Transforming the Singapore Built Environment Industry

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ABSTRACT

Singapore government has been pushing to raise the construction productivity level since 2015 and have set aside 2nd tranch of S$450m of Construction Productivity Capability Fund (CPCF) as part of 2nd Construction Productivity Roadmap. The S$150m Public Sector Construction Productivity Fund (PSCPF) has also been introduced in February 2017 to spur the adoption of innovative and productivity solutions for public sector projects. This is further push with the Construction Industry Transformation Map (Construction ITM).

The key thrusts of the Construction ITM is to develop the Built Environment Sector into an Advanced and Integrated Sector, with Progressive and Collaborative Firms and to provide Good Jobs for Singaporeans working in this sector.

This paper discusses on key initiatives on the Construction ITM led by the government through collective effort with the Industry Professional Institutions, Institutes of Higher Learning (IHLs) and Unions, coming together to lead the BE Sector transformation.

Through the key thrusts, it drives changes and encourages on adoption of innovation technologies pushing new boundaries such as Design for Manufacturing Assembly (DfMA) – Pre-fabricated Pre-finished Volumetric Construction (PPVC) and Mechanical & Electrical System; Integrated Digital Delivery (IDD); It also promotes Early Contractor's Involvement, Collaborative Contracting and emphasis on quality and performance instead of price on procurement of construction work and consultancy service. To enhance the BE sector workforce, there is also a comprehensive Manpower Development plan in place, working collectively between the Industry, government and IHLs through this tripartite arrangement.

The Construction ITM has also help shape the evolving roles of quantity surveyors as we embrace on the technology, different procurement approaches, of which the writer will share his perspective on this.

Keywords: Built Environment, Transformation, QS Profession

1. INTRODUCTION

To further raise the Singapore's construction productivity level through the second Construction Productivity Roadmap, the Singapore Government, on 10 March 2015, announced that a fresh funding of S$450 million will be set aside as the second tranche of Construction Productivity Capability Fund (CPCF). This additional funding aims to help push for higher productivity gains in the industry over the next 3 years (June 2015 to May 2018). To-date, approximately 9,000 firms from the Singapore built-environment sector have benefitted from this scheme. Under this second Construction Productivity Roadmap, a target average site productivity improvement of 2% to 3% (per annum from 2010 to 2020) has been set.

A S$150 million Public Sector Construction Productivity Fund (PSCPF) has also been introduced in February 2017 to spur the adoption of innovative and productive solutions for public sector projects. This is further pushed with the Construction Industry Transformation Map (CITM) which Building & Construction Authority (BCA) laid out in later part of 2017, to lead the built environment sector transformation.

2. CONSTRUCTION ITM (INDUSTRY TRANSFORMATION MAP)

The global trends shaping the Built Environment Sector is mainly driven by Digital Revolution, Rapid Urbanisation and Climate Change which drives various demand and responses: -

- Digital Revolution – increased in artificial intelligence and advent of smart buildings, new construction technologies and digitalised work processes;

- Rapid Urbanisation – increased in built environment and the need for advanced technologies to build faster and better; and

- Climate Change – increased in sustainability effort and stronger demand for green building expertise.

The Built Environment Sector has always been viewed as less prestigious as compared to other industries, lower career advancement opportunities, poor health and safety, sensitive to economic upheavals and little promotion on industry branding. These image over time has posed challenges for the Sector to attract talents into the industry and to retain the people within the sector.

The government through BCA laid out the Construction Industry Transformation Map (ITM) in October 2017. The ITM set out a vision for our built environment sector to transform itself into an advanced and integrated sector, with progressive and collaborative firms setting the pace, and which provides good jobs for Singaporeans. 2018 was when it set the collective gears in motion.

The Construction Industry Transformation Map (ITM), under the Built Environment cluster, is one of 23 ITMs identified under a $4.5 billion Industry Transformation Programme mooted by the Future Economy Council (FEC).

It was developed in close partnership with the industry, trade associations and chambers (TACs), institutes of higher learning (IHLs) and unions after extensive consultation.

Through this initiative, the government hopes to transform the construction sector into one that adopts technologies to make the sector more advanced and integrated. They aim to train a total of 80,000 professionals specialising in green buildings, Design for Manufacturing and Assembly (DfMA) and Integrated Digital Delivery (IDD) by 2025.

We have identified 3 key areas for this transformation:

- Build Efficiently – Design for Manufacturing and Assembly (DfMA);
- Build Green – Green buildings; and
- Build Smart – Integrated Digital Delivery (IDD)

3. HOW CAN WE TRANSFORM THE BUILT ENVIRONMENT INDUSTRY?

The vision for the Construction ITM is to develop 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.

To achieve this vision, the key strategies are to: (i) increase adoption of DfMA and IDD and greater push for Green Buildings (ii) build progressive and collaborative firms, and (iii) support workforce needs and aspirations.

(a) Increase adoption of DfMA

One of our key approaches to achieve our desired vision is the adoption of DfMA technologies. We aim to achieve 40% DfMA adoption in construction projects by 2020. A robust DfMA eco-system will make DfMA technologies price competitive and enable widespread adoption. To achieve this, the strategies are to:

- Generate lead demand to build-up experience and create economies of scale - Given the strong public sector demand, Government Procurement Entitles (GPEs) will continue to scale up adoption of DfMA technologies through the Productivity Gateway Framework (PGF). For the private sector, the Government will continue to roll out Government Land Sales (GLS) with appropriate DfMA conditions. The Government will also provide funding support for private sector projects that adopt DfMA technology voluntarily.

- Build supply capacity and capabilities - Up to ten Integrated Construction and Prefabrication Hubs (ICPHs) will be rolled out by 2020, depending on the need of the industry. Currently, there are five (5) ICPHs.

BCA has also partner with the industry, including key technical agencies and industry practitioners, to develop a series of guidebooks on DfMA technologies. These guidebooks provide simple and practical tips as well as good practices for the various DfMA technologies. The first guidebook in the series is the Prefabricated Prefinished Volumetric Construction (PPVC) guidebook.

The Prefabricated Prefinished Volumetric Construction (PPVC) guidebook is the first instalment of a series of guidebooks on DfMA technologies. It was developed through a collaborative effort involving BCA, key technical agencies and industry practitioners.

This guide provides simple and practical tips to practitioners on how PPVC is designed, fabricated, inspected, delivered and installed to achieve its functional requirements and workmanship standards. Good practices such as upfront planning and design to incorporate PPVC adoption are also covered. Practitioners are encouraged to use this guide to innovate and improve further on PPVC design, fabrication and installation.

(b) Increase adoption of IDD

The next key approach is to drive IDD adoption. IDD adoption will be raised through a two-pronged approach:

- Progressively Building up IDD Capabilities – Since 2015, BCA has mandated the adoption of Building Information Modelling (BIM) for key projects requiring Architectural and Engineering submissions in BIM for new projects > 5000m2, as BIM is a necessary pre-cursor for the wider adoption of IDD. BCA has also developed the Singapore Virtual Design and Construction (VDC) Guide to build capability on collaborating using BIM. The BCA Academy (education arm of BCA) has also reviewed and developed its BIM/VDC training programmes to include IDD scope.

- Drive Adoption of IDD – BCA also embarked on developing standards for IDD to ensure interoperability and encourage adoption of shared platforms and IDD solutions in both public and private sector projects. The Centre for Lean & Virtual Construction (CLVC) will provide an incubating environment, especially for smaller firms which lack the capacity to develop their own in-house systems and processes, to test bed IDD solutions.

These key strategies for IDD and wider digitalisation across the sector was developed within a comprehensive IDD Plan.

(c) Pushing Boundaries for Green Building

BCA has completed the review of the 3rd Green Building Masterplan. It has defined Super Low Energy (SLE) Buildings in Singapore context, identifying the greening of key schools with Ministry of Education and partnered Singapore Green Building Council (SGBC) to build up the industry ecosystem energy retrofits.

There will be greater focus on end user initiatives and launching pilot Green Mark schemes with Health Promotion Board (HPB) for healthier workplace.

It has also launched the SLR programme (i.e. SLE Challenge, SLE Buildings Technology Roadmap) and introduced Green Mark scheme for SLE.

BCA has reported that they have achieved the greening of approximately 37% of existing building stock in 2018, with more than 3400 green building projects. The target set by the Government is to green up to 80% of the building stock by 2030.

(d) Build Strong and Capable firms

As part of industry transformation, it is important to support firms in capability building. To support a sustainable and collaborative sector, the Government has undertaken the review of the public procurement frameworks and contracting practices.

- Better Differentiation of 'Quality' and Greater Transparency

  The Quality-Fee Selection Method (QFM) for consultants and the Price-Quality Method (PQM) for contractors are being reviewed. The objective is to encourage sustainable bidding behaviour and larger investments in technology and innovation to improve productivity, uplift quality and enhance collaboration among firms. In particular, higher weightage will be placed on non-price components and the differentiation of the 'Quality' score between tenderers will
  be made clearer. Greater transparency of the 'Quality' component of public sector projects will also be made available to encourage firms to improve performance through healthy competition.

- Facilitate Greater Collaboration among Firms

  The Early Contractor Involvement (ECI) procurement method has been one of the approaches to promote better collaboration between the project stakeholders. Contractors are engaged early to provide construction inputs during the design stage to facilitate the integration of the overall design and construction processes.

  Beyond ECI, Collaborative Contracting approach is seen to further enhances integration by promoting mutual trust and collaboration in executing projects that could result in less changes and claims.

  A working committee was set up to review the adoption of collaborative contracting.

(e) Support workforce needs and aspiration

To drive the transformation of the built environment sector, the quality of the workforce needs to be strengthened, especially for the key professions of built environment, engineering and architecture.

- Attract more Singaporeans into the sector – The growth of IDD, DfMA and Green Buildings will create new and good jobs that will be attractive to the younger and more IT-savvy Singaporeans. These jobs will involve higher skills, which come with more competitive salaries and a better working environment. Firms will also need

  to strengthen HR practices, and the overall image of the sector will need to be improved through sustained rebranding.

  The Government through BCA will continue to partner industry firms to offer scholarship and sponsorship programmes, which have succeeded in attracting a new wave of young Singaporean built environment professionals.

- Build Key Competencies – Industry transformation has to be driven by a strong core of PMETs who are well equipped with core engineering skills as well as the requisite skills in IDD, DfMA and Green Buildings.

  By 2025, the target is to train 20,000 personnel in IDD, 35,000 in DfMA and 25,000 in green buildings. To achieve this, a Built Environment SkillsFuture Tripartite (BEST) taskforce was set up. The taskforce look at providing more structured internships, and lead in training more new graduates in response to industry feedback to help graduates become fully job ready. The work of the taskforce has been completed and detailed recommendations have been made.

4. KEY PROGRESS ON THE ITM JOURNEY

The following are some key progress of the respective key thrust of the ITM as reported by BCA early part of 2019: -

Advanced & Integrated Sector

(a) Design for Manufacturing Assembly (DfMA)

DfMA refers to the practice of manufacturing as many building parts as possible in a factory; prefabricated parts are then assembled on site. Whilst game-changing technologies such as Prefabricated Bathroom Units (PBUs), Prefabricated Pre-finished Volumetric Construction (PPVC), Cross Laminated Timber (CLT), Glued Laminated Timber (Glulam), etc. are examples of DfMA concept.

The usage of PPVC has increased in recent years due to the continued Singapore Government's initiatives to improve productivity, such as stipulating mandatory requirement for the adoption of PPVC for new developments sold under selected Government Land Sales (GLS) Programme.

There has been an increase in the proportion of larger projects (above $85 million) adopting DfMA. We have also witnessed the completion of Clement Canopy (jointly developed by Singland and UOL), which is the first GLS site and is currently the world's tallest completed concrete Prefabricated Prefinished Volumetric Construction (PPVC) development. This has certainly marked a major milestone in Singapore's DfMA journey. There are also various residential projects adopting PPVC.

On the public residential front, as industry capacity grows, Housing & Development Board (HDB) which undertakes the public housing development is also doubling up its rate of using concrete PPVC to a third of its projects in 2019.

As we ramp up adoption and build capability to build using PPVC and other DfMA structural systems, we have begun to see first signs of prefabricated Mechanical, Electrical and Plumbing (MEP) systems in recent projects, such as the Global Switch data centre, CapitaSpring and Punggol Digital District. Despite being a relatively newer DfMA technology, we expect to see prefabricated MEP systems being adopted in some large projects above $150mil in the upcoming years.

BCA has since reported having made good progress in improving site productivity. For 2018, we have achieved an estimated cumulative site productivity improvement of 15% compared to 2010 levels, when we launched the big push to improve productivity in our sector.

(b) Green Buildings – Super Low Energy (SLE) Programme

In the area of green buildings, together with industry stakeholders, the industry has built on the decade of success of the BCA Green Mark scheme to introduce the Super Low Energy (SLE) Programme. The programme aims to spur best-in-class energy efficient buildings in the tropics, challenging our sector to design and deliver buildings that are at least 60% more energy efficient than 2005 standards. Response has so far been encouraging with 20 public and private developers pledging their commitment to the SLE programme.

The long-term impact of SLEs will go beyond energy efficiency and the realm of climate action. The demand for SLE technologies and consultancy services will open up niche opportunities both locally and globally, bringing added value to our sector and benefiting the entire eco-system. Firms that are just embarking on your green building journey are invited to work closely with BCA and the Singapore Green Building Council. Together, it can better set new benchmarks for the industry and the region.

BCA has reported that they have achieved the greening of approximately 37% of existing building stock in 2018, with more than 3400 green building projects. The target set by the Government is to green up to 80% of the building stock by 2030. There have also been 30 committed SLE projects in the pipeline.

(c) Integrated Digital Delivery (IDD) – IDD Implementation Plan

At the end of 2018, BCA launched the Integrated Digital Delivery (IDD) Implementation Plan. The adoption of IDD optimises the use of digital technologies throughout the four stages of the built environment lifecycle - Design, Fabrication, Construction and Asset Delivery & Management. This is not digitalisation merely for the sake of doing it. As we build bigger and take on projects of greater complexity within shorter time frames, building efficiently and strengthening collaboration across the entire value chain and reducing mistakes and abortive work will be mission critical.

BCA reported that there are already 12 IDD 'live' demonstration projects spanning healthcare, industrial, community, educational, commercial and residential developments to show how project stakeholders can reap the benefits of adopting IDD. There will be more projects to come.

Progressive and Collaborative Firms

(d) Pilot Collaborative Contracting Model

Currently, there are pilot projects identified to adopt pilot collaborative contracting model.

An Option Module E under Public Sector Standard Conditions of Contract (PSCOC) was developed incorporating key collaborative ingredients such as: -

- Working Relationship – work together in a collaborative environment;
- Early Notification – Early Notification Register on Cost and Time matters to be maintained;
- Settlement of disputes – establish a Dispute Board (Singapore Infrastructure Dispute Management Protocol 2018.
- Reference to Superintending Officer, Dispute Board and Arbitration.

(e) Changes to Security of Payment Act

Since the induction of the Building and Construction Industry Security of Payment Act in 2004, this is the first time where amendments were made to the Act.

The Building and Construction Industry Security of Payment (Amendment) Bill 2018 has been passed in Parliament on 2 October 2018.

The key amendments to the SOP Act focus on the following:

- Expanding and clarifying the scope of the application of the Act
- Enhancing requirements on handling of payment claims and responses
- Improving the adjudication processes

BCA is working on the necessary changes to the SOP Regulations and are working towards operationalising these amendments in the second half of 2019.

(f) Review of Standard Consultancy Agreement

BCA is currently undertaking the review of the Standard Consultancy Agreement and they have been seeking feedback from the industry through professional institutions.

Good Job for Singaporeans – Manpower Capabilities Development

(g) Manpower Capabilities Development

To develop good jobs for Singaporeans within Built Environment Sector, one of the key efforts is to develop the manpower capabilities.

Further to the recommendations from the BEST Taskforce, the iBuildSG Tripartite Committee was formed to drive the implementation. This Committee is represented by BCA, Professional Bodies / Boards, Trade Associations, Institutes of Higher Learning (IHLs), Other Government Agencies and Unions.

The iBuildSG Tripartite Committee focuses on: groom industry leaders, attract new talent, retain PMETs (Professional, Managers, Executives and Technicians) and building of required competencies.

It will also work on developing the Skills Framework for the BE Sector, where this Framework is a national wide SkillsFuture initiatives developed for the Singapore workforce to promote skills mastery and lifelong learning. The 5 key features of the Skills Framework are – Sector Information, Career Map/Pathways, Occupation and Job Roles, Skills and Competencies and Training Programmes.

5. BUILDSG – THE NATIONAL MOVEMENT

The BuildSG is a national movement for Built Environment Sector that underscores the tripartite collaboration to as part of the industry transformation: -

- Generate economic growth;
- Capture opportunities for Singapore Firms
- Provide good jobs for Singaporeans

The BuildSG movement is supported by the BuildSG Transformation office under BCA where there are 3 centres focusing on the respective effort: -

- iBuildSG – Talents and Skills
- weBuildSG – Enterprise development
- SGBuilds – International opportunities

To foster greater Tripartite collaboration effort and develop plans jointing across unions, Trade Associations and Chambers (TACs) and Government, BuildSG Tripartite Committee was formed with representatives from both public and private sectors. The Committee focuses on ITM-related policies, initiatives and collaborative events and opportunities.

6. QS PROFESSION TRANSFORMATION

As part of the Construction ITM, all key professional group (i.e. Architects, Engineers, Developers, Quantity Surveyors, Project Managers, Builders and Contractors) formulated the respective ITM Plan which was presented to the Future Economy Committee (FEC) Sub-Committee for Built Environment Sector.

The following are the key thrust of the transformation action plan for QS Profession :-

- Accreditation of Professional QS Scheme;
- Building Competence and Education – through CPD and CET programme;
- Raise Profile and Brand Outreach; and
- Adopt Technology and New Capabilties.

The Construction ITM has also help shape the evolving roles of quantity surveyors as we embrace on the technology, different procurement approaches. While the primary role of QS being the "Financial and Contracts Gatekeeper" in the Principal Consultants' Team remains, there will be greater demand for a strong knowledge and skillset in contract and procurement coupled with professional experience to drive the new way of working.

In the case of DfMA project, QS is expected to lead on the formulation of contracting framework (i.e. key contract conditions as standard form of contract does not fully addressed some of the DfMA conditions), procurement strategy and also drive the Early Contractors' Involvement (ECI) process while keeping a tight cost management and control of the project.

Similarly, for Collaborative Contracting approach, it is envisaged that the QS would take lead on the formulation of contracting framework and conditions (such as collaborative provisions, incentive mechanism) and procurement strategy. In this approach, it helps to promote partnering mindset and reduce disputes during construction and finalisation of account. The QS will play an essential role in the approach.

7. CONCLUSION

While we live in an era of transformation and businesses have to be ready to respond to unexpected changes on many fronts. With Industry 4.0, robotics, automation, artificial intelligence and other burgeoning trends are potential to disrupt the BE Sector. However, these advancements in technologies also offer many opportunities for our industry to build up new capabilities and to stay ahead of the competition.

We can stay put to wait for the unexpected changes to overtake the BE Sector and Profession, or we can proactively ride the wave of transformation to build our capabilities and be ahead of the game. Let's take lead on the BE Transformation than been transformed.

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