## MEDIA RELEASE

**FOR IMMEDIATE RELEASE**

# TRANSFORMING THE WAY WE BUILD AT SINGAPORE'S INAUGURAL INTERNATIONAL BUILT ENVIRONMENT WEEK (IBEW)

- *IBEW is the region's first built environment event that provides a shared platform to showcase progressive firms and innovative technologies across the entire built environment value chain*
- *Singapore to top-up a further $20m for the Green Buildings Innovation Cluster (GBIC) programme to boost the drive to develop super low energy buildings*
- *First grant under BCA-IMDA joint grant call for common digital platform awarded to Delphi Pte Ltd*
- *Singapore's Buildability Framework to be enhanced to support innovation in driving productivity outcomes*

**Singapore, 4 September 2019** – The inaugural IBEW welcomed more than 12,000 overseas and local visitors to the first of its kind built environment event in the region. Themed "Transforming the Way We Build" – IBEW brings together the whole built environment value chain to an integrated platform which showcases progressive firms and the latest innovations in the industry, set against the backdrop of global trends like urbanisation, digitalisation, and climate action. IBEW is jointly presented with twelve (12) Trade Association and Chambers (TACs)[1] and participation from

[1] The 12 TACs are (i) Association of Property and Facility Managers, (ii) International Facility Management Association (Singapore Chapter), (iii) Real Estate Developers' Association of Singapore, (iv) Singapore Green Building Council, (v) Singapore Institute of Building Limited, (vi) Singapore Institute of Valuers & Surveyors, (vii) Society of Project Managers, (viii) Specialists Trade Alliance of Singapore, (ix) The Association of Consulting Engineers Singapore, (x) The Institution of Engineers Singapore, (xi) The Singapore Contractors Association Limited, and (xii) The Singapore Institute of Architects.

more than 20 Singapore firms and partner agencies. This collective spirit across the built environment value chain represents the power of the BuildSG movement[2].

2 Mr Hugh Lim, BCA CEO, said, “Since the Construction Industry Transformation Map (ITM) was launched two years ago, our Built Environment sector has seen good progress. Leading firms are staying ahead of the curve through deep capability building, strong collaborations and co-creating effective solutions for the built environment sector. The inaugural IBEW is a shared platform that reflects both the aspirations and the progress of the built environment sector in Singapore. Together with like-minded international partners, we envision IBEW to be *the* platform in the region for rich exchange of ideas and co-creating innovative solutions to transform the built environment.” (see *Annex A*)

3 The Construction ITM identified three key transformation areas: Green Building, Integrated Digital Delivery (IDD) and Design for Manufacturing and Assembly (DfMA) underpinned by research and innovation and manpower development. Through collaboration and co-creation with the industry and academia, the ITM seeks to bring about an advanced and integrated sector, with progressive and collaborative firms, supported by a skilled and competent workforce, offering good jobs for Singaporeans.

4 As part of advancing our Green Building agenda, BCA has been supporting research and innovation efforts to push the boundaries of transformation. The Green Buildings Innovation Cluster (GBIC), managed by BCA, has enabled the development of several energy-efficient technologies. These have been translated into commercial solutions adopted in Singapore and overseas (examples in *Annex A*).

5 The latest recipient of grant support as a GBIC-Demonstration project is the PSA Corporation, who will develop a Net Zero Energy Building as part of the Tuas Port, projected to achieve energy savings of 58% when compared to the same

[2] BuildSG is a national movement to transform the way we build Singapore and it is a collaborative effort by the industry and government for firms to keep ahead of the curve through deep capability building, strong collaborations and co-creating effective solutions for the BE industry.

building had it been designed to comply purely with energy efficiency regulations. They will be exploring the use of coloured building-integrated photovoltaics[3] (BIPVs) in its administration building which will be integrated with the building walls, replacing the need for ordinary façade cladding. It provides an alternative to conventional photovoltaics (PVs) for buildings with limited roof space, as a combination of conventional PVs and BIPVs can also help better manage energy demands of the buildings by providing a steadier power generation pattern throughout the day. To support our national drive toward Super Low Energy (SLE[4]) buildings such as the PSA Corporation's Net Zero Energy Building, the National Research Foundation Singapore has provided a funding of $20 million to enhance the GBIC programme. (see *Annex B*)

6 In addition, to help building owners and developers source for innovative Super Low Energy (SLE) technologies, BCA and Hitachi have also launched the SLE Buildings Smart Hub[5] – the first digital knowledge portal for green buildings in the region.

7 To support the adoption of Integrated Digital Delivery (IDD), BCA and the Infocomm Media Development Authority (IMDA) had earlier launched a joint grant call for common digital platforms in November 2018. IMDA has awarded to Delphi Pte Ltd, a joint venture between Hubble Pte Ltd, and Aurum Investments Pte Ltd (a subsidiary of Woh Hup Holdings Pte Ltd), a grant to develop an interoperable and common platform that will digitally connect project parties, namely developers, designers, fabricators, builders, and building operators so that they can share digital assets through this AI-powered platform catered specifically for the construction sector. Third-party service providers, such as quantity surveyors, M&E consultants, DfM consultants, can offer their own digital products and services on the platform. The ability to more accurately estimate demand for materials and manpower, realise just-in-time efficiencies, ensure error-free transactions, and eventual reduction of re-

[3] PSA, together with the Solar Energy Research Institute of Singapore (SERIS) and BIPV suppliers are currently working to have the BIPV panels certified in accordance with regulatory requirements of authorities.
[4] A Super Low Energy (SLE) building refers to a Green Mark certified building that achieves more than 60% of energy savings over the 2005 level.
[5] https://www.sleb.sg

work through the use of new digital and data services, are some of the benefits of such a digital platform. (see *Annex C*)

8 To accelerate DfMA adoption which improves the quality of our buildings, minimises noise and dust from construction sites to the neighbours and the surrounding environment, as well as boosts site productivity, BCA will be introducing several enhancements to our Buildability Framework. Large residential non-landed projects with a Gross Floor Area (GFA) of 25,000$m^2$ and more will be required to meet a higher buildability requirement. After several years of capability building and more than 140 DfMA projects, we recognise that developments of this size are able to capitalise on the benefits of DfMA and enjoy economies of scale from off-site (factory) production. In order to place more focus on design instead of just regulatory compliance, there will also be outcome-based options that consultants may adopt for these large residential non-landed developments instead of following the usual code compliance method. We will also be exempting small projects with a gross floor area (GFA) below 5,000sqm from the need to comply with the buildability framework. More details will be announced at a later stage.

9 The outcome-based options will also be extended to other development types from 2020. In addition, there will be greater emphasis on DfMA in structural, architectural, and Mechanical, Electrical and Plumbing (MEP) works in the new 2020 Code of Practice (COP) on Buildability. BCA will invite firms to participate in a pilot to walk-through the proposed changes, so that key learning points can be included in the detailed 2020 COP.

10 Lastly, research and innovation in the built environment sector has also transformed – the Built Environment Accelerate to Market Programme (BEAMP) has opened up new opportunities for start-ups and innovators, in the built environment sector. Since its launch, it has garnered interest from 53 innovators within the Built Environment and adjacent Sectors. From this pool of innovators, 14 were shortlisted to work with companies in the built environment to solve real life challenges. One such firm is Tagvance who worked with Straits Construction to develop an Internet of Things (IoT) network, to relay positioning data of people and assets so as to

enhance safety on the worksite. The novelty of this development is in its ability to address the challenge of penetrating through dense concrete structures to track vertical positioning in both semi-confined and large spaces which are both quite common on construction sites. (see *Annex D*)

**IBEW 2019 – An Integrated Platform for the Built Environment**

11 IBEW 2019 features BE Connect, a premier business platform that brings together urban solution providers from Singapore, developers from the region, and the investment community to address urban challenges in the region. Over the past 9 months, BCA has met with close to 100 developers in China, India, and South East Asia to understand their needs, introducing solutions, and sharing relevant experience by Singapore's urban solution providers. BE Connect marks a major milestone in a year-round effort to assist buyers in the region to access fully integrated solutions across the entire built environment value chain for their building needs.

12 IBEW 2019 offers four co-located tradeshows, gathering the latest innovations and industry solutions for the built environment. Returning in its 12th edition, BEX Asia spotlights sustainable solutions for buildings across all sectors and in its 5th edition, Mostra Convegno Expocomfort (MCE) Asia zooms in on solutions to maximise building efficiency and energy operations. New to the portfolio are Innobuild (IB) Asia presenting cutting-edge construction materials, tools and technologies to drive construction productivity and resource efficiency, and Smart Cities and Buildings (SCB) Asia highlighting the convergence of technology and construction creating more liveable cities.

13 Together, the tradeshows encompass the entire Built Environment value chain and gather over 550 local and international exhibiting brands from more than 30 markets. More than 70 industry leaders will be sharing their insights on the hottest technologies and trends at the tech talk seminar areas covering 3 thematic topics at Digital Rally, Energy Xchange and Green View. The exhibitions will welcome over 70

delegation groups from 7 markets to discuss and exchange ideas on the latest innovations that will shape the future of sustainable cities.

14 BCA and its tripartite (Public, Private, People) partners will continue its efforts to support the built environment sector to achieve greater quality and productivity standards, build progressive and collaborative firms and support workforce needs and aspirations. At the same time, we recognise that leading Singapore firms are able to provide cutting edge solutions to meet the needs of developers from across the region. Together, we can look forward to an exciting programme which outlines how we can all ***transform the way we build***.

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**Issued by the Building and Construction Authority on 4 September 2019**

**Enclosed:**

Annex A: Factsheet on ITM Progress

Annex B: Factsheet on Green Buildings Innovations Cluster Top Up and Demonstration Project

Annex C Factsheet on BCA-IMDA Common Digital Platforms Grant Call

Annex D: Factsheet on BEAMP Demo Day

## About BCA

The Building and Construction Authority (BCA) of Singapore champions the development of an excellent built environment for Singapore. BCA's mission is to shape a safe, high quality, sustainable and friendly built environment, as these are four key elements where BCA has significant influence. In doing so, it aims to differentiate Singapore's built environment from those of other cities and contribute to a better quality of life for everyone in Singapore. Hence, its vision is to have "a future-ready built environment for Singapore". Together with its education arm, the BCA Academy, BCA works closely with its industry partners to develop skills and expertise that help shape a future-ready built environment for Singapore. For more information, visit www.bca.gov.sg.

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**Strategic Partner:**

**Official Media Partner:**

## Annex A: Factsheet on ITM Progress

1 The Construction ITM was launched in October 2017, with the view to transform the construction industry into an advanced and integrated sector with widespread adoption of leading technologies, led by progressive and collaborative firms and supported by a skilled and competent workforce, offering good jobs for Singaporeans.

### Design for Manufacturing and Assembly (DfMA)

2 Through the DfMA approach, buildings are designed with major components and modules fabricated off-site in a controlled manufacturing environment, then brought on-site for assembly. With more works done offsite, manpower and time needed to construct buildings are significantly reduced. With increase in productivity, sites have the potential to deliver buildings and infrastructure projects more quickly to end users. Work sites are cleaner, safer, and create less disamenities to the surrounding living environment. Over the course of **more than 140 DfMA projects**, we have found that the DfMA approach has indeed enabled us to achieve higher quality, productivity and sustainability in a traditionally manpower-intensive construction industry.

3 Singapore firms have also been investing in capability building to undertake DfMA projects. To date, more than 80 (architectural, C&S, engineering and M&E) consultancy firms and about 60 builders have undertaken over 140 DfMA projects in Singapore. We have also seen several leading firms investing in highly automated plants to produce higher quality prefabricated components and modules for DfMA in Singapore. In all, our industry has, since 2010, achieved a cumulative site productivity improvement of about 15%, and this will rise to 20% by the end of 2020, with the completion of more DfMA projects.

### Integrated Digital Delivery (IDD)

4 Integrated Digital Delivery (IDD) refers to the use of digital technologies to integrate work processes and connect stakeholders working on the same project throughout the construction and building life-cycle: namely, from design, to off-site

fabrication, to on-site assembly and construction, and finally to operations and maintenance. IDD helps project teams to smoothen coordination, avoid miscommunication and reduces abortive works during construction.

5 The IDD Implementation Plan was launched in November 2018. IDD is being piloted in over 20 projects now and 30-40 more will adopt IDD in the coming year. These projects cover a wide spectrum of building types, from residential, institutional, industrial to commercial projects. Collaboration across the entire value chain is key to meeting the demands of the future, where we expect buildings to become more complex, high-density yet liveable and sustainable. Our industry's efforts in IDD to leverage data and digital technologies to connect the different project parties will help to facilitate this process.

**Green Buildings**

6 Buildings contribute one-quarter of Singapore's carbon emissions and the industry has endeavoured to lower this through Singapore's green building journey since 2005. To date, we have greened close to 40% of our gross floor area in buildings, on track to meet the target of 80% by 2030. In September last year, BCA launched the Super Low Energy Programme to push the boundaries of energy efficiency in buildings even more. The programme was jointly developed with industry and academia, with best-in-class SLE buildings beginning to show 60% greater energy efficiency over 2005 levels. To date, 17 projects have already been certified and another 15 projects are ongoing (as of Aug 19).

**Manpower**

7 The Construction ITM creates good jobs for Singaporeans through transformation. There is funding support from Government, and training to upskill workers in the construction sector. In addition, guided by the iBuildSG Tripartite Committee, our Institutes of Higher Learning (IHLs) have been updating their curricula to better equip students with the competencies to participate in this transformation.

8 As of March 2019, about 40,000 persons have been trained in the three transformation areas. This number will grow to 47,000 by 2020.

**DfMA examples:**

- P&T Group provides architectural and structural consultancy services to several DfMA projects in Singapore (i.e. Mass Engineered Timber (MET) for schools, Prefabricated Prefinished Volumetric Construction (PPVC) for Housing and Development Board (HDB) public housing, Structural Steel for commercial development, etc.). P&T also provided consultancy services for a residential project adopting steel Modular Integrated Construction (MiC) in Hong Kong.
- Surbana Jurong provides architectural, structural and M&E consultancy services to residential, dormitory and healthcare projects adopting PPVC and prefabricated Mechanical, Electrical, and Plumbing (MEP) systems in Singapore. Due to their expertise in DfMA, Surbana Jurong has unlocked opportunities in the APAC region where they have been appointed as the PPVC consultant for a project in Hong Kong.
- TW-Asia Consultants Pte Ltd provides structural consultancy services for private residential PPVC projects in Singapore. These projects include Le Quest mixed development, Lake Grande Condominium and Clement Canopy Condominium. TW-Asia has also been involved in the structural design of regional projects in Vietnam and Thailand. Particularly, in Hong Kong, for MiC.
- Tiong Seng Contractors Pte Ltd is the main contractor for dormitory, school and healthcare projects in Singapore adopting PPVC. The firm completed a housing project in Yangon, Myanmar, with one of the residential blocks built using PPVC in 2018. Tiong Seng also signed three (3) Memorandum of Understanding (MOUs) to set up precast factories in Tianjin.
- These progressive firms have also proactively evolved from employing the traditional method of construction. They have since developed capabilities in DfMA and successfully undertaken DfMA projects in Singapore. Their capabilities in DfMA in the Singapore market are now well entrenched and they are also starting to gain international recognition. This has helped them to develop a competitive edge to export their expertise overseas.

| Firm | DfMA expertise areas | Examples of DfMA Project in Singapore | Overseas DfMA Project experience |
|---|---|---|---|
| P&T Group | a) DfMA consultancy services provided:<br>i. Architectural consultancy<br>ii. Structural consultancy<br>b) Project types:<br>i. Residential, commercial and institutional projects<br>c) Number of DfMA projects in Singapore:<br>i. More than 10 PPVC, 2 MET, 2 structural steel and 1 Prefab MEP project | a) Rivervale Community Club (MET/Prefab MEP)<br>b) 22-Storey Parc Botannia Condominium (PPVC) | Provided consultancy services for a residential project adopting steel Modular Integrated Construction (MiC) in Hong Kong. |
| Surbana Jurong | a) DfMA consultancy services provided:<br>i. Architectural Consultancy<br>ii. Structural Consultancy<br>iii. M&E Consultancy<br>b) Project types:<br>i. Residential, dormitory and healthcare projects<br>c) Number of DfMA projects in Singapore:<br>i. 9 PPVC, 1 MET, 1 structural steel and 2 Prefab MEP projects | a) Woodlands Health Campus (Prefab MEP)<br>b) 12-storey Wisteria Commercial and Condominium (PPVC) | Appointed as the PPVC consultant for a project in Hong Kong |
| TW-Asia Consultants Pte Ltd | a) DfMA consultancy services provided:<br>i. Structural consultancy<br>b) Project types:<br>i. Residential and institutional projects<br>c) Number of DfMA projects in Singapore: | a) 16-storey Le Quest Commerical and Condominium (PPVC)<br>b) 40-storey Clement Canopy | Involved in the structural design of regional projects in Vietnam and Thailand. Particularly, in |

| | | | |
|---|---|---|---|
| | i. More than 10 PPVC and 1 multi-tech^ project | Condominium (PPVC) | Hong Kong, for MiC. |
| Tiong Seng Holdings | a) Main contractor<br>b) Project types:<br>i. Dormitory, institutional and healthcare projects<br>c) Number of DfMA projects in Singapore:<br>i. 5 PPVC projects | a) Dormitory at JTC Space @Tuas (PPVC)<br>b) Northshore Primary School (PPVC) | a) Completed a housing project in Yangon, Myanmar, with one of the residential blocks built using PPVC in 2018; and<br>b) Signed three (3) MOUs to set up precast factories in Tianjin. |

^ *Multi-tech refers to PPVC / MET / Advanced Precast Concrete System (APCS) / Prefabricated MEP*

**IDD examples:**

| Firm | IDD expertise areas | Examples of IDD Projects in Singapore | Overseas IDD Project experience |
|---|---|---|---|
| Ong & Ong Group | a) IDD implementation in the Architectural, Structural and M&E consultancy services, including:<br>a. Building Information Modelling (BIM)<br>b. Virtual Design & Construction (VDC)<br>c. Analysis & Simulation<br>d. Computational & Automation<br>e. Information Management<br>b) Project types: | a) North-South Corridor Package N110<br>b) Sloane Residences<br>c) HDB Sembawang N2C3-5 | BIM departments set up in regional offices (KL, Jakarta, Vietnam, Bangkok and China) to provide BIM and IDD services to 15 projects in Malaysia, 27 projects in Vietnam and 7 |

| | | | |
|---|---|---|---|
| | a. Commercial, conservation, hospitality, industrial, infrastructure, institutional, mixed-use, religious, residential projects and public spaces<br>c) Digital achievements:<br>a. 3 IDD projects: 1 infrastructural and 2 residential projects<br>b. Won the 2016 BCA Platinum BIM Award (Organisation category)<br>c. Won the MOHH BIM award for the design stage in the Jurong West Nursing home<br>d. Collaborative Cloud platform implementation (CDE) using BIM 360 solutions for 100% of all projects and all offices | | projects in Indonesia as of today. These include the Kamala Kandara residential hub in Bekasi, Indonesia, the KL Eco-City and the Eco Ardence green building development in Selangor, Malaysia. |
| ID Architects | a) IDD implementation in the Architectural services, including:<br>i. Building Information Modelling (BIM)<br>ii. Virtual Design & Construction (VDC)<br>iii. Mixed Reality | a) PSA Maintenance Base Development at Tuas F2 Terminal, including administration building, resource hub, store, workshops | Together with IDATechnology, carried out projects in Myanmar, Sri Lanka, Malaysia and Palau, including the DHL Facility at the KL International |

| | | | |
|---|---|---|---|
| | iv. Project Information Management<br>b) Project types:<br>a. Commercial, healthcare, hospitality, industrial, infrastructure, institution, interior, master planning, mixed development, residential, sports & recreation<br>c) Digital achievements:<br>a. 1 IDD project: 1 industrial project<br>b. Won the 2019 UOB SME Digital Leap AWard (Medium SME category)<br>c. Established affiliate company IDATechnology, to accelerate digital transformation of the BE sector through their Digit-Alpha solution<br>d. Won the 2017 BCA Gold BIM Award (Organisation category) | and main intake substations | Airport, Malaysia, a resort development at Koror, Palau, and a villa development at Yangon, Myanmar. |

**GM SLE examples:**

- MKPL Architects is a Singaporean Practice which was involved in 2 SLE projects, including the recently awarded SMU's Tahir Foundation Connexion and in more than 5 Green Mark higher rating projects. Tahir Foundation Connexion is a net zero energy building in the heart of the city. The Architects have designed the

building to respond the surroundings and our topical climate through the use of advanced cooling systems, on-site solar energy and sensors, leading to energy savings of 500MWh per year (similar to the energy consumption of 110 4-room HDB flats a year). This creates a comfortable, vibrant and healthy place for students and staff to learn and collaborate, whilst reducing the energy required to operate the building. As a leading business school, SMU through the Tahir Foundation Connexion and their green initiatives campus wide, shows that going green makes good business sense.

- GreenA Consultants is a Singaporean SME which was involved in 4 local SLE projects, has also participated in more than 15 overseas GM projects, including African countries like Rwanda and Tanzania. They received the Sustainable Building Award 2016 – Most Acclaimed Green Consultancy (Africa & Asia).

| Firm | Expertise areas | Examples of SLE Projects in Singapore |
|---|---|---|
| MKPL Architects | a) Singaporean architectural firm which provides consultancy services and shows commitment and expertise in their field.<br><br>b) Project types:<br>i. Institutional projects, Residential (Public/Private), Mixed Use<br><br>c) Examples of higher rated Green Mark projects in Singapore:<br>i. Public Housing Development at Bidadari<br>ii. Public Housing Development at Bedok Beacon<br>iii. NUS Ventus (University Campus Infrastructure Building)<br>iv. SMU School of Law Building<br>v. SMU Residences at Prinsep<br>vi. Woodleigh Village | a) SMU-X Tahir Foundation Connexion (A-South 2)<br><br>Ongoing projects targeting GM SLE:<br>b) SMU-X A-South 3 |
| GreenA Consultants | a) Singapore certified environmental sustainability design firm (ESD) that provides green reporting, certification | Development of Camp Facilities at |

| | | |
|---|---|---|
| | advisory, environmental and energy studies services.<br><br>b) Received the Sustainable Building Award 2016 – Most Acclaimed Green Consultancy (Africa & Asia). Involved in more than 15 overseas GM projects, including African countries like Rwanda and Tanzania.<br><br>c) Project types:<br>i. Institutional projects, commercial, Private Residential, Mixed Use<br><br>d) Examples of higher rated Green Mark projects in Singapore:<br>i. Changi Airport Terminal 4<br>ii. Passion Wave at Marina Bay<br>iii. NTU Hall of Residential 4<br>iv. Project Hamptons<br>v. DSM Dyneema APAC Technical Center | Kranji Camp III for OES<br><br>Ongoing projects targeting GM SLE:<br>a) Nee Soon South CC<br>b) PSA Maintenance Base<br>c) Proposed Hangar Complex |

**Smart FM examples:**

CBM Pte Ltd – A local firm and subsidiary of City Developments Limited (CDL), is committed to enhance their operational flexibility through technology deployment, developing their staff through training programmes and continuously improve their processes. They have also embarked on their own Smart FM initiatives to harness data and optimise the deployment of resources. These include Smart CCTV analytics which allows security monitoring to be automated, alleviating the need for manual patrolling. By uniting siloed systems, CBM is able to provide strategically planned integrated smart solutions to increase productivity and effectiveness.

## Annex B: Factsheet on Green Buildings Innovations Cluster Top Up and Demonstration Project

### Background

1 Research, development and demonstration (RD&D) plays a key role in BCA's Green Building Masterplans, to push the envelope and accelerate the adoption of promising building energy-efficient (EE) technologies and solutions in the industry.

2 In 2014, National Research Foundation Singapore (NRF) provided a funding of $52 million for BCA to set up the Green Buildings Innovation Cluster (GBIC) as a one-stop integrated RD&D hub to experiment, exhibit and exchange knowledge of promising energy-efficiency solutions with stakeholders. Over the past five years, GBIC has supported a total of 32 projects, many of which have been translated into industry solutions and been adopted in actual building projects in Singapore and overseas.

3 Guided by the long-term goal of "super low energy buildings for the tropics", a Super Low Energy (SLE) Programme and Technology Roadmap was launched in 2018 to bring about significant changes in Singapore's energy landscape in a whole-of-government effort. Arising from this, NRF will provide additional funding of $20 million to enhance the GBIC programme to further push the boundaries of energy efficiency.

### Objectives

4 GBIC will be enhanced towards industry-led and deployment-oriented R&I projects and will serve as the central focal point to reinforce the national drive towards greater energy efficiency as well as to streamline, coordinate and disseminate building EE-related activities. The overall objectives of GBIC are to:

- Develop and demonstrate novel and market-proven solutions in a mix of building types;
- Validate performance, raise and build awareness and capability;
- Proliferate energy efficiency across the built environment.

**Key benefits**

5 GBIC will consolidate existing green building RD&D efforts and capabilities. It will also provide platforms for the demonstration of promising novel technologies such that they can be brought closer to market adoption. Results of the demonstration projects will be measured and documented in detail. These results can then guide subsequent R&D directions. The experience and learning points from this endeavour will also be shared with industry stakeholders.

**Key activities**

6 GBIC will now have four key activities; Competitive Research Programme, Prototyping, Demonstration and SLEB Smart Hub.

i. Competitive Research Programme (CRP)

This provides a platform for the industry to collaborate with the local and international R&D community to develop applicable solutions with significant impact in building energy efficiency and with high market adoption potential.

ii. Prototyping [New]

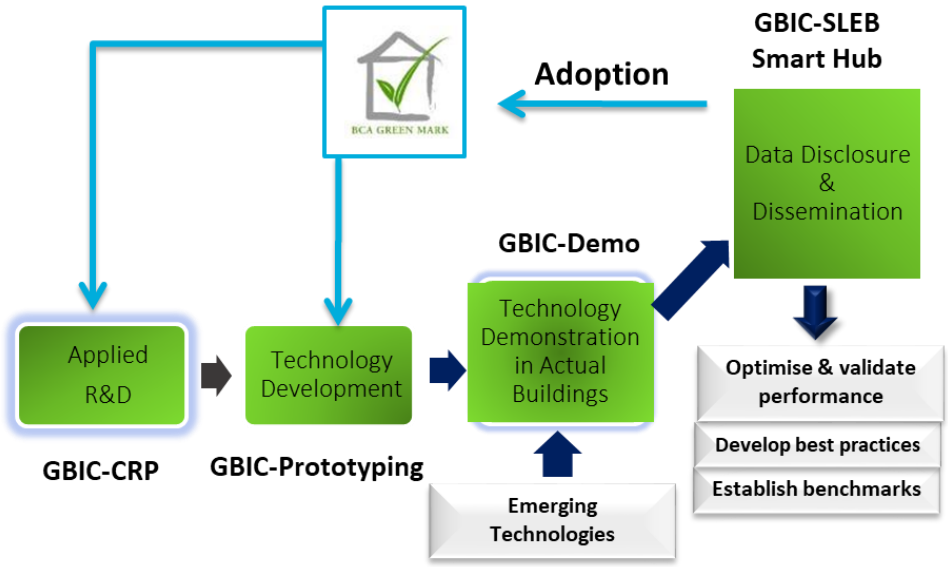
This provides a platform for “out-of-lab” research outcomes to be refined and customised for actual building application and to support promising solutions from local/overseas companies for further development and adoption in our local environment. In addition, it aims to encourage building owners, consultants and the stakeholders to adopt a more holistic approach to strive for greater energy efficiency at an early design stage of the building project.

iii. Demonstration

This serves to demonstrate novel energy efficient technologies that have not been widely implemented locally in operating buildings. The programme aims to link building owners and technology providers with each other in order to establish platforms where industry can test and showcase these technologies to generate local performance data for verification. By doing so, these demonstrated technologies can be replicated in other buildings and eventually, commercialised.

iv. SLEB Smart Hub

This is a centralised national database of building energy efficiency performance data and technologies with powerful smart data tools enabling professionals to make better decisions to adopt innovative technologies. The SLEB Smart Hub will allow companies to share the latest green building technologies with building owners, professionals, researchers and policymakers.



**Green Buildings Innovation Cluster Demonstration Project**


7 The upcoming Tuas Port will be developed in four phases and terminal operations for the first phase is expected to start in 2021. As part of PSA Singapore's sustainability plan to reduce carbon emissions, PSA is looking to develop green terminal buildings in the port.

8 This 6-storey Administrative Building (under the Green Building Innovation Cluster Demo) will be part of the Tuas Port Maintenance Base, and will house an operations centre which will manage all terminal operations for Phase 1 of Tuas Port, as well as a canteen, an engineering office and briefing rooms. It is expected to be ready in the fourth quarter of 2020.

9 The Administrative Building will be the first major building and the first Super Low Energy Building (SLEB) to be completed in Tuas Port and is projected to achieve energy savings of 58% over the baseline building design.

10 This translates to an Energy Utilisation Index (EUI) of 98kWh/m²/year compared to the baseline EUI of 235Wh/m²/year. With PSA's plans to incorporate rooftop PVs for the entire Tuas Maintenance Base which will generate electricity of 2,795 MWh/year, the energy consumption of the Tuas Maintenance Base (including

the Administrative Building) would be offset by renewable energies, making it a Net Zero Energy development.

**Building Integrated Photo-Voltaics (BIPV)**

11 Free from any shade, the Administrative Building is ideal for the installation of building-integrated photovoltaic (BIPV) modules in place of regular cladding in the northern, southern and western façades of the building without adding redundant layers. BIPV is one of the promising renewable energy technologies, and its use in parts of a building envelope such as the roof, skylights and facades will generate a sustainable PV power. A silent system that generates on-site electricity, this BIPV system will reach its peak in power generation at a different time than roof-mounted PV systems on the other buildings within the Maintenance Base and this will balance on-site energy consumption and on-site energy generation. With a total area coverage of about 1,700 sqm, the BIPV system on this building is estimated to generate 130,000 kWh of energy annually.

**Other Innovations**

12 In addition to BIPV, PSA adopted several innovative technologies arising from R&D as well as emerging technologies that have yet to be widely adopted in Singapore include:

a) Enhanced passive displacement cooling (PDC) system for the office areas. The “Thermosiphon Beam” developed by Nanyang Technological University (NTU) can increase the cooling capacity by 50% compared to existing PDC systems. The technology resulted in the spin-off company Air T&D Pte Ltd;
b) A hybrid evaporative cooling system conceptualised by GreenA Consultants. This mixed-mode versatile system is designed to respond to various weather conditions by combining different cooling technologies such as free cooling, heat recovery cooling and evaporative cooling to achieve thermal comfort for the users;
c) Precision secondary pumping system to replace the conventional primary-pumping system by using the latest digital technologies to deliver chilled water based on precise demand control;

d) Variable air volume (VAV) thermal diffusers integrated with Electronically Commutated (EC) Fan Coil Units (FCUs) to allow greater part-load controls to harness energy savings;
e) Intelligent building management system (BMS) integrated with Indoor Environmental Quality (IEQ) sensors (developed by NUS and spin-off into SenSING Pte Ltd) and the Model Predictive Controls (developed by NTU under GBIC-CRP funding). This system provides real-time data for lighting controls and weather data for ACMV controls; and
f) Thermal breaks in the façade system to reduce thermal heat gains into the building. The testbed will provide insights for the ongoing research project on the enhancement of building code on the Envelop Thermal Transfer Value (ETTV).

## Annex C: Factsheet on BCA-IMDA Common Digital Platforms Grant Call

### What is Integrated Digital Delivery?

1 Integrated Digital Delivery (IDD) refers to the use of digital technologies to integrate work processes and connect stakeholders working on the same project throughout the construction and building life-cycle: namely, from design, to off-site fabrication, to on-site assembly and construction, and finally to operations and maintenance.

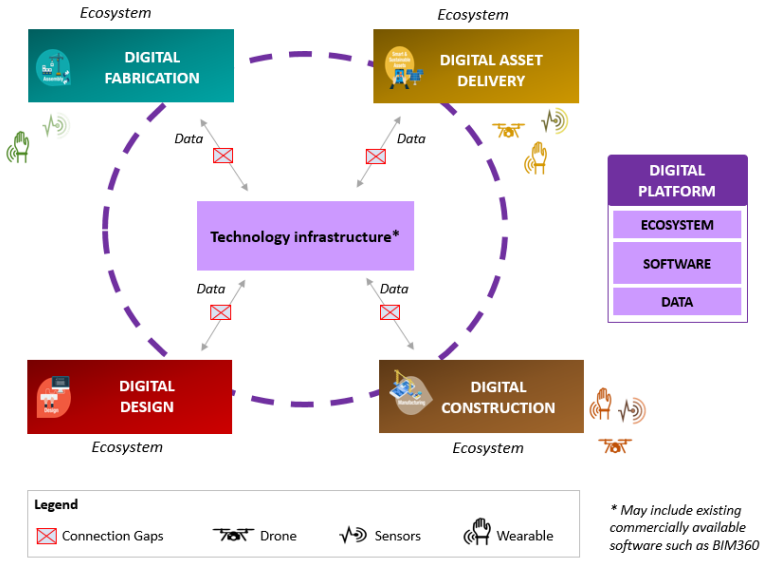
2 IDD is one of the key thrusts in the Construction Industry Transformation Map (ITM), and is aligned to the nation's efforts in transforming its construction industry by creating a highly-skilled workforce trained in use of the latest architecture, engineering, construction and operations technologies.

### IMDA Joint Grant Call for Development of Construction Digital Platforms

3 In support of the Integrated Digital Delivery (IDD) thrust, IMDA and BCA launched a joint S$4 million technology grant call in November 2018.

### Construction Digital Platforms

4 A digital platform comprises three fundamentals – the integration of an ecosystem, software and usage of data. With a relevant business model, the digital platform can help companies digitalise and benefit from the digital platform itself.



1) Requirements of a construction digital platform:

- The proposed construction digital platforms should support the integration of at least one aspect of the IDD that addresses a problem or a challenge in the built environment.
- It must enable interoperability of data through established open data formats commonly adopted in the built environment.
- It should enable firms to collaborate, and allow innovative solutions and other third-party solution providers to plug in through open application programme interface (APIs).
- The ability of computer systems or software to exchange and make use of information / data

2) Proposals for construction digital platforms:

- Singapore-based technology firms are encouraged to submit proposals that will identify new business models, develop new revenue streams, and create greater business opportunities for the built environment.
  - Technology firms will be able to collaborate with built environment practitioners to develop technology-enabled business models and construction digital technologies together.

**Delphi Digital Platform for the Construction Industry**

5 Digital platforms are to create value by facilitating exchanges between two or more interdependent groups[6]. Typically, such platforms aggregate ecosystems of end-users and producers (demand and supply) to transact with each other through technology. This enables increased information sharing, enhances collaboration, drives innovation in new products and services, and encourages growing network effects in a Digital Economy.

6 In an industry where there is a lack of capitalizing on data usage, lack of interconnectivity between different solutions platform, and interoperability issues due to current isolated systems, IMDA and BCA has awarded the development of a

[6] "Five Ways to Win with Digital Platforms", Accenture, 2016

Construction Digital Platform to Delphi Pte Ltd, a joint venture between Hubble Pte Ltd and Aurum Investments Pte Ltd.

7 Delphi will deploy a cloud-based digital platform that will offer a suite of digital services to allow even the smallest contractor to manage a project end-to-end from the time he receives 2D or 3D drawings from the architect until the end of the construction phase. The contractor will be able to send specifications to and collaborate with fabricators, mechanical and electrical engineers, sub-contractors, suppliers, and supply chain players on a single unified platform. This digital platform will help participants overcome problems such as a lack of interconnectivity between different technology solutions and other interoperability issues.

8 Beyond contributing to the digitalisation of the construction sector, the Hubble Digital Platform is envisaged to catalyse the growth of the technology industry catering to the construction sector. The onboarding of currently manual and paper-based projects on to the digital platform will create new opportunities for technology companies to diversify their markets and capabilities and customer base. As the platform will be built on open standards, new and existing third-party technology service providers such as quantity surveyors, M&E consultants, DfM consultants, can offer their own digital products and services on the platform. It is hoped that the platform will expand beyond Singapore, and support the export potential of our local technology industry.

9 Another objective of this digital platform is the development of data products that can be used by different types of built environment related companies. Similar to how financial houses package and sell insights to the investor community, it is hoped that the platform will be able to generate and sell insights to the construction community to help them better prepare to meet market demands. For example, Delphi will develop AI algorithms to understand how much materials and manpower will be required for specific building types. Such information can help contractors to bid for projects more accurately, and help suppliers to manage inventory better.

10 As one of the early adopters of Delphi's digital platform, IMDA and BCA will work closely with Delphi to ensure that the platform is open and that it meets the needs of the construction sector. Woh Hup Pte Ltd, one of Singapore's largest privately-owned construction and civil engineering specialists, is committed to be one of the early adopters of the Hubble Digital Platform, to pilot three projects - Kim Chuan Depot, Parksuites, Nyon@Amber – during the initial development and testing phases.

**Industry Quote**

11 "The construction industry undertakes large and complex projects with massive amount of data generated, most of which goes uncollected. We want to change this. We seek to transform the construction industry with the data it generates. The aim is for the Hubble platform to play an integral role as the central data repository for the entire construction industry - where data is collected, stored, and utilised for optimisation and monetisation. We envision the Hubble platform to be the Bloomberg of construction where organisations across the entire Integrated Digital Delivery value chain such as property developers, architects, contractors, and facilities managers - can collaborate, share, transact, and monetise their data. We will begin our endeavour by focusing on the pre-fabrication and pre-casting segment of the industry, which involves complex coordination across multiple stakeholders and where the most material and cost data will be collected," said Lin Shijing, Founder & CEO, Hubble Pte Ltd

12 "Woh Hup believes that a Construction Digital Platform will hugely benefit the whole industry. The Hubble platform will provide a seamless, integrated channel for data collection, data analysis and data sharing, where stakeholders are able to aggregate their own practices with other members within the industry. This open process will allow individual organisations to learn from each other, and facilitate accelerated growth for them and for the industry as a whole. We are excited about this opportunity to work with IMDA, BCA and Hubble to transform industry practices for the better," said, Yong Derong, Executive Director, Woh Hup (Private) Limited.

**About Delphi**

13 Hubble Pte. Ltd and Woh Hup Pte. Ltd. via their investment arm Aurum Investments Pte. Ltd. have entered into a joint venture with Delphi Pte. Ltd. to develop a Construction Digital Platform (CDP) for Singapore's construction industry.

14 Hubble is a Singapore technology company focused on the Construction industry. Founded in 2016, Hubble has bootstrapped and grown rapidly – with consecutive years of profitability - to become one of the leading technology start-ups in the Construction industry. Hubble was recognised as one of the 15 most promising start-ups (out of 400 nominations) in the SG TechBlazer Competition in 2018 and selected to represent Singapore in the 2018 Asia Pacific ICT Alliance Awards (APICTA Awards) competition in Guangzhou, China.

15 Woh Hup is one of Singapore's largest privately-owned construction and civil engineering specialist with a 2500 strong workforce generating annual revenues of $1 billion. Woh Hup will be entering this joint venture via Aurum. Aurum is a Singapore-based multi-million-dollar venture capital fund wholly owned by Woh Hup Holdings Pte Ltd. With an aim to identify and invest in 2 - 3 human centric proptech startups every year, Aurum hopes to empower change and facilitate growth for business, professionals, individuals and its investments across the region.

## Annex D: Factsheet on BEAMP Demo Day

1 The Built Environment Accelerate to Market programme (BEAMP) facilitates the deployment of innovative solutions to the market through demand matching and funding support for start-up innovators. 14 teams from this BEAMP cycle will participate in this year's BEAMP Demo Day.

### Phases in BEAMP

2 One cycle of BEAMP consists of two (2) phases:

### a. Phase 1: Accelerate Solution Development Phase

In Phase 1, the solutions are "fast-tracked" to meet the needs of the industry. These needs will be identified by the industry who will also act as challenge statement owner (CSO[7]) throughout the programme. This phase is expected to take 3 – 5 months. During this solution development, regulators will also be consulted to identify possible bottlenecks that could impede the solution adoption. The outcome of Phase 1 is a minimum viable product (MVP[8]).

With a MVP, shortlisted innovators[9] will then showcase their solution at the "Demo Day". During "Demo Day", the interests of stakeholders (Industry, value chain players, venture companies) are consolidated in order to solicit support for downstream solution refinement, pilot deployment and technology investment for the subsequent "Market Development" phase.

### b. Phase 2: Market Development Phase

In Phase 2, CSOs are engaged with innovators to drive further solution refinement, test-bed the technology through a pilot and build up low level manufacturing capabilities to facilitate downstream adoption. This phase aims to grow demand for

[7] *CSOs stands for Challenge Statement owners. CSOs are Industry Stakeholders who proposed challenge statement(s) to address their near-term organisational challenge(s).*
[8] *A minimum viable product is the most pared down version of a product that can still be released. An MVP has 3 key characteristics; i) enough value that people are willing to use or buy it initially; ii) demonstrates enough future benefit to retain early adopters; iii) provides a feedback loop to guide future development.*
[9] *Innovators are solution providers who solve challenge statement(s) proposed by CSOs.*

the solutions and provide a sustainable business model. This phase may take up to 18 months to yield results.

**Thematic Challenges**

3 The proposed themes for the 2nd cycle of BEAMP includes the following:

a. **Streamlining construction delivery processes** through Integrated Digital Delivery (IDD), Facilities Management, Maintainability and Design for Manufacturing and Assembly (DfMA) solutions. Possible solution areas are:
   i. IDD solutions to improve productivity in DfMA and Integrated Construction Prefabrication Hubs (ICPHs) processes
   ii. Integrated solutions for Maintainability and Quality related activities
   iii. Smart assets management solutions
   iv. DfMA solutions in building design
b. **Advancing construction technologies** through Robotic, 3D Printing and Advanced Materials. Possible solution areas are:
   i. Development of new capabilities in 3D Printing for ICPHs
   ii. Integrated Robotic solutions for onsite and offsite work

**Program Accelerator**

4 BCA has engaged **TNB Accelerator Pte Ltd** to co-organise the programme. TNB Accelerator will:

a. Surface and consolidate challenges of industry and transform them to challenge statements which are relevant and of interests to the innovation community.
b. Bring in innovations (locally, regionally and globally) that fit the challenge statements
c. Help innovators to shape their business models
d. Provide access to innovation network to drive innovation development and adoption *(e.g. potential solution providers, investors, VCs, production facilities, and market for solutions)*

**Funding Support**

5 Enterprise Singapore has a funding scheme to support shortlisted and eligible local innovators. Funding quantum would vary for local-SME[10] and local non-SME innovators. To qualify as local SMEs, the companies must fulfil the following criteria:

- Registered and operating in Singapore
- Have minimum of 30% local shareholding
- Have group annual sales turnover of not more than S$100 million or group employment of not more than 200 employees

6 Local SMEs that are shortlisted to participate in the programme will be provided with funding support of up to 70%[11] of the qualifying project cost, capped at S$30,000 for phase 1 (Accelerate Solution Development Phase) and capped at S$250,000 for phase 2 (Market Development Phase).

Examples of qualifying and non-qualifying cost are:

| Qualifying Cost | Non-Qualifying Cost |
|---|---|
| • Manpower<br>• Equipment and Software[12]<br>• Professional Consultancy | • Maintenance<br>• Warranty<br>• Common Office Equipment |

7 Foreign companies are invited to participate. However, to qualify for government's funding, foreign technology providers are required to co-develop the solution with Singapore SMEs.

**Proposal Evaluation**

8 During proposal submission, innovators may apply for (1) Accelerate Solution Development or (2) Market Development, depending on the technical maturity of the solution proposed.

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[10] *SME refers to Small & Medium Enterprises*

[11] *Local non-SMEs can be funded up to 50% of qualifying project cost, subjected to the same funding caps for both phases*

[12] *Equipment and software are supported at up to 50% for local SMEs and up to 30% for local non-SMEs*

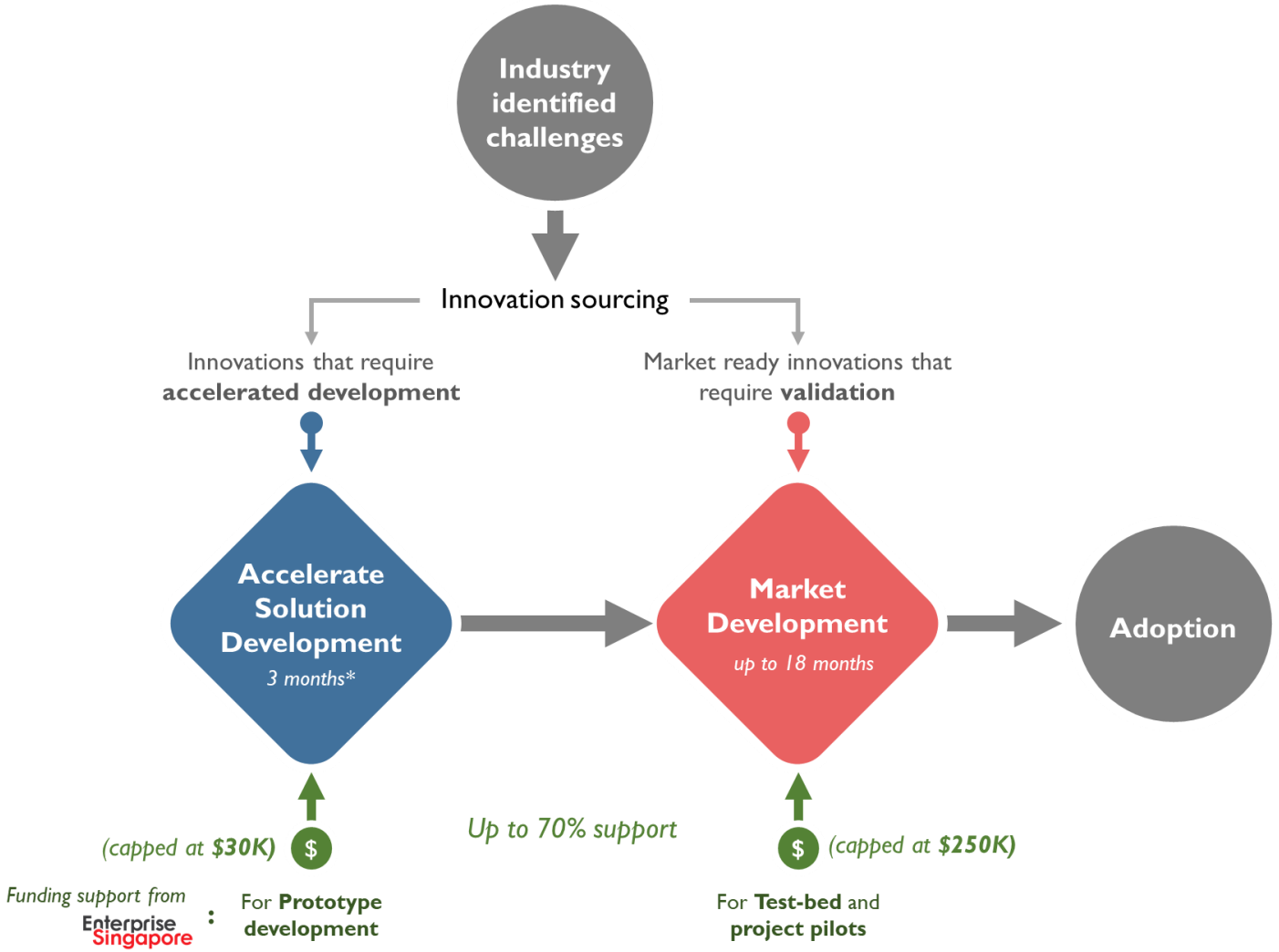
9 Assessment for accelerate solution development phase would focus on technological offering of the innovators while assessment for the market development phase would include both technological offering and financial capability of innovators. Innovators who wish to apply directly to the market development phase must fulfil the following criteria:

- Have a fully functional prototype to demonstrate on Demo Day
- Confirmation from the CSOs to test-bed/pilot the solution
- Demonstrate that the company is capable of funding the full project via means such as investments, revenue or capital

10 If the potential innovators fail to meet one or more of the above criteria, they will be further assessed on a case-by-case basis.

11 The evaluation process for both stage 1 and 2 from proposal submission to award is expected to take around 12 weeks.

## Schematic flow diagram of Built Environment Accelerate to Market Programme



**Programme Timeline for 2nd Built Environment Accelerate to Market Programme Cycle**

## List of Awarded Innovators for 1st BEAMP Cycle

### 1. Accelerate Solution Development Phase (9 projects)

| | |
|---|---|
| **Company:** | Tagvance |
| **Project Title:** | Industrial IoT Tracking Platform |
| **Challenge Statement Owner :** | Straits Construction |
| **Scope of the Project:** | Tagvance works with Straits Construction to develop an IoT network, comprising of tags and sensors riding on Long Range wireless communication (LoRa) and Bluetooth 5.0, to relay positioning data of people and assets in order to enhance work safety.<br><br>The IoT network can potentially penetrate through dense concrete structures, track vertical positioning in both semi-confined and large spaces which are common in construction sites. |

| | |
|---|---|
| **Innovator:** | Nucon Labs |
| **Project Title:** | Prioritisation Engine for Streamlined Coordination |
| **Challenge Statement Owner :** | Kimly Construction |
| **Scope of the Project:** | Nucon Labs works with Kimly Construction to develop an AI platform, powered by historical production data, to automate the prioritisation of matters to follow-up and streamline the process of decision making for its users.<br><br>The novelty lies in the Natural Language Processing (NLP) model in the AI platform to read natural language (especially Southeast Asian English) and extract critical information. |

| | |
|---|---|
| **Innovator:** | Vebits |
| **Project Title:** | Smart Sensor for Detection of Foreign Objects from Aggregated Stockpiles |
| **Challenge Statement Owner :** | Samwoh Corporation |
| **Scope of the Project:** | Vebits develops an affordable camera system which is able to recognise foreign objects in stockpiles through the incorporation of an AI-driven video analytics software and machine learning.<br><br>The cost-effective solution is selected by Samwoh for its ability to separate non-metallic materials from stockpiles. |

| | |
|---|---|
| **Innovator:** | Unabiz |
| **Project Title:** | Asset Tracking and Utilisation Monitoring with Sigfox |
| **Challenge Statement Owner :** | Samwoh Corporation |
| **Scope of the Project:** | Unabiz develops cost-effective assets tracking and utility monitoring device which rides on Sigfox (i.e. Low Power Wide Area Network) network technology.<br><br>The solution allows critical data such as location and utilisation rate of assets to be transmitted at low cost and low battery consumption. |

| | |
|---|---|
| **Innovator:** | OneWork |
| **Project Title:** | Smart Trackers for Monitoring Workers' Health and Safety |
| **Challenge Statement Owner :** | Facebook Singapore (*in collaboration with Fortis Construction*) |
| **Scope of the Project:** | The solution detects workers' health and location in urban construction on BIM platform for accident prevention and reduce critical response time.<br>It is done through a safety wearable device attached to a safety helmet which integrates multiple technologies such as LPWAN (Low-Power Wide-Area), RFID (Radio-Frequency Identification), health monitoring sensors and GPS system.<br><br>Safety supervisors are able to track workers' health and safety and movement over a backend software in construction sites with low connectivity. |

| | |
|---|---|
| **Innovator:** | Boustead Projects |
| **Project Title:** | Integrated System for Facilities Management |
| **Challenge Statement Owner :** | Echo Base (*affiliated to Razer Singapore*) |
| **Scope of the Project:** | Boustead Projects works with Echo Base to deploy an open platform that will consolidate the monitoring and execution of building-related operations.<br><br>The main innovation is the integrated platform for all systems and devices in the building environment to leverage their data to implement complex business processes which are otherwise impossible when using the standalone systems. |

| | |
|---|---|
| **Innovator:** | Aviation Virtual |
| **Project Title:** | BIM-based Augmented Reality for Dimensional and Spatial Verification of Building Elements |
| **Challenge Statement Owner :** | Building and Construction Authority |
| **Scope of the Project:** | Aviation Virtual has developed a wearable device for BCA which maps BIM model as an augmented reality (AR) overlay onto structures or open spaces at construction sites. It facilitates the inspection process by giving real-time measurement and feedback.<br><br>The responsiveness of the device enables real-time feedback to its users by segmenting heavy BIM file into multiple smaller segments to improve software responsiveness. |

| | |
|---|---|
| **Innovator:** | Aviation Virtual |
| **Project Title:** | Drone-Based Scanning of Buildings for 3D Modelling |
| **Challenge Statement Owner :** | Building and Construction Authority |
| **Scope of the Project:** | The solution improves the efficiency and accuracy of inspection activities by developing an integrated building inspection solution by combining multiple technologies such as LIDAR scanning, BIM-related technology and drones.<br><br>It is adopted by BCA to demonstrate effectiveness of 3D model in virtual reality environment for data analytics. |

| | |
|---|---|
| **Innovator:** | Aespada Technologies |
| **Project Title:** | Smart Logistics Platform |
| **Challenge Statement Owner :** | JTC Corporation |
| **Scope of the Project:** | Aespada Technologies provides a smart logistics platform which allows construction companies to gain access to a network of heavy vehicle providers.<br><br>The solution aims to reduce inefficiencies and optimise resources by connecting and coordinating the movement of assets in the construction industry. |

## 2. Market Development Phase (5 projects)

| | |
|---|---|
| **Innovator:** | Qi Square |
| **Project Title:** | Digitalising Building Energy Performance Optimisation |
| **Challenge Statement Owner :** | JTC Corporation |
| **Scope of the Project:** | Building on their virtual energy audit platform, QISquare works with JTC Corporation to optimise building performance by developing a multi-physics simulation model. The model will create an accurate representation of 'Digital Twins' for real-time operational control.<br><br>The solution provides a cost effective way for building owners and developers to make continuous improvements and informed decisions such as retrofitting investments. |

| | |
|---|---|
| **Innovator:** | VR Collab |
| **Project Title:** | Auto Checker with Virtual Reality Modelling |
| **Challenge Statement Owner :** | Housing Development Board (HDB) |
| **Scope of the Project:** | VRCollab works with HDB to further develop an auto-checker module within the existing multi-user virtual reality communication tool which enables the Building Quality team to inspect a virtual mock-up instead of the conventional timber mock-up.<br><br>The solution would improve the user experience and application by allowing end users to select and checks semantic rules based on flexible filters. |

| | |
|---|---|
| **Innovator:** | EP Watson |
| **Project Title:** | Effective Management of Equipment Maintenance and Utility Rate |
| **Challenge Statement Owner :** | Samwoh Corporation |
| **Scope of the Project:** | EP EAM is a cloud-based telematics platform for tracking off-road equipment that provides Samwoh with real-time operational intelligence to become more productive and profitable.<br><br>EP Watson's NB-IoT tracker is ruggedised, affordable and OEM agnostic. The platform integrates with third party Can Bus devices to extract granular datapoints such as fuel consumption & diagnostic trouble codes. |

| | |
|---|---|
| **Innovator:** | Novade |
| **Project Title:** | Innovative Predictive Planning Solution |
| **Challenge Statement Owner :** | Soilbuild Construction |
| **Scope of the Project:** | Novade's platform improves full coordination of construction project with information from various stakeholders as well as project information in integration with BIM model.<br><br>The key novelty is the real-time digitisation of coordination work that allows engineers to make informed decisions to prioritise jobs without having stakeholders to meet up in person. |

| | |
|---|---|
| **Innovator:** | Xjera Labs |
| **Project Title:** | Innovative Tracking and Predictive System for Workplace Safety |
| **Challenge Statement Owner :** | Kimly Construction |
| **Scope of the Project:** | Building on their visual analytics platform which has been deployed at Chong Qing and Tuas Port, Xjera Labs works with Kimly to further develop and enhance their analytics platform to provide warnings for safety breaches, identification of hazardous objects and rule based intrusion alerts.<br><br>The complete solution is a holistic site safety management tool which is marketable and commercially viable for the industry. |