ANNEX A

Built Environment Living Laboratory Framework

Background

1 Technology innovation will be a key enabler for Built Environment firms to strengthen their competitiveness and help navigate the new normal in a post-COVID-19 future. To do so, firms need to be aware of the opportunities available to test out new and innovative solutions that could benefit the built environment.

2 The new Built Environment Living Laboratory Framework (BE LLF) will be a platform to facilitate the test-bedding of innovative proposals in living spaces, such as designated areas within Punggol Town and Jurong Lake Gardens. The BE LLF seeks to strengthen partnerships between the public and the private sector and will open up opportunities to harness and trial new, emerging technologies as we continue to develop cities for tomorrow.

How the BE LLF can assist

3 The BE LLF aims to help firms and technology solution providers in three ways:

a) First, a "one-stop" shop will be available for firms to submit innovative test-bedding proposals. The "one-stop" service will be administered by the Built Environment Technology Alliance (or BETA), and open to all BE firms and technology solution providers. This provides firms a single touchpoint to submit and process their proposals, without having to approach multiple agencies on their own.

b) Second, proposals that demonstrate merit and acceptable risk will be expedited for test-bedding in living laboratories. Any innovative test-bedding proposal that is ready for deployment and beneficial to the built environment could be accepted under the BE LLF.

c) Lastly, firms will receive support to navigate regulatory clearance processes, and where necessary, a 'regulatory sandbox[1]' could be introduced for proposals facing regulatory issues. This will provide firms greater confidence to continue innovating and enable them to build up their track record.

4 Through the BE LLF, firms will be able to gain access to Government living laboratories to testbed their innovation and receive assistance from MND agencies to ensure smooth deployment of the proposals at the living laboratories. All BE firms with promising proposals are encouraged to submit their proposals to the LLF "one-stop" shop. More details on the BE LLF and on how to submit a proposal to BE LLF can be found here.

[1] Regulatory sandboxes create "safe spaces" where firms may be granted temporary regulatory waivers to test their innovative solutions.

ANNEX B

Skills Framework for Built Environment

1. The skills framework aims to provide a common skills language for stakeholders in the Built Environment (BE) sector. It is aligned with, and supports the Construction Industry Transformation Map (ITM) [2] and Real Estate ITM[5] (focusing on the Facilities Management sub-sector) under the BE cluster, by identifying pivotal BE jobs, outlining career pathways as well as existing and emerging skills to support the growth and transformation of the sector. It also aims to facilitate skills recognition and supports the design of training programmes, complementing our manpower strategies in talent attraction, retention and skills development.

2. It was jointly developed by the Building Construction Authority, SkillsFuture Singapore and Workforce Singapore, together with employers, trade associations and chambers (TACs), unions, professional boards, and education institutions.

Who is it for?

3. The Skills Framework for Built Environment would serve the following:

- **Individuals** who wish to join or progress within the BE sector, will be able to assess their career interest, identify relevant training programmes to prepare for their desired jobs or upgrade their skills in areas valued by employers for career advancement;
- **Employers** will be able to recognise the skill levels of their employees, and invest in supporting their career development and skills upgrading;
- **Education and training providers** can gain insights on sector trends, existing and emerging skills that are in demand, and curate their training programmes/curriculum to address the sector's needs;
- **Government, union and professional bodies** will be able to analyse skills gaps and design appropriate manpower development initiatives or programmes to upgrade manpower capability and professionalise the sector;
    - For example, accrediting bodies (e.g. TACs) can develop/review their accreditation schemes to provide validation for the relevant skills and competencies to uplift the standing of their respective BE professions; and
- **Procurers (i.e. Government Procuring Entities or Private Developers)** can specify requirements for personnel with relevant skillsets or be able to better differentiate them during tender evaluation, when procuring BE services.

Key Components

4. The Skills Framework for Built Environment contains information on the sector, occupations/job roles, skills and competencies required for each job role,

[2] An outcome of close tripartite efforts, the ITMs outline the collective vision of 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.

possible career pathways, and the training programmes available to help facilitate skills upgrading and mastery. The key information compiled under the Skills Framework include:

- **Sector information** – provides information on key statistics, trends and workforce profiles in the sector

- **Career pathways** – depict the pathways for vertical and lateral progression for advancement and growth. Eight tracks have been identified, covering 49 job roles. These tracks include:

    - Architectural Consultancy and Design
    - Construction Management (Production)*
    - Construction Management
    - Digital Delivery Management*
    - Engineering Consultancy and Design
    - Facilities Management
    - Project Management
    - Quantity Surveying

**Construction Management (Production) and Digital Delivery Management are new emerging career tracks that have emerged as a result of industry transformation objectives [for Design for Manufacturing & Assembly (DfMA) and Integrated Digital Delivery (IDD) respectively].*

BE Career Map:

SkillFuture_Built Environment ...

- **Skills and competencies** – cover a total of 163 existing and emerging technical skills and competencies, 18 generic skills and competencies, and their respective descriptions. Some of the emerging skills identified include:

    - Computational Design – the use of programming and computational strategies for design processes to enable design automation and optimisation;
    - Design for Manufacturing and Assembly (DfMA) – application of DfMA principles throughout the construction project lifecycle to ensure effectiveness, safety and economies of scale for manufacturing and assembly;
    - Design for Maintainability (DfM) – application of DfM principles throughout the project lifecycle to ensure effectiveness, safety and economies of scale for maintenance tasks;
    - Integrated Digital Delivery (IDD) Application – driving the adoption, integration and implementation of IDD technologies to manage projects and building lifecycle efficiently from digital design, digital fabrication and digital construction to digital asset delivery and management; and
    - Smart Facilities Management – integration of digital technologies and smart automation into facility operations and maintenance to optimise efficiency and performance.

- **Training programmes[3] for skills upgrading and mastery** – provide information on training programmes to help aspiring individuals and in-service employees acquire skills necessary for various job roles. Some examples of new training programmes will include:

    - Specialist Diploma in Smart Facilities Management
    - Specialist Diploma in Computational BIM for Infrastructure
    - Modular MEP Design and Prefabrication
    - Principles of Integrated Digital Delivery
    - IDD Project Implementation
    - SGUnited Skills Courses:
        - SGUS Diploma (Conversion) in Integrated Digital Delivery (Built Environment)
        - NUS SGUS Programme 5D BIM for Built Environment Professionals
        - SGUS Specialist Diploma in Building Information Modelling (BIM) Management
        - SGUS Building Service & Energy Management
        - Up-Skill in Building Systems, Performance & Sustainable Design
        - SGUS Facilities Management
        - Be a Built Environment Specialist

More information on the Skills Framework for Built Environment can be found at www.skillsfuture.sg/skills-framework/built-environment.

[3] Full list of training programmes to be made available in end-2020.

ANNEX C

(i) Alvin Fong Yew Chung, Virtual Design Construction Manager
Kimly Construction Pte Ltd

Keeping pace with change

As Virtual Design Construction (VDC) Manager, Alvin Fong has always looked for innovative ways of working. This inquisitive hunger has allowed him to adapt to changes in the industry.

“During the 1997 financial crisis, I was tasked to design two main routes of the New Water pipe lines. Nothing in school prepared me for it. I was given a book and met the contractor to find as much information as possible. Despite these challenges, I managed to deliver. In times of need, we need to have a flexible mindset,” he shares.

When he started his career as a draughtsperson, Alvin’s first goal was to learn from the seniors. “When the Internet was in its infancy, lots of practical and trade secrets were ‘locked’ in more experienced minds.”

At Kimly Construction, Alvin impressed his superiors with his dedication. While working on his projects, he seized the opportunity provided by the BCA-Kimly iBuildSG Diploma Sponsorship (Part-Time) to deepen his industry knowledge and took up courses in Building Information Modelling (BIM) and Virtual Design and Construction (VDC) to improve his technical know-how. With these in-demand skills, he could be better equipped to take on new projects and opened up more career advancement opportunities.

While he used to focus on acing every task, now he sees the importance of uplifting and empowering his team. “There is only so much one pair of hands can do. Maximising productivity has to be a team effort.”

In fact, being a team player is a must. “Being courteous and open-minded is essential as Virtual Design Construction encompasses all stakeholders from design to facility management.”

Refining his people skills has proved useful in his current role, which involves dealing with a large number of people. It entails developing, implementing and enforcing VDC protocols across the company, managing and planning daily operations, ensuring

clients' requirements are met, incorporating innovative technologies into the company's workflow, and coaching and mentoring his staff.

Alvin is always on the lookout for game-changer technologies. "Automation and constant workflow review are key to staying relevant," he says. "I hope to build more automated workflows using cloud-enabled technology, robotics and computer vision."

To achieve this, he is eyeing a degree in construction management and hopes to improve his skills in Design Thinking and Systems Thinking, using the Skills Framework to plan his path forward. "The Skill Framework provides information on the jobs and skills to take up to propel our career progression."

Alvin encourages young industry hopefuls to be open to possibilities. "We need to think out of the box. Never stop learning," he says.

(ii) Alford Yu, Deputy Project Manager
KTC Group

Progressing on the right track

For Alford Yu, Singapore's MRT stations and railway lines are more than a daily commute. It is a feat of engineering, architecture and collaboration. "Constructing Singapore's railway is an enormous endeavour."

This insight came from Alford's experience at the forefront of Singapore's rail construction. Currently, he is leading a team from KTC Group to construct Orchard Boulevard MRT station for the upcoming Thomson-East Coast Line. Over his six-year tenure at the company, he advanced steadily, gained valuable experiences and was eventually promoted to Deputy Project Manager.

What does it take to excel in his role? "I consider myself a generalist, where my knowledge to perform my role is very diverse." As Alford explains it, this entails construction methodologies for individual trades involving Architecture, Civil Engineering, and Mechanical and Electrical Engineering, as well as planning skills, negotiation skills, and safety and design considerations. Alford never stops learning as he continues to upgrade himself through courses in project management,

construction productivity, BIM Management, and Virtual Design and Construction. He believes in honing his skills to value-add to his work.

Having the right expertise is only half the battle, being a great communicator is essential. When leading competitive tender bids, Alford makes it a priority to coordinate with his team members and consultants.

Ultimately, Alford believes anyone entering the industry must be adaptable, open to other viewpoints and able to explain theirs with clarity. “The construction industry is very dynamic, different clients have different requirements. How certain things were previously done may not be applicable to future jobs.”

What’s his next goal? Alford sets his sights on two areas: safety and design. “I noticed that I’m lacking in safety knowledge. I want to deepen my understanding of the safety regulations and risk assessment. The design aspect is also something I am enthusiastic about.”

Alford recommends the Skills Framework for the Built Environment for practitioners who want to grow their career. “It will be a structured way of understanding what skillsets are required for different types of career progression in this industry,” he says. “There are many specialist trades with specific knowledge and related work experience to acquire. Having the Skills Framework would definitely assist me in identifying the capabilities I should build, especially for qualities which employers would look out for in managing their projects!”