



CONSTRUCTION  
INDUSTRY COUNCIL  
建造業議會



# Roadmap for Building Information Modelling Strategic Implementation in Hong Kong's Construction Industry

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## Purpose

This Reference Material has been prepared by the Working Group on Roadmap for BIM Implementation (Working Group) established under the Committee on Environment and Technology (now the Committee on Environment, Innovation and Technology) of the Construction Industry Council (CIC). It summarises the Working Group's views on the strategic implementation of Building Information Modelling (BIM) in Hong Kong's construction industry.

The purpose of this Reference Material is:

1. To share the experience of construction industry practitioners using BIM in Hong Kong;
2. To present the construction industry's views and concerns on the current adoption of BIM in Hong Kong;
3. To realise the global trend toward adopting BIM in the construction industry;
4. To summarise the benefits and constraints of adopting BIM in Hong Kong;
5. To help industry stakeholders to prepare to voluntarily adopt BIM; and
6. To propose the way forward for BIM's strategic implementation in Hong Kong.

No quantitative data analysis is presented in this Reference Material but reference is made to the experience of overseas countries that have implemented BIM. For example, in 2013, McGraw-Hill Construction published a report on the business value of BIM for Architecture, Engineering and Construction (AEC) in the United States. The report provides statistical information that validates BIM's positive impact on the design, construction and operation of projects. In addition, the United Kingdom's Cabinet Office has also published an Investor's Report that illustrates the measurable benefits of adopting BIM.

Though it is an important component of strategically implementing BIM across an asset's life cycle, Facilities Management has not been included in this phase of the study. Given its complications, it has been excluded to simplify the study and facilitate an earlier release of this report. The Working Group may consider including Facilities Management by updating this Reference Material in next phase of the study.

## Executive Summary

Building Information Modelling (BIM) is not just a 3D drawing tool but a new way of holistically managing the information related to construction projects, from planning to design, construction and operations. It offers a new method of working that uses modern technology to facilitate project management and execution. BIM enables better control of the construction process and enhances cross-disciplinary collaboration, internal coordination, external communication, problem solving, decision-making support, productivity management and risk management.

At a project management level, BIM benefits cross-disciplinary collaboration by facilitating early engagement with the relevant disciplines. Moreover, BIM can also help with localised engineering solutions such as clash analysis, shadow analysis, cost analysis, design scheme options, etc.

However, in addition to the benefits of adopting BIM, challenges and setbacks should also be carefully considered.

### Accelerating Global Adoption

The construction industry is adopting BIM on a global scale. The United States, the United Kingdom, a number of major European countries, Singapore and South Korea have mandated the use of BIM in public construction projects. Some countries have set up agencies to manage the nationwide implementation of BIM and the introduction of best practices and standards. A number of countries will require BIM to be adopted in the near future.

An overview of BIM adoption around the world is outlined as below:

- The United States** - Since 2006, the General Services Administration has included spatial programme BIMs as part of the minimum requirements for submissions to the Office of Chief Architect for final concept approvals. The country is a mature BIM market and leads BIM best practice.
  
- Singapore** - The country issued its nationwide BIM implementation roadmap in 2011. BIM is used as part of the public sector building project procurement process. In 2015, BIM submission will be mandatory for new building projects over 5,000m<sup>2</sup>.
  
- United Kingdom** - From 2016 onwards, the government will require the mandatory use of BIM in public sector projects. The country aims to become the BIM leader in Europe.
  
- Mainland China** - BIM has been included as part of China's 12<sup>th</sup> Five Year Plan (2011 – 2015). The country is formulating a BIM framework.
  
- 10+ Other Countries** - In addition to Canada and South Korea, the majority of European countries require the use of BIM in public construction projects. Some countries have set up agencies to manage nationwide implementation and introduce best practices and standards.

Around the world, BIM-related practices and issues surrounding planning, adoption, technology and performance are moving at a fast pace, especially in developed countries. Hong Kong's construction industry must keep pace with the majority of developed countries. Local AEC companies need trained staff with the relevant skill sets and associated BIM facilities to compete for jobs and projects outside of Hong Kong.

## Hong Kong's Construction Industry is Getting Ready for Change

In Hong Kong's construction industry, BIM is at an early stage in the adoption process. However, individual practitioners have, to varying extents, been preparing themselves for the introduction of BIM. Some fast movers are almost ready for adoption while others are observers closely monitoring the adoption and utilisation of BIM. An overview of the current situation is as follows:

- Private Developers**
- Most private developers have adopted BIM to differing extents, ranging from project planning to being a mandatory requirement for particular developments. The Real Estate Developers Association of Hong Kong encourages its members to adopt BIM.
- Public Clients**
- The Hong Kong Housing Authority, MTR Corporation and Airport Authority Hong Kong have already adopted BIM and are moving forward at a fast pace.

As early as 2009, the Development Bureau's Works Departments adopted BIM technology for some public works projects. Based on this experience, they have selected additional projects that will use BIM at different stages of the works. They are also exploring the use of BIM for asset management.

The Buildings Department has completed a consultancy study titled "Feasibility Study on the Implementation of an Electronic Submission System in the Buildings Department". The consultancy study recommends that the Buildings Department liaises with relevant bureaux and departments to take the initiative to set up a cross-departmental Electronic Submission platform in the future for processing electronic plans, including those in the BIM format. The study recommends that after local BIM standards have been established and sufficient training has been provided to Buildings Department staff, the Buildings Department may amend the relevant practice notes to accept submission of building plans in BIM format for Gross Floor Area (GFA) checking.

- Architects** - The majority of architecture firms will soon be ready to adopt BIM. Some firms are experts in the technology.
- Engineers** - The majority of engineering consulting firms will soon be ready to adopt BIM. Some of the firms are experts in the technology.
- Surveyors** - Currently developing BIM best practices in surveying and considering offering value-added services through BIM.
- Contractors** - The majority of large contractors have been testing BIM to improve site safety, work scheduling, cost control, and constructability analysis.
- Training Institutes** - The Vocational Training Council (VTC) and Hong Kong Institute of Vocational Education (IVE) have included BIM training in construction-related higher diploma programmes. Some universities offer optional BIM courses as part of their degree curriculums. CIC has incorporated foundational BIM knowledge in a number of its training programmes for frontline site staff.

Some organisations and companies in Hong Kong have been progressively advancing their use of BIM, for example, constructing 5D models that include time and cost, applying BIM to site safety, integrating BIM and GIS and so on, widening the application of information technology in the construction industry.

While individual stakeholders are preparing for, or have prepared to use BIM, they wish to see a more organised and systematic approach that drives the industry-wide adoption of BIM in Hong Kong through the concerted efforts of the construction industry.

*Key Driving Force – Commitment from the Industry and Project Clients*

Construction industry stakeholders generally agree that the construction industry is expecting an industry-wide catalyst to boost the use of BIM and for an industry leader to blueprint, drive, accelerate and engage its implementation.

In order to sustain the industry's momentum, gaining project clients' commitment to advancing construction through the use of BIM is necessary.

### *Benefits of BIM for Project Clients*

Project clients (e.g. property developers, the government and public bodies) are generally recognised as the key stakeholders driving the adoption of BIM. From the project client's perspective, BIM can help to:

- (a) Provide multi-dimensional visual images and timely information related to construction projects;
- (b) Test models and quickly generate options for better decision-making in respect of time, cost, process, risk, etc.;
- (c) Detect design faults (especially clashes) and minimise the number of changes;
- (d) Improve site safety management and education;
- (e) Enhance financial risk management and minimise financial claims due to variations and delays;
- (f) Facilitate better project coordination by bringing together relevant participants in the construction project to collaborate and achieve an integrated design at an early stage;
- (g) Facilitate third party and public engagement by enhancing communications with a view to soliciting the support of the community at the project planning stage.

### *The Way Forward*

The Working Group on Roadmap for BIM Implementation, chaired by Ms Ada FUNG of the Hong Kong Housing Authority, was established under the Committee on Environment and Technology (now the Committee on Environment, Innovation and Technology) of the Construction Industry Council. The Working Group was formed to define a roadmap and implementation strategies to drive the widespread adoption of BIM in Hong Kong's construction industry. To this end, the Working Group recommends that the industry implements the following three imminent initiatives:

1. **ESTABLISHMENT OF STANDARDS** - Devise a common set of standards, best practices or reference documents to facilitate the wider use of BIM in construction projects;
2. **PROMOTION** - Carry out additional promotional activities targeting industry stakeholders who are not familiar with the use and benefits of BIM. Activities should demonstrate BIM's benefits to the top management of major project clients as they are key drivers of BIM adoption and play a vital role in preparing their organisation to adopt BIM. Promotion should not be limited to local practitioners but also include exposure to regional and international practices;
3. **TRAINING** - Build Hong Kong's BIM capacity and skills by driving curricular change in construction-related and computer science programmes offered by academic institutes. Provide BIM training in three areas: BIM model development, management of BIM, and use of BIM models.

## **BIM Definition**

The term Building Information Modelling (BIM) refers to the ability to use, reuse and exchange information, of which electronic documents are just a single component. BIM is much more than 3D rendering or electronic version of paper documents. By implementing BIM, “risk is reduced, design intent is maintained, quality control is streamlined, communication is clearer, and higher analytic tools are more assessable” (CRC Construction Innovation (2007), “Business Drivers for BIM”).

“BIM is the development and use of a computer software model to simulate the construction and operation of a facility. The resulting model, a BIM, is a data-rich, object-oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users’ needs can be extracted and analysed to generate information that can be used to make decision and improve the process of delivering the facility. The process of using BIM models to improve the planning, design and construction process is increasingly being referred as Virtual Design and Construction” (Associated General Contractors of America, “AGC Guide to BIM”).

At its highest level, a BIM model is an intelligent digital representation of physical and functional characteristics about a capital facility (“<http://en.wikipedia.org>”). A BIM model has the following characteristics:

1. A BIM model is a parametric, relational database that ties together multiple layers of information about specific objects – every object in the building. The model can also store information far beyond design and construction details, and become the owner’s operation and maintenance data source.
2. A BIM model is “smart”. A change to a component is reflected in all components to which it relates. When making changes, not only the view changes but also the information in the database of the model, and those views and analysis all use the same database.
3. A BIM model offers a constant 3D representation of the building. Because all the information in a BIM model is 3D, a 3D view of a structure, from any angle, at any section, can be generated at any time during the design process, and in the same programme the designers and engineers are already working in.

4. A BIM model is an intelligent tool that can be used for study and analysis across multiple disciplines. Because the elements in a BIM model contain their attributes and characteristics (e.g. thermal conductivity, geometry, surface materials, etc.), the model can be used to simulate a structure's behaviour.
  
5. A BIM model is a permanent and living document. With BIM, all the information is not only in one place, the BIM model can be an active management tool in the whole life cycle of an asset.

## 1. Background

In view of a growing trend for using BIM in construction works projects, the then Committee on Environment and Technology (now renamed Committee on Environment, Innovation and Technology) has undertaken to define the Roadmap for BIM Implementation in Hong Kong's construction industry.

A seminar titled "Building Information Modelling for the Future" was organised on 11 October 2011 to engage professionals and experts to share their relevant project experiences with participants. The speakers, from Housing Department, Hong Kong Polytechnic University, and Hong Kong Institute of Building Information Modelling shared their insight and vision in the future application of BIM. The successful seminar was over-subscribed which reflected the industry's interest in BIM.

The five challenges set out by Professor from Hong Kong Polytechnic University at the seminar were:

- (a) Challenge 1: Building Information Modelling or Management?
- (b) Challenge 2: Who owns the Intellectual Property?
- (c) Challenge 3: Do we need to change the contractual arrangements?
- (d) Challenge 4: Legal and Insurance Concerns
- (e) Challenge 5: Lack of skilled BIM managers

At the discussion session of the seminar, there was much debate over the challenges.

In consideration of the great interest from the industry, the then Committee on Environment and Technology established a Working Group on Roadmap for BIM Implementation to define the strategic implementation plan and set out the roadmap at industry level.

Furthermore, the adoption of BIM is already a global trend. Hong Kong construction industry must keep up with the fast pace of the global adoption of BIM so as to maintain Hong Kong's Architecture, Engineering and Construction (AEC)

competitiveness in the region and even in the world. Hong Kong's AEC companies would need suitable BIM skill sets to compete for jobs/ projects outside the Hong Kong market in the foreseeable future.

## 2. Introduction

In consideration of the great interest from the industry on the use of BIM in Hong Kong, the then Committee on Environment and Technology (now renamed Committee on Environment, Innovation and Technology) considered the need to take forward the adoption of BIM in a more systematic and strategic way. As the scope of studies covers a wide range of topics from technical aspects, business considerations to market transformation, the then Committee on Environment and Technology undertook to commence the study through taking an overview on the adoption of BIM in Hong Kong's construction industry with a view to drawing up a roadmap and strategic implementation of BIM in the construction industry in Hong Kong aiming to enhance productivity and efficiency, as well as promote understanding, an open BIM standard and exchange of experience.

The then Committee on Environment and Technology set up a working group, namely the Working Group on Roadmap for BIM Implementation (Working Group), with major participants in BIM application as members to prepare the overview. The Working Group focuses its effort:

- (a) To define strategies for achieving the market transformation with respect to the application of BIM in construction industry.
- (b) To identify the possible scope of application in local construction industry and those factors affecting the suitability or causing limitations of BIM application in local construction projects.
- (c) To identify the potential impacts on the construction supply chain arising from the adoption of BIM such as changes in planning and design approaches, mode of collaboration among different entities of the construction supply chain, training needs, etc.
- (d) To identify the areas which require further and detailed investigation and the needs of collaborative research or studies with relevant organisations or appropriate research institutes.

Members of the Working Group are listed in **Annex A**.

The discussions, observations, findings and suggestions by the Working Group are summarised in the following sections of the Reference Material.

### 3. The Function of BIM

BIM is not just a drawing tool but a new tool to holistically manage information relating to construction projects from planning stage, to design, construction and operational stages. It is a new way of working, using new technology to facilitate project management and execution, better construction process control, cross-disciplinary collaboration, internal coordination, problem solving, and risk management.

A building information model contains information of the geometry, spatial relationships, geographic information, quantities and properties of building elements, cost estimates, material inventories and project schedule. This model can be used to demonstrate the entire building life cycle (Bazjanac, 2006). As a result, quantities and shared properties of materials can be readily extracted. Scopes of work can be easily isolated and defined. Systems, assemblies, and sequences can be shown in a relative scale with the entire facility or group of facilities. The construction documents such as the drawings, procurement details, submitted processes and other specification can be easily interrelated (Khemlani et al, 2006).

A model could be used for the following purposes:

- Visualization: 3D renderings can be easily generated with lesser effort.
- Fabrication/ shop drawings: it can assist in producing shop drawings for various building systems, for example, the sheet metal ductwork shop drawings can be quickly produced once the model is completed.
- Simulation analysis: a model can be easily adapted to graphically illustrate the performance of the building, such as direct sunlight study, natural ventilation, heat gain, evacuation plans, etc.
- Facilities management: a model can be used for renovations, space planning and operation and maintenance activities.
- Cost estimating: Some BIM software has built-in cost estimating features. Material quantities can be automatically extracted and updated when any changes are made in a model.

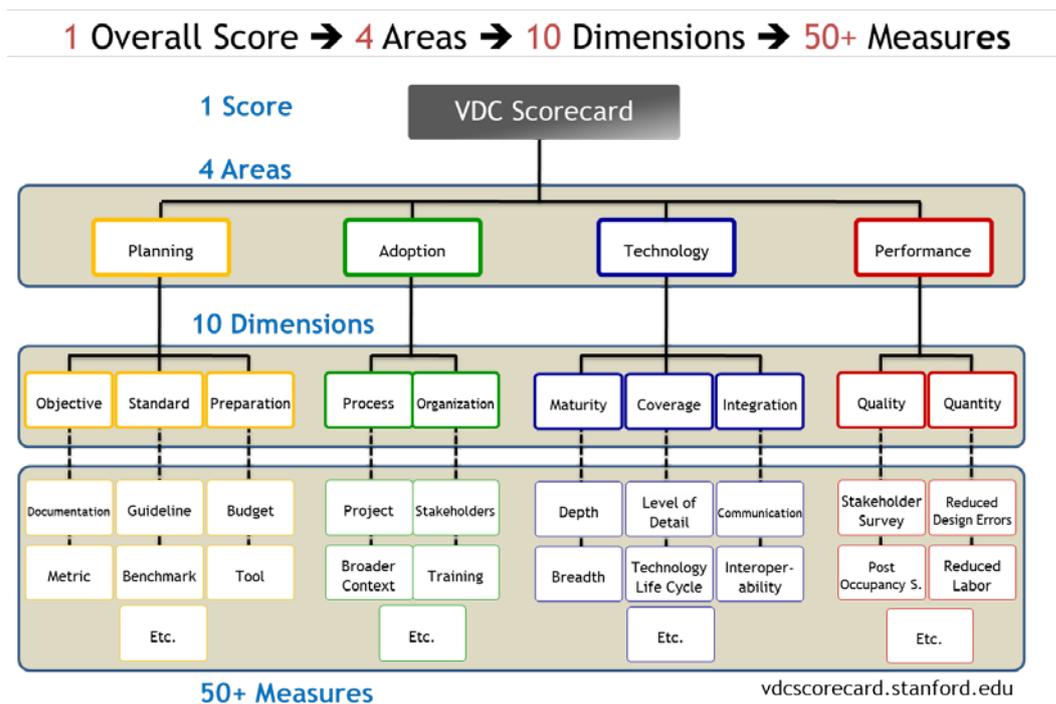
- Construction sequencing: a model can be effectively used to provide accurate information for materials ordering, fabrication, and delivery schedules.
- Conflict, interference and collision detection/ checking: because BIM models are created to scale and in 3D space, all major systems can be checked for interferences. As such, this process can be used to verify whether building components are conflicting with each other.

#### **4. Review of the Adoption of BIM in the Hong Kong's Construction Industry**

Global investment in capital projects is growing at a rate that will soon outpace GDP growth, with a projected 67% growth in construction globally by 2020 according to "Global Construction 2020, A Global Forecast for the Construction Industry Over the Next Decade to 2020" (Mike Betts, 2009). Construction productivity growth is marginal or negative over the past two decades. Adoption of BIM is accelerating in reaction to this problem, and is expected to reach 80% in some sectors this decade according to "SmartMarket Report on Building Information Modelling: Transforming Design and Construction to Achieve Greater Industry Productivity" (McGraw Hill, 2008). To evaluate BIM maturity and its contribution to construction value, Dr. Calvin Kam, one of the directors of Stanford University's Center for Integrated Facilities Engineering (CIFE) started the research and development of the Virtual Design and Construction (VDC) Scorecard since 2009, a methodical framework (Figure 1) focusing on qualitative planning as well as quantitative performance metrics and other areas to track and control BIM/ VDC use. Evaluations are benchmarked against other current projects around the world, and the "scores," are used to identify areas of strength and weakness to drive performance improvements.

The overall VDC Score illustrates how the project is ranked among other projects in the global market via a 5-level innovation ranking system in a range from "Conventional Practice" (without BIM) to "Innovative Practice" (industry 'firsts'). The ranking system continues at a deeper level of four Areas: Planning, Adoption, Technology, and Performance; these areas are in turn sub-divided into ten divisions and over 50 measures.

Figure 1: Framework of VDC Scorecard



By using the 10 award-winning projects of 2012 Autodesk Hong Kong BIM award as the representatives of the Hong Kong market, Dr. Kam presented the evaluation results of these 10 projects using the 5-level ranking system of the VDC Scorecard. The Median Score indicated the BIM implementation of Hong Kong construction projects is currently at “Advanced Practice” (Figure 2 and Figure 3). It should be noted that the median here is suggested on the basis of statistical population limited to the 10 Hong Kong BIM award projects only.

Figure 2: Median Score Breakdown of Hong Kong Practice Based on Hong Kong BIM Award Projects.

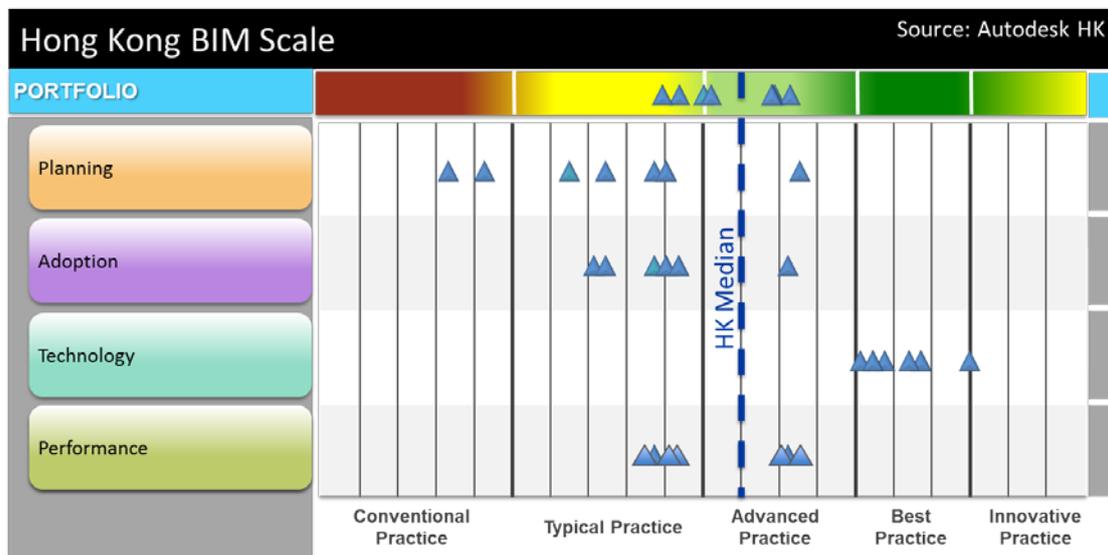
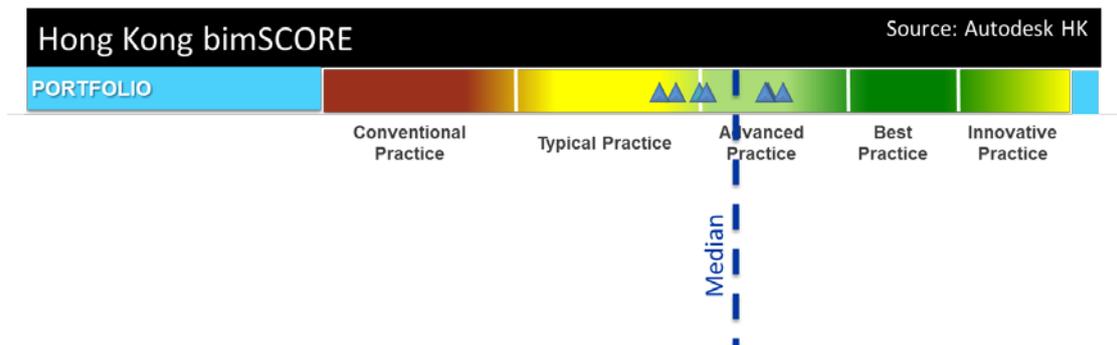
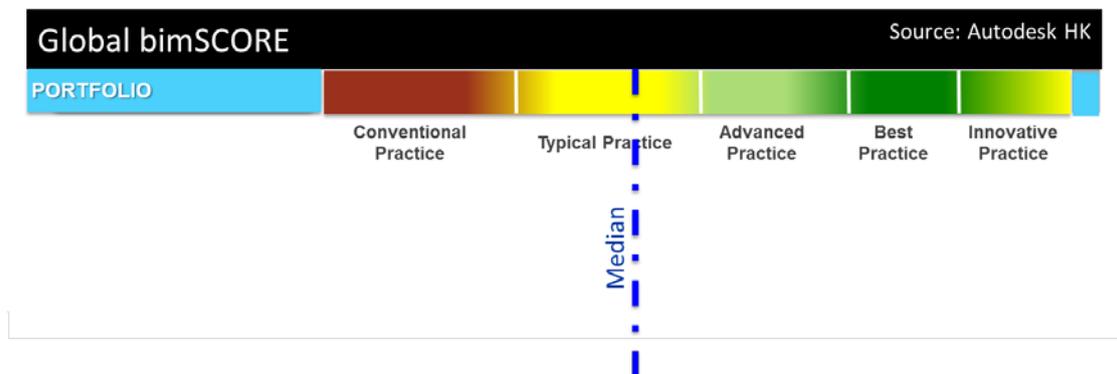


Figure 3: Overall Median Score of Hong Kong Practice Based on Hong Kong BIM Award Projects.



Leveraging the framework’s scalable score weighting system, Dr. Kam’s team benchmarked these Hong Kong projects with the global database and observed that when compared to global state of BIM practice, the Hong Kong median score however shifts from “Advanced Practice” to the “Typical Practice” rank (Figure 4).

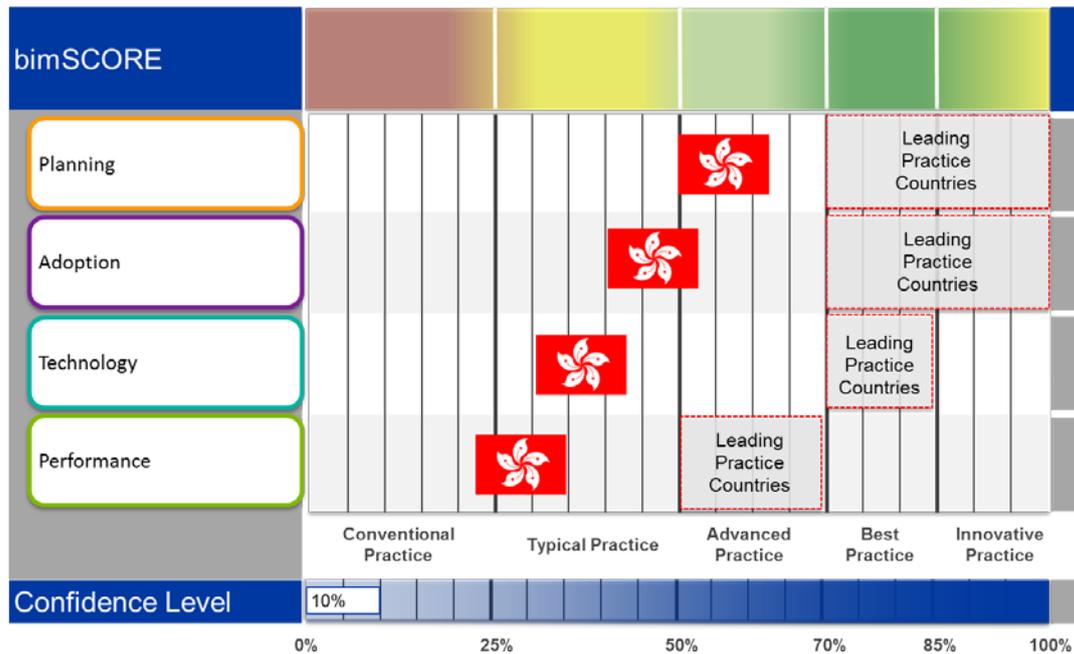
Figure 4: Overall Median Score of Hong Kong Practice Based on World-wide Projects.



Compared with international practice of BIM with respect to these four areas, Hong Kong is strongly encouraged to keep up with the fast pace of the global adoption of BIM. Recently, some organisations and companies in Hong Kong are taking a step forward in using BIM and even pioneer in some areas, e.g. 5D BIM conforming to Standard Method of Measurement of Building Works 4th Edition (SMM4), application of BIM for site safety, integration of BIM and GIS, etc.

Still, there is scope for us to learn in the global marketplace (Figure 5):

Figure 5: Comparison of Leading Practice Countries and Hong Kong Practice.



### **BIM Practice by Leading Practice Countries**

**Planning:** Leading practice countries have established national standards and guidelines for BIM implementation, and governmental agencies or jurisdictions within these leading nations may have individual BIM requirements for both public and private projects.

**Adoption:** Leading practice countries have high rates of BIM adoption, due to both governmental or owner requirements, as well as pressure to maintain competitive advantage in an increasingly BIM-enabled marketplace.

**Technology:** Technology employed in leading practice countries is both broad and mature. BIM are commonly used for visualization, documentation, performance analyses, and increased automation of design and construction tasks.

**Performance:** Few countries have objectively demonstrated improved performance with BIM adoption. Most assessments of BIM's contribution to improved performance rely on subjective representations and few quantitative metrics, without benchmarks or performance targets based on historical data.

## **Initiatives for Hong Kong Suggested by CIFE Stanford University**

Hong Kong has the human and capital resources to become a world leader in use of BIM and VDC implementation, as well as a profound need for rapid, economical, and ecological expansion of the built environment. The government and commercial companies of Hong Kong have several opportunities to realize this potential:

**Planning:** Invest in shared BIM standards to harmonize BIM implementation across a spectrum of design, construction, and operation disciplines. Establish performance measures and target goals.

**Adoption:** (1) Establish BIM and VDC education programmes at all levels from executive to apprentice to keep decision-makers informed of latest value propositions and strategies leveraging BIM, and build skill sets of the Architects, Engineers, Contractors, Owners and Operators (AECOO community) who design, deliver, and manage the built environment. (2) Incentivize beneficial use of BIM in public and private projects through education grants, bonuses, and/ or benefit sharing agreements.

**Technology:** Engage implementation in all categories of BIM users from visualization to automation, throughout the AECOO community, and in all stages of project life cycle from conceptualization to operation and recycling.

**Performance:** Develop meaningful corporate, industry, and national targets for project and built environment performance; track how BIM contributes to realization of these goals.

While all of these steps can contribute to raising Hong Kong's use of BIM, and more importantly position Hong Kong to enjoy the benefits brought by superior implementation of BIM and VDC methods, the most important first step is engagement. Dr. Kam urges everyone in the Hong Kong AECOO community to reach out and take a next step with BIM.

## Types of BIM Users in Hong Kong

As a whole, BIM implementation in the construction industry in Hong Kong is still in the primary stage. Individual participants' knowledge of BIM and capability to utilise BIM are diversified. In Hong Kong, two extreme types of BIM users exist - one type is a fast mover and follower getting ready to move fast, the other type is an observer.

<i>Type of BIM User</i>	<i>Example (Note: including but not limited to)</i>
(1) Fast Mover, and Follower Getting Ready to Move Fast	<ul style="list-style-type: none"><li>- Hong Kong Housing Authority</li><li>- MTR Corporation</li><li>- Airport Authority Hong Kong</li><li>- West Kowloon Cultural District Authority</li><li>- A number of major private developers</li><li>- Government works departments</li><li>- Majority of engineering, architectural and surveying consultants</li><li>- Certain disciplines of surveying consultants</li><li>- Majority of major contractors</li></ul>
(2) Observer	<ul style="list-style-type: none"><li>- Some other private developers</li><li>- Some other consultants</li><li>- Some other contractors in particular the smaller sized ones</li></ul>

**Updates on the Progress of the BIM Adoption in Hong Kong (as of March 2014)**

Starting from the establishment of the Working Group on Roadmap for BIM Implementation of the CIC in September 2012, the followings summarise the major activities carried out by different stakeholders which aim to promote wider adoption of the BIM in Hong Kong's construction industry:

**A. Construction Industry Council**

<i>Corresponding Perspective</i>	<i>Corresponding Initiative</i>	<i>Major Activity</i>
A. Collaboration	A.1 - To setup industry recognised co-ordinating body to foster collaboration locally and internationally	<ul style="list-style-type: none"> <li>a. Setup a Working Group on Roadmap for BIM Implementation in 2012 to define strategies for achieving the market transformation with respect to the application of BIM in the construction industry.</li> <li>b. The Working Group published the Final Draft Report of the Roadmap for BIM Strategic Implementation in Hong Kong's Construction Industry in September 2013.</li> <li>c. The Working Group published Final Report of the Roadmap for BIM Strategic Implementation in Hong Kong's Construction Industry in September 2014.</li> </ul>
B. Incentive and Proven Benefit	B.1 - To promote public and private clients to take the lead	<ul style="list-style-type: none"> <li>a. Published a BIM Factsheet in May 2013 provide project clients with a view of benefits brought about by BIM from a project client's perspectives.</li> <li>b. Organised an Annual Conference on 29 November 2013 themed -"Construction Innovation: Productivity and Technology" in</li> </ul>

		<p>which key topics in relation to BIM were discussed, including:</p> <ul style="list-style-type: none"> <li>- Global BIM Practices &amp; their Latest Trend</li> <li>- Maximising Value of BIM</li> <li>- Legal Implications of BIM</li> <li>- BIM in Facilities Management</li> <li>- International and Local Resolutions towards BIM.</li> </ul> <p>c. Organised and collaborated BIM Year 2014 with BIM stakeholders to promote adoption of BIM systematically and publicly.</p> <p>d. Arranged TV interview (ATV's TV Programme: Money World) about the business value and financial value of BIM with Mr. Kevin POOLE and Ms. Ada FUNG in January 2014.</p>
	<p>B.2 - To build-up a collection of client's initiatives with proven benefit</p>	<p>Hong Kong Green Building Council (HKGBC) and Business Environment Council (BEC) have formed a Joint Working Group to identify strategies and to provide solid and practical recommendations to the Environment Bureau on initiatives that could increase the reduction, reuse and recycling of construction and demolition (C&amp;D) waste in Hong Kong. The use of BIM is encouraged for C&amp;D waste reduction at source.</p>
<p>C. Standards and Common Practices</p>	<p>C.1 - To establish delivery standard and common practice</p>	<p>a. Setup a Task Group on Establishment of Industry Standards for BIM Implementation in 2013 - aims to identify the types of standards, specifications, common practices, or reference documents which are essential or beneficial to wider adoption of BIM.</p>

		<p>b. Commissioned a consultant, in March 2014, for the preparation of BIM Standards (Phase One) – to prepare common BIM Standards for Hong Kong’s local practices (by referencing to existing BIM standards of Housing Authority, MTRC, HKIBIM) and trying to bridge regional BIM practices to facilitate wider adoption of BIM in Hong Kong.</p> <p>c. Made research funding available for practical research including BIM by Hong Kong’s research institutes.</p>
D. Legal and Insurance	D.1 – To review procurement practice and contracts provisions	Organised an Annual Conference in November 2013 themed -“Construction Innovation: Productivity and Technology” in which legal implications and issues of possible unfair competition of the adoption of BIM were considered and explored. Insights were shared by speakers from legal professional and national policy makers.
	D.2 – To review IP right and data ownership	Organised an Annual Conference in November 2013 themed -“Construction Innovation: Productivity and Technology” in which legal implications, intellectual property rights, and issues of possible unfair competition of the adoption of BIM were considered and explored. Insights were shared by speakers from legal professional and national policy makers.

<p>F. Promotion and Education</p>	<p>F.1 – To offer institutional support and promotional activities</p>	<p><u>BIM Education in Globe</u></p> <p>Provided contribution to the publication named “BIM Education – Global – Summary Report – 2013” issued in January 2014 by NASPEC Construction Information, Australia. This report provides a summary of the current status of BIM education in a number of countries across the globe.</p> <p><u>Professional Development</u></p> <p>Contributed and supported HKIE - Building Services Division’s one day short course themed “BIM in Building Services” in March 2014.</p> <p><u>Sponsorship and Industry Support</u></p> <p>a. Sponsored annual conferences and events held by different professional organisations, for example: HKIBIM, HKIS, buildingSMART Hong Kong, etc., especially HKIBIM and HKIPM’s latest seminar on project management by BIM in March 2014, HKIE’s Hi-tech Fiesta 2014, etc.</p> <p>b. Contributed and provided support to events held by different professional organisations, for example: HKIBIM, HKIS, HKIE, buildingSMART Hong Kong, etc.</p>
	<p>F.2 – To expedite the building up of BIM capacity and capability</p>	<p><u>BIM Careers</u></p> <p>Supported and contributed in HKTDC’s Education and Careers Expo 2014 in which careers in BIM and construction industry have been introduced to industry practitioners and general public.</p>

		<p><u>BIM Training Center</u></p> <p>Setting up training centers and laboratories for BIM in CIC's Training Centers in which a number of brands of BIM systems and 3D printer (if possible) would be installed/ provided.</p> <p><u>Registration and Accreditation Service (RAS)</u></p> <p>Planning to setup a new service named "RAS" to accredit BIM training programme/ course according to specified training ladder; and register professional qualification of BIM professionals.</p> <p><u>Curriculum Change</u></p> <p>Liaising with universities/ IVE to consider incorporating BIM into their curriculum of their degree and higher diploma courses.</p>
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<p>I. Global Competitiveness</p>	<p>I.1 To maintain Hong Kong Architecture, Engineering and Construction (AEC) competitiveness among worldwide competitors equipped with higher productivity and new technology</p>	<p><u>Regional Presence and Connection</u></p> <ul style="list-style-type: none"> <li>a. The CIC and Hong Kong Housing Authority participated in the joint Asia Pacific Economies Cooperation (APEC) and the Association of Southeast Asian Nations (ASEAN) forum on “How Building Information Modelling Standards Can Improve Building Performance,” in June 2013 at Medan Indonesia.</li> <li>b. The CIC coordinated delegates from relevant HKSAR Government Works Departments and Hong Kong Housing Authority to the Government BIM Symposium and International Panel of Experts on BIM in Singapore in July/ August 2013.</li> </ul> <p><u>International Presence and Connection</u></p> <ul style="list-style-type: none"> <li>a. Continue to connect with international institutes (e.g. latest collaboration with Constructing Excellence of UK by signing of Memorandum of Understanding for Collaboration in 2013).</li> <li>b. Continue to update international media (e.g. BCI Asia, Engineering News-Record (ENR), BIM Academy, etc.) with latest development in the adoption of BIM in Hong Kong, for example: published article titled “Hong Kong and BIM the Road Ahead” in BIM Academy issued on 27 November 2013.</li> </ul>
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## **B. Government**

As early as 2009, some Works Departments began adopting BIM technology for public works projects. The Highways Department pioneered the application of BIM technology in the Tuen Mun Road improvement project, and later utilised it in the Central-Wan Chai Bypass project. Based on this experience and other pilot studies, Works Departments have been extending the use of BIM technology for public works projects. Different projects, with relatively complex building and/or structural requirements, are adopting the use of BIM technology.

In addition, many Works Departments have developed and implemented a BIM staff training plan. By the end of 2014, over 1,000 engineering staff will have received various levels of BIM training.

In addition to using BIM for the design and construction stage, Works Departments would also like to apply BIM for the operation and maintenance stages. In this connection, they are considering to include the requirement to submit as-built BIM models for operation and maintenance (or facility management) in work contracts. Moreover, Works Departments will explore the use of BIM as an asset management tool.

## **C. Public Sector Employers**

With regards to BIM adoption in the public sector and local construction industry, both the Hong Kong Housing Authority (HA) and Mass Transit Railway Corporation (MTRC) are fast movers.

In recent years, the MTRC has already applied BIM to some of its railway projects. The company's next target is to adopt BIM across its property projects and facilities management.

The HA began accumulating its BIM experience in 2006. Currently, it has 21 active BIM projects at various stages of development and procurement. Of these, 5 are at the design stage, 2 at the tender stage, 11 are still under construction, and 3 at the completion stage. From 2014/15, BIM will be applied to all new projects. Other Research and Development (R&D) projects in progress include: quantity take-off from

the BIM model; the full use of the BIM model for plumbing installation, roof thermal transfer value (RTTV) calculations, glare analysis, and BIM and RFID integration for facilities management; and the integrated use of BIM and GIS for development contextual studies.

In terms of training, over two-thirds (67%) of the HA's professional and technical staff are BIM trained. Training for new staff will continue and existing courses will be restructured to cover managerial topics, the HA's BIM project execution plan and modelling guidelines. To further facilitate the Quantity Take-off (QTO) of structural elements for cash flow forecasts and payments, a new guide that outlines the standard approach of modelling for structural elements is being developed.

With regards to promotional activities, both organizations work very closely with the CIC and support a variety of BIM conferences and seminars.

#### **D. Private Sector Employers**

Currently, The Real Estate Developers Association of Hong Kong (REDA) has no BIM policy due to the diversity of its members, which range from large organisations to individual businesses, and their varied opinions. However, some major developers are interested in driving the adoption of BIM and REDA has welcomed them to use the tool in their management process.

#### **E. Professional Organisations**

In addition to regularly providing a wide variety of BIM courses, seminars, and conferences on a wide range of different subjects (e.g. building services, project management, spatial data infrastructure, trade-specific courses and software training), professional organisations focus on BIM in different ways.

Architects are looking at how to manage the contrasting use of BIM between engineers, consultants and contractors. They suggest that profession-specific BIM training (e.g. BIM for architects, BIM for engineers, BIM for surveyors, etc.) is needed.

Surveyors are working closely with the Lands Department on the use of 3D spatial data. A task force has been set up to investigate how to extract accurate data for land

surveying and issues related to BIM implementation in GIS (e.g. the lack of interoperability between GIS and BIM tools).

BIM professional organisations are establishing a “BIM Certified Expert” system and refining the education, examination and certification details with the industry. They are promoting the idea of an open BIM standard through the use of Industry Foundation Classes (IFC). The organisations also act as a platform to connect different sectors and academies to share views on how to promote BIM, industry requirements related to complexity, standards and training, and the future use of BIM.

Utilities professionals have recently developed a BIM standard, which is based on the AEC (UK) BIM Standard for utility equipment. A new discipline called “BIM for Infrastructure” was founded on 1 April 2014 and a BIM competition will be organised in 2014.

## **F. Contractors**

Major contractors are aggressively providing their members with BIM training to meet the increasing number of public and private tenders that require BIM capabilities.

Some clients, such as the MTRC, Hong Kong International Airport and Hong Kong Disneyland, have begun to handover the BIM model to the main contractors upon contract award or tender for further development during the construction stage. Works departments are also considering this initiative.

Some clients wish to use BIM model in the construction stage despite BIM is not used in the design. They request contractors to develop a full BIM model from a set of 2D drawings, typically within the first 3 months of contract. The contractor is also responsible for carrying out clash detection. However, the main contractors believe that clash detection should be carried out during the design phase to maximise the value of BIM, instead of handing over this responsibility to the main contractors to manage during the construction phase.

In terms of resources, the majority of contractors are subcontracting their BIM work to local or offshore specialists, while a limited number of larger businesses are setting up their own in-house BIM teams and investing in 4D/ 5D BIM capabilities.

The majority of BIM work is either subcontracted or carried out by the main contractor's BIM consultant.

## **G. Academia**

Academic institutions in Hong Kong have been offering a variety of BIM training courses since 2005. Lectures and seminars are regularly conducted to promote BIM from different perspectives, such as international, industrial, etc.

The Hong Kong Polytechnic University, the University of Hong Kong and the Chinese University of Hong Kong are changing their curriculums to include BIM in their undergraduate and postgraduate programmes, as well as conducting research into the use of BIM for RFID, carbon emissions and safety. The universities teach students how to plan and use BIM software, and engage it as part of the collaboration process. In addition, The Hong Kong University of Science and Technology is actively researching the integration of artificial intelligence with BIM for the design of mechanical, electrical and plumbing engineering (MEP) and application of radio-frequency identification (RFID) with BIM for MEP.

The VTC and IVE provide BIM courses as part of their higher diploma programmes and in-service levels targeting BIM technicians and operators. The VTC and IVE also provide tailor made BIM training programmes to businesses depending on the needs of the industry.

## 5. Driving Organisations and Approaches Worldwide

Quite a number of countries are working on the enablement of BIM adoption. Their driving organisations and key driving approaches for the adoption of BIM in their respective construction industries are as follows:

<i>Country</i>	<i>Driving Organisation (Type of Driving Organisation)</i>	<i>Motivation</i>	<i>Driving Approach and Current Status</i>
USA	General Services Administration (Government)	<ul style="list-style-type: none"> <li>- Better project management for spacing planning, project scoping, cost prediction, energy saving analysis, security planning</li> <li>- Better quality assurance by means of higher compliance, accuracy, and efficiency</li> </ul>	<p>The General Services Administration (GSA) is a pioneer in advocating the adoption of BIM for public sector projects. GSA has developed a suite of BIM guidelines for submission for major federal government projects.</p> <p>It has required mandatory BIM submission for major federal government building projects since 2006.</p>
	Army Corp of Engineers (Government)	No such information	It has required mandatory use of BIM for all its projects.
Canada	The Institute for BIM in Canada (Association)	No such information	The Institute for BIM in Canada leads and facilitates the coordinated use of BIM in the design, construction and management of the Canadian built environment.
United Kingdom	The Cabinet Office of Government Construction Board (Government)	<ul style="list-style-type: none"> <li>- Cost savings is public reform measures in the Government Construction Strategy which targets 15-20% efficiency savings</li> <li>- BIM stimulates innovation and growth in the UK construction</li> </ul>	The BIM Industry Working Group and Government Construction Board have prepared a staged BIM implementation plan to increase BIM use over a five-year period by 2016. By 2016, the Government will require mandatory use of BIM in public sector centrally procured construction project.

<i>Country</i>	<i>Driving Organisation (Type of Driving Organisation)</i>	<i>Motivation</i>	<i>Driving Approach and Current Status</i>
		sector - Increase capability of the UK construction sector	UK has published BIM Standards namely BS1192:2007, BS ISO 29481-1:2010, BIP 2207.
Germany	No centralised collaboration	- Mandatory use of BIM from 2017 for project sum > EUR100M - Better risk management - Improve communication to public and project stakeholders	The BIM software market is dominated by home-grown products, and there is not yet widespread adoption of BIM.
Denmark	Individual state clients (The Royal/ Government)	No such information	Danish state clients such as the Palaces & Properties Agency, the Defence Construction Service, and the Danish University Property Agency require mandatory use of BIM for their projects.
Norway	Statsbygg (Government)	- to improve efficiency and quality in public and private construction sectors	The Norwegian government has stated its commitment to succeed in BIM adoption in 2010. It requires the use of IFC/ BIM for new buildings.
	Norwegian Defence Estates Agency (Government)	No such information	The Agency is running three BIM pilot projects.
Finland	Senate Properties (property services agency) (Government)	No such information	Finland's state property services agency, Senate Properties, requires the use of BIM for its projects since 2007.  It requires IFC/ BIM in its projects and intends to have integrated model based operation in future.
Netherlands	Rijksgebouwen-dienst (Government)	No such information	On 1 November 2011, the Rijksgebouwen-dienst, the agency within the Dutch Ministry of Housing,

<i>Country</i>	<i>Driving Organisation (Type of Driving Organisation)</i>	<i>Motivation</i>	<i>Driving Approach and Current Status</i>
			Spatial Planning and the Environment that manages government buildings, introduced the RGD BIMnorm which was updated on 1 July 2012.
Iran	The Iran Building Information Modelling Association (Association)	No such information	IBIMA shares knowledge resources of BIM to support construction engineering management decision-making.
Singapore	Building & Construction Authority (Government)	<ul style="list-style-type: none"> <li>- Industry wide adoption of BIM by 2015</li> <li>- Raise construction productivity</li> </ul>	<p>BIM submission for regulatory approval via CORENET is being implemented.</p> <p>BIM is used as part of public sector building project procurement.</p> <p>In 2015, BIM submission will be mandatory for new building projects &gt; 5000 m<sup>2</sup>.</p>
South Korea	Public Procurement Service (Government)	No such information	South Korea's Public Procurement Service made the use of BIM compulsory for all projects over S\$50 million and for all public sector projects by 2016.
Australia	Organisations such as Australian Productivity Commission, the Australian Construction Industry Forum (ACIF), Australian Procurement & Construction Council (APCC) & Built Environment Industry Innovation Council (BEIIC)	<ul style="list-style-type: none"> <li>- Accelerate the uptake of BIM to support uplifting building sector productivity by 20% by 2020</li> <li>- Secure better value for money of Government capital expenditure</li> </ul>	BIM is starting to take off, but governments and industry associations are being urged to help speed up the process. The Sydney Opera House is an excellent example of how BIM is used in the management of existing buildings.

<i>Country</i>	<i>Driving Organisation (Type of Driving Organisation)</i>	<i>Motivation</i>	<i>Driving Approach and Current Status</i>
	are playing a substantial role in facilitating the BIM collaboration. (Public Organisation)		
Middle East	Gulf Cooperation Council (Association)	<ul style="list-style-type: none"> <li>- Have mandatory BIM</li> <li>- Deliver productive, consistent and high quality work</li> <li>- Manage product life cycle and waste stream more efficiently</li> <li>- Explore more green opportunity through BIM</li> </ul>	Qatar and Jordan Government take the lead for BIM standards adoption. UAE Government is developing automated plan checking system. They are building up a regional BIM hub community.
Mainland	Government	<ul style="list-style-type: none"> <li>- Improve efficiency in whole construction industry</li> <li>- BIM has been included in the National 12th Five Year Plan.</li> </ul>	They promote the integration of BIM application with specific tasks of Architecture, Engineering and Construction (AEC) in project life cycle. They are developing standards for BIM in project management and data exchange.
	Tsinghua University (academy)	No such information	Formulate a BIM framework for China.

The adoption of BIM in the construction industry is now a global trend. USA, Canada, the United Kingdom, a number of major European countries, Singapore and South Korea have already required the use of BIM in public construction projects. Some of them have set up agencies (for example: Canadian BIM Council) to manage nation-wide implementation of BIM and the introduction of good practices and standards. A number of countries will even require the mandatory adoption of BIM in near future. They are: USA, the United Kingdom, Germany, Singapore, South Korea, Gulf Cooperation Council, etc.

The common views on the BIM movement shared globally are:

Regional Motivation:	<ul style="list-style-type: none"> <li>- Enhance Architectural, Engineering and Construction (AEC) competitiveness in region by building up regional BIM hub (esp. USA, UK, Singapore, Gulf Cooperation Council)</li> <li>- Export construction service via BIM to their region</li> </ul>
National Motivation:	<ul style="list-style-type: none"> <li>- Uplift productivity by better project management, risk management, consistency and quality of output</li> <li>- Facilitate cost saving and “value for money” of government capital expenditure</li> <li>- Enhance capability of construction in terms of innovation and value-added</li> </ul>
Strategies of the Adoption:	<ul style="list-style-type: none"> <li>- Pull Strategy: Project clients taking the lead so as to create market demand</li> <li>- Push Strategy: Increase BIM adoption by changing line of thinking, better understanding, improving knowledge and skill, changing of procurement practice, etc.</li> <li>- Promotion of BIM (especially to the top management of project clients)</li> <li>- Establishment of BIM infrastructure (e.g. BIM standards, protocol, object library, sharing platform, open BIM for interoperability, etc.)</li> <li>- Incentivising BIM adopters</li> <li>- International collaboration</li> </ul>
Key Initiatives:	<ul style="list-style-type: none"> <li>- Setup agency/ task force to steer industry transformation</li> <li>- Require BIM or mandate the adoption of BIM</li> <li>- Develop BIM roadmap, policy, standards, procurement guide, revision to contract requirement</li> <li>- Demonstrate and show case local practice of the adoption of BIM, especially the pros, cons and limitation of the adoption</li> <li>- Advance BIM for facilities management</li> </ul>

## 6. Benefits Brought by the Adoption of BIM

By adopting BIM in the construction value chain, stakeholders in the construction industry may perceive the following benefits:

No	Stakeholder	Benefit Brought by the Adoption of BIM
1	End-user (Community) of infrastructure	<ul style="list-style-type: none"> <li>- improved efficiency of construction and hence earlier use of the facility and less disturbance during construction</li> <li>- improved understanding of the expected end-result through visualizations and virtual prototypes</li> <li>- improved safety and security during operation through early identification of the adequacy of relevant equipment provided</li> </ul>
2	Infrastructure Owner and Investor	<ul style="list-style-type: none"> <li>- improved capital investment costs (lower costs and better predictability)</li> <li>- improved life cycle costs (lower costs and better predictability)</li> <li>- improved project schedule</li> <li>- improved quality-cost ratio (higher quality with the same costs or the same quality with lower cost) through better analysis and simulations supporting decision-making</li> <li>- improved marketing by better communication and service for clients</li> <li>- improved safety and security during operation through early identification of the sufficiency of various relevant equipment provided</li> </ul>
3	Facility Manager	<ul style="list-style-type: none"> <li>- improved life cycle costs (lower costs and better predictability)</li> <li>- improved quality-cost ratio through accurate and up-to-date as-built and maintenance information</li> <li>- improved safety and security during operation</li> </ul>

No	Stakeholder	<i>Benefit Brought by the Adoption of BIM</i>
		<p>through early identification of the sufficiency of various relevant equipment provided</p> <ul style="list-style-type: none"> <li>- facilitation of addition, alteration and improvement works at a later stage</li> <li>- facilitation of asset management</li> </ul>
4	Contractor	<ul style="list-style-type: none"> <li>- improved productivity by efficient information processes within individual tasks and among different tasks during bidding, cost estimation, scheduling, procurement, site activities, etc.</li> <li>- improved quality-cost ratio through better productivity and fewer errors</li> <li>- mitigated/ avoided risks leading to economic loss</li> <li>- improved competitiveness by better communication and service for clients</li> <li>- improved project safety and environmental performance</li> </ul>
5	Construction Professional (Architect, Engineer, Surveyor)	<ul style="list-style-type: none"> <li>- positive impact on project schedule and cost estimation</li> <li>- improved productivity through lesser rework because of changes and contradicting documents</li> <li>- improved quality-cost ratio through better coordination of different disciplines</li> <li>- overcoming of practical difficulties and avoid contradictory design at early stage</li> <li>- improved competitiveness by better communication and service for clients</li> </ul>
6	Manufacturer and Supplier of Construction Material and Component	<ul style="list-style-type: none"> <li>- improved market segment through better understanding by professionals of the suitability for particular projects</li> <li>- improved productivity and quality-cost ratio by streamlining the information flows between</li> </ul>

<i>No</i>	<i>Stakeholder</i>	<i>Benefit Brought by the Adoption of BIM</i>
		product requirement and manufacturing processes
7	Software Industry	- demand for system development and enhanced technology by widespread use of BIM
8	Insurance Industry	<ul style="list-style-type: none"> <li>- improved quality-cost ratio by reduction of financial risk through better information flow and transparency</li> <li>- reduction of claims due to unsafe work</li> </ul>

Note: The above table illustrates the benefits to the stakeholders in the general construction value chain. The benefits for other stakeholders, for example, Council for Sustainable Development, Hong Kong Green Building Council, Committee on Revitalization of Historical Buildings, etc. may be considered for inclusions in future study.

## 7. Forces Driving the Adoption of BIM

The Working Group's views on the forces driving the adoption of BIM are set out below.

### a. Increase in Productivity and Efficiency

#### **Project Planning and Decision-Making Support**

- i. In whole-life terms, BIM offers a cost-effective engineering solution at an affordable level of capital investment. BIM minimises management costs, reduces delivery times, cuts waste across processes and lowers the cost of in-service management.
- ii. BIM enables clients to visualise a design, which enhances their understanding. BIM's visualisation capabilities show what different options look like, not only upon completion but before and during the works. Visual representations can help to solicit public support (e.g. District Council consultation, public engagement) and aid decision-making.
- iii. According to a Center for Integrated Facility Engineering (CIFE) survey of overseas construction markets, BIM contributed to 7% reduction in project time. The exact local benefits of BIM may be further explored in a future study.

#### **Management Support**

- iv. BIM unites project participants so that design decisions can be made earlier. Design is no longer sequential; it can occur in conjunction with other processes.
- v. BIM will become a tool for more efficient asset and facilities management. An accurate BIM model provides the necessary information for routine maintenance. It can be updated to reflect additions, alterations and modernisations as needed.
- vi. BIM enables greater use of prefabricated materials and systems to speed up construction while maintaining high quality.

### **Sharing Information**

- vii. With BIM, information is more easily shared, offers added value and can be easily reused, enabling faster and more efficient working processes.
- viii. Architects and design engineers can also benefit from BIM. BIM enables better storage of all design data within a 3D model. 2D plans and drawings can be semi-automatically generated from this model. Architects and engineers can easily make changes to the design, while the drawings and details are updated automatically. A BIM-based drawing production process ensures consistency among a project's many plans and drawings.
- ix. When BIM is correctly aligned with the method of measurements, the programme can generate the necessary quantity of materials for measurement purpose.

## **b. Cost Savings and Waste Reduction**

### **Reduced Number of Requirement Changes**

- i. Cost savings can be achieved by using BIM to check for structural, architectural and building services clashes so as to reduce the number of rework and requirement changes. Construction waste and claim opportunities are consequently reduced.
- ii. As a result of fewer changes, the likelihood of claims, and the time and cost that a client may spend on litigation could be reduced.
- iii. According to a CIFE survey of overseas construction markets, BIM has helped companies to save up to 10% of the contract value through clash detections. The exact local benefits may be further explored in a future study.

### **Sustainable Engineering Solution**

- iv. Based on its robust platform for analysis, BIM promotes sustainability. Using a BIM model and simulation programme, a full 3D energy consumption analysis can be performed with a short lead time compared to the long lead time required to produce a traditional 2D model.

### **Streamlined Procurement**

- v. BIM facilitates cross-project bulk purchasing and material inventory control.

## **c. Improved Quality and Integration**

### **Inter-disciplinary Coordination**

- i. BIM enables significant improvements in inter-disciplinary coordination, leading to a reduction in errors and fewer coordination-based changes during construction. According to a CIFE survey of overseas construction markets, BIM helped to eliminate 40% of unbudgeted changes. The exact local benefits may be further explored in a future study.
- ii. BIM's new relationship models enable efficient cross-management of the numerous interfaces that characterise infrastructure programmes and projects. Multiple interfaces often result in inefficiencies. BIM not only encourages cooperation across boundaries but has the potential to remove boundaries altogether.
- iii. BIM facilitates the fabrication of complex architectural designs by enabling a seamless connection between design and fabrication, expediting the manufacturing and/or fabrication of engineered structural components.

### **Providing Assurance**

- iv. As a project moves into the construction phase, the depth of information contained within a 3D BIM model improves the contractor's ability to understand the design details and resolve problems. It also enables engineers to check the work against the specification and validate any anomalies. The integrated single model promotes continuous review and testing of the design for constructability and potentially for maintenance and operation.
- v. With BIM, project proposals can be rigorously analysed, simulations can be performed quickly and performance can be benchmarked, enabling improved and innovative solutions. In essence, BIM "pre-builds" a project, allowing problems to be addressed as and when found throughout the design process.
- vi. The design, construction and operational information contained in the BIM model can be used throughout the infrastructure life cycle.

### **d. Improving Public Understanding of a Proposal**

- i. BIM significantly improves a project team's ability to present the specifics of a design and their intentions to stakeholders and the public, for example, aesthetics, air flow impact, visual impact, traffic impact, sunlight and shadow, etc. Proposals can be better understood by the public through accurate visualisations.

### **e. Better Management Control and Reduced Project Risk**

#### **Project Management**

- i. Using BIM in the design phase makes it possible to monitor requirement changes and design changes throughout the design process.
- ii. BIM systems can produce a "schedule of quantities", enabling the construction sequence to be simulated prior to construction. This

facilitates cost management, cash flow management and activity programming for project management.

- iii. Construction with input from many disciplines and project interfaces is a challenge. BIM can help each party to better understand the built environment and facilitate clash resolution among different groups before construction work commences.
- iv. BIM provides previews of the site planning and construction works, assists with the development of a method statement and enhances the understanding of construction safety issues that may arise.

### **Cost Management**

- v. Material quantities are automatically calculated by the BIM model, which can help to assess the cost impact of design changes.
- vi. Performance is more predictable using BIM and the life cycle costs are better understood.
- vii. According to a CIFE survey of overseas construction markets, BIM helps to improve the accuracy of cost estimates by 3% and reduce the time taken to generate cost estimates by 80%. The exact local benefits may be further explored in a future study.

## **f. Initiatives from Public Clients**

Case studies featuring public clients who have successfully implemented new technology and methods will benefit the construction industry. Moving forward, public clients who adopt BIM could help to drive the implementation and development of smart technology. Once the benefits of BIM are appreciated and well recognised, the technology is expected to be self-sustaining.

According to two public clients, the Hong Kong Housing Authority and MTRC, BIM helps them to:

- i. Develop a multi-dimensional picture that contains timely information related to a construction project;

- ii. Test a model and quickly generate options for better decision-making in respect of time, cost, process and risk during the planning and design phase to avoid on-site problems;
- iii. Detect upstream design faults, especially clashes, and minimise downstream design changes;
- iv. Provide better site safety management, risk management and safety education;
- v. Provide better financial risk management and minimise financial claims due to variation and delay;
- vi. Unite the relevant disciplines and participants in the construction supply chain at an early design stage, which facilitates coordinated design;
- vii. Facilitate third party and public engagement by improving communication with visual assessments at the planning and design stage.

Public clients responsible for small civil engineering works and small scale building projects can also benefit from BIM in the following areas:

- Provision of accurate 3D coordinates;
- A strong repository of construction information for future retrieval;
- Improvements to site safety;
- Enhanced construction sequence and method;
- Better decision-making with accurate information so as to reduce design changes, rework and wastage, and contractor's claims;
- Reduction in the information lost during the handover from designer to contractor;
- More consistent and standardised exchange of information, inter-organisational communication and team collaboration, which can minimise human error.

Realising the benefits of BIM is not dependent on the nature of the construction project but on:

- The project planning approach;
- The risk management approach;
- The project coordination approach;
- The communication approach across disciplines and along the construction supply chain.

## **g. Initiatives by Private Clients**

Clients are in a strong position to unite the different parties involved in a project. All consultants and contractors have the desire to do a better job for their clients and establish a good reputation within the industry. BIM creates significant value across all phases of the project life cycle, especially after the project handover when further advantages can be gained. In addition, clients receive robust operation and maintenance tools that meet their facility's long-term needs. BIM also benefits clients in the following ways:

- i. BIM is the vital link between asset creation and asset management, driving efficiencies throughout the life cycle to release resources for critical infrastructure needs.
- ii. Optimal asset performance is achieved through early virtual prototyping, simulation and the use of "in use" data feedback that aims to reduce asset operation costs.
- iii. Better business outcomes – the result of early and collaborative decision-making – and a clearer link between design decisions and cost implications.
- iv. Increase performance predictability through more detailed asset and life cycle planning.
- v. Increase the surety of investment and decision-making by reducing the need to review different datasets at different stages, and improving visualisation with respect to clarity, confidence and risk management.
- vi. Reduce the capital cost of an asset (e.g. reduced overall review cycle, better construction project outcome, etc.) by reducing waste in the construction process.
- vii. The one-stop shop approach adopted by some private clients could easily realise the benefits of using BIM.

## **h. CIC's Initiatives**

As a statutory platform for communication and collaboration among construction industry stakeholders, the CIC has taken the initiative to spearhead the adoption of BIM and keep Hong Kong's construction stakeholders abreast of international standards and developments. The CIC's main goals are:

- i. To represent, support and advocate on behalf of Hong Kong's construction industry and academies to facilitate an environment conducive to the effective deployment of BIM;
- ii. To collaborate and develop best practices for BIM in Hong Kong while maintaining connections to international practitioners;
- iii. To form a collective voice dedicated to BIM.

## **i. Others**

Additional resources related to the driving forces behind the adoption of BIM can be found in, but are not limited to, **Annex C**.

## 8. Challenges to BIM Adoption

Challenges to BIM adoption are summarised as below:

### a. Standards and Protocols

The power of BIM lies in its ability to communicate across the entire life cycle of an infrastructure project, from its conception to use for asset management purposes. To this end, a recognised standard is essential to facilitate the application of BIM throughout the infrastructure life cycle. However, current limitations include:

- i. Lack of a common standard and protocol for data interoperability and data management so that BIM models can be efficiently shared between different disciplines. Some countries, including the United Kingdom, the USA and Singapore, have their own common standards and protocols;
- ii. Lack of a process to ensure that all disciplines in a project work from the same data and meet the same standards, requirements and protocols.

### b. Contract and Submission Requirements

Currently, standard contracts clearly define and allocate the responsibilities and risks among contracting parties. Prior to BIM adoption, changes are needed to reflect the new shared responsibilities with regards to generating information and aligning duties. Moreover, there is a need to review:

- i. Existing contract provisions to guide the collaborative use of BIM along the supply chain within a construction project;
- ii. Existing contract provisions to steer the collaborative use of BIM and bridge the gap between asset creation and asset management;
- iii. The acceptance of building plans submitted in BIM format by the relevant authorities.

### **c. System Compatibility and Data Exchange**

- i. Current BIM software does not support direct and straightforward cross-platform data exchange but functions as a standalone application.
- ii. There is currently no way to create a common data environment.

### **d. Existing Culture and Mindset**

#### **Promote a New Working Style**

- i. Project participants may not appreciate the value of collaboration and may not understand the importance of different parties working together on the same project throughout its duration.
- ii. In general, the current discussion surrounding BIM in Hong Kong focuses on its use or design, rather than changing the existing mindset to trigger new BIM-enabled design and construction solutions.
- iii. Individual public clients, developers and building owners are driving a change in mindset in their organisations and project teams to encourage a collaborative approach; however, this will take time. A proactive change programme has been ongoing in the Hong Kong Housing Authority since 2006.

#### **Enhancing the Value of Different Disciplines**

- iv. Some participants are concerned that their discipline may lose its value in a construction project that has adopted BIM. In fact, BIM may help participants to execute labour intensive work (e.g. CAD drafting, quantity measurement) thereby freeing participants to focus on value-added work and activities.
- v. To promote the adoption of BIM, a framework is needed to re-assign the roles and responsibilities of individual parties through the construction supply chain.

## **e. Collaboration, Work Sequence and Procurement Models**

### **New Work Sequence and Roles**

- i. A BIM model is active throughout the life cycle of a building; it serves the needs of multiple stakeholders at different times and meets a variety of requirements. BIM modelling differs from current practices, where documentation is printed and shared and details are replicated as information passes through different stakeholders, from design to construction to facility management.
- ii. In the future, when BIM is fully integrated across the infrastructure life cycle, both the working process and the role of each stakeholder will differ from current practices.

### **Procurement and Changing Involvement**

- iii. BIM engages stakeholders earlier by front-loading a project's work schedule, i.e. different stakeholders in the supply chain are involved from an early stage. Current procurement practices do not include different stakeholders in the initial stages of a project.
- iv. BIM may change the traditional definition of design and construction and the order in which different stakeholders are involved in a construction project. Because of the increased ability to share information, over time, traditional barriers will diminish. Those with specific skills, such as structural engineers or construction managers, will still be required in a project that uses BIM, but the nature of their contribution may be different.

## **f. Legal, Rights and Insurance Issues**

### **Legal and Rights Issues**

- i. Stakeholders are concerned that their liability for any errors and omissions that affect the BIM model will increase and question if fees and contract provisions can properly reflect this, and whether they want to be responsible for this liability.
- ii. There is a lack of relevant contract terms and legal standards that reflect the changes in data ownership, confidential information, risk allocation, and procurement practices that will be affected by the adoption of BIM.

### **Insurance and Responsibility**

- iii. For projects that adopt BIM, the responsibilities of each stakeholder have not been clearly defined and it is therefore difficult to adjust the stakeholder's insurance policies to cover their responsibilities. The insurance industry believes that the adoption of BIM creates uncertainty with regards to financial risk. Without a clear understanding of each stakeholder's responsibilities, insurers may therefore hesitate to expose themselves to unknown levels of risk.

Additional views on the challenges facing the adoption of BIM can be found in, but are not limited to, **Annex E**.

## **g. Investment, Time Cost and Effort**

Adopting BIM incurs initial investment costs related to management and administrative processes, including staff time, hardware, software and training. However, these additional costs may be offset by efficiency and schedule gains.

## **h. Data Accuracy and Accountability**

### **Control Mechanisms and Accountability**

- i. During the life cycle of a construction project, different parties will submit or contribute data to the BIM model. Consequently, there are concerns regarding the accuracy and control of data entered into the model and which party is ultimately responsible for any inaccuracies. Requests for complicated indemnities made by BIM users and the offer of limited warranties and disclaimers of liability by designers are essential issues that have yet to be resolved.
- ii. BIM's integrated concept blurs the level of responsibility to the extent that some stakeholders' exposure to risk and liability may increase. For example, the owner of a building files a lawsuit over a perceived design fault. The architects, engineers and other contributors to the BIM model will have to determine who is responsible for the error. The lead professional may be held responsible as a matter of law while finding it difficult to prove the fault of other parties who also contributed data to the BIM model.

### **Data Definition and Technological Interface**

- iii. Infrastructure elements, costs and schedules are layered into a BIM model. As a result, managing the interface between different systems becomes an issue. At present, most project management and modelling tools are developed in isolation. It is essential to find a way to link these systems and assign responsibility for the accuracy, completeness and coordination of infrastructure elements, costs and the scheduled import and export of data to/from these individual tools and models.

## **i. Software Localisation**

- i. Since most BIM software has been developed based on U.S. or European standards, any design standards included in the software must be reviewed and customised to suit Hong Kong practices. However, this process requires a long lead time, software vendors' commitment and an

industry-wide consensus. Otherwise, third party middleware may be needed to bridge the gap in standards.

#### **j. Others**

Additional resources related to the challenges of BIM adoption can be found in, but are not limited to, **Annex C**.

## 9. Disciplinary Operational Benefit and Concern

The following table sets out in broad terms how BIM is perceived by various disciplines and participants in the industry.

	Regulator	Client	Architect	Surveyor	Civil & Structural Engineer	E&M Engineer	Contractor	Manufacturer/ Fabricator	Facilities Manager
Individual Discipline Operational Benefits	<ul style="list-style-type: none"> <li>- Set out roadmap and strategy, with the industry's consent to:</li> <li>(a) facilitate greater efficiency and effectiveness of construction supply chains,</li> <li>(b) reduce industry's asset costs and achieve greater operational efficiency,</li> <li>(c) assist in the creation of a forward-thinking platform on which the industry can base to achieve growth.</li> </ul>	<ul style="list-style-type: none"> <li>- Better tool for coordinated data across a broad consultant and contractor team.</li> <li>- Potentially, a faster and less expensive design/ construction process.</li> <li>- 3D visualization to enable internal and public communication .</li> <li>- A "living model" for the centralised adapting library for facility management.</li> </ul>	<ul style="list-style-type: none"> <li>- Robust tool for enhanced client and team understanding of design options.</li> <li>- Integrated platform for inter-disciplinary coordination, with much stronger potential for identifying conflicts and errors before construction.</li> <li>- Less rework, because everyone can understand the design earlier, costs are known earlier and clashes are detected earlier.</li> </ul>	<p><u>Quantity Surveying</u></p> <ul style="list-style-type: none"> <li>- Reduce time spending on measurement &amp; quantification.</li> <li>- Speed up cost estimate, BQ, taking off.</li> <li>- Remove inaccuracies that creep into human measurement.</li> <li>- Opportunity to offer higher value service &amp; more creative service</li> </ul> <p><u>Land Surveying</u></p> <ul style="list-style-type: none"> <li>- Accurate spatial data of the terrain model ensure the design matches with the actual site situation and thus reduce redesign work.</li> </ul>	<ul style="list-style-type: none"> <li>- Visualization tool enabling earlier collaboration with architect.</li> <li>- Significant capabilities and tools for inter-disciplinary coordination.</li> <li>- BIM model forms basis of analytical programmes, speeding the design feedback process.</li> </ul>	<ul style="list-style-type: none"> <li>- Visualization tool enabling earlier collaboration with architect.</li> <li>- Significant capabilities and tools for interdisciplinary coordination.</li> <li>- Ability to integrate mechanical systems and maintenance data.</li> <li>- BIM model forms basis of analytical programmes such as energy studies, speeding the design feedback process.</li> </ul>	<p><u>Main Contractor</u></p> <ul style="list-style-type: none"> <li>- Ability to "inherit" usable data which can be sorted as desired, and used for quantity surveys, estimates, project management/ cost records, etc.</li> <li>- Platform for 4D modelling, construction scheduling, and constructability analysis.</li> <li>- Visualization tool for subcontractor marketing, bid packaging, and coordination.</li> </ul> <p><u>Subcontractor</u></p> <ul style="list-style-type: none"> <li>- More usable information during bidding, transferable to preparation of bids and work planning.</li> </ul>	<ul style="list-style-type: none"> <li>- Ability to integrate existing data with manufacturing/ fabrication technology, saving significant data creation/ input effort.</li> <li>- Platform for 4D modelling, construction scheduling, and constructability analysis.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction ends with true "living" as built.</li> <li>- BIM model becomes facility management database and management tool. Flexible and changeable over time.</li> <li>- A living, more accurate tool for (i) code compliance checking; (ii) asset management; (iii) capital cost projections; (iv) square footage and space data.</li> </ul>

	Regulator	Client	Architect	Surveyor	Civil & Structural Engineer	E&M Engineer	Contractor	Manufacturer/ Fabricator	Facilities Manager
<b>Individual Discipline Operational Concerns</b>	<ul style="list-style-type: none"> <li>- Can BIM truly provide benefits to the industry?</li> <li>- What to achieve through BIM?</li> <li>- Will the software development obstruct the development of the construction industry?</li> <li>- Any proprietary problem? unfair play? disrupt competition?</li> <li>- Will Hong Kong AEC lose competitiveness to the global competitors if they do not have the BIM skillset?</li> <li>- What are the industry's expectation and needs?</li> </ul>	<ul style="list-style-type: none"> <li>- Can BIM provide budget and cost control?</li> <li>- Will the data be maintained and remain at high quality? Was it 100% accurate to begin with?</li> <li>- Will consultants and in-house staff know how to use and apply the technology?</li> <li>- How can the BIM model be used within the client's organisation for other activities, such as workflow/ activity modelling in the built spaces?</li> </ul>	<ul style="list-style-type: none"> <li>- Will more project control be ceded to other disciplines, particularly contractor?</li> <li>- How are traditional contract documents coordinated and produced?</li> <li>- Using BIM to its advantage requires more effort in early stages. Will this be paid, and so how?</li> <li>- How does the architect manage efficiently the many additional collaborators in the early design phases?</li> </ul>	<p><u>Quantity Surveying</u></p> <ul style="list-style-type: none"> <li>- What &amp; how to develop skill &amp; process needed to integrate BIM &amp; QA process?</li> <li>- Is there method &amp; standard for model development and the level of details required?</li> <li>- Can model be configured to construction method for deriving BQ?</li> <li>- How to filter model data for checking that they comply with rules?</li> </ul> <p><u>Land Surveying</u></p> <ul style="list-style-type: none"> <li>- Integration of BIM and Geographic Information System (GIS) is necessary. However, the tools and data interoperability are not well developed.</li> </ul>	<ul style="list-style-type: none"> <li>- Will the software programmes be truly interoperable, allowing the link for analytical and calculation tools to be used seamlessly?</li> <li>- Will the extra effort required in early stages be compensated?</li> <li>- If structural BIM data is transferred to manufacturers and fabricators, what are the contractual, risk, and compensation effects?</li> </ul>	<ul style="list-style-type: none"> <li>- With the migration of data responsibility to contractor, will engineers end up working for the contractors?</li> <li>- Will the software programmes be truly interoperable, allowing the link for analytical and calculation tools to be used seamlessly?</li> <li>- Will the extra effort required in early stages be compensated?</li> </ul>	<ul style="list-style-type: none"> <li>- Will the contractor be able to obtain the model data in a usable format as a basis for further development (shop drawings, etc.)?</li> <li>- What are the risks of owning the data, and will the contractor be paid appropriately, especially given the "inheriting" of data from the architect and engineering team and passing it on to the facility management team?</li> </ul>	<ul style="list-style-type: none"> <li>- Will fabricators be able to obtain the model data in usable format as a basis for further development, especially given actual and potential legal barriers during the bidding and construction phases?</li> </ul>	<ul style="list-style-type: none"> <li>- Will the facility management team inherit a model that truly reflects as-builts and will they be able to keep the model updated?</li> <li>- How adaptable will the model be in future years as the model must incorporate renovations, maintenance, etc.? Will this be expensive?</li> </ul>

Source: BIM: A Marketing Primer and Call to Action (Note: some enhancements have been added to these two tables as per Hong Kong's local situation)

## 10. The Roadmap and Strategic Implementation Plan

To successfully implement BIM, attention must be paid to two key areas: the BIM data model and BIM working process. Taking into account value, benefit, issue and concern, the following recommendations have been developed to help to guide the successful implementation of BIM in Hong Kong. A timeline is intentionally not included in this version of the study as it can only be proposed after industry-wide acceptance and understanding of BIM have been achieved.

### A. Collaboration

Initiative No:	<b>A.1</b>
Perspective:	Collaboration
Initiative:	To set up an industry-recognised coordinating body to foster collaboration locally and internationally
Activity:	<ul style="list-style-type: none"> <li>- Act as the central body to lead change and facilitate implementation work alongside a communication strategy.</li> <li>- Promote the adoption of BIM throughout the construction supply chain in Hong Kong.</li> <li>- Realise the industry's expectations and requirements of BIM practitioners and initiate curriculum changes in academic institutes to raise the industry's BIM capability.</li> <li>- Foster local collaboration across industry bodies and institutions in order to develop and promote the necessary standards, protocols, practices, legal frameworks and educational programmes according to an industry-accepted implementation plan, timeline and scale.</li> <li>- Foster international collaboration to develop a global view of standards such as best practice and shared practice.</li> <li>- Integrate and reconcile design and construction stakeholders, who aim to advance projects faster, with operation and maintenance</li> </ul>

	<p>stakeholders, who wish to inject more items or provisions into a design.</p> <ul style="list-style-type: none"> <li>- Operate a library for case studies, shared documents and standards, best practice, etc. under a single portal.</li> <li>- Establish an expert hub to share the latest developments, standards, best practice and knowledge for international operations.</li> </ul>
Suggested Action Parties:	CIC

Initiative No:	<b>A.2</b>
Perspective:	Collaboration
Initiative:	To promote project-wide collaboration along the project supply chain
Activity:	<ul style="list-style-type: none"> <li>- Redefine the work process and role of each participant to prepare for the full integration of BIM across the relevant processes. Jobs, roles and responsibilities should also be redefined accordingly.</li> <li>- Integrated BIM will affect contractual and process issues. Collaborative effort is needed to study this impact and suggest solutions to tackle these challenges.</li> </ul>
Suggested Action Parties:	<p>Leading: HKIBIM and buildingSMART Hong Kong</p> <p>Participants: Public and private clients, professional organisations (HKIA, HKIS, HKIE, AAP, ACEHK, ACQS, HKCA, HKFEMC, etc.)</p>

Initiative No:	<b>A.3</b>
Perspective:	Collaboration
Initiative:	To appoint a BIM Manager in construction project team
Activity:	<ul style="list-style-type: none"> <li>- Consider the need for a BIM Manager who is responsible for BIM project strategy, developing a BIM execution plan, auditing BIM, coordinating inter-disciplinary BIM, content creation and maintenance, etc.</li>   <li>- The BIM Manager would be responsible for communicating and developing an integration mindset and whole life cycle systems mindset among project participants.</li>   <li>- Develop the BIM Manager's professional standards.</li> </ul>
Suggested Action Parties:	<p>Leading: CIC</p> <p>Participants: HKIBIM, buildingSMART Hong Kong and training institutes</p>

## B. Incentive and Proven Benefit

Initiative No:	<b>B.1</b>
Perspective:	Incentive and Proven Benefit
Initiative:	To encourage public and private clients to take the lead
Activity:	<ul style="list-style-type: none"> <li>- Enable top management to understand the benefits of BIM and prepare their organisation to adopt BIM.</li> <li>- Allocate resources and engage BIM service providers to help key organisation and construction firms to introduce BIM.</li> <li>- Launch pilot projects (including, but not limited to, civil engineering, building, and design and build works) with BIM utilised by all participants across the whole project life cycle.</li> <li>- Explore ways to incentivise the use of BIM in public and private sector projects.</li> </ul>
Suggested Action Parties:	<p>Leading: CIC</p> <p>Participants: Public and private clients</p>

Initiative No:	<b>B.2</b>
Perspective:	Incentive and Proven Benefit
Initiative:	To develop a collection of client initiatives that demonstrate clear and proven benefits
Activity:	<ul style="list-style-type: none"> <li>- Collect experiences and feedback from project clients who have used BIM to manage projects, assets and the various participants in the construction supply chain.</li> <li>- Explore and demonstrate the quantitative benefits of adopting BIM with respect to project costs as well as the operating cost of an organisation.</li> <li>- Illustrate how BIM can support a project in terms of standards, procurement, collaboration, work processes, benefits and issues, etc.</li> <li>- Advance a client's ability to outline specific BIM requirements and work</li> </ul>

	with a BIM enabling team.
Suggested Action Parties:	buildingSMART Hong Kong and others

Initiative No:	<b>B.3</b>
Perspective:	Incentive and Proven Benefit
Initiative:	To develop a collection of case studies for other stakeholders that demonstrate the benefits of BIM
Activity:	<ul style="list-style-type: none"> <li>- Collect experiences and feedback from users who have adopted BIM to manage projects, assets and the various participants in the construction supply chain.</li> <li>- Advise and share the most updated real operations methods and innovative ideas to improve the operations model in a strategic approach with practitioners.</li> <li>- Establish a platform for practitioners in the construction industry to communicate the real operations model and take part in information sharing.</li> <li>- Explore and demonstrate the benefits of adopting BIM.</li> <li>- Illustrate how BIM can work in the life cycle of an infrastructure project.</li> </ul>
Suggested Action Parties:	buildingSMART Hong Kong and others

Initiative No:	<b>B.4</b>
Perspective:	Incentive and Proven Benefit
Initiative:	To provide support to small scale companies
Activity:	<ul style="list-style-type: none"> <li>- Encourage the use of BIM among small and medium enterprises (SME). SMEs may wish to apply for government funding to enable this transformation. Resources are illustrated in <b>Annex D</b>.</li> <li>- Coordinate with the relevant authorities to provide subsidised training programmes to teach BIM technical skills.</li> </ul>
Suggested Action Parties:	CIC

### C. Standards and Common Practices

Initiative No:	<b>C.1</b>
Perspective:	Standards and Common Practices
Initiative:	To establish delivery standards and common practices
Activity:	<ul style="list-style-type: none"> <li>- Build a reference document that provides a unified BIM standard, methodology, convention and the required level of detail so that it can be easily applied to different projects with reasonable modifications.</li>   <li>- Build a reference document that provides guidance on how to implement BIM at a project level throughout the project life cycle.</li>   <li>- Define a family of BIM components and their attributes for quantity surveying and analysis. The aim is not to develop an industry-wide components library.</li>   <li>- Bridge the Hong Kong standards and shared practices with those of regional practitioners (e.g. Singapore's Building and Construction Authority).</li> </ul>
Suggested Action Parties:	CIC's Task Group for Preparation of Hong Kong BIM Standards

## D. Legal and Insurance

Initiative No:	<b>D.1</b>
Perspective:	Legal and Insurance
Initiative:	To review procurement practices and contract provisions
Activity:	<ul style="list-style-type: none"> <li>- Review each discipline's current contract agreements, procurement system and scope of work to enable the cooperative use of BIM among the different parties of a construction project.</li> <li>- Review the Standard Method of Measurements (SMM) and link them with BIM.</li> <li>- Define the amount of BIM data to be included in a construction contract.</li> <li>- Define appropriate clauses to incorporate BIM data and models into a construction contract.</li> <li>- Review current procurement practices, approval and payment practices for works-in-progress.</li> <li>- Formulate and establish standards or guidelines for procuring BIM services, including the scope of service, outlined deliverables at each stage, terms and conditions, fee structure and payment schedule, etc.</li> </ul>
Suggested Action Parties:	HKIS and ACQS to coordinate with public and private clients

Initiative No:	<b>D.2</b>
Perspective:	Legal and Insurance
Initiative:	To review IP rights and data ownership
Activity:	<ul style="list-style-type: none"> <li>- Review the legal principles governing Intellectual Property (IP) rights and how they apply to information held in a BIM environment.</li> <li>- Review data and information ownership and sharing.</li> <li>- Review accountability for using or updating data and information.</li> <li>- Review ownership and usage as well as liability, which may affect insurance policies.</li> </ul>
Suggested Action Parties:	CIC to carry out desktop research to review current practices in Singapore, the United Kingdom and Mainland China.

## E. Information Sharing and Handover

Initiative No:	<b>E.1</b>
Perspective:	Information Sharing and Handover
Initiative:	To establish a management framework that facilitates the collaborative production of architectural, engineering and construction information
Activity:	<ul style="list-style-type: none"> <li>- Creating a single repository of BIM data for the complete supply chain of an individual project may not be practical (as per the AEC (UK) BIM Standard), as each discipline requires its own BIM model to deliver its contractual obligation. Instead of a single model for common use, it is more beneficial to create a common data environment for each project. Information for each discipline would be created in a specific area. Once checked, approved and signed-off, individual BIM models could be released to the shared area, which is accessible by the parties participating in the project.</li> <li>- Suggest a mechanism to control and manage an inter-disciplinary common data environment.</li> <li>- Maintaining the integrity and relevance of information or data is an important aspect of retaining its value and benefit to users. Proper data storage, data sharing, access permissions and updating responsibilities should be considered in detail. Guidelines are needed to help participants maintain and manage data in order to retain accurate and up-to-date asset records.</li> <li>- Develop a data exchange methodology for all participants along the construction supply chain to: (a) Improve the information retrieval and exchange process; (b) Enhance the quality and scope of information delivered by the supply chain; and (c) Increase data integrity.</li> </ul>
Suggested Action Parties:	<p>Leading: HKIBIM and buildingSMART Hong Kong</p> <p>Participants: Public and private clients, professional organisations (HKIA, HKIS, HKIE, ACEHK, AAP, HKCA, HKFEMC, etc.)</p>

## F. Promotion and Education

Initiative No:	<b>F.1</b>
Perspective:	Promotion and Education
Initiative:	To offer institutional support and execute promotional activities
Activity:	<ul style="list-style-type: none"> <li>- Professional organisations can help to further implement BIM by promoting the technology and its advantages to clients.</li>   <li>- Professional organisations can help to expand the implementation of BIM by promoting the technology and its advantages to its members and marshalling members' responses to the challenges of adopting BIM.</li>   <li>- Forge consensus and support among organisations with a view to working together to advance the industry's capacity and capabilities.</li>   <li>- Engage the top management of clients with the concept of BIM, as they are in the best position to drive adoption. Clearly explain the benefits of BIM to their organisation.</li> </ul>
Suggested Action Parties:	<p>Leading: CIC</p> <p>Participants: Professional organisations</p>

Initiative No:	<b>F.2</b>
Perspective:	Promotion and Education
Initiative:	To expedite the development of BIM capacity and capabilities
Activity:	<ul style="list-style-type: none"> <li>- In the long-term, universities and training institutes need to provide sufficient training options featuring a variety of technical modules, such as BIM management and R&amp;D at various levels. Sample courses could include a BIM CPD course, BIM certificate course, BIM diploma course, etc. Academic institutions may consider including BIM courses as part of the relevant curriculums for degrees and diplomas.</li>   <li>- Extend BIM training from construction-related programmes to other engineering and computer science programmes.</li>   <li>- Design and offer suitable training covering three functions:</li> </ul>

	<p>(a) BIM model development;  (b) BIM model management;  (c) Using built BIM models.</p> <ul style="list-style-type: none"> <li>- Offer comprehensive and systematic training courses for new BIM positions, particularly BIM Managers and BIM Modellers.</li> <li>- Initiate a train-the-trainer programme to cascade training efforts to individual companies.</li> <li>- Sponsor and steer long-term research on required initiatives.</li> <li>- Implement a fast-track BIM training programme for in-service professionals and management staff to understand BIM from a management perspective rather than a technical perspective.</li> <li>- In-service professionals should be trained to use BIM themselves instead of relying on BIM consultants.</li> </ul>
<p><b>Suggested  Action Parties:</b></p>	<p>Leading: CIC  Participants: HKIBIM and training institutes, professional organisations, public and private clients</p>

Initiative No:	<b>F.3</b>
Perspective:	Promotion and Education
Initiative:	To expedite of the industry's capacity and capability to integrate infrastructure project management and infrastructure asset management
Activity:	<ul style="list-style-type: none"> <li>- In the long-term, universities and training institutes should consider adding infrastructure project management and infrastructure asset management courses to their degree and diploma curriculums.</li> <li>- Implement a fast-track training programme for in-service professionals and management staff to understand integration from a management perspective instead of a technical perspective. For example, offer cross training and rotational schemes to encourage mutual understanding between different teams.</li> <li>- Explore the possibility of providing of on-the-job training, which provides professionals and technicians with practical experience using BIM.</li> </ul>
Suggested Action Parties:	Universities, training institutes, professional organisations, public and private clients

## G. Sufficient Digital Capability and Vendor Support

Initiative No:	<b>G.1</b>
Perspective:	Compliant BIM Tool
Initiative:	To enable and ensure sufficient digital capability and vendor support
Activity:	<ul style="list-style-type: none"> <li>- An integrated BIM system relies on compatible data formats, i.e. the ability to merge models from various sources and especially different BIM systems. To improve this process, efforts must be made to develop open technology (or middleware) and data formats.</li> <li>- Software providers should ensure that design standards are localised to suit Hong Kong practices.</li> <li>- Software providers should ensure that within the BIM system, there is a modelling function that enables users to produce the final construction documents.</li> <li>- Software providers should facilitate the integration between BIM and downstream system applications to fulfil the needs of facilities management and frontline maintenance staff.</li> <li>- Introduce more BIM system providers in Hong Kong to provide greater choice and promote competition, with the aim of: (a) avoiding a monopoly created by a limited choice of vendors; and (b) maintaining quality services and systems.</li> <li>- Relevant authority's practice notes concerning the submission of building plans in AutoCAD/ Microstation format for GFA checking may need to be revised to accept the submission of building plans in BIM format.</li> </ul>
Suggested Action Parties:	<p>Leading: HKIBIM</p> <p>Participants: Public and private clients, professional organisations (HKIA, HKIS, HKIE, ACEHK, AAP, HKCA, HKFEMC, etc.)</p>

## H. Risk Management

Initiative No:	<b>H.1</b>
Perspective:	Audit and Risk Management
Initiative:	To adopt a strategic risk management process for BIM implementation
Activity:	<ul style="list-style-type: none"> <li>- Commission a risk assessment for BIM implementation at a project and corporate level. The purpose of the risk assessment is to identify possible risk areas and determine how they can be mitigated individually and collectively to reduce and marginalise potential problems following the adoption of BIM-enabled technologies and collaboration.</li> <li>- Commission a legal service to draft BIM-specific contractual provisions (avoiding the aggressive use of disclaimers, indemnification and non-reliance clauses) that aim to eliminate, limit or manage the risks associated with BIM.</li> </ul>
Suggested Action Parties:	CIC to carry out desktop research to review current practices in Singapore, the United Kingdom and Mainland China.

## I. Global Competitiveness

Initiative No:	<b>I.1</b>
Perspective:	Global Competitiveness
Initiative:	To maintain the competitiveness of the Hong Kong Architecture, Engineering and Construction (AEC) industry in the face of worldwide players, who are equipped with greater productivity and new technology
Activity:	<ul style="list-style-type: none"> <li>- Review and monitor global trends and the latest construction technology and keep Hong Kong's construction industry updated.</li> <li>- Facilitate skills, knowledge and experience sharing between the international market and Hong Kong market.</li> </ul>
Suggested Action Parties:	CIC

## 11. The Next Steps

In order to address the needs of high priority stakeholders and drive the wider adoption of BIM in Hong Kong, the Working Group has suggested the following possible actions:

<u>No.</u>	<u>Major Concern to be Addressed</u>	<u>Possible Action</u>
1.	Some clients do not possess the expertise to define deliverables, state their expectations and define the scope of BIM in their projects.	Provide clients with industry-approved standards, specifications, shared practices or reference documents. The Hong Kong Housing Authority, MTRC and other developers may wish to share their own standards or requirements for the industry's reference.
2.	BIM adoption and use are mainly driven by client demand. However, some major clients have no plans to adopt BIM.	Major clients need to become familiar with BIM and prepare for adoption.
3.	Quite a few of top management of Architecture, Engineering and Construction (AEC) companies, developers and some clients may not fully understand the nature of BIM or its benefits.	Share the benefits of BIM and cultivate an understanding of BIM among top management.
4.	To devise suitable educational programmes, academic institutions need to understand:	Initiate a curriculum change to develop the industry's BIM capabilities.
	a. The industry's expectations and requirements of BIM Managers and Modellers;	The CIC requests to work closely with academic institutes to drive changes to the relevant courses.
	b. The role and responsibilities of	

BIM Managers and Modellers at work or in a construction project.

In response to the suggested actions, the Working Group recommends that three key initiatives are implemented immediately:

- (a) **ESTABLISHMENT OF STANDARDS** - Devise a set of standards or specifications to facilitate the wider use of BIM in construction projects. Standards should include, but are not limited to: (i) Project Execution Plan; (ii) Modelling Methodology; (iii) Level of Detail; and (iv) Component Presentation Style and Data Organisation. The scope should include, but not be limited to architectural, structural, civil engineering, and MEP BIM models in stages of conceptual, preliminary design, detailed design, construction and as-built;
- (b) **PROMOTION** - Carry out promotions targeting industry stakeholders who are not familiar with the use and benefits of BIM, or who are observers or new to the idea of adopting BIM, especially the top management of major project clients. As the key drivers of BIM adoption, it is important that these stakeholders appreciate the benefits of BIM and prepare their organisation to adopt BIM. Promotion should not be limited to local practitioners but also include regional and international practices;
- (c) **TRAINING** - Develop the industry's BIM capacity by driving curricular change in construction-related and computer science academic programmes, and provide BIM training in three areas: BIM model development; management of BIM; and use of BIM models.

Accordingly, a task group has been set up to focus on identifying and steering the development of standards, specifications, shared practices and reference documents that will help the industry to adopt BIM. The members of the Task Group on Establishment of Industry Standard are set out in **Annex B**.

Moreover, the CIC can play an active role collaborating with current BIM users to promote BIM. The CIC can produce publications to disseminate news related to BIM, share the updates and progress of industry stakeholders, organise BIM-related events (e.g. seminars and conferences), and arrange visits and exchanges with overseas organisations.

The CIC will continue to participate in regional official meetings with a view to creating more opportunities for collaboration within the region as well as Mainland China. The CIC maintains its commitment to working with international institutes and updating international media channels with the latest developments related to BIM adoption in Hong Kong

The CIC also continues to collaborate with training institutes including universities, the IVE and VTC, professional organisations, and the CIC's own training academy to develop an industry-wide training framework and coordinated training programmes. Furthermore, with the concerted support of professional organisations, in particular the HKIBIM, the CIC is tentatively planning to set up a "Registration and Accreditation Service" to outline the qualification framework for BIM professionals, to accredit BIM training programmes and courses, and to provide a recognised register of BIM professionals.

## **12. Going Forward**

The Reference Material summarises current knowledge and experience shared amongst the Members of the Working Group in the use of BIM.

While relevant stakeholders are invited to make reference to the initiatives set out in the afore-mentioned chapters for follow-up actions as they consider appropriate, further reviews or discussions on some focused areas or topics with reference to the suggested initiatives and activities can help promote the adoption of BIM in Hong Kong.

The CIC is recommended to centralise the updates from Hong Kong's construction industry regarding the progress of the adoption of the BIM in Hong Kong; and provide/share these updates and the initiatives taken as-needed. Meanwhile, update to the Section "Updates on the Progress of the BIM Adoption in Hong Kong" in Chapter 4 of this Reference Material will be carried out on an as-needed basis.

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Important Note: The information provided in this Annex is for general reference only. The CIC does not warrant that the information is free from any error and/ or omission.

## Annex D

### **Resources of Government Funding Support for SMEs for the Adoption of Technology**

There are various government funding support schemes to assist SMEs for the adoption of technology in Hong Kong. The information provided in this section is a summary *for reference only*.

- a) **SME Loan Guarantee Scheme** - The Scheme is offered by the Trade and Industry Department (TID) to profit making SMEs to help them to secure loans from the participating lending institutions for installation & equipment, working capital needs. Details of the scheme are in **Annex D.1**.
  
- b) **New Technology Training Scheme** - This scheme under the Innovation and Technology Commission (ITC) is provided to SMEs to assist their staff trained in a new technology that would be useful to their business. The scheme provide up to 50% training fee subsidy to the applicants. Details of the scheme are in **Annex D.2**.
  
- c) **Small Enterprise Research Assistance Fund** - The Fund is offered for technology entrepreneurs and SMEs to carry out Research and Development (R&D) on innovation and technology. Funding support of up to HK\$6M will be provided on a dollar-for-dollar matching basis. Details of the scheme are in **Annex D.3**.
  
- d) There are other schemes such as University Industry Collaboration Fund, SME Export Marketing Fund, SME Development Fund, General Support Programme Fund which may also provide assistance to SMEs to adopt technology. Details of these schemes are in **Annex D.4**.

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**Annex D.1**

## SME Loan Guarantee Scheme by TID

### Provisions

- It aims at assisting SMEs in enhancing productivity and competitiveness;
- It helps SME to secure loans from the participating lending institutions for acquiring business installation & equipment, meeting working capital needs of general business uses.

### Eligibility of Application

- The organisation should be profit making business in Hong Kong.

### Funding Scheme

- Amount of guarantee is 50% of the approved loan, cap at HK\$ 6M;
- The guarantee period is up to a maximum of five years, counting from the first drawdown date of the loan;
- The offered interest rate will be subject to assessment of applicant's business nature and financial strength by the lending institution.

### Remarks

- According to conversation with Trade & Industry Department enquiry hotline (Phone: 2398 5129, Email: sgs\_enquiry@tid.gov.hk), this scheme is applicable for SMEs for the purpose of adoption of new Software technology such as BIM technology.

### Reference Link

- [http://www.smefund.tid.gov.hk/english/sgs/sgs\\_objective.html](http://www.smefund.tid.gov.hk/english/sgs/sgs_objective.html)

Important Note: The information provided in this Annex is for general reference only. The CIC does not warrant that the information is free from any error and/ or omission.

## **Annex D.2**

### New Technology Training Scheme by ITC

#### Provisions

- It aims to provide assistance to companies with their staff trained in a new technology that would be useful to their business. New technologies include those which are not widely applied in Hong Kong and the absorption and application of which will significantly benefit Hong Kong.

#### Eligibility of Application

- The organisation should be non-government / non-subvented organisation in Hong Kong to acquire a new technology for commercial application; and
- The staff to be trained should be permanent resident sponsored by employer.

#### Funding Scheme

- Subsidize at most 50% of course fee;
- The exact terms and conditions such as amount of subsidy; number of staff registered for course per SME is subject to agreement between course provider and Vocational Training Council (VTC as course administrator).

#### Remarks

- According to conversation with HK Innovation and Technology Commission enquiry hotline (phone: 2836 1212, email: fred@vtc.edu.hk), this scheme is applicable for SMEs training in new technology such as BIM technology which are not widely applied in Hong Kong and the absorption and application of which will significantly benefit Hong Kong.

#### Reference Link

- <http://www.itc.gov.hk/en/funding/ntts.htm>

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## Small Enterprise Research Assistance Fund by ITC

### Provisions

- A programme which provides funding support to technology entrepreneurs and small enterprises to carry out Research and Development (R&D) on innovation and technology.

### Eligibility of Application

- The organisation should be incorporated in Hong Kong under the Companies Ordinance (Cap. 32);
- The organisation should be less than 100 employees;
- The organisation should not be a large company<sup>1</sup>; and
- The organisation should not be a subsidiary of or significantly owned/controlled by a large company.

### Funding Scheme

- For projects approved for funding, funding support of up to HK\$6M will be provided on a dollar-for-dollar matching basis;
- Project period should not be longer than 2 years;
- The recipient company will hold all intellectual property rights arising from the project;
- The funding will be recouped if the project is able to generate revenue or the recipient company is able to attract third-party investment;
- Projects with a project period of 12 months or longer can apply for financial assistance under the Internship Programme<sup>2</sup> to hire additional staff. Each project can hire up to 2 interns;

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<sup>1</sup>A "large company" generally means a company that meets one of the following criteria: a) a publicly listed company; b) a positive cashflow generated from operating activities in the ordinary and usual course of business of at least HK\$20M in aggregate for the two most recent financial years; or c) has a market cap (or company asset) of at least HK\$100M.

<sup>2</sup>The Research and Development (R&D) Cash Rebate Scheme aims to reinforce the research culture among private companies and encourage them to establish stronger partnership with designated local public research institutions. Under the Scheme, a company will receive a cash rebate equivalent to 30% of its expenditure in two types of applied R&D projects – a) projects under the Innovation and Technology Fund (ITF) (ITF projects); and b) projects funded entirely by the companies and conducted by the designated local public research institutions ("Partnership projects").

Important Note: The information provided in this Annex is for general reference only. The CIC does not warrant that the information is free from any error and/ or omission.

- The recipient company can also apply for the Research and Development Cash Rebate Scheme<sup>^</sup> to receive a cash rebate of up to 30% of the company's financial contribution to the project;

Reference Link

- Small Entrepreneur Research Assistance Programme (SERAP)  
<http://www.itf.gov.hk/l-eng/SERAP.asp>
- GSP Internship Programme  
<http://www.itf.gov.hk/l-eng/GSP-ip.asp>
- Research and Development Cash Rebate Scheme  
<http://www.itc.gov.hk/en/funding/crs.htm>
- Public Sector Trial Scheme  
<http://www.itf.gov.hk/l-eng/PSTS.asp>

Note: ^ The Public Sector Trial Scheme provides funding support for production of prototypes/samples and conducting of trial schemes in the public sector to facilitate and promote the realisation and commercialisation of R&D results under ITF projects. The prototypes/samples and the trial schemes should aim to facilitate the development of new products not already available in the market currently, and employing the R&D results/deliverables of the completed ITF projects.

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**Annex D.4**

## Other potential/reference SMEs schemes in Hong Kong

### A) University Industry Collaboration Fund by ITC

#### Provisions

- It aims to stimulate private sector interest in Research and Development (R&D) through leveraging the knowledge and resources of universities. The emphasis is on close collaboration between private companies and universities in HK. There are three schemes under this programme:
  - Teaching Company Scheme (TCS) –provide graduate students from university;
  - Matching Grant for Joint Research –include researcher from university;
  - Industrial Research Chair scheme – chaired by researcher from university in natural science or engineering fields.

#### Eligibility of Application

- The organisation should be incorporated in Hong Kong; and
- The organisation should engage in commercial activities as the applicant and a local university as the partner.

#### Funding Scheme

- Up to HK\$ 30M, exceed HK\$ 30M need Hong Kong Legislative Council Finance Committee approval;
- For TCS, contribute each graduate up to HK\$ 7,500 monthly, cap to HK\$ 180,000 for project;
- For other 2 schemes, project cost covers the university's project related expenses. Company bears no less than 50% of the project cost.

#### Reference Link

- <http://www.itf.gov.hk/l-eng/UICP.asp>

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## B) SME Export Marketing Fund by TID

### Provisions

- It aims at helping SMEs to expand business through participation in export promotion activities.

### Eligibility of Application

- The organisation should be profit making business in Hong Kong participating in export promotion activities.

### Funding Scheme

- 50% of total expenditures, cap at HK\$ 50,000;
- Cumulative amount up to HK\$ 200,000.

### Reference Link

- [http://www.smefund.tid.gov.hk/english/emf/emf\\_objective.html](http://www.smefund.tid.gov.hk/english/emf/emf_objective.html)

## C) SME Development Fund by TID

### Provisions

- It aims at providing financial support to projects carried out by non-profit organisations operating as support organisations, trade and industrial organisations, professional bodies or research institutes to enhance the competitiveness of Hong Kong's SMEs in general or SMEs in specific sectors.

### Eligibility of Application

- The organisation should be non-profit organisations (professional bodies, research institutes, etc.).

### Funding Scheme

- 90% of total project expenditure, cap at HK\$ 2M.

### Reference Link

- [http://www.smefund.tid.gov.hk/english/sdf/sdf\\_intro.html](http://www.smefund.tid.gov.hk/english/sdf/sdf_intro.html)

Important Note: The information provided in this Annex is for general reference only. The CIC does not warrant that the information is free from any error and/ or omission.

## D) General Support Programme Fund by ITC

### Provisions

- It is a programme for non-R&D projects that contribute to the upgrading and development of industries as well as fostering an innovation and technology culture in Hong Kong. Projects to be supported under this programme may include conferences, exhibitions, seminars, workshops, promotional events, studies and surveys, youth activities, events or projects to support platform building / upgrading of industry, etc. In general, this programme will not support projects for promotion of products/services of a specific commercial entity.

### Eligibility of Application

- The organisation should be non-profit making trade and industry organisation, charity organisation such as district council, university or institute.

### Funding Scheme

- Up to HK\$ 21M for each approved project;
- Exceed HK\$ 21M need Hong Kong Legislative Council Finance Committee approval

### Reference Link

- <http://www.itf.gov.hk/l-eng/GSP.asp>

**Further Views on Legal Issues Associated with BIM**

**i. Legal Implication and Intellectual Property Right Issues Associated with BIM**

Speakers in the CIC Conference 2013 held on 29 November 2013 (The Speaker) thought the legal risks facing employers and consultants included duty of care, ownership and insurance.

Duty of Care

An employer expects a consultant to take reasonable skill and care in the delivery of design and professional services. With all the benefits of BIM, there is a potential to alter the duty of care and the delivery of it.

However, in the long term, quality may decrease as designers try to cascade down their obligation to others (e.g. sub-contractors, sub-consultants) through joint venture or sub-consultation, especially in sophisticated projects where there are large pyramids of consultancy. This may create ambiguity in the responsibility of error checking when information is passing around each other or integrated together as a centralized BIM model. And as a result, risk emerges in the delivery of service. This is something consultants will have to be aware of as the practice evolves.

Ownership

Ownership of a design has traditionally been the property of the designer subject to a licence, given to the owner, to use that design for a certain purposes. However, BIM is capable of providing a wealth of information of not just the initial project but the longer term operation and maintenance of an asset. How the model develops during the project, who puts what into the design, and who retains ownership of that knowledge are issues that need to be clarified to avoid disputes. The eventual BIM after delivery of a project will be the product of the input from many sources. The giving up of that control and possession is an important consideration.

### Insurance

In regards to insurance, there is as yet no consistent policy language developed by the insurance industry that deals with the insurable or uninsurable parts of BIM. Given the collaborative nature of BIM, the issue of insurance remains a grey area. If a problem from the design arises, being able to track where it originated and where it was solved also remains a consideration.

### Intellectual Property Rights

In terms of ownership of intellectual property rights (IPR) in BIM, it is also an area that can lead to disputes given the free flow of information into a model from various sources. A subcontractor's detail design information can easily end up in the hand of his/ her competitor when he/ she transfers the BIM model over to the owner. It was advised that provisions should be made in a contract to track the input in a design as it may result in extra fees entitlement if some IPR are handed over in a project. The UK has set up some protocols regarding IPR which may be worth considering in the Hong Kong context.

The most pressing issue for contractors in Hong Kong grappling with BIM is the identification of clashes in design. A lot of the contracts place an obligation on contractors for a specific time to identify clashes and to deal with them such that claim opportunity can be secured.

The key issue is for the various parties to understand what they are delivering, who is responsible for different stages in the BIM development, and whether BIM is just for the delivery of the project or for the ongoing operation and maintenance.

## **ii. No Unfair Competition in the AEC Family due to Adoption of BIM**

Anti-competitive practices in Hong Kong have been subject to a lot of dialogue over the past few years. However, there is no legislation or common law rule in Hong Kong in operation as yet which prohibits anti-competitive conduct. This will change when the conduct rules of the Competition Ordinance come into effect in late 2014.

The Competition Ordinance will have two conduct rules. The first is driven towards the pricing issue and beyond that to an undertaking which might give effect to an agreement that a concerted practice or association of companies may have the effect of distorting or restricting competition in Hong Kong. The second relates to any undertaking of abuse of market power or the restricting or distorting of competition in Hong Kong through nefarious conduct.

There was a distinction to be drawn between something that is anti-competitive in legal terms and something that is just not fair, and it will be quite a challenge to test anti-competitive conduct under the conduct rules. In terms of BIM skills available in the market, Hong Kong is quite well served, and no evidence of unfair practices.

BIM takes off in the market, dominant players may emerge and this is where monopolistic practices could occur and breach the conduct rules. He advised the way to keep the ground level was to ensure BIM was open and accessible in terms of information, guidance and training.

Singapore has not experienced any unfair practices in regards to BIM as the country has adopted an open approach to BIM, allowing for the free exchange of information, with government support. Given the open nature of BIM in terms of standards and data flow unfair practices are unlikely to occur, even if there is a dominant player in the market.

The strategy in Singapore had been to engage and collaborate with solution providers whether they were dominant or not. By working closely with vendors they have been able to come out with suitable BIM programmes and address technical issues. Unfair competition was not an issue in Singapore as the government structure doesn't allow for it.

When a BIM requirement was introduced to public works projects 10 years ago it faced fierce opposition from the industry. However, based on a survey done a year ago, more than 70% of firms are adopting BIM in USA. Adopting BIM on an open standards basis improves productivity and smart building technology.

In order to promote fair play and competition it is important that there is a BIM standard so different systems can talk to one another. If BIM technology is to be mandatory there has to be more than one or two vendors that can provide the technology to ensure fair competition.

BIM will soon become a required technology, a trend that has been driven by the Hong Kong Housing Authority. As we are now living in a '3D' world it is easier to visualise BIM from designers through to the frontline workers. By bringing everything to the public and making it accessible, this will drive the use of BIM and by having open systems will ensure that there is fair competition in Hong Kong.

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## Feedback Form

### Roadmap for BIM Strategic Implementation in Hong Kong's Construction Industry

Thank you for reading this publication. To improve our future editions, we would be grateful to have your comments.

(Please put a "✓" in the appropriate box.)

<b>1. As a whole, I feel that the publication is:</b>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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<b>Practical</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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