

Building with speed and quality through high-tech

October 19, 2016



Mr Wong, the National Development Minister (third from left) and BCA's Dr Keung (fourth from left) with NTU's 3D printer, which can produce concrete structures. PHOTO: BUILDING AND CONSTRUCTION AUTHORITY

Technologies to help productivity

Your future home might be planned using virtual reality, built with a 3D printer and inspected by a robot for quality.

What may sound like a sci-fi movie could become reality in a few decades as Singapore ramps up its construction productivity and employs more efficient building methods.

Construction site productivity has grown by an average rate of 1.3 per cent per year since 2009, but there is still room for improvement, said National Development Minister Lawrence Wong yesterday at the launch of the Singapore Construction Productivity Week at the Singapore Expo.

As such, the Government is adopting a string of measures to raise productivity growth to the national target of 3 per cent a year.

Technologies to boost productivity

Area	Examples	Benefits
 Design for manufacturing and assembly (DfMA)	<ul style="list-style-type: none"> • Prefabricated pre-finished volumetric construction (PPVC), where building modules are constructed in factories before being assembled on-site • Precast concrete, engineered timber, structural steel and hybrid combinations 	<ul style="list-style-type: none"> • Scalable • Fewer workers, less noise on site • Better construction quality
 Automated equipment/robotics	<ul style="list-style-type: none"> • Robotic assembly line in prefabrication hubs • Autonomous robots at work sites 	<ul style="list-style-type: none"> • Able to work 24/7 • Can perform monotonous tasks more quickly, accurately and efficiently
 Infocomm technology	<ul style="list-style-type: none"> • Data analytics to anticipate issues such as bottlenecks • Logistics simulation to predict potential delays and problems and smoothen logistics process 	<ul style="list-style-type: none"> • Faster communication and data sharing • Reduces duplication and errors • Easy access to accurate and real-time information
 Building information modelling (BIM) and virtual design and construction (VDC)	<ul style="list-style-type: none"> • Smart BIM tools with artificial intelligence to optimise design, aid decision making and solve problems • Virtual/augmented reality for construction and facilities management 	<ul style="list-style-type: none"> • Allows for holistic design and construction process • Improves communication and collaboration • Enhances visualisation
 3D printing	<ul style="list-style-type: none"> • Printing of complicated geometries and customised structures in various materials 	<ul style="list-style-type: none"> • Able to work 24/7 • Reduces need for moulds and formwork
 Advanced construction materials	<ul style="list-style-type: none"> • Ultra-high performance concrete • Alternative structural materials • Durable corrosion protection coatings 	<ul style="list-style-type: none"> • Reduces weight and amount of material • Easier maintenance • Increases strength and shelf-life
 Civil engineering works	<ul style="list-style-type: none"> • Advanced precast solutions like super-long-span bridge beams and large volumetric precast for underground spaces 	<ul style="list-style-type: none"> • Less disruption to surroundings • Faster construction

Source: BUILDING AND CONSTRUCTION AUTHORITY STRAITS TIMES GRAPHICS

Such methods, some of which are already in practice here, are expected to speed up the building process, rely on fewer workers and boost construction quality. For instance, prefabricated, prefinished volumetric construction, which involves building modules in factories before assembling them on-site, can save up to 40 per cent in man-days.

About 400 industry players, public agencies, institutes of higher learning and research institutions were consulted for this road map.

"BCA will now study how we can support these different research priorities and give them a greater push," said Mr Wong.

BCA chief executive John Keung said the first step is to look for funding for such technologies, which are typically more expensive. But he is not too worried about cost. Said Dr Keung: "Once the industry is familiar with (such technologies), there will be economies of scale... and the cost will come down."

Some of these technologies were on show yesterday at the event's BuildTech Asia exhibition, organised by Sphere Exhibits and hosted by BCA.

For instance, Nanyang Technological University's Singapore Centre for 3D Printing showcased a 3D printer that can produce concrete structures.

The aim is to have such printers build customised structures such as pillars and beams eventually, said Associate Professor Tan Ming Jen, the centre's programme director for building and construction.

The Government will also look at stipulating productivity outcomes, such as manpower savings, for future government land sales (GLS) sites, but without mandating any specific technology. Currently, the use of specific technologies such as prefabricated pre-finished volumetric construction is mandated for selected GLS sites.

But the new requirement will allow "more innovation and scope" for firms bidding for the sites to come up with their own productive methods, said Dr Keung.

Builders will also receive bonus points for productivity in their workmanship quality scores if they adopt less labour-intensive designs and materials, such as engineered wood and prefabricated bathroom units.

Dr Keung said productive methods bring many benefits, including saving time, minimising construction noise and improving worksite safety, without compromising on quality in the process.

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