities and Countries	Reason for Comparison
New York, USA; Frankfurt, Germany	These cities were proposed due to their desirable manpower profiles, and comparable relative GDP contribution. These cities also may have significant initiatives owing to their unique domestic conditions and technological advancements, and expected growth projections and high demand for new product and labour.
London, UK; Hong Kong SAR, China	
Shanghai, China; Tokyo, Japan	
San Francisco, USA; Copenhagen, Denmark	
Helsinki, Finland; Riyadh, Saudi Arabia	

5.2 Key Learnings from Benchmark Cities

Key Workforce Challenges Identified that are Shared with Other Cities

Across the cities studied as part of this research, a summary of the challenges observed are:

Labour Shortage	Low Profitability
due to low attractiveness of the sector and skills gaps in current employees	due to low productivity and increasing costs across materials, manpower and shipping

1 Labour Shortage

The sector faces **reduced capacity:**

- **Strong talent competition from adjacent sectors** i.e., Singapore and New York face competition from other growing sectors such as Infocomm Technology, that draws employment away from the Built Environment sector.
- **Strong hiring competition from adjacent regions**, i.e., Hong Kong attributes labour shortage due to strong hiring competition from Macau, Singapore and Malaysia.

The sector faces **inadequate capability,** with skilled workers being in demand but not available**:**

- Overall, all cities examined have identified a shortage of skilled manpower as a key challenge faced, with labour market issues that have been exacerbated by declining immigration and decreased mobility over the last two years.
- **Technology Development vs Rate of Adoption:** As the sector moves towards digitalisation, **the current pace of technology developments outpaces the rate of adoption in the sector**. While there is a higher demand for workers who are skilled in leveraging technology, the current workforce is not upskilled or reskilled to the necessary competency levels yet.
  - **Design & Construction** – In Japan, the ageing population has also been identified as a challenge in the bid to equip workers with skillsets to adopt and operate technologies that have been invested in.
  - **Facilities Management** – In the US (New York, San Francisco), there is demand for individuals with skills to manage complex building systems. In Germany, there is demand for advisory services to be provided by FM professionals to support business productivity.
- **Ageing Workforce and Loss of Knowledge:** While the ageing population is more prevalent in Asian countries, the sector predominantly employs a greater proportion of mature workers. This gradually maturing workforce raises challenges as there is an **expected loss of knowledge and a lack of continuous talent pipeline**. i.e., Singapore, Shanghai, Hong Kong, and Tokyo are cities with more prevalent ageing population issues which aggravates the unavailability of skilled workers in the future.
- **Unattractive Wages:** The sector is observed to **typically pay relatively low wages as compared to other sectors**, which makes it difficult to attract skilled talent. Most countries do not break into the top three sectors for wages, with countries like Singapore, Germany, Shanghai and Riyadh paying wages that are relatively lower than at least 50% of the other sectors in these cities.

5.2 Key Learnings from Benchmark Cities

Key Challenges Identified that are Shared with Other Cities

2 Low Profitability

Rising costs remains a consistent factor across all cities, with **material, manpower and shipping costs having risen over the years.**

- Manpower costs have been observed to increase across all cities, with the price of skilled labour increasing as the sector competes for limited talent.
- **Design & Construction** – The cluster has seen increasing costs in building materials, as observed in countries like Singapore, US and China.
- **Facilities Management** – The cluster has seen increasing costs of operations (i.e., cleaning as an outcome of COVID-19, and is expected to continue) and face potential delays in remodeling and/or renovations for efficiencies due to downstream effects from construction delays.

Also, despite the potential benefits associated with sector's overall digital transformation, there is **generally high resistance displayed by the sector in investing in technology** due to high capital costs involved. Across all cities, investments in technology have been observed to varying degrees of maturity, with local governments providing financial incentives to encourage adoption in the sector i.e., USA, Finland, Hong Kong; or introducing mandates i.e., BIM adoption in Germany, Denmark.

It has also been noted that there is a **growing global interest in increasing the sustainability practices** of the sector, where countries have implemented long-term goals and targets to increase the demand of sustainable construction activities. These activities encompass the entire construction value chain and facilities management, as environmentally friendly or energy-efficient buildings are initiated from design stage with the final building management in mind. Increasing focus is observed in the sector in reducing carbon footprint and ensuring efficient waste management, leveraging technology to achieve these targets.

Due to the similar challenges that have been observed, the following key learnings have been derived that can potentially be applied to Singapore in order to address some of the local workforce challenges faced:

Labour Shortage

1. Investing in **upskilling and/or reskilling workforce**
2. **Reviewing salary practices** in terms of salary adjustment methodologies and current wage bands, to **increase the attractiveness of the sector** and attract or retain talents
3. Continue enhancing **sectoral branding** to **improve perceptions** and attract or retain talents

Low Profitability

1. Continue **encouraging adoption of technology**, through inclusion of requirements or mandates or funding programmes to alleviate high costs of initial investments
2. **Leveraging partnership models** to boost sector productivity and achieve outcomes

Some of the efforts observed in other cities may have similar ongoing efforts in Singapore to address similar issues. However, cities may be at different phases of the efforts, such as London having a trial programme for Flexible Work Arrangements in the Construction sector compared to others that may still be planning for them. Another example would be enhancing the sectoral branding through closer partnerships between the industry and educational institutes in running outreach and apprenticeship programmes, seen in countries such as Germany, USA and UK. It is therefore important for Singapore to consider the local application of similar initiatives.

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LABOUR SHORTAGE

1 Investing in upskilling and/or reskilling workforce

Critically, manpower shortage from both capacity and capability is a common issue that the BE sector faces globally. Across comparator cities, it has been observed that each city has undertaken efforts in identifying means to build the necessary capabilities within citizens – so as to potentially address the labour shortage through developing the talent pipeline.

Singapore can look to mirror fellow comparator countries' initiatives to continue and expand its upskilling and reskilling efforts, enabling both the sector and young talents to be equipped with the relevant skills for the rapidly changing needs in the BE sector:

Initiatives	Design & Construction	Facilities Management
Apprenticeships/ Traineeships/ Internships/ Student and Graduate Programs	▸ In **San Francisco (USA)**, CityBuild Academy (CBA) partnered with City College of San Francisco to offer an **18-week pre-apprenticeship and construction administration training** to San Francisco residents, to **meet the demands of the construction industry.**[7] ▸ **Balfour Beatty (UK)** employs **more than 150 apprentices, 300 trainees, and approximately 700 graduate and part-time degree talent** per year to **address the local skills shortage and invest in local talent.**[8]	▸ In **New York (USA)**, the New York City Department of Education's Division of School Facilities initiated an **internship program** that pairs students with facilities management professionals to **gain experience towards an apprenticeship program.**[9] ▸ In **London (UK)**, Institute of Workplace and Facilities Management (IWFM) has partnered with Department for Work and Pensions to **identify potential employees** to **choose FM as a career of choice.**[10] ▸ **ISS (Germany)** offers nationwide apprenticeships across various functions are offered, allowing employees to **upskill and multi-skill in their desired domains.**[11]
Financing/ Offering Trainings	▸ **London's Adult Education Budget (UK)** provides **skills support** to industries that are experiencing major staffing shortages to **help adults train and gain valuable skills** they need to **improve their job prospects.**[12] ▸ In **New York City (USA)** the **NYC Accelerator programme** provides **training resources** for a spectrum of stakeholders such as building owners, board members, property managers, and contractors, to **make buildings more sustainable.**[13]	

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LABOUR SHORTAGE

1 Investing in upskilling and/or reskilling workforce (Cont'd)

Initiatives	Design & Construction	Facilities Management
Skills Mandates/ Accreditation	▸ **China's Management Measures mandates** general contractors involved in the **Engineering, Procurement and Construction (EPC) practice** to **possess qualifications in engineering design and construction** that correspond to the project's scale.[14]	▸ The **Federal Buildings Personnel Training Act (USA)** requires all federal personnel that provide building operations and maintenance services to be in **possession of certain competencies.**[15]
Partnerships for Upskilling	▸ In **Denmark**, a partnership was formulated between "operators in the construction value chain, relevant authorities, and stakeholder organisations"[16] – with the **Knowledge Centre for Circular Economy in Construction to "guide** building owners, contractors, advisers and municipalities on **recycling of Construction & Demolition (C&D) waste** and on **problematic substances in rebuilding, renovation and demolition**".[17] ▸ **Wilmott Dixon (UK) partnered with local colleges and borough councils** as part of the Building Lives Academy (BLA) initiative aims to **upskill young local talent** with hands-on experience and **build housing projects** in the local communities.[18]	▸ In **Denmark**, partnership between Copenhagen Municipality and BMT-BYG A/S allow stakeholders involved to **gain new knowledge and competencies** by learning from each other.[19]

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LABOUR SHORTAGE

2 Reviewing salary practices in terms of salary adjustment methodologies and current wage bands to increase the attractiveness of the sector and attract or retain talents

Low compensation has been observed as a common issue within the sector across countries. Singapore can consider reviewing its salary practices across the entire sector by, mirroring fellow comparator countries' initiatives:

Initiatives	Design & Construction Facilities Management
Increases in Salary/Minimum Wage	▸ Governments in **London**[20], **Hong Kong**[21], and **Saudi Arabia**[22] have **increased their national minimum wage** – which these sectors adhere to. ▸ In **Finland, wages in the sector rise in pace with other sectors**, retaining attractiveness to the local workforce.[23]
Transparency of Salaries	▸ **Transparency of salaries** is mandated in **San Francisco (USA)** and **New York City (USA)**, requiring employers with 15 or more employees in California[24] or employers with 4 or more employees in New York City[25] to **include salary information in job postings**.

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LABOUR SHORTAGE

3 Continue enhancing sectoral branding to improve perceptions and attract or retain talents

The sector's low appeal of attracting talent is not unique to Singapore and can be observed as a phenomenon across other cities such as New York, San Francisco, Frankfurt, London and Tokyo. This can be attributed to several reasons like strong talent competition from adjacent sectors and a small talent pool. Similarly, the local BE sector faces the challenge of enhancing the appeal of the sector to attract new talent and retain existing talent.

Singapore can consider mirroring the initiatives that fellow comparator countries who have embarked on in enhancing the attractiveness of the sector through:

Initiatives	Design & Construction	Facilities Management
Outreach and Networking Events	▸ In **Denmark**, the **Innovation Network for Sustainable Construction (InnoBYG)** facilitates **knowledge sharing**, **networking** and **development** in the construction sector.[26] ▸ In the **UK**, firms partnered with BuildUK to **develop a shared action plan to improve the image of the construction sector**, helping to **attract**, **develop**, and **maintain the workforce demanded by the industry**, and **support potential entrants into the sector**.[27]	▸ Across **multiple countries**, the **International Facility Management Association (IFMA)** supports branding efforts through the **different local chapters** – with such events serving as **networking opportunities for FM professionals**.
Flexible Working Arrangements	▸ In **London (UK)**, **flexible working arrangements** and **improved work-life balance tests** conducted had **successful outcomes**; proving its **effectiveness to enhance the appeal of the sector**.[28]	

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LABOUR SHORTAGE

3 Continue enhancing sectoral branding to improve perceptions and attract or retain talents (cont'd)

Initiatives	Design & Construction	Facilities Management
Promoting Diversity of Workforce	▸ In **New York City (USA)**, New York Build serves as a platform for key issues around **'Women in Construction' and 'Diversity in Construction'** to **boost the sector's attractiveness.**[29] ▸ Through **partnership with Non-Traditional Employment for Women, Lendlease (USA)** looks to **support the diversification of the construction workforce.**[30]	▸ **Pareto FM (UK)** engaged with Hearst UK to **expand Pareto FM's Women in Engineering program**, leveraging on Hearst's large reach of **more than a third of women** in the UK and its' huge online following, to **reach out to and attract more women to enter the facilities management sector.**[31] ▸ **Hines (USA)** partners with local non-profit organisations, universities, and high schools to **reach out to women for a career in the FM industry.**[32]

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LOW PROFITABILITY

1 Continue encouraging the adoption of technology, through the inclusion of requirements or mandates or funding programmes to alleviate high costs of initial investments

Critically, manpower shortage from both capacity and capability is a common issue that the BE sector faces globally. The adoption of technology is widely regarded as a key lever to address productivity challenges within the sector, with digital transformation paving the way forward for the sector.

Singapore can look to mirror fellow comparator countries' initiatives to drive technology adoption, such as:

Initiatives	Design & Construction Facilities Management
Investing in Digital Transformation	**KIRA-Digi**, launched in **Finland**, created an open and interoperable digital information management ecosystem for the BE sector; **financing more than 130 pilot projects** to provide new solutions and operating systems in the sector, such as the integration of data, IoT, and BIM in building control inspections.[33] ▸ The **Hong Kong Government** introduced a **HK$1 billion Construction Innovation and Technology Fund (CITF)** in 2019 to **expedite digital transformation** across its BE sector[34], **supporting the adoption of technologies to boost productivity, uplift built quality, improve site safety,** and **enhance environmental performance.**[35] ▸ In **San Francisco (USA)**, the construction sector **received $1.3 billion in total funding to drive innovation** in 2020[36] , and there has since been a **rise in developing technologies.**[37]
Developing Digital Platforms	▸ In **Finland**, the **Ministry of Environment launched Lupapiste**, a **nation-wide digital platform for electronic services in the real estate and building industries**. Lupapiste enables **construction licenses to be issued online**[38], while architects and designers can also **submit plans online, reducing the processing time up to 90%.**[39] ▸ **Germany** introduced a **standardised electronic material procedure called eBG** for building inspection authorities to **facilitate submission, processing, forwarding and approval of building applications**. The process has allowed for an **increase of 30% of application** in 2014, as compared to 2011.[40]
Mandates relating to Technology	▸ In **Germany, BIM** was **mandated as part of all public contracts** to **encourage and increase the adoption of such technology by the private sector**.[41] ▸ In April 2016, the **UK government mandated the use of BIM for all public projects**, following an announcement in 2011.[42] By 2021, **71% of the 1,000 firms surveyed in the UK have incorporated and utilised BIM in their projects.**[43]

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LOW PROFITABILITY

1 Continue encouraging the adoption of technology, through the inclusion of requirements or mandates or funding programmes to alleviate high costs of initial investments (cont'd)

The following examples are fellow comparator countries' initiatives categorised into the different technology trends:

Technology Trends	Design & Construction	Facilities Management
RPA/Robots and Automation	▸ **Skanska (USA)** leveraged **RPA** to automate time-consuming and repetitive customer invoice handling, processing, payments, reminders and the management of accounting journals, **increasing efficiency and productivity** while **decreasing human error.**[44]	▸ **ViaBot (USA)** utilised **robots** to perform sweeping and security services automatically and throughout the year, providing support for facility maintenance services by **alleviating the labour shortage** and **mitigating occupational hazard risks.**[45]
	▸ **Daiwa House Group (Japan) increased their usage of construction robots** amidst aging workforce, **saving up to 30% in labour costs.**[46]	
Virtual Reality/ Augmented Reality	▸ The project team from **Kerry Properties Limited (Hong Kong)** reviewed and validated the spatial feeling of the property design using **Virtual Reality equipment** such as goggles and immersive CAVE system, which **saves costs and ensures zero wastage.**[47]	
Building Information Modelling (BIM) Technology	▸ **AS+P (Germany) combined the use of BIM with Geographical Information System (GIS)** to accelerate, optimise planning and processes for the purpose of **quality assurance** and **communication through virtual reality.**[48]	▸ **Kerry Properties Limited (Hong Kong) implemented BIM processes** across the entire project life cycle of Wong Chuk Hang Station's property development[49], **reducing rework and errors** and **gaining better predictability.**
	▸ In **Germany**, the Federal Ministry of Transport and Digital Infrastructure (FMDTI) collaborated with the private sector to **implement BIM** in Germany's BE sector **to enhance awareness of its practical usage.**[50]	

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LOW PROFITABILITY

1 Continue encouraging the adoption of technology, through the inclusion of requirements or mandates or funding programmes to alleviate high costs of initial investments (cont'd)

The following examples are fellow comparator countries' initiatives categorised into the different technology trends (cont'd):

Technology Trends	Design & Construction	Facilities Management
5G, Internet of Things (IoT) & Smart Buildings	▸ In **China**, a **5G Construction Site** was developed, leveraging on a network with **increased speed of transmission to trial futuristic applications**.[51]	▸ **Infogrid (UK)** provides an **end-to-end smart building system**, where artificial intelligence analysis is combined with IoT sensors to **allow automation of compliance checks** related to carbon emissions or water wastage.[52]
	▸ **Polyteck (UK)** implemented **smart sensors** and a **complete IoT-sensing solution** for Mechanical and Engineering Systems, which allows building managers, on-site engineers, on-site security and maintenance providers **access to personalised information** on Air and Space Temperature and Refrigerant Pressure.[53]	
Blockchain	▸ **Polyteck (UK)** makes use of **crypto-currency** and **blockchain technology**, which **quickens the payment transfer process** and **creates a stronger mechanism for audit trails**.[54] ▸ **Gammon (China)**, a Construction and Engineering Contractor, leverages on **blockchain technology** and integrates a mobile application, dashboard, and real-time notifications to **improve collaboration, transparency and accountability** among stakeholders.[55]	

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LOW PROFITABILITY

2 Leveraging partnership models to boost sector productivity and achieve outcomes

To leverage economies of scale, it has been observed that there are increased partnership models within the sector, between government and private sector; or a trend towards delivering integrated/aggregated services. Singapore can look to mirror fellow comparator countries' initiatives in partnership models to boost sector productivity:

Initiatives	Design & Construction	Facilities Management
Private-Public Partnerships (PPP)	▸ With **Finland government's support** in R&D initiatives, **private firms can invest in physical capital** such as machines and processes that **enable workers to be more productive, justifying the higher wages**.[56]	
	▸ In 2018, the **Construction Leadership Council** in the **UK** developed the **Construction Sector Deal**, an "**ambitious partnership between the industry and the government** that aims to **transform the sector's productivity** through **innovative technologies** and a **more highly skilled workforce**".[57]	▸ In 2003, **the Danish Enterprise and Building Authority** started to **financially support** Denmark's municipalities and counties who wished to embark on PPPs related to facilities management and building operations and maintenance.[58] PPPs were established to involve private sector participation to provide services for public infrastructure and deliver assets that are managed with **high quality** and **cost efficiencies**.[59]

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

KEY LEARNINGS TO ADDRESS LOW PROFITABILITY

2 Leveraging partnership models to boost sector productivity and achieve outcomes (cont'd)

Initiatives	Design & Construction	Facilities Management
Partnerships between Companies	▸ **Al Ramz (Saudi Arabia)** partnered with Watheeq Proptech to **develop affordable**, **sustainable** and **quality**, **quick-to-market residential housing** in Saudi Arabia using 3D printing, prefabricated buildings, and construction robots.[60] ▸ **NCC (Finland)** partnered with a construction technology start-up, Buildots, to **pilot AI models** in two of their residential and commercial projects.[61] This granted NCC access to a **single source of truth** and allowed them to **keep track of issues closely** and **free up time for site engineers**.[62]	▸ **ISS (Denmark)** partnered with Achilles, a supply chain risk management solution provider, to **launch a web platform database** in 2019, called ProcurePASS[63]. ProcurePASS supports supply chain decisions by **maintaining a global database of suppliers**, allowing for suppliers to be **fairly and transparently assessed** and facilitates ISS to **adopt best practices globally**.[64]
	▸ **Shanghai Industrial Investment Corporation (China)** partnered with Arup to **design zero-energy buildings (ZEBs)**, a **greenhouse gas neutral transport system**, a **self-sufficient water system** and a **fully renewable energy system** in Dongtan city.[65] By transforming Dongtan into an eco-city, it **reduced the city's ecological footprint by 60%** and **energy requirements by 66%**.[66]	

5.2 Key Learnings from Benchmark Cities

Key Learnings to Address Identified Challenges

Preparing workforce for skills in demand

Critically, it is important to note that while new technology and construction methods are being adopted, traditional construction skills i.e., Engineering remain in demand to continue maintaining and extending the built environment. Across the sector, **skills in demand are likely to correlate to trends** – such as increasing demand for sustainability and green buildings, and digitalisation[67], as well as regulations on a national or global level.

Singapore must be aware of the growing categories of skills and associated skills, so as to evaluate and equip the workforce accordingly. These categories include:

- **Trade specific or Technical skills**, defined as traditional skills and technical skills that "enable deployment of Smart Construction methods during all stages of a project"[68]; for Facilities Management, automation of tasks and the move towards integrated facilities management have also resulted in a rise of advisory skill sets due to the changing nature of the ask of the job role, and change management related skills (stakeholder management, project management) to facilitate workplace shifts
- **Technology and Digital related skills**, i.e., Robotic and Drones, BIM, Big Data, AI and Machine Learning[69], Internet of Things[70]
- **Legislation and Regulation related skills** i.e., Regulatory Submission and Clearance
- **Sustainability related skills**, i.e., Reuse and Recycling of Construction Waste, Green Building and related certifications[71]
- **Alternative Construction Methods related skills**, i.e., Modular Integrated Construction Method, DfMA[72]

It is expected that the **demand for technical skills will not vary very differently from current demands**, beyond the necessary upskilling for digital or domain-related needs. Increasingly, however, employees in the **sector will be expected to employ collaborative skills** as the entire value chain becomes more closely knit – driving a "efficient, strategic and collaborative method of working".[73]

At higher job levels, managerial and technical skills are expected to be increasingly intertwined. As construction moves towards a blend of on-site and off-site, increased complexities of the end-to-end processes must be understood by managerial job roles, who **may leverage digital tools to optimise delivery and manage teams**.[74]

Studies have indicated that the **future of the sector may lie in multi-skilling** – as technology continues to blur the boundaries between traditional trades, with construction technology replacing aspects of the process, equipping employees with a blend of skills is more likely to futureproof them and allowing for firms to withstand demand shocks in the sector.[75]

5.2 Key Learnings from Benchmark Cities

Practices to Continue within Singapore

This study acknowledges that there are existing practices within Singapore that are already in place to address local challenges, and should be continued moving forward:

KEY PRACTICES TO CONTINUE WITHIN SINGAPORE

1 Schemes to support technology adoption

Initiatives to drive the adoption of smart technology, as observed in the case studies of New York and Hong Kong. Examples of such investment initiatives that can be continued include:

Technology Adoption	1. **BuildSG Transformation Fund** Supports the adoption of DfMA and IDD technologies across the sector[76], which includes: ▸ The Productivity Innovation Project (PIP)[77] ▸ The Off-site Construction Special Scheme (OCSS)[78] ▸ The Productivity Solutions Grant (PSG)[79] 2. **Investment Allowance Scheme** Provides tax relief for firms that use construction equipment that improves productivity.[80] 3. **Integrated / Aggregated FM Grant** Supports the adoption of progressive FM procurement and strategies, processes and technologies.

2 Efforts to attract fresh talent into the BE Sector

Initiatives to facilitate a continuous talent pipeline into the BE Sector at various career levels. Examples of these talent attraction policies that can be continued include:

Students	1. **iBuildSG Club** Student-centric interest club focusing on generating interest and awareness on BE Sector matters and careers.[81] 2. **MOE Singapore-Industry Scholarship (SgIS)** Undergraduate scholarship targeting young Singaporean talent with interest to contribute in Singapore's strategic sectors (e.g., BE Sector).[82] 3. **iBuildSG BE Formation Programme and internships** Industry preparatory programme to better prepare students for work in the BE Sector through meaningful internship.[83] 4. **Youth Chapters of TACs** Platforms with curated activities for younger members of TACs to engage in dialogue on BE Sector matters.[84] 5. **Work Study Programmes (by IHLs and BCAA)** Offered by ITE, Polytechnics and Universities as alternate upgrading pathways for ITE, Diploma students.

5.2 Key Learnings from Benchmark Cities

Practices to Continue within Singapore

KEY PRACTICES TO CONTINUE WITHIN SINGAPORE (cont'd)

3 Efforts to attract fresh talent into the BE Sector (cont'd)

Mid Careers	Targeted programmes that support mid-careerists, which is not easily observed in other countries and/or in nascent levels of development. Such programmes allow for greater exploration of talent from other sectors: **1. Career Conversion Programme (CCP)** Mid-career individuals to undergo skills conversion and move into new occupations or sectors that have good prospects and opportunities for progression.[85] **2. SGUnited Mid-Career Pathways Programme** Full-time attachment programme for mid-career individuals to gain meaningful industry-relevant skills and experience.[86] **3. Career Trial** Scheme to encourage jobseekers and host companies who are unsure about the job fit to go through a short-term trial before considering formal employment.[87] **4. SkillsFuture Career Transition Programme (SCTP)** Train-and-place programme supporting skill development of mid-careerists to improve employability and pivot to new sectors or job roles.[88]

4 Initiatives to upskill and retain talent already in the Sector

Initiatives that aim to augment skills shortage issues that Singapore has been facing, as well as enable talent to be equipped with the relevant skills to meet the demands of the BE sector:

1. **BE Skills Framework aligned Accreditation Schemes**

   Provides standardised means for the sector to validate and recognise the skills and competencies of BE professionals.[89] Currently, there are 5 accreditation schemes that have been launched for the sector.

   It has also been observed that countries such as China have used Singapore's vocational training and accreditation programmes as a model, to alleviate structural unemployment issues by ensuring accessibility to education.[90]

2. **BE Young Leaders Programme (YLP)**

   Proactively identifies, engages and grooms young talented professionals to groom the next generation of industry leaders.[91]

3. **Capability Transfer Programme (CTP)**

   Plugs capability gaps in the local job market by supporting companies in speeding up the transfer of skills from foreign specialists to Singaporean professionals.[92]

5.2 Key Learnings from Benchmark Cities

Practices to Continue within Singapore

KEY PRACTICES TO CONTINUE WITHIN SINGAPORE (cont'd)

5 Firm-specific schemes to support business transformation

Initiatives that support business transformation, to make BE jobs more productive and attractive for workers, while benefiting enterprises in retaining skilled workers:

1. **Human Capital Diagnostic Tool (HCDT)**

   Provides assessment on a company's HR maturity level across 11 HR areas such as recruitment, training and development, performance management, talent management and employee engagement.[93]

2. **Productivity Solutions Grant (PSG) & Job Redesign (JR)**

   Funding encourages enterprises to work with pre-approved Job Redesign (JR) consultants to redesign work processes, tasks and responsibilities.[94]

3. **SkillsFuture Queen Bee Network**

   Support ecosystem to guide organizations (particular SMEs) in identifying and acquiring the skills needed for business transformation. Network is led by industry leading companies with strong sectoral expertise, leadership and influence.[95]

4. **SkillsFuture Enterprise Credit (SFEC)**

   Encourages employers to invest in enterprise transformation and capabilities of their employees through a one-off credit on out-of-pocket expenses on supported initiatives.

5. **Company Training Committee (CTC) Grant**

   Supports companies that have formed Company Training Committees (CTC) to implement enterprise and workforce transformation plans that would lead to better worker and business outcomes (e.g., wage increase and/or career development plans).[96]

06

Recommendations

6.1 Summary of Recommendations

Summary of Key Manpower Study Findings and Recommendations

5 KEY CHALLENGES HAVE BEEN IDENTIFIED AS AN OUTCOME OF THE STUDY...

Technology adoption remains slow in the BE sector, despite seeing the long term benefits

Good awareness of ITM skills but **adoption of ITM skills in the BE sector remains low**

Jobs must undergo change to ensure readiness of tasks and/or work processes for the future BE sector

Sector remains unattractive to attracting new and retaining existing talent

Workforce issues continue to be a challenge due to **ageing workforce and low talent inflow**

...5 KEY RECOMMENDATIONS HAVE BEEN IDENTIFIED TO ADDRESS THESE CHALLENGES

1. **Accelerate the adoption of technology** enabling greater efficiency and productivity, to develop a **skilled local workforce** to **drive talent attraction**
2. **Industry forerunners to lead the way** for the **entire value chain** to **drive upskilling** and to **adopt and implement ITM skills**
3. **Jobs to be redesigned** to **drive workforce transformation**, in response to technology adoption and process changes
4. **Enhance sector attractiveness** by changing **people culture** and **practices**
5. **Increase focus on designing, curating and implementing programmes that provide exposure and experience** for current and future workforce

To put these recommendations into action, this would require commitment and action by stakeholders in the sector. The 4 key stakeholders for the sector have been identified as:

KEY STAKEHOLDERS

Companies | Government | Educational institutes | TACS/unions

The BE sector faces one of the most unique propositions and challenges due to the highly intertwined nature of the different companies and the value chain. The nature of the **key challenges has been identified to impact the sector as a whole, across both D&C and FM**. This study recognises that for the recommendations to be effective, it **requires close collaboration and commitment from all stakeholders in order to manifest the desired outcomes**. The recommendations on the following pages provide a view of how these recommendations can be taken by stakeholders and driven to success.

6.1 Summary of Recommendations

Overview of Recommendations

Click the relevant recommendation to access more details:

1 Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

While there was general industry awareness of the need to accelerate adoption of technology, actual adoption remains slow across the sector. This recommendation provides guidance for firms to develop technology roadmaps and adoption strategy, with consideration of downstream impact to employees and the business. With that, companies are enabled to make informed decisions and commit to technology adoption in support of the business. Additionally, this recommendation strives to ensure companies are continuously supported throughout their digital transformation journey, through new and continued efforts of the government.

Stakeholders involved:

2 Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

The workforce skills gap remains a critical area of concern for firms. Industry forerunners must lead the value chain in driving workforce transformation. Firms need to invest in upskilling employees and attracting and recruiting new talent with the right skillsets to drive industry transformation. This recommendation aims to better align skills needed by the sector and available training programmes. It also strives to introduce more conducive learning environments for employees to have sufficient and effective learning opportunities. Furthermore, this recommendation intends to ensure the sector is continuously equipped with the right skills for the future by making education accessible and continuous. This is to help the sector supplement for skills gaps and ensure talent can meet changing demands.

Stakeholders involved:

3 Jobs to be redesigned to drive workforce transformation, in response to technology adoption and process changes

Jobs must undergo change to address the challenge of technology adoption and experience improvement in work processes in the BE sector. Companies can redesign job to support employees in impacted job roles. This recommendation guides companies to understand the job transformation process and its impact, precautions to take and ways to overcome challenges to ensure successful job redesign. This may help companies make decisions and commit to job redesign efforts to add value to job roles and complement transformation efforts.

Stakeholders involved:

4 Enhance sector attractiveness by changing people culture and practices

The BE sector is expected to face greater challenges in attracting new talent and/or retaining existing talent if employee preferences and the sector's offerings continue to diverge. This recommendation highlights the critical role of companies, Government, and Trade Associations and Chambers (TACs)/Unions to work together in enhancing Human Resource (HR) practices, Employee Value Proposition (EVP), and eventually increase the overall attractiveness of the BE sector.

Stakeholders involved:

5 Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

Given the local context of the aging workforce and declining talent in joining the sector, establishing a robust talent pipeline is a challenge. This recommendation suggests ways for the industry to attract and retain talent through the intentional design, curation and implementation of programmes that provide greater exposure and experience, with long-term recognition of valuable work experience desired by the sector.

Stakeholders involved:

Legend

Companies | Government | Educational institutes | TACS/unions

6.1 Summary of Recommendations

Overview of Recommendations by Stakeholder

Click the relevant recommendation to access more details:

Companies | Government | Educational institutes | TACS/unions

1 **Accelerate the adoption of technology** enabling greater efficiency and productivity, to develop a **skilled local workforce** to **drive talent attraction**

- Identify and assess ways to adopt technology
- Consolidate focus and support for technology adoption

2 **Industry forerunners to lead the way** for the **entire value chain** to **drive upskilling** and to **adopt and implement ITM skills**

- Invest in employee upskilling and reskilling
- Continue partnership with Industry and TACs/Unions on upskilling and reskilling
- Partner with Companies and TACs on designing curriculum and certifications
- Partner with IHLs and Companies to co-design and develop PET, CET and accreditation programmes, driving improvements of local workforce capabilities

3 **Jobs to be redesigned** to **drive workforce transformation**, in response to technology adoption and process changes

- Adopt job redesign process to complement technology adoption and/or business process changes

4 **Enhance sector attractiveness by changing people culture and practices**

- Review HR practices, including Compensation, Employee Value Proposition and Organisation Culture
- Provide resources for uplifting of HR practice maturity
- Partner with TACs to drive sectoral branding efforts
- Partner with Government to drive sectoral branding efforts and improvements of local workforce conditions

5 **Increase focus on designing, curating and implementing programmes that provide exposure and experience** for current and future workforce

- Review and/or establish talent pipeline initiatives (i.e., internships, mid-career transfers)
- Raise awareness and support retention of talent pipeline to sector
- Enhance career conversion programmes to attract/re-attract talent into sector

6.2 Recommendation 1

Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

Persistent workforce challenges in the form of talent shortage are expected to continue, especially given the local context of low birth rates and declining talent joining the BE sector. While the sector leverages foreign talent to augment existing manpower gaps, it is not a long-term sustainable solution to be standalone.

Given the criticality of augmenting manpower gaps – a challenge that is faced globally – a common consensus is the sector's direction in leveraging technology to make processes more efficient and effective. While the study identified that there is a general awareness of the urgency and need to accelerate adoption of technology, technology adoption remains slow across the BE sector.

SUMMARY OF INITIATIVES

ROLE OF COMPANIES

As a first step, companies should look towards actively identifying and assessing ways to adopt technology to augment manpower issues – be it through leveraging technology to:

- Reduce highly manual and/or laborious tasks through robots and automation
- Optimise project resource planning and scheduling, balancing efficiency and capacity
- Minimise project downtime and disruption through equipment maintenance and monitoring

For further details on the role of Companies, see here.

For examples of implementation, please see Case Study: Certis.

For further details on how technology can be applied to the sector, see Appendix: Application of Technology Trends.

ROLE OF GOVERNMENT

To support companies in their digital transformation journey, the government should look to consolidating focus and support across 4 key areas:

- Resources for companies to assess maturity and readiness for technology adoption
- Continue to provide funding for companies to adopt technology
- Continue to include technology-related requirements in projects
- Continue to raise awareness of technology application and benefits

For further details on the role of Government, see here.

6.2 Recommendation 1

Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

ROLE OF COMPANIES

Return to Recommendation 1 / Overview

For Companies who are not aware of first steps to take, they can consider **assessing their digital maturity** and developing a Technology Roadmap through a 3-step process:

1 Identify digital maturity stage and desired technology adoption strategy

Determine technology vision	▸ How are we as a business looking at digitalising our operations?
Determine technology adoption strategy	▸ What areas of opportunity are we looking to address? What technology can we adopt to address this?
Determine digital maturity	▸ Are we ready to adopt the technology? ▸ Do we have the right levers in place (people, processes) to accelerate and implement the technology into work processes?
Determine way forward	▸ What is the roadmap that we are looking at for adoption?

To address the questions above:

- BE Companies can also look to leverage existing grants to fund adoption, e.g. Productivity Innovation Project, IFM/AFM Grant.

2 Assess impact on jobs and skills based on technology adoption strategy

Based on the technology solutions adopted, identify which job roles will be impacted	▸ Which job roles will be responsible for implementing this technology? ▸ Which job roles will be responsible for leveraging this technology?
Identify the impact on job roles	▸ What skills will this job role require to successfully utilise this technology? ▸ What is the skills gap that incumbents currently have that must be closed?

3 Design and implement talent management strategies to address impact

Determine strategies to address skills gap	▸ How can we upskill our current incumbents to close skills gaps? ▸ Should we look at hiring talent to fill skills gaps? ▸ What skills and profile of talents should we be looking for?

Companies could focus on developing necessary people levers, i.e., change of mindset towards embracing technology and adoption through activating change management levers:

- **Transparency** on technology roadmap and vision for the entire company, to drive buy-in
- **Commitment to providing resources** to augment existing workforce's capabilities, with upskilling and reskilling opportunities to address impacted job roles
- **Training and development opportunities** – Impacted employees who will have to leverage technology and/or have their jobs replaced by technology should be offered access to opportunities to upskill and/or reskill themselves

6.2 Recommendation 1

Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

ROLE OF COMPANIES (cont'd)

Return to Recommendation 1 / Overview

As the BE sector comprises of companies with different sizes and levels of maturity, each of these stakeholders can also accelerate technology adoption in different ways:

Industry Leaders

- Leaders continue to **set the pace and take the lead** in these efforts, investing in new technologies and leading the clusters forward.
- Adoption by Industry Leaders ideally **drives market behaviour** and can also drive adoption and **standardisation of technology platforms** across the entire value chain. Standardisation, or least compatibility of platforms, is critical to allow for **seamless interactions and handovers** across the different stages of the value chain.
- Industry Leaders can consider additional considerations around leading technology adoption, such as:
  - For their own organisations, leaders must **drive mindset shift** around technology adoption.
  - Firms with **contracting powers** (i.e., Developers) can **spur widespread private sector adoption** by including requirements for technology adoption as part of private project contracts. To augment barriers to adoption due to high cost of technology, firms can also consider **extending and sharing technology resources** for smaller firms to pilot and adopt technologies.
  - Leaders can lead **BE technology exhibitions** to better market the digital transformation of the sector by showcasing **benefits** and **returns on investment** of technology applications, to enhance business use cases.

Industry Players

- Firms in this tier can look to **proactively accelerate** their **awareness and adoption** of potential technology solutions to address manpower and productivity challenges.
- Industry Players can consider additional considerations around leading technology adoption, such as:
  - **Leverage available funding programmes** for technologies in the sector to alleviate high cost of initial investment.
  - **Participate in BE technology exhibitions** to network with Leaders and other Players and acquire knowledge on the benefits and applications of latest BE technologies.

Industry Novices

- For firms in this tier, a more curated, guided manner in identifying and investing in technology is required. This can be achieved by looking towards Industry Leaders, as well as support from Government and Associations through **matching to viable solution providers** based on Company's needs.

6.2 Recommendation 1

Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

ROLE OF GOVERNMENT

Return to Recommendation 1 / Overview

To support Companies in their digital transformation journey, Government should look to **consolidating focus and support across 4 key areas:**

A Provide resources for companies to assess maturity and readiness for technology adoption

- **Identify relevant technology stacks and pre-approved technologies for companies**, to provide guidance on technologies to potentially adopt and leverage for greater synergy and collaboration through standardization of platforms.
- **Drive the adoption of pre-approved technologies through launch of pilot programmes**, with a **focus on demonstrating how technologies can be implemented** in a company, with support on how to activate levers to sustain transformation i.e., people, process and technology.
- **Design assessment frameworks and consultation partnerships** for companies to leverage and reference in consideration for their technology strategy and future technology adoption methods.

B Continue to provide funding for companies to adopt technology

- Given the nascent stage of technology adoption which has only been accelerated in the last two years as an outcome of the pandemic, **continued funding programmes are needed in the short- to medium-term** to alleviate the initial high cost of investment as the sector embarks on digital transformation.
- Study's participants shared that funding is viewed as **especially important for technologies that are in growth stages of adoption but have been identified as critical to the continued success of each cluster** i.e., DfMA, BIM Technology.

C Continue to include technology-related requirements in projects

- **Technology adoption requirements** should continue to be **mandated in public procurement contracts** to provide impetus for adoption and drive adoption at scale across the sector, technology adoption can continue to be mandated for public procurement tenders.
- Study's participants shared that the **sector is unlikely to adopt technologies** beyond what is contractually required due to a lack of justification for the high investment cost. By mandating technology adoption, alongside the recommendation for private sector contracting firms to implement this clause as well, **widespread adoption** will ideally be achieved through demand levers.

Note: Requires partnership with Companies (Contracting Firms)

D Continue to raise awareness of technology application and benefits

- **Greater awareness of technology and its transformational impact** is required to be cultivated. Efforts can be led by a combination of government, TACs and companies who are industry leaders, to **showcase benefits and returns on investment**, to enhance business use cases.
- Study's participants shared that a **sector-wide mindset shift** is needed as firms are currently unwilling to invest in technologies due to a lack of awareness of returns on investment.
- Study's participants also shared that a **greater awareness of the digitalisation/ transformation opportunities** in the sector would also **serve as potential attraction mechanisms**, to attract talent into the sector.

Note: Requires partnership with TACs and Companies (Industry Leaders)

6.2 Recommendation 1

Accelerate the adoption of technology enabling greater efficiency and productivity, to develop a skilled local workforce to drive talent attraction

AVAILABLE INITIATIVES AND GRANTS

Return to Recommendation 1 / Overview

To support companies in their digital transformation journey, there are existing local government programmes that are already in place.

SECTOR-WIDE INITIATIVES

- In 2021, BCA introduced the BuildSG Transformation Fund to financially support the Industry in adopting technologies such as DfMA and IDD.
- BCA has developed the Built Environment Technology Adoption (BETA), which serves as a research and innovation platform where member firms can collaborate with Leaders to develop and adopt technology innovations in the BE sector.
- BCA organizes the annual International Built Environment Week, which enables the Industry to network and exchange ideas on latest technologies in the D&C and FM cluster.
- BCA and URA have developed CORENET X in close collaboration with the other regulatory agencies and leading built environment professionals, firms and Trade Associations and Chambers (TACs). It is slated for implementation by the end of 2023.

DESIGN & CONSTRUCTION

- The Productivity Solutions Grant (PSG) allows the local SMEs to have up to 70% of the costs of adopting pre-approved digital solutions to be co-funded with BCA.
- The Productivity Innovation Project (PIP), which co-funds up to 70% of technology adoption and innovations costs to drive construction productivity.
- The Productivity Gateway Framework (PGF) was introduced in 2015 to provide a structured process for Government Procuring Entities to implement productive technologies e.g., DfMA and procurement practices downstream during the construction of their public sector projects.

FACILITIES MANAGEMENT

- The Guide to Smart FM was launched on 1 October 2019, aimed at providing Building Owners, FM Managers, FM Companies (FMCs) and Service/ Solution Providers a reference in the smart FM journey.
- The Integrated Facilities Management (IFM) and Aggregated Facilities Management (AFM) Grant was launched in 2022, to facilitate collaboration of leading FMCs and service buyers and aggregate services across three (3) or more existing buildings.

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

The **workforce skills gap** remains critically one of the **key areas of concerns** for firms in terms of equipping employees with the necessary skills and hiring graduates with the right skills, to address future megatrends and technology trends. Participants have also shared concerns that with a majority of the sector's workforce being mature, there will be **potential loss of knowledge and experience** if no pipeline of future talent is established.

Based on participants' inputs, **upskilling and reskilling talent should be prioritised** as it is critical **to prepare the workforce with the right skill sets** to complement technology adoption, prepare for increased adoption and commonplace of ITM skills, and develop adaptability to manage high pace of change in workforce environment.

SUMMARY OF INITIATIVES

ROLE OF COMPANIES

Companies can invest in employee upskilling and reskilling through the following ways:

- Continue paving the way in renewed focus on training and development
- Define and address organisational training needs
- Leverage on available training programmes to upskill current employees

For further details on the role of Companies, see here.

ROLE OF GOVERNMENT / TACs/UNIONS

To guide industry and workforce in upskilling and/or reskilling, Government and TACs/Unions can:

- Continue their partnership in the development of accreditation schemes and training frameworks
- Design CET to complement higher education, to address gaps as observed by companies

For further details on the role of Government, TACs/Unions, see here.

For examples of implementation, please see Case Study: Woh Hup

ROLE OF EDUCATIONAL INSTITUTES

Educational Institutes can partner with Companies and TACs:

- In designing and updating current curricula across the sector, and encourage continuous education
- To formalise educational qualifications and certifications

For further details on the role of Educational Institutes, see here.

ROLE OF TACs/UNIONS

TACs can partner with:

- IHLs to co-design and develop PET and CET programmes, with a view of continuous education
- Companies to formalise and integrate accreditations

For further details on the role of TACs/Unions, see here

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

ROLE OF COMPANIES

Return to Recommendation 2 / Overview

With people a critical enabler of the success of the sector, companies must **prioritise upskilling and reskilling of employees** to ensure that the workforce is equipped with in-demand and future skills, especially to meet changing sector demands as a result of megatrends and technology trends.

As the sector comprises of companies with different levels of size and maturity, efforts to upskill and reskill employees can be segmented by company types, as detailed below and on the following page.

Continue paving the way in renewed focus on training and development

Buy-in and commitment is needed by Industry Leaders to pave the way in training employees, especially for junior and mid-roles which are more likely to be impacted in a shorter time-horizon.

Industry Leaders

- Industry Leaders are already paving the way in setting the importance of training and development. Some of the study's participants have already **begun developing and/or enhancing existing in-house training programmes**, taking reference from the Skills Framework to address skills gaps as a result of megatrends and technology trends. Progressive firms have also **extended training and development to their sub-contractors, to ensure an equitable level of capability in the delivery of services.**
- The **continuation of such practices**, anchored on the Skills Framework as a reference point, is **critical to ensure that the sector is kept up to date** in terms of skills relevancy and capabilities.
- Forward-looking Industry Leaders can also **consider co-designing training and education programmes** in conjunction with IHLs and TACs, that marry company's and employees' needs. These programmes can be made available to the whole sector – to allow for an uplift of the entire BE sector. Alternative methods of training can be designed beyond formal classroom learning i.e., VR/AR for operations training, bite sized modules.

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

ROLE OF COMPANIES (cont'd)

Return to Overview of Recommendation 2

Define and address organisational training needs; leverage on available training programmes to upskill current employees

For Industry Players and Novices, buy-in and commitment is needed to training employees, especially for junior and mid-roles which are more likely to be impacted in a shorter time-horizon.

Industry Players

- Firms in this tier can look towards first **defining their organisational training needs**, and consequently designing **training roadmaps** for employees to meet changing sector skills' demands.
- Additional considerations around training and development include dedicating **time and bandwidth** for employees to upskill/reskill in relevant domains, to ensure workforce is kept current and up to date, and to enable **lifelong learning** as a talent retention mechanism.

Industry Novices

- Firms in this tier usually face challenges in building new capabilities due to limited resources available and should **focus on upskilling current employees** to meet **specialised needs**.
- Firms in this tier can look to:
  - Leveraging on **available training programmes** in collaboration with IHLs and TACs to offer a practical, relevant development roadmap for new talent, to meet changing sector demands
  - Dedicating **time and bandwidth** for employees to upskill/reskill in relevant domains, to ensure workforce is kept current and up to date, and to enable lifelong learning as a talent retention mechanism

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

ROLE OF GOVERNMENT / TACs/UNIONS

Return to Recommendation 2 / Overview

To address sector-wide upskilling and reskilling needs, as well as ensure that the sector is continuously equipped with the right skills for the future, the government and TACs can set up platforms such as a Centre of Excellence for Continuous Education and Training to drive skills development and training for the sector.

These platforms can support the sector through:

A Continued partnership with TACs in the development of accreditation schemes and training frameworks to guide Industry and workforce in upskilling and/or reskilling

- TACs are currently leading the development of accreditation schemes. To drive progress towards upskilling and/or reskilling of the sector, Government should continue partnering with TACs to develop accreditation schemes and training frameworks as these are critical in forming the skeleton of sector training roadmaps.
- For growing areas of interest (i.e., ITM skills), there is an increased need to develop a structured training framework that guides the sector in achieving the desired competency for the ITM skills.

B Design of CET to complement higher education, to address gaps as observed by Companies

- In conjunction with IHLs, the Centre of Excellence can help to oversee CET programmes that complement existing PET curriculum, to address knowledge and ability gaps.
- Study's participants have identified that due to time constraints faced by educational institutes, the sector must **support the development of necessary skill sets** by providing robust on-the-job training programmes for graduates that address desired skill sets.
- Leveraging the **list of skills identified as in-demand**, CET programmes should be reviewed to ensure that they minimally address the skills in demand.
- Programmes can also be **redesigned and delivered in alternative methods** beyond traditional classroom settings, especially given the hands-on nature of the sector that requires marriage of theory and practical application.

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

ROLE OF EDUCATIONAL INSTITUTES

Return to Recommendation 2 / Overview

To support broader skills upgrading initiatives aligned to ITM skills, educational institutes can look to establishing partnerships in delivering updated and relevant curriculum and skills.

A Co-design and develop PET and CET Programmes

- The nature of technology is that it **evolves at a fast pace**, which also impacts the continuous and high-speed evolution of skills in demand i.e., digital tools and platforms in use today may not be in use tomorrow.
- While the sector looks towards IHLs in preparing and equipping students and graduates with the necessary skills as they enter the workforce – encompassing core technical skills, as well as developing broad based skills that train them to be adaptable and flexible, there is **limited capacity and capability** that can be achieved within the fixed time frame of higher education.
- By **designing education to be continuous** – with PET as primary and core and CET as an extension, Industry, TACs and IHLs can collaborate and identify skills that are considered critical to be taught at a higher education level, and TACs and IHLs can **design and develop CET programmes** to augment the gaps.

Note: Requires partnership with TACs

B Partner with Companies and TACs

Design and update current curricula across the sector, with the aim to encourage continuous education

- IHLs can collaborate with Industry to **provide direct input on skills in demand**, for IHLs to take into consideration as they design and update their curriculum. TACs can help facilitate this by consolidating representative inputs across the sector.
- **Continuous education models** would help to supplement the limited curriculum time that educational institutes currently have to impart necessary skills to participants.

Formalise educational qualifications and certifications

- **Formalise continuous educational qualifications and certifications**, to supplement existing gaps in the sector i.e., Quantity Surveying for the D&C cluster.
- Formalisation of continuous educational qualifications and certifications would also help to **increase recognition of newly learned skills**, for employees to potentially take on new roles or job tasks.
- Partner with companies to navigate how to **value accreditations with recognition** i.e., reward for upskilling outcomes.

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

ROLE OF TACs/UNIONS

Return to Recommendation 2 / Overview

To support broader skills upgrading initiatives aligned to ITM skills, TACs/Unions can look to establishing partnerships in driving improvements of local workforce capabilities.

A Co-design and develop PET and CET Programmes

- TACs can help facilitate the **consolidation of representative inputs** from the industry skills in demand, and funnel the inputs to the necessary channels e.g.:
  - Working with IHLs for curriculum (PET/CET) design, Adult Training Organisations for CET design
  - Working with IHLs to formalise educational qualifications for existing gaps in the sector i.e., Quantity Surveying for the D&C cluster

B Formalise and implement accreditation schemes

- TACs can work closely with companies to formalise and implement accreditation schemes in the sector, i.e., acceptance and recognition of accreditations as qualifications, with link to remuneration and career progression.

Note: Requires partnership with Educational Institutes

6.3 Recommendation 2

Industry forerunners to lead the way for the entire value chain to drive upskilling and to adopt and implement ITM skills

AVAILABLE INITIATIVES AND GRANTS

Return to Recommendation 2 / Overview

To support companies in their skills upgrading initiatives, there are existing local government, educational institutes and TAC-led programmes that are already in place.

SECTOR-WIDE INITIATIVES

- Since 2020, BCA has been in partnership with various TACs to launch accreditation schemes aligned to the Skills Framework. To date, 5/8 functional tracks of the Skills Framework have identified accrediting bodies that are supporting the accreditation efforts.
- SGBC has a Digital Academy that "provides on-demand access to green building knowledge, expertise and insights", so as to equip professionals with the necessary skills related to green buildings and sustainability.
- SkillsFuture Singapore (SSG) launched the SGUnited Skills Programme in 2020, partnering with IHLs and BCA Academy to help individuals acquire in-demand and emerging skills in the BE sector. Over the 2-year duration, more than 10 new courses were offered to help mid-career professionals join the BE sector.
- Following the recommendation of the Built Environment SkillsFuture Tripartite (BEST) taskforce, study's educational institute participants have shared that they have revamped their curriculum to focus on ITM skills e.g., IDD, Green Buildings and Smart Facilities Management, as well as technologies, e.g., IoT and BIM.

DESIGN & CONSTRUCTION

- Educational Institutes engaged in the study shared that they have been working with TACs to develop their course management and Quantity Surveying modules, where students would be able to receive certificates upon completion of the modules.

FACILITIES MANAGEMENT

- BCA, SIFMA and IHLs have been in collaboration to develop the FM workforce via digital training, preparing for the SFw, and issuing FM certifications upon course completions.
- Such practice has been viewed favourably by study's participants as BCA acts as a bridge to help identify industry needs and facilitate relevant CET programmes to be produced.

6.4 Recommendation 3

Jobs to be redesigned to drive workforce transformation, in response to technology adoption and process changes

Jobs must undergo change to address the challenge of the lack of or insufficient preparation for technology adoption and experience improvement in work processes in the BE sector. To support impacted job roles, Companies can consider **leveraging the job redesign process** to facilitate the transition.

Job redesign also can facilitate the trend of multi-skilling, where individuals are expected to be equipped with cross-domain skill i.e., Facilities Technicians may be equipped with digital skills such as basic data dashboard interpretation and understanding, and operations of Robotic Equipment; Construction Management Project Managers would need an understanding of supply chains in order to effectively manage on-the-ground supply chain disruptions.

Job redesign needs to be considered in relation to other components within the larger workforce transformation process, and therefore be **embedded into a Company's overall business strategy**. Further effort should be taken to link the job redesign process to downstream workforce management activities.

SUMMARY OF INITIATIVES

ROLE OF COMPANIES

Companies can look towards adoption of the job redesign process to support the impact on jobs arising from technology adoption or process changes in the areas of (not limited to):

Employee Engagement	Job Satisfaction	Knowledge and Skills	Productivity and Task-variety	Work Fatigue and Job Monotony

Companies also have to consider the role that different HR functions play in the job redesign process, particularly in the areas of Learning and Development, Performance Management, Compensation and Benefits and Recruitment and Selection.

To ensure the success of job transformation efforts, companies have to take precautions and devise strategies to mitigate and overcome potential challenges.

For further details on the role of Companies, see here.

For examples of implementation, please see Case Study: Certis

6.4 Recommendation 3

Jobs to be redesigned to drive workforce transformation, in response to technology adoption and process changes

ROLE OF COMPANIES

Return to Recommendation 3 / Overview

Companies can look towards adoption of the job redesign process to support the impact on jobs arising from technology adoption or process changes.

Job Redesign

Process of modifying how work is performed in an existing job, to **raise productivity and realise the maximum efficiency of jobs**, and therefore **remain competitive** in the long run. Job redesign can play a critical role in helping Companies develop and better equip the workforce to deal with the specific needs and challenges of the BE sector, exacerbated by COVID-19.

Job Enlargement

Job enlargement involves **widening an employee's job scope through the addition of tasks** and is often due to reduced time spent on original job scope enabled by enhanced processes and/or technology adoption.

Outcomes

- Enhanced employee engagement
- Increased task variety and opportunities for growth
- Improved job satisfaction and expansion of skillsets

Job Enrichment

Job enrichment involves delegating **additional, higher-level responsibilities** aimed at enhancing employee satisfaction and allow for upskilling.

Outcomes

- Development of knowledge and skills
- Sense of accomplishment that provide motivation for advancement
- Greater preparedness for high-level roles

Job Reconfiguration

Job reconfiguration involves adjusting an existing job scope by **reshaping priorities** and tasks to achieve new outcomes, often to support a change in company strategy.

Outcomes

- Increased task variety
- Increased task specialization
- Reduced non-value add work and increased productivity

Job Simplification

Job simplification **involves breaking down complex jobs** into several simpler parts to, reducing work pressure on employees, and allowing for greater focus in achieving objectives.

Outcomes

- Reduced work fatigue
- Reduced job monotony
- Increased productivity

For further details on areas HR should consider in the job redesign process, see next page.

6.4 Recommendation 3

Jobs to be redesigned to drive workforce transformation, in response to technology adoption and process changes

ROLE OF COMPANIES (cont'd)

Return to Recommendation 3 / Overview

HR's Considerations for Job Redesign

To ensure success of job redesign, companies need to consider job redesign in relation to other activities within the larger workforce transformation process. Ideally, job redesign should be embedded into the overall business strategy, complementing other efforts such as digitalisation or business process review.

In implementing job redesign, two areas should be taken into consideration:

1 Link the job redesign process to downstream workforce management activities

Learning and Development

- Identify skill gap between existing and redesigned job role.
- Develop training roadmap to equip employees for the future job role.

Performance Management

- Establish and revise new performance goals of the redesigned job.

Compensation and Benefits

- Review existing wages for newly redesigned job based on the new responsibilities and skills of the job.

Recruitment and Selection

- Incorporate new tasks and skills for redesigned jobs to refine the recruitment and selection processes for job candidates.

2 Adopt and implement complementary change management initiatives

Companies should take steps to anticipate and mitigate potential challenges that employees may face in the job redesign process, which includes concerns regarding the stability of their current jobs. By establishing an effective change management, Companies will be able to ensure the success of the job redesign process.

To overcome the likelihood of facing challenges, such as difficulties with new work processes, Companies should establish a clear and definite reason for engaging in job redesign and empower managers to guide and facilitate employees in transformation, through active encouragement.

For further details on how jobs and skills might change, see Appendix: Job Dashboards

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

With **changing employee preferences** that deviates from the sector's offerings and a significantly lower than average salary in comparison to other sectors, the BE sector is expected to face greater difficulties in attracting new talent and/or retaining existing talent. To address the sector's lack of attractiveness, HR practices need to enhance in maturity and complement sectoral branding efforts.

SUMMARY OF INITIATIVES

ROLE OF COMPANIES

To attract and retain talent, companies can look to reviewing HR practices across 3 domains:

- Compensation
- Employee Value Proposition (EVP)
- Organisation Culture

For further details on the role of Companies, see here.

ROLE OF GOVERNMENT

Efforts to enhance HR practices within the sector can be led by the Government in the areas of:

- Updating sectoral salary benchmarks (e.g., MOM's occupational wage survey, wage Information section under the Skills Framework for Built Environment) to guide compensation practices
- Uplifting HR practices through providing committed companies with support in elevating and improving their HR maturity

For further details on the role of Government, see here.

For examples of implementation, please see Case Study: DLE.

ROLE OF TACs/UNIONS

To enhance HR practices and complement sectoral branding efforts to position jobs to attract and retain talent. In partnership with Government and Companies, TACs/Unions can encourage firms to plug into available salary benchmarking platforms and information (e.g., MOM occupational wages, wage Information section under the Skills Framework for Built Environment) to drive improvements of local workforce conditions, by providing insights on salary guidelines and leading initiatives to uplift the HR practices.

For further details on the role of TACs/Unions, see here.

ROLE OF GOVERNMENT / TACs

To address the lack of attractiveness of the sector, the government and TACs can work towards enhancing sectoral branding by clearly establishing the criteria of "Good and Essential Jobs" and providing clarity through identification of these job roles under the respective functional tracks in the sector. The shift in narrative helps to value-add and illustrate the BE sector as a high productivity sector.

For further details on the role of Government, TACs/Unions, see here.

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF COMPANIES

Return to Recommendation 4 / Overview

While the government can take ownership to relook at and update current guides for HR practice enhancements, companies can embark on their HR uplift journey by referring to past initiatives until revised guides are available for alignment:

- **Wage Information section under the Skills Framework for Built Environment**, as salary benchmarks for reflection; companies should keep in mind that the Wage Information is from 2020 and should be viewed retrospectively
- **IHRP's Human Capital Diagnostic Tool** for a holistic assessment of their HR practices
- **HR Pledge & Guidebook for a Better Built Environment Workplace** to leverage as a reference for the sector's past leading practices

Companies can consider reviewing their HR practices across **Compensation**, through a 3-step process:

Compensation

Review current salary practices and wage bands and adjust/design with the aim of elevating and providing fair, comparable compensation for employees.

1 Identify benchmark sectors and determine benchmark wages for job roles in scope

- Wages can be referenced from **MOM Occupational Wage Survey or salary surveys** conducted by survey houses, or the Wage Information section under the Skills Framework for Built Environment.
- For Industry Leaders, these companies may **look beyond benchmarking against just the BE sector** and seek to benchmark against other sectors to build their salary ranges, as they are often competing against other sectors for talent.

2 Determine desired market position within the sector

- For Companies who seek to pay above market and leverage salary as an attraction lever, they may seek to position their wages at P75 of the market and pay at a higher position.
- For Companies who seek to **pay as per the market**, they may position their **salary ranges at P50.**

3 Design salary ranges around desired market position

- Salary ranges would be designed around the market position, with an approximate min and max.
- Companies will have to **relook at existing employees** and **determine pay adjustment methodology.**

For further details for Employee Value Proposition and Organisation Culture, see next page.

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF COMPANIES

Return to Recommendation 4 / Overview

Companies can consider reviewing their HR practices across **Employee Value Proposition (EVP)**, through a 4-step process:

Employee Value Proposition

To identify key drivers attracting employees to the sector and strengthen the organisation's offerings for attraction and retention.

1 Determining principles and foundation of EVP

- **Establish the principles** to support the EVP for the company.
- **Identify employment elements** to be included in EVP.

2 Assess current state of organisation's EVP

- **Review** current EVP.
- Ensure **alignment** of EVP to external organisational branding.

3 Design EVP

- Design **EVP message**, incorporating current state feedback obtained and **focusing** on **organisational strengths and competitive advantage.**
- Ensure **alignment** of EVP to external organisational branding.

4 Rollout and sustain EVP

- **Integrate EVP messages** into organisation i.e., in People's Handbook, Values, or reinforced messages in regular communication.
- **Assign ownership and resources** to ensure that organisation policies and processes are constantly aligned to EVP.
- Embark on **employer branding efforts** by marketing and communicating the EVP internally and externally.
- **Regularly review** the EVP for relevance and amend, if required.

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF COMPANIES

Return to Recommendation 4 / Overview

Companies can consider reviewing their HR practices across Organisation Culture, through a 3-step process:

Organisation Culture

Strengthen organisation culture, with focus on delivering ideal workplace environment e.g., desired EVP, work-life balance.

1 Establish culture and values

- **Assess and understand** organisation's existing culture.
- Define **desired culture blueprint.**
- Develop **business case** to obtain alignment and buy-in from stakeholders on prioritised values.
- **Plan rollout** of culture cascading activities and culture stewards for ownership.

2 Communicate and reinforce culture and values

- Implement **planned activities** to cascade the defined culture to all levels of the organisation.
- Regularly communicate and reinforce the **desired culture** through **leadership behaviours, integration in HR practices** and **targeted communication efforts** i.e., Mission, Vision and Organisational Values, desired behavioural traits.

3 Sustain culture and values

- **Monitor** the **successful integration** of the desired organisational culture and values.
- **Continually assess consistency of integration** across different employee groups and levels.

As the BE sector comprises of companies with different sizes and levels of maturity, each of these stakeholders can also review and implement changes in HR practices in different ways:

Industry Leaders

- Across the sector, it is observed that Industry Leaders have **already begun reviewing salary practices** to be competitive and attractive.
- For Industry Leaders, additional considerations around HR practices include:
  - Designing **holistic remuneration packages** that targets to compete against other competitor sectors for talent beyond the sector
  - Putting into place **robust HR practices** in the areas of training and development, positive workplace culture, aligned to **supporting employees' long-term career growth** and development within the sector

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF COMPANIES

Return to Recommendation 4 / Overview

Industry Players

- For the broad base of firms in this tier, Industry Players can look towards designing **sector-competitive salaries.**
- For Industry Players, additional considerations around HR practices include:
  - **Leveraging sectoral salary benchmarks** to design salary bands to remunerate their talent accordingly
  - Identifying and designing **robust value-differentiators** compared to other sector players for talent – through EVP, Culture and/or Training and Development opportunities

Industry Novices

- For firms in this tier, competitive remuneration is usually a challenge due to the size and resources available. Firms in this tier can look to **designing holistic workplace experiences** for the workforce, through reinforcement of strong organisation culture and flexibility in working.
- However, firms ought to **work towards compensating as per sectoral salary benchmarks** or face greater loss of manpower as talent will naturally move towards Industry Leaders and Players, in search of appropriate remuneration.

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF GOVERNMENT

Return to Recommendation 4 / Overview

The Government should **prioritise developing and enhancing HR practices** that support talent attraction and retention in the sector. HR practice enhancements should further complement sectoral branding efforts to maintain and enlarge the existing talent pool. Efforts to enhance HR practices within the sector can be led by Government in the areas of:

1 Updating sectoral Salary Guidelines with consistently to guide compensation practices

- It is timely for Government to relook at and update **sectoral salary benchmarks** (e.g., Wage Information section under the Skills Framework for Built Environment) annually, to serve as **latest benchmark reference points** for firms in the sector (one for each cluster).
- Companies can **leverage these guidelines** as references to set their own **comparable salary bands** for remuneration.
- Employees are also able to **gauge the value of their position** and seek comparable compensation, thus **uplifting the wages of the sector** through market forces.

2 Uplifting HR practices

To enable organisations to tap on these HR levers to retain and attract talent, Government can facilitate the **matching of available HR programs** to Companies (i.e., IHRP's Human Capital Diagnostic tool, ESG's Enterprise Development Grant, WSG's HR Tech Transformation Programme), and ensure that these programs are appropriately revised with latest HR best practices:

- While firms have highlighted the need to have robust Employee Value Proposition and Organisation Culture related initiatives, HR process and capability improvement **must be done holistically** rather than in portions.
- For Industry Novices and Players, greater support may be required in ensuring basic foundational HR areas are robust, i.e., Talent Attraction, Performance Management, Compensation and Benefits and Learning and Development.
- New programs centered on **trialing technology adoption** and augmenting HR practices can be rolled out, to push Companies to adopt technology and undergo workforce transformation simultaneously.

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF TACs/UNIONS

Return to Recommendation 4 / Overview

Associations and Unions can look to continue and strengthen partnership with the government in **driving improvements of local workforce conditions.**

1 Consultation on Sector Salary Guidelines

Unions can...

- Be **consulted** and brought in to ensure that design of salaries are commensurate and **in line with larger salary policies** i.e., Local Qualifying Salary, which impacts adjacent sectors to the BE sector.
- **Partner** with Government and Companies to **encourage** firms to utilise available salary benchmarking platforms and information (e.g., MOM occupational wages, wage Information section under the Skills Framework for Built Environment).
- Take the **lead in partnering the sector** in **driving changes** across salary band revisions.

2 Lead initiatives in uplifting HR maturity for the sector

TACs can...

- Conduct **HR master classes** to train HR professionals across key pillars identified for upskilling, i.e., Compensation, Employee Value Proposition and Organisation Culture.
- Provide **advisory support** to organisations seeking grants and support the Government in the matching of available HR programs to companies (i.e., IHRP's Human Capital Diagnostic tool, ESG's Enterprise Development Grant, WSG's HR Tech Transformation Programme).

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

ROLE OF GOVERNMENT / TACs

Return to Recommendation 4 / Overview

To improve public and potential employees' perception of the sector, the government and TACs should work towards enhancing sectoral branding. The shift in narrative helps to value-add and illustrate the BE sector as a high productivity sector.

To anchor this initiative amongst the multiple job roles in the sector, focus for sectoral branding efforts can be placed on the list of Good and Essential job roles that have been identified.

Good and Essential Jobs

Good and Essential Jobs are defined as job roles that:

- With the appropriate levers in place, will be **able to provide attractive remuneration** and **career progression** for job holders
- Are **critical** for the sector's successful, continuous operations and are **not easily replaceable due to need for local expertise and continuity**

The list of roles are*:

- Architect
- Civil and Structural Engineer
- Mechanical Engineer/Electrical Engineer
- Assistant Project Manager (Construction)/ Construction Manager
- Project Manager
- Quantity Surveyor
- Production Manager/Assistant Production Manager
- Specialist (Digital Delivery)
- Facilities Manager/ Facilities Engineer

Note:

The selection of job roles above does not preclude the rest of the sector's roles as important. Due to the highly technical and complex nature of the sector, all job roles are considered to be critical. The selection of job roles above are in line with the criteria outlined, and intend to serve as a foci for the sector to centre sectoral branding efforts to attract talents.

Additional Key Insights

In consultation with stakeholders, branding efforts should complement overarching priorities, determined as **(1) retaining existing employees** and **(2) securing future pipeline** of employees for new and in demand roles, and succession purposes in terms of local knowledge and expertise.

Given the identification of these job roles, branding efforts to support these outcomes could therefore be **centered** on:

- Driving attractiveness of these job roles from a **long-term career perspective**
- Highlighting the **importance and contributions** of these job roles
- Availability of these job roles to provide desired **flexibility and work-life integration**

* Roles listed here are adapted from the Skills Framework for Built Environment

6.5 Recommendation 4

Enhance sector attractiveness by changing people culture and practices

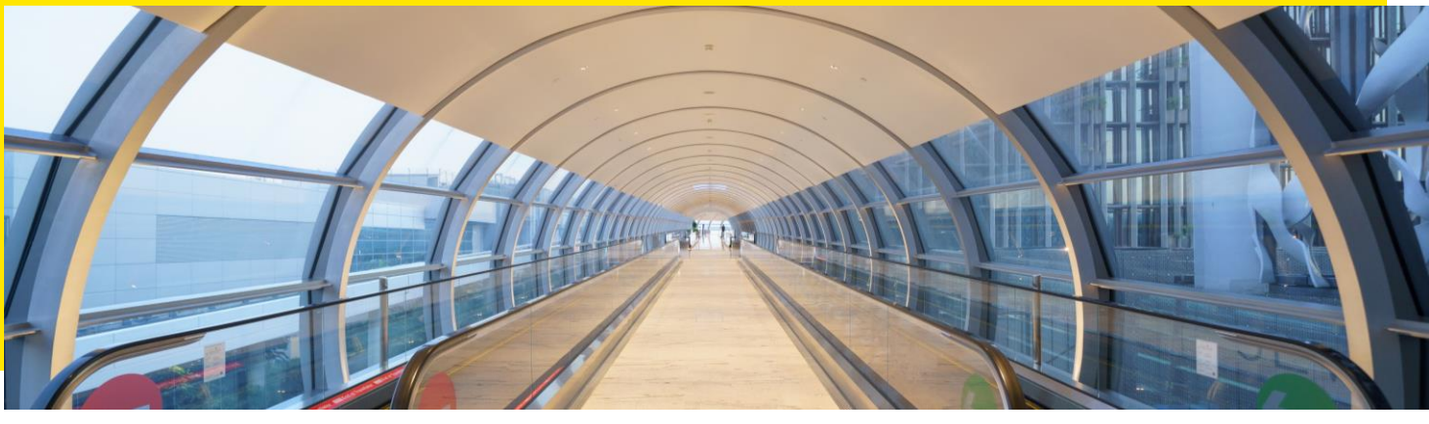
ROLE OF GOVERNMENT / TACs

Return to Recommendation 4 / Overview

Additional Key Insights (cont'd)

However, this should be completed by other initiatives, such as:

- Facilitating **local knowledge transfer** to ensure technical expertise and capabilities are retained, and to reinforce the local talent pipeline
- **Incentivising and encouraging** the **hiring of talent in these job roles to ensure business continuity**
- **Raising awareness** and inclusion of these job roles in **public procurement contracts** as requirements
- **Partnership with IHLs** to develop and **ensure availability and focus of curriculum and programmes** that equip graduates with relevant skill sets for desired Good and Essential Jobs



6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

Given the local context of low birth rates and declining talent in joining the sector, there is a need to revisit and re-evaluate the talent pipeline, and engage talent at an early stage to build the necessary capacity and capabilities. Targeted approaches to enhance talents' awareness of the sector and its careers through should be explored to establish a robust talent pipeline.

SUMMARY OF INITIATIVES

ROLE OF COMPANIES

Companies can implement the following strategies to address resource challenges:

- Review and/or establish structure of internship programmes.
- Explore mid-careerists/ unconventional talent to augment manpower gaps.
- Conduct early outreach to educational institutes to engage and attract students.

For further details on the role of Companies, see here.

ROLE OF EDUCATIONAL INSTITUTES

To attract talent into joining the BE sector, educational institutes can consider the following approaches:

- Raise awareness of career opportunities and pathways in the sector.
- Review IHL structure to enhance vocational/ hands-on components.

For further details on the role of Educational Institutes, see here.

For examples of implementation, please see Case Study: ITE and Case Study: SIT.

ROLE OF TACs/UNIONS

To address resource challenges, TACs/Unions can consider to enhance career conversion programmes to attract/re-attract talent into the sector, through identification of job roles for prioritisation and establishing partnerships with Companies.

For further details on the role of TACs/Unions, see here.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

To build potential pipeline in line with the sector's needs, Companies can **consider reviewing the structure of internship programmes**, in partnership with IHLs, to develop talent through 3 key areas:

- Review and/or establish structure of internship programmes.
- Explore mid-careerists/ unconventional talent to augment manpower gaps.
- Conduct early outreach to educational institutes to engage and attract students.

Review and/or establish structure of internship programmes

Internship programmes designed and driven with clearly defined, consistent outcomes

To drive desired behavioural traits and knowledge transfer, internship programmes should look to **define outcomes to drive desired behavioural traits and knowledge transfer** as well as **measurable metrics** that students can work towards and be assessed upon for proficiency, relative to the duration of the internship.

For companies in the sector, their response may differ depending on their sizes or level of maturity:

Industry Leaders

- As representatives of the BE sector, Industry Leaders are in the **best position** to attract, train, and develop talent for the sector.
- As the Industry has shared views on extension of duration for internship programmes, Leaders need to **pave the way in designing meaningful internship/attachment programmes** for students that commensurate to the length of the internship.
- Industry Leaders could look to continue leading the sector by curating quality internship/ attachment programmes in partnership with IHLs, with **clear learning outcomes and expectations** across proposed timeframes, driving a practical, realistic experience for interns to return to the BE sector.

Industry Players / Industry Novices

- For Industry Players and Industry Novices, firms can look to work with Industry Leaders and Educational Institutes, **leveraging designed programmes** for students to provide early exposure to the sector.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

Review and/or establish structure of internship programmes (cont'd)

Recognition of internship work experience

For internship and attachment programmes to become viable talent pipelines in the sector, students must **feel incentivised** to commit to the internship – especially if the time period is sought to be extended. **Interns should be treated as valuable assets** and assigned a **capable mentor** that can prepare and inspire them to become future employees of the firm.

Internships can be **recognised upon completion** by companies as **valid work experience** – which accrues to graduates who join firms upon graduation and are **remunerated accordingly for this experience**. This can be a consistent practice across the entire sector, where internship experience at one company can be recognised at another company as valid work experience. Graduates who join firms upon graduation should be remunerated accordingly for substantial internship experience.

For companies in the sector, their response may differ depending on their sizes or level of maturity:

Industry Leaders

- Industry Leaders of similar stakeholder type (i.e., Developers) can partner together to design a consistent, aligned internship programme, with agreed upon outcomes.
- For students who have undergone long-term internships at one Company, the work experience can be **recognised as transferable** across all partners and factored into remuneration accordingly.
- This allows for the development of a common viable talent pool that the sector can look towards accessing and leveraging for growth.

Industry Players / Industry Novices

- Both Industry Players and Novices can look to **emulate** similar partnerships and/or leveraging in designing internship/attachment programmes that Industry Leaders have designed, to contribute and access the talent pool.
- Industry Players and Novices should look at interns as a **value-adding workforce**, rather than as temporary staff to alleviate manpower shortages in the short-term.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

Review and/or establish structure of internship programmes (cont'd)

Close partnership with IHLs to redesign internship programme structure

Companies must look towards partnering IHLs closely to ensure the success of internship programmes – especially as the sector looks to extend existing internship durations amidst pre-defined, constrained PET durations.

Industry Leaders / Industry Players / Industry Novices

Industry can look to partner IHLs in the following ways:

- Providing **inputs to IHLs on the design of internship programmes**, with internship experience aligned to existing PET curriculum and academic modules
- Partnering with Educational Institutes to **deliver full-time work-study programmes, with placement opportunities in organisations**
- **Offering work placement opportunities and accelerated career pathways** upon graduation that **commensurate to internship experience**

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

Explore mid-careerists / unconventional talent to augment manpower gaps

Supporting mid-career transitions

While the BE sector traditionally does not observe a high volume of inter-sector inflow, **talent from other sectors remain an under-utilised source** that the **sector should consider to augment existing manpower gaps**, especially for tracks with high mobility options.

To support this, considerations for the sector and HR include:

1 Recognition of relevant prior experience

- For mid-careerists who may not necessarily possess BE-specific experience, the sector should look towards **identifying relevant qualifications and/or transferable skillsets** in hiring.
- Awareness and identification of comparable job roles for the BE sector allows for better identification of potential sources of talent from other sectors, and design of **comparable compensation and benefits packages** to attract talent.
- While the sector looks towards highly technical job roles with relevant experience, HR personnel should be **trained to identify potential mid-careerists with relevant qualifications**, despite potentially irrelevant experience – especially with high leakage of the sector's graduates.
- To facilitate mid-careerists, **contractual agreements** which stipulate minimum years of experience for personnel requirements could also allow for recognition of transferable work experience for mid-career entrants, thereby driving demand for this talent pool.

2 Design and/or leverage training programmes to bridge skills gaps

- For mid-careerists with relevant qualifications and/or transferable skill-sets, training programmes for career conversions should be **targeted at augmenting skills gaps** rather than route training.
- **Acknowledge work experiences** possessed by mid-careerists, and accelerate entrants with relevant experience into the sector where possible.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

Explore mid-careerists/ unconventional talent to augment manpower gaps (cont'd)

Exploring non-traditional talent including women and mature workers

As a **traditionally physical sector**, there has been a **deterrence to attract certain demographics** of the workforce (i.e., women, mature workers) in non-senior job roles. Through job redesign, these job roles can be redesigned to facilitate the attraction of alternative workforce demographics, enabling for retention of the mature workforce, to support knowledge and experience retention for **skills transfers**. As the sector looks to **augment physical, manual tasks with technology** and the emergence of new jobs, non physically-abled people can potentially fulfil the required profile of workers.

For companies in the sector, their response may differ depending on their sizes or level of maturity:

Industry Leaders

- Leaders can look to designing and implementing diverse hiring initiatives that encourage women and mature candidates as part of the talent pool.
- This is even more important due to the mature demographic of this sector, where retention of the **mature workforce is requisite to retain knowledge and experience for skills transfers**. To achieve this, firms in this tier could look to employing various initiatives such as:
  - Accelerating adoption of technology to replace manual, physically laborious tasks
  - Curating and designing training programmes that augment skills gaps for mature workers, recognizing that their training and developmental needs can be different from other workers
  - Conducting **job redesign** for roles impacted by megatrends and technology trends, designing roles' responsibilities that explore flexibility and inclusivity

Industry Players / Industry Novices

- Firms should **leverage existing job redesign toolkits** to examine and enhance existing job roles, with reference to practices and initiatives embarked on by Industry Leaders. Firms should also review potential for technology adoption to facilitate job redesign and leverage existing grants and schemes to adopt.
- With the growth of **IDD-related roles**, the shift towards technology-led positions are likely to increase. D&C and FM firms can consider exploring alternative talent sources to be hired in such job roles, with talent sought from other adjacent sectors i.e., Infocomm Technology.
- **D&C firms** can consider looking towards trends in **off-site construction** (through DfMA) to redesign current on-site job roles, which require less physical labour but more supervisory review and coordination, which can be completed by alternative sources of talent.
- As FM tasks grow increasingly automated and move from preventive to predictive maintenance, **FM firms** can explore opportunities for job redesign including **multi-skilling** (i.e., awareness of building management, security and maintenance), shifting from **manual to advisory services.**

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF COMPANIES

Return to Recommendation 5 / Overview

Early outreach to educational institutes to engage and attract students

Early outreach

Companies should look to explore increased upstream partnerships with IHLs as well as primary and secondary schools, to **engage and prepare students from an early age** for careers in the BE sector.

For companies in the sector, their response may differ depending on their sizes or level of maturity:

Industry Leaders

- While TACs/Unions can take ownership to engage PSEIs students, Industry Leaders could lead initiatives to **work with primary and secondary schools to expand existing outreach efforts to younger students** and **drive early interest** in the BE sector.
- Design and run curated programmes for students that provide hands-on experiential learning relevant to the sector, introducing and setting expectations of the sector early, helping the public to visualise the career paths in the BE sector.

Industry Players / Industry Novices

- Industry Players and Novices can look to work with Industry Leaders, IHLs as well as primary and secondary schools, **leveraging designed programmes** for students to provide early exposure to the BE sector.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF EDUCATIONAL INSTITUTES

Return to Recommendation 5 / Overview

To support the sector in attracting talent and complementing Companies' initiatives in reaching out to students in the upstream educational value chain, Educational Institutes can play a part in supporting the sector's bid in engaging students and pitching the D&C and FM clusters as a career of choice.

1 Raise awareness of career opportunities and pathways in the sector

Partner with companies to run student engagement and exposure programmes

- Partnered companies can help run **on-site exposure programmes** to engage, educate, and pique students' interest in the BE sector by providing a **realistic exposure** to the industry, and allowing them to see **first-hand** the processes and outcomes of Built Environment projects.

Note: Requires partnership with Companies

Continue to support sectoral branding efforts through student engagement

- Institutes play a **pivotal role** in sector branding efforts, in terms of educating students that the sector goes beyond traditional construction workstreams, and includes **end-to-end value chain activities** from design to facilities management. Job roles are also **changing and emerging** as a result of megatrends and technologies adoption and will drive increased outputs for the sector that remains in consistent demand.
- Educational institutes can also **give emphasis to identified Good and Essential Jobs**, ensuring students are aware of the importance of the sector, and the impact of Good and Essential Jobs.

2 Design and/or leverage training programmes to bridge skills gaps

Partner companies to incorporate longer-term Work-Study Programmes within existing curricula, and move towards hybrid education models

Educational institutes can partner (or continue to partner) companies to run **structured, longer-term work-study programmes** for relevant courses, addressing sector concerns about the limited practical exposure that students currently gain:

- A minimum 1-year programme duration would allow students to be better prepared for full-time positions, due to having more time for **exposure to different project phases**, while completing academic requirements.
- **Hybrid education models** would complement existing curricula, allowing students to undertake on-the-job training as **part of their academic semester.**
- Co-designing these internship programmes with Companies to ensure learning outcomes are met may open possibilities for **academic credit substitutions** through practical experience.

AVAILABLE INITIATIVES AND GRANTS

SECTOR-WIDE INITIATIVES

- ITE and SIT are currently working closely with the industry to deliver work-study programmes for students, such as the ITE Work-Study Diploma Programme and the SIT Integrated Work Study Programme.

6.6 Recommendation 5

Increase focus on designing, curating and implementing programmes that provide exposure and experience for current and future workforce

ROLE OF TACs/UNIONS

Return to Recommendation 5 / Overview

To support Companies to tap on alternative sources of manpower i.e., talent from other sectors, mature workforce etc. Government and TACs/Unions can lead efforts to enhance career conversion programme opportunities that attract/re-attract talent into the sector.

1 Prioritise job toles for career conversion opportunities

While the Government can continue to provide funding for career conversion opportunities, TACs can **roll out career conversion programs** for the list of job roles to be prioritised.

2 Partnerships with companies

Government, TACs/Unions and IHLs can look to partner with Companies to:

- Design **specific, technical conversion programmes** for these job roles, thereby expanding current Career Conversion Programme offerings.
- Design programmes of a **shortened duration**, should individuals be equipped with relevant, transferable skill sets and/or qualifications.

This initiative **must be paired with wider HR maturity improvement initiatives**, such as salary uplift and enhancement of HR practices, to make the sector a competitive and compelling choice for mid-career transitions.

Additional Recommendations for Companies' Consideration

The recommendations outlined in the next few pages focus on how stakeholders can potentially adopt and effect changes that target specific workforce-related outcomes. Beyond those recommendations, the following outline ways companies can explore partnerships with other companies and stakeholders to drive adjacent outcomes that may benefit their operations.

Potential partnerships can be formed in:

COMPANIES IN THE BE SECTOR

- Companies can consider to partner or increase partnerships with other companies in the industry, to **deliver end-to-end services** that complement each other.
- By working with other BE firms in the sector, **greater resource sharing** can be achieved through:
  - Exposure to technology that may not have been **financially viable** for a single firm's utilisation (i.e., BIM licenses for smaller firms)
  - Skills and capability development across all partners through **knowledge sharing** and **skills transfer**
  - Development of standardised work approach, leveraging **best practices** for improved and efficient project delivery
- Companies can also explore partnership with niche service providers with complementary technology and/or skill sets, to augment existing capability and capacity gaps. Partnerships with such service providers can **provide training opportunities to upskill existing employees** with the necessary capabilities to perform supervision and/or operational execution of the technology, as required. For e.g., partnerships with service providers in IoT can be explored, whose technology complements existing BE processes.

ROLE OF EDUCATIONAL INSTITUTES

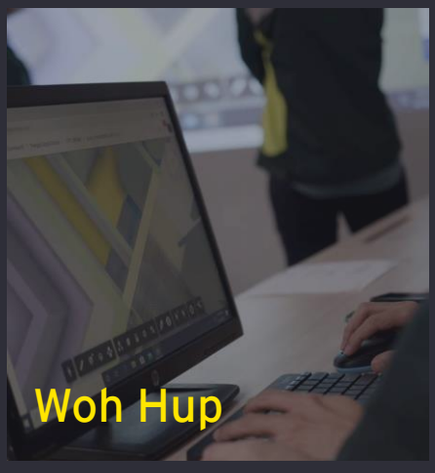
Beyond partnership with educational institutes in developing future talent, companies can partner / continue partnering with them on research and development initiatives, leveraging IHLs' **resources** to drive technology innovation in BE practices. IHLs can facilitate the development process as test beds for new innovations developed.

6.8 Case Studies

Overview of Case Studies

To complement the recommendations that have been laid out in the earlier pages of this section, 5 case studies have been developed that feature real-life examples of companies/institutions and how they have implemented the proposed recommendations:

Optimising work processes and enhancing productivity using new technologies



Adopting and implementing ITM skills for success

Strengthening its people culture and practices to become an employer of preference

Designing and implementing programmes that provide exposure and experience for future workforce

Designing and implementing programmes that provide exposure and experience for future workforce

6.8 Case Studies: CERTIS

How Certis is optimising work processes and enhancing productivity using new technologies

Return to Recommendation 1 / 3

Incorporating new technologies into current work processes

The impetus for technology adoption is more present than ever, especially in the quest for increased productivity and to meet the challenge of a workforce shortage. Yet, the adoption of technology is often slow due to high investment costs and low immediate return of investments. However, for organisations who have successfully embraced digital within their operations, the long-term benefits are seen to be worth the investments.

Certis has certainly demonstrated as much, a leading integrated services provider that has leveraged and incorporated technology in the services they provide. One such example of how they have adopted technology to improve productivity is at Jewel Changi Airport, where Certis' AI powered smart solution Mozart (a Security+ platform) supports their effective management of the facility by facilitating collaboration across various functions of security, facilities management and customer experience.

The adoption and rollout of such technology is not in silo. To augment and enhance the implementation, Certis has dedicated effort to the accompanying redesign and creation of job roles to complement the technology. With the creation of an Operations Centre where monitoring of equipment and services can be centralised and consolidated, this frees up workload from existing employees, which can be directed to pursue higher value tasks – which is where job redesign comes in.

While job redesign supports the achievement of productivity gains, Certis' approach has been fundamentally centered on people and its benefits: how can existing employees be equipped with career opportunities through capability improvements or process improvements, such as through enhanced future career pathways.[a]

Three key areas of action were leveraged by Certis to effect the redesign:[b]

1

Tasks were digitalised to replace highly manual work that could otherwise be done by robots (i.e. delegating large common areas to robots, and leveraging human intervention to focus on a niche or hard-to-reach areas), or replace scheduling by leveraging available data collected from multi-sensory network (i.e., toilet cleanings were proactively scheduled by data collected from people counters and ammonia sensors).

2

An integrated digital orchestration platform was deployed that aggregated and analysed operational information and real time data drawn from a network of devices. This data is used to identify, match and assign tasks to specialised staff as required. In Jewel Changi Airport, the system monitors and consolidates data from over 5,000 sensors.

3

With the adoption of technology to support resource optimisation and allocation, employees were then considered for multi-skilling and cross-functional learning opportunities. For Security and Cleaning personnel, this included being upskilled in customer engagement, basic technology and troubleshooting, which opens opportunities for alternative, wider career pathways. Technology is also leveraged to manage people performance – by performing real-time monitoring of task completion, this data was fed into people development areas such as training needs identification, performance assessments; and operationally to build machine learning models to improve predictive analyses and refine performance-based metrics.[c]

Deployment of Robots. Photo © Certis.

Source: Case Study consultation with Certis Cisco (S) Pte Ltd

[abc] *Singapore Business Federation (2022). EFM Lighthouse Project Insights Report. https://sustainable-employment.sbf.org.sg/wp-content/uploads/2022/07/EFM%20Lighthouse%20Project%20Insights%20Report.pdf*

6.8 Case Studies: CERTIS

How Certis is optimising work processes and enhancing productivity using new technologies

Return to Recommendation 1 / 3

Benefits of adopting digital solutions and technology

Technology has been greatly leveraged as an enabler within Certis, synergising operational pillars and optimising resources. It has resulted in increased productivity and time-saving gains, as well as a reduction of manpower requirements and expedited deployment of its security and cleaning personnel in daily operations. Certis has also seen further benefits such as the reduction of work duplication and improved collaboration within the organisation; the move towards data-driven decisions and operations has improved efficiency and allows Certis to perform early identification of faults and issues.

With the additional time savings, Certis has also looked to capitalise on upskilling efforts for their employees, such as equipping their security officers with cross-functional skills in facilities management (i.e., electrical, plumbing, identifying and rectifying faults). This allows employees to broaden their skill sets and capabilities outside of the security function and provides a means of career growth and development. This also helps to increase flexibility and internal mobility within the organisation, and help employees better understand how business operations are working across the organisation.

Through these opportunities, it has made it possible for employees to feel more confident and comfortable at their jobs, resulting in them value adding in higher level job scope and affording the opportunity to earn better wages. Examples of successful job redesign initiatives within Certis include redesigning Security Officers and Security Operations Center Operators to becoming IFM Operations Centre Operators.

Multi-pronged approach for success

Additionally, to unlock the potential for success in the sector, Certis identified that there are many cogwheels that are instrumental to the success, and must all be equivalently moved to succeed:

1

Sectoral shift towards the use of outcome-based contracts – which allows for successful job redesigns due to the flexibility it provides organisations in fulfilling client demands, by leveraging the deployment of cross-trained professionals. This shifts away from the traditional demand for fixed manpower, which may result in an inefficient use of manpower resources, and allows for a more agile model while still achieving desired outcomes.

2

Availability of information on assets and faults – enabled by technology to support the ease of collection, consolidation and consideration of data, the greater availability of information allows for better awareness and understanding of current state, and to also to make better decisions that are driven by data analysis and outcomes.

2 of Certis' IFM employees looking at their multi-service orchestration platform, Mozart. Photo © Certis.

6.8 Case Studies: CERTIS

How Certis is optimising work processes and enhancing productivity using new technologies

Multi-pronged approach for success (cont'd)

Return to Recommendation 1 / 3

3

Minimum of 3+2 contract partnerships – with long-term contracts, organisations can commit to planning for employees' professional development. This is due to the assurance that arises of both the financial security afforded by these contracts, and the likely demand for new skills and technologies from the partnership that spurs development. Such partnerships are instrumental in facilitating investment in technology adoption and employee upskilling efforts, which can then potentially lead to redesigned job roles that utilise the new technologies and skills.

4

Mutual agreements on regulatory wages and costs – with greater adoption and rollout of progressive wage models, the Facilities Management sub-sector expects to be highly impacted by increasing costs from both a regulation standpoint, as well as wanting to reward employees who are performing higher value work with greater technology adoption and job redesign. Building flexibility into contracting models between stakeholders that shares the impact of regulatory wages and costs allows for continued, quality service delivery.

5

Grants to reward training effort and success - a key outcome from upskilling and reskilling should be the parallel increase in wages for job role holders, as an outcome of expanded skill sets, the capability of performing higher value work and increased productivity. The offer of grants by the Government that rewards trainings efforts and successes is a signal to organisations and employees that there is a worthwhile investment in skills development, with the presence of such incentives potentially lowering employees' resistance towards upskilling and continuous education.

6

People process technology / Man method machine – these three aspects form the core of any effective transformation or change that occurs, and it is vital to recognise that these three pillars do not work in silo but work in synergy with each other, and require strong collaboration and integration in order to be successful. Transformation cannot occur in one without the other, and all three must be considered – i.e. when new technology is adopted, people and processes must be adjusted accordingly in order to reap the maximum benefits from such a change.

7

Regulatory review on cross-deployment of disciplines – current regulatory requirements are very inflexible with manpower deployment, and is further restricted through contracting models that are not Headcount or Hybrid-based. Given the challenges that the sector faces, flexibility allows for greater solutioning; coupled with the desire to offer employees augmented career pathways and performing higher value work that is enabled through skills development, regulations must allow for greater flexibility in how employees are deployed across disciplines.

A combination of the above initiatives will ideally lead to an exponential increase in productivity that benefits all stakeholders.

KEY TAKEAWAYS

- Technology adoption must be done in conjunction with redesign and process re-engineering – ensuring that individuals are equipped with the right capabilities and processes that enable and reward are in place to complement the adoption.
- How companies integrate systems, processes and people will play a key role in building a holistic and sustainable value proposition and ameliorating outcome-based contract performance metrics.
- While the sector engages in efforts to transform and change in order to meet the demands of the future, existing regulatory restrictions and processes must also be examined to ensure that they are compatible with the desired future end-state, and adjusted where necessary.

6.8 Case Studies: WOH HUP

How Woh Hup has adopted and implemented ITM skills for success

Return to Recommendation 2

Adopting and implementing ITM skills

As part of the sector's transformation efforts, the Industry Transformation Map for the Built Environment sector identified key technologies and skill sets that the sector would need going forward in order to excel. This includes skills in the areas of Integrated Digital Delivery (IDD), Design for Manufacturing and Assembly (DfMA), to name a few.

Woh Hup has been an early, long-time adopter of such ITM skills. Having adopted IDD since 2008, their commitment and excellence was recognised at BCA's inaugural IDD Awards in 2021, where Woh Hup received awards at both firm and project levels.[a] By adopting IDD, Woh Hup has been able to reap productivity gains through the reduction of process times – in modelling efforts, inspections, and defects management. Today, Woh Hup is already exploring opportunities in 4D and 5D designs with subcontractors, and 6D designs with Facility Management stakeholders as a means of adopting and using BIM technology – bolstering efforts in integrating IDD across the entire Built Environment value chain.

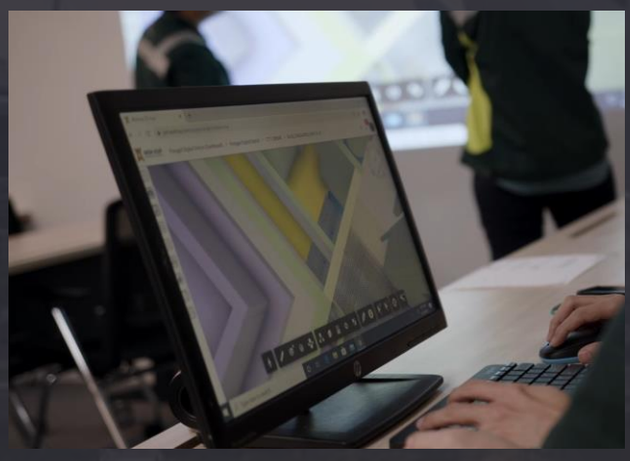
Woh Hup has also adopted DfMA in their projects, and currently has 8-10 ongoing projects related to Prefabricated Prefinished Volumetric Construction (PPVC) and Prefabricated Bathroom Unit (PBU). In developing Woh Hup's Technical Hub in 2018[b], various DfMA technologies such as Mass Engineered Timber (MET), PPVC, and structural steel have been utilised[c] to deliver the final project.

By adopting DfMA, Woh Hup has increased the efficiency and productivity of their projects due to the shorter construction period.[d] With stringent quality control put in place in prefabrication factories, this ensures the uniform quality of prefabricated components. In addition, with most of the construction work being done off-site, the manpower required to be on-site has been reduced. The adoption of various ITM skills has also led to overall productivity improvements, with an estimated 30% in the recent project for The Tapestry.[e]

Leading the drive to digitalize

Woh Hup recognizes that the adoption of technology is key to the industry's continued growth, and thus critical that the entire value chain must be equipped with the necessary skill sets. In response, Woh Hup has conceptualized and implemented in-house training programmes for their project teams including their clients, consultants and subcontractors on IDD.[f]

The strong digital focus also spurred the company to hire a Chief digitalisation Officer to lead the digitalisation efforts as an outcome of technology trends and their intersection with the ITM skills – which are brought about by the growing availability and scalability of technology.



Team discussion through BIM modelling. Photo © Woh Hup.

6.8 Case Studies: WOH HUP

How Woh Hup has adopted and implemented ITM skills for success

Return to Recommendation 2

Emphasis upskilling the workforce

Woh Hup acknowledged that there is a wide plethora of skills and competencies that their existing workforce must learn and/or relearn, especially in response to changing megatrends and technology trends. This is a challenge, especially for more mature workers who may be resistant to change or may encounter difficulty in learning new skills. The nature of the industry also limits the format in which training can occur, where traditional classroom methodology may not be viable.

To facilitate upskilling, Woh Hup has embarked on leveraging technology to deliver the necessary training by providing bite-sized courses, such as the Safety Induction Course. Woh Hup has also leveraged the directory of accredited and certified courses to help facilitate the learning process and direct their employees to upskill accordingly. Underpinning their training strategy is Woh Hup's focus on building a change mindset and learning agility for their workforce, to enable lifelong learning and to stay ahead of competitors.

Woh Hup shares that a key challenge in adopting and implementing ITM skills arises from the lack of unified adoption across the entire value chain. Without the appropriate scale of adoption, ITM skills provide limited benefits that may not justify adoption when seen in isolation. There is a need to invest in labour, education and protection in adopting DfMA; and greater agility, coordination and quality control when applying IDD. However, Woh Hup believes that this can be achieved with the support of the government in encouraging ITM adoption, by supporting smaller businesses as a component of the wider BE ecosystem and determining the optimal rate of transformation based on the level of company maturity.

KEY TAKEAWAYS

- While Woh Hup has observed benefits from adopting and implementing ITM skills, they believe that the benefits of adoption can only be fully realized if the entire value chain adopts these skills and uses them in tandem.
- Sectoral agencies should also continue to support the adoption of ITM skills and foster the learning development of their employees.

Source: Case Study consultation with Woh Hup Pte Ltd

[a] *BCA Awards 2021. https://www.wohhup.com/bca-awards-2021/*

[b] *Woh Hup Projects – Woh Hup Technical Hub. https://www.wohhup.com/project/woh-hup-technical-hub/*

[c] *Woh Hup Technical Hub. https://www1.bca.gov.sg/buildsg/productivity/design-for-manufacturing-and-assembly-dfma/mass-engineered-timber/mass-engineered-timber-case-study-woh-hup-technical-hub*

[d] *Construction Plus Asia. (2021) Inaugural BCA IDD Awards recognises 17 outstanding firms and building projects. https://www.constructionplusasia.com/sg/inaugural-bca-idd-awards-recognises-17-outstanding-firms-and-building-projects/*

[e] *BCA. Annex A: Factsheet on Built Environment Industry Transformation Map (BE ITM). https://www1.bca.gov.sg/docs/default-source/docs-corp-news-and-publications/media-releases/ibew-opening_media-release_annexes.pdf*

[f] *Construction Plus Asia. (2021) Inaugural BCA IDD Awards recognises 17 outstanding firms and building projects. https://www.constructionplusasia.com/sg/inaugural-bca-idd-awards-recognises-17-outstanding-firms-and-building-projects/*

6.8 Case Studies: DLE M&E Pte Ltd

How DLE is strengthening its people culture and practices to become an employer of preference

Return to Recommendation 4

New ways of working offer more flexibility in the workforce

The Built Environment sector is no stranger to manpower challenges, which has only been exacerbated by a small labour market that shrunk during COVID-19 and the increasing difficulties in attracting young local talent. For companies, it is vital to consider how to not only be attractive to potential talent but also how to retain existing talent.

Even before the onset of the pandemic, DLE has been looking for ways to relook its people culture and strengthen talent retention mechanisms, as well as how to become an employer of choice. In recent years, DLE has leveraged two key levers to drive change: adoption of digitalisation efforts and work-life strategies – which has driven a greater employee-oriented strategy that they consider critical in their people strategy.

New ways of working offer more flexibility in the workforce

In the last two years, DLE has sought to and successfully implemented flexible work arrangements within the company. The changes in work arrangement arose in response to restrictions and changes demanded by COVID-19, but have become an integral, core part of DLE's work. The policies are people-centric and family-friendly, with employees entitled to related time-off, health & wellness programmes, and caregiving leave.

These changes were only achievable through the adoption of technology. Coincidentally before the start of the pandemic, DLE had already begun to explore how they could allow for remote work, equipping employees with remote access and a human resource (HR) mobile application – which proved to be critical in the next few months as they responded to site restrictions. These technologies have allowed employees to telecommute and work remotely.

> From a holistic standpoint, it is more than just Flexible Work Arrangements. We will also need to focus on other areas such as work life, leave, health benefits and the adoption of HR technologies, for it to work in unity.
>
> Sarah Tham
> Director

Benefits of new ways of working in conjunction with technology (1/2)

Through the adoption of people-oriented policies and technology, DLE has enabled employees to have greater autonomy in managing work responsibilities alongside personal needs. The flexibility of working arrangements – while noted to be largely implemented for corporate staff at the moment, DLE shared they have intentions to expand to on-site staff where possible – has been complemented by the use of technology to boost the performance and retention of existing workers. DLE sees one key benefit as higher staff morale, with employees feeling more valued and resulting in higher productivity.[a]

Source: Case Study consultation with DLE M&E Pte Ltd

[a] *Tham, S. (2022, July 17). Work-life balance in the Construction Sector. TODAY. https://www.todayonline.com/voices/talent-hunt-work-life-balance-construction-sector-yes-its-possible-some-creativity-1945356*

6.8 Case Studies: DLE M&E Pte Ltd

How DLE is strengthening its people culture and practices to become an employer of preference

Return to Recommendation 4

Benefits of new ways of working in conjunction with technology (2/2)

Together, in partnership with BCA, DLE's digitalisation push has also benefitted DLE in improving its pipeline of talent, being able to attract more local young talent – which DLE deems as critical for paving the way for innovative, engineering designs. DLE has adopted technologies such as Building Information Modelling (BIM), which is also used in Virtual Design and Construction (VDC) to optimise on-site manufacturing techniques.[b] These new practices have allowed the company to be forward-looking and to adopt new ways of working. The increased adoption of digital tools has appealed largely to the younger generations, as such, increasing the demand for students joining DLE after they graduate.

DLE has also been awarded the BCA's Integrated Digital Delivery Award – Project Category (Gold) in 2021.They were recognised for their outstanding IDD adoption and demonstration of good practices at the firm and project level in the JTC Logistics Hub construction project. Furthermore, DLE has been awarded the Tripartite Alliance Awards in 2018[d], and a Building Information Modelling (BIM) Gold award (Organisation) from BCA in 2017 – which recognises outstanding efforts for the adoption of BIM and VDC[e], cementing its position as a company that excels in building a progressive workplace.

DLE employees using BIM Modelling for deeper multi-party collaboration and project efficiency.

Photo © BCA, provided by DLE.

KEY TAKEAWAYS

- Companies in the Built Environment sector should empower their people as it is a critical element to the success of their organisation and people strategy – and while hygiene factors such as salary are important, they are not sustainable in the long-term without complementing effects such as investments in technology and improvements in productivity.
- As part of employer branding, it is crucial that employees believe that their firms are forward-thinking, innovative and technologically savvy – they will also feel happy with higher job satisfaction working for such organisations.
- Companies to continuously implement and keep up with the new ways of working, to ensure that their business stays relevant and competitive as work aspirations have changed due to the pandemic.

DLE believes people remains a key lever of success for them – and have demonstrated their commitment to their own people. Despite the challenges faced as a Small and Medium Enterprise, DLE has demonstrated their ability to build for long-term growth and success. By investing in talent, increasing the adoption of technology and redesigning supporting work processes, DLE is ensuring their business stays relevant and competitive in the BE sector.

Source: Case Study consultation with DLE M&E Pte Ltd

[b] *BCA. (2020, May 19). Going digital: 3 questions with David Goh, Director of DLE M&E. https://www1.bca.gov.sg/buildsg-emag/articles/going-digital-3-questions-with-david-goh-director-of-dle-m-e*

[c] *Tham, S. (2022, July 17). Work-life balance in the Construction Sector. TODAY. https://www.todayonline.com/voices/talent-hunt-work-life-balance-construction-sector-yes-its-possible-some-creativity-1945356*

[d] *DLE Achievements. https://www.dle.com.sg/achievements/*

[e] *Tan, H. (2017, June 14). Teamwork and technology equal success. SPH Content Lab.*

6.8 Case Studies: ITE

How ITE is designing and implementing programmes that provide exposure and experience for future workforce

Return to Recommendation 5

Bridging between theory and experience

The core and future of the Built Environment sector is in its people, with the institutions playing a critical role in developing the talent pipeline for the sector's continued success. Yet, one of the biggest gaps observed between academia and industry is the bridging of theory and experience, which remains a challenge in the highly technical BE sector as they seek to equip future talent for success. In response, ITE has worked extensively to tackle this challenge, preparing their students through the Work-Study Diploma (WSDip) programme, whose core strength is in preparing students through learning by doing.[a]

How ITE has partnered with the industry to develop the future workforce

The Work-Study Diploma programme was launched in 2018. For the BE sector, ITE offers programmes in Mechanical & Electrical Services Supervision and Vertical Transportation which were released in 2018 and 2019 respectively. Designed through consultation with BCA and the industry, these WSDip programmes were created to address a shortage of technical specialist officers in the sector by bridging the gap between theory and application and linking graduates to the trade areas that they are trained for. A technical committee comprising Industry Players, Trade Associations and Government representatives was formed to provide advice on the training curriculum.

The WSDip in Mechanical & Electrical Services Supervision was launched in 2018 while the WSDip in Vertical Transportation programme was launched in 2019, with participants from companies such as Keong Hong Construction and Chevalier International Holdings Limited. Participating companies recruit and sponsor ITE graduates for the WSDip programme over a duration of 2.5 years. A list of competencies for on-the-job training (OJT) is provided to the companies to guide them in implementing workplace training, complementing the training at ITE. Throughout the programme, ITE closely supports the trainees and works closely with their supervisors, monitoring both their work and academic performance to ensure the well-being of the trainees.

Since its launch, the programme has seen three graduating batches as of 2022 and has thus far been well-received. Companies have acknowledged it as a good platform for companies to train and evaluate employees and acquire the technical knowledge and skills to support the work on-site. For trainees, the programme has helped to enhance their careers through certification and work experience accumulation; on top of the credentials, they are also able to gain more familiarity with the industry and their future. ITE has also observed an increased number of students that stay in the sector after having undergone the programme. This can be attributed to both the career prospects and experience that the programme allows for graduates of the programmes have seen career promotions and/or salary increments that are tied to the credentials and work experience in the company.

Practical experience is key to understanding the sector

For trainees, being equipped with the right skills and relevant experience is essential in preparing them for the workplace – especially when it breeds confidence in their daily work, which can potentially translate to job satisfaction and talent retention rates. It is crucial for trainees to discover more about their professional interests and to gain practical experience in their chosen career field, obtaining first-hand experience and applying what they have learned in school.

Alongside offering the Work-Study Diploma, ITE offers enhanced internships for their students for all courses. In a similar process to the WSDip, the enhanced internship is based on a task list. This arrangement is established between ITE and the companies, to ensure that students have a meaningful internship where they perform tasks that are relevant and useful, and that they are better prepared for their work in the future.[b]

Source: Case Study consultation with Institute of Technical Education

[a] *Work Study Diploma* https://www.ite.edu.sg/courses/work-study-diploma

[b] *Close to 1,600 Companies Now Offering Enhanced Internship to ITE Students* https://www.ite.edu.sg/docs/default-source/student-services/newsrelease14nov.pdf?sfvrsn=5dca4b91_3

6.8 Case Studies: ITE

How ITE is designing and implementing programmes that provide exposure and experience for future workforce

Return to Recommendation 5

Practical experience is key to understanding the sector (cont'd)

ITE has noted that a key stakeholder throughout the internship experience is the company that the interns are assigned to. It is essential for the company to provide ongoing proper supervision to the intern and help stimulate their interests with real-world experiences. Positive experiential learning will provide students with the opportunity to apply the knowledge and skills they have learned, which will increase their interest in working for jobs relevant to their course of study. The school also believes that career progression in the BE sector should be shared with students so that they see the possibilities of a long-term career and will be more inclined to join the BE sector.

Photo © ITE

KEY TAKEAWAYS

- For students to benefit the most out of any work experience programmes, the right levers for success must be in place – structured programmes with defined learning outcomes that focus on ensuring that students are equipped with the right knowledge and experience as they transit into the workforce, as well as equipping them with the right guidance and a positive experience will go a long way in retaining them within the sector.
- Close partnerships and active involvement of hiring companies in the design and execution process is required in order to successfully deliver a programme, so that the schools and companies can actively tailor and adjust the structure to meet evolving trends.
- ITE believes that the BE sector is a good sector, and is invested in supporting the growth and development of it. As Singapore continuously develops the country, the sector remains critical for success – and there are likely opportunities for good jobs and good pay, given how roles within the sector are essential, the equivalent of "doctors and nurses for the buildings in the sector". ITE hopes that the industry is able to continue attracting and retaining good talent in this sector, especially in lieu of levers in place to support this.

6.8 Case Studies: SIT

How SIT is designing and implementing programmes that provide exposure and experience for future workforce

Return to Recommendation 5

Generating interest for the BE sector

Lauded as one of the hallmark features of a Singapore Institute of Technology (SIT) education, SIT's Integrated Work Study Programme (IWSP) is a compulsory programme for all final-year students. The programme has benefitted multiple batches of students, with the latest being the fourth cohort from Civil Engineering and the sixth cohort from Sustainable Infrastructure Engineering (Building Services) [SIE (BS)]). The IWSP is designed to enable graduates to integrate deeply with industry – in line with SIT's mandate as a university of Applied learning. Students in programmes such as Civil Engineering (CVE) and SIE (BS) are equipped with foundational knowledge before they embark on their IWSP in the relevant industry during their final year. This will support their development to become industry-ready graduates[a].

During their IWSP, students undertake work attachments with companies for a period of 8 to 12 months. This unique opportunity allows them to develop an in-depth understanding of the industry or sector and the company they are attached to. SIT works closely with industry partners e.g., government agencies, consultants, contractors to identify and source for suitable work opportunities. This ensures that there are sufficient opportunities for students who take the IWSP as a mandatory part of their curriculum.

SIT's partnership with industry

The first batch of SIE (BS) students undertook their IWSP in 2017 while the first batch of CVE students did their programme in 2019. Long-term partnerships and the support of participating companies such as LTA and Woh Hup are essential in providing opportunities for our students every year.

Students are regarded as fresh graduates and given opportunities to gain a strong understanding of the industry. As part of their IWSP, students are also tasked with a capstone project, which allows them to draw from their knowledge and experience to create solutions for real-world problems. The programme allows students to bridge theory and practice; acquire specialised knowledge; and develop professional capabilities. This practical experience reduces the time needed for work orientations and allows fresh graduates to transition smoothly into their chosen field and careers.

IWSP complements university curriculum

A minimum 8-month duration is the typical requirement for the IWSP. This is part of a conscientious effort by SIT to allow students sufficient time to gain exposure, understanding, and familiarity with the work environment. The longer duration also allows them to contribute what they have learnt to the company after the initial period of onboarding and training. Students return to SIT for classroom learning once a month and the content of these classroom sessions is meant to complement their work experience. The classes touch on topics such as ethics, lifelong careers in the BE sector, integrating the Green Masterplan at work and are facilitated by industry practitioners.

Photo © SIT

While technical knowledge is important, SIT also focuses on equipping students with skills that support adaptability and problem solving in order to train students to be resilient in the face of uncertainty.

Source: Case Study consultation with Singapore Institute of Technology

[a] *Integrated Work Study Programme https://www.singaporetech.edu.sg/integrated-work-study-programme*

6.8 Case Studies: SIT

How SIT is designing and implementing programmes that provide exposure and experience for future workforce

Return to Recommendation 5

SIT understands that classroom learning alone is insufficient and real-life work experience is critical to help students develop the necessary skills and competencies to succeed at work. It is crucial that SIT students leverage the extended time period to develop professional competencies in their chosen field, as it may help them accelerate their professional advancement when they enter the working world.

The IWSP is also designed to ensure that students receive the necessary support to perform well in the programme. SIT's Centre for Career Readiness provides students with support during the employment process as they undergo assessment for employment. The Centre curates potential positions that are relevant and provides structured learning outcomes during the process. Students are assigned an academic supervisor who will work closely with students' work supervisors to track and monitor their progress. SIT's Professional Officers are a group of practicing professionals with strong industry knowledge and experience. They join academic staff in teaching and preparing students to be industry-ready graduates. Professional Officers are actively involved in the IWSP as academic supervisors as well as IWSP module coordinators.

Outcome of fostering student's interest

SIT's efforts to pique their students' interest have enabled graduates to possess a better understanding of the BE sector. As a result, 90% of SIT's Civil Engineering graduates are still employed in the relevant industry. Not only did SIT students appreciate what the sector has to offer, but they are also cognizant of the latest industry trends. They are therefore better prepared for the demands of the BE sector when they graduate.

The key enabler of success for the IWSP lies in attracting and retaining talent in the BE industry. Students are given advance job offers from participating companies throughout their IWSP and can join these companies upon graduation. In fact, SIT's Graduate Employment Survey (GES) 2021 results showed that 70% of the civil engineering graduates received job offers from their IWSP company, with 41% accepting the offers.

KEY TAKEAWAYS

- A long-term perspective of the BE sector must be shared with students, so that students and fresh graduates can see the possibilities of a long-term career and be more inclined to join the BE sector. This can be achieved through greater awareness and exposure to the sector and companies' plans and practices.
- The right guidance and a positive experience will go a long way towards retaining graduates who are working in the industry. To equip students with the necessary knowledge and experience, structured programmes with precise learning objectives are needed, that focus on ensuring that students are equipped with what they need to transition into the workforce.
- In order for this programme to be effective, there needs to be close collaboration and active participation of the industry in the design and implementation process. This will drive opportunities and enhance our students' learning experience. The university and the companies must also actively customise and adapt the programme structure regularly to keep up with changing trends.

07

Appendix

7.1

Detailed Methodology

7.1.1 Details of Key Stakeholders Engaged

7.1.2 Details of Stakeholder Engagements

7.2

Impact to Jobs and Skills

7.2.1 Job Dashboards

7.2.2 Mobility Dashboards

7.2.3 Skills in Demand/Emerging

7.2.4 Emerging Job Roles Dashboards

7.2.5 Reskilling Roadmaps

7.3

Application of Technology Trends

7.4

References

7.1.1 Details of Key Stakeholders Engaged

Details of Key Stakeholders Engaged

BUILT ENVIRONMENT INDUSTRY COMPANIES

- AcePLP.com Pte Ltd
- AECOM Singapore Pte. Ltd.
- AETOS Holdings Pte. Ltd.
- Alniff Industries Pte Ltd
- APS Engineering Service
- ARA Asset Management Limited
- Arcadis Pte Ltd
- Arup Pte Ltd
- Asia Arc Pte Ltd
- Atelier Ten (Asia) Pte. Ltd.
- Atkins Design Engineering Consultants Pte Ltd
- B K Tan Consultants
- B+H Architects (Singapore) Pte Ltd
- Based On A True Story
- Beca Carter Hollings & Ferner (S.E.Asia) Pte Ltd
- Bescon Consulting Engineers Pte
- BG&E Consulting Engineers Pte Ltd
- BRC Asia Ltd
- Brown Consulting Pte. Ltd.
- BSD Building System & Diagnostics
- CA Facilities Pte Ltd
- CAGA Consultants Pte Ltd
- CapitaLand Development Pte Ltd
- CapitaLand Integrated Commercial Trust
- CapitaLand Pte Ltd
- CBM International Pte Ltd.
- CBM Pte Ltd
- CBM Security Pte Ltd
- Certis Integrated Facilities Management Pte Ltd
- CH2M Hill Singapore Private Limited
- Chan & Chan Engineering P/L
- Chuan Lim Construction Pte Ltd
- CIAP Architects Pte Ltd
- Construction Professionals Pte Ltd
- COWI Singapore Pte Ltd
- CPG Consultants Pte Ltd
- CPG Corporation Pte Ltd
- CPG Facilities Management Pte Ltd
- CPG International Pte Ltd
- CPG Signature Pte Ltd
- Cushman & Wakefield
- D Consultancy
- Deluge Fire Protection (S.E.A)
- Design Link Architects Pte Ltd
- DLE M&E Pte Ltd
- DLM Pte Ltd
- DP Architects Pte Ltd
- DP Sustainable Design Pte Ltd
- D-Team Engineering
- Earth-In-Mind Pte Ltd
- ECAS Consultants Pte Ltd
- EM Services Pte. Ltd.
- ENGIE Services Singapore Pte Ltd
- Engineers 9000 Pte Ltd
- Exceltec Property Management Pte Ltd
- Expand Construction Pte Ltd
- Faithful+Gould Pte. Limited
- Fonda Global Engineering Pte Ltd
- G & W Precast Pte Ltd
- G-Energy Global Pte Ltd
- Gims & Associates Pte Ltd
- GreenA Consultants Pte Ltd
- Greyform Pte Ltd
- Henderson Security Services
- HL Building Materials Pte Ltd
- HPX Consulting Engineers Pte Ltd
- HT Consulting Engineers
- ID Architects Pte Ltd
- ISS Facility Services Private Limited
- J.Y.Lee Consulting Engineers
- Jacobs Engineering Singapore Pte Ltd
- Jacobs International Consultants Pte. Ltd.
- Jardine Engineering (S) Pte Ltd
- Jones Lang Lasalle Property Consultants Pte Ltd
- Joseph & Ang Engineers

7.1.1 Details of Key Stakeholders Engaged

Details of Key Stakeholders Engaged

BUILT ENVIRONMENT INDUSTRY COMPANIES (cont'd)

- Kimly Construction Pte Ltd
- KK Lim & Associates Pte Ltd
- KTC Group
- KTP Consultants Pte. Ltd.
- Lander Loke Architects
- Lendlease Pte Ltd
- Lian Soon Construction Pte Ltd
- Lum Chang Building Contractors Pte Ltd
- Meinhardt (Singapore) Pte Ltd
- Millenniums Consultants Pte. Ltd.
- Mott MacDonald Singapore Pte Ltd
- NatSteel Holdings Pte. Ltd.
- Obayashi Singapore Private Limited
- One Smart Engineering Pte Ltd
- Ong&Ong Pte Ltd
- Peak Engineering and Consultancy Pte Ltd
- PH Consulting Pte Ltd
- Pico Guards Pte Ltd
- Pintary Foundations Pte Ltd
- PM Link Pte Ltd
- Power-Plus (S) Pte Ltd
- Procore Technologies Pte Ltd
- Prostruct Consulting Pte. Ltd.
- Ribar Industries Pte Ltd
- Rider Levett Bucknall LLP
- Robin Village Development Pte Ltd
- SAA Architects Pte Ltd
- Savills Singapore Pte Ltd
- SCDA Architects Pte Ltd
- Silverliners Pte. Ltd.
- SIPM Consultants Pte Ltd
- SM1 Consulting Engineers
- Squire Mech Pte. Ltd.
- ST Engineering Synthesis Pte Ltd
- Sunray Woodcraft Construction
- Surbana Jurong Consultants Pte Ltd
- Surbana Jurong Pte Ltd
- Systematic Holdings Pte. Ltd.
- T. Y. Lin International Pte Ltd
- Tanglin Corporation
- Teamwork Consultants
- Tech Onshore MEP Prefabricators Pte Ltd
- Techniques Air-Conditioning & Engineering
- Thermal Pte Ltd
- Thymn Pte Ltd
- Turner & Townsend
- Unipac Consulting Engineers LLP
- United Tec Construction
- VIA+ Design Pte Ltd
- Web Earth Pte Ltd
- Winner Engineering Pte Ltd
- Woh Hup (Private) Limited
- WOHA Architects Pte Ltd
- WSP Consultancy Pte Ltd

7.1.2 Details of Stakeholder Engagements

Details of Key Stakeholders Engaged

TRADE ASSOCIATIONS & CHAMBERS, UNIONS

- Association of Consulting Engineers Singapore
- Association of Property & Facility Managers
- Building Construction and Timber Industries Employees' Union
- e2i
- Institution of Engineers Singapore
- Prefabrication Association of Singapore for Precast and Steel
- Real Estate Developers' Association of Singapore
- Singapore Contractors Association Limited
- Singapore Green Building Council
- Singapore Institute of Architects
- Singapore Institute of Building Limited
- Singapore International Facility Management Association
- Singapore Institute of Surveyors and Valuers
- Society of Project Managers
- Specialists Trade Alliance of Singapore
- Union of Security Employees

INSTITUTES OF HIGHER LEARNING

- National University of Singapore
- Nanyang Technological University
- Singapore Institute of Technology
- Singapore University of Social Sciences
- Singapore University of Technology and Design
- Institute of Technical Education
- Nanyang Polytechnic
- Ngee Ann Polytechnic
- Republic Polytechnic
- Singapore Polytechnic
- Temasek Polytechnic

PROFESSIONAL BOARDS

- Board of Architects
- Professional Engineers Board

GOVERNMENT MINISTRIES AND AGENCIES

- Ministry of Education
- Ministry of Home Affairs
- Ministry of Manpower
- National Environment Agency
- Ministry of National Development
- JTC Corporation
- Public Utilities Board
- SkillsFuture Singapore
- Workforce Singapore

7.1.2 Details of Stakeholder Engagements

Details of Stakeholder Engagements

C-SUITE INTERVIEWS

16 C-suite Interviews were conducted with 16 companies consisting of C-suite and senior management representatives across the BE sector. Insights were solicited on three key themes:

THEME #1
Trends impacting the sector

- Megatrends and emerging technologies that will impact/are impacting the sector
- Workforce challenges as a result of technology and megatrends
- Focus areas in the Industry Transformation Map

THEME #2
Impact of trends on jobs and skills

- Impact of technology and megatrends on functional tracks and jobs
- Emerging job roles and skills that will be in demand
- Skills and training needs for the sector

THEME #3
Talent management, attraction and retention

- Best practices to attract, develop, and retain talent
- Opportunities for mid-career entrants

VALIDATION SESSIONS

22 Validation Sessions were conducted with stakeholders (i.e., Industry Firms, TACs, and IHLs) across the BE sector, we solicited insights on three key themes for each round:

	THEME #1	THEME #2	THEME #3
Round 1	Trends impacting the functional track ▸ Megatrends and emerging technologies that will impact/are impacting the sector ▸ Workforce challenges as a result of technology and megatrends ▸ Focus areas in the Industry Transformation Map	Impact of trends on jobs and skills ▸ Impact of technology and megatrends on functional tracks and jobs ▸ Emerging job roles and skills that will be in demand ▸ Skills and training needs for the sector	Talent management, attraction and retention ▸ Best practices to attract, develop, and retain talent ▸ Opportunities for mid-career entrants
Round 2	Trends impacting the functional track ▸ Impact of remote work to the functional tracks ▸ Estimated time horizon of trends impacting each functional track ▸ Estimated time horizon of impact for each job role	Opportunities in the functional track ▸ Skills to prioritise for upskilling in each functional track ▸ Drivers, time horizon, and demand for emerging job roles ▸ Skill adjacencies within and outside the sector	Upskilling talent ▸ Awareness and adoption of key government initiatives ▸ Talent development initiatives and best practices ▸ Impact of outsourcing

7.1.2 Details of Stakeholder Engagements

Details of Stakeholder Engagements

FOCUS GROUP DISCUSSIONS

In the Focus Group Discussion conducted with IHL representatives relevant to the BE sector, we solicited insights on three key themes.

THEME #1
Trends impacting the sector

- Key trends observed in the sector in the past and for the future
- Underlying drivers of identified key trends, and mitigation solutions for challenges
- Impact of key trends on jobs and skills in the sector

THEME #2
Impact of trends on jobs and skills

- Jobs and skills in demand based on key trends
- Efforts to prepare graduates for the future of work

THEME #3
Talent management, attraction and retention

- How IHLs, firms, and professional bodies can collaborate to meet the changing needs of the sector
- Possible ways to increase sector appeal to students

In the Focus Group Discussion conducted with ESD firms relevant to the BE sector, we solicited insights on three key themes.

THEME #1
Global trends for sustainability and the impact on Jobs & Skills

- Sustainability trends and their impact on the job roles and skills
- Skills in demand and the skills gap in the workforce arising from sustainability trends
- Job demand projection for ESD firms

THEME #2
Opportunities arising from the sustainability trends

- Emerging sustainability job roles and skills within the BE sector
- Pace and magnitude of creation of emerging jobs and skills

THEME #3
Talent management, attraction and retention

- Potential talent sources to bring in talent
- How to ensure there is transfer of knowledge for our local talent

INDUSTRY VISIONING WORKSHOP

During the Industry Visioning Workshop, industry representatives across the sector were brought together to:

Assess proposed recommendations

- Based on potential obstacles and commitment required

Identify actionable steps moving forward

- Actionable steps that can be taken in the short-term (6-12 months) and longer to drive the recommendations

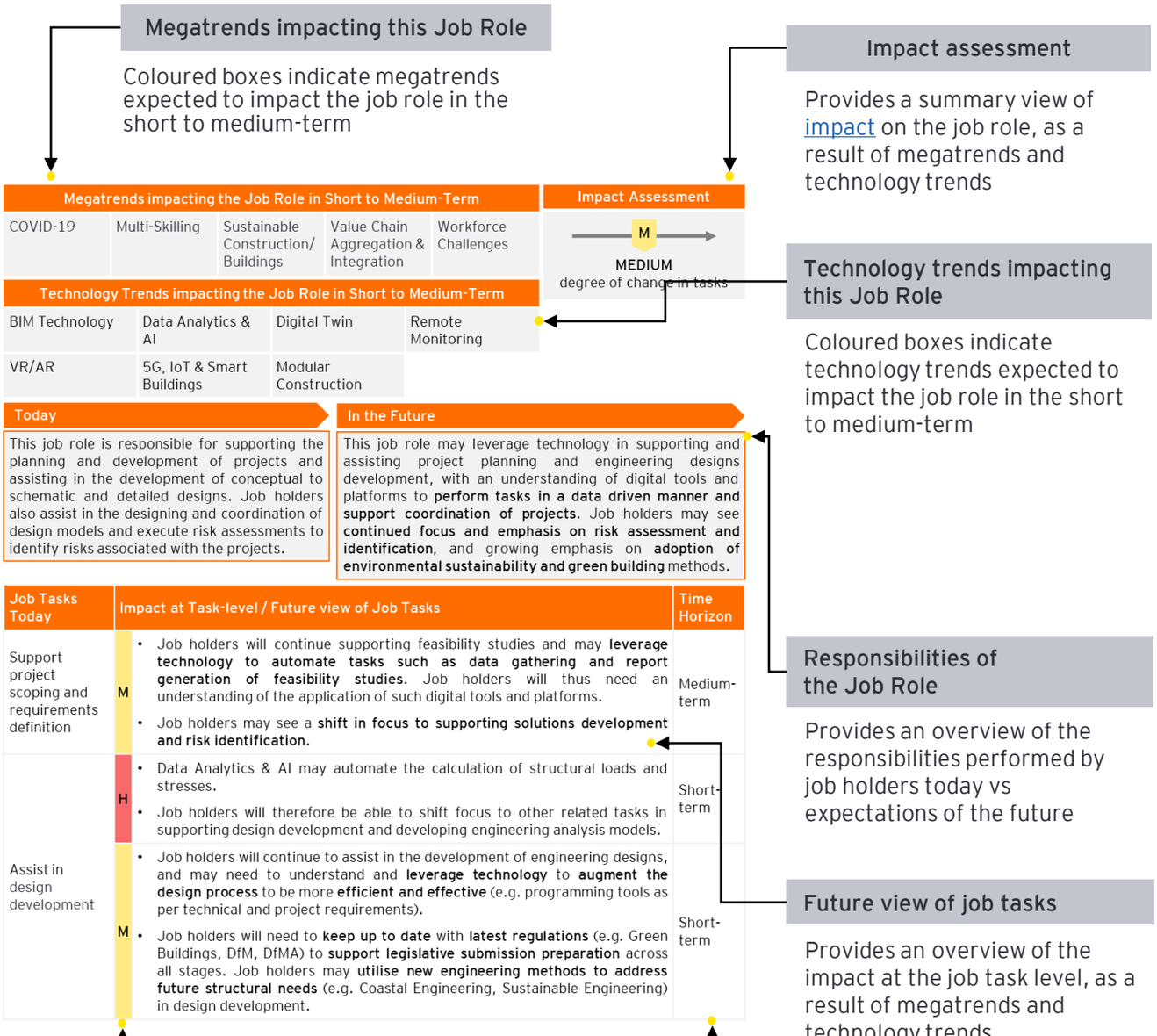
Align across the sector

- Commitment required from stakeholders
- Immediate actionable steps with regard to the recommendations

7.2.1 Job Dashboards

Guide to Impact Assessment for Each Job Role

To read the Impact Assessment for each Job Role, refer to the guide below:



7.2.1 Job Dashboards

Architectural Associate

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for supporting the pre-design and design work based on project requirements. Job holders assist in gathering necessary documents and information for contracting and procurement, and track construction work to ensure alignment with design objectives.

In the Future

This job role may leverage technology to enhance the support for current tasks and will need to be equipped with an **understanding of how to utilise technologies to deliver outcomes** in a more efficient and accurate manner. Job holders may shift focus to **perform value-added tasks**, such as **reviewing data consolidation and input accuracy**, with continued focus on compliance to regulations, and **adopting environmental sustainability and green building methods in delivery**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support the feasibility and design phase	M	▸ Job holders will continue to support pre-design work and feasibility studies and support the design processes to meet project objectives. ▸ Preparation of site and zoning analyses outcome reports may be augmented by technology (e.g., BIM Technology and Data Analytics & AI). Job holders need to understand **how to leverage digital tools and platforms to support report preparation**.	Short-term
Execute documentation and tendering	L	▸ Building contracts may move towards smart contracts (enabled by technology e.g., Blockchain). Job holders will need to **develop capabilities in administering standard smart contracts and conducting procurement exercises**.	Long-term

7.2.1 Job Dashboards

Architectural Associate

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct checks for construction and completion	M	▸ Job holders will continue to check that construction work satisfies the design intent. Job holders may need to **leverage digital tools and platforms** (e.g., VR/AR, BIM Technology) **to conduct checks**. ▸ Artificial Intelligence and RPA can augment the compliance process by identifying non-compliance of designs with authorities' requirements. Job holders will thus **need to intervene and address non-compliance**.	Short-term
Gather information for continuous improvement initiatives	M	▸ Job holders will need to **be aware of evolving trends and technologies** (e.g., designing for maintainability, sustainability, modular construction) and its **implications on the delivery of architectural services**, so as to support the use of them.	Short-term

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Integrated Digital Delivery Application
Regulatory Submission and Clearance		
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management	Programming and Coding	

7.2.1 Job Dashboards

Architect

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for the pre-design and design phases of the project such as design development, documentation and compliance review. Job holders contribute to the construction and completion phases and develop the overall project schedules.

In the Future

This job role may leverage technology to **accelerate design development and documentation**, and allow for **greater oversight and visibility on construction and completion phases**. Job holders will need familiarity with technology to **complement activities occurring across the value chain, such as project reviews and handover**. Job holders may be expected to have a continued focus on compliance with relevant regulatory requirements and stakeholder management, as well as a growing focus in **incorporation of best practices as per evolving trends and technologies** (e.g., environmental sustainability).

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage feasibility and design phase	M	▸ Job holders will continue to conduct pre-design work and feasibility studies, and may be expected to **effectively utilize digital tools and platforms** (e.g., BIM Technology) **to augment the design process, increasing the efficiency of design and delivery**. ▸ Job holders may **use digital tools** (e.g., RPA, AI) to **perform design development compliance checks** in adherence to government and client's requirements and standards. Job holders will need to **perform interventions for non-compliance in the design phase.**	Short-term
Conduct documentation and tendering	L	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to **advise on appropriate procurement methods and selection of building contracts**, administration of any smart contract, and management of data associated.	Long-term

7.2.1 Job Dashboards

Architect

Job Tasks Today		Impact at Task-level / Future view of Job Tasks	Time Horizon
Facilitate meetings and handover for construction and completion	M	▸ Job holders may need capabilities to **leverage technology** (e.g., AI and RPA) **to accelerate the compliance process** by identifying non-compliance of designs and construction with authorities' requirements. Job holders will need to **review the accuracy of generated findings**, and **keep abreast of regulatory requirements to address non-compliance**.	Medium-term
	M	▸ Job holders may need to develop capabilities to **leverage digital tools and platforms** (e.g., BIM Technology) **in collaboration and communication** with architectural professionals and builders for design documentation and management, **to effectively conduct meetings and facilitate construction with builders, and manage handover of projects**.	Short-term
Manage people and organisational functions	L	▸ Job holders will continue to **perform people management tasks** (i.e., on-the-job coaching, lead teams), and may see greater emphasis on **managing compliance of project delivery outcomes and maintenance** of ethical business practices with changing regulatory requirements.	Short-term
Propose continuous improvement initiatives	M	▸ Job holders will need to keep updated on the latest industry developments so as to **propose opportunities for use and improvements** to architectural services.	Short-term
Develop drawings*	L	▸ Job holders will still be required to develop shop drawings, while Artificial Intelligence and RPA can **accelerate the development by reducing time to consolidate and/or gather required foundational information**.	Medium-term
	L	▸ Job holders will still need to develop as-built drawings, while RPA can **accelerate the development of as-built drawings by consolidating changes** occurred across the entire construction process for documentation.	Medium-term

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Application	
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management	Programming and Coding	

* Only applicable to Project Architects in Contractor firms

7.2.1 Job Dashboards

Senior Architect

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Impact Assessment

M

MEDIUM
degree of change in tasks

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Today

This job role is responsible for reviewing the pre-design and design phases of the project, and providing direction on the design development and documentation processes. Job holders review contract and procurement methods, project schedules and designs to ensure regulatory compliance.

In the Future

This job role may be impacted by technology, which **changes the way project review is performed**. Job holders need to be familiar with evolving trends and technologies so as to be able to **provide direction across design development and documentation processes**, and **facilitate close collaboration across the value chain** that is enabled by technology and trends towards aggregation and integration. Job holders may be expected to have a continued focus on **incorporating environmental sustainability and ensuring compliance to regulatory requirements**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review deliverables for feasibility and design phase	M	▸ Job holders will continue to review design developments and provide resolution where required. As the use of digital tools and platforms (e.g., BIM Technology) is expected to grow in adoption, an **understanding of the tools and platforms** will be required for job holders to be able to effectively **review outcomes and drive the design process**. ▸ Job holders see the prevalence of digital tools (e.g., RPA, AI) to perform **review of design development compliance checks in adherence to government and client's requirements and standards**. Job holders will thus need to **shift focus to addressing non-compliance effectively and efficiently**.	Short-term
Review documentation and tendering	L	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to review contract administration, procurement methods and selection of building contracts.	Long-term

7.2.1 Job Dashboards

Senior Architect

Job Tasks Today		Impact at Task-level / Future view of Job Tasks	Time Horizon
Oversee meetings and handover for construction and completion	L	▸ With greater integration and aggregation across the sector's value chain, job holders may be required to **place greater emphasis on identifying opportunities for engagement and collaboration with specialists**.	Short-term
	M	▸ Job holders may need to develop capabilities to **leverage digital tools and platforms** (e.g., BIM Technology) in **collaboration and communication** with architectural professionals and builders for design documentation and management, **to review construction designs by builders and oversee handover of projects**, in compliance with authorities' requirements.	Short-term
Manage people and organisational functions	L	▸ Job holders may need an **understanding and application of digital tools and platforms to effectively drive coordination** across project teams and other relevant parties. ▸ Job holders will need to continuously **keep up to date with skills in-demand** and apply the knowledge to **identifying technical and business recruitment, training and development needs** for the organisation.	Short-term
Implement continuous improvement initiatives	M	▸ Job holders will continue to **drive implementation of continuous improvement initiatives** across architectural services, technologies, and environmental sustainability and green building strategies. ▸ Job holders may leverage digital tools (e.g., Data Analytics) to **conduct effective cost-benefit analyses and viability assessments** of initiatives to drive successful implementation.	Short-term
Develop drawings*	L	▸ Job holders will still be required to develop shop drawings, while Artificial Intelligence and RPA can **accelerate the development by reducing time to consolidate and/or gather required foundational information**.	Medium-term
	L	▸ Job holders will still need to develop as-built drawings, while RPA can **accelerate the development of as-built drawings by consolidating changes** occurred across the entire construction process for documentation.	Medium-term

7.2.1 Job Dashboards

Senior Architect

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management		

7.2.1 Job Dashboards

Architectural Assistant

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for assisting with data analysis to support pre-design and design work execution. Job holders use digital tools and platforms, and computational model data to assist with pre-design and design phases. Job holders also assist with the documentation phases by gathering information.

In the Future

This job role may be expected to be **increasingly proficient in the use of digital tools and platforms**, and well-versed in **analysing data from computational models to assist with pre-design and design phases**. Job holders may be expected to keep abreast of evolving trends and technologies so as to continue supporting the use and adoption of them in architectural services.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Analyse and maintain data for feasibility and design phase	M	▸ Job holders will continue to analyse data from site analyses and have **proficiency in data analysis capabilities to interpret and refine the findings**. ▸ Job holders may need to be equipped with the capabilities to **ensure maintenance of design databases and documentation in line with common data standard**s. ▸ Job holders will continue to assist in **development of computational designs**, **leveraging BIM to automate designs** and developing capabilities to **assist in complex design development**.	Short-term
Execute documentation and tendering	L	▸ Building contracts may move towards smart contracts (enabled by technology e.g., Blockchain), and job holders will need to develop capabilities in **administering standard smart contracts and conducting procurement exercises.**	Long-term
	M	▸ Job holders may need to be equipped to **perform and adjust the analysis of performance of buildings against computational designs in response to trends** (e.g., environmental performance) through digital tools and platforms used in computational analysis.	Short-term
Gather information for continuous improvement initiatives	M	▸ Job holders will need to be **aware of evolving trends and technologies** (e.g., designing for maintainability, sustainability, modular construction) and its **implications on the delivery of architectural services**, so as to support the use of them.	Short-term

7.2.1 Job Dashboards

Architectural Assistant

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Computational Design	Critical Thinking
Design for Maintainability	Design for Manufacturing and Assembly	Integrated Digital Delivery Application
Regulatory Submission and Clearance	Stakeholder Management	
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management	Programming and Coding	

7.2.1 Job Dashboards

Architectural Executive

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for reviewing data during the feasibility and design phases. Job holders are involved in developing computational models, provide advice on procurement methods, and propose opportunities for improvement and adoption of the latest industry trends.

In the Future

This job role may be expected to be **increasingly proficient in review** and **application of data in feasibility and design** phases, with capabilities in **computational model developments**, and **facilitate collaboration across the value chain with increased aggregation and integration.** Job holders may need to keep abreast of evolving trends and technologies so as to advise on procurement methods and continue proposing opportunities for use and adoption in architectural services.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Analyse design database and documentation for feasibility and design phase	M	▸ Job holders will continue to develop computational designs using digital tools and platforms, and may need to **upskill with relevant industry knowledge and skills to accurately incorporate potential impact into designs.** Job holders may leverage digital tools and platforms (e.g., BIM Technology) **to develop complex computational models.** ▸ Job holders may also leverage knowledge of trends and technologies in **providing inputs and alternatives of construction and build materials** (e.g., impact of modular construction).	Short-term
Conduct documentation and tendering	L	▸ Building contracts may move towards smart contracts (enabled by technology e.g., Blockchain), and job holders will need to acquire an understanding and capabilities to **advise on appropriate procurement methods and selection of building contracts, administration of any smart contract, and management of data associated.**	Long-term
	M	▸ Job holders may need to **validate the analysis of performance of buildings against computational designs** in response to trends (e.g., environmental performance) through digital tools and platforms used in computational analysis.	Short-term

7.2.1 Job Dashboards

Architectural Executive

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage people and organisational functions	L	▸ Job holders will continue to perform people management tasks (i.e., on-the-job coaching, lead teams), and may see **greater emphasis on managing compliance of project delivery outcomes and maintenance of ethical business practices** with changing regulatory requirements.	Short-term
	M	▸ Digital tools and platforms may be leveraged to **manage effective and efficient communication among project teams and other stakeholders.**	Short-term
Propose continuous improvement initiatives	M	▸ Job holders will need to be updated on the latest industry developments so as to **propose relevant opportunities for use and improvements to architectural services.**	Short-term

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Biophilic Design in Built Environment	Building Information Modelling Application	Computational Design
Critical Thinking	Design for Maintainability	Design for Manufacturing and Assembly
Integrated Digital Delivery Application	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Application	
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management	Programming and Coding	

7.2.1 Job Dashboards

Senior Architectural Executive

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for reviewing and validating data in the feasibility and design phases. Job holders also review designs, contract administration, and procurement methods, as well as keep abreast of industry trends to implement opportunities for continuous improvement initiatives.

In the Future

This job role may be expected to be **increasingly proficient in use of digital tools and platforms in delivering clients' designs, and in data review and validation**. Job holders may need to keep abreast and **up to date with evolving trends and technologies so as to be able to establish procurement methods and drive improvement opportunities** in architectural services.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Validate design database and documentation for feasibility and design phase	M	▸ Job holders will continue to perform review and validation of designs, design databases, documentation and use of materials, leveraging digital tools and platforms. ▸ Job holders will need **to be aware of the impact of new materials and designs to validate the use of them** in line with direction of industry transformation and goals (i.e., adoption of modular construction, use of sustainable materials). ▸ Job holders will also be expected to **possess relevant knowledge** of **regulations**, so as to continue **ensuring reviewed designs for clients are in compliance** with authorities' requirements.	Short-term
Review documentation and tendering	L	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to **review contract administration, procurement methods and selection of building contracts**.	Long-term
	M	▸ Job holders will need capabilities in **utilising digital tools and platforms** to **perform performance evaluation** of buildings against parametric designs.	Short-term

7.2.1 Job Dashboards

Senior Architectural Executive

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Manage people and organisational functions	L ▸ Digital communication tools may augment the collaboration process, with job holders possessing an **understanding and application of digital tools and platforms** to effectively **drive coordination** across project teams and other relevant parties. ▸ Job holders will need to continuously **keep up to date** with **skills in-demand** and apply the knowledge to identifying **technical and business recruitment, training and development** needs for the organisation.	Short-term
Implement continuous improvement initiatives	M ▸ Job holders will continue to drive implementation of continuous improvement initiatives across improvements in architectural services, technologies, and environmental sustainability and green building strategies. ▸ Job holders may need to Job holders may **leverage digital tools** (e.g., Data Analytics) to conduct **effective cost-benefit analyses** and **viability assessments** of initiatives to drive successful implementation.	Short-term

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Biophilic Design in Built Environment	Building Information Modelling Application	Computational Design
Critical Thinking	Design for Maintainability	Design for Manufacturing and Assembly
Integrated Digital Delivery Application	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Application
Technology Scanning		
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management		

7.2.1 Job Dashboards

Associate Director (Architecture)/Principal Architectural Executive

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for driving the pre-design and design development phases and project schedules development. Job holders oversee contract administration and contractors' and subcontractors' performance. Job holders also promote a collaborative environment that incorporates new technologies.

In the Future

This job role may need an understanding of the digital tools and platforms as **technology plays a role in the pre-design and design development phases**, and will be required to **ensure alignment with clients, development of project schedules and oversee performance and progress**. Job holders may see **greater emphasis placed on driving and promoting a collaborative environment that incorporates emerging trends and technologies** into architectural services.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Endorse and establish policies, processes and procedures for feasibility and design phase	L ▸ Job holders will continue to endorse outcomes of pre-design work and feasibility studies and sign-off developed designs. Job holders will need **familiarity with digital tools and platforms used to access, endorse and sign-off on designs**. ▸ Job holders will continue to be the subject matter expertise, and apply the **technical knowledge to develop processes to effectively resolve design developments and technical issues** (e.g., use of alternative materials in construction) and **establish policies and procedures** for documentation (e.g., common data standards).	Short-term
Oversee documentation and tendering	L ▸ Job holders may need to understand **smart contracting technologies** to **oversee contract administration** and **establish procurement methods and processes**.	Long-term

7.2.1 Job Dashboards

Associate Director (Architecture)/Principal Architectural Executive

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Oversee progress for construction and completion	L	▸ Job holders will need to be **familiar with collaborative digital tools and platforms** (e.g., BIM Technology) to **oversee construction progress** and **drive collaboration and synergies** between project stakeholders.	Short-term
Drive strategies for people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand and apply the knowledge to drive initiatives** addressing technical and business recruitment, training and development needs.	Short-term
Drive continuous improvement initiatives	M	▸ Job holders may need **data interpretation capabilities to evaluate benefits, trade-offs and impact of new technologies**, and **understand data insights** to endorse recommendations for architectural services improvements.	Short-term

The following TSCs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Scanning	
Emerging Technical Skills and Competencies		
Design Sustainability and Ethics Management		

7.2.1 Job Dashboards

Assistant Civil and Structural Engineer/Technical Executive (Civil and Structural Engineering)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for supporting the planning and development of projects and assisting in the development of conceptual to schematic and detailed designs. Job holders also assist in the designing and coordination of design models and execute risk assessments to identify risks associated with the projects.

In the Future

This job role may leverage technology in supporting and assisting project planning and engineering designs development, with an understanding of digital tools and platforms to **perform tasks in a data driven manner and support coordination of projects**. Job holders may see **continued focus and emphasis on risk assessment and identification**, and growing emphasis on **adoption of environmental sustainability and green building** methods.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support project scoping and requirements definition	M	▸ Job holders will continue supporting feasibility studies and may **leverage technology to automate tasks such as data gathering and report generation of feasibility studies**. Job holders will thus need an understanding of the application of such digital tools and platforms. ▸ Job holders may see a **shift in focus to supporting solutions development and risk identification**.	Medium-term
Assist in design development	H	▸ Data Analytics & AI may automate the calculation of structural loads and stresses. ▸ Job holders will therefore be able to shift focus to other related tasks in supporting design development and developing engineering analysis models.	Short-term
	M	▸ Job holders will continue to assist in the development of engineering designs, and may need to understand and **leverage technology** to **augment the design process** to be more **efficient and effective** (e.g., programming tools as per technical and project requirements). ▸ Job holders will need to **keep up to date** with **latest regulations** (e.g., Green Buildings, DfM, DfMA) to **support legislative submission preparation** across all stages. Job holders may **utilise new engineering methods to address future structural needs** (e.g., Coastal Engineering, Sustainable Engineering) in design development.	Short-term

7.2.1 Job Dashboards

Assistant Civil and Structural Engineer/Technical Executive (Civil and Structural Engineering)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Assist in tendering processes	H ▸ RPA may automate the gathering of information to estimate project costs and resources. Job holders will shift their focus towards assisting to prepare project estimates.	Medium-term
Assist in project execution	M ▸ Job holders may **leverage digital communication tools to liaise with contractors and subcontractors on project design execution**, and be adept in using such tools (including remote monitoring tools) to **support site work coordination**. ▸ Job holders may also need **familiarity with digital tools and platforms** (e.g., BIM Technology, Digital Twin models) to **assist in the execution and documentation** of **testing and commissioning processes** for project handovers.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Computational Design	Construction Technology
Data Collection and Analysis	Design for Maintainability	Design for Manufacturing and Assembly
Green Building Strategy Implementation	Integrated Digital Delivery Application	Regulatory Submission and Clearance
Technology Application		
Emerging Technical Skills and Competencies		
Analytics and Computational Modelling	Biophilic Design in Built Environment	Coastal Engineering
Critical Thinking	Environmental Sustainability Management	Hydrodynamic and Flood Mitigation
Programming and Coding	Sustainable Engineering	Tunnel Engineering Management
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Civil and Structural Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Impact Assessment

M

MEDIUM
degree of change in tasks

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Today

This job role is responsible for managing the planning and development of projects, developing concepts to schematic and detailed designs based on requirements; and conducting project assessments and provides feasible and creative solutions. Job holders participate in the tendering processes and monitors contractors and subcontractors. Job holders also plan the manpower allocation and provide on-the-job coaching to junior staff.

In the Future

This job role may leverage technology in management of project planning and development, **enhancing the robustness of solutions proposed through adopting data-driven approaches in addressing feasibility concerns and project risks**. Job holders may need an understanding of technology to **apply in facilitating the tendering process and monitoring work progress**, and awareness of trends and technologies so as to **incorporate the use of environmental sustainability and green building methods into designs**. Job holders may see continued focus on people management in response to evolving trends and technologies.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Define project scope and requirements	M	▸ Job holders will continue to conduct feasibility studies and compile associated project risks, and may see technology (e.g., Data Analytics & AI) **enhancing the generation of feasibility study outcomes** to be more efficient and accurate. ▸ Job holders may also need **data interpretation skills** to **interpret and evaluate data insights from feasibility studies to propose robust, data-driven solutions** to relevant stakeholders.	Short-term
Conduct design development	M	▸ Job holders will continue to develop engineering designs, and may be expected to **leverage technology to augment the design process to be more efficient and effective** (e.g. Data Analytics and RPA can automate calculations, programming of analysis models to reduce design conflicts). ▸ Job holders will also need ensure that designs **incorporate the use of relevant methods** (e.g., Green Buildings, DfM, DfMA). Job holders may also need to **keep abreast of new engineering methods to meet future structural needs** (e.g., Coastal Engineering, Sustainable Engineering). ▸ Job holders may need capabilities to **amend engineering analysis models** in consideration of the **impact of trends on design specifications**, ensuring **avoidance of design and engineering conflicts**.	Short-term

7.2.1 Job Dashboards

Civil and Structural Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct design development (cont'd)	L	▸ Job holders will also **continue to develop legislative submissions** across all project stages.	Short-term
Perform tendering processes	L	▸ Job holders may need an understanding of smart contracting technology (e.g., Blockchain) to **prepare tender and contractual terms on alternative platforms and conduct pre-qualification and assessments** for tender selection.	Long-term
	M	▸ Data Analytics & Artificial Intelligence may **augment quantitative estimation for project costs and resources** and help job holders develop more accurate estimates in a shorter duration. Job holders will need to **possess data interpretation skills to validate the estimates** with technical experts.	Short-term
	L	▸ As-built designs may be automated and consolidated in digital platforms through the use of digital tools (e.g., RPA). Job holders will still need to **validate the design output, and understand how to utilise the technology to apply changes to the as-built designs**, as required.	Medium-term
Monitor project execution	M	▸ Job holders may also need an **understanding of real-time data captured of the construction process and how to interpret it efficiently**, so as to **monitor execution and liaise effectively with contractors** to resolve the necessary defects.	Short-term
Manage people and organisational functions	M	▸ Job holders may see **increased emphasis on on-the-job coaching** to support the adoption of digital tools and platforms. ▸ Job holders may need an understanding and **application of collaborative tools and platforms** (e.g., BIM Technology) **to coordinate work activities plans and manpower allocation**, and track work progress.	Short-term

7.2.1 Job Dashboards

Civil and Structural Engineer

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Computational Design	Construction Technology
Critical Thinking	Data Collection and Analysis	Design for Maintainability
Design for Manufacturing and Assembly	Green Building Strategy Implementation	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Application	
Emerging Technical Skills and Competencies		
Analytics and Computational Modelling	Biophilic Design in Built Environment	Coastal Engineering
Environmental Sustainability Management	Hydrodynamic and Flood Mitigation	Programming and Coding
Sustainable Engineering	Tunnel Engineering Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Senior Civil and Structural Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for driving the overall execution of projects. Job holders review designs, specifications, calculations, and other submittals, and also oversee the project assessment phases, ensuring designs and models are developed according to requirements. Job holders lead the tendering processes, and manage a team of engineers, ensuring continuous performance improvement.

In the Future

The job role continues to drive overall execution of projects and may need an **understanding of digital tools and platforms**, so as to **perform the review of design components and oversee project assessment phases.** Job holders may see **greater emphasis on effective team management** and on keeping abreast of trends and technologies so as to **ensure continuous performance improvement and drive implementation of environmental sustainability and green building strategies.**

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review project scope and requirements	L	▸ Job holders will continue to review outcomes of feasibility studies and proposed solutions. Job holders will need to **possess data interpretation capabilities** and **familiarity with the digital tools and platforms** used in the development process to **make amendments and address areas of discrepancy** as required. ▸ Job holders will need an **understanding of data insights and interpretation**, to be able to **leverage study outcomes and develop data-driven risk management plans and risk controls**.	Short-term
Review design development	L	▸ Job holders will continue to review designs and will need to ensure that the **use of relevant methods** (e.g., Green Buildings, DfM, DfMA) **has been incorporated**. Job holders may **utilise new engineering methods to address future structural needs** (e.g., Coastal Engineering, Sustainable Engineering) in design development. ▸ Job holders will need to keep up to date with latest regulations to effectively review legislative submissions across all project stages.	Short-term
Review tendering process	L	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) **to review tender and contractual terms on alternative platforms**.	Short-term

7.2.1 Job Dashboards

Senior Civil and Structural Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review project execution	L	▸ With the use of digital tools and platforms for data sharing and documentation (e.g., BIM Technology), job holders will need to be **familiar with the technology to access the project designs and review as-built designs for accuracy**, and review contractors' and subcontractors' works against requirements and quality standards.	Short-term
Monitor people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and apply the knowledge to **identifying technical and business recruitment, training and development** needs for the organisation.	Short-term
	M	▸ Job holders may need to understand how to **leverage project planning tools and potential increased availability of data gathered**, enabled by real-time monitoring, to **perform monitoring tasks and re-prioritise work activities and manpower allocation to mitigate delays** in project delivery as required.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Computational Design	Construction Technology
Critical Thinking	Data Collection and Analysis	Design for Maintainability
Design for Manufacturing and Assembly	Green Building Strategy Implementation	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Analytics and Computational Modelling	Biophilic Design in Built Environment	Coastal Engineering
Environmental Sustainability Management	Hydrodynamic and Flood Mitigation	Programming and Coding
Sustainable Engineering	Tunnel Engineering Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Associate Director (Civil and Structural Engineering)/Principal Civil and Structural Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for the overall planning, development, and execution of projects. Job holders review final design submittals, feasibility of solutions and manage internal and external stakeholder expectations. Job holders drive the tendering processes and lead negotiations, oversee talent recruitment and development processes and are responsible for the department's financial positions.

In the Future

The job role may need an **understanding of digital tools and platforms** so as to have oversight of and be able to spearhead overall planning, development and execution of projects, and perform endorsement and approvals and review of feasibility of proposed designs and solutions where required. Job holders may see continued focus on **keeping abreast of trends and technologies** to **maintain subject matter expertise** in civil and structural engineering and technical and engineering competence, and may see greater emphasis on **contributing to talent recruitment and development processes of the organisation for long-term benefits**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Endorse project scope and requirements	L	▸ Job holders will continue to perform endorsement of feasibility study outcomes, project scope and requirements.	Short-term
Endorse design development	L	▸ Job holders will continue to endorse designs. ▸ Job holders will continue to review designs and will need to ensure that the **use of relevant methods** (e.g., Green Buildings, DfM, DfMA) **has been incorporated**. Job holders may **utilise new engineering methods to address future structural needs** (e.g., Coastal Engineering, Sustainable Engineering) in design development. ▸ Job holders will need to keep up to date with latest regulations to effectively approve legislative submissions across all project stages.	Short-term
Endorse tendering processes	L	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) **to endorse tender and contractual terms on alternative platforms**.	Medium-term

7.2.1 Job Dashboards

Associate Director (Civil and Structural Engineering)/Principal Civil and Structural Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Oversee project execution	L	▸ With the use of digital tools and platforms for data sharing and documentation (e.g., BIM Technology), job holders will need to be **familiar with the technology to access the project designs and perform necessary approvals.**	Short-term
Drive people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and **apply the knowledge to drive initiatives addressing technical and business recruitment, training and development needs.**	Short-term
	M	▸ Job holders will need to **leverage data insights** derived from real-time data and historical performance to **formulate optimised project staffing and acquisition.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Computational Design	Construction Technology
Critical Thinking	Data Collection and Analysis	Design for Maintainability
Design for Manufacturing and Assembly	Green Building Strategy Implementation	Integrated Digital Delivery Application
People Management	Project Risk Management	Regulatory Submission and Clearance
Stakeholder Management	Technology Scanning	
Emerging Technical Skills and Competencies		
Analytics and Computational Modelling	Biophilic Design in Built Environment	Coastal Engineering
Environmental Sustainability Management	Hydrodynamic and Flood Mitigation	Programming and Coding
Sustainable Engineering	Tunnel Engineering Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Assistant Mechanical Engineer/Assistant Electrical Engineer/Technical Executive (Mechanical Engineering)/Technical Executive (Electrical Engineering)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for supporting the planning and development of projects. Job holders assist in the development of engineering designs based on project requirements.

In the Future

This job role may **leverage technology** to **augment the planning and development** of projects, with tasks such as calculations and data gathering being able to be automated. Job holders may see a **shift in focus towards value adding** in **engineering design development tasks**, and **understanding and applying technology to ensure seamless and efficient coordination with relevant stakeholders** for successful project design execution.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support project scoping and requirements definition	M	▸ Job holders will continue supporting feasibility studies and may **leverage technology to automate tasks such as data gathering and report generation of feasibility studies.** Job holders will thus need an understanding of the application of such digital tools and platforms. ▸ Job holders may see a **shift in focus to supporting solutions development** and **assisting in effective coordination** among relevant stakeholders.	Medium-term
Assist in design development	H	▸ Data Analytics & AI may automate load analyses and the calculations for equipment selection. ▸ Job holders will therefore be able to shift focus to other related tasks in supporting design development, assisting conduct of simulation modelling and analyses, and supporting design changes and service coordination.	Short-term
	M	▸ Job holders will continue to assist in the development of engineering designs, and may need to **understand and leverage technology to augment the design process to be more efficient and effective** (e.g., programming tools to support design changes). ▸ Job holders may need to apply latest trends and regulations (e.g., sustainability and maintainability considerations) in assisting design development	Short-term

7.2.1 Job Dashboards

Assistant Mechanical Engineer/Assistant Electrical Engineer/Technical Executive (Mechanical Engineering)/Technical Executive (Electrical Engineering)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assist in tendering process	M	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) to **support preparation of tender terms, drawing and specifications on alternative platforms.** ▸ Job holders may also be expected to **use digital tools to enhance the efficiency of preparing baseline budgets, schedules and project success metrics.**	Medium-term
Assist in project execution	M	▸ Job holders will continue execution of testing and commissioning processes. Job holders may need an **understanding of digital tools and platforms** (e.g., BIM Technology) **to prepare shop drawings and handover documentation for review.** ▸ Job holders may also need to **use digital communication technology to liaise with project stakeholders** for matters related to execution of project designs.	Short-term
	H	▸ RPA may automate the compilation of defect reports.	Medium-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Analytics and Computational Modelling	Building Information Modelling Application	Computational Design
Construction Technology	Data Collection and Analysis	Design for Maintainability
Design for Manufacturing and Assembly	Green Building Strategy Implementation	Integrated Digital Delivery Application
Regulatory Submission and Clearance	Technology Application	
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	Programming and Coding
Sustainable Engineering	Tunnel Engineering Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Mechanical Engineer/Electrical Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for managing the planning and development of projects, and develops mechanical and/or electrical engineering designs based on project requirements. Job holders are responsible for designing mechanical and electrical systems, conduct project assessments and provide solutions based on assessment results. Job holders also participate in tender process and assist with projects' cost and budgets, plan team's manpower and provides on-the-job coaching to junior staff.

In the Future

This job role may **leverage technology to manage planning and development of projects**, to enhance the efficiency and accuracy of simulation modelling and analyses, calculations, and to enhance the ease of coordination with relevant stakeholders such as utility providers and agencies. Job holders may see **continued focus on design development** and may need an understanding and application of technology to **interpret data findings and/or run computational models to provide feasible and creative solutions**. Job holders may also see **greater emphasis on keeping abreast of evolving trends and technologies**, so as to **incorporate new technologies into engineering design projects**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Define project scope and requirements	M	▸ Job holders will continue to conduct feasibility studies and compile associated project risks, and may see technology (e.g., Data Analytics & AI) **enhancing the generation of feasibility study outcomes to be more efficient and accurate.** ▸ Job holders may also need **data interpretation skills** to **interpret and evaluate data insights** from feasibility studies to **propose robust, data-driven solutions** to relevant stakeholders. ▸ Job holders will be required to **leverage digital communication tools to coordinate with utility providers and agencies on project progress in a timely manner.**	Short-term

7.2.1 Job Dashboards

Mechanical Engineer/Electrical Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct design development	M	▸ Job holders will continue to develop engineering designs, and may be expected to **leverage technology to augment the design process to be more efficient and effective** (e.g., Data Analytics and RPA can automate load analyses and calculations). ▸ With evolving tools and platforms for design submissions, job holders will need to **understand and utilise required tools for submission purposes**. ▸ Job holders may need to be **aware of and incorporate latest trends** (e.g., sustainability and maintainability considerations) **in design development**, and take into consideration latest regulations for project requirements, technical aspects relevant codes and standards as well as good practices. ▸ Technology (e.g., Data Analytics & AI) may augment simulation modelling and analysis processes. Job holders will need to be eq**uipped with skills to interpret analyses outcomes to manage design changes and services coordination**, and **apply to complex modelling and analyses**.	Short-term
Perform tendering processes	M	▸ Job holders may also be expected to **use digital tools to augment the efficiency in development of baseline budgets, schedules and project success metrics**.	Medium-term
	L	▸ Job holders may need an understanding of **smart contracting technology** (e.g., Blockchain) to **prepare tender terms, drawings and specifications on alternative platforms** and conduct pre-qualification and assessments for tender selection.	Medium-term
Monitor project execution	M	▸ Job holders will still need to develop shop drawings, installation methods and equipment and materials schedules, and may be **expected to leverage technology** (e.g., RPA and AI) **to accelerate segments of the development work** (e.g., information gathering across the approval process). ▸ Job holders may also need an **understanding of real-time data captured of the construction process and how to interpret it efficiently**, so as to be **monitor execution and liaise effectively with contractors** to resolve the necessary defects. ▸ Job holders will still oversee testing and commissioning, and will need to be **familiar with digital tools and platforms** (e.g., BIM Technology) **and building project records for the handover process**.	Short-term
Manage people and organisational function	M	▸ Job holders may see **increased emphasis on on-the-job coaching to support the adoption of digital tools and platforms**. ▸ Job holders may need an **understanding and application of collaborative tools and platforms** (e.g., BIM Technology) to track work progress.	Short-term

7.2.1 Job Dashboards

Mechanical Engineer/Electrical Engineer

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Analytics and Computational Modelling	Building Information Modelling Application	Computational Design
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Green Building Strategy Implementation
Integrated Digital Delivery Application	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Scanning
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Programming and Coding	Sustainable Engineering
Tunnel Engineering Management		
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Associate Director (Civil and Structural Engineering)/Principal Civil and Structural Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for driving the overall project execution, reviewing mechanical and/or electrical system designs, specifications, calculations, and other submittals. Job holders oversee the project assessment phases and ensure the mechanical and/or electrical systems designs, and models are developed in accordance with project requirements. Job holders also lead the tendering processes and are responsible for costs and budgets, manage a team of engineers and ensure continuous performance improvement.

In the Future

The job role continues to drive overall execution of projects, and may need an understanding of digital tools and platforms so as to perform the review of mechanical and/or electrical design components, and oversee project assessment phases. Job holders may see **greater emphasis** on **effective team management** and on **keeping abreast of trends and technologies** so as to ensure **continuous performance improvement** and drive implementation of **environmental sustainability** and **green building strategies**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review project scope and requirements	L	▸ Job holders will continue to review outcomes of feasibility studies and proposed solutions. Job holders will need to **possess data interpretation capabilities and familiarity with the digital tools and platforms** used in the development process, to **make amendments and address areas of discrepancy** as required. ▸ Job holders will need an **understanding of data insights and interpretation**, to be able to **leverage study outcomes and develop data-driven risk management plans and risk controls**. ▸ Job holders will need an understanding of digital tools used in project progress monitoring to **oversee coordination with utility providers and agencies on project progress**.	Short-term
Review design development	L	▸ Job holders will continue to review designs and will need to **ensure that the use of relevant methods** (e.g., Green Buildings, DfM, DfMA) **has been incorporated**. Job holders may **utilise new engineering methods to address future structural needs** (e.g., Coastal Engineering, Sustainable Engineering) in design development.	Short-term

7.2.1 Job Dashboards

Senior Mechanical/Senior Electrical Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review design development (cont'd)	L	▸ Job holders will need to understand the **application of technology** to **simulation modelling and analyses**, so as to be able to **review outcomes** for complex **modelling and analyses**, and **oversee design changes** and services coordination. ▸ Job holders will also be expected to possess **relevant knowledge** of **regulations**, so as to continue ensuring reviewed designs for clients are in compliance with authorities' requirements.	Short-term
Review tendering process	L	▸ Job holders may need an understanding of **smart contracting technology** (e.g., Blockchain) to review tender terms, drawings and specifications on alternative platforms.	Short-term
Review project execution	L	▸ With the use of **digital tools and platforms** for **data sharing** and **documentation** (e.g., BIM Technology), job holders will need to be **familiar with the technology** to access the project designs and review shop drawings, installation methods, equipment and materials schedules for accuracy, and review contractors' and subcontractors' works against requirements and quality standards.	Short-term
Monitor people and organisational functions	L	▸ Job holders will need to continuously **keep up to date** with **skills in-demand** and apply the knowledge to identifying **technical and business recruitment**, **training and development** needs for the organisation.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Analytics and Computational Modelling	Building Information Modelling Application	Computational Design
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Green Building Strategy Implementation
Integrated Digital Delivery Application	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Scanning
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Programming and Coding	Sustainable Engineering
Tunnel Engineering Management		
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Associate Director (Mechanical Engineering/Electrical Engineering)/Principal Mechanical Engineer/Principal Electrical Engineer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for the overall planning, development, and execution of projects. Job holders provide expertise in creative, innovative design solutions, and review final mechanical and electrical systems design submittals. Job holders also review the feasibility of the solutions and manage stakeholder expectations. Job holders drive the tendering processes and lead business negotiations. Job holders oversee talent recruitment and development processes and are responsible for the department's finances.

In the Future

The job role may need an **understanding of digital tools and platforms so as to have oversight of** and be able to spearhead overall planning, development and execution of projects. Job holders perform endorsement, approvals and review of feasibility of proposed designs and solutions where required. Job holders may see **continued focus on keeping abreast of trends and technologies to maintain subject matter expertise** in mechanical and/or electrical engineering and technical and engineering competence, and may see **greater emphasis on contributing to talent recruitment and development processes** of the organisation for long-term benefits.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Endorse project scope and requirements	L	▸ Job holders will continue to perform endorsement of feasibility study outcomes, project scope and requirements.	Short-term
Endorse design development	L	▸ Job holders will continue to endorse designs. Job holders will also need an **understanding of digital tools and platforms** (e.g., BIM Technology) used in design development, **to approve and endorse project designs and calculations**. ▸ Job holders will continue to endorse designs and **ensure that they are in line with latest requirements and considerations** (e.g., sustainability and maintainability considerations). ▸ Job holders will need to keep up to date with latest regulations to effectively approve legislative submissions across all project stages.	Short-term

7.2.1 Job Dashboards

Associate Director (Mechanical Engineering/Electrical Engineering)/Principal Mechanical Engineer/Principal Electrical Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive tendering processes	L	▸ Job holders may need an **understanding of project planning and estimation tools and data insights, to endorse planning outcomes and sign-off** on baseline budgets, schedules and project success metrics.	Medium-term
Oversee project execution	L	▸ With the use of **digital tools and platforms for data sharing and documentation** (e.g., BIM Technology), job holders will need to be **familiar with the technology to access** the shop drawings, installation methods, and equipment and materials schedules **and perform necessary approvals**.	Short-term
Drive people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and **apply the knowledge to drive initiatives addressing technical and business recruitment, training and development needs**.	Short-term
	M	▸ Job holders will need to **leverage data insights** derived from real-time data and historical performance to **formulate optimised project staffing and acquisition.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Analytics and Computational Modelling	Building Information Modelling Application	Computational Design
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Maintainability	Design for Manufacturing and Assembly	Green Building Strategy Implementation
Integrated Digital Delivery Application	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Scanning
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Programming and Coding	Sustainable Engineering
Tunnel Engineering Management		
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Assistant Quantity Surveyor/Assistant Cost Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

HIGH
degree of change in tasks

Today

This job role assists with taking measurements and in overall contract administration, supporting the tender process until award, and gathering information for the preparation of cost estimates, reports, and payments.

In the Future

This job role is **at risk of displacement due to a high proportion of its tasks potentially being automated through technology**. Job holders may see a **need to upskill** and **grow familiarity** in **adopting and utilising technology** in preparation for the future (i.e., operating Digital Twin models and platforms, smart contracting), as well as look to **performing higher order tasks** (from data input to analysis). **Growing trends in sustainability** may also see job holders **acquiring knowledge in carbon costing and applying these in life cycle and project costing**.

Job Tasks Today		Impact at Task-level / Future view of Job Tasks	Time Horizon
Gather information for measurements and tender documentation	H	▸ The use of digital tools (e.g., RPA) may automate the task of gathering measurements for various forms of contract bills, and updating rate schedules. ▸ Technologies (e.g., Robots & Automation and Remote Monitoring, enabled by 5G) may automate the conduct of measurements, admeasurements and re-measurements taking.	Short-term
Assist with cost planning and control	H	▸ Cost data compilation and entry, as well as the preparation of cost estimates and plans, cash flow projections and periodic cost reports may be automated by technologies (e.g., Data Analytics & AI, RPA).	Short-term
Support preparation of tenders	H	▸ Tender document preparation may be automated by the use of digital tools (e.g., RPA) to automate the data collection and information collation process.	Short-term
	M	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) to continue **supporting preparation of tender documents on alternative platforms**.	Medium-term

7.2.2 Job Dashboards

Assistant Quantity Surveyor/Assistant Cost Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support post-contract administration	H	▸ Digital tools (e.g., AI) may perform claims and payment documents verifications for final accounts. The use of RPA can support communication of payment regimes to relevant stakeholders.	Short-term
	M	▸ Job holders may be required to **leverage digital tools** (e.g., Data Analytics & AI) **to support the preparation of data-driven valuations and payment recommendations**.	Short-term
Assist with tendering and estimation*	M	▸ Job holders may continue to gather market research on prices for resources, and may be **expected to interpret gathered data and derive insights**.	Long-term
	H	▸ The compilation of tenders may be automated by the use of digital tools (e.g., RPA).	Short-term
Assist with construction cost*	M	▸ Compilation of information for management reports on profitability may be automated by digital tools (e.g., RPA). Job holders will need to **shift focus towards assessing information for insights** to draft management reports. ▸ Generation of cash flow forecasts may be augmented by digital tools (e.g., Data Analytics & AI). Job holders will need to **develop capabilities in utilising digital tools to perform forecasting in consideration of complex variables** (e.g., impact of trends).	Short-term

For this job role, it is expected that there is a significant proportion of tasks that are impacted. For more information on potential career pathways for the Assistant Quantity Surveyor/Assistant Cost Manager, please refer to Appendix : Mobility Dashboards.

* Only applicable to Contracting Quantity Surveyor

7.2.1 Job Dashboards

Quantity Surveyor/Contracts Manager/Cost Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for taking measurements and drafting tender documentation. Job holders prepare cost estimates and costing details for further analyses, complete cost management, and contract administration of the project, including preparing of claims and final account settlement.

In the Future

This job role may **leverage technology in automating** manual tasks such as measurements taking and claims preparations. Job holders will need an **understanding and familiarity of the technology application** to perform their tasks in an effective and efficient manner, and **leverage data insights to conduct cost management and contract administration**, such as preparing data driven cost estimates and costing details. Job holders may also need to **keep abreast of evolving trends and technologies so as to advise** upon industry, construction materials, procurement methods and regulations **as per digitalisation and sustainability trends**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Prepare measurements and tender documentation	M ▸ Technology (e.g., Robots & Automation, Remote Monitoring enabled by 5G) may automate the process of measurements, admeasurements and re-measurements taking. Job holders may see a **shift in focus to interpreting the outcomes** from measurements takings and **leveraging technology** to **accelerate the processing of measurements** into various forms of contract bills. ▸ Technology may also automate preparation of information (i.e., schedule of rates). Job holders will need to be equipped to use **digital tools and platforms to enhance the efficiency of drafting preliminaries and trade preambles**. ▸ Job holders will continue to use BIM or any relevant software in the course of their work, and **may see adoption of more digital tools and platforms across the value chain and various stakeholders they work with** (i.e., for review of technical specifications). Job holders will need to be equipped with the capabilities to utilise various digital tools and platforms.	Short-term

7.2.1 Job Dashboards

Quantity Surveyor/Contracts Manager/Cost Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Prepare and conduct cost planning and control	M	▸ Job holders will continue to conduct cost analyses. Job holders may see a **shift in focus to delivering enhanced cost planning and control outcomes**, and may be expected to **develop capabilities in leveraging technology** (i.e., Data Analytics & AI, RPA) **in augmenting and accelerating the preparation** of cost planning and control components (i.e., cost estimates, cost plans). ▸ Job holders may be expected to **manage and interpret various data sources** in the course of preparing cost planning and control, and will need to be **equipped with capabilities in interpreting and leveraging data** to perform their tasks, and in conducting accurate cost checking during design development. ▸ Job holders will continue to prepare plans and projections, and may need to **be aware of alternative design or method of construction trends** so as to accurately conduct cost evaluation.	Short-term
Prepare and analyse tenders	M	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) to **prepare tender documents and assist with pre-qualifications on alternative platforms**.	Short-term
Conduct post-contract administration	M	▸ Job holders will continue to conduct post-contract administration, and may leverage technology to augment valuations preparations, **applying data insights and analysis to prepare data-driven recommendations** for payment. ▸ Job holders will also continue to be **responsible for communication of payment regime across relevant stakeholders**, and may need **to leverage digital communication tools** for effective implementation. ▸ Valuation and claims variations may be generated with the support of technology (e.g., data analytics, AI models). Job holders must be equipped with the capabilities to **effectively utilise this technology in generating outcomes in support of tasks**.	Short-term
	H	▸ Claims preparations can be potentially automated by the use of technology (e.g., RPA).	Short-term
Conduct tendering and estimation*	M	▸ Job holders may leverage technology (e.g., AI, RPA) to build up prices for resources, and will **need to understand programming parameters for such** technology applications.	Short-term

* Only applicable to Contracting Quantity Surveyor

7.2.1 Job Dashboards

Quantity Surveyor/Contracts Manager/Cost Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct construction cost and resource procurement*	M	▸ Job holders will continue to conduct cash flow forecasting and monitoring, and may be expected to leverage technology (e.g., Data Analytics & AI) to **enhance the robustness of the forecasting outcomes**. Job holders will therefore **need data interpretation and application skills to adjust forecasting and monitoring** as required and to draw insights for profitability report drafting. ▸ Job holders will need to be **aware of latest trends for alternative design or method of construction** (e.g., innovative building materials, modular construction) to inform the order placement with subcontractors and suppliers.	Short-term
	H	▸ Technology (e.g., RPA) may augment rote tasks such as order placement with subcontractors and suppliers.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Contract Administration and Management	Critical Thinking
Data Collection and Analysis	Life Cycle Costing and Analysis	Procurement Coordination and Policy Development
Stakeholder Management	Technology Application	Value Engineering
Emerging Technical Skills and Competencies		
Artificial Intelligence Application	Green Building Strategy Implementation	Programming and Coding
Regulatory and Submission Clearance		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

* Only applicable to Contracting Quantity Surveyor

7.2.1 Job Dashboards

Senior Quantity Surveyor/Senior Contracts Manager/Senior Cost Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for analysing measurements and reviewing tender documents. Job holders implement procurement strategies, review cost estimates and cash flow forecasts, and manage the complete post-contract administration processes.

In the Future

This job role may **leverage technology** in delivering more accurate and efficient outcomes for analysis and review of measurements, tender documentation and cost estimates. Job holders may need **familiarity and understanding of the utilisation and application of technology** so as to **leverage data insights** to **better support delivery** of customers' and/or project objectives through resource planning, cost monitoring and profitability, in lieu of **growing digitalisation and sustainability trends**, and may see continued **focus on communication and collaboration tasks** amongst multiple stakeholders.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Analyse measurements and tender documentation	M	▸ Job holders will continue to use BIM models in performing analysis and validation of cost plans and reviewing technical specifications. Job holders may need capabilities in **adjusting models to ensure robust analysis and validation outcomes.**	Short-term
Review cost planning and control	L	▸ Job holders will continue to review cost planning and control outcomes, and may need capabilities **to perform the review process using digital tools and platforms**.	Short-term
	M	▸ Job holders will continue to **review accuracy of life-cycle costing in line with latest trends and regulations**, and advise stakeholders on **alternative designs and construction methods.**	Short-term
Review tenders and implement procurement strategies	L	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) **to implement procurement strategies.**	Long-term

7.2.1 Job Dashboards

Senior Quantity Surveyor/Senior Contracts Manager/Senior Cost Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review and evaluate post-contract administration	M	▸ Job holders will continue to review post-contract administration components, and will need to be able to **interpret data insights so as to advise on payment regimes and perform claims analysis** on behalf of relevant parties. ▸ Job holders may need to **be aware of and evaluate a wider scope of considerations** (e.g., supply chain disruptions) **in conducting contractual risk evaluations**.	Short-term
Conducting tendering and estimation	M	▸ Technology (e.g., RPA) can automate compilation of tasks and perform reporting and preliminary analysis of tenders received. Job holders will need to **shift focus to management of cost adjustment exercises and negotiations** with shortlisted tenderers.	Short-term
Review and liaise with stakeholders on construction cost and resource procurement*	M	▸ Job holders may leverage and apply digital tools (e.g., Data Analytics) in the **formulation of data-driven resource plans and programmes**, and to advise relevant stakeholders on matters of cost, contractual implications and progress during the period of works. ▸ Job holders may need to be **aware of latest trends in alternative methods of design and construction to apply in formulation of resource planning and programmes** and advise on resource procurement.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Contract Administration and Management	Critical Thinking
Data Collection and Analysis	Life Cycle Costing and Analysis	People Management
Procurement Coordination and Policy Development	Stakeholder Management	Technology Application
Technology Scanning	Value Engineering	
Emerging Technical Skills and Competencies		
Artificial Intelligence Application	Green Building Strategy Implementation	Programming and Coding
Regulatory and Submission Clearance		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

* Only applicable to Contracting Quantity Surveyor

7.2.1 Job Dashboards

Associate Director (Quantity Surveying)/ Contracts Director

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for overseeing the measurement and tender documentation processes. Job holders advise on relevant contracts, endorse cost estimations and final accounts, monitor cash flow forecasts, and establish policies for payments and post-contract administration matters.

In the Future

This job role may see continued focus on **keeping abreast of trends and technologies** and its application to the function, so as to drive adoption of industry best practices and use of technology. Job holders may need an understanding of technology application to perform endorsement of cost plans, and mitigate associated risks. Job holders may **see greater emphasis** on **providing advisory services** to drive **cost efficiency and competitiveness** through **improving processes**, in lieu of **digitalisation and sustainability trends**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Validate measurements and tender documentation	L	▸ Job holders will need to **be aware of best practices** in BIM models usage, so as to **drive best practices across the project phases**.	Short-term
Drive cost planning and control	L	▸ Job holders will continue to drive cost planning and control, and may continue to need to **apply alternative designs and methods of construction**, so as to **understand the impact to cost plans**.	Short-term
Define procurement strategies	L	▸ Job holders may need an understanding of **smart contracting technology** (e.g., Blockchain) to **establish procurement strategies**, and to be able to **advise various forms of contracting for stakeholders**.	Long-term
Oversee post-contract administration	L	▸ Job holders will need to **understand regulatory risks arising from adoption of new technologies**, so as to **effectively define policies that reduce contractual risks**.	Short-term

7.2.1 Job Dashboards

Associate Director (Quantity Surveying)/ Contracts Director

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Lead tendering and estimation*	M	▸ Job holders may **leverage digital tools** (e.g., AI) to **augment the estimates of price fluctuations**, and **drive better establishment** of overheads and profits. ▸ Job holders will continue to lead cost adjustment exercises and negotiations with shortlisted tenderers, **leveraging data insights to drive discussions**.	Short-term
Oversee construction cost and resource procurement*	M	▸ Job holders may leverage and apply digital tools (e.g., Data Analytics) to **perform forecasting of resource and programming needs, and profitability of construction works**. ▸ Job holders will continue to provide strategic subject matter expertise, applying technical knowledge to **advise the impact of new trends and technologies** on cost, contractual implications, procurement of resources or progress during the period of works.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Contract Administration and Management	Critical Thinking
Data Collection and Analysis	Life Cycle Costing and Analysis	People Management
Procurement Coordination and Policy Development	Stakeholder Management	Technology Application
Technology Scanning	Value Engineering	
Emerging Technical Skills and Competencies		
Artificial Intelligence Application	Green Building Strategy Implementation	Programming and Coding
Regulatory and Submission Clearance		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

* Only applicable to Contracting Quantity Surveyor

7.2.1 Job Dashboards

Production Supervisor

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Impact Assessment

MEDIUM
degree of change in tasks

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Today

This job role assists in production planning and performs day-to-day operations of the factory site. Job holders comply with production schedules and perform construction operations. Job holders adhere to cost, time, and quality guidelines established in predefined contracts while complying with relevant regulatory requirements and processes.

In the Future

This job role may **leverage technology to automate production planning tasks** such as information and data consolidation, as well as enable **remote supervision of factory sites** for operations and risks. Job holders may see **continued focus on conducting maintenance and performing corrective actions** to rectify faults and may **need data interpretation skills to support predictive maintenance** for equipment and machines, allowing for proactive and efficient operational responses. Job holders may also see **greater emphasis on adherence to safety policies and standards and guidelines**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support production planning and logistics	M	▸ Job holders may need an **understanding of digital platforms** (e.g., BIM Technology) **application to reference shop drawings for production work**, as documentation across the value chain is increasingly consolidated. ▸ Job holders may also leverage digital tools (e.g., Data Analytics & AI) to support planning of production schedule events, equipped with the ability to **apply the tools to optimise planning**.	Short-term
	H	▸ RPA may automate the consolidation process across information gathering for labour and equipment calculations, data on material and outputs quantity and production and output data. Job holders will need to validate the consolidated output. ▸ Job holders will need to be familiar with consolidation of data onto digital tools and platforms, in line with the trend towards common data standards.	Short-term
	M	▸ Job holders may need to **interpret machine monitoring data** enabled by digital tools (e.g., IoT) and **shift towards conducting real-time, proactive maintenance** instead of reactive maintenance.	Short-term

7.2.1 Job Dashboards

Production Supervisor

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Supervise and support factory production	M	▸ Digital tools (e.g., Remote Monitoring, Io) may enable remote supervision and inspection. Job holders will thus need to be **equipped with capabilities in employing these technologies effectively to perform supervisory tasks**, and to take corrective actions to rectify production faults if required. ▸ Job holders may look to leverage digital planning tools (e.g., Data Analytics & AI) **to derive data insights for optimisation of manpower planning.**	Short-term
Comply with safety and sustainability standards	M	▸ Job holders may need to know how to **operate Remote Monitoring technologies to conduct inspections remotely and safely.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Common Data Environment Management	Process Improvement and Optimisation	Technology Application
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Production Manager/Assistant Production Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Impact Assessment

MEDIUM
degree of change in tasks

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Today

This job role is responsible for managing all technical aspects of the factory site and keeping track of resource requirements. Job holders also plan the sequence of events from production to bringing the module from the factory to the construction site, and is expected to coordinate the crew, supplies, and equipment.

In the Future

This job role may **leverage technology to enhance the management of the factory site** in automating calculations, estimations and planning tasks, and enhance the accuracy of tracking resource requirements. Job holders will need an **understanding and ability of technology application**, so as to **deliver production in adherence to time, cost and quality**, and may see **growing emphasis on keeping abreast of trends and technologies** to **assess viability of continuous improvement initiatives.**

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct production planning and logistics	M	▸ Job holders may need to be **familiar with digital platforms** (e.g., BIM Technology) **used for the storage and communication of specifications, shop drawings and job orders documents**, so as to effectively review them. ▸ Job holders may need to **interpret machine monitoring data** enabled by digital tools (e.g., IoT) **to supervise timely conduct of maintenance activities**. ▸ Job holders may **leverage digital communication tools to conduct review meetings and communications with relevant stakeholders**.	Medium-term
	H	▸ Digital tools (e.g., Data Analytics & AI, RPA) may automate calculations of labour and equipment requirements, and production estimates and outputs. RPA can also be leveraged to draft logistics schedules in alignment with output production and delivery time. ▸ Job holders will thus need capabilities to utilise these digital tools so as to develop variations of outputs based on potential change in production needs. ▸ Job holders may see a shift in focus towards stakeholder management and machine maintenance tasks.	Short-term

7.2.1 Job Dashboards

Production Manager/Assistant Production Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assess factory production	M	▸ Job holders may leverage digital tools (e.g., Data Analytics & AI) to optimise planning of storage space, logistic arrangement and transportation of deliverables, and manpower allocation. Job holders may need to be equipped with the **capabilities to utilise these digital tools and interpret data insights for improved efficacy**.	Short-term
	M	▸ Job holders may also **leverage digital tools for monitoring factory operations** (e.g., IoT sensors) to monitor for production faults and allow for timely investigations.	Medium-term
	M	▸ Technology trends (e.g., Robots and Automation) may be **leveraged to augment manpower planning for improved efficacy**. Job holders will need to **understand application of such technology to optimise manpower planning**.	Medium-term
Gather data for and assess viability of proposed continuous improvement initiatives	M	▸ The use of digital tools for monitoring may also facilitate the gathering of data for time and cost management improvement plans. Job holders may need to have **capabilities to interpret and translate the collected data into the plans**. ▸ Digital tools (e.g., Data Analytics & AI) may augment the viability assessment of continuous improvement initiatives. Job holders will thus **need capabilities to apply these digital tools in their assessment, to understand their impact on assessment outcomes**.	Medium-term
Ensure safety and sustainability standards	L	▸ Job holders may need to be aware of latest trends (e.g., sustainable construction, modular construction) and its **impact on organisational environmental sustainability and green building standards and guidelines**.	Short-term
	M	▸ Job holders will continue to facilitate inspections and ensure compliance with safety policies and practices, and may **leverage digital tools** (e.g., remote monitoring) **to perform these inspections**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Automated Process Design	Common Data Environment Management	Process Improvement and Optimisation
Robotic and Automation Technology Application	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Senior Production Manager

Megatrends impacting the Job Role in Short to Medium-Term.				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role leads and monitors the planning for production. Job holders are responsible for organizing logistics and production schedules and ensuring that the organisation has sufficient resources for production to take place in a timely manner.

In the Future

This job role may see **greater integration of technology in tasks for leading and monitoring production planning**, including logistics schedule management and resource management. Job holders may be expected to have an **understanding of utilising technology to manage planning**, and **interpret data insights so as to optimise and develop plans and schedules** that are sufficiently resourced, and meet time, cost and quality objectives. Job holders may see **continued focus on managing alignment to compliance, regulatory and legislative requirements**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Analyse production planning and logistics	M ▸ Development of construction masterplans, labour and machining schedules and procurement may be augmented by the use of digital tools (e.g., Data Analytics & AI) to analyse requirements and optimise their development. Job holders will need **proficiency in using these digital tools and interpreting data insights, to optimise schedules for efficiency**. ▸ Similarly, these digital tools may also augment the analysis process for current production estimates and outputs, to develop optimal production output goals. Job holders will need to **possess data analytical and interpretation capabilities to validate, interpret, and refine outputs as necessary**. ▸ Job holders will need to **continue fostering collaboration with stakeholders to meet production objectives**, and may apply findings from data-driven analyses to achieve them.	Short-term

7.2.1 Job Dashboards

Senior Production Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review and monitor factory production	M	▸ Digital tools and platforms (e.g., Remote Monitoring, IoT, BIM) may be **leveraged to enhance the monitoring of building progress and factory production operations**. Job holders will be expected to **understand and leverage the technology in assessing factory performance**, and supervising investigations of the causes of production faults to address performance gaps as required.	Short-term
	M	▸ Job holders may need to **understand how technology** (e.g., Robots and Automation) can be leveraged to augment manpower allocation, and review the manpower planning for feasibility and efficiency.	Medium-term
Evaluate and implement proposed continuous improvement initiatives	M	▸ Digital tools (e.g., Data Analytics & AI) may enhance the conduct of cost-benefit analyses and generate more robust outcomes. Job holders will need **capabilities to interpret the outcomes** and apply these to **support the implementation process**. ▸ Job holders will need to have **capabilities to interpret and translate data** gathered from digital tools and platforms into proposals for continuous improvement initiatives. Job holders will also need an **understanding of evolving trends and regulations** (e.g., Common Data Environment) **to effectively implement data and documentation management processes**.	Short-term
Drive safety and sustainability with organisational standards and guidelines	L	▸ Job holders will need to **continue implementing organisational environmental sustainability and green building standards and guidelines**, and **be aware of relevant trend**s (e.g., sustainable construction, modular construction) in order to do so.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Automated Process Design	Common Data Environment Management	Process Improvement and Optimisation
Robotic and Automation Technology Application	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Factory Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for the overall planning, development and execution of production and quality assurance processes. Job holders establish the output goals for each project and develop procedures and policies to achieve these goals. Job holders define inspection criteria, implement processes to enhance quality control and drive strategies to ensure quality assurance in production.

In the Future

This job role may **leverage technology in performing oversight-related tasks**, i.e., overseeing planning, development and execution of production and quality control or quality assurance processes. Job holders may need an understanding of technology so as to **interpret dashboards and data to establish data-driven output goals**, and to implement **processes to enhance quality control**. Job holders may see **continued focus on quality management and adherence to requirements and regulatory guidelines**, and growing emphasis on keeping abreast of trends and technologies to **lead adoption and drive culture of continuous improvements** in support of time and cost improvements.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Oversee production planning and logistics	L	▸ Job holders will continue to oversee production planning and logistics, and may need to be **familiar with the relevant digital tools and platforms so as to oversee and endorse schedules as required.** ▸ Job holders may also need **data interpretation capabilities to review data insights and establish production output goals that are data-driven and optimal** for the factory.	Short-term
Oversee factory production	L	▸ Job holders will continue to oversee factory production, and may need to be **familiar with the relevant digital tools and platforms so as to endorse documentation**, and **oversee building progress and transportation of deliverables.** ▸ Job holders will continue to play a role of a subject matter expert, and **be aware of the impact of latest trends and technologies on operational policies, procedures and standards development.**	Short-term
	M	▸ In response to gaps in the factory production process, job holders may also be expected to **leverage their knowledge of trends and technologies, and technical expertise to recommend corrective actions** to rectify production faults.	Short-term

7.2.1 Job Dashboards

Factory Manager

Job Tasks Today		Impact at Task-level / Future view of Job Tasks	Time Horizon
Drive continuous improvement initiatives	M	▸ Job holders will continue to lead the adoption of the latest built environment trends and technologies, and are expected to be aware of latest developments to facilitate the adoption process. Job holders may be expected to **leverage digital tools** (e.g., Data Analytics & AI) **to evaluate benefits, trade-offs and impact of new technologies and lead a robust adoption process.**	Short-term
	L	▸ Job holders may also see **greater emphasis on leading adoption of latest techniques available to achieve product quality**, achieved by driving a culture of continuous improvement.	Short-term
Drive quality assurance processes	L	▸ Job holders may need an **understanding of latest production methods**, so as to **determine relevant thresholds for quality audit inspections.**	Medium-term
	L	▸ Job holders will continue to be responsible for keeping organisation updated of latest relevant assurance requirements and regulatory guidelines, and will need to stay current on latest trends and regulations.	Short-term
Drive organisational adoption of safety policies, processes, and procedures	L	▸ Job holders will continue to **apply knowledge of latest trends** (e.g., sustainable construction) to **successfully drive organisational adoption of environmental sustainability and green building strategies.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Automated Process Design	Common Data Environment Management	Process Improvement and Optimisation
Robotic and Automation Technology Application	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Quality Assurance Supervisor/Quality Control Supervisor

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role assists in conducting quality inspections and gathering data to identify non-conformances with relevant standards and requirements. Job holders are expected to be familiar with the organisation's production processes and the relevant quality assurance requirements.

In the Future

This job role may see technology automate tasks related to documentation, data consolidation and collation. Job holders may also see a **shift in focus in leveraging technology to increase efficiency in conducting inspections and site surveillance**, preparation of quality plans. Job holders may see **continued focus on follow-through and compliance to quality control and safety requirements**, and **growing emphasis on adherence to sustainability standards and guidelines**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assist with the development of quality assurance and quality control plan	M	▸ Digital tools and platforms (e.g., RPA) may automate segments of QA/QC plans preparation, and perform documentation of systems and controls. ▸ Digital tools (e.g., Data Analytics & AI, IoT) can enable increased availability and access to production data. Job holders will need to be equipped with capabilities to **apply data analysis skills to identify conditions impacting production quality in a more rapid manner**. ▸ Job holders may also **leverage digital tools and platforms to perform consolidate of project timeline data**, and **shift focus to carrying out inspections**.	Short-term
Assist with quality assurance processes	M	▸ Job holders may need **operational capabilities in implementing digitalized inspection checklists** with the **potential adoption of digital platforms as means of data storage and sharing**. ▸ Job holders may also need to be **aware of the impact of trends and technologies** (e.g., Innovative Building Materials, Sustainable Construction) **and its impact on production processes and use of materials**, to ensure alignment and compliance with quality and regulatory requirements.	Short-term
	H	▸ Digital tools (e.g., RPA) can automate data collection for quality assurance purposes (i.e., qualification and employment data, suppliers and subcontractors engaged).	Short-term

7.2.1 Job Dashboards

Quality Assurance Supervisor/Quality Control Supervisor

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assist with quality control procedures	H	▸ Digital tools (e.g., RPA) may automate the collation and compilation of quality inspections data.	Medium-term
	M	▸ Job holders may need **operational competency in digital tools for the conduct of virtual site surveillance** (e.g., Remote Monitoring) to continue assisting in these tasks. ▸ Job holders may **need an awareness of new production methods and materials** (e.g., sustainable materials) that may impact production processes, so as to **effectively follow up with production team on correction of defects.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Common Data Environment Management	Design for Manufacturing and Assembly	Process Optimisation
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	Technology Application
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Quality Assurance Manager/Quality Control Manager/Quality Assurance Engineer/Quality Control Engineer/Planner

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for conducting quality inspections and analysing data to identify non-conformances with relevant standards and requirements. Job holders are familiar with the organisation's production processes and the relevant quality assurance requirements and regulatory guidelines, and are responsible to coordinate production, supply lines and occasionally implement quality assurance and quality control plans.

In the Future

This job role may see technology (e.g., Remote Monitoring, IoT) **leveraged to enhance the ease and efficiency of conducting inspections** and **identifying non-conformance with relevant standards and requirements.** Job holders may need an understanding of technology and **apply it to coordination and planning of production/supply** lines. Job holders may see **continued focus on verifying adherence to quality assurance requirements and manage communications across stakeholders** in various disciplines and production teams.

Job Tasks Today.	Impact at Task-level / Future view of Job Tasks		Time Horizon
Conduct production planning and logistics	H	▸ Digital tools (e.g., RPA) can consolidate specifications and job orders and plan for production lines.	Short-term
	M	▸ Job holders may be **expected to see closer collaboration with relevant stakeholders to meet expected production schedules** in lieu of the sector's shift towards aggregation and integration. ▸ Digital tools (e.g., Data Analytics & AI, IoT) can enable increased availability and access to production data. Job holders will need to be **equipped with capabilities to leverage data and draw insights** so as to **develop optimised production plans**.	Short-term
Prepare for factory production	M	▸ Digital communication tools may be used to **update relevant stakeholders in an increasingly timely manner**, with updates potentially able to be automated (e.g., use of IoT, RPA).	Short-term

7.2.1 Job Dashboards

Quality Assurance Manager/Quality Control Manager/Quality Assurance Engineer/Quality Control Engineer/Planner

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Prepare quality assurance and quality control plan	M	▸ Job holders may be expected to **play a role** in **adoption of new technologies and/or processes**, requiring technical expertise in new developments to solution and recommend improvement areas for production quality. Job holders may also need to **provide alternative methods to enhance efficiency of quality assurance and quality control procedures execution**. ▸ Digital tools (e.g., Data Analytics & AI) can be **applied upon gathered historical data to enhance inspection planning** across project phases.	Short-term
Propose continuous improvement initiatives	L	▸ Job holders will continue to conduct research on latest techniques available, **be aware of latest related developments** (e.g., alternative materials) so as to **integrate the impact into organisation's quality management system**.	Short-term
Conduct and analyse quality assurance processes	M	▸ Job holders may need **operational capability in utilising digital tools and platforms to draft inspection checklists**. ▸ Job holders may also need to **leverage digital communication tools to communicate across disciplines and production teams**, and **may need to facilitate cross-disciplinary collaboration for quality standards**.	Short-term
	H	▸ Digital tools (e.g., AI, RPA) can automate the analysis of personnel data, and suppliers and subcontractors information for compliance.	Short-term
Conduct quality control procedures	M	▸ Job holders will need **operational competency in digital tools that may conduct virtual site surveillance** (e.g., Remote Monitoring) to continue assisting in these tasks.	Medium-term
	M	▸ Digital tools (e.g., Data Analytics & AI) can be leveraged to enhance the efficiency of quality performance data analysis. Job holders must be **equipped with data analytics and interpretation skills** to **analyse and interpret the data, and leverage insights derived to perform quality control issues and risks identification**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Common Data Environment Management	Design for Manufacturing and Assembly	Process Optimisation
Technology Scanning		
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	Technology Application
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Senior Quality Assurance Manager/Senior Quality Control Manager/Senior Planner

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	Robots & Automation	VR/AR	5G, IoT & Smart Buildings
Innovative Building Materials	Modular Construction	3D Printing	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for implementing all quality inspections on-site and off-site to ensure adherence to the relevant quality assurance requirements and regulatory guidelines. Job holders manage coordination across the production, quality assurance and quality control teams.

In the Future

This job role may leverage technology in increased ease and efficiency in overseeing quality inspections, enabled by technology (e.g., BIM, Remote Monitoring). Job holders may need an understanding and ability to apply technology to facilitate the review process that they are responsible for, to interpret data and dashboards, and evaluate effectiveness and adequacy of quality policies, and adherence of factory processes to quality assurance requirements and regulatory guidelines. Job holders may see growing emphasis on **keeping abreast of trends to implement environmental sustainability** and **green building standards and guidelines** in the course of their work.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage production planning, logistics and factory production	M	▸ Job holders will continue to review production plans and logistics, and may need an **understanding and operational competency in digital planning tools to perform the review process**.	Short-term
	M	▸ Digital tools (e.g., AI) may augment the review process of reports and plans for accuracy. Job holders will see a **shift in focus in resolving issues arising from the review process and address any complications as a result of constant improvements** in building designs (i.e., adoption of alternative design and construction methods) and its impact on the production process.	Short-term
Evaluate quality assurance and quality control plan	L	▸ Job holders will continue to be responsible for the evaluation of quality assurance and quality control plans.	Short-term
	M	▸ Job holders will need to **continuously keep up to date with skills in-demand and apply the knowledge to ensure that quality personnel are adequately trained** for their responsibilities.	Short-term

7.2.1 Job Dashboards

Senior Quality Assurance Manager/Senior Quality Control Manager/Senior Planner

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review continuous improvement initiatives	L	▸ Job holders will continue to leverage their subject matter expertise in evaluating techniques applied to enhance and review improvement initiatives for the organisation's quality management system. Job holders will need to **be aware of latest techniques for evaluation**.	Short-term
Assess and develop reports for quality assurance processes	M	▸ Digital tools (e.g., IoT, Data Analytics) may augment the production quality monitoring process. Job holders will need **proficiency in interpreting monitoring data and identifying anomalies** to determine production continuity and/or suspension.	Short-term
Determine strategies for quality control procedures	M	▸ Job holders may require capabilities in **interpreting gathered data** enabled by technology (e.g., IoT) **to determine and eliminate sources of quality problems**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Common Data Environment Management	Design for Manufacturing and Assembly	Process Optimisation
Emerging Technical Skills and Competencies		
Critical Thinking	Stakeholder Management	Technology Application
Technology Scanning		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Site Supervisor/Trade Supervisor/Project Coordinator

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

Today, this job role is responsible for supporting the day-to-day operations of the construction site, from site preparations to build-out. Job holders coordinate between the various disciplines and construction teams.

In the Future

This job role may leverage technology in the support of day-to-day operations of the construction site, automating tasks such as document and information collation. Job holders may need an **understanding of technology application** to facilitate **efficient coordination and communication** across disciplines and construction teams, and to perform supervision of work activities (that may transit to remote supervision).

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support construction phase	M	▸ Job holders continue to be responsible for supporting the management of operations and associated risks and will see continued focus on compliance and risk management. ▸ Job holders may be expected to **utilise digital communication tools and platforms** (e.g., BIM Technology, Digital Twin), and be aware of trends and technologies (e.g., DfMA) **to better support coordination and communication across various disciplines and construction teams**. ▸ Job holders may need an **understanding and ability to utilise digital tools** (e.g., Remote Monitoring, IoT) **to carry out regular inspections and supervision remotely**, with continued focus on ensuring compliance to regulatory and legislative requirements, processes and procedures. However, job holders may **still need exposure to on-site activities to gain necessary construction site experience**. ▸ Job holders may also need **to adopt the use of robotic and technology automation in execution of construction plans**, and will need to be familiar with its application for successful execution.	Short-term
Support project completion and closure	H	▸ Compilation and tracking of errors, defects and variations may be automated by digital tools (e.g., RPA, AI).	Short-term
	M	▸ Digitalisation of databases and documentation will require job holders to **understand the application of digital tools and platforms, to support the preparation and collation of technical documents** for project handover and closure.	Short-term

7.2.1 Job Dashboards

Site Supervisor/Trade Supervisor/Project Coordinator

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Critical Thinking	Design for Manufacturing and Assembly
Project Risk Management	Regulatory Submission and Clearance	Stakeholder Management
Technology Application		
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Robotic and Automation Technology Application	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Site Supervisor/Trade Supervisor/Project Coordinator

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for managing all aspects of the construction site, from site preparations to build-out. Job holders ensure that the construction, installation and assembly of components, equipment and systems are aligned with the construction plans and drawing designs.

In the Future

This job role may leverage technology in managing construction site operations, in **enabling efficient and seamless coordination and communication across various disciplines and construction teams.** Job holders may need an understanding of technology application to perform monitoring and management of construction plans and drawing designs, ensure that they are aligned to and in adherence to time, cost and quality. Job holders may see **continued emphasis on compliance to relevant regulatory and legislative requirements**, and **growing emphasis on adaptability in adopting and applying technology to enhance productivity.**

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage construction phase	M	▸ Job holders continue to be responsible for management of operations and associated risks and will see continued focus on compliance and risk management. ▸ Job holders may be **expected to utilise digital communication tools and platforms** (e.g., BIM Technology, Digital Twin), and be aware of trends and technologies (e.g., DfMA) **to manage coordination and communication across various disciplines and construction teams.** Digital planning tools may also be utilised to **augment the preparation of construction progress reports and documentation from project meetings through provision and availability of data**, with job holders able to perform project management more effectively. ▸ Digital tools (e.g., Remote Monitoring, IoT) may also be **leveraged to carry out inspections remotely.** However, job holders may **still need exposure to on-site activities to gain necessary construction site experience.** ▸ Job holders may need to **stay up to date with the latest technological advancements and trends so as to effectively provide subcontractor guidance on technical aspects.** Job holders may also leverage this information to identify relevant stakeholders for action items and follow-ups from project meetings.	Short-term

7.2.1 Job Dashboards

Engineer/Assistant Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Manage project completion and closure	M	▸ Job holders will need to understand the application of digital tools and platforms (e.g., BIM Technology, AI) in **augmenting the accuracy and speed of identification of errors, defects and variations based on construction plans and drawing designs.** ▸ Digitalisation of databases and documentation will require job holders to **have an understanding of digital tools and platforms to prepare technical, project handover and closure documents.** ▸ Job holders may also need to conduct research on latest techniques available, **be aware of latest related developments that may drive alternative design and construction methods**, hence **impacting the management of testing and commissioning of components, equipment and systems.**	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Critical Thinking	Design for Manufacturing and Assembly
Project Risk Management	Regulatory Submission and Clearance	Stakeholder Management
Technology Application		
Emerging Technical Skills and Competencies		
Data Collection and Analysis	Environmental Sustainability Management	Robotic and Automation Technology Application
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Assistant Project Manager (Construction)/ Construction Manager

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for managing the execution of construction operations. Job holders validate the construction, installation and assembly of components, equipment and systems. Job holders also assess compliance with the relevant regulatory requirements.

In the Future

This job role may need to understand how to **leverage data insights to perform assessment and verification of processes and outcomes** as required. Job holders may need to have an **understanding and familiarity with digital tools and platforms so as to perform handover and closure tasks**, as well as facilitate stakeholder management. Job holders may see **growing emphasis on problem-solving skills to resolve construction phase and project queries** in a timely and efficient manner, and the need to keep abreast of latest trends to **apply sustainability and green building standards**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assess progress and quality of construction phase	M	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) **to support preparation of construction contractual and tender documents**, and may see this task automated by the use of digital tools (e.g., RPA).	Medium-term
	M	▸ Job holders continue to be responsible to manage construction sites and associated risks, and will see continued focus on compliance and risk management. ▸ Job holders may **leverage digital tools** (e.g., BIM Technology, Digital Twin) **to automate the identification of construction requirements**. Job holders may also **apply such digital tools to perform assessment of project progress against contractual terms**, and quality assurance and control standards against stakeholders expectations. Job holders will be **expected to identify gaps through the data gathered and address it**. ▸ Job holders may also need **stay up to date with the latest technological advancements and trends** (e.g., DfMA, Sustainability) and its **impact on construction requirements**. ▸ Job holders may need **capabilities to operate digital tools** (e.g., Remote Monitoring, IoT) **to assess regular inspections and subcontractors' work activities** and ensure compliance against regulatory requirements and performance expectations.	Short-term

7.2.1 Job Dashboards

Assistant Project Manager (Construction)/ Construction Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Verify for project completion and closure	M	▸ Digital tools (e.g., BIM Technology, AI) may **augment the verification of documentation** (i.e., list of errors, defects and variations, technical documents for project handover and closure). Job holders will **continue to perform technical verification** where required.	Short-term
	M	▸ Digital tools may also automate the preparation of project handover and closure documents for approval and submission. Job holders will need to keep up to date with regulations, to prepare documents in compliance with relevant regulatory, legislative and maintenance requirements. ▸ Job holders may also need an **understanding of digital tools and platforms used for collaboration** across the sector, **to ensure compatibility and successful project handover**.	Short-term
Manage people and organisational functions	M	▸ Job holders may see **increased emphasis on on-the-job coaching to support the adoption of digital tools and platforms** for teams. ▸ Job holders may need an **understanding and application of collaborative tools and platforms** (e.g., BIM Technology) **to track work progress**.	Short-term
Gather data for and assess viability of proposed continuous improvement initiatives	M	▸ The use of digital tools for monitoring may also facilitate the gathering of data for time and cost management improvement plans. Job holders may need to have **capabilities to interpret and translate the collected data into the plans**. ▸ Digital tools (e.g., Data Analytics & AI) may augment the viability assessment of continuous improvement initiatives. Job holders will thus need **capabilities to apply these digital tools in the assessment process**.	Medium-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Manufacturing and Assembly	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Application
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Robotic and Automation Technology Application	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Senior Project Manager (Construction)/Project Manager (Construction)

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

Today, this job role is responsible for leading and monitoring the execution of construction operations. Job holders optimise project plans, lead constructability reviews for the construction and installation of equipment and systems. Job holders adhere to and monitor compliance with the relevant regulatory requirements, and oversee the implementation of sustainable engineering strategies to promote a culture of continuous improvement.

In the Future

This job role may need a **good understanding of how technology can be applied through digital tools and platforms**, so as to effectively monitor construction operations execution. Job holders may also need an **understanding of data insights and interpretation to support project management, problem solving and decision making** in managing construction operations. Job holders may see **growing emphasis on keeping abreast of evolving trends and technologies** so as to effectively implement organisational environmental sustainability and green building standards and guidelines and **promote a culture of continuous improvement**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage construction phase	M	▸ Job holders may need to acquire understanding and skills to **utilise digital tools and platforms** (e.g., BIM Technology, Data Analytics & AI) **to augment the preparation of construction plans based on project requirements**. ▸ Job holders may need to be **aware of the impact of trends and technologies** (e.g., supply chain disruption, DfMA) across the sector and **address their impact in construction plans**. Job holders may also leverage this information in managing action items and follow-ups, in engaging the necessary stakeholders. ▸ Job holders will need the **ability to operate digital tools and platforms to perform monitoring and management of the construction progress** (e.g., Remote Monitoring, IoT), and manage non-compliance or deviations identified in a timely manner.	Short-term

7.2.1 Job Dashboards

Senior Project Manager (Construction)/Project Manager (Construction)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage project completion and closure	L	▸ Job holders will continue to be responsible for stakeholder management in response to project completion and closure, and may **leverage the availability of information via digital tools and platforms to provide timely updates as required.**	Short-term
	M	▸ Job holders may also need to **be aware of evolving trends and technologies that may drive alternative design and construction methods, and monitor the impact to the process** of testing and commissioning of components, equipment and systems.	Short-term
Drive safety and sustainability with organisational standards and guidelines	L	▸ Job holders will continue to ensure implementation and compliance to safety policies, processes and procedures, and will need to **be aware of latest trends** (e.g., sustainable construction) **and regulations, and its impact on safety and sustainability.**	Short-term
Manage people and organisational functions	L	▸ Job holders will need to **continuously keep up to date with skills in-demand** and **apply the knowledge to identifying technical and business recruitment, training and development needs for the organisation.**	Short-term
Evaluate and implement proposed continuous improvement initiatives	L	▸ Job holders will continue to evaluate feasibility of technology adoption and perform implementation, leveraging technical expertise and latest knowledge of technologies to facilitate this outcome.	Short-term
	M	▸ Digital tools (e.g., Data Analytics & AI) may enhance the conduct of cost-benefit analyses and generate more robust outcomes. Job holders will **need to have capabilities to interpret and translate data gathered from digital tools and platforms into proposals** for continuous improvement initiatives.	Short-term

7.2.1 Job Dashboards

Senior Project Manager (Construction)/Project Manager (Construction)

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Manufacturing and Assembly	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Application
Technology Scanning		
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Supply Chain Management	Robotic and Automation Technology Application
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Project Director (Construction)

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
RPA	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for overseeing the overall construction operations and influencing the overall roadmap and direction for construction projects. Job holders strategise and establish policies and procedures to manage time, cost, quality, health, safety, and environmental issues effectively. Job holders also formulate sustainable strategies and lead a team of senior engineers to ensure efficiency in construction operations.

In the Future

This job role may see technology augmenting existing tasks, by **allowing job holders to leverage data insights to strategise and establish data-driven policies and procedures** in alignment to construction project objectives. Job holders may see **continued emphasis on a high level of technical and engineering competence**, and growing emphasis on keeping abreast of evolving trends and technologies so as to **formulate and drive related sustainable strategies, procedures and guidelines, and promoting culture of continuous improvement**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Oversee construction phase	L ▸ Job holders will continue to oversee the construction phase, providing endorsements and establishing policies and procedures. Job holders may **need to keep up to date with trends and regulations** (e.g., DfMA) to **inform the establishment of policies and procedures**. ▸ Job holders may also need **operational understanding of digital tools and platforms, so as to oversee construction progress, and manage progress delays** (e.g., supply chain disruptions) in a timely manner. ▸ Job holders may be **expected to facilitate enhanced collaboration** across various disciplines and the sector by **leveraging technical expertise** and **understanding the impact of industry trends and technologies** on various disciplines, so as to **manage action items and follow-ups effectively**.	Short-term
Oversee project completion and closure	L ▸ Job holders will continue to oversee the management of stakeholders, and may see **growing complexity in stakeholder types due to increased aggregation and integration** of the value chain and resulting partnerships. Job holders may need to be **equipped to manage complex stakeholder relationships** for the project completion and closure phase.	Short-term

7.2.1 Job Dashboards

Project Director (Construction)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and **apply the knowledge to drive initiatives addressing technical and business recruitment, training and development needs**.	Short-term
Drive continuous improvement initiatives	M	▸ To lead a robust adoption process of new technologies, job holders will have to be **aware of the latest built environment trends and technologies**, and may be expected to be **capable of leveraging digital tools** (e.g., Data Analytics & AI) **to evaluate benefits, trade-offs and impact**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Construction Technology	Critical Thinking	Data Collection and Analysis
Design for Manufacturing and Assembly	People Management	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Scanning
Emerging Technical Skills and Competencies		
Environmental Sustainability Management	Supply Chain Management	Robotic and Automation Technology Application
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Assistant Project Manager/Project Management Executive

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is responsible for performing relevant research, data collection and coordination to support the Project Manager and Senior Project Manager in the planning and execution of projects. Job holders understand the basics of the overall project life cycle and can perform the assigned tasks in an efficient and timely manner.

In the Future

This job role may leverage technology in automating related tasks such as data collection and document collation. Job holders may need an **understanding and familiarity in technology application to apply towards enhancing efficiency of project-related coordination** across various disciplines and project teams, and may see **growing emphasis on ensuring project compliance to relevant regulatory and legislative prerequisites**, and ensuring projects follow environmental sustainability and green building standards and guidelines.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support project planning	M	▸ Collation of project planning and execution documents can be automated by digital tools (e.g., RPA). Job holders may also require **an understanding of smart contracting technology** (e.g., Blockchain) and **preparation of documents on alternative contracting platforms**. ▸ Job holders may also **leverage digital tools** (e.g., Data Analytics & AI) **to perform compliance checks** of project planning and execution documents against regulatory and legislative requirements, and may **need to be aware of evolving trends and regulations to achieve this** (e.g., sustainability).	Medium-term
	M	▸ Job holders may be expected to **leverage digital communication tools** (e.g., BIM Technology, Digital Twin) **to enhance efficiency of coordination** across various disciplines and project team.	Short-term
Perform coordination for project progress and completion	M	▸ The use of digital tools (e.g., Data Analytics & AI, RPA) can be leveraged to **collect data for project progress reporting and benchmarking, and collation of variation order requests**. ▸ Job holders will continue to work closely with various disciplines and project teams and be responsible for close and effective coordination to meet the project timeline and budget.	Short-term
	M	▸ Given the evolving nature of work towards hybrid arrangement, job holders may need an **understanding in operationalising site meetings with various stakeholders using remote technology** (e.g., Remote Monitoring, VR/AR).	Short-term

7.2.1 Job Dashboards

Assistant Project Manager/Project Management Executive

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Construction Technology	Critical Thinking
Data Collection and Analysis	Integrated Digital Delivery Application	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Application
Emerging Technical Skills and Competencies		
Environmental Sustainability Management		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Project Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

Today, this job role is responsible for the overall planning, implementation, and completion of projects within specified cost, time and quality. Job holders maintain compliance with the relevant regulatory and legislative requirements, at all times, and play an active role in contributing to the organisation's continuous improvement initiatives.

In the Future

This job role may leverage technology to augment the overall planning, implementation and completion of projects, utilising digital tools and platforms to manage project stakeholders and project delivery. Job holders may need an **understanding and ability to apply technology in automating** the **preparation of project reports and documents** where possible, and **shift greater focus towards resolving issues** arising from project execution, risk management, safety management and quality assurance and control. Job holders may also see **greater emphasis on versatility and understanding across functions** as the sector moves towards aggregation and integration, so as to effectively manage projects and stakeholders and **actively contribute to continuous improvement initiatives**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage project planning	M	▸ Job holders may need an **understanding of smart contracting technology** (e.g., Blockchain) **to support preparation of contractual and tender documents**, and may see this task automated by the use of digital tools (e.g., RPA).	Medium-term
	M	▸ Job holders continue to be responsible to manage various disciplines and project teams to integrate overall project plans, and may **leverage digital planning tools** (e.g., BIM Technology, Data Analytics & AI) **to enhance identification of project requirements**, regulatory and legislative prerequisites in consideration for project execution. ▸ Job holders will need an **understanding of the impact of trends and application of technologies** across various disciplines and project teams, so as to **identify project requirements accurately** (e.g., choice of design and construction methods) and **enhance the integrity of overall project plans.**	Short-term

7.2.1 Job Dashboards

Project Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage project progress and completion	M	▸ Digital tools and platforms (e.g., RPA, Data Analytics & AI, BIM Technology) may augment the preparation of project progress reports and relevant documentations in an efficient manner. ▸ Job holders continue to be responsible for management of project progress and completion, and may **need to anticipate and address any issues and manage overall project delivery** across various disciplines and project teams. ▸ Given the evolving nature of work towards hybrid arrangement, job holders may **need operational competency in conducting site meetings with various stakeholders using remote technology** (e.g., Remote Monitoring, VR/AR).	Short-term
Gather data for and assess viability of proposed continuous improvement initiatives	M	▸ Digital tools (e.g., Data Analytics & AI) may augment the viability assessment of continuous improvement initiatives. Job holders will thus **need capabilities to apply these digital tools in their assessment**, and to **keep up with technological trends to understand their impact on assessment outcomes**.	Medium-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Construction Technology	Critical Thinking
Data Collection and Analysis	Integrated Digital Delivery Application	Project Risk Management
Regulatory Submission and Clearance	Stakeholder Management	Technology Application
Emerging Technical Skills and Competencies		
Environmental Sustainability Management		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Senior Project Manager

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role manages numerous large-scale and complex projects for the organisation. Job holders are responsible for defining project scopes, objectives, plans and performance measuring criteria to ensure that the completion of project deliverables is in accordance with the required standards and expectations. Job holders also lead project reviews to identify synergies and areas of improvement across projects.

In the Future

This job role may **leverage technology to augment the management of large scale and complex projects**, utilising digital tools and platforms to monitor adherence of overall project delivery to quality, timeline and budgets. Job holders may leverage data availability and insights to **pre-emptively identify synergies and areas of improvements across projects**, and **actively apply necessary interventions to manage and minimise risks**. Job holders may also see **greater emphasis on versatility and understanding across functions** as the sector moves towards aggregation and integration, keeping abreast of trends and technologies to successfully **propose and implement continuous improvement initiatives**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review and evaluate project planning	L	▸ Job holders will continue to ensure implementation and with regulatory and legislative requirements, processes and procedures, and will **need to be aware of latest trends** (e.g., sustainable construction) **and regulations, and its impact on safety and sustainability**.	Short-term
	M	▸ Job holders may be expected to develop data interpretation capabilities to assess project requirements and project plans and identify and propose areas of improvement. Job holders **may apply the use of digital tools** (e.g., Data Analytics & AI) **to explore variations** of project plans, to **define optimal project requirements and integrated project plans**. ▸ Job holders may also need to **possess operational competency in using digital tools and platforms for project planning, ensuring compatibility across various disciplines and project teams** to enable effective project management.	Short-term

7.2.1 Job Dashboards

Senior Project Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review project progress and completion	M	▸ Job holders will continue to manage stakeholders across the project lifecycle, to obtain approval and manage requests and expectations. Given the evolving nature of work towards hybrid arrangement, job holders may **need operational competency in leading site meetings with various stakeholders using remote technology** (e.g., Remote Monitoring, VR/AR). ▸ Digital tools (e.g., BIM Technology, Digital Twin) may **provide job holders the means to monitor the management of overall project delivery** across various disciplines and project teams. Job holders will require operational competency in the technologies to monitor project progress. ▸ Digital tools (e.g., Data Analytics & AI) may also be leveraged to assess resourcing needs in response to variations in project delivery. Job holders will need to **assess and interpret data insights to identify gaps in project delivery and effectively address them** to support progress and completion of projects.	Short-term
Manage people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand and apply the knowledge to identifying technical and business recruitment, training and development needs** for the organisation.	Short-term
Evaluate and implement proposed continuous improvement initiatives	L	▸ Job holders will continue to evaluate feasibility of technology adoption and perform implementation, leveraging technical expertise and latest knowledge of technologies to facilitate this outcome.	Short-term
	M	▸ Digital tools (e.g., Data Analytics & AI) may enhance the conduct of cost-benefit analyses and generate more robust outcomes. Job holders will need **capabilities to interpret the outcomes and apply findings to support the implementation process**. ▸ Job holders will need to have capabilities to **interpret and translate data gathered from digital tools and platforms into proposals** for continuous improvement initiatives.	Short-term

7.2.1 Job Dashboards

Senior Project Manager

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Construction Technology	Critical Thinking
Data Collection and Analysis	Integrated Digital Delivery Application	People Management
Project Risk Management	Regulatory Submission and Clearance	Stakeholder Management
Technology Application	Technology Scanning	
Emerging Technical Skills and Competencies		
Environmental Sustainability Management		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Project Director (Project Management)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Data Analytics & AI	Digital Twin	Remote Monitoring
VR/AR	5G, IoT & Smart Buildings	Modular Construction	

Impact Assessment

LOW
degree of change in tasks

Today

This job role drives the strategic planning and authorisation of projects. Job holders play a strategic role in the organisation and advise stakeholders on project quality and challenge to ensure project completion. Job holders formulate strategies to optimise project staffing and ensuring alignment of project costs within the budget, and also spearhead the adoption of new technologies and processes in the organisation.

In the Future

This job role continues to play a strategic role in the organisation, but may need **to acquire an understanding** of **data interpretation** so as to **leverage data insights** derived from data analytics or related technology to augment robustness of advice and formulation of strategies for project optimisation. Job holders may see **continued emphasis** on **keeping abreast of evolving trends and technologies** and **establishing connections** with stakeholders, so as to spearhead adoption of new technologies and processes where relevant in the organisation.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Endorse and drive project planning	L ▸ Job holders will continue to perform endorsement of project documentation, and drive project strategies in line with project objectives of time, cost and quality, and in compliance with regulatory and legislative requirements. Job holders may **need operational competency in operating digital tools and platforms to perform endorsement of relevant documentation**. ▸ Job holders may also need to **be aware of latest trends, applying technical expertise to refine integrated project plans** based on industry best practices.	Short-term
Drive project progress and completion	L ▸ Job holders will continue to be responsible for overseeing management of stakeholders to obtain approval and manage requests and expectations. Job holders may **leverage the availability of information via digital tools and platforms** (e.g., BIM Technology) **to provide timely updates** as required. ▸ Job holders will also continue to oversee project progress and completion, and will need to be **aware of evolving trends** (e.g., workforce challenges) **and its impact,** to as to **oversee the necessary interventions to minimise disruptions to project delivery on time, cost and quality**.	Short-term

7.2.1 Job Dashboards

Project Director (Project Management)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and **apply the knowledge** to **drive initiatives addressing technical and business recruitment, training and development needs**.	Short-term
Drive continuous improvement initiatives	M	▸ To lead a robust adoption process of new technologies, job holders will have to be **aware of the latest built environment trends and technologies**, and may be expected to be **capable of leveraging digital tools** (e.g., Data Analytics & AI) **to evaluate benefits, trade-offs and impact**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Construction Technology	Critical Thinking
Data Collection and Analysis	Integrated Digital Delivery Application	People Management
Project Risk Management	Regulatory Submission and Clearance	Stakeholder Management
Technology Scanning		
Emerging Technical Skills and Competencies		
Environmental Sustainability Management		
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Assistant Specialist (Digital Delivery)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

M

MEDIUM
degree of change in tasks

Today

This job role is responsible for assisting in project delivery, development and adoption of digital solutions and competency building. Job holders participate in product and model development, planning, research and/or testing of digital solutions and training. Job holders gather data and information to understand business needs and user requirements to support adoption and implementation of digital and/or automated building solutions and resolves issues.

In the Future

This job role may continue to leverage technology to assist in project delivery, with **potential greater emphasis on their role in the development and adoption of digital solutions and competency building** for the organisation. Job holders may need to keep abreast of evolving trends and technologies so as to **be familiar with technology application and support adoption and implementation, coaching of digital solutions for project stakeholders, and resolve testing and troubleshooting** where required.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Facilitate project delivery and collaboration	M ▸ Job holders will need to **keep themselves updated with trends and technology** and **apply the knowledge to continuously develop** current BIM models. ▸ Job holders may also need to **incorporate trends and technologies** in conducting building simulations, **to explore alternative methods of design and construction.**	Short-term

7.2.1 Job Dashboards

Assistant Specialist (Digital Delivery)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Gather information and data to manage technological adoption	M ▸ Digital tools and platforms may automate the process of quantitative information gathering. Job holders may see a **shift in focus** in **gathering information through qualitative engagements** with relevant stakeholders and **focus towards solutioning**. ▸ Job holders will need to **understand the latest technological trends and the application of new digital solutions and processes** to support the acquisition and development, and subsequent adoption by the organisation. ▸ Digital planning tools and platforms may automate the digital solution adoption against defined timelines. Job holders may instead see a **shift in focus to supporting testing and troubleshooting to address delays in adoption**.	Short-term
Gather information to building digital competency	L ▸ As the pace of digital adoption is expected to grow, job holders will need to be **increasingly proficient in supporting the adoption of digital solutions** in the organisation, having a basic understanding of how technologies are implemented in projects, and **acting as both coach and champion for the other functions**. ▸ Job holders will need to **keep up to date with skills in-demand to gather information on organisational learning needs and training** related to digital solutions.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Building Information Modelling Application	Change Management	Common Data Environment Management
Critical Thinking	Emerging Technology Synthesis	Integrated Digital Delivery Application
Learning and Development	Programming and Coding	Stakeholder Management
Emerging Technical Skills and Competencies		
Artificial Intelligence Application	Robotic and Automation Technology Application	
Emerging Critical Core Skills		
Communication	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Specialist (Digital Delivery)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role is involved in project delivery, digital solutions development and adoption and competency building. Job holders interpret business requirements and help to translate them into digital solutions, and are familiar with digital solutions and business requirements to add value to the business. Job holders provide timely and value-added services to end-user digital solutions, and ensure that the quality of information and models prepared by the specialists adhere to the prescribed standards and protocol for sharing and coordination purposes.

In the Future

This job role may continue to leverage technology in project delivery, and see **greater emphasis on their role in digital solutions development, adoption and competency building within the organisation**. Job holders may see greater need to keep abreast of new technologies to facilitate the adoption of relevant digital solutions within the organisation, **possessing interdisciplinary skills to ensure digital solutions and business requirements add value to the business**, and **providing necessary training to stakeholders**, so as to enhance project outcomes.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Implement digital project delivery and collaboration	M	▸ Job holders may **see development of more complex BIM models due to greater availability and integration of data**, and the use of BIM Technology as a single data source, and will have to develop capabilities to perform the necessary checks and audits accordingly. Job holders will still be required to rely on their technical expertise to resolve discrepancies and non-compliance.	Short-term
	L	▸ With increased adoption towards BIM and digital tools and platforms, job holders **may see greater emphasis on implementing modelling and exchange protocols for information sharing**, and will require coordination and communication among stakeholders.	Short-term

7.2.1 Job Dashboards

Specialist (Digital Delivery)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Identify and develop automation solutions to manage technological adoption	M	▸ Job holders will need to be **aware of the application of new digital solutions and processes**, so as to identify relevant solutions to address pain points and business requirements. ▸ Digital tools (e.g., Data Analytics & AI) may enable job holders to **conduct data analysis more effectively in assessing viability** of digital solutions adoption and determining productivity gains, and **integrate data analysis findings and business acumen to determine organisation's technology adoption strategy**. ▸ Job holders may see a **larger role in performing testing and troubleshooting of digital solutions**, in support of the organisation's technological adoption.	Short-term
Provide coaching to build digital competency	M	▸ As the pace of digital adoption may be expected to grow, job holders will need to be increasingly proficient in supporting the adoption of digital solutions in the organisation, **understanding how technologies are implemented in projects**, and **acting as both coach and champion** for the other functions. ▸ Job holders will need to understand the **application of new digital solutions and processes and develop capabilities** in utilising the technologies, so as to provide coaching to project stakeholders on use of digital solutions.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Application Support and Enhancement	Applications Integration	Building Information Modelling Application
Change Management	Common Data Environment Management	Critical Thinking
Emerging Technology Synthesis	Integrated Digital Delivery Application	Learning and Development
People Management	Programming and Coding	Stakeholder Management
Emerging Technical Skills and Competencies		
Artificial Intelligence Application	Robotic and Automation Technology Application	
Emerging Critical Core Skills		
Communication	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Lead (Digital Delivery)

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Impact Assessment

LOW
degree of change in tasks

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Today

This job role is responsible for playing leading roles in project delivery, digital solutions development, adoption, competency building, and innovation. Job holders oversee the development and acquisition of digital solutions, and implement policies and processes to support the organisation's strategies. Job holders are responsible for analysing how digital solutions can be used to optimise processes and are involved in technology adoption, innovation, and associated change management activities. Job holders establish guidelines for the implementation of new solutions and continuous process improvement to drive capability building.

In the Future

This job role may continue to play a leading role in its current scope of project delivery, digital solutions development, adoption, competency building and innovation. Job holders may see **greater emphasis on change management skills going forward**, as they **drive capability building efforts within the organisation**, **establish guidelines for new solutions implementation and continuous process improvement**, and keep up with the pace of change.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive project digital delivery and collaboration	L	▸ Job holders will need to keep themselves updated with technology trends and understand the application of new digital solutions and processes, to establish IDD adoption strategies for best practices, processes and tools, and modelling and exchange protocols for information sharing.	Short-term
	M	▸ Job holders may **see increasing demand for complex information requirements due to evolving methods for project delivery**. Job holders will have to **develop problem solving capabilities and leverage digital tools and platforms to solution complex approaches** for stakeholders and resolve issues as required.	Short-term

7.2.1 Job Dashboards

Lead (Digital Delivery)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Lead technological adoption	L	▸ To lead technological adoption in the organisation, job holders will need to be **aware of latest technologies and its application and impact on the organisation**, applying subject matter expertise to establish procedures and guidelines to facilitate the adoption. ▸ Job holders will continue to be responsible for updating relevant stakeholders on the status of digital implementation, and achieving buy-in. Job holders may also see **greater emphasis on encouraging collaboration and partnerships** with vendors in alignment to organisation's technology adoption strategy.	Short-term
	M	▸ Job holders may need to **develop and leverage cross-disciplinary knowledge to develop prototypes and Proof of Concepts** as the sector moves towards greater integration and aggregation.	Medium-term
Develop training framework to build digital competency	L	▸ Job holders will need to be **aware of skills in-demand and apply the knowledge in the development of current training frameworks and organisational learning strategies**.	Short-term
Develop policies to drive innovation	L	▸ Job holders may see **greater focus on promoting an innovative mindset and culture** within the organisation, in support of organisational and digital transformation efforts. Job holders will be expected to **play a role in change management in driving innovation**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Change Management	Common Data Environment Management	Critical Thinking
Emerging Technology Synthesis	Integrated Digital Delivery Application	Learning and Development
People Management	Stakeholder Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Chief Digital Officer

Megatrends impacting the Job Role in Short to Medium-Term				
COVID-19	Multi-Skilling	Sustainable Construction/ Buildings	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

LOW
degree of change in tasks

Today

This job role is responsible for overseeing the overall implementation and innovation of digital solutions in the organisation to achieve digital transformation of the business. Job holders lead the strategic direction of the team to ensure efficiency in projects and operations, drive collaboration within organisation and endorse the work done by the digital team. Job holders are able to anticipate trends and disruptions in the industry to help the organisation prepare for various changes in the industry.

Future

This job role may see continued focus in overseeing overall implementation and innovation remaining consistent, with **growing emphasis on change management skills to successfully drive change** within the organisation. Job holders may see growing emphasis on their role in anticipating trends and disruptions in the industry, **applying new digital solutions and ensuring the organisation achieves digital transformation**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Endorse standards and policies for project delivery and collaboration	L	▸ Job holders will continue to drive adoption of industry best practices for project information, and will **need to be aware of latest trends to ensure practices are up to date.**	Short-term
	M	▸ Job holders may see **growing focus on multi-displinary adoption of digital design coordination tools and processes** as the sector moves towards greater aggregation and integration, and will need to be equipped with capabilities to lead adoption for project delivery and collaboration.	Short-term

7.2.1 Job Dashboards

Chief Digital Officer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks	Time Horizon
Endorse technological adoption	L ▸ Job holders will continue to endorse policies and guidelines for technological adoption, and will be **expected to be aware of latest digital solutions and best practices for potential application to the organisation.** ▸ Job holders will be expected to continue to apply technical knowledge and providing subject matter expertise in resolving digital issues, and may be **expected to be familiar with more complex digital solutions with cross-platform operability** as the sector moves towards greater integration and aggregation across the value chain.	Short-term
Endorse training framework to build digital competency	L ▸ Job holders will need to be **aware of skills in-demand arising from new technologies and adoption**, so as to endorse training frameworks and set policies and training budgets for the organisation.	Short-term
Endorse policies to drive innovation	L ▸ Job holders may see **greater focus on promoting an innovative mindset and culture** within the organisation, in support of organisational and digital transformation efforts. Job holders will be expected to **play a role in change management** through endorsement of innovation initiatives.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Change Management	Critical Thinking	Emerging Technology Synthesis
Learning and Development	People Management	Stakeholder Management
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Facilities Technician

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role ensures that facilities are safe and functional by performing preventive and corrective maintenance activities, and technical troubleshooting for mechanical and electrical issues in compliance with the quality and safety standards, regulations and organisational Workplace Safety and Health (WSH) practices.

In the Future

This job role may see technology **enhance the efficiency and accuracy in planning preventive and corrective maintenance activities**, through obtaining better data insights and predictions from the use of technology (e.g., sensors). Job holders may thus see **greater emphasis on resolving technical investigations** in a **timely manner**, and need an understanding of technology application in completing documentation and providing summary reports. Job holders may see **continued focus on compliance** to **relevant requirements** (e.g., sustainability and regulatory).

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Perform facility operations activities	M	▸ Job holders will continue to perform maintenance works, and may see a **rise in preventive maintenance tasks** due to greater availability of building data that is enabled by technology (e.g., 5G, IoT & Smart Buildings). ▸ Job holders may also **leverage technology** (e.g., Robots & Automation) to **support maintenance work**, and will need competency to operate them. ▸ Digital tools (e.g., Data Analytics & AI, RPA) can augment the documentation on procedures and schedules of maintenance works and accelerate the completion process.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability** for **application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

7.2.1 Job Dashboards

Facilities Technician

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Green Facilities Management	Robotic and Automation Technology Application	Smart Facilities Management
Emerging Technical Skills and Competencies		
Critical Thinking		
Emerging Critical Core Skills		
Digital Fluency		

7.2.1 Job Dashboards

Technical Officer

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role reviews the facility's preventive and corrective maintenance activities, leads technical investigations, conducts risks assessments to ensure compliance with Workplace Health and Safety practices, and liaises with third-party service deliverers to ensure timely maintenance or repair works.

In the Future

This job role may leverage technology to ensure the compliance of maintenance activities with quality and safety standards and regulations, using sensors and data analytics to track potential non-compliance. Job holders may need an **understanding of technology's application** in **performing remote supervision** and **inventory tracking**, thus allowing for greater emphasis on leading timely resolutions of technical investigations. Job holders may also need to **enhance existing technical knowledge** by keeping abreast of trends and technologies, and **familiarising themselves with potential new facility types and associated maintenance**, and a continued focus on compliance to relevant requirements (e.g., sustainability and regulatory).

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Review and supervise facility operations activities	M	▸ Job holders may need competencies in **operating digital tools that enable remote inspection and supervision** (e.g., Remote Monitoring) and **interpreting data insights from maintenance work** to review work progress. ▸ Job holders may also need capabilities to **understand and interpret digital tools** that track maintenance or repair works **to supervise work progress** of third party service providers.	Short-term
	H	▸ Tracking of consumable and non-consumable items data may be automated by technologies (e.g., IoT & Smart Buildings, RPA).	Short-term
Conduct safety and sustainability assessments	M	▸ In lieu of the trend towards sustainability, job holders may **see increasing emphasis on identifying sustainability improvement opportunities**, and will **need data analysis capabilities to draw insights from performance data**.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability for application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

7.2.1 Job Dashboards

Technical Officer

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Green Facilities Management	Robotic and Automation Technology Application	Smart Facilities Management
Emerging Technical Skills and Competencies		
Critical Thinking	Data Collection and Analysis	Environmental Sustainability Management
Emerging Critical Core Skills		
Communication	Digital Fluency	

7.2.1 Job Dashboards

Technical Executive

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role performs inspections on preventive and corrective maintenance activities, closes fault calls or escalates matters up, manages third party service deliverers to ensure timely maintenance and repair works, and develops safety reports.

In the Future

This job role may **leverage technology in performing inspections on maintenance activities, enabling remote inspection and supervision opportunities**. Job holders may need an understanding of technology application so as to **effectively perform on-the-job coaching** where required, and manage a team of technicians effectively. Job holders may need to keep abreast of evolving trends and technologies to **successfully implement continuous improvement initiatives**, and be able to recommend relevant ways to improve environmental sustainability in the course of their work.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Inspect and check facility operations activities	M	▸ Job holders may need competencies in **operating digital tools that enable remote inspection and supervision** (e.g., Remote Monitoring). ▸ Job holders may also **require stronger communication and collaboration skills in the management of third party service providers** as the sector moves towards greater integration and aggregation.	Short-term
	H	▸ Digital tools (e.g., RPA) can automate procurement processes for consumable and non-consumable items, and perform documentation checks on procedures and schedules of maintenance works.	Short-term
Assist in budgets and contracts	M	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) in drafting of maintenance contracts and SLAs.	Medium-term
	M	▸ Digital tools (e.g., Data Analytics & AI, IoT) may be **leveraged to enhance the identification of servicing needs and schedules** in an efficient manner.	Short-term

7.2.1 Job Dashboards

Technical Executive

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Support investigations and develop reports on safety and sustainability	M	▸ In view of the trend towards sustainability, job holders may see **increasing emphasis on proposing data-driven recommendations to improve environmental sustainability**, augmented by an awareness of latest trends and technologies.	Short-term
Manage people and organisation	M	▸ Job holders will be **expected to continue managing a team of technicians and perform on-the-job coaching** in response to impact on tasks as a result of trends and technologies.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability for application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Contract Administration and Management	Data Collection and Analysis	Green Facilities Management
People Management	Smart Facilities Management	Stakeholder Management
Technology Application		
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Building Supervisor

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role coordinates the facility operations and maintenance activities, attends to users' requests and feedback, and ensures that execution of the facilities operations, repairs and retrofitted works comply with quality and safety standards and are carried out within budget.

In the Future

This job role may **leverage technology to perform coordination of facility operations and maintenance activities**, applying an understanding of technology (e.g., sensor readings, interpretation of data dashboards) to **optimise coordination and ensure compliance of operations and works** to quality and safety standards and regulations. Job holders may see growing emphasis on attending to users' requests and feedback in a timely manner.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Track and coordinate facility operations activities	H	▸ Digital tools (e.g., IoT, Robots & Automation) can automate tracking of building assets.	Short-term
	M	▸ Job holders may **need familiarity with digital communication tools and platforms** (e.g., BIM Technology, Building Management Systems) to **coordinate facility operations and retrofitting activities, and routine maintenance services** in an efficient manner. ▸ Job holders may also **leverage digital tools and platforms to track facility operations**, and facilitate the timely attendance to user' requests and feedback. ▸ Job holders may **need competencies in operating digital tools that enable remote inspection** of building assets' conditions.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability** for **application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

7.2.1 Job Dashboards

Building Supervisor

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Green Facilities Management	Robotic and Automation Technology Application	Smart Facilities Management
Emerging Technical Skills and Competencies		
Critical Thinking	Technology Application	
Emerging Critical Core Skills		
Digital Fluency		

7.2.1 Job Dashboards

Building Officer/Facilities Officer/Property Officer

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role coordinates the facility operations and maintenance activities, conducts risks assessments to ensure compliance with Workplace Health and Safety (WSH) practices, and liaises with third-party service deliverers to ensure repair or maintenance works provided are timely, safe and of quality.

In the Future

This job role may **leverage technology to perform coordination of operations, maintenance activities and asset movements**, applying an understanding of technology (e.g., sensor readings, interpretation of data dashboards) to **optimise coordination and movements operations**, and ensure compliance to quality and safety standards and regulations. Job holders may see **growing emphasis on attending to users' requests and feedback in a timely manner** across multiple facilities due to integration/aggregation of FM services, and **must effectively communicate and liaise** with relevant stakeholders for timely delivery of repair and maintenance works.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Coordinate and supervise facility operations activities	M	▸ Job holders may need **familiarity with digital tools and platforms** (e.g., BIM Technology, Building Management Systems) **to coordinate facility operations and retrofitting activities**, and movements of building assets. ▸ Job holders may also **leverage digital tools and platforms to communicate with relevant personnel and provide necessary data and information**, to achieve timely actions in response to user requests and feedback.	Short-term
Conduct safety and sustainability assessments	M	▸ In view of the trend towards sustainability, job holders may see **increasing emphasis on identifying sustainability improvement opportunities**, and will **need data analysis capabilities to draw insights from performance data**.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability** for **application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

7.2.1 Job Dashboards

Building Officer/Facilities Officer/Property Officer

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Green Facilities Management	Robotic and Automation Technology Application	Smart Facilities Management
Stakeholder Management	Technology Application	
Emerging Technical Skills and Competencies		
Critical Thinking	Data Collection and Analysis	Environmental Sustainability Management
Emerging Critical Core Skills		
Digital Fluency		

7.2.1 Job Dashboards

Building Executive/ Facilities Executive/ Property Executive

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role manages personnel involved in different facilities operations, deploys relevant personnel for timely response to tenants' requests and feedback, monitors the service delivery of third-party service deliverers, tracks fault calls, and develops safety reports.

In the Future

This job role may **leverage technology in enhancing personnel management across different operations** in the facility, **utilising digital tools and platforms to manage deployment across multiple facilities** due to integration/aggregation of FM services. Job holders may see **growing emphasis on ensuring compliance to safety practices** for employees and third-party service deliverers, and ensure that they keep abreast of trends and technologies so as to **recommend and implement continuous improvement and environmental sustainability improvement initiatives**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Manage facility operations activities	M	▸ Job holders may need familiarity with digital tools and platforms (e.g., BIM Technology, Building Management Systems) to manage facility operations and retrofitting activities, and movements of building assets. Job holders may need to **evaluate feasibility of technology adoption and apply subject matter expertise in recommending actions to be taken** arising from progress reports. ▸ Job holders may also **leverage digital tools and platforms to track fault cases and progress, and deploy personnel proactively** to provide timely actions in response to user requests and feedback. ▸ Job holders may also **require stronger communication and collaboration skills to manage quality of services** by third party service providers as the sector moves towards greater integration and aggregation.	Short-term
	H	▸ Digital tools (e.g., RPA) can automate procurement processes for consumable and non-consumable items, and perform documentation checks on procedures and schedules of maintenance works.	Short-term

7.2.1 Job Dashboards

Building Executive/ Facilities Executive/ Property Executive

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Assist in budgets and contracts	M	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) in drafting of maintenance contracts and SLAs.	Medium-term
	M	▸ Digital tools (e.g., Data Analytics & AI, IoT) may be **leveraged to enhance the identification of servicing needs and schedules** in an efficient manner.	Short-term
Support investigations and develop reports on safety and sustainability	M	▸ In view of the trend towards sustainability, job holders may see **increasing emphasis on proposing data-driven recommendations** to improve environmental sustainability, augmented by an awareness of latest trends and technology.	Short-term
Manage people and organisation	M	▸ Job holders will be expected to continue managing a team of technicians and **perform on-the-job coaching in response to impact on tasks as a result of trends and technologies**.	Short-term
Engage in continuous improvement	M	▸ Job holders will need to be **equipped with operational capability for application of smart facilities management trends or technologies**, to continue providing inputs for improvement within the facility.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Contract Administration and Management	Data Collection and Analysis	Green Facilities Management
People Management	Smart Facilities Management	Stakeholder Management
Technology Application		
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	
Emerging Critical Core Skills		
Transdisciplinary Thinking		

7.2.1 Job Dashboards

Facilities Manager/Facilities Engineer

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role evaluates the operations of facilities, builds trust and rapport with users, assesses the performance of third-party service deliverers, reviews safety reports, implements sustainability guidelines, develops tender specifications and maintenance contracts, sources quotations, and proposes budget plans.

Future

This job role may leverage technology and its applications (e.g., sensors, data analytics) in **enhancing the evaluation robustness of facilities operations for operational readiness**, and may need to **possess data analysis and interpretation skills**. Job holders may see **growing emphasis on contract management and administration** in view of evolving operating and contracting models due to integrated/aggregated FM service delivery, and need to keep abreast of evolving trends and technologies to successfully implement sustainability guidelines. Job holders may also see **continued focus on keeping technical knowledge current** to apply to building maintenance, so as to successfully lead and coach facilities teams.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Analyse and assess facility operations activities	M	▸ Job holders may see availability of greater amount or more robust data sets for facility operations, enabled by technology (e.g., 5G, IoT). Job holders may **need capabilities to understand and leverage** the **gathered data in evaluating performance** of facility operations and service delivery of third-party service providers, **addressing gaps where required**. ▸ Job holders will also need to **understand how to leverage data to enhance analysis outcomes** of maintenance data and procurement projections to potentially **reduce maintenance downtime and increase cost-savings**.	Short-term
Develop budgets and contracts	M	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to develop tender specifications, maintenance contracts and SLAs on alternative platforms.	Medium-term
	H	▸ Consolidation of quotations may be automated by digital tools (e.g., RPA).	Short-term

7.2.1 Job Dashboards

Facilities Manager/Facilities Engineer

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Implement safety and sustainability practices	M	▸ Job holders may see **increased focus in implementing environmental sustainability guidelines and practices** in accordance to the organisation's green building strategy.	Short-term
Manage people and organisation	M	▸ Job holders may need to **equip themselves with data analysis** and **interpretation capabilities**, so as to interpret data gathered by technology (e.g., Smart Buildings, IoT). Job holders will need to **apply the data insights to optimise resources availability and capability**.	Short-term
Propose continuous improvement initiatives	M	▸ Job holders may need to equip themselves with data analysis capabilities to **make robust data-driven decisions that improve time, cost and quality management**, leveraging building data availability enabled by digital tools (e.g., Data Analytics & AI). ▸ Job holders will need to be **aware of latest facilities management trends or technologies** (e.g., Smart Buildings) **and the impact of adoption**, so as to **propose opportunities** for digital adoption and improvements.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Contract Administration and Management	Data Collection and Analysis	Design for Maintainability
Green Facilities Management	People Management	Smart Facilities Management
Stakeholder Management	Technology Application	
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Senior Facilities Manager

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

MEDIUM
degree of change in tasks

Today

This job role formulates plans to improve facilities' operations, ensures consistency of service standards, evaluates services, cascades organisational WSH practices, outlines sustainability guidelines, reviews tender specifications and budget plans, evaluates quotations, and develops maintenance contracts.

Future

This job role may need an understanding of technology application and data interpretation skills so as to **leverage data insights and formulate data-driven plans for facilities operations improvement**. Job holders may need an understanding of digital tools and platforms to monitor and evaluate service standards. Job holders may need to keep abreast with evolving trends and technologies to **effectively manage changing contracting models** due to trends of integration/aggregation of FM services, and **continued focus on smart facilities, safety and sustainability guidelines** as per green building strategies.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Recommend improvements and evaluate facility operations	M	▸ Job holders will continue to be expected to formulate plans and recommendations to improve facility operations and service quality, and may require **capabilities to interpret and analyse greater volumes of data available** (enabled by technology e.g., 5G, IoT) **to develop more robust recommendations.** ▸ Job holders may also see **growing focus on incorporating latest trends and technologies in facility operations planning** that address growing areas of interest (e.g., Green Buildings, Sustainable Methods).	Short-term
Review and evaluate budgets and contracts	L	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to review tender specifications, maintenance contracts and SLAs on alternative platforms.	Medium-term
	M	▸ Job holders may need to be **aware of risks arising from new trends** (e.g., partnership models arising from integrated/aggregated FM) **and review incorporation in contractual terms and tender specifications.**	Short-term

7.2.1 Job Dashboards

Senior Facilities Manager

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Cascade safety and sustainability practices	L	▸ Job holders may see increased focus in cascading environmental sustainability guidelines and practices, **adjusting measures to effectively realise organisation's green building strategies**.	Short-term
Oversee people and organisation management	M	▸ Job holders will need to **continuously keep up to date with skills in-demand** and apply the knowledge to **drive initiatives addressing technical and business recruitment, training and development needs**.	Short-term
Evaluate and implement proposed continuous improvement initiatives	M	▸ Digital tools (e.g., Data Analytics & AI) may **enhance the conduct of cost-benefit analyses and generate more robust outcomes**. Job holders will need **capabilities to interpret the outcomes** and apply to support the implementation process.	Short-term
	M	▸ Job holders will continue to see growing focus on implementation of latest facilities management trends and technologies (e.g., Smart Buildings), and will need to be equipped **with understanding the application of such trends and technologies to ensure successful implementation**.	Short-term

The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Contract Administration and Management	Data Collection and Analysis	Design for Maintainability
Green Facilities Management	People Management	Smart Facilities Management
Stakeholder Management	Technology Application	Technology Scanning
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.1 Job Dashboards

Associate Director (Facilities Management)

Megatrends impacting the Job Role in Short to Medium-Term			
COVID-19	Multi-Skilling	Value Chain Aggregation & Integration	Workforce Challenges

Technology Trends impacting the Job Role in Short to Medium-Term			
BIM Technology	Blockchain	Data Analytics & AI	Digital Twin
Remote Monitoring	RPA	Robots & Automation	VR/AR
5G, IoT & Smart Buildings	Modular Construction		

Impact Assessment

LOW
degree of change in tasks

Today

This job role drives strategies to improve facility operations, build strategic relationships, drive service excellence, formulates organisational Workplace Safety and Health (WSH) practices and green building strategies, approves tender specifications, awards works to selected bidders and endorses contracts.

In the Future

This job role **continues to be responsible for driving strategies to improve facility operations**, and may need to keep abreast of the latest trends and technology trends so as to **bolster their subject matter expertise, and formulate relevant practices and strategies in support of service excellence**. Job holders may need an **understanding of digital tools and platforms to perform approval tasks**.

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive quality standards and action plans for facility operations	L	▸ Job holders will continue to be responsible for driving improvement and action plans for facility operations in a timely and responsive manner, and **may leverage technical expertise in driving improvement initiatives aligned to latest trends** (e.g., Green Buildings).	Short-term
Approve budgets and contracts	L	▸ Job holders may need to **understand smart contracting technologies** (e.g., Blockchain) to approve tender specifications, maintenance contracts and SLAs on alternative platforms.	Medium-term
	M	▸ Job holders may need to be **aware of risks arising from new trends** (e.g., partnership models arising from integrated/aggregated FM) **and ensure alignment of contractual terms and tender specifications for approval**.	Short-term
Cascade safety and sustainability practices	L	▸ Job holders may see increased focus in driving environmental sustainability guidelines, practices and culture. Job holders will need to **keep up to date with latest environmental regulations to ensure adherence and compliance** for the organisation.	Short-term

7.2.1 Job Dashboards

Associate Director (Facilities Management)

Job Tasks Today	Impact at Task-level / Future view of Job Tasks		Time Horizon
Drive people and organisational functions	L	▸ Job holders will need to continuously **keep up to date with skills in-demand** and apply the knowledge to **drive initiatives addressing technical and business recruitment, training and development needs**.	Short-term
Drive continuous improvement initiatives	M	▸ Job holders will be expected to continue to lead the adoption of facilities management trends and technologies (e.g., Smart Buildings, Integrated/Aggregated FM) and may be **expected to leverage digital tools** (e.g., Data Analytics & AI) to **evaluate benefits, trade-offs and impact of new trends and technologies adoption**.	Short-term

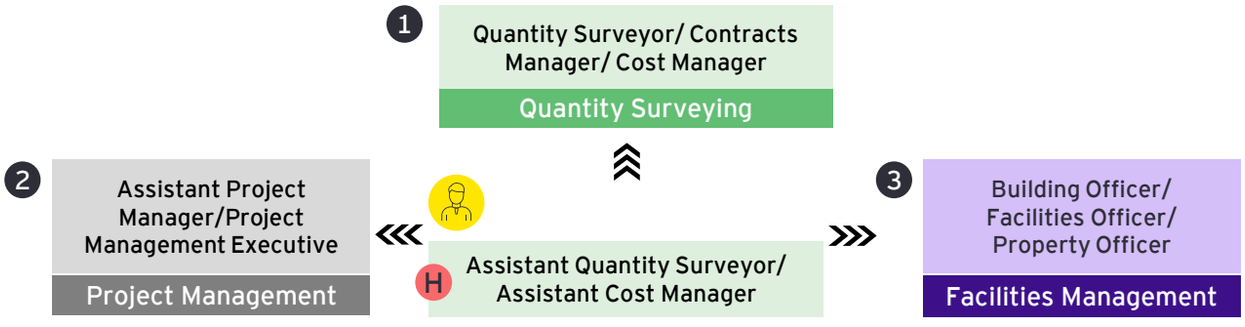
The following TSCs/CCSs have been identified as in-demand/emerging for the job role going forward:

In-demand Technical Skills and Competencies		
Contract Administration and Management	Data Collection and Analysis	Design for Maintainability
Green Facilities Management	People Management	Smart Facilities Management
Stakeholder Management	Technology Scanning	
Emerging Technical Skills and Competencies		
Critical Thinking	Environmental Sustainability Management	
Emerging Critical Core Skills		
Digital Fluency	Transdisciplinary Thinking	

7.2.2 Mobility Dashboards

Overview of Mobility Opportunities for High Impact Role

MOBILITY OPTIONS



IMPLICATION OF HIGH IMPACT ROLE

It is expected that the Assistant Quantity Surveyor/Assistant Cost Manager (AQS/ACM)'s **job role will have to evolve to remain relevant within the sector**. Existing tasks performed by this job role, such as data and information compilation, claims and payment verifications, are expected to be highly impacted and automated by technology trends. (See: Job Dashboard for AQS/ACM)

The following pages provides a view of the two kind of mobility pathways that an individual who is currently in the AQS/ACM job role can consider:

- **Vertical movement to the Quantity Surveyor/Contracts Manager/Cost Manager** – which would require upskilling in existing technical skills, as well as acquiring new skills per the new job role level and as a result of trends.

  Going forward, it is expected that the job role could evolve in two ways:

  - **Expand to cover the baseline work formerly performed by the Quantity Surveyor/Contracts Manager/Cost Manager (QS/CM/CM) role**: The job roles of the AQS/ACM and the QS/CM/CM may converge, as the AQS/ACM must look to perform higher order tasks in order to value-add in this role. Job holders will also need to acquire proficiency and understanding of digital tools and platforms that are applied in the job role, and how to effectively utilise it so as to be able to focus on providing value-added tasks i.e., interpreting data to conduct analysis of cost plans; familiarity with alternate digital platforms to facilitate the contracting process.

  - **Emerging area of sustainability-related advisory**: In line with the trend and growing importance of sustainability, the QS function may see growing impetus for upskilling in sustainability-related skills so as to accurately cost and advise in areas such as carbon estimates (e.g., embodied carbon) or procurement of sustainable materials.

  As accreditation plays a critical role in differentiating job levels, job holders will also need to focus on upskilling and acquiring the required professional accreditation to progress up the QS track.

- **Lateral movement to other Functional Tracks (Project Management, Facilities Management)** – for individuals who are keen to explore other roles within the sector, should they not wish to remain within the function. Such career movements would potentially require investment of necessary resources, effort and time to upskill and learn new functional-specific skill sets but can be alleviated by skill sets that may be transferable across functions.

7.2.2 Mobility Dashboards

Guide to Mobility Dashboards

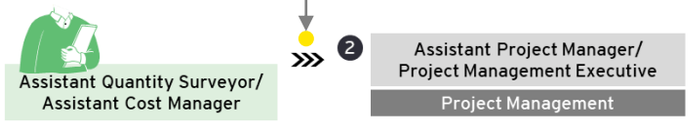
Methodology and Key Considerations*

The potential career pathways identified for the AQS/ACM role are aligned to the SFw for Built Environment. With reference to the Career Map and Skills Map, the study accounted for key factors such as potential lateral movements between adjacent functional tracks as well as transferrable skill sets and skills gaps to be bridged. The study also considered factors such as the career level of the AQS/ACM, and qualitative insights contributed by industry players.

To read the Mobility Dashboard, refer to the guide below:

Mobility Option

Diagram that illustrates type of mobility option (vertical / lateral).



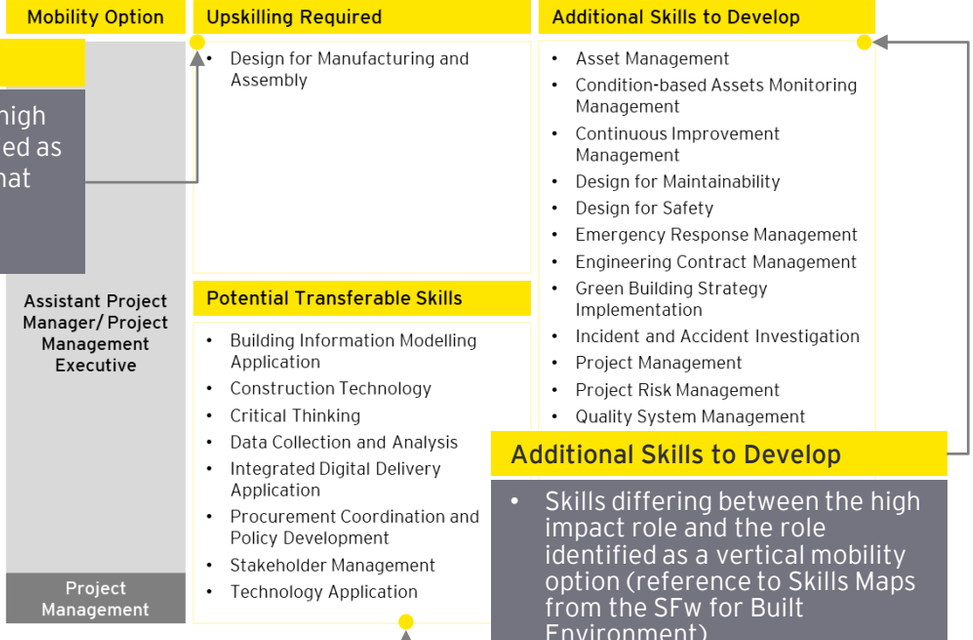
A potential job role the AQS/ACM could **laterally move into is the Assistant Project Manager/ Project Management Executive in the Project Management function.** However, there would be a need to invest the necessary resources, effort and time to develop additional skills required for the intended role. Although a substantial number of additional skills (i.e. Project Management, Project Risk Management) are required to move into the Assistant Project Manager/Project Management Executive's role, job holders **will be able to leverage existing transferable skills and capabilities,** such as their **existing skills related to understanding and application of technology** (i.e. Building Information Modelling Application, Construction Technology) **applied to the new function's future technology-driven tasks of the intended role,** e.g. conducting coordination for overall project plan integration using BIM Technology.

Upskilling required

Overlapping skills between high impact role and role identified as a vertical mobility option, that require upskilling to a level higher.

Transferable Skills

Overlapping skills between the mobility role and existing role in the Built Environment sector that do not require upskilling.



Additional Skills to Develop

- Skills differing between the high impact role and the role identified as a vertical mobility option (reference to Skills Maps from the SFw for Built Environment)
- Note: These additional skills can be developed through on-the job learning. It is not compulsory to attend training courses to develop these skills.

*Skills proficiency levels are not taken into account in this assessment as upskilling plays an imperative part in enabling job holders to be future-ready and adaptable. Successful mobility is also dependent on business needs and employees' aspirations that are not part of this assessment.

7.2.2 Mobility Dashboards

Mobility Dashboard to Quantity Surveyor/ Contracts Manager/ Cost Manager

VERTICAL MOBILITY OPTIONS

1

Quantity Surveyor/ Contracts Manager/ Cost Manager

Quantity Surveying

Assistant Quantity Surveyor/ Assistant Cost Manager

Mobility Option	Upskilling required	Additional Skills to Develop
Quantity Surveyor/ Contracts Manager/ Cost Manager	▸ Construction Technology ▸ Contract Administration and Management ▸ Data Collection and Analysis ▸ Design for Manufacturing and Assembly ▸ Ethical Climate ▸ Integrated Digital Delivery Application ▸ Life Cycle Costing and Analysis ▸ Measurement of Building and Construction Works ▸ Procurement Coordination and Policy Development ▸ Project Cost ▸ Stakeholder Management ▸ Technical Writing ▸ Technology Application	▸ Artificial Intelligence Application ▸ Business Negotiation ▸ Continuous Improvement Management ▸ Dispute Resolution ▸ Green Building Strategy Implementation ▸ Programming and Coding ▸ Project Feasibility Assessment ▸ Project Risk Management ▸ Regulatory and Submission Clearance ▸ Technical Presentation ▸ Value Engineering
Quantity Surveying	**Potential Transferable Skills** ▸ Building Information Modelling Application ▸ Critical Thinking ▸ Research and Information Synthesis	

To **move into the following vertical mobility option**, the Assistant Quantity Surveyor/Assistant Cost Manager **would need to explore upskilling a portion of their existing technical skills that are required at a higher level** in this new role (i.e., Contract Administration and Management, Data Collection and Analysis), and **developing new skills** (i.e., Project Feasibility Assessment, Value Engineering) that are **required and in line with an accelerated progression into this role**. For the function as a whole, **new skills in the areas of digital** (i.e., Programming and Coding) **and sustainability** (i.e., Green Building Strategy Implementation) are also potentially explored for development.

7.2.2 Mobility Dashboards

Mobility Dashboard to Assistant Project Manager/ Project Management Executive

LATERAL MOBILITY OPTIONS

2 **Assistant Project Manager/Project Management Executive**

Project Management

Assistant Quantity Surveyor/ Assistant Cost Manager

Mobility Option	Upskilling required	Additional Skills to Develop
Assistant Project Manager/ Project Management Executive Project Management	▸ Design for Manufacturing and Assembly **Potential Transferable Skills** ▸ Building Information Modelling Application ▸ Construction Technology ▸ Critical Thinking ▸ Data Collection and Analysis ▸ Integrated Digital Delivery Application ▸ Procurement Coordination and Policy Development ▸ Stakeholder Management ▸ Technology Application	▸ Asset Management ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Design for Maintainability ▸ Design for Safety ▸ Emergency Response Management ▸ Engineering Contract Management ▸ Green Building Strategy Implementation ▸ Incident and Accident Investigation ▸ Project Management ▸ Project Risk Management ▸ Quality System Management ▸ Regulatory Submission and Clearance ▸ Value Engineering ▸ Workplace Safety and Health Culture Development ▸ Workplace Safety and Health Framework Development and Implementation

A potential job role the AQS/ACM could **laterally move into is the Assistant Project Manager/ Project Management Executive in the Project Management function.** However, there would be a need to invest the necessary resources, effort and time to develop additional skills required for the intended role. Although a substantial number of additional skills (i.e. Project Management, Project Risk Management) are required to move into the Assistant Project Manager/Project Management Executive's role, job holders **will be able to leverage existing transferable skills and capabilities**, such as their **existing skills related to understanding and application of technology** (i.e. Building Information Modelling Application, Construction Technology) **applied to the new function's future technology-driven tasks of the intended role**, e.g. conducting coordination for overall project plan integration using BIM Technology.

7.2.2 Mobility Dashboards

Mobility Dashboard to Building Officer/ Facilities Officer/ Property Officer

LATERAL MOBILITY OPTIONS

Assistant Quantity Surveyor/ Assistant Cost Manager

3 Building Officer/ Facilities Officer/ Property Officer

Facilities Management

Mobility Option	Upskilling required	Additional Skills to Develop
Building Officer/ Facilities Officer/ Property Officer Facilities Management	▸ -	▸ Building Management System Implementation and Control ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Emergency Response Management ▸ Engineering Drawing Interpretation and Management ▸ Facilities Shut-down and Re-start ▸ Fire Protection System Maintenance ▸ Green Facilities Management ▸ Incident and Accident Investigation ▸ Inventory Management ▸ People Management ▸ Quality System Management ▸ Robotic and Automation Technology Application ▸ Smart Facilities Management ▸ Technical Inspection ▸ Value Engineering ▸ Workplace Safety and Health Framework Development and Implementation

Potential Transferable Skills

- Integrated Digital Delivery Application
- Stakeholder Management
- Technology Application

A potential job role the AQS/ACM could **laterally move into is the Building Officer/ Facilities Officer/ Property Officer in the Facilities Management function**. However, there would be a need to invest a significant amount of resources, effort and time to develop additional skills required for the intended role. Although a substantial number of additional skills (i.e., Building Management System Implementation and Control, Facilities Shut-down and Re-start) are required to move into the Building Officer/ Facilities Officer/ Property Officer's role, job holders **will be able to leverage existing transferable skills and capabilities**, such as their **existing skills related to data gathering and interpretation, understanding and application of technology** (i.e., Critical Thinking, Data Collection and Analysis, Integrated Digital Delivery Application) **applied to the new function's future technology-driven tasks of the intended role**, e.g., navigating digital tools and platforms to coordinate movements of building assets and facility operations and retrofitting activities.

7.2.3 Skills in Demand/Emerging

Definition of Skills in Demand not available in SFw for BE and/or newly created

The study identified a list of additional skills in demand that are currently not available in the Skills Framework for Built Environment, but may be available in other Skills Frameworks, or will be newly created. The definitions for these identified skills are as below:

Skills that can be adapted from other Skills Frameworks

Design Sustainability and Ethics Management	Create designs that consider the limitations, regulations and guidelines on intellectual property, sustainability, diversity, inclusivity and accessibility, aligning to behaviours and actions which are generally accepted in the profession
Environmental Sustainability Management	Integrate environmental sustainability through the development, implementation and review of sustainability strategies and programmes against industry best practices
Sustainable Engineering	Design, construct and operate engineering systems and assets to optimise energy management and enhance environmental performance

New Skills to be created

Coastal Engineering	Design, construct and operate engineering systems to protect coastal structures
Hydrodynamic and Flood Mitigation	Perform flood hazard assessment based on simulation modelling, and design solutions to mitigate potential flooding
Tunnel Engineering Management	Apply various excavation techniques in conjunction with geology and structural engineering skills, to build tunnels of different uses

7.2.4 Emerging job roles dashboards

Architectural Technologist

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends i.e., BIM Technology, Digital Twin, Modular Construction, and 5G, IoT & Smart Buildings

Other Considerations

Companies looking to enhance efficiency of and streamline architectural work processes can leverage this specialised job role.

Responsibilities of the Role

The Architectural Technologist is responsible for using their expertise in technology to produce building designs and overcome structural challenges. The job holder collaborates with architects and construction design teams on the infrastructure design process while drafting the design plans. The job holder also builds knowledge of legal processes to manage contracts and apply legal rules during the drafting process.

Job Tasks

- Leverage technology expertise (e.g., Computer Aided Design Software) to draft structural designs and prototypes, in collaboration with architects and engineers
- Lead and manage architectural progress by producing building scans that enable architects and engineers to perform their jobs roles efficiently and accurately
- Devise, lead and oversee the development of technical software and solutions to future potential architectural challenges in the Design & Construction cluster
- Maintain knowledge of current architectural technical standards, and keep abreast of cutting-edge architectural systems and processes

Technical Skills and Competencies

3D Modelling	Application Support and Enhancement	Architecture Design	Augmented Reality Application
Building Information Modelling Application	Computational Design	Construction Technology	Continuous Improvement Management
Contract Administration and Management	Critical Thinking	Data Collection and Analysis	Design for Maintainability
Design for Manufacturing and Assembly	Design for Safety	Design Sketching	Design Standards and Specification
Design Thinking Practice	Emerging Technology Synthesis	Façade Design	Green Building Strategy Implementation
Integrated Digital Delivery Application	Material Studies and Production Processes	Placemaking and Programming of Spaces	Regulatory Submission and Clearance
Stakeholder Management	Technical Drawing	Technical Presentation	Technology Application
Technology Road Mapping			

Critical Core Skills

Collaboration	Communication	Digital Fluency	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Climate-Change Response Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

- Technology trends i.e., 5G, IoT & Smart Buildings
- Megatrends i.e., Sustainable Construction/ Buildings

Other Considerations

Contractors keen on addressing the consequences of climate change and mitigate further damage to Design & Construction systems and processes can leverage this specialised job role.

Responsibilities of the Role

The Climate-Change Response Engineer will work with the team to design and implement immediate, short-term solutions that promptly addresses the detrimental effects of climate change. The job holder is also responsible for utilising information technologies to enable greener construction and production processes to address environmental degradation, in the short-term. The job holder will employ technology solutions to predict environmental impacts and implement restorative measures.

Job Tasks

- Develop short-term, immediate initiatives to address environmental impacts of climate change while increasing the usage of environmentally friendly materials
- Employ information technologies i.e., IoT, to provide input on and enable transformation of climate change-related damage through adoption of greener production systems and processes
- Monitor and assess the effectiveness of climate change response solutions against targets set, to determine whether objectives are being met
- Maintenance and continuous enhancement of climate change response initiatives, systems and processes

Technical Skills and Competencies

3D Modelling	Analytics and Computational Modelling	Artificial Intelligence Application	Biophilic Design in Built Environment
Building Information Modelling Application	Climate Change Management	Civil and Structural Engineering Management	Coastal Engineering
Continuous Improvement Management	Design for Maintainability	Design Thinking Practice	Environmental Sustainability Management
Geotechnical Engineering Management	Green Building Strategy Implementation	Hydrodynamic and Flood Mitigation	Integrated Digital Delivery Application
Material Studies and Production Processes	Natural Ventilation Design	Project Risk Management	Quality System Management
Regulatory Submission and Clearance	Site Assessment and Analysis	Solar Photovoltaic Systems Design	Structural Testing
Sustainable Engineering	Tunnel Engineering Management	Value Analysis	Value Engineering

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Climate-Change Response Engineer

Estimated Time Horizon: Short-term

Critical Core Skills

Collaboration	Communication	Customer Orientation	Problem Solving
Transdisciplinary Thinking			

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Environmental Sustainability Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

- Technology trends i.e., 5G, IoT & Smart Buildings
- Megatrends i.e., Sustainable Construction/ Buildings

Other Considerations

Companies looking to install environmental sustainability initiatives that addresses sustainability of Design & Construction systems and processes in the long-term, can leverage this job role.

Responsibilities of the Role

The Environmental Sustainability Engineer is responsible for tracking and monitoring the usage of resources, so as to develop and implement environmentally sustainable solutions for the project. The job holder will also be responsible for monitoring and enhancing the effectiveness of the solutions to reduce consumption and wastage in the long-term. The job holder may be involved in environmental sustainability development projects that require familiarity with the green rating process, to ensure projects' achievement of green standards.

Job Tasks

- Track, analyse, report and forecast resource usage demands and carbon emission levels to determine sustainable and cost-effective outcomes for projects
- Develop, oversee and assess long-term environmental sustainability plans and solutions i.e., usage of sustainable materials, to achieve desired targets and/or determine whether project objectives are met
- Determine inefficiencies in existing Design & Construction systems and processes to implement appropriate solutions
- Conduct sustainability assessments using environmental certification standards, and manage the green rating process of Design & Construction projects

Technical Skills and Competencies

3D Modelling	Biophilic Design in Built Environment	Building Information Modelling Application	Civil and Structural Engineering Management
Coastal Engineering	Compliance with Legal Regulations	Computational Design	Construction Technology
Continuous Improvement Management	Design for Maintainability	Design Thinking Practice	Environmental Sustainability Management
Geotechnical Engineering Management	Green Building Strategy Implementation	Hydrodynamic and Flood Mitigation	Integrated Digital Delivery Application
Material Studies and Production Processes	Project Risk Management	Quality System Management	Regulatory Submission and Clearance
Site Assessment and Analysis	Structural Testing	Sustainable Engineering	Technical Inspection

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Environmental Sustainability Engineer

Estimated Time Horizon: Short-term

Critical Core Skills

Collaboration	Communication	Customer Orientation	Problem Solving
Transdisciplinary Thinking			

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Computational Designer

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends i.e., BIM Technology, Digital Twin, Modular Construction, and 5G, IoT & Smart Buildings

Other Considerations

Companies who are seeking support in developing and maintaining services that enable the automation of Design & Construction systems and processes can leverage this specialised job role.

Responsibilities of the Role

The Computational Designer is responsible for the development, maintenance and implementation of applications and services that support the organisation in achieving their goal of automating Design & Construction systems and processes. Job holders also ensures adherence to the requirements specified by the development, design and construction teams. Job holders will be involved in solving challenging problems through the application of technology.

Job Tasks

- Develop, maintain and implement applications and services to provide solutions for design and delivery problem statements given by clients
- Automate construction design tasks and apply computational strategies by encoding design decisions using various computer languages
- Communicate and coordinate with project teams and subject matter experts to develop 3D computational prototypes
- Conduct research to anticipate client's needs and expectations and keep abreast of the latest design and construction trends to stay ahead in the sector

Technical Skills and Competencies

3D Modelling	Analytics and Computational Modelling	Application Support and Enhancement	Applications Integration
Autonomous Systems Technology and Application	Building Information Modelling Application	Civil and Structural Engineering Management	Computational Design
Continuous Improvement Management	Design for Maintainability	Design for Manufacturing and Assembly	Design for Safety
Design Standards and Specification	Design Thinking Practice	Engineering Drawing and Design Specifications	Engineering Drawing Interpretation and Management
Green Building Strategy Implementation	Integrated Digital Delivery Application	Integrated System Design and Application	Material Studies and Production Processes
Project Management	Project Risk Management	Quality System Management	Research and Information Synthesis
Robotic and Automation Technology Application	Stakeholder Management	Workflow Digitalisation	

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Computational Designer

Estimated Time Horizon: Short-term

Critical Core Skills

Collaboration | Communication | Problem Solving | Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Data Scientist/Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as BIM Technology, Data Analytics & RPA, Digital Twin, Remote Monitoring and 5G, IoT & Smart Buildings.

Other Considerations

Companies seeking to leverage data to derive valuable insights for decision making, performance optimisation and problem solution, can take advantage of this specialised job role.

Responsibilities of the Role

The Data Scientist/Engineer is responsible for collecting, cleaning and analysing data to uncover patterns and provide valuable inputs that help solve real-world urban Design & Construction issues. The job holder will also utilise machine learning models to address issues with regards to Design & Construction. The job holder will use the data collected to identify and understand business problems and opportunities within the company and translate them into technical requirements.

Job Tasks

- Design, develop, validate, test and implement algorithms to perform statistical analyses which provide actionable inputs for the firm's Design & Construction systems and processes
- Build, test, and maintain database pipeline architecture
- Monitor, review and enhance existing statistical models, while keeping abreast of emerging statistical models that can be leveraged on for data analysis
- Use statistical techniques and programming languages like Python, to collect, clean and analyse data
- Ensure compliance with data governance and company security policies

Technical Skills and Competencies

3D Modelling	Analytics and Computational Modelling	Artificial Intelligence Application	Autonomous Systems Technology Application
Building Information Modelling Application	Civil and Structural Engineering Management	Computational Design	Construction Technology
Continuous Improvement Management	Critical Thinking	Data Collection and Analysis	Design for Manufacturing and Assembly
Design Thinking Practice	Engineering Drawing and Design Specifications	Engineering Drawing Interpretation and Management	Integrated System Design and Application
Programming and Coding	Quality System Management	Robotic and Automation Technology Application	Structural Testing
Systems Thinking	Technical Inspection	Technology Application	Technology Scanning

Critical Core Skills

Collaboration	Communication	Problem Solving	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Solar Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

- Technology trends such as BIM Technology and 5G, IoT & Smart Buildings.
- Megatrends i.e., Sustainable Construction/ Buildings.

Other Considerations

Companies looking to incorporate sustainable energy practices i.e., solar energy solutions in their Design & Construction processes, can leverage the expertise of this specialised job role.

Responsibilities of the Role

The Solar Engineer is responsible for the design, installation, execution and management of solar technologies and solar photovoltaic (PV) systems, which include energy storage systems, and solutions. The job holder will also be responsible for working with external or internal teams, such as clients, contractors, vendors or procurement teams to coordinate the efforts required to execute and incorporate solar PV projects into the company.

Job Tasks

- Conduct site visits to collect relevant information to support the designing of commercial and utility-scale solar power systems
- Plan, design, install and execute various solar energy systems and solar PV projects for residential and commercial buildings
- Analyse solar system designs for simulation and testing and coordinate the layout of components for optimisation of solutions with computer-aided design (CAD) software
- Establish checklists for review and/or inspection of ongoing and completed solar installation projects

Technical Skills and Competencies

3D Modelling	Building Information Modelling Application	Computational Design	Construction Technology
Continuous Improvement Management	Data Collection and Analysis	Environmental Sustainability Management	Green Building Strategy Implementation
Integrated Digital Delivery Application	Material Studies and Production Processes	Project Feasibility Assessment	Project Risk Management
Quality System Management	Regulatory Submission and Clearance	Renewable Energy System Management and Integration	Robotic and Automation Technology Application
Site Assessment and Analysis	Solar Photovoltaic Energy Assessment	Solar Photovoltaic Systems Design	Stakeholder Management
Structural Testing	Sustainable Engineering	Technical Inspection	Technical Presentation
Technical Writing	Technology Application		

Critical Core Skills

Collaboration	Communication	Problem Solving	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Robotic Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as BIM Technology, Digital Twin, Modular Construction, Remote Monitoring, Robots & Automation and 5G, IoT & Smart Buildings.

Other Considerations

Companies who seek to adopt and/or enhance existing robotics to alleviate labour shortage issues at construction sites, may leverage this specialize job role.

Responsibilities of the Role

The Robotic Engineer is responsible for designing and developing prototypes and models of robotic equipment for use at construction sites. The job holder also builds and tests the machines and maintains the software used to control these equipment. The job holder is involved in the development of algorithms to improve and refine the navigation techniques of the construction robotic equipment, so as to better address and resolve labour shortage issues at construction sites.

Job Tasks

- Conceptualise, design and develop prototypes and models of construction robotic equipment
- Monitor, maintain, and enhance operational safety and efficiency of construction robotic equipment
- Provide technical support, troubleshoot, configure and debug construction robotic equipment and implement any necessary modifications
- Work with clients, engineers, developers, project managers, and stakeholders to understand the requirements and demands of construction robotic equipment and keep abreast of technology trends for application
- Collaborate with academia to translate academic research into production-ready systems and models

Technical Skills and Competencies

Continuous Improvement Management	Design for Manufacturing and Assembly	Emerging Technology Synthesis	Engineering Support Management
Equipment and Systems Installation and Commissioning Management	Equipment and Systems Testing	Equipment Qualification	Integrated Digital Delivery Application
Internet of Things Management	Machine Learning Application	Programming and Coding	Project Risk Management
Quality System Management	Robotic and Automation Technology Application	Site Assessment and Analysis	Stakeholder Management
Technical Inspection	Workplace Safety and Health Culture Development	Workplace Safety and Health Framework Development and Implementation	

Critical Core Skills

Collaboration	Communication	Digital Fluency	Problem Solving
Transdisciplinary Thinking			

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Metadata Project Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as BIM Technology, Digital Twin, Modular Construction, Remote Monitoring and 5G, IoT & Smart Buildings.

Other Considerations

Companies seeking actionable insights to streamline workflows and ensure accountability of data, may look to leverage this specialised role.

Responsibilities of the Role

The Metadata Project Manager is responsible for driving metadata management initiatives and establishing processes and systems to monitor the comprehensiveness and quality of Design & Construction-related metadata. The job holder will establish and maintain value proposition, strategy, and associated roadmap for a robust enterprise metadata management program and lead the design and delivery of enterprise metadata management information and platforms, and application approaches. The job holder may also monitor and create progress reports and performance measurement metrics.

Job Tasks

- Drive and oversee the design, delivery and maintenance of metadata systems and processes
- Provide actionable insights and/or potential solutions for any issues detected in the Design & Construction process
- Participate in meetings, projects, initiatives and activities to help establish strategies and workflow roadmaps for a robust enterprise metadata management program
- Communicate and coordinate with stakeholders to define data rules, improve monitoring tools and dashboards and ensure progress/improvement in the metadata management

Technical Skills and Competencies

Application Support and Enhancement	Applications Integration	Business Innovation	Business Needs Analysis
Business Risk Management	Common Data Environment Management	Continuous Improvement Management	Data Collection and Analysis
Design for Manufacturing and Assembly	Emerging Technology Synthesis	Innovation Management	Integrated Digital Delivery Application
Programming and Coding	Systems Integration	Systems Thinking	Technology Application
Technology Road Mapping			

Critical Core Skills

Communication	Digital Fluency	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Digital Systems Engineer

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as BIM Technology, Digital Twin, Modular Construction, Remote Monitoring and 5G, IoT & Smart Buildings.

Other Considerations

Companies looking to enhance workplace productivity and improve organisational resilience in Design & Construction, can leverage this specialised role.

Responsibilities of the Role

The Digital Systems Engineer is responsible for the development, integration, monitoring, and optimisation of current and new processes and systems. The job holder will work with the team to continuously innovate and integrate existing and new systems, in accordance with clientele demands and technical requirements, to deliver unique multi-disciplined solutions. The job holder will also manage the potential complexities and risks of the solutions, to ensure the delivery of high-quality solutions.

Job Tasks

- Research and develop strategic maps and execution plans for the development, implementation and/or integration of new and current processes and systems in Design & Construction
- Liaise with clients to understand clients' requirements to create unique multi-disciplinary solutions
- Analyse and review results and/or outputs of the solutions to inform and optimise the configuration and quality of existing products
- Review the progress and needs of the working team and keep abreast of cutting-edge digital solutions available in the market

Technical Skills and Competencies

Application Support and Enhancement	Applications Integration	Artificial Intelligence Application	Augmented Reality Application
Building Information Modelling Application	Business Needs Analysis	Construction Technology	Continuous Improvement Management
Critical Thinking	Data Collection and Analysis	Design for Manufacturing and Assembly	Emerging Technology Synthesis
Integrated Digital Delivery Application	Integrated System Design and Application	Programming and Coding	Project Risk Management
Quality System Management	Systems Integration	Systems Thinking	Technology Application
Technology Road Mapping	Technology Scanning		

Critical Core Skills

Collaboration	Communication	Customer Orientation	Problem Solving
Transdisciplinary Thinking			

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Facility Management Data Analyst

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as Data Analytics & AI, Digital Twin, Robots & Automation, Remote Monitoring and 5G, IoT & Smart Buildings.

Other Considerations

Companies keen on leveraging FM related data i.e. Building Management Systems etc. to enhance FM systems and processes, can take advantage of this specialised job role.

Responsibilities of the Role

The Facility Management Data Analyst is responsible for developing and maintaining databases related to facilities management, life cycle costing and maintenance. The job holder will engage with teams to identify and resolve inefficiencies within the company, and report on the analyses made with the data collected.

Job Tasks

- Develop data collection models and databases for data collection and analysis that bolsters planning, maintenance and optimisation initiatives which aim to enhance efficiency of FM assets
- Use statistical techniques to collect, filter and clean FM-related data i.e., Building Management Systems, for complex analysis
- Present data using data visualisation techniques to communicate with stakeholders on priorities for key FM business decisions and outcomes
- Deliver high-quality, action-oriented FM-related recommendations and insights based on descriptive, prescriptive and predictive analysis

Technical Skills and Competencies

Analytics and Computational Modelling	Building Management System Implementation and Control	Condition-based Assets Monitoring Management	Continuous Improvement Management
Contract Administration and Management	Data Centre Facilities Management	Data Collection and Analysis	Data Mining and Modelling
Data Storytelling and Visualisation	Emerging Technology Synthesis	Engineering Drawing Interpretation and Management	Facilities Shut-down and Re-start
Green Facilities Management	Integrated Digital Delivery Application	Inventory Management	Life Cycle Costing and Analysis
Procurement Coordination and Policy Development	Programming and Coding	Project Management	Project Risk Management
Quality System Management	Robotic and Automation Technology Application	Smart Facilities Management	Stakeholder Management
Technical Inspection	Technical Writing	Technology Application	Value Engineering

Critical Core Skills

Collaboration	Communication	Digital Fluency	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Specialist (Digital FM/ Engineering)

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as Data Analytics & AI, Digital Twin, Robots & Automation, Remote Monitoring and 5G, IoT & Smart Buildings.

Other Considerations

Companies seeking to enhance workplace productivity through automating current and new FM systems and processes, can leverage this specialised job role.

Responsibilities of the Role

The Specialist (Digital FM/Engineering) is responsible for designing, coding, testing, implementing and troubleshooting digital FM technologies and platforms into current operations and work processes. The job holder will also communicate with teams and stakeholders to drive digital FM by using integrated systems to automate facilities management functions and as a result deliver a cost-effective, comfortable and sustainable environment.

Job Tasks

- Design, implement and maintain digital FM technologies and platforms i.e., Building Information Modelling (BIM), Building Management System, Building Automation System etc. that facilitate the automation of FM-related operations and work processes
- Facilitate FM systems improvements and troubleshoot systems to ensure functional operations
- Communicate and coordinate with teams and stakeholders to understand specific requirements and demands in the automation of FM functions, to ensure alignment across all stakeholders
- Propose technical solutions and improvement based on analyses of available digital FM technology options

Technical Skills and Competencies

Application Support and Enhancement	Asset Management	Autonomous Systems Technology Application	Building Information Modelling Application
Building Management System Implementation and Control	Business Performance Management	Change Management	Commissioning and Start-up Management
Common Data Environment Management	Condition-based Assets Monitoring Management	Continuous Improvement Management	Critical Thinking
Emerging Technology Synthesis	Facilities Shut-down and Re-start	Green Facilities Management	Integrated Digital Delivery Application
Inventory Management	Process Improvement and Optimisation	Programming and Coding	Quality System Management
Robotic and Automation Technology Application	Security Surveillance Management	Smart Facilities Management	Stakeholder Management
Systems Thinking	Technology Application		

Critical Core Skills

Collaboration	Communication	Digital Fluency	Transdisciplinary Thinking

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Sustainability Facility Manager

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as 5G, IoT & Smart Buildings.

Other Considerations

Companies keen on incorporating sustainability initiatives to achieve cost efficiencies in FM-related systems and processes, can leverage this specialised job role.

Responsibilities of the Role

The Sustainability Facility Manager is responsible for identifying, implementing and managing cost-efficient opportunities to incorporate sustainability initiatives, and monitoring its effectiveness. The job holder will require an understanding of energy and sustainability management and predictive maintenance procedures.

Job Tasks

- Identify and develop projects to implement best-in-class sustainable technologies, processes, products and standards in support of the firm's sustainability goals for FM
- Manage FM-related sustainability initiatives, identify inefficiencies, and ensure efficient utilisation of energy resources
- Prepare regular reports to update stakeholders i.e., clients, on progress of sustainability initiatives and recommend improvements or steps to take moving forward
- Establish global collaboration in sustainability projects to keep up with the latest and/or upcoming sustainability trends and technologies in FM

Technical Skills and Competencies

Asset Management	Building Information Modelling Application	Building Management System Implementation and Control	Business Performance Management
Carbon Footprint Management	Condition-based Assets Monitoring Management	Continuous Improvement Management	Contract Administration and Management
Data Collection and Analysis	Design for Maintainability	Design for Safety	Design Thinking Practice
Emergency Response Management	Energy Management and Audit	Engineering Drawing Interpretation and Management	Environmental Management System Framework Development and Implementation
Environmental Sustainability Management	Facilities Shut-down and Re-start	Fire Protection System Maintenance	Green Facilities Management
Incident and Accident Investigation	Indoor Environmental Quality Improvement	Integrated Digital Delivery Application	Inventory Management
Life Cycle Costing and Analysis	Manpower Planning	People Management	Procurement Coordination and Policy Development

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Sustainability Facility Manager

Estimated Time Horizon: Short-term

Technical Skills and Competencies (cont'd)

Project Cost	Project Feasibility Assessment	Project Management	Project Risk Management
Quality System Management	Robotic and Automation Technology Application	Smart Facilities Management	Stakeholder Management
Sustainability Management	Sustainability Reporting	Technical Inspection	Technical Presentation
Technical Writing	Technology Application	Value Engineering	Workplace Safety and Health Culture Development
Workplace Safety and Health Framework Development and Implementation			

Critical Core Skills

Collaboration	Communication	Decision Making	Developing People
Digital Fluency	Transdisciplinary Thinking		

Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.4 Emerging job roles dashboards

Energy and Sustainability Solutions Architect

Estimated Time Horizon: Short-term

Trends Impacting This Role

Technology trends such as Data Analytics & AI, Digital Twin, and 5G, IoT & Smart Buildings.

Other Considerations

Companies who are keen on establishing sustainability solutions to achieve cost efficiencies can look to this specialised job role.

Responsibilities of the Role

The Energy and Sustainability Architect will work with clients and client account teams to design, develop, and secure approval for energy and sustainability solutions to achieve desired outcomes i.e. optimised energy spend, lower total cost of ownership, and reduced carbon emissions. The job holder will also be required to use subject matter expertise in energy efficiency, to provide valuable insight and present business opportunities and solutions to colleagues and clients.

Job Tasks

- Analyse, design, and develop energy and sustainability solutions and projects
- Perform energy and sustainability assessments and audits of client portfolios to develop comprehensive solutions and write reports on the evaluation of sustainability performance
- Provide meaningful insights as a subject matter expert, to bolster existing energy and sustainability solutions
- Design and develop cost-efficient projects, while ensuring low or reduced energy and carbon usage

Technical Skills and Competencies

Building Information Modelling Application	Carbon Footprint Management	Computational Design	Construction Technology
Continuous Improvement Management	Design for Maintainability	Energy Management and Audit	Environmental Management System Framework Development and Implementation
Environmental Sustainability Management	Green Building Strategy Implementation	Integrated Digital Delivery Application	Material Studies and Production Processes
Project Costs	Project Feasibility Assessment	Site Assessment and Analysis	Solar Photovoltaic Energy Assessment
Sustainability Management	Technical Drawing	Technical Presentation	Technology Application
Value Engineering			

Critical Core Skills

Collaboration	Communication	Digital Fluency	Transdisciplinary Thinking

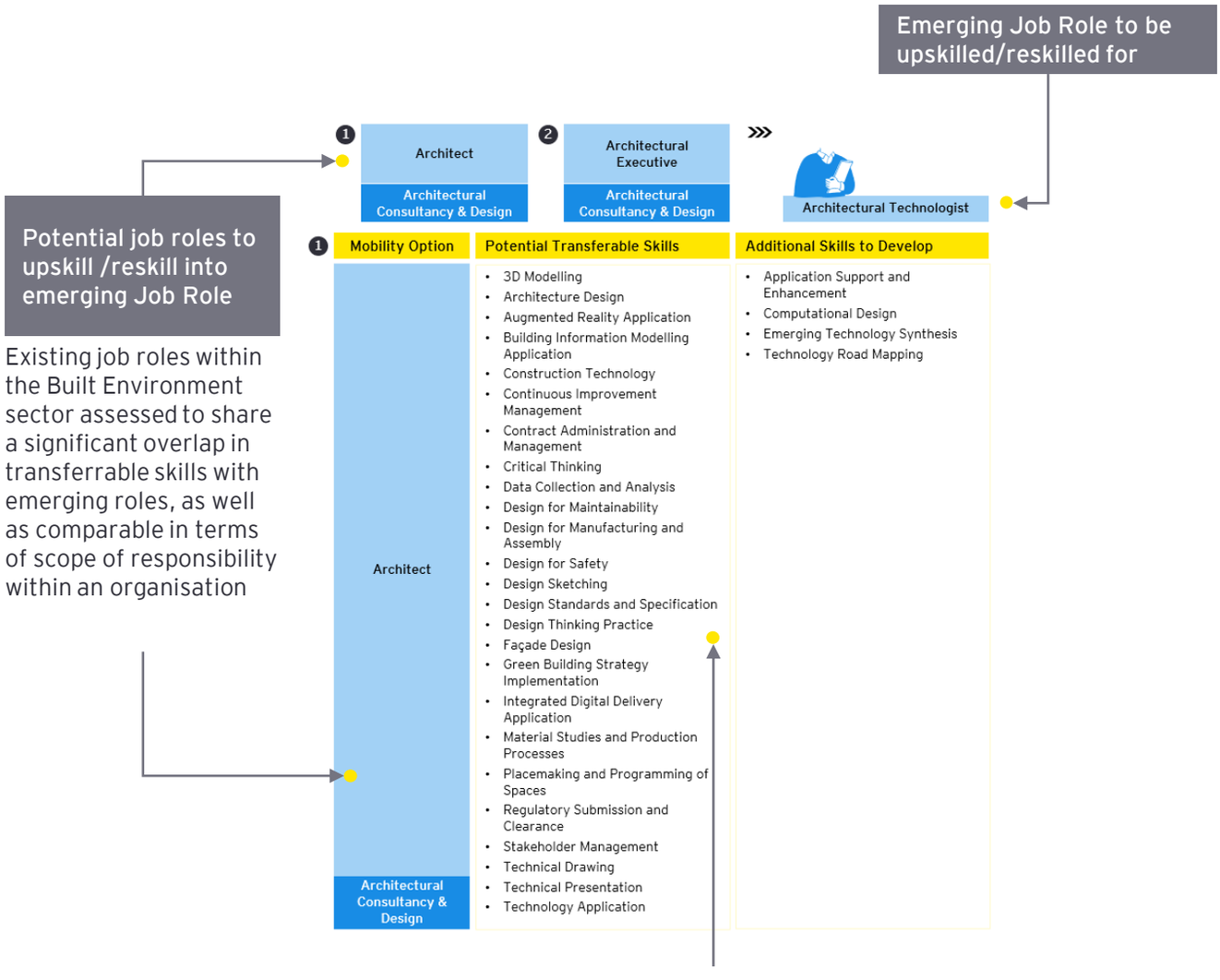
Note: *Skills highlighted are not exhaustive but have been preliminarily identified as potentially most pertinent to the job role and may be adjusted based on individual organisational strategy and needs.*

7.2.5 Reskilling roadmaps

Guide to Reskilling Roadmaps

The study has identified that **6 out of the 13 emerging job roles can potentially be filled by existing talents** within the Built Environment sector, with a moderate level of reskilling and upskilling to take up new responsibilities.
In addition to the job dashboards developed for emerging jobs, reskilling roadmaps were also developed for existing jobs in the sector exhibiting overlap in technical skills with emerging job roles, as possible career pathways for job holders.

GUIDE TO RESKILLING ROADMAPS



Skills listing

The skills referenced here are available in the Skills Framework:

- "Potential Transferrable Skills" indicate overlap in skills between the emerging role and existing role in the Built Environment sector
- "Additional Skills to Develop" indicate new skills that job holders in existing job roles will need to be reskilled in to take on emerging roles

7.2.5 Reskilling roadmaps

Architectural Technologist

1 Architect — Architectural Consultancy & Design

2 Architectural Executive — Architectural Consultancy & Design

>>> Architectural Technologist

1 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Architect Architectural Consultancy & Design	▸ 3D Modelling ▸ Architecture Design ▸ Augmented Reality Application ▸ Building Information Modelling Application ▸ Construction Technology ▸ Continuous Improvement Management ▸ Contract Administration and Management ▸ Critical Thinking ▸ Data Collection and Analysis ▸ Design for Maintainability ▸ Design for Manufacturing and Assembly ▸ Design for Safety ▸ Design Sketching ▸ Design Standards and Specification ▸ Design Thinking Practice ▸ Façade Design ▸ Green Building Strategy Implementation ▸ Integrated Digital Delivery Application ▸ Material Studies and Production Processes ▸ Placemaking and Programming of Spaces ▸ Regulatory Submission and Clearance ▸ Stakeholder Management ▸ Technical Drawing ▸ Technical Presentation ▸ Technology Application	▸ Application Support and Enhancement ▸ Computational Design ▸ Emerging Technology Synthesis ▸ Technology Road Mapping

7.2.5 Reskilling roadmaps

Architectural Technologist (cont'd)

1 Architect — Architectural Consultancy & Design

2 Architectural Executive — Architectural Consultancy & Design

Architectural Technologist

2 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Architectural Executive Architectural Consultancy & Design	▸ 3D Modelling ▸ Augmented Reality Application ▸ Building Information Modelling Application ▸ Computational Design ▸ Construction Technology ▸ Continuous Improvement Management ▸ Critical Thinking ▸ Design for Maintainability ▸ Design for Manufacturing and Assembly ▸ Design for Safety ▸ Design Thinking Practice ▸ Façade Design ▸ Integrated Digital Delivery Application ▸ Placemaking and Programming of Spaces ▸ Regulatory Submission and Clearance ▸ Stakeholder Management ▸ Technical Drawing ▸ Technical Presentation ▸ Technology Application	▸ Application Support and Enhancement ▸ Architecture Design ▸ Contract Administration and Management ▸ Data Collection and Analysis ▸ Design Sketching ▸ Design Standards and Specification ▸ Emerging Technology Synthesis ▸ Green Building Strategy Implementation ▸ Material Studies and Production Processes ▸ Technology Road Mapping

7.2.5 Reskilling roadmaps

Climate-Change Response Engineer

1 Civil and Structural Engineer

Engineering Consultancy & Design

Climate-Change Response Engineer

1 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Civil and Structural Engineer Engineering Consultancy & Design	▸ Analytics and Computational Modelling ▸ Biophilic Design in Built Environment ▸ Building Information Modelling Application ▸ Civil and Structural Engineering Management ▸ Coastal Engineering ▸ Design for Maintainability ▸ Environmental Sustainability Management ▸ Green Building Strategy Implementation ▸ Hydrodynamic and Flood Mitigation ▸ Integrated Digital Delivery Application ▸ Project Risk Management ▸ Regulatory Submission and Clearance ▸ Sustainable Engineering ▸ Tunnel Engineering Management	▸ 3D Modelling ▸ Artificial Intelligence Application ▸ Climate Change Management ▸ Continuous Improvement Management ▸ Design Thinking Practice ▸ Geotechnical Engineering Management ▸ Material Studies and Production Processes ▸ Natural Ventilation Design ▸ Quality System Management ▸ Site Assessment and Analysis ▸ Solar Photovoltaic Systems Design ▸ Structural Testing ▸ Value Analysis ▸ Value Engineering

7.2.5 Reskilling roadmaps

Solar Engineer

1 Civil and Structural Engineer

Engineering Consultancy & Design

Solar Engineer

1 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Civil and Structural Engineer Engineering Consultancy & Design	▸ Building Information Modelling Application ▸ Computational Design ▸ Construction Technology ▸ Data Collection and Analysis ▸ Environmental Sustainability Management ▸ Green Building Strategy Implementation ▸ Integrated Digital Delivery Application ▸ Project Risk Management ▸ Regulatory Submission and Clearance ▸ Stakeholder Management ▸ Sustainable Engineering ▸ Technology Application	▸ 3D Modelling ▸ Continuous Improvement Management ▸ Material Studies and Production Processes ▸ Project Feasibility Assessment ▸ Quality System Management ▸ Renewable Energy System Management and Integration ▸ Robotic and Automation Technology Application ▸ Site Assessment and Analysis ▸ Solar Photovoltaic Energy Assessment ▸ Solar Photovoltaic Systems Design ▸ Structural Testing ▸ Technical Inspection ▸ Technical Presentation ▸ Technical Writing

7.2.5 Reskilling roadmaps

Facility Management Data Analyst

1 Technical Executive — Facilities Management

2 Building Executive/ Facilities Executive/ Property Executive — Facilities Management

Facility Management Data Analyst

1 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Technical Executive Facilities Management	▸ Building Management System Implementation and Control ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Contract Administration and Management ▸ Data Collection and Analysis ▸ Engineering Drawing Interpretation and Management ▸ Facilities Shut-down and Re-start ▸ Green Facilities Management ▸ Integrated Digital Delivery Application ▸ Inventory Management ▸ Life Cycle Costing and Analysis ▸ Procurement Coordination and Policy Development ▸ Project Management ▸ Project Risk Management ▸ Quality System Management ▸ Robotic and Automation Technology Application ▸ Smart Facilities Management ▸ Stakeholder Management ▸ Technical Inspection ▸ Technical Writing ▸ Technology Application ▸ Value Engineering	▸ Analytics and Computational Modelling ▸ Data Centre Facilities Management ▸ Data Mining and Modelling ▸ Data Storytelling and Visualisation ▸ Emerging Technology Synthesis ▸ Programming and Coding

7.2.5 Reskilling roadmaps

Facility Management Data Analyst

1 Technical Executive — Facilities Management

2 Building Executive/ Facilities Executive/ Property Executive — Facilities Management

Facility Management Data Analyst

2 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Building Executive/ Facilities Executive/ Property Executive Facilities Management	▸ Building Management System Implementation and Control ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Contract Administration and Management ▸ Data Collection and Analysis ▸ Engineering Drawing Interpretation and Management ▸ Facilities Shut-down and Re-start ▸ Green Facilities Management ▸ Integrated Digital Delivery Application ▸ Inventory Management ▸ Life Cycle Costing and Analysis ▸ Procurement Coordination and Policy Development ▸ Project Management ▸ Project Risk Management ▸ Quality System Management ▸ Robotic and Automation Technology Application ▸ Smart Facilities Management ▸ Stakeholder Management ▸ Technical Inspection ▸ Technology Application ▸ Value Engineering	▸ Analytics and Computational Modelling ▸ Data Centre Facilities Management ▸ Data Mining and Modelling ▸ Data Storytelling and Visualisation ▸ Emerging Technology Synthesis ▸ Programming and Coding

7.2.5 Reskilling roadmaps

Specialist (Digital Facility Management/ Engineering)

1 Technical Executive — Facilities Management

2 Building Executive/ Facilities Executive/ Property Executive — Facilities Management

3 Facilities Manager/ Facilities Engineer — Facilities Management

Specialist (Digital FM/ Engineering)

1 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Technical Executive Facilities Management	▸ Building Management System Implementation and Control ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Facilities Shut-down and Re-start ▸ Green Facilities Management ▸ Integrated Digital Delivery Application ▸ Inventory Management ▸ Quality System Management ▸ Robotic and Automation Technology Application ▸ Smart Facilities Management ▸ Stakeholder Management ▸ Technology Application	▸ Application Support and Enhancement ▸ Asset Management ▸ Autonomous Systems Technology Application ▸ Building Information Modelling Application ▸ Business Performance Management ▸ Change Management ▸ Commissioning and Start-up Management ▸ Common Data Environment Management ▸ Critical Thinking ▸ Emerging Technology Synthesis ▸ Process Improvement and Optimisation ▸ Programming and Coding ▸ Security Surveillance Management ▸ Systems Thinking

7.2.5 Reskilling roadmaps

Specialist (Digital Facility Management/ Engineering)

1 Technical Executive — Facilities Management

2 Building Executive/ Facilities Executive/ Property Executive — Facilities Management

3 Facilities Manager/ Facilities Engineer — Facilities Management

Specialist (Digital FM/ Engineering)

2 Mobility Option

Building Executive/ Facilities Executive/ Property Executive

Facilities Management

Potential Transferable Skills

- Asset Management
- Building Management System Implementation and Control
- Condition-based Assets Monitoring Management
- Continuous Improvement Management
- Facilities Shut-down and Re-start
- Green Facilities Management
- Integrated Digital Delivery Application
- Inventory Management
- Quality System Management
- Robotic and Automation Technology Application
- Security Surveillance Management
- Smart Facilities Management
- Stakeholder Management
- Technology Application

Additional Skills to Develop

- Application Support and Enhancement
- Autonomous Systems Technology Application
- Building Information Modelling Application
- Business Performance Management
- Change Management
- Commissioning and Start-up Management
- Common Data Environment Management
- Critical Thinking
- Emerging Technology Synthesis
- Process Improvement and Optimisation
- Programming and Coding
- Systems Thinking

7.2.5 Reskilling roadmaps

Specialist (Digital Facility Management/ Engineering)

1 Technical Executive — Facilities Management

2 Building Executive/ Facilities Executive/ Property Executive — Facilities Management

3 Facilities Manager/ Facilities Engineer — Facilities Management

→ Specialist (Digital FM/ Engineering)

3 Mobility Option	Potential Transferable Skills	Additional Skills to Develop
Facilities Manager/ Facilities Engineer Facilities Management	▸ Asset Management ▸ Building Information Modelling Application ▸ Building Management System Implementation and Control ▸ Business Performance Management ▸ Condition-based Assets Monitoring Management ▸ Continuous Improvement Management ▸ Facilities Shut-down and Re-start ▸ Green Facilities Management ▸ Integrated Digital Delivery Application ▸ Inventory Management ▸ Quality System Management ▸ Robotic and Automation Technology Application ▸ Security Surveillance Management ▸ Smart Facilities Management ▸ Stakeholder Management ▸ Technology Application	▸ Application Support and Enhancement ▸ Autonomous Systems Technology Application ▸ Change Management ▸ Commissioning and Start-up Management ▸ Common Data Environment Management ▸ Critical Thinking ▸ Emerging Technology Synthesis ▸ Process Improvement and Optimisation ▸ Programming and Coding ▸ Systems Thinking

7.2.5 Reskilling roadmaps

Sustainability Facility Manager

1 Facilities Manager/Facilities Engineer

Facilities Management

Sustainability Facility Manager

1 Mobility Option

Facilities Manager/ Facilities Engineer

Facilities Management

Potential Transferable Skills

- Asset Management
- Building Information Modelling Application
- Building Management System Implementation and Control
- Business Performance Management
- Condition-based Assets Monitoring Management
- Continuous Improvement Management
- Contract Administration and Management
- Data Collection and Analysis
- Design for Maintainability
- Design for Safety
- Design Thinking Practice
- Emergency Response Management
- Engineering Drawing Interpretation and Management
- Facilities Shut-down and Re-start
- Fire Protection System Maintenance
- Green Facilities Management
- Incident and Accident Investigation
- Indoor Environmental Quality Improvement
- Integrated Digital Delivery Application
- Inventory Management
- Life Cycle Costing and Analysis
- Maintenance Scheduling
- Manpower Planning
- People Management
- Procurement Coordination and Policy Development
- Project Cost
- Project Feasibility Assessment
- Project Management
- Project Risk Management
- Quality System Management
- Robotic and Automation Technology Application
- Smart Facilities Management
- Stakeholder Management
- Technical Inspection
- Technical Presentation
- Technical Writing
- Technology Application
- Value Engineering
- Workplace Safety and Health Culture Development
- Workplace Safety and Health Framework Development and Implementation

Additional Skills to Develop

- Carbon Footprint Management
- Energy Management and Audit
- Environmental Management System Framework Development and Implementation
- Environmental Sustainability Management
- Sustainability Management
- Sustainability Reporting

7.3 Applications of technology trends

Potential Application and Time Horizon for Architectural Consultancy & Design

As part of the study, the following technology trends were identified to impact Architectural Consultancy & Design in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Architectural Consultancy & Design**
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses. ▸ Digital 3D models of buildings can be created with various data captured, such as dimensions, materials, and time needed for completion etc. ▸ Architectural firms engaged in the study have shared implementation use cases, leveraging BIM Technology as a drafting and communication tool to draft designs, better communicate with other disciplines, and obtain productivity in downstream activities.
Data Analytics & Artificial Intelligence	▸ Data Analytics can be used to analyse statistics such as usage and human traffic, energy usage, and productivity to ensure designs support user needs.
Digital Twin	▸ Digital Twin models can be used to view design changes in real-time simulations, allowing the testing of various scenarios and choices, such as construction materials or façade design.
Modular Construction	▸ Modular Construction increases architectural design flexibility as it allows the fabrication and integration of unique parts. ▸ However, Architectural firms engaged in the study have shared that the limits of Modular Construction (e.g., mold constraints) should be considered upfront in the design stage.
Remote Monitoring	▸ Remote Monitoring tools (e.g., drones) can be used for remote site assessments and topography work. ▸ Architectural firms engaged in the study have shared that they have used drones for site assessment, topography work and support the documentation for post building completion.
5G, Internet of Things (IoT) & Smart Buildings	▸ Understanding is required on the placement and incorporation of IoT sensors in buildings such as the placement of panels.
Virtual Reality / Augmented Reality	▸ VR/AR tools can help clients visualise building designs before they are built and minimise coordination issues. ▸ Architectural firms engaged in the study have shared that they use BIM with VR/AR software to do building design walkthroughs with clients. VR/AR was also used for spatial appreciation in the design stage of their local projects.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Architectural Consultancy & Design

As part of the study, the following technology trends were identified to impact Architectural Consultancy & Design in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Architectural Consultancy & Design**
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms.
Robots & Automation	▸ Robots can make models to convey design intent and site topography models, and operate heliodon and photogrammetry.
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
3D Printing	▸ 3D Printing machines can render detailed physical models to visualise building designs and make early design tweaks before the actual building is constructed.
Innovative Building Materials	▸ Innovative Building Materials will affect building designs and construction materials chosen by Architects due to the different properties of the materials. ▸ In the UK, Architectural firm, Foster + Partners designed the Bloomberg London office, to incorporate integrated ceiling panel system made of thin, high-tech aluminum petals that were able to dissipate sound, reduce lighting glare, and dissipate heat in the office's interior, resulting in reportedly 40% less energy usage than typical lighting systems. The firm also designed the building's exterior with bronze fins on the façade, which help to modulate temperature and airflow, while blocking external noise, allowing natural ventilation to cool the building and creating a conducive work environment.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Engineering Consultancy & Design

As part of the study, the following technology trends were identified to impact Engineering Consultancy & Design in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Engineering Consultancy & Design**
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses. ▸ BIM can be used to build digital models of building systems to simulate building operation, as well as to determine structural loads and requirements for the design.
Modular Construction	▸ Modular fabricated units need to be accounted for when designing the building's mechanical and electrical systems and structure.
Remote Monitoring	▸ Engineering firms engaged in the study shared that they have deployed Remote Monitoring tools to remotely oversee project execution, enabling Engineers to monitor and supervise sites remotely amidst manpower challenges, and quickly resolve defects issues.
Data Analytics & Artificial Intelligence	▸ Data Analytics can process and assess key data such as mechanical, electrical, and structural performance, allowing potential issues to be addressed early on when anomalies are identified. ▸ In Singapore, Engineering and Real Estate Development firm, Boustead Singapore, created a mobile digital hub out of a shipping container with portable Virtual Reality (VR) tools to facilitate meetings. The VR walk-throughs can be used to understand how buildings look like when it is completed. The 3D model uses 3D laser scanning and AI verification to check whether the built outcomes adhere to the BIM model as construction progresses.
Digital Twin	▸ Digital Twin models can be used to view system changes in real-time simulations, allowing the testing of various scenarios such as weather changes and cooling/heating systems. ▸ In Shanghai, Engineering and Construction firm, China Railway Shanghai Engineering Bureau, used BIM methodologies and unmanned aerial vehicles (UAVs) to establish an immersive Digital Twin of Beihu sewage treatment plant. This ensured more reliable engineering workflows, improving methods of managing project progress and cost and enhancing the execution and safety of on-site construction.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Engineering Consultancy & Design

As part of the study, the following technology trends were identified to impact Engineering Consultancy & Design in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Engineering Consultancy & Design**
Virtual Reality / Augmented Reality	▸ VR/AR tools enables the testing of engineering designs in a simulated environment, to identify potential safety risks and required design adjustments.
5G, Internet of Things (IoT) & Smart Buildings	▸ Data collected by IoT can be used to evaluate system strengths and vulnerabilities, enabling the early detection and tweaks of technical issues.
Innovative Building Materials	▸ Innovative Building Materials will affect building systems designed by Engineers as they have to account for the different properties of the materials. ▸ Engineering firms engaged in the study have shared the development of new processes to focus on reducing carbon emissions through engineering designs across the project lifecycle, such as re-using materials or using low carbon materials and technologies. These processes aim to decarbonise the BE sector and support their clients to achieve a net-zero strategy.
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms, aiding in the preparation of documents for tenders and project handovers, as well as structural calculations.
3D Printing	▸ 3D Printing machines can create physical models of engineering structures to visualise and make early design tweaks to structures before they are constructed. ▸ Design and production processes therefore become more efficient with less mistakes leading to reworks.
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Robots & Automation	▸ Robotic assistants can be leveraged upon to install mechanical/electrical systems in less accessible areas of buildings, reducing safety risks.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Quantity Surveying

As part of the study, the following technology trends were identified to impact Quantity Surveying in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Quantity Surveying**
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses. ▸ Information stored in BIM models can be used to support the estimating and costing processes. ▸ 5D BIM models can extract approximated quantities from different 3D BIM models and add them to the 4D schedule to finalise the 5D cost budgets.
Data Analytics & Artificial Intelligence	▸ Data Analytics & Artificial Intelligence can be used to prepare cost estimates during the preliminary stages by predicting potential construction cost overruns.
Digital Twin	▸ Quantity Surveying firms will lead and support the data and information management process of Digital Twin models, ensuring that models are successfully created, deployed, and updated. ▸ Quantity Surveying firms engaged in the study shared that Digital Twin modelling is a key technology to collaborate with construction firms on.
Modular Construction	▸ Costs arising from offsite activities, such as Modular Construction, need to be accounted for in costing estimates, due to the prefabrication processes involved. ▸ By reducing the manpower and time required onsite for assembly, Modular Construction can help to reduce project costs.
Remote Monitoring	▸ Remote Monitoring tools can visually document site activities for claims verification, measurement-taking, monitoring and controlling costs and use of materials, and identification of potential risks that could impact the budget.
Robotics Process Automation (RPA)	▸ RPA can generate preliminary cost estimates and streamline tender management processes by automating manual data entry of information from tenderers. ▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Quantity Surveying

As part of the study, the following technology trends were identified to impact Quantity Surveying in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Quantity Surveying**
5G, Internet of Things (IoT) & Smart Buildings	▸ 5G cameras allows high-quality camera footages of site activities to be quickly uploaded to Cloud for claims verification, measurement-taking, monitoring and controlling costs and use of materials, and identification of potential budget risks.
Innovative Building Materials	▸ Innovative Building Materials may have different cost properties, which need to be accounted for by Quantity Surveyors to ensure accurate costing estimates.
Virtual Reality / Augmented Reality	▸ VR/AR tools can be worn to conduct site inspections for quantity reconciliation.
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Robots & Automation	▸ Autonomous Mobile Robots (AMRs) can take and record precise measurements on site.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Construction Management (Production)

As part of the study, the following technology trends were identified to impact Construction Management (Production) in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Construction Management (Production)**
Remote Monitoring	▸ Remote Monitoring tools (e.g., IP cameras enabled by AI) can allow construction production activities to be supervised remotely. It can track real-time movements and detect accidents and incidents, e.g., unauthorised entry or work interruptions.
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses. ▸ BIM Technology can be used to estimate costs of production based on project designs.
Digital Twin	▸ Digital Twin models can be used to review production designs in relation to the overall project design, ensuring functionality and effectiveness of the designs.
Modular Construction	▸ Modular Construction allows for more efficient building processes by enabling off-site production in conjunction with on-site activities. ▸ In Denmark, Construction Management (Production) startup, Stykka, leverages on technology and digital fabrication to produce circular, built-in interiors that promote sustainability and decrease production waste and cost. Stykka collaborated with CPH Village, a Danish Modular Construction company to create a sustainable modular prototype for CPH Village's third student housing project. The circular, modular housing prototype follows the principles of Design for Disassembly, which facilitates repairing, refurbishing and maintenance processes, and lowers operating expenses.
Robots & Automation	▸ Industrial and articulated robots can be leveraged to automate repetitive tasks in the construction production process, e.g. assembly of building components.
5G, Internet of Things (IoT) & Smart Buildings	▸ IoT sensors can be leveraged to provide real-time visibility on the status of factory machines for preventive actions to be taken.
Data Analytics and Artificial Intelligence	▸ Data Analytics can be used to perform project risk analysis, predictive analysis, asset and equipment management, process optimisation, and project budgeting and planning.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Construction Management (Production)

As part of the study, the following technology trends were identified to impact Construction Management (Production) in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Construction Management (Production)**
Innovative Building Materials	▸ Innovative Building Materials may require new production processes to be fully utilised, and practitioners need to account for the new materials' different properties and processes to ensure consistently high quality of output.
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms.
Virtual Reality / Augmented Reality	▸ VR/AR can be leveraged to view real-time information on equipment status and identify issues early on for predictive maintenance.
3D Printing	▸ 3D Printing machines can be leveraged as autonomous tools to produce actual and mock-ups of pre-fabricated building components, reducing manpower cost, production time and material waste. ▸ In the USA, Industrial Design and Branding firm, Fuseproject, partnered with 3D printing construction firm, ICON, and non-profit developer, New Story to create a 50-unit housing village for farm workers in Latin America using 3D printing construction technology. Notably, the concrete printer was able to build an entire house in less than 24 hours, at the cost of approximately $5,456.
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Construction Management

As part of the study, the following technology trends were identified to impact Construction Management in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Construction Management**
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses. ▸ BIM Technology can be leveraged to perform cost estimations, site analysis, and phase planning, review project designs and perform project quantitative analyses. ▸ In Hong Kong, Property Development company, Kerry Properties Limited, implemented BIM processes across the entire project life cycle of Wong Chuk Hang Station's property development, reducing rework and errors and gaining better predictability.
Data Analytics and Artificial Intelligence	▸ Data Analytics can be used to perform project risk analysis, predictive analysis, asset and equipment management, process optimisation, and project budgeting and planning. ▸ In the USA, Project Development and Construction Group, Skanska partnered with StructionSite, an intelligent project tracking software provider that streamlines remote site documentation. The partnership enables Skanska to apply real-time data collection to all of its construction site across the country, allowing the company to receive in-depth insights generated by AI about progress of completion of a construction site.
Digital Twin	▸ Digital Twin models can be used to simulate the building's operational performance and to review project designs in collaboration with other stakeholders. ▸ In Finland, Construction firm NCC Finland partnered with a construction technology start-up, Buildots, to pilot AI models in two of their residential and commercial projects within Helsinki. Buildots provided hardhat-mounted cameras to allow NCC to capture all details of construction site indoor, and used AI technology to provide objective, data-backed insights to contractors and project managers. Digital twin of the site was created through Buildots' software, granting NCC access to a single source of truth and allowed them to keep track of issues closely and free up time for site engineers.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Construction Management

As part of the study, the following technology trends were identified to impact Construction Management in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Construction Management**
Modular Construction	▸ As firms increasingly adopt Modular Construction techniques, there will be an increase in off-site activities that practitioners will have to keep in mind when coordinating project and construction processes. ▸ In the USA, Modular Construction firm, FullStack, partnered with HPD, the department that oversees affordable housing in NYC, to build a 167-unit apartment building using modular construction for low-income and formerly homeless New Yorkers, expected to be completed 25% to 30% faster than traditional building projects. This would increase production efficiency and reduce labour costs. ▸ In the UK, software firm Modulous used artificial intelligence to facilitate high-speed design and delivery of high quality, affordable homes, and digitally integrated the supply chain to allow automated procurement and rapid assembly of modules off-site.
Remote Monitoring	▸ Remote Monitoring tools can be used to conduct remote supervision of construction works.
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms. ▸ In the USA, Project Development and Construction Group, Skanska leveraged RPA to automate time-consuming and repetitive customer invoice handling, processing, payments, reminders and the management of accounting journals, increasing efficiency and productivity while decreasing human error.
5G, Internet of Things (IoT) & Smart Buildings	▸ 5G can be leveraged to understand site activities in real-time, e.g., monitoring the health, location, and status of site machinery, and to perform remote or autonomous construction operations. ▸ IoT sensor can collect real-time construction site data on concrete maturity, structural health, waste management, location and weather, enabling informed decisions to be made on the coordination of site activities ▸ In Finland, Developer and Builder SRV used IoT sensors during the construction of a new campus building for Aalto University, enabling real-time monitoring of site progress and timely responses to incidents. This enhances efficiency of construction, saving time and costs, improving traffic flow, and reducing adverse environmental effect.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Construction Management

As part of the study, the following technology trends were identified to impact Construction Management in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Construction Management**
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Virtual Reality / Augmented Reality	▸ VR/AR tools can be leveraged for safety training, enabling the familiarisation of safety procedures and risks in a simulated construction environment, as well as to visualise proposed construction and variations in projects. ▸ In the USA, Construction Contracting firm, Suffolk Construction, built a virtual reality space in their San Francisco office, allowing stakeholders, including both employees and clients, to view project designs and concepts in an immersive experience. ▸ In Hong Kong, Property Development company, Kerry Properties Limited, reviewed and validated the spatial feeling of the property design using VR equipment such as goggles and immersive CAVE system, which saves costs and ensures zero wastage.
3D Printing	▸ 3D Printing machines can produce scale building mock-ups to help teams check and clarify building configurations.
Innovative Building Materials	▸ Innovative Building Materials may require new construction processes to be fully utilised, and practitioners need to account for the new materials' different properties and processes to ensure adherence to project deadlines, quality of output, and safety of employees.
Robots & Automation	▸ Construction robots can be leveraged to automate and accelerate labour-intensive construction works, e.g., excavation and transferring of materials.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Project Management

As part of the study, the following technology trends were identified to impact Project Management in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Project Management**
Modular Construction	▸ As firms increasingly adopt Modular Construction techniques, there will be an increase in off-site activities that practitioners will have to keep in mind when coordinating project and construction processes.
Remote Monitoring	▸ Remote Monitoring tools can be used to oversee the progress of projects, enabling time efficiency as it reduces the need for on-site travel and physical presence.
BIM Technology	▸ BIM Technology will be used as a communication and project coordination tool due to its capacity as a shared platform for stakeholders.
Data Analytics & Artificial Intelligence	▸ Data Analytics will be used to perform project risk analysis, predictive analysis, asset and equipment management, process optimisation, and project budgeting and planning.
Digital Twin	▸ Digital Twin models allow Project Managers to monitor and simulate the building in real-time operation, allowing them to make better-informed decisions based on simulated scenarios of user interactions.
Virtual Reality / Augmented Reality	▸ VR/AR tools can be used to visualise proposed construction and variations in projects. ▸ In the USA, Construction Contracting firm, Suffolk Construction, built a virtual reality space in their San Francisco office, allowing stakeholders, including both employees and clients, to view project designs and concepts in an immersive experience.
5G, Internet of Things (IoT) & Smart Buildings	▸ 5G technology can sync up the devices of various disciplines and project teams to ease communication and collaboration. ▸ Real-time data collected by IoT sensors can be used to track and monitor project progress and spending and anticipate project needs and risks.
Innovative Building Materials	▸ Innovative Building Materials may require new construction processes to be fully utilised, and practitioners need to account for the new materials' different properties and processes to ensure adherence to project deadlines, quality of output, and safety of employees.
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources for project progress reporting. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms, for practitioners to utilise when managing projects.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Project Management

As part of the study, the following technology trends were identified to impact Project Management in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Project Management**	
Blockchain		▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Robots & Automation		▸ AI-enabled robots can autonomously capture 3D scans of construction sites and feed the captured data into a deep neural network to identify the progress status of different sub-projects.
3D Printing		▸ 3D Printing machines can create scale building mock-ups to be used as a visual aid to ease coordination with various disciplines and project teams.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Digital Delivery Management

As part of the study, the following technology trends were identified to impact Digital Delivery Management in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Digital Delivery Management**
BIM Technology	▸ BIM Technology acts as a common shared platform for all stakeholders to access project designs and data, enabling workflows to leverage on data captured to perform end-to-end building and cost analyses.
Data Analytics & Artificial Intelligence	▸ Data Analytics & Artificial Intelligence will be leveraged upon to develop automation solutions through simulations, machine learning, and stress testing.
Digital Twin	▸ Digital Twin models can be used by Digital Delivery professionals to simulate automation solutions in real-time scenarios.
Modular Construction	▸ Understanding of Modular Construction and its applications is needed to lead the adoption of technologies across the sector.
Remote Monitoring	▸ Understanding of Remote Monitoring and its applications is needed to lead the adoption of technologies across the sector.
5G, Internet of Things (IoT) & Smart Buildings	▸ Understanding of 5G, Internet of Things (IoT) & Smart Buildings and its applications is needed to lead the adoption of technologies across the sector.
Blockchain	▸ Blockchain enables faster construction processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Robotics Process Automation (RPA)	▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms. ▸ Practitioners need to be familiar with the usage of RPA in project processes to lead the adoption of RPA in the sector.
Robots & Automation	▸ Understanding Robots & Automation and its applications is needed to lead the adoption of technologies across the sector.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Digital Delivery Management

As part of the study, the following technology trends were identified to impact Digital Delivery Management in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Digital Delivery Management**
Virtual Reality / Augmented Reality	▸ VR/AR can be leveraged to help users visualise, test and understand prototypes. ▸ Building simulations can be performed with the use of VR/AR technology, enabling a more immersive and comprehensive experience, aiding to detect design and system clashes.
Innovative Building Materials	▸ Understanding of Innovative Building Materials and its applications is needed to lead the adoption of technologies across the sector.
3D Printing	▸ 3D Printing machines can create models to help users better understand the orientation and spacing of prototypes.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Facilities Management

As part of the study, the following technology trends were identified to impact Facilities Management in the following potential ways:

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Facilities Management**
Data Analytics & Artificial Intelligence	▸ Data Analytics will be used to gain insights on building operational and maintenance performance, indicating areas for improvement or remedy. ▸ In Germany, Real Estate and Facilities Management firm, Apleona, partnered with IBM to co-create cloud-based smart environments to adapt and cater to facility users' needs. The firm achieved this by processing and transferring existing real estate and facility management data across various platforms through technologies such as cloud, AI, data analytics and sensors. This innovative cloud-based solution has been increasingly adopted by international firms from other industries, e.g., technology, energy, and automation.
Digital Twin	▸ Facility Managers can monitor key performance indicators in real-time using Digital Twin models, allowing them to gather data to optimise maintenance activities and identify areas for improvement.
Modular Construction	▸ Awareness of modular construction techniques in the design and development of buildings will be required to factor in maintenance and floor space management.
Remote Monitoring	▸ Remote Monitoring tools (e.g. security and surveillance cameras) can be leveraged to monitor facilities activities in real-time and review facility incidents, e.g., security breaches.
Robots & Automation	▸ Mobile cleaning and security robots can clean and conduct security checks in facilities, reducing reliance on manpower. ▸ Facilities Management firms engaged in the study have shared that mobile robots have been deployed to perform security and cleaning services in facilities. ▸ In the USA, Robotics startup Viabot uses robots, named RUNO, to perform sweeping and security services automatically and throughout the year, providing support for facility maintenance services by alleviating the labour shortage and mitigating occupational hazard risks.
Virtual Reality / Augmented Reality	▸ VR/AR can provide visual information of the facility to be used for smart maintenance and repairs and virtual navigation of facilities

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.3 Applications of technology trends

Potential Application and Time Horizon for Facilities Management

As part of the study, the following technology trends were identified to impact Facilities Management in the following potential ways (cont'd):

Technology Trends Impacting the Functional Track	Applications of Technology Trends for **Facilities Management**
5G, Internet of Things (IoT) & Smart Buildings	▸ 5G, IoT & Smart Buildings can be leveraged as autonomous tools to monitor, control and improve facilities operations, e.g., heating, ventilation, air conditioning, lighting, security and other systems, maximising facility users' comfort while minimising energy consumption. ▸ Facilities Management firms engaged in the study shared that they have partnered Internet of Things (IoT) providers to install sensors across client facilities, to provide real-time data to the Digital Twin model that they can then leverage upon to identify issues, monitor collected data, and implement cost-effective operations.
BIM Technology	▸ Building data captured in BIM will be used to make better, data-driven decisions on the building's operation and maintenance.
Blockchain	▸ Blockchain enables faster processes and cost savings by eliminating the intermediaries in contracts and payments; changes and transactions are recorded in secure digital ledgers that all stakeholders have access to for transparency. ▸ Project collaterals and designs are also secure, along with records of activities, allowing stakeholders to have a source of factual truth in cases of dispute.
Robotics Process Automation (RPA)	▸ RPA can automate work required such as scheduling of facilities management activities, process utility billing, monitor utility consumption, create inventory, and manage security access. ▸ Invoicing and compiling of documents can be streamlined by using RPA to automatically access relevant data from various sources. ▸ Key project data can be automatically compiled by RPA from BIM Technology platforms.
Innovative Building Materials	▸ Innovative Building Materials may help to drive sustainability targets through reduced carbon emissions during construction or operations, and will affect building maintenance processes.

Legend
Technology trend is likely to impact in the...

- Short-term time horizon (Current to 2 years)
- Short to Medium-term time horizon
- Medium-term time horizon (2 to 5 years)
- Medium to Long-term time horizon
- Long-term time horizon (>5 years)

7.4 References

Consolidated List of References

1. Blackrock. (n.d.). What are megatrends? https://www.blackrock.com/sg/en/investment-ideas/themes/megatrends
2. Wee, R. (2021, May 18). Built environment sector anticipating greater digitalisation and collaboration. The Business Times. https://www.businesstimes.com.sg/government-economy/singapore-budget-2021/built-environment-sector-anticipating-greater
3. Hall, R. (2021, February 16). The construction industry's new priority: Greater technology adoption. AXA XL. https://axaxl.com/fast-fast-forward/articles/the-construction-industrys-new-priority_greater-tech-adoption
4. Hall, R. (2021, February 16). The construction industry's new priority: Greater technology adoption. AXA XL. https://axaxl.com/fast-fast-forward/articles/the-construction-industrys-new-priority_greater-tech-adoption
5. Building and Construction Authority. (2017, October 24). Construction ITM to pave the way for digital integration and better jobs [Press Release]. https://sgbc.sg/images/ITMPR2017.pdf
6. Building and Construction Authority. (2018, February 8). Transforming the real estate industry to be future-ready [Press Release]. https://www1.bca.gov.sg/docs/default-source/docs-corp-news-and-publications/media-releases/pr_reitm.pdf?sfvrsn=e040278d_2
7. San Francisco Office of Economic and Workforce Development. (n.d.). CityBuild Academy. https://oewd.org/citybuild-academy
8. Balfour Beatty. (n.d.). Further and faster: Closing the construction skills gap. https://balfourbeatty.com/how-we-work/public-policy/further-and-faster-closing-the-construction-skills-gap/
9. Chenoweth, H. (2017, June 14). How can districts attract millennials to work in facilities management. K12 Facilities Forum. https://info.k12facilitiesforum.com/blog/how-can-school-districts-attract-millennials-to-work-in-facilities-management
10. Institute of Workplace and Facilities Management. (2020). UK Government launches new resources for job seekers and employers affected by COVID-19. https://www.iwfm.org.uk/resource/uk-government-launches-new-resources-for-job-seekers-and-employers-affected-by-covid-19.html
11. ISS. (n.d.). Apprenticeship and dual studies. https://www.de.issworld.com/de-de/karriere/karrieremoeglichkeiten/ausbildung
12. Building and construction. (n.d.). London Skills and Development Network. https://lsdn.org.uk/courses/building-and-construction/
13. Trainings. (n.d.). New York City Accelerator. https://www1.nyc.gov/site/nycaccelerator/resources/trainings.page
14. Chambers and Partners. (2021, June 11). Construction law 2021. https://practiceguides.chambers.com/practice-guides/construction-law-2021/china/trends-and-developments
15. Federal buildings personnel training act program case study. (2018, August 1). Whole Building Design Guide. https://www.wbdg.org/continuing-education/workforce-development/fbpta-program
16. OECD environmental performance reviews: Denmark 2019. (n.d.). OECD iLibrary. https://www.oecd-ilibrary.org/sites/d1eaaba4-en/index.html?itemId=/content/component/d1eaaba4-en
17. OECD environmental performance reviews: Denmark 2019. (n.d.). OECD iLibrary. https://www.oecd-ilibrary.org/sites/d1eaaba4-en/index.html?itemId=/content/component/d1eaaba4-en
18. Willmott Dixon. (2022, January12). Willmott Dixon ramps up national upskilling programme. https://www.willmottdixon.co.uk/news/willmott-dixon-ramps-up-national-upskilling-programme-1
19. Jensen, P. A. Nielsen, K. & Nielsen, S. B. (2008). Facilities management best practice in the Nordic countries: 36 cases. Centre for Facilities Management—Realdania Research. https://backend.orbit.dtu.dk/ws/portalfiles/portal/247574835/BestPractice_UK_3_1K.pdf
20. Living Wage Foundation. (n.d.). What is the real living wage? https://www.livingwage.org.uk/what-real-living-wage
21. Labour Department Hong Kong. (2021, June 10). Statutory minimum wage. https://www.labour.gov.hk/eng/news/mwo.htm
22. Webster, F & Rosseau, S. (2020, December 3). Saudi Arabia to increase minimum wage, make labor reforms in 2021. Mercer Global. https://www.mercer.com/our-thinking/law-and-policy-group/saudi-arabia-to-increase-minimum-wage-make-labor-reforms-in-2021.html
23. Wood, M. (2016). The effect of immigrant labour on wages and price levels in the construction industry in Finland. Hanken School of Economics. https://helda.helsinki.fi/bitstream/handle/10138/166499/wood.pdf?sequence=3&isAllowed=y
24. Shepherd, L. (2022, September 28). California Law Will Require Pay Range in Job Ads. The Society for Human Resource Management. https://www.shrm.org/resourcesandtools/legal-and-compliance/state-and-local-updates/pages/california-pay-transparency.aspx
25. Smith, A. (2022, October 28). New York City Pay Transparency Law Takes Effect Nov. Society for Human Resource Management. https://www.shrm.org/resourcesandtools/legal-and-compliance/state-and-local-updates/pages/new-york-city-pay-transparency-law.aspx
26. OECD environmental performance reviews: Denmark 2019. (n.d.). OECD iLibrary. https://www.oecd-ilibrary.org/sites/d1eaaba4-en/index.html?itemId=/content/component/d1eaaba4-en
27. BuildUK. (2015). Action Plan 2015 http://builduk.org/wp-content/uploads/2015/08/Action-Plan-2015.pdf
28. Timewise. (n.d.). Construction's first industry-wide flexible working pilot finds wellbeing soars [Press Release]. https://timewise.co.uk/article/press-release-constructions-first-industry-wide-flexible-working-pilot-finds-wellbeing-soars
29. Who attends. (n.d.). New York Build Expo. https://www.newyorkbuildexpo.com/who-attends

7.4 References

Consolidated List of References

30. Reed, E. (2019, February 28). Bridging the skilled workforce gap to promote sustainable economic growth. Lendlease. https://www.lendlease.com/articles/2019/02/27/19/54/bridging-the-skilled-workforce/
31. Pareto FM. (n.d.). Pareto win hard services deal with Hearst UK. https://www.paretofm.com/single-post/pareto-win-hard-services-deal-with-hearst-uk
32. Hines. (n.d.). Women's network. https://www.hines.com/about/diversity-and-inclusion/womens-network
33. KIRA-digi. (n.d.). Objectives of KIRA-digi. http://www.kiradigi.fi/en/info/vision-and-objectives.html
34. RIB Software. (2019, March 13). The construction innovation and technology fund (CITF): An investment in the future of Hong Kong construction. https://www.itwocostx.com/company/blog/the-construction-innovation-and-technology-fund-citf-an-investment-in-the-future-of-hong-kong-construction/
35. Hong Kong Productivity Council. (2020). Construction innovation and technology fund (CITF). https://www.hkpc.org/sites/default/files/2020-10/mkt_citf_en.pdf
36. Morkos, R. (2021, December 14). To deliver the infrastructure boom, construction giants must open their doors to startups. Fortune. https://fortune.com/2021/12/14/deliver-infrastructure-biden-bill-boom-construction-startups-real-estate-technology-rene-morcos/
37. Morkos, R. (2021, December 14). To deliver the infrastructure boom, construction giants must open their doors to startups. Fortune. https://fortune.com/2021/12/14/deliver-infrastructure-biden-bill-boom-construction-startups-real-estate-technology-rene-morcos/
38. Basu, M. (2019, March 28). Why Finland issues 95% of building permits digitally. GovInsider. https://govinsider.asia/innovation/why-finland-issues-95-of-building-permits-digitally/
39. Solita. (n.d.). Building permits online. https://www.solita.fi/en/customers/building-permits-online/
40. Electronic construction and approval procedure (eBG). (n.d.). Berlin.de. https://www.berlin.de/ebg/
41. Ritter, N. & Beuthan, T. (2017, June 30). BIM law and regulation in Germany. CMS. https://cms.law/en/int/expert-guides/cms-expert-guide-to-building-information-modelling-bim/Germany
42. Slowey, K. (2016, April 7). Betting on BIM: Inside the UK's new construction technology mandate. Construction Dive. https://www.constructiondive.com/news/betting-on-bim-inside-the-uks-new-construction-technology-mandate/416952/
43. National Building Specification. (n.d.). Digital construction report 2021. http://www.thenbs.com/digital-construction-report-2021/
44. UiPath. (n.d.). Increasing efficiency, improving productivity and minimizing risk at Skanska. https://www.uipath.com/resources/automation-case-studies/skanska-construction-rpa
45. ViaBot provides facilities with automated outdoor maintenance. (2021, May 10). Facility Executive. https://facilityexecutive.com/2021/05/viabot-provides-facilities-with-automated-outdoor-maintenance/
46. Construction robot that could achieve 30% labor saving unveiled in Tokyo. (2018, April 19). The Mainichi. https://mainichi.jp/english/articles/20180419/p2a/00m/0na/022000c
47. BIM Construction Industry Council. (2019). Real practice of adopting BIM with integrated project delivery. https://www.bim.cic.hk/Upload/successful_project/11/file_1/ba7b5f930eca4db499fe39fa218d1b60.pdf
48. AS+P. (n.d.). Services. https://www.as-p.com/services/
49. BIM Construction Industry Council. (2019). Real practice of adopting BIM with integrated project delivery. https://www.bim.cic.hk/Upload/successful_project/11/file_1/ba7b5f930eca4db499fe39fa218d1b60.pdf
50. Ritter, N. & Beuthan, T. (2017, June 30). BIM law and regulation in Germany. CMS. https://cms.law/en/int/expert-guides/cms-expert-guide-to-building-information-modelling-bim/Germany
51. Beijing launces first 5G construction site with smart glasses and heart monitors. (2020, May 20). Global Construction Review. https://www.globalconstructionreview.com/beijing-launches-first-5g-construction-site-smart/
52. Infogrid raises $15.5m to make "any building smart". (2020, December 14). This Week in FM. https://www.twinfm.com/article/infogrid-raises-155m-to-make-any-building-smart
53. Polyteck. (n.d.). IoT remote monitoring solutions.https://www.polyteck.co.uk/development-regeneration/iot-remote-monitoring-solutions
54. Polyteck becomes first London FM company using cryptocurrency. (2021, July 27). This Week in FM. https://www.twinfm.com/article/polyteck-becomes-first-london-fm-company-using-cryptocurrency
55. Gammon Construction. (2018, January 16). Gammon's commitment in innovation earns industry recognition. https://www.gammonconstruction.com/en/articles.php?news_id=81
56. European Commission. (2020, June 9). European and Nordic support for first Finnish PPP financing for public schools [Press Release]. https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1026
57. Her Majesty's Government. (2018). Industrial strategy: Construction sector deal. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/731871/construction-sector-deal-print-single.pdf
58. Jensen, P. A. Nielsen, K. & Nielsen, S. B. (2008). Facilities management best practice in the Nordic countries: 36 cases. Centre for Facilities Management–Realdania Research. https://backend.orbit.dtu.dk/ws/portalfiles/portal/247574835/BestPractice_UK_3_1K.pdf
59. Jensen, P. A. Nielsen, K. & Nielsen, S. B. (2008). Facilities management best practice in the Nordic countries: 36 cases. Centre for Facilities Management–Realdania Research. https://backend.orbit.dtu.dk/ws/portalfiles/portal/247574835/BestPractice_UK_3_1K.pdf
60. Al Ramz partners with Watheeq Proptech to develop sustainable housing in Saudi Arabia. (2021, October 4). International Finance. https://internationalfinance.com/al-ramz-partners-with-watheeq-proptech-develop-sustainable-housing-saudi-arabia/

7.4 References

Consolidated List of References

61. Buildots' AI models piloted by Nordic construction giant NCC's Finnish operations in two Helsinki building projects. (2022, February 17). PR Newswire. https://www.prnewswire.com/il/news-releases/buildots-ai-models-piloted-by-nordic-construction-giant-nccs-finnish-operations-in-two-helsinki-building-projects-301484594.html
62. Buildots' AI models piloted by Nordic construction giant NCC's Finnish operations in two Helsinki building projects. (2022, February 17). PR Newswire. https://www.prnewswire.com/il/news-releases/buildots-ai-models-piloted-by-nordic-construction-giant-nccs-finnish-operations-in-two-helsinki-building-projects-301484594.html
63. ISS Singapore. (n.d.). Supplier relations. https://www.issworld.com/en/how-we-work/our-way-of-working/supplier-relations
64. ISS Singapore. (n.d.). Supplier relations https://www.issworld.com/en/how-we-work/our-way-of-working/supplier-relations
65. China green building and sustainable building. (n.d.). Alliance Experts. https://www.allianceexperts.com/en/knowledge/countries/asia/sustainable-building-in-china/
66. Dongtan eco-city in China designed by Arup. (2008, December 14). Design Build Network. https://www.designbuild-network.com/projects/dongtan-eco-city/
67. European Commission. (2017). European construction sector observatory: Improving the human capital basis. https://www.oneplanetnetwork.org/sites/default/files/from-crm/improving_the_human_capital_analytical_report.pdf
68. Construction Leadership Council. (2019). Future skills report. https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/CLC-Skills-Workstream_Future-Skills-Report_June-2019_A4-Print-Version.pdf
69. Construction Industry Training Board. (2022). Skills and training in the construction industry 2021. https://www.citb.co.uk/media/wnpb2l0k/citb-skills-and-training-report-2021.pdf
70. Building, Civil Engineering and Built Environment Training Board. (2020). Manpower update report: Building, civil engineering and built environment industries. https://vpet.vtc.edu.hk/wiki/images/5/50/2020_Building%2C_Civil_Engineering_and_Built_Environment_Manpower_Update_Report_2020_%28BCETB%29_Final.pdf
71. Building, Civil Engineering and Built Environment Training Board. (2020). Manpower update report: Building, civil engineering and built environment industries. https://vpet.vtc.edu.hk/wiki/images/5/50/2020_Building%2C_Civil_Engineering_and_Built_Environment_Manpower_Update_Report_2020_%28BCETB%29_Final.pdf
72. Building, Civil Engineering and Built Environment Training Board. (2020). Manpower update report: Building, civil engineering and built environment industries. https://vpet.vtc.edu.hk/wiki/images/5/50/2020_Building%2C_Civil_Engineering_and_Built_Environment_Manpower_Update_Report_2020_%28BCETB%29_Final.pdf
73. European Construction Sector Observatory. (2017). Improving the human capital basis. https://www.oneplanetnetwork.org/sites/default/files/from-crm/improving_the_human_capital_analytical_report.pdf
74. European Construction Sector Observatory. (2017). Improving the human capital basis. https://www.oneplanetnetwork.org/sites/default/files/from-crm/improving_the_human_capital_analytical_report.pdf
75. McKinsey & Company. (2017). Reinventing construction: A route to higher productivity. https://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-construction-A-route-to-higher-productivity-Full-report.pdf
76. Building and Construction Authority. (2022, June 16). BuildSG transformation fund. https://www1.bca.gov.sg/buildsg/buildsg-transformation-fund
77. Building and Construction Authority. (2022, March 10). Productivity innovation project. https://www1.bca.gov.sg/buildsg/buildsg-transformation-fund/productivity-innovation-project
78. Building and Construction Authority. (2021, May 28). Off-site construction special scheme (OCSS). https://www1.bca.gov.sg/buildsg/buildsg-transformation-fund/off-site-construction-special-scheme-ocss
79. Building and Construction Authority. (2022, March 10). Productivity solutions grant. https://www1.bca.gov.sg/buildsg/buildsg-transformation-fund/productivity-solutions-grant
80. Building and Construction Authority. (2021, August 16). Investment allowance scheme (IAS). https://www1.bca.gov.sg/buildsg/buildsg-transformation-fund/investment-allowance-scheme-ias
81. Terra SG. (2020, June). iBuildSG Club. https://www.terra.sg/ibuildsg
82. Ministry of Education. (2023, January 16). Sponsoring organisations. https://www.moe.gov.sg/sgis/sponsoring-organisations
83. Building and Construction Authority. (2019). iBuildSG Built Environment Formation Programme. https://www1.bca.gov.sg/public/students/ibuildsg-built-environment-formation-programme
84. Singapore Institute of Architects. (2022). Youth Architects League (YAL). https://sia.org.sg/young-architects-league-yal/
85. Workforce Singapore. (2021, April 1). Career Conversion Programmes (CCP) for Employers. https://www.wsg.gov.sg/programmes-and-initiatives/career-conversion-programmes-employers.html

7.4 References

Consolidated List of References

86. Workforce Singapore. (2020, December 3). SGUnited Mid-Career Pathways Programme for Mid-Career Individuals. https://www.wsg.gov.sg/programmes-and-initiatives/SGUnitedMidCareerPathways-Trainees.html
87. Workforce Singapore. (2020, December 3). Career Trials for Employers. https://www.wsg.gov.sg/programmes-and-initiatives/career-trial-employers.html
88. SkillsFuture Singapore. (2022). SkillsFuture Career Transition Programme. https://www.skillsfuture.gov.sg/sctp
89. Workforce Singapore. (2021, April 1). Career conversion programmes (CCP) for employers. https://www.wsg.gov.sg/programmes-and-initiatives/career-conversion-programmes-employers.html
90. Skillsfuture career transition programme. (2022, June 8). SkillsFuture Singapore. https://www.skillsfuture.gov.sg/sctp
91. Building and Construction Authority. (n.d.). Young Leaders Programme. https://www1.bca.gov.sg/buildsg/leadership-initiatives/young-leaders-programme
92. Workforce Singapore. (n.d.). Capability Transfer Programme. https://www.wsg.gov.sg/programmes-and-initiatives/capability-transfer-programme.html
93. Institute for Human Resource Professionals. (n.d.). IHRP HCDT. https://www.ihrp.sg/hcdt/
94. Workforce Singapore. (n.d.). Support for Job Redesign under Productivity Solutions Grant (PSG-JR). https://www.wsg.gov.sg/productivity-solutions-grant-job-redesign.html
95. Enterprise for Jobs & Skills. (n.d.). SkillsFuture Queen Bee Networks. https://www.enterprisejobskills.gov.sg/content/upgrade-skills/skillsfuture-queen-bee-networks.html
96. NTUC Learning Hub. (n.d.). Company Training Committees (CTCs). https://www.ntuclearninghub.com/company-training-committees-ctcs

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