ABOUT THE BUILT ENVIRONMENT ACCELERATE-TO-MARKET PROGRAMME

1. The Built Environment Accelerate-to-Market Programme (BEAMP) supports promising innovators as they develop technology solutions for the built environment.

BEAMP Phases

2. Each BEAMP cycle consists of two phases.

a. Accelerate Solution Development Phase

Projects under the Accelerate Solution Development phase will take around three to six months to complete. In this Phase, industry firms identify needs and challenges faced through Challenge Statements; these participating firms are known as Challenge Statement Owners (CSO). Innovators are invited to respond to these Challenge Statements by submitting proposals about how their existing solutions or a prototype based on their expertise or proprietary technology can be adapted / applied to address the Challenge Statements and meet the industry's needs. These proposals are assessed by an evaluation committee before they are selected for the Programme. Shortlisted innovators will then work with the Challenge Statement Owner to develop a minimum viable product (MVP*) that is expected to be completed in three to six months.

With a MVP, shortlisted innovators** will have the opportunity to give a demonstration of their developed solution at the Built Environment Demo Day (as part of the International Built Environment Week), where the innovators can solicit support from other industry firms and investors for the further refinement, support and deployment of their solutions e.g., for the subsequent "Market Development" phase.

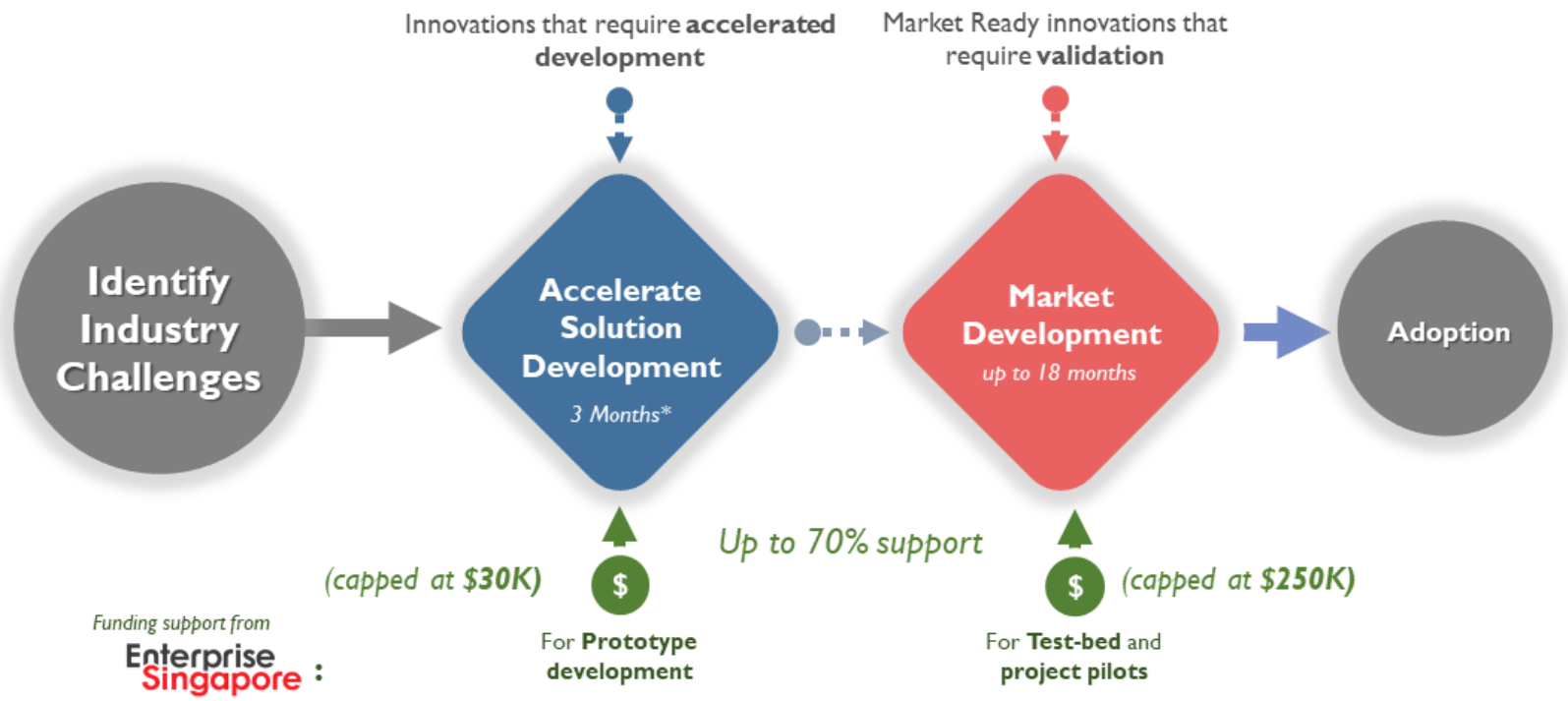
**is the most pared down version of a product that can still be released. An MVP has three main characteristics: (i) enough value that people are willing to use or buy it initially; (ii) demonstrates enough future benefit to retain early adopters; and (iii) provides a feedback loop to guide future development.*

*** Innovators are solution providers who solve challenge statement(s) proposed by CSOs.*

b. Market Development Phase

Projects under the Market Development phase go through further solution refinement and test-bedding and are expected to take up to 18 months to complete. In this Phase, Challenge Statement Owners work with innovators to refine existing solutions and technology so that they can be tested at a site and for eventual manufacturing and commercialisation. This phase supports the innovators to create the market demand for their solutions, providing them with a sustainable business model. This phase may take up to 18 months.

An overview / flow of the Programme is illustrated below:



BEAMP's Seven Tracks (Thematic Challenges)

3. There are seven tracks under BEAMP:

   a. Advanced Construction Materials: *New alternative construction materials that improve a building's performance e.g. durability, sustainability, reduction of noise during construction.*

   b. Advanced Design and Fabrication: *New technologies that improve productivity by supporting off-site prefabrication and modular building designs and construction*.

   c. Automation and Robotics: *Improving construction productivity and reducing reliance on manpower with automation and robotics solutions, applied from design through construction and post-construction phases.*

   d. Building Inspection, Maintenance and Facility Management: *Improving productivity, minimising safety risks, and reducing manpower reliance for building inspection maintenance and facilities management.*

   e. Digital Asset Delivery and Management: *Collecting and enabling data exchange seamlessly among project teams and building professionals from design through construction and post-construction phases, improving productivity.*

   f. Construction Site Safety: *Improving the safety of workers and personnel who access construction work sites.*

   g. Smart Estate Management: *Allowing estate managers to use intelligent technologies such as smart sensors and Internet of Things (IoT) devices which can respond to physical signals, collect and analyse the data generated, and help estate managers to work smarter and more efficiently.*

Accelerator

4. **Padang & Co** has been appointed to manage the third cycle of BEAMP. Padang & Co will:

   a. Consolidate the industry firms' challenges into challenge statements which are relevant and can interest innovators.

   b. Bring in innovators (locally, regionally and globally) with innovations that may overcome the challenges.

c. Help innovators to shape their business models and sharpen their pitch in preparation for the market commercialisation of their innovations.
d. Build a network of innovators, investors and venture capitalists, and manufacturers to foster a culture of innovation development and market commercialisation for the built environment.

Funding Support

5. Enterprise Singapore supports local small and medium-sized enterprises (SMEs) with the Enterprise Development Grant (EDG) (for eligible enterprises) with up to 70% of qualifying costs, capped at S$30,000 for the Accelerate Solution Development (ASD) phase and S$250,000 for the Market Development (MD) phase.

6. Companies keen to apply for the Enterprise Development Grant (EDG) should meet these criteria:

a. Be registered and operating in Singapore
b. Have a minimum of 30% local shareholding
c. Be in a financially viable position to start and complete the project

Proposal Evaluation

7. When submitting their proposals, innovators may apply for (1) Accelerate Solution Development or (2) Market Development, depending on the technical maturity of their solution(s).

8. Assessment under the Accelerate Solution Development phase would focus on innovativeness and technical merit of the proposed solution, and how well it addresses the Challenge Statement, while assessment under the Market Development phase would include additional factors such as market potential of proposed solution and financial capability of the innovator.

The eight innovators under BEAMP Cycle 3

1. In BEAMP's current third cycle and supported by accelerator Padang & Co, 11 new innovations from eight innovators were chosen out of 66 proposals submitted in response to 23 challenge statements.

2. Details of the 11 innovations and the eight innovators:

Advanced Design and Fabrication: *New technologies that improve productivity by supporting off-site prefabrication and modular building designs and construction.*	
1	**DigitalBuild Pte Ltd** offers Design Automation solutions that use BIM, Virtual Design and Construction (VDC) and other software tools to improve and optimise construction work processes. **Industry Firm:** CKR Contract Services Pte Ltd **Innovation: Unit Layout Plan Optimisation for Prefabricated Prefinished Volumetric Construction (PPVC) Projects** Developing a design simulation tool to rapidly explore permutations of a unit plan layout for PPVC projects, so that designer and builders can optimise their Design for Manufacturing and Assembly (DfMA) designs and assess if they comply with the building's design parameters. The tool optimises the unit layout plan and as a result, reduces the number of moulds required for fabrication.
2	**T-Bot Technologies Pte Ltd** provides hardware and software solutions that create workflows that cater to the needs of their customers. **Industry firm:** Tiong Seng Contractors Pte Ltd **Innovation: 3D-Printed Bespoke Building Components** Developing an end-to-end workflow that allows physical objects with complex one-of-a-kind designs to be produced using 3D printing methods. It uses computational design to generate optimal printing pathways, yielding the strongest structures with the least amount of materials needed. It allows builders such as Tiong Seng Contractors Pte Ltd to customise the printing of complicated building components.

Automation and Robotics: *Improving construction productivity and reducing manpower reliance with automation and robotics solutions, applied from design through construction and post-construction phases.*	
3	**OPERVA AI Pte Ltd** is a technology company that helps asset construction and maintenance professionals build and maintain their assets smarter, faster and safer. *(also innovation #7)* **Industry Firm:** RCC-Greatearth JV Pte Ltd **Innovation: Drone Photogrammetry for Site Monitoring** Developing an advanced drone photogrammetry* application that automatically plans out drone flight operations by checking the weather, plotting out the flight path, and computing the camera shots required to complete the photogrammetry. **The technology of obtaining reliable information about physical objects and the environment through recording, measuring and interpreting photographic images, patterns of electromagnetic imagery, among others.*
Building Inspection, Maintenance and Facility Management: *Improving productivity, minimising safety risks and reducing manpower reliance for building inspection maintenance and facilities management*.	
4	**Argyle Pte Ltd a** provides a reality capture of the built environment, digital libraries of built assets, 3D construction, verification and construction animation. **Industry firm:** Penta-Ocean Construction Co Ltd. **Innovation: Layout Information Gathering for As-built Services in the Ceiling Space** Developing an as-built ceiling space survey kit by integrating three technologies – LIDAR* scanning, hexapod** robotics, and remote first-person view piloting systems. The survey kit allows contractors such as Penta-Ocean Construction Co Ltd to carry out 3D scans and inspections of ceiling spaces and the as-built mechanical & electrical (M&E) services within. This innovation helps to minimise the safety risks for workers, avoid disruption to property owners' operations and make ceiling surveys less time-consuming. * *Light detection and ranging: A method of determining ranges by targeting an object with a laser and measuring the time for the reflected light to return to the receiver.* ** *A mechanical vehicle that walks on six legs.*

5	**LightHaus Photonics Pte Ltd** focuses on two key advanced optronics concepts that significantly reduce the cost of laser vibrometry and hyperspectral imaging for many cost-sensitive industries. The company has also wide technical expertise to provide customised solutions to optics-related applications. **Partner:** BCA **Innovation: Close-up Inspection of Building Facades** Developing an inspection device that uses multispectral Short Wave Infrared (SWIR) imaging* based on InGaAs** sensor technology to detect dampness in concrete. The device measures the unique spectral information*** of every scanned object and detects water moisture based on its absorption in the 1000nm to 1600nm wavelength range. ** Used for producing images based on radiation in the region of the infra-red electromagnetic spectrum invisible to the naked eye.* *** A high-speed, highly sensitive detector of electromagnetic radiation.* **** Chemical composition.*
Digital Asset Delivery and Management: *Collecting and enabling data exchange seamlessly among project teams and building professionals from design through construction and post-construction phases.*	
6	**Augmenteed Pte Ltd** offers software platforms that help industries design and build digital workflows for frontline technicians at the construction sites. **Industry firm:** Hong Leong Holdings Limited & King Hup Construction Pte Ltd **Innovation: Progress Monitoring for Cabinet Installation** Developing a no-code development platform* that digitises the process of cabinet installation for King Hup Construction Pte Ltd by deploying a customised application. The platform captures data without errors and allows King Hup Construction Pte Ltd to share the installation progress in real-time with the project team, such as quantity surveyor and management. **Allows programmers and non-programmers to create application software through graphical user interfaces and configuration instead of traditional computer programming.*
7	**OPERVA AI Pte Ltd** is a technology company that helps asset construction and maintenance professionals build and maintain their assets smarter, faster and safer.

	(also innovation #3) **Industry firm:** Penta-Ocean Construction Co Ltd. **Innovation: Common Data Environment System for Construction Management** Developing a single visual and collaborative software platform for construction professionals which connects to various software solutions. The platform unifies information across these different software solutions, thus eliminating the need to collate information. It enables Penta-Ocean Construction Co Ltd to fulfil all their document management, site management, safety management and project management needs using one platform.
8	**VRcollab Pte Ltd** is a Singapore-based developer of a multi-user virtual reality tool that fosters collaboration, design co-ordination for architecture, engineering and construction. The tool converts building information models for use in virtual reality by concentrating on the design at hand, enabling architects, engineers and builders to walk in their buildings before they are built. *(also innovation #9)* **Industry firm:** RCC-Greatearth JV Pte Ltd **Innovation: Augmented Reality Visualisation for Precast Element Installation and Inspection** Developing a BIM-to-AR (augmented reality) solution that allows RCC-Greatearth JV Pte Ltd's project team to visualise installation and inspection of the structural elements of a project using the structural BIM data using prefabrication. This solution will be integrated with the RCC-Greatearth JV Pte Ltd's existing Integrated Digital Delivery platform so that workers can readily access the BIM metadata onsite.
9	**VRcollab Pte Ltd** is a Singapore-based developer of a multi-user virtual reality tool that fosters collaboration, design co-ordination for architecture, engineering and construction. The tool converts building information models for use in virtual reality by concentrating on the design at hand, enabling architects, engineers and builders to walk in their buildings before they are built. *(also innovation #8)* **Partner:** Housing and Development Board (HDB)

	Innovation: Automated Addition and Alternation Work Plans Submission Processing Developing a solution that applies artificial intelligence, i.e. machine learning and optical character recognition technology*, to databases of legacy 2D building plans. This would help HDB easily manage and organise their drawings and documents with search indexing. **Automates data extraction from printed or written text from a scanned document or image file and then converting the text into a machine-readable form.*
10	**Groundup.ai** is an artificial intelligence and sensors company with robust capabilities to help industrial enterprises in sectors like heavy machinery and manufacturing create better strategies through a data-driven approach. *(also innovation #11)* **Industry firm:** Santarli Construction Pte Ltd **Innovation: Lifting Schedule Optimisation for Tower Cranes** To develop a platform that helps to optimise Santarli Construction Pte Ltd's tower crane lifting schedule planning. It also allows Santarli Construction Pte Ltd to capture real-time data of the crane lifting process to improve visibility, productivity and decision-making among project team members.
11	**Groundup.ai** is an artificial intelligence and sensors company with robust capabilities to help industrial enterprises in sectors like heavy machinery and manufacturing create better strategies through a data-driven approach. *(also innovation #10)* **Industry firm:** Chuan Lim Engineering Pte Ltd **Innovation: Excavator Usage Monitoring** Developing an Internet of Things (IoT) solution that monitors and provides insights to improve the productivity of Chuan Lim Engineering Pte Ltd's worksite and excavator fleet. The solution will comprise high-resolution cameras and computer vision that monitor worker fatigue, excavator idling time* as well as soil volume and materials. ** Excavator is deployed on-site and remains switched on but is not being used in activities such as digging.*

Two successes from the Built Environment Accelerate-to-Market Programme

#1

UnaBiz Pte Ltd is a tech-agnostic Internet of Things (IoT) service provider, that specialises in low-power wide-area (LPWA) sensor technologies that are affordable and scalable. UnaBiz Pte Ltd also serves the built environment with IoT solutions for facilities management – with the deployment of hardware sensors across public spaces in malls, education institutes, public buildings, hospitals and transportation hubs. They have collaborated with firms ranging from Surbana Jurong, Certis Cisco and Singapore Airlines to develop and deploy solutions in facilities management.

Industry firm: Samwoh Corporation

Innovation: Asset Tracking and Utilisation Monitoring with Sigfox (completed ASD phase)

UnaBiz Pte Ltd's Asset Tracking and Utilisation Monitoring uses Sigfox LPWA sensor to monitor and track equipment at the construction site due to its long-range network coverage. The sensor solution allows Samwoh Corporation to collect location data of its construction assets at low cost and low energy consumption. The multi-purpose sensor can also be scaled up to provide further insights on asset utilisation rate, which helps enterprises optimise resource allocations and implement preventative maintenance.

Benefit: With the Asset Tracking and Utilisation Monitoring, industry firms can track their assets' utilisation levels and location, and the technology can be applied across different asset models and variants. The industrial Sigfox tracker has an expected five years of battery life in the field after deployment, compared to 3G operated solutions that are more power-hungry. With the increased efficiency and reduced cost of the solution, it is able to support scalability and mass deployment.

#2

Qi Square Pte Ltd is a spin-off company from the Nanyang Technological University, that provides industry firms with digital tools that promote energy efficiency, sustainability and carbon emissions reduction.

Partner: JTC Corporation (JTC)

Innovation: Enhanced Virtual Energy Audits Using Machine Learning (completed both ASD and MD phases)

Qi Square Pte Ltd's Enhanced Virtual Energy Audits is a digital tool that collects data from buildings to create virtual models and simulate their energy performances.

Benefit: The Virtual Energy Audit was able to produce energy models that achieved more than 95% accuracy, and subsequently identify energy conservation measures

that could be deployed to achieve up to 30% cumulative savings for building owners. The learnings from this project, were also used by the company in developing an AI-enabled cloud platform, BtrLyf.com to facilitate instant assessment of buildings and identifying relevant energy saving measures and their return on investment, fully automatically. This platform will greatly improve the productivity of the teams working on green building projects and enable professionals to assess green buildings remotely and cost-effectively in the post-pandemic economy.