

CONSTRUCTION AND FACILITIES MANAGEMENT | INDUSTRY DIGITAL PLAN

A guide for enterprises to assess their digital readiness and opportunities to go digital, and acquire solutions to enable plugging into Integrated Digital Delivery (IDD).



An initiative by:



Sector lead:



In collaboration with:



Supported by:



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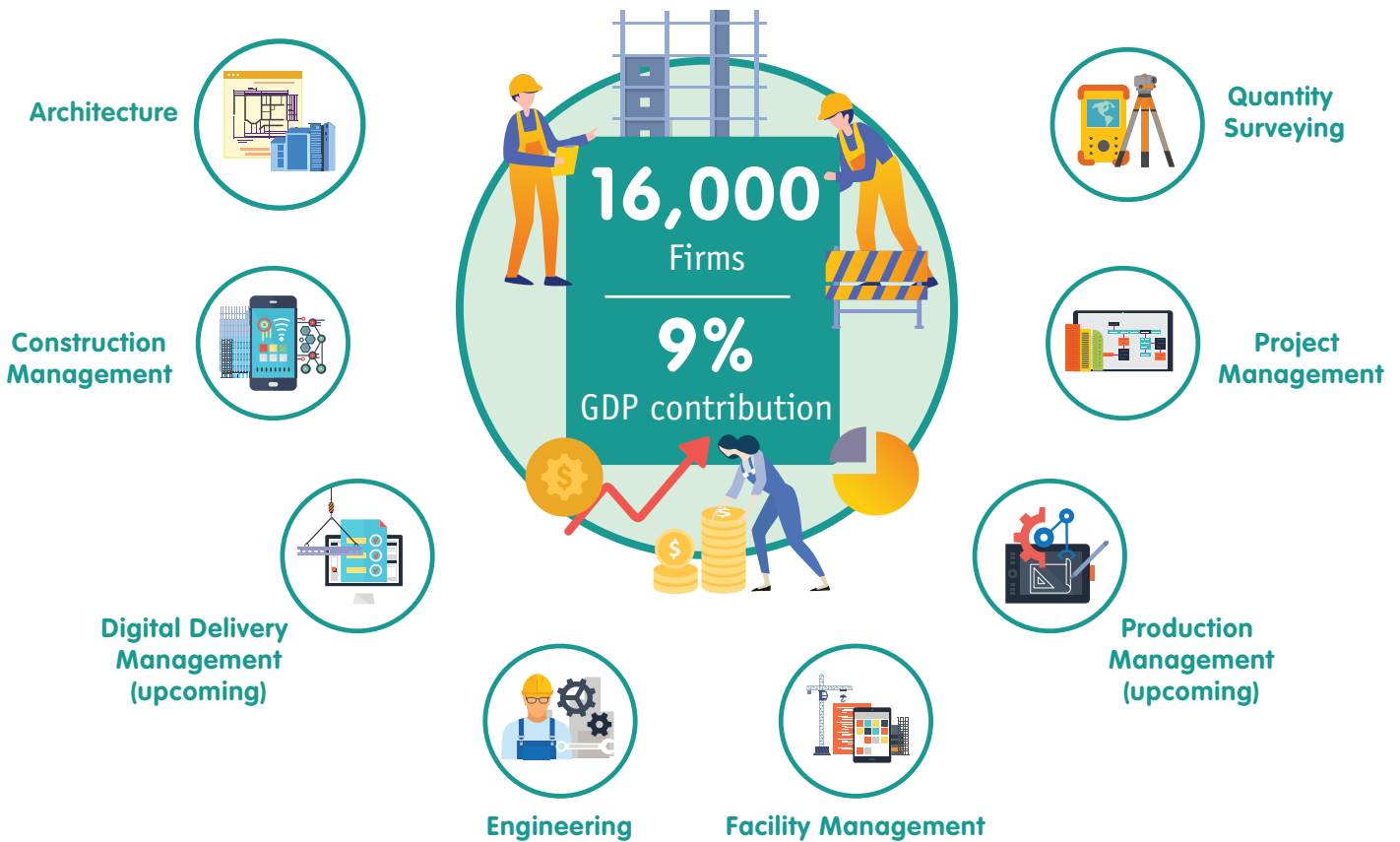
ADDITIONAL INFORMATION



01

OUR CONSTRUCTION AND FACILITIES MANAGEMENT SECTOR

The Construction and Facilities Management Sector is an important pillar of Singapore's economy, building safe, sustainable and progressive environments to live, work and play in, contributing to a better quality of life for Singaporeans.



THE BUILDING AND CONSTRUCTION LIFE-CYCLE

Streamlining work processes and connecting stakeholders through digital data, innovation and technology across the whole project life-cycle from design, fabrication, construction to facilities management to deliver a better outcome for end users.

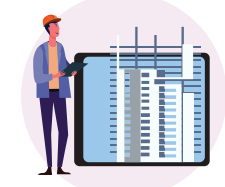
Digital Design

Engaging stakeholders to achieve optimised and coordinated design that meets client's, regulatory and downstream requirements.



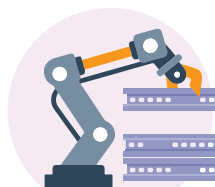
Digital Asset Delivery & Management

Real-time monitoring for operations and maintenance to enhance asset values.



Digital Fabrication

Translating design to standardised components for automating off-site production.



Digital Construction

Just-in-time delivery, installation and monitoring of on-site activities to maximise productivity and minimise rework.



02 TRENDS IMPACTING CONSTRUCTION AND FACILITIES MANAGEMENT SECTOR



Increasing gap in digital skills and capabilities

prevailing among the various stakeholders in the labour intensive construction ecosystem, causing delays and abortive works.



Low degree of collaboration and alignment of construction information

among the various stakeholders through the different stages of project implementation.



Lack of shared platforms and standards

to fully integrate various parties involved in building projects, resulting in most work done on-site.

INDUSTRY TRANSFORMATION MAP

The Construction Industry Transformation Map (ITM) launched in 2017 envisions creating an advanced and integrated sector with widespread adoption of leading technologies, led by progressive and collaborative firms well-poised to capture business opportunities, and supported by a skilled and competent workforce offering good jobs for Singaporeans.

To achieve this vision, the key strategies are to:

- (i) increase adoption of Design for Manufacturing and Assembly (DfMA) and Integrated Digital Delivery (IDD);
- (ii) build progressive and collaborative firms; and
- (iii) support workforce needs and aspirations.



Click [here](#) or scan this QR code for more details on the Construction ITM

03 SMES GO DIGITAL

Aligned to the Industry Transformation Map (ITM), the Industry Digital Plan (IDP) is part of the SMEs Go Digital Programme that helps to make going digital simple for SMEs.

SG:D | SMEs GO DIGITAL

3 STEPS TO GO DIGITAL



For more information

Scan the QR code or visit
www.imda.gov.sg/SMEsGoDigital

Support available

- Consultancy Services (SME Digital Tech Hub)
- Pre-Approved Solutions
- Start Digital Pack
- Digital Project Management Services
- Government Grants (e.g. Productivity Solutions Grant (PSG); SkillsFuture Enterprise Credit (SFEC))

1

Is your business digital-ready?

Find out using the Industry Digital Plan (IDP) for your sector.

2

How do you get started?

Take up pre-approved solutions with grant support.

3

Where can you get help?

Contact the nearest SME Centre for support.

SMEs Go Digital comprises the following:

Industry Digital Plan (IDP)

Guide on digital solutions and training required for each stage of your business growth.

Pre-Approved Solutions

Proven SME-friendly digital solutions pre-approved by IMDA to meet your business needs. Government grants such as Productivity Solutions Grant (PSG) are available for the adoption of these solutions.

Start Digital Pack

Foundational digital solutions for new SMEs, to help you get a head start in going digital.

Consultancy Services (SME Digital Tech Hub)

Expert advice you can tap on, to transform your business using digital technologies.

Digital Project Management Services

Project managers with expertise to support you in implementing the digital solutions.

04 DIGITAL ROADMAP

This digital roadmap serves as a guide for you to follow on your digital journey.

STAGE 01	STAGE 02	STAGE 03
GETTING DIGITAL ECONOMY READY Uplifted Digital Capabilities, Optimised Operations	GROWING IN THE DIGITAL ECONOMY Integrated Ecosystem, Streamlined Processes	LEAPING AHEAD Intelligent Business, Autonomous Operations
 3D Modelling, Immersive Visualisation and Analysis	 BIM for Asset Delivery/Facilities Management	 Blockchain for Progress Verification
 Building Information Modelling (BIM)-to-Field (Hardware/Software)	 Built Environment Digital Platform	 Data and Artificial Intelligence (AI)-driven Decision Support System
 Coordination Tools and Collaboration Platform		
 Digital Wearables for Workers' Health and Safety	 Computational Design	 Intelligent National Productivity and Quality Specification (iNPQS)
 e-Permit-to-work (e-PTW)		
 Facilities Management Workflow Automation (e.g. Smart Access, Energy Management and Smart Metering, Mobile Inspection, Digital Signage)	 Coordinated Regulatory Approvals and Rule-based Model Checker	 Robotics for Autonomous Construction and Facilities Management
 Quantity Surveying and Valuation		
 Site/Yard Management	 Integrated and Smart Worksite Monitoring and Inspection	
BUSINESS CAPABILITIES Accounting Management, Human Resource Management, Customer Relationship Management, Sales Management, Inventory Management, Fleet Management and Cybersecurity		




Note: This roadmap will be updated over time as digitalisation of the industry progresses and new technologies are introduced to the industry.

STAGE 01

GETTING DIGITAL ECONOMY READY

Uplifted Digital Capabilities, Optimised Operations

Build core digital competencies and acquire digital solutions.

SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 <p>3D Modelling, Immersive Visualisation and Analysis</p>	<p>Create 2D/3D models from initial concept to final documentation for construction.</p> <p>Render cinematic-quality models for architectural visualisation.</p> <p>Design sustainable and efficient buildings with advanced simulation engines and insights on building performance.</p>	<ul style="list-style-type: none"> • Enable effective presentation of projects to clients by communicating project benefits through 3D photo-realistic visualisation. • Save documentation time and efforts involved in design stage. • Speed up design process and contribute to minimising waste from early stage. • Provide actionable insights through early diagnosis at design stage.
 <p>BIM-to-Field (Hardware/Software)</p>	<p>Perform reality captures to accurately record site information for better area visualisation, and to auto-assemble point cloud for integration with BIM model.</p>	<ul style="list-style-type: none"> • Provide better area visualisation and facilitate informed decision-making before work starts on-site.
 <p>Coordination Tools and Collaboration Platform</p>	<p>Enable different construction disciplines (Architects, Engineers, Contractors etc.) to collaborate on the same BIM project, across the design, construction and operation phases.</p>	<ul style="list-style-type: none"> • Reduce reworks and improve productivity. • Reduce conflicts and changes during construction. • Reduce risks of using outdated information. • Track issues and allow project members to communicate accountability for corrective actions. • Address challenges in real-time throughout project life-cycle.

STAGE 01

GETTING DIGITAL ECONOMY READY

Uplifted Digital Capabilities, Optimised Operations

Build core digital competencies and acquire digital solutions.



SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 <p>Digital Wearables for Workers' Health and Safety</p>	<p>Track critical health and safety information such as human fatigue and stress, heat stress and ergonomic risks so as to alert affected parties accordingly to avoid safety incidents.</p>	<ul style="list-style-type: none"> • Address safety issues in the workplace and health condition of the workers that may impact safety. • Track data and remind workers and supervisors through audio and visual alerts.
 <p>e-Permit-to-work (e-PTW)</p>	<p>Submit, track and monitor PTW applications for high risk activities digitally via a centralised system.</p>	<ul style="list-style-type: none"> • Enhance productivity through reduced paperwork and waiting time. • Increase accountability by tracking approval of PTW applications in real-time. • Increase ease of access and visibility of permits through auto-generation of dashboards and reports. • Enhance detection of potential incompatible works.
 <p>Facilities Management Workflow Automation (e.g. Smart Access, Energy Management and Smart Metering, Mobile Inspection, Digital Signage)</p>	<p>Automate the creation, tracking, logging and/or closing of incidents upon triggers by sensors/humans; to provide for reporting, document management, tracking of energy consumption, and resource management; and to provide display of real-time content.</p>	<ul style="list-style-type: none"> • Reduce turnaround time with streamlined workflow process. • Automate incident reporting and track with single point operator.

STAGE 01

GETTING DIGITAL ECONOMY READY

Uplifted Digital Capabilities, Optimised Operations

Build core digital competencies and acquire digital solutions.




SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 Quantity Surveying and Valuation	Automate take-off based on BIM for accurate quantity and cost estimation.	<ul style="list-style-type: none">• Provide fast, effective and efficient quantity take-off and cost estimation.• Produce reliable quantities and competitive cost estimates.• Improve cost database management to reduce information loss.
 Site/Yard Management	<p>Plan and manage site activities using BIM model and digital layouts.</p> <p>Manage material and equipment on construction sites and monitor the production quality and progress.</p>	<ul style="list-style-type: none">• Reduce paperwork on-site and during project operations.• Boost productivity and streamline site processes.

STAGE 02

GROWING IN THE DIGITAL ECONOMY

Integrated Ecosystem, Streamlined Processes

Integrate and streamline key processes along the value chain.

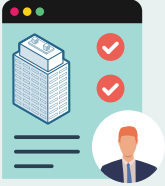

SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 <p>BIM for Asset Delivery/ Facilities Management</p>	<p>Manage defect resolution during handover and maintenance, and support building and maintenance operations.</p>	<ul style="list-style-type: none"> • Systematise manual inspection of assets and facilities through automation, resulting in more reliable inspection reports. • Provide capabilities for preventive maintenance.
 <p>Built Environment Digital Platform</p>	<p>Facilitate data sharing in different formats among project partners over the project life-cycle to coordinate their work activities, monitor issue resolutions and smoothen project delivery. It also allows project partners access to an ecosystem of suppliers to source for the right materials.</p>	<ul style="list-style-type: none"> • Gain access to timely information. • Resolve errors in a timely manner. • Reduce reworks and delays • Source from a wider range of materials. • Improve overall project performance.
 <p>Computational Design</p>	<p>Explore creative and alternative design scenarios, and automate the adaptation of building configuration changes through parametric design, relationship modelling, and computing logic.</p>	<ul style="list-style-type: none"> • Explore more design choices leading to desired solutions for productivity gains. • Automate repetitive tasks to speed up design process.

STAGE 02

GROWING IN THE DIGITAL ECONOMY

Integrated Ecosystem, Streamlined Processes

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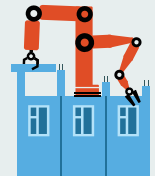
SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 Coordinated Regulatory Approvals and Rule-based Model Checker	Verify model quality and code compliance via an automated model checker prior to coordinated submission for regulatory approval.	<ul style="list-style-type: none">• Improve design and BIM quality through automated checking.• Streamline regulatory submission and approval process.
 Integrated and Smart Worksite Monitoring and Inspection	<p>Provide real-time digital monitoring and insights to project health in a connected digital environment for various site solutions and technologies.</p> <p>Monitor on-site activities such as through sensors and video analytics to provide alerts to potential safety and health risks including those posed by vehicles/machines, fatigue, noise, dust, heat and working at height.</p>	<ul style="list-style-type: none">• Centralise site data, progress, and inspections.• Analyse data and create dashboards to drive decision making.• Provide real-time identification of worksite hazards.• Improve safety and health of workers.

STAGE 03

LEAPING AHEAD



Intelligent Business, Autonomous Operations

Enable forward-thinking Large Local Enterprises (LLEs) and their key SMEs partners to venture overseas.

SOLUTION CATEGORY	DESCRIPTION	BENEFITS
 <p>Blockchain for Progress Verification</p>	Record construction progress efficiently and in a verifiable and permanent way.	<ul style="list-style-type: none"> • Increase security as approved transactions are encrypted and stored across a network of computers. • Reduce cost as there is no need for middlemen.
 <p>Data and AI-driven Decision Support System</p>	Increase project predictability and performance through cumulative data collection, machine learning, and artificial intelligence.	<ul style="list-style-type: none"> • Mitigate risks in construction predictably. • Improve cost, schedule, and resource planning and forecasts.
 <p>Intelligent National Productivity and Quality Specification (iNPQS)</p>	Allow user to compose specifications that can be linked to the BIM model.	<ul style="list-style-type: none"> • Improve productivity through integration of BIM with common specifications for architectural and engineering works. • Ensure traceability of requirements. • Able to link with latest products, and local and international standards.
 <p>Robotics for Autonomous Construction and Facilities Management</p>	<p>Undertake strenuous and repetitive works such as brick stacking, painting and cleaning.</p> <p>Greet visitors and help them with navigation information.</p>	<ul style="list-style-type: none"> • Reduce repetitive and laborious tasks done by human and free them up to spend time on higher value tasks. • Reduce number of workplace accidents.

05 DIGITAL SKILLS NEEDED

Digital skills are required for all construction and facilities management job roles to varying levels of proficiency. All job roles may require upskilling to support your digitalisation journey.

ALL PROJECT TEAM MEMBERS	TEAM MEMBERS WHO ARE ADVANCED USERS
TECH BASIC COURSES Broad-Based Integrated Digital Delivery (IDD) Understanding and Awareness Vendor-Specific Solutions Training	TECH ADVANCED COURSES Higher Proficiency Digital Skills to perform tasks in Integrated Digital Delivery (IDD) projects at various stages
	
JOB ROLES (EXAMPLES)	
ARCHITECT, ENGINEER, QUANTITY SURVEYOR, CONSTRUCTION MANAGER, PROJECT MANAGER, FACILITIES MANAGER	
UPCOMING: PRODUCTION MANAGEMENT, SPECIALIST (DIGITAL DELIVERY)	

DIGITAL ROADMAP ON TRAINING

	STAGE 01 GETTING DIGITAL ECONOMY READY	STAGE 02 GROWING IN THE DIGITAL ECONOMY	STAGE 03 LEAPING AHEAD
TECH BASIC COURSES	<ul style="list-style-type: none"> • SkillsFuture for Digital Workplace • Introduction to Construction Industry Transformation Map (ITM) and Integrated Digital Delivery (IDD) • Understanding Building Information Modelling (BIM) Data and Modelling 	<ul style="list-style-type: none"> • Overview – Integrated Digital Delivery (IDD) Concepts and Project Framework • Understanding Project Collaboration • Understanding Construction Site Management 	<ul style="list-style-type: none"> • Understanding Digital Design for Manufacturing and Assembly (DfMA) • Understanding Virtual Construction • Basics to Smart Facilities Management (FM)
	VENDOR-SPECIFIC SOLUTIONS TRAINING		
TECH ADVANCED COURSES	<ul style="list-style-type: none"> • Basic Building Information Modelling • Intermediate Building Information Modelling (Coordination & Documentation) • Advanced Building Information Modelling (Computational) 	<ul style="list-style-type: none"> • Integrated Digital Delivery (IDD) Project Planning and Execution 	<ul style="list-style-type: none"> • Integrated Digital Delivery (IDD) Application and Development • Data Analytics and Machine Learning • Internet of Things

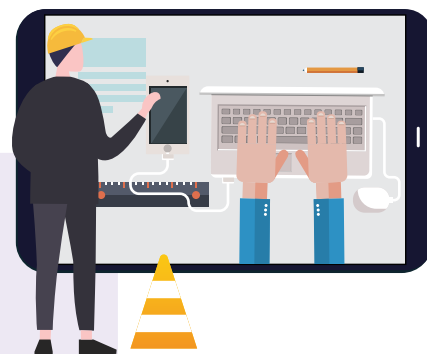
Please visit BCA Academy, <https://bcaa.edu.sg/idd> and Singapore Polytechnic, <https://www.sp.edu.sg/pace/construction-and-facilities-mgt-idd-idp> for details.

06 GET STARTED TODAY

You will be supported at every stage of your digital journey, through three simple steps:

1 Is your business digital-ready?

Find out if you are digital ready by using the IDP resources [here](#) or scan the QR code.



2 How do you get started?

Visit the [Tech Depot](#) website to contact solution providers to purchase and implement digital solutions. If funding support is required, apply for Productivity Solutions Grant (PSG). You can also apply for training subsidies under [SkillsFuture Enterprise Credit \(SFEC\)](#).



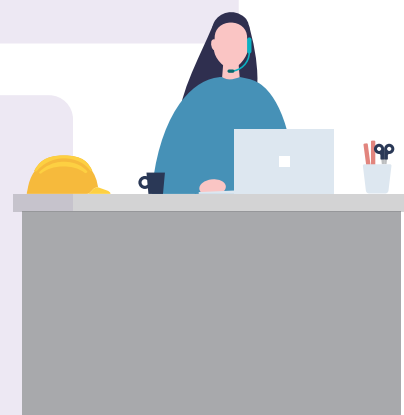
Tech Depot



SFEC

3 Where can you get help?

- Make an appointment with a Business Advisor at your nearest SME Centre for digital advice, or be referred to the Principal Consultants at SME Digital Tech Hub for more advanced digital needs.
- Contact [Singapore Manufacturing Federation \(SMF\)](#) for digital project managers who can help you implement your digital solutions.



07 FOR MORE INFORMATION

FOR SMEs

DIGITAL SOLUTIONS

SMEs Go Digital

<https://www.imda.gov.sg/SMEsGoDigital>

Tech Depot

<https://www.smeportal.sg/content/tech-depot/en/tech-solutions.html>

BE SAFE ONLINE HANDBOOK

https://www.csa.gov.sg/~media/csa/documents/publications/be_safe_online/be_safe_online_handbook.pdf

BUSINESS ADVISORY & DIGITAL CONSULTANCY

SME Centres managed by Trade Associations

- Association of Small and Medium Enterprises (ASME)
- Singapore Chinese Chamber of Commerce & Industry (SCCCI)
- Singapore Indian Chamber of Commerce & Industry (SICCI)
- Singapore Malay Chamber of Commerce & Industry (SMCCI)
- Singapore Manufacturing Federation (SMF)

<https://www.enterprisesg.gov.sg/contact-info/overview>
Enterprise Infoline: +65 6898 1800

SME Digital Tech Hub

<http://www.digitaltechhub.sg>

Digital Project Management Services

<http://www.smfederation.org.sg/capability-capacity-development/project-management-services>

INDUSTRY STAKEHOLDERS

Association of Consulting Engineers Singapore

<http://aces.org.sg/>

Building Construction And Timber Industries Employees' Union

<http://www.batu.org.sg/>

Real Estate Developers' Association of Singapore

<http://www.redas.com/>

Singapore Green Building Council

<https://www.sgbc.sg/>

Singapore Institute of Architects

<https://sia.org.sg/>

Singapore Institute of Surveyors and Valuers

<http://www.sisv.org.sg/>

Singapore International Facility Management Association

<http://wgs1.net/ifma-sg/>

Specialists Trade Alliance of Singapore

<http://stas.org.sg/>

The Institution of Engineers, Singapore

<https://www.ies.org.sg/>

The Singapore Contractors Association Ltd

<https://www.scal.com.sg/>

FOR INDIVIDUALS

CAPABILITY UPGRADING

BCA Academy

<https://bcaa.edu.sg/idd>

Singapore Polytechnic

<https://www.sp.edu.sg/pace/construction-and-facilities-mgt-idd-idp>

SCAL Academy

<http://www.scal-academy.com.sg/>

Course Directory

<http://www.skillsfuture.sg/credit>

Fundamentals for Future Economy

<http://www.skillsfuture.sg/digitalworkplace>

SkillsFuture Series

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

CAREER FACILITATION

WSG's Careers Connect

<http://www.wsg.gov.sg/career-services.html>

e2i Centres

<http://e2i.com.sg/app/>

FOR ICM VENDORS

SMEs Go Digital

<https://www.imda.gov.sg/SMEsGoDigital>



imda.gov.sg
bca.gov.sg



twitter.com/IMDAsg



facebook.com/IMDAsg
facebook.com/BCASingapore



youtube.com/IMDAsg
youtube.com/BCASingapore



linkedin.com/company/IMDAsg
linkedin.com/company/BCASingapore



instagram.com/IMDAsg
instagram.com/BCASingapore