FACTSHEET ON CONSTRUCTION AND FACILITIES MANAGEMENT

INDUSTRY DIGITAL PLAN

Background

1. The Construction and Facilities Management (FM) Sector is a key pillar of Singapore's economy, contributing 9% of the nation's Gross Domestic Product (GDP) and supported by 16,000 enterprises. The building life-cycle comprises four segments, namely: Design, Fabrication, Construction and Asset Delivery & Management.

2. Building and construction projects often involve many different parties – developers, consultants, builders, sub-contractors, suppliers and facility managers. There is a need for timely access to information to ensure closer coordination and collaboration among the many industry stakeholders across the building life-cycle and ecosystem. Digital technology thus plays an important role in ensuring that correct and consistent information is readily available, which helps streamline processes, and reduce rework arising from mistakes and increase safety. Many of these industry stakeholders are small and medium-sized enterprises (SMEs), which would benefit from access to timely information through the adoption of digital technology.

3. The Construction and FM Industry Digital Plan (IDP) [1] is part of the SMEs Go Digital programme that is designed to help SMEs go digital.

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[1] www.go.gov.sg/imda-construction-idp

4. Under the IDP, we will set aside $19 million in funding (under the Productivity Solutions Grant (PSG) of the BuildSG Transformation Fund (BTF)) until January 2023 to support SMEs[2] to defray costs for adoption of pre-approved solutions that enhances productivity. SMEs can access ESG's online centralised portal, Tech Depot, to access the list of pre-approved digital solutions and to apply for funding to adopt these solutions at the Business Grants Portal. The funding will cover up to 70% of the qualifying cost. Firms can make multiple applications until January 2023, subject to a funding cap of $30,000 per firm.[3]

5. The IDP provides enterprises with a step-by-step guide on the digital solutions and necessary skills to adopt at each stage of their growth. The IDP will be updated progressively as newer technologies are introduced and are adopted by the industry.

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[2] To qualify for the grant, the applicant must meet the following criteria: (i) the applicant must be registered in Singapore; (ii) have > 30% local shareholding ownership; and (iii) have annual sales turnover $\leq$ S$100 million or staff strength of $\leq$ 200 employees. The applicant must also have its primary and/or secondary business activity in the Construction and FM-related sub-sectors according to the Singapore Standard Industrial Classification (SSIC) code. Their purchase/subscription of the IT solution must be solely for use in Singapore (i.e. not for the use of another party or the applicant's overseas entities).

[3] Firms will not be allowed to apply for the same pre-approved solution more than once within the funding period. The list of pre-approved solutions under the IDP will be updated as newer technologies are introduced over time.

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 AI-driven Decision Support System**
Coordination Tools and Collaboration Platform	**Computational Design**	**Intelligent National Productivity and Quality Specification (iNPQS)**
Digital Wearables for Workers' Health and Safety	**Coordinated Regulatory Approvals and Rule-based Model Checker**	**Robotics for Autonomous Construction and Facilities Management**
e-Permit-to-work (e-PTW)	**Integrated and Smart Worksite Monitoring and Inspection**	
Facilities Management Workflow Automation (e.g. Smart Access, Energy Management and Smart Metering, Mobile Inspection, Digital Signage)		
Quantity Surveying and Valuation		
Site/Yard Management		

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 1: Getting Digital Economy Ready.** Digital solutions listed in stage 1 will enable SMEs to build their core digital competencies and optimise operations[4]. These digital solutions are important building blocks to enable enterprises to begin their Integrated Digital Delivery[5] (IDD) journey

- **Stage 2: Growing in the Digital Economy.** The second stage emphasises the need to be part of an integrated ecosystem, so that enterprises can grow with their peers in the digital economy. This stage highlights the importance of IDD for construction enterprises to integrate and streamline key processes along the value chain.

- **Stage 3: Leaping Ahead.** The third stage enables enterprises to implement advanced digital technologies to strengthen their competitive edge, and enable them to venture into overseas markets and influence their SME partners to uplift their digital capabilities. This will also allow them to plug in to the IDD.

6.   The IDP also includes a Digital Roadmap on Training to ensure that the industry's workforce is adequately prepared with the necessary skills and knowledge to adopt digital solutions and is ready for changes that come with digital transformation.

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[4] These include digital modeling, visualisation, analysis, quantity surveying and valuation, site and yard management, asset management and facilities management for SMEs.
[5] IDD aims to connect various industry parties involved in building and construction projects over the entire building life-cycle through digital information and technology.

DIGITAL ROADMAP ON TRAINING

	STAGE 01 GETTING DIGITAL ECONOMY READY	STAGE 02 GROWING IN THE DIGITAL ECONOMY	STAGE 03 LEAPING AHEAD
TECH BASIC COURSES	• SkillsFuture for Digital Workplace • Introduction to Construction Industry Transformation Map (ITM) and Integrated Digital Delivery (IDD) • Understanding Building Information Modelling (BIM) Data and Modelling	• Overview – Integrated Digital Delivery (IDD) Concepts and Project Framework • Understanding Project Collaboration • Understanding Construction Site Management	• Understanding Digital Design for Manufacturing and Assembly (DfMA) • Understanding Virtual Construction • Basics to Smart Facilities Management (FM)
	VENDOR-SPECIFIC SOLUTIONS TRAINING		
TECH ADVANCED COURSES	• Basic Building Information Modelling • Intermediate Building Information Modelling (Coordination & Documentation) • Advanced Building Information Modelling (Computational)	• Integrated Digital Delivery (IDD) Project Planning and Execution	• 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.

7.   The sector-specific IDPs are central to the SMEs Go Digital programme[6], which comprises the following:

- **Consultancy Services**
  For a more comprehensive review of their business, SMEs can approach Business Advisors at their nearest **SME Centre**[7] for business diagnosis and advisory on digital solutions relevant to their operations. SMEs that require specialist consultancy on sophisticated technologies, such as data analytics and cybersecurity, will be referred to the Principal Consultants at the **SME Digital Tech Hub**[8]. These digital consultancy services are provided at no cost to SMEs.

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[6] www.imda.gov.sg/SMEsGoDigital
[7] List of SME Centres can be found: https://www.enterprisesg.gov.sg/contact/overview
[8] www.digitaltechhub.sg

- **Digital Project Management Services**
  SMEs can also engage **Digital Project Management Services**[9] to support them in the implementation of digital solutions. The project managers can help with business processes re-engineering and job redesign to get the maximum benefits and have more sustainable outcomes from going digital.

- **Pre-approved Solutions**
  SMEs looking to build core digital competencies and optimise operations can choose from the list of pre-approved solutions on Tech Depot and receive grant support for eligible projects. Tech Depot is a one-stop, centralised platform aimed at improving SMEs' access to technology and digital solutions. SMEs can visit www.smeportal.sg/techdepot for more information.

- **Start Digital**
  For SMEs that are just starting their business or are new to digital technology, they can take up a Start Digital Pack[10] to start their business right with foundational and competitively-priced digital solutions. New SMEs can take up any two solutions free for at least six months with a minimum 18-month contract period from five categories: Accounting, Human Resources Management & Payroll, Digital Marketing, Digital Transactions and Cybersecurity. The solutions are pre-approved by IMDA and offered by Start Digital Partners like DBS, M1, Maybank, OCBC, Singtel, StarHub and UOB.

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[9] Digital Project Management Services can be accessed: http://www.smfederation.org.sg/capability-capacity-development/project-management-services
[10] www.imda.gov.sg/StartDigital

SME Feature - Guan Ho Construction Co Pte Ltd

1. Guan Ho is one of Singapore's pioneers in the construction industry, with over 60 years of experience. Guan Ho was conferred the BCA Award in various categories for the past years. Some of the latest awards include the BCA Construction Excellence Award (Merit) for Kindergarten Package II, BCA Green and Gracious Builder Award (Excellent) and BCA Construction Excellence Award (Excellence) for Nanyang Primary School and West Spring Primary School.

Featured IDD project - Punggol Town Hub

2. Guan Ho is the main contractor for the construction of the Punggol Town Hub, an integrated hub that boasts a hawker centre and a library, among other amenities. Adopting Integrated Digital Delivery (IDD) for the entire building process, Guan Ho has utilised various technologies to enhance coordination and productivity.

3. The Punggol Town Hub is also one of the first 12 demonstration projects announced during the launch of BCA's IDD Implementation Plan in Nov 2018, and the first IDD project for both the developer, the People's Association, and Guan Ho.

Digital Project Management Information System

4.   Guan Ho deployed Virtual Reality (VR) technology during the project to enable real time rendering of designs to enhance stakeholders' interaction. The use of Building Information Modelling (BIM) meant the team could check the interfacing connection between the structural steel beams and precast columns in 3D instead of looking at it in 2D drawings.


5.   Drones were used to capture real-time aerial images of the construction site, which allowed the team to monitor progress easily during the actual construction stage. Compared to 18.5 manhours required for traditional site walks, there is time savings of approximately 33% when drones are used.
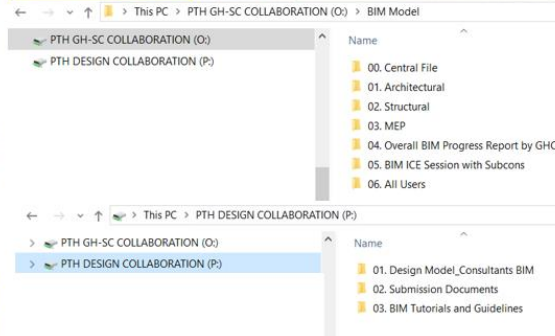
6.   Guan Ho adopted cloud-based collaboration to enjoy real-time information sharing on the project data, which greatly enhanced project coordination, execution and validation. The company estimates up to 20% time savings

through cloud-based collaboration, compared to 14.6 manhours used in conventional 2D drawings as a result of improved communication and collaboration among stakeholders, which also facilitated more informed decision-making.

Logistics Tracking Platform for Structural Steel and Precast Elements
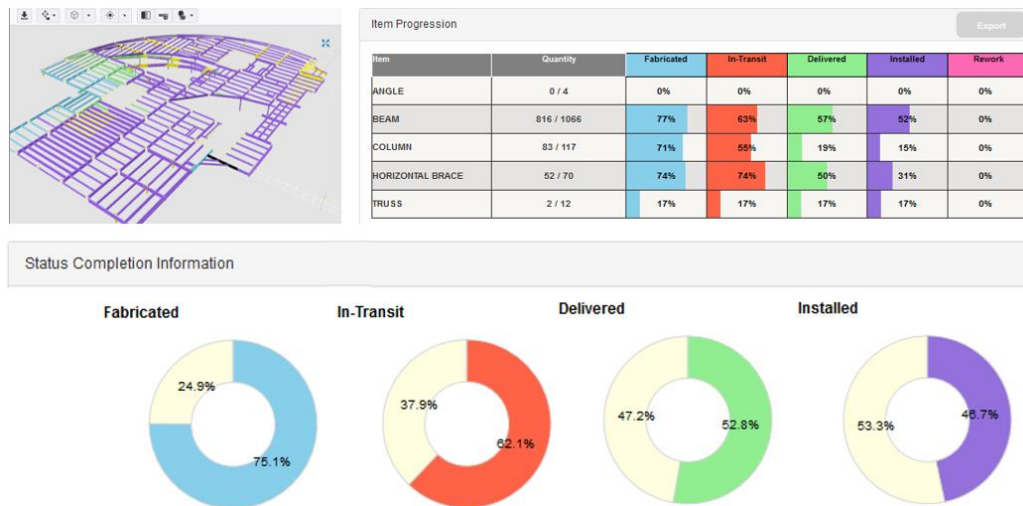
7.   Guan Ho worked closely with their structural steel fabricator Kong Hwee Iron Works and precaster Eastern Pretech to set up a logistics tracking platform for structural elements such as precast columns and structural steel beams. The use of live tracking of the prefabricated components through QR codes enhanced logistic processes including more efficient inventory control during fabrication, efficient allocation of space for materials on-site, and monitoring of structural elements delivery to reduce the risk of delay during the construction process.

8.   The quality and defects validation status of the component was also recorded, thus enabling Guan Ho to have a better gauge of the number of components that can leave the plant, reducing the need for site storage and achieving just-in-time delivery for installation on the building. Thus, achieving 23% time savings from this digitalised inventory control, as compared to 266 manhours using manual report.

Digital Safety Management System
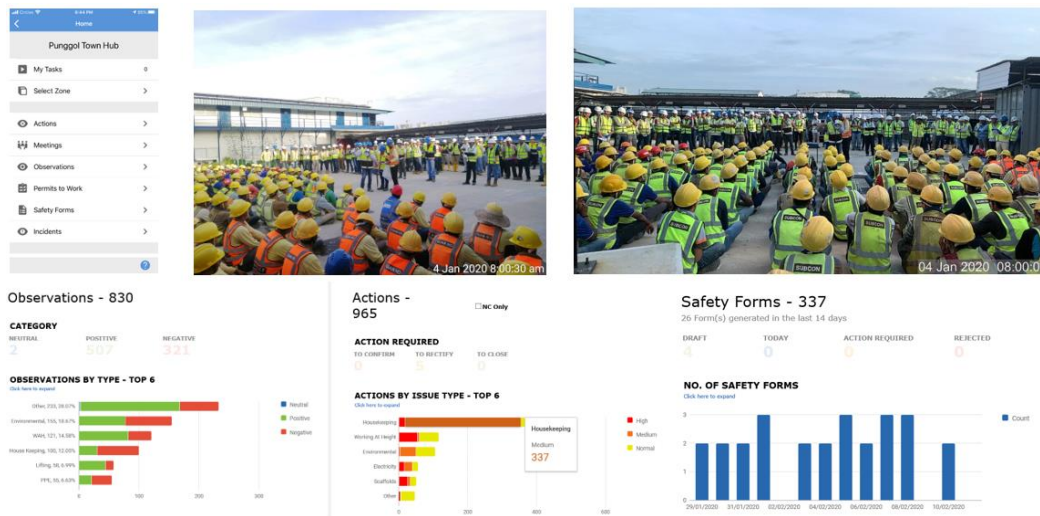
9. The system facilitates real-time reporting, tracking and follow-up of safety issue on site. In addition, Guan Ho also used an advanced rendering software to help safety supervisors to identify safety hazards through 3D visualization.

10. Guan Ho enjoyed up to 32% time savings using e-permit-to-work, as compared to the current paper submission by the worker, with manual validation carried out by the safety supervisor, which took 38 minutes. Up to 35% of time savings were also reaped from the lodgement of non-conformances during safety inspection, incident reporting and safety inspection of machinery and tools, compared to using hardcopy reports.

Digital Quality / Defects Management System
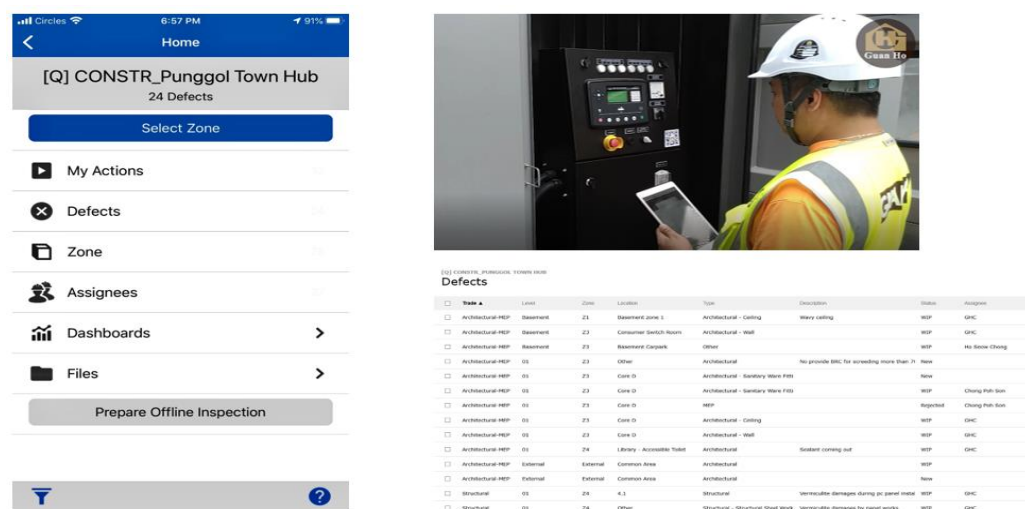
11. The cloud-based digital quality and defects management system receives updates from mobile devices to ensure timely reporting, tracking and quicker follow up of defects discovered at the construction site. There is 30% time savings to churn out consolidated reports, and up to 20% improvement in the management of defects, as a result of proper categorising and organising of issues for easy identification, follow-up and delegation to the appropriate parties.

Additional resource: Guan Ho Video

SME Feature – MKPL Architects Pte Ltd

1. Formed in March 1995, MKPL is an architectural firm that aims to combine master planning, architecture, landscape, interior and furniture design to produce a total design product. The firm's design philosophy focuses on creating strong, clear architecture forms and spaces that are comfortable and liveable, viewing the vernacular and regional culture as a rich resource that can suggest appropriate solutions and references. Advances in technology and construction are also embraced as opening existing possibilities in ways of living and interacting with the environment.

2. MKPL has received more than 70 national and international awards, including the RIBA International Awards for Architectural Excellence and the Singapore Institute of Architects (SIA) Architectural Design Award.

3. MKPL's key objectives in embarking on Integrated Digital Delivery (IDD) is to facilitate more time for their architects to think about design and for their project team and clients to better appreciate and refine the design to meet their needs. To digitalise the practice, MKPL developed processes to suit their workflows. While there had been reservations among various stakeholders initially, more and more parties grew to be open about process transformation to accommodate new technology, allowing the firm to move forward. Today, MKPL is fully committed to digitalising the right way and for the right reasons, not adopting new technology for the sake of it.

Virtual Planning and Design

Virtual design of SMU Connexion

4. MKPL uses a combination of modelling, rendering and computational solutions to carry out space planning, simulation of environmental conditions and on the interiors to ensure the design not only meets the client's requirements, but is also sustainable both in its materials and also with the surroundings.

Design for Buildability

BIM model of Woodleigh Village

5.   MKPL uses a Buildability Score Plug-in solution to their BIM model to automatically generate schedules of standardised components, saving up to 90% of time originally used to verify buildability manually. This frees up more time for the architects to focus on refining the design to enhance the buildability of the project downstream.

Virtual Walk-through

Sengkang Grand Mall & Residences

6.   Sengkang Grand Mall & Residences is one of the iconic first-of-its kind integrated development with a retail mall, community club, hawker centre, community plaza, childcare centre, bus interchange and seamless connectivity to Buangkok MRT station.

7. Due to the design complexity of this integrated development, MKPL adopted virtual walk-through presentation to main stakeholders for effective communication and approval.

8. Compared to the multiple still images, MKPL believes that the virtual walk-through help various project stakeholders understand the infrastructure effectively. Using virtual walk-throughs, there is an improvement of approximately 50% in terms of communication time for clarification.

Additional resource: MKPL Architects Video