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CONSTRUCTION INDUSTRY COUNCIL
建造業議會

Co-Organisers 協辦機構



發展局
DEVELOPMENT BUREAU



香港房屋委員會
Hong Kong Housing Authority

BIM @ CIC CONFERENCE 2013

CONSTRUCTION INNOVATION : PRODUCTIVITY AND TECHNOLOGY

建築資訊模型 @ 2013年建造業議會研討會
「建造業新領域：生產力與科技」

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Mr. LEE Shing-see

GBS, OBE, JP
Chairman
Construction Industry Council

李承仕先生

金紫荊星章，OBE，太平紳士
建造業議會主席

Welcome Remarks 開幕辭

After greetings, Mr. LEE said the Construction Industry Council (CIC) was delighted to organise this annual conference once again which had become the flagship event for Hong Kong's construction industry bringing together the various stakeholders. He thanked the co-organisers, the Development Bureau and the Hong Kong Housing Authority, the 18 sponsors, 41 supporting organisations, and two supporting media organisations for their support and participation.

After addressing the theme of "Construction Innovation: Productivity and Technology", he acknowledged the work of the Organising Committee chaired by Ir Kevin POOLE in arranging the excellent programme and attracting such a line up of expert speakers and more than 260 delegates.

He observed that Hong Kong's construction industry was at a stage of transformation where all practitioners, especially those at the top, must look at how to work differently to achieve a breakthrough in productivity, competitiveness and more critically, in sustainability. Mr. LEE said we are now in perhaps the busiest phase of construction in Hong Kong's history and the forecast is for this level of activity to continue for at least 10 years.

After providing an overview of the programme, Mr. LEE recognised the efforts of the CIC's Working Group on Roadmap for BIM Implementation which was chaired by Ms. Ada FUNG, and supported by representatives from more than 20 stakeholder groups. The Working Group has recently released its *Final Draft Report of the Roadmap for BIM Strategic*

李承仕主席首先代表建造業議會（議會）歡迎各位與會者，並表示議會很高興這個一年一度的研討會成為了香港建造業界聚首一堂的盛事。他感謝協辦單位包括發展局、香港房屋委員會、18個贊助商、41個支持機構、以及兩個傳媒機構的支持和參與。

李主席就研討會主題「建造業新領域：生產力與科技」發表了演說，並鳴謝由潘嘉宏工程師領導的研討會籌委會精心的安排，邀請了眾多專家講者出席，吸引了超過260名代表參與。

他表示，目前香港的建造業正處於轉型階段，業內人士尤其管理層，均必須發展新的作業方式，在生產力、競爭力以及最重要的可持續性方面尋求突破。李主席稱，香港建造業或許正處於歷來最繁忙的階段，更預料這個勢頭至少持續十年。

李主席簡單介紹了研討會議程，並感謝由馮宜萱女士領導、獲超過20個持分者團體代表參與的建造業議會實施建築資訊模型路線圖工作小組作出的努力。工作小組最近發表了《香港建造業策略性推行建築資訊模型路線圖之最終草擬報告》，為業界持分者更廣泛採用建築資訊模型（BIM）訂下了策略性方向。

Implementation in Hong Kong's Construction Industry which charts a strategic course for industry stakeholders in the wider adoption of Building Information Modelling (BIM).

BIM is now being discussed a lot more but Hong Kong is still lagging behind many of its counterparts in the adoption of BIM. However, Mr. LEE said, this does give us the opportunity to look and learn from the experience of others as we make strides ahead.

The CIC sees an urgent need to catch up with the fast pace of the global trend in the adoption of BIM in order to maintain the competitiveness of Hong Kong's construction industry in the region and internationally. He said it was important to know what is happening around us and we need to open our eyes to see how others are doing outside Hong Kong.

By developing the skills of our professionals through the wider adoption of BIM, Hong Kong's industry will find it more capable of competing for construction projects in the global market.

現時愈來愈多人討論BIM，但香港在應用BIM方面仍然落後於其他國家。李主席認為這正好給予我們機會，在踏步向前的同時，觀摩他人的經驗並從中學習。

為了維持香港建造業在地區和全球的競爭力，議會明白必須加快步伐，以追上全球採用BIM技術的趨勢。他認為最重要是知道我們周圍在發生甚麼事，並放眼世界看看香港以外是怎樣做。

透過廣泛採用BIM令專業人士的技術更加進步，香港的建造業就更有能力在市場上競逐國際建築工程。

當持分者已為採用BIM作好準備，他們會希望整個建造業齊心協力，更廣泛採用BIM，以發展一個更有組織、更有系統的方法。除了路線圖和業界持分者的參與，議會亦會擔當協調和推動的角色，協助香港建造業採用BIM。

為推動香港業界採用BIM，議會與業界持分者正合作擬備《建築資訊模型標準編制（第一期）》。李主席表示，議會將繼續與BIM業內人士及建造業持分者攜手合作，推動BIM在香港的應用，並邀請與會人士提出看法、建議和專業方案。「創新就是要新的做法，而BIM正是新的做法。我們需要你們提出新的觀點。」

While individual stakeholders are preparing or have prepared to use BIM, they wish to see a more organised and systematic approach towards the industry-wide adoption of BIM in Hong Kong through the concerted efforts of the whole construction industry. Through this Roadmap and ongoing engagement with industry stakeholders, the CIC is taking the co-ordinating and facilitating role for BIM in Hong Kong's construction industry.

In order to facilitate the industry to easily adopt BIM, the CIC is preparing BIM Standards (Phase One) for Hong Kong practice in collaboration with the industry stakeholders. Mr. LEE said the CIC will continue to work hand-in-hand with BIM practitioners and construction industry stakeholders to promote the applications of BIM in Hong Kong. He invited participants to provide their views, suggestions and expert solutions. "Innovation is a new way, and BIM is the way to go. We need to have your new thinking."



Mr. CHAN Mo-po, Paul
Secretary for Development
Development Bureau
Hong Kong Special Administrative Region

陳茂波先生
香港特別行政區發展局局長

Keynote Address
專題演講

陳茂波局長在專題演講中提到如何透過科技、創新和提高生產力，協助香港建造業應對土地短缺等挑戰和市民對綠色生活的訴求。

他表示使用BIM是大勢所趨，香港亦必須與全球並駕齊驅。他很高興看見議會領頭推廣廣泛應用BIM，現今的首要任務就是訂立本地的BIM標準。

香港特區政府於2009年起在工務工程中採用BIM技術。路政署率先在屯門公路項目使用BIM，隨後又應用於中環灣仔繞道工程。政府在工務工程中採用BIM現有一套獨特的策略，首先在更多工務工程的不同階段推行試驗計劃，例如橋樑、隧道、樓宇、以及機電工程等，再而推動不同持分者參與合作，例如建造業議會、軟件專家顧問以及承建商，共同探討BIM在香港建造業的發展潛力。政府亦會指定個別項目以研究BIM在資產管理層面的應用。

陳局長表示，政府已展開全面的BIM員工培訓計劃，預計到2014年底，將有逾一千名工程人員已接受不同程度的BIM培訓。

他又表示，政府計劃設立預製件工場以提高生產力，專門切割和屈紮鋼筋。在工地外預製組件，能騰空更多地方予需要在工地進行的工程使用，亦可更有效控制工作環境，提升工業安全、減少廢料和降低成本。同時亦可讓年輕人在良好的環境下發展所長，減少人手流失。

政府於工務工程引入創新意念（ICS）採購制度程序，以鼓勵投標者主動創造機會為建造業注入創意和創造力。在投標評估程序中，這個全新的ICS階段獲置於傳統呈交技術和成本方案之前，而在創新及創造力方面得分較低的投標者，通常會被淘汰。觀塘海濱項目就是第一個採用ICS方法的試驗計劃。

陳局長表示，發展局正與創新科技署合作，在多項研究和發展項目進行試驗計劃以加強工地安全，同時提升工務工程項目的表現和成本效益，最終提升生產力。

他表示，議會研究了一套主要表現指標，評估本地建造業的表現和生產力。第一套指標在2013年4月的建造業表現報告中發表，回顧建造業在2001年至2011年的表現。以建築工程人均總值為例，每名工人的貢獻和生產力自2009年起已有提升。

Mr. CHAN's speech addressed how through technology, innovation and greater productivity the construction industry could meet the challenges facing Hong Kong such as the land shortage and citizens' aspiration for a greener living environment.

He said it was important for Hong Kong to keep pace with the global trend in BIM and was glad to see that the CIC is championing the movement to promote the wider adoption of BIM. The task now is to establish a local BIM standard.

The Hong Kong Special Administrative Region (HKSAR) Government adopted BIM technology in public works projects in 2009. The Highways Department pioneered the application of BIM technology with the Tuen

Mun Road Project and later in the Central-Wai Chai Bypass Project. The Government has now developed a specific strategy to adopt BIM in public works. Firstly, it has extended the trial programme to include more public works projects such as bridges, tunnels, buildings, and electrical and mechanical works at different stages. Secondly, it has engaged and collaborated with various stakeholders including the CIC, software specialist consultants, and contractors to explore the full potential of BIM in Hong Kong's construction industry. The Government will also earmark projects to explore the use of BIM in asset management.

He said the Government had launched a comprehensive staff training plan on BIM and by the end of 2014 more than 1,000 engineering staff would receive different levels of BIM training.



He said the Government plan was going to set up an offsite prefabrication yard for offsite cutting and bending of reinforced steel bars in order to improve productivity. Offsite construction can also free up the space required for onsite work and also create a well controlled factory environment that will enhance work safety, reduce wastages and consequently reduce costs. It should also provide a more comfortable environment for young graduates to develop their skills thereby improve the retention rate of labour.

The Government introduced the Innovation and Creativity Screening (ICS) approach in procuring public works projects to create an environment conducive for tenderers to proactively explore opportunities for bringing innovative and creative features to construction. A new ICS stage has been added to the works tendering assessment process before the traditional technical proposal and fee proposal stages. Tenders with the lowest score on innovation and creativity will usually be screened out. The Kwun Tong Promenade Project is the first trial programme to adopt the ICS approach.

Mr. CHAN said the Development Bureau was collaborating with the Innovation and Technology Commission to conduct trials on various research and development projects to enhance site safety and increase the efficiency and cost effectiveness of public works projects which will be translated to productivity enhancement.

He said the CIC had developed a set of Key Performance Indicators to gauge the performance of the local construction industry so as to be able to measure productivity. The first set of indicators was published in the construction industry performance report in April 2013 providing an overview of industry performance from 2001 to 2011. Taking the gross value of construction works per capita as an example it shows the contribution or productivity per worker has been increasing since 2009.



Hon Charles Peter MOK

Member
Legislative Council
Hong Kong Special Administrative Region

莫乃光先生

香港特別行政區立法會議員

How Information Technology Could Help to Improve Construction Productivity 如何利用資訊科技提高建造生產力



The Hon Charles MOK, who represents the Information Technology Functional Constituency of the Legislative Council, said that the construction industry faced similar challenges to other sectors in Hong Kong's economy namely human resources in terms of a shortage in young skilled professionals.

He praised the Construction Industry Council for providing good training opportunities and incentives to encourage people to enter into the industry. The question facing the industry is how Information Technology can play a role in improving productivity in the construction industry as it has done in other sectors. BIM will play a leading role in that transformation.

He said the typical measurements when talking about productivity included cost effectiveness, time saving, quality and quantity improvement, minimising waste, and team and resource management. As industries became more competitive, not just competing in Hong Kong but measured against regional and global standards, the need for such benchmarks becomes more obvious.

In other sectors the use of technology and innovation has enabled them to move forward in terms of service and quality of products. Manufacturing has advanced with automation, quality control programmes, enterprise resource planning, and logistics management. In terms of big infrastructure projects there is an obvious need to use technology to be more efficient, innovative and environmentally sensitive.

In education, technology is being more widely used and e-learning has been taking on greater importance. Under the HKSAR Government's Digital 21 Strategy one of the key proposals is to teach programming at all levels in schools to ensure young people understand the logic of computers. Mr. MOK said computer literacy is now a skill that is as important as learning a language or knowing about maths.

The medical sector in Hong Kong will also see benefits with developments in integrating technology and the electronic health record. This, he said, will create a lot of opportunities for remote diagnosis and treatment.

代表資訊科技界別的立法會議員莫乃光先生表示，香港建造業跟其他行業面對同一個挑戰，就是人力資源的缺乏，尤其年輕的專業人才。

他讚揚議會提供良好的培訓機會和推動力，吸引年輕人加入建造業。建造業目前面對的難題正是如何利用資訊科技提高生產力。而BIM正好在這個轉型過程中，扮演領導角色。

莫乃光議員表示，討論生產力通常會提及成本效益、節省時間、提升質量、減廢，以及團隊和資源管理等。隨著建造業競爭愈來愈大，而且跨越界別從香港伸展至地區內以至全球，行業對訂定基準的需求已顯而易見。

科技和創新可以讓使其他行業提供更好的服務和提高產品質素。製造業透過自動化、質量測控計劃、企業資源規劃和物流管理等方面大幅進步。大型基建項目亦明顯需要科技來達致更有效、更創新和更環保。

科技在教育界的應用亦愈來愈廣泛。電子學習愈趨重要，香港特區政府的「數碼21」資訊科技策略其中一個主要建議，是在全港學校加入編寫程式課程，確保年輕一代掌握電腦邏輯。莫議員表示，學習電腦知識已跟學習語言和數學同樣重要。

香港的醫療行業同樣因為結合科技和電子醫療記錄的發展而受惠。莫議員認為這做法正可增加遙距診斷和治療的機會。

In the Legislative Council the issue of BIM has been raised with legislators calling on the Government to further promote the use of BIM to improve productivity and efficiency, and reduce waste.

He said BIM was not just limited to the creation of three dimensional (3D) models but allowed for project management by managing all data from construction to operation; management support in providing information for maintenance and planning; reducing or managing costs by calculating the costs through the system; scenario simulation and analysis of sunlight, ventilation and heat absorption; and procurement and logistics management to ensure materials are managed on schedule.

In a study by Lott & Barber Architects comparing two dimensional (2D) Computer-Aided Design (CAD) and BIM on the same project, it was estimated 686 hours could be saved with the use of BIM, an overall productivity improvement of 38% in various tasks including design, development, documentation, review, and co-ordination.

立法會內亦曾就BIM的議題作出討論。有議員促請政府進一步推廣BIM的應用以加強生產力和效率，同時減廢。

他表示，採用BIM不只局限於繪製三維模型，同時更能夠為項目管理所有由施工到使用階段的數據；為維修和規劃提供資訊及管理支援；利用系統計算從而降低或管理成本；模擬情景和分析日照、通風和吸熱量；按程序管理物料採購和物流。

Lott & Barber Architects 進行了一項研究，在同一個項目中比較電腦輔助設計（二維）和BIM的表現。研究結果顯示，使用BIM可節省 686小時，而各方面的整體生產力，包括設計、開發、存檔、檢討和合作等整體提高了38%。

資訊科技業界的新發展，例如雲端計算，將允許透過實時視像化和模擬更有效地共享訊息，促進訊息交流和溝通，提升BIM的效用。

隨著可持續發展愈來愈重要，樓宇業主亦可利用模型的數據進行樓宇管理、創造新價值以及優化能源使用。

然而，如果這些工具缺少相關專業知識的人才使用，一切好處均難以兌現。莫議員呼籲為年輕專才提供更多培訓，確保他們精通這些技術。

New developments in the Information Technology industry such as cloud computing will allow for more efficient information sharing through real-time visualisation and simulation, and facilitate information sharing and communication to enhance the BIM experience.

As sustainable development becomes increasingly important, building owners will be able to make use of the modelling data to manage the building or to create new value, and for energy use optimisation

However, without the people with the knowledge and expertise to utilise these tools the benefits cannot be realised. Mr. MOK called for more training to be provided to ensure young professionals will be proficient in these technologies.



Mr. Don WARD

Chief Executive
Constructing Excellence, United Kingdom

Don WARD 先生

英國 Constructing Excellence 行政總裁

How to Benchmark Productivity within the Construction Industry

如何在建造業內訂立生產力基準



Constructing Excellence was set up over 10 years ago by the Government of the United Kingdom (UK) with a mission to be a national, regional and local platform for industry improvement to deliver better value for clients, industry and users through collaborative working.

It has six core activities to support continuous development: action, research and innovation; Key Performance Indicators (KPIs) and benchmarking; demonstrations; networks; guidance and training; and leadership and influence.

Over the past 20 years a number of major government reports into the UK construction industry have recommended measures for change with an emphasis on improving productivity. Mr. WARD said the UK industry previously had a reputation for the delivery of projects late and over budget, but through a concerted effort over the last 10 years the industry has improved to now be able to deliver mega projects.

The KPIs adopted for the industry included: safety; delivery (time and cost); client satisfaction; and environmental performance. Based on the 12 years of data, he said safety has improved with the accident rate down by 40% and fatalities down by 70%.

Since 1998 demonstration projects have been used to put into practice new ideas whether technical or management. By almost all measures these new demonstration projects outperformed the rest of the industry.

He said the construction industry is difficult to benchmark and a long time was spent to normalise indicators to be able to compare various measures. The key to success was to continuously compare performances against others, then using the lessons from the best to make improvements.

He outlined a seven-stage benchmarking process: decide what to measure; collect data; calculate KPIs; report the results; analyse the results; take action; and measure again. One of the challenges was to take the large amount of data and turn it into useful information, he said.

He identified six critical success factors for collaborative working: early involvement (entire supply chain); selection by value (not just procurement by the lowest price); common processes and tools (BIM); measurement of performance (continuous improvement); long term relationships (lean); and aligned commercial arrangements (such as New Engineering Contract (NEC) to incentivise parties to work together).

He said BIM is a transformational set of technologies that is as much about collaborative working, as it is about technology. It enables the early involvement of more parties and to be able to manage the large amount of data all of which can feed back into benchmarking productivity.

The UK Government's latest report, *Construction 2025*, is a blueprint for the next 10 years. Mr. WARD said it stressed the wider adoption of BIM and to work on the 'attractiveness' of the industry to attract both new recruits and financial institutions to invest more in companies and projects.

At last, he explained that the value of client outcomes far outweighs the project costs with an example showing how a £1 million worth construction project can lead to a £5 million operation, £200 million business costs, and £250 - 2,000 million outcomes over its entire lifecycle; and it is important for us to spend money as cost effectively as possible on the design and construction stages so that better value can be brought in the final outcome.

英國政府逾十年前成立 Constructing Excellence機構，旨在為建造業提供國內、區內和本土平台，透過協同合作為客戶、業界和使用者提供更優質服務。

機構主要通過六項活動支援持續發展：行動、研究與創新、主要表現指標（KPIs）與基準、範例、網絡、指引及培訓，以及領導能力和影響力。

過去20年來，英國政府寄予建造業的報告均有提及出致力提高生產力的改革措施。WARD先生表示，英國的建造業因經常延遲交付和超出預算而遭詬病，但經過十年的努力，英國建造業在處理大型項目上已有進步。

建造業採用的KPIs包括：安全、交付（時間及成本）、客戶滿意度，以及環保表現。根據12年來的數據顯示，安全表現已有所改進，意外率下降了40%，而致命工業意外率亦下降了70%。

自1998年起，英國建造業已於示範項目中引入新的技術或管理概念，這些項目比起業內其他項目在各方面均有非常突出的表現。

他表示，要訂立可比較不同措施的指標需要花很多時間，因此為建造業訂立基準可謂相當困難。而成功的關鍵，是要不斷與他人的表現作比較，然後參考最好的作業方式並作出改善。

他提出了訂定基準的七個程序：決定要量度甚麼；收集數據；計算KPIs；報告結果；分析結果；採取行動；以及重新測量。他表示搜集大量數據並將之演化為有用資料亦是其中一項挑戰。

WARD先生又列舉了六項協同合作的重要因素：早期參與（整個供應鏈）；按價值選擇（並非只採購最低價產品）；共用程序和工具（BIM）；測量表現（持續改進）；長期關係（精益）；以及配合商業安排（如新工程合同鼓勵各方面合作）。

他認為，BIM是一套協同合作和科技同樣重要的革命性技術。它讓項目的各方人士能於早期參與，亦可處理大量數據，作為生產力的基準。



英國政府的最新報告《Construction 2025》是未來十年的發展藍圖。WARD先生表示，報告提到在更廣泛使用BIM的同時亦要增加建造業吸引力，除了吸引更多新血入行，更要吸引金融機構增加於公司及項目上的投資。

最後，他引用一個價值100萬英鎊的項目作例子，指其在整個生命週期內產生500萬英鎊的運作成本、2億英鎊的營業成本、以及2億5千萬至20億英鎊的成果，換言之客戶成果的价值其實遠超項目成本，因此我們應盡量投資於設計和建築階段的成本效益，以創造價值更大的最終成果。



Ir WONG Tin-cheung, Conrad

Vice Chairman
Yau Lee Holdings Limited

黃天祥工程師

有利集團有限公司副主席

**How to Achieve Lean Construction with
New Technologies and Construction Methods**

**如何利用創新科技及
建築方法實現精益施工**



Ir WONG defined lean construction as maximising productivity while minimising waste, be that waste of products or of time by changing designs. He identified four areas where lean construction can be achieved: better machinery, standardisation, offsite fabrication, and better planning and resource management.

With labour costs in Hong Kong high, any work that can be mechanised made good commercial sense. He said there is an increasing use of robots in the construction industry and referred to the leading countries in this field as Germany and Japan. He predicted that the commercial use of robots in Hong Kong's construction industry is 5 to 10 years away. However, the development of artificial intelligence and robots that are able to carry out more complicated human tasks still remained some way away.

In his two factories in China, laser cutting machinery and robotic arms are already in use. The way the industry is evolving, the client demand for quality is getting higher therefore there is a need to manufacture much better form work which precision machinery is capable of.

Standardisation is very popular in Hong Kong as it can reduce time and costs. However, markets like Japan are more standardised than Hong Kong in the use of precast design. In order for standardisation to be commercially viable the quantity needs to be high, but often in Hong Kong as the design is complicated it is not a viable option. He said if we are serious about increasing productivity and reducing labour costs we need to look at standardising components such as window and door sizes for the entire industry, not just for a particular project. He said one way to tackle the limited amount of labour is by changing the way we design, with the challenge to make more beautiful designs but also more standardised ones.

黃天祥工程師對於精益施工的定義是：提升生產力至最高的同時把浪費減至最少，包括成品浪費和因改動設計而造成的時間浪費。他提出四個可實踐精益施工的範疇，分別是優化機器、標準化、預製組件、以及更好的規劃和資源管理。

香港勞工成本高昂，任何可以機械化的工序都是商機。黃天祥工程師表示，建造業使用機械人的情況有上升趨勢，當中又以德國和日本的技術尤其領先。他預計五至十年內香港建造業就會引入機械人用於商業用途。然而，要發展人工智能和機械人執行更複雜的人手任務，前路仍然漫長。

黃工程師於內地開設的兩間工廠已開始使用雷射切割機器以及機械臂。行業正面臨轉變，客戶對質素的要求愈來愈高，因此更必須使用更精密的器材製造更優質的產品。

標準化可節省時間和降低成本，在香港已十分盛行。然而，日本等市場較香港在預製件設計方面更加標準化。要實踐標準化以獲取商業利益需要大量同樣設計的預製件，但由於香港預製件設計往往比較複雜，因此標準化並非可行方案。黃工程師表示，假如我們是認真想要提高生產力和降低成本，則需要整個行業使用標準化組件，例如窗和門等，而並不限於指定項目。他又認為，解決人手短缺的其中一個方案是改變設計模式，唯創造美觀同時標準化的設計可算是一項挑戰。

要推行標準化和模組化，各工程項目的設計必會非常相似，難免犧牲了建築物的獨特性。但他表示，這樣一來生產力的上升潛力將非常巨大，因此亦是值得考慮。

預製組件同樣在香港實施了數十年，通常是由中國內地的廉價勞工和工廠生產。他預料在香港使用預製組件的趨勢將會持續，建築工地將變成虛擬組裝工廠，生產力亦得以提高。

黃工程師表示，由於經濟不斷變化，很難估算需要製造多少組件才能達致成本效益。其他要考慮的因素，包括在工地外預製組件的技術可行性、安全考量、人手供應情況、時間和成本效益、以及環保因素等。

黃天祥工程師表示，BIM將改變由投標到工地管理等整個建築過程。BIM不但改善了管理人員、設計師和前線員工的溝過程，更可協助識別潛在風險，提供更好的穩固和防護配置，減低意外風險，提升安全表現。

他表示，結合其他陸續出現的嶄新技術，BIM將會繼續改變香港建造業，而行業亦可考慮如何採用納米技術和三維打印等現有技術提高商業效益。

The trade off in standardisation and modularisation is that projects need to be similar in design thus reducing the uniqueness of buildings. He said the potential increase in productivity would be enormous so it is worthwhile to consider.

Offsite fabrication has been utilised in Hong Kong for several decades by making use of cheaper labour and factories in Mainland China. He predicted the trend of prefabrication to continue in Hong Kong turning construction sites into virtual assembly plants to improve productivity.

He said it is difficult to estimate the cost benefits of how many pieces need to be produced to be commercially viable as the economics are constantly changing. Other factors to be considered are whether it is technically feasible for components to be manufactured offsite, safety considerations, labour availability, time-cost benefits, and environmental considerations.

Ir WONG said that BIM is going to change the entire construction process from tendering to site management. The communication process is improved through BIM with managers, designers and frontline workers all involved. It is also able to identify risk hazards and provide better holding and fencing configurations to reduce risks all of which enhance safety performance.

He said BIM integration with other emerging technologies will continue to change the way the construction industry in Hong Kong performs as well as how the industry can utilise nano technologies and 3D printing which are now far more commercially viable.




Mr. Andrew HILL

Chief Operating Officer
CSI Global Services, Australia

Andrew HILL 先生

澳洲 CSI Global Services 營運總監

Construction Information Technology to Asset Creation and Asset Management Approach 運用資訊科技創造及管理資產



CSI Global Services assists clients with developing and benefiting from implementing BIM processes.

Mr. HILL highlighted some of the industry impediments to BIM including: the lack of a champion in an organisation to drive it; the lack of understanding and a clear vision of goals; no set-up process and implementation plan; the financial commitment required; and little encouragement to innovate or offer innovation at tender if price is still 70% to 80% of assessment.

Through the planning, design and operation stages BIM can offer general productivity improvements through reductions in waste, improvements in safety, better constructability, and a more sustainable environment.

For the successful utilisation of BIM, Mr. HILL recommended the presence of the following: a corporate BIM policy; a solid BIM development team to manage the implementation; a BIM execution and implementation plan with clear milestones and objectives; and a clear work flow.

He said the benefits in having a clear work flow are a defined structure for deliverables throughout the project and that all information requirements are captured early to make decisions easier. Effectively, it provides a systematic approach to the management and delivery of information.

He said BIM had evolved over the past decade. Quoting figures from McGraw Hill Construction, the level of BIM adoption in North America has grown from 28% in 2007 to 71% in 2012. Today BIM provides for design visualisation, design analysis, project co-ordination, clash detection, schedules and quantities, and project collaboration. Comprehensive audit processes also ensure that the correct materials are procured.

BIM offers improved logistics. Mr. HILL gave a real life example of reducing from seven to five the number of cranes that would be required on a project by using BIM which would amount to savings of AUD20,000 (approximate HK\$145,000) per week for 36 months.

He also gave the example of BIM being able to provide way finding for emergency exits in a hospital project by providing an articulated model for evacuation planning, offering clear and manageable paths out of the buildings.

Trade installation sequencing capability identifies which trade needs to be onsite and when, and what is to be installed. It also allows for better coordination for commissioning and decommissioning of equipment.

BIM allows for elements to be tracked in minutes rather than hours in the case of an emergency for example the shutting off of a water valve. It can allow for a predictive maintenance system for cost effective replacement of assets. While real time performance reviews can improve energy efficiency such as monitoring the angle of tilted shutters.

Data of the BIM model is the centre of asset management. The key of it is how to make use of that data and integrate it to multiple systems.



CSI Global Services協助客戶發展BIM的程序，並從中受益。

HILL先生指出了建造業在應用BIM方面的一些阻礙：缺乏組織領袖推動；缺乏理解及對目標的清晰願景；沒有建立程序和推行計劃；需要投入的財政預算；如價格仍然是評估的70%至80%，在招標時對創新科技的鼓勵十分少。

BIM可在規劃、設計和使用階段透過減廢、加強安全、提高施工性和環境的可持續性以提高整體的生產力。

為了成功採用BIM，HILL先生提出了以下建議：訂立一套企業BIM政策；成立一套穩健的BIM發展團隊管理推行情況；訂定一套BIM執行和實施計劃並在當中設定明確的里程碑和目標；並規劃清晰的工作流程。

他表示，清晰的工作流程有助定出工程項目的交付程序以及盡早顯示所有資訊，方便更容易地作出決定。BIM亦提供一套有系統的方法進行資訊管理及傳送。

他更引用McGraw Hill Construction的數據分析BIM在過去十年的演變，並指BIM在北美的使用率已由2007年的28%上升至2012年的71%。時至今天，BIM的技術已能做到設計視像化、設計分析、項目合作、衝突檢測、定時定量、以及項目協同合作等。全面的審計流程亦有助確保採購正確的物料。

BIM亦有助改善物流。在HILL先生提出的一個真實例子中，工程項目使用BIM後把原來所需的起重機由七部減至五部，以36個月的工程周期計算，每星期就節省了2萬澳元（約14萬5千港元）。

他又提出另一個醫院建築項目的例子，說明BIM在其中如何透過清晰的模型提供了清楚又可行的路徑離開建築物，協助製作疏散計劃並定出緊急出口位置。

BIM更備有供求安裝測序能力，能識別哪些安裝工作需要在現場及何時進行，並更好地協調安裝或拆卸裝置工作。

BIM更可按每分鐘而非每小時監測所有因素，使工程人員能及時處理關閉水閘等即時問題。BIM亦能提供一個可預計的維修系統方便更換資產，從而提高成本效益；而其實時表現檢視則可監察百葉窗的角度等情況，改善能源效益。

BIM數據就是資產管理的中心，而其中的重點就在於如何運用和整合這些數據，應用到不同的系統當中。



Dr. Calvin KAM

Director of Industry Programs
Center for Integrated Facility Engineering
Stanford University, the United States

甘嘉恒博士

美國史丹福大學綜合設施工程中心工業課程總監

Business Value of Building Information Modelling at a Glance for Senior Executives

從高級管理人員的角度 看建築資訊模型的商業價值



Dr. KAM said the business value from BIM could be only realised with the right mindset otherwise it may not offer any return on investment. Innovation can be brought into practice at government level by integrating BIM into public works projects and it can also be driven by professional associations.

He stated that there is proven business value in BIM in that it is able to achieve three times the usual energy efficiency, 60% of reduction in design time; and with automation it is able to conduct design integration in a matter of seconds rather than hours. To date, Dr. KAM and his team have studied 150 BIM cases in 12 countries that demonstrate the business value.

Basing much of his presentation on an analogy with the development and utilisation of the space shuttle, Dr. KAM said vision did not translate into reality without the necessary resources and mindset being in alignment. If innovation is not used in the right way it is the equivalent of

the space shuttle driving along a street. Similarly with BIM, if it is simply used as a design tool its full potential will not be realised. Without a clear purpose for BIM, it may not offer a reasonable return on investment. He said return can be eight times the investment but he has also heard some owners complain of paying eight times as much without seeing any business value from BIM.

Dr. KAM said BIM should be the driver for design and not an afterthought. Business value cannot be realised if BIM is treated as 'business as usual' with no timely feedback or if the various contracted parties are defensive about or late in sharing information. BIM should not be regarded as just an add-on to an existing contract.

How we launch BIM is also an important consideration as it can alter the way a project is launched, the way risks and rewards are shared, and the contract awarding process.

甘嘉恆博士認為，唯有抱持正確的心態，才能實現BIM的商業價值，否則難以得到投資回報。政府可以於工務工程中採用BIM，專業團體推動也可以協助推行，將創新科技融入實踐。

甘博士指，BIM甚具商業價值，例如它可提升能源效益達三倍、縮短60%設計時間，以及透過自動化在數秒內進行設計整合，而不用花數小時進行。至今，甘博士及他的團隊已在12個國家和地區進行了150項BIM商業價值個案研究。

甘博士在演說中借用太空穿梭機的發展和使用，以類比論證的手法指出缺乏所需的資源和心態則難以實現願景。沒有把創新科技應用在正確的方向，就如同穿梭機在街上行駛一樣。如果只是把BIM當作一種設計工具來使用，它的潛能就不能完全發揮。沒有明確目標地使用BIM，也就沒有理想的投資回報。甘博士表示，使用BIM有時可獲取高達投資額八倍的回報，但也聽說過有業主投訴，即使付出了八倍的投資卻也沒有受惠於BIM的商業價值。

甘博士認為早於設計階段就應該採用BIM，而非後來才作出考慮。假如採用BIM只被當作是普通商業設計工具而缺乏適時的回應，或者參與者不肯或遲遲都沒有分享資訊，那BIM的商業價值就不能顯現。BIM不應只被視為既有合約的附加條件。

我們推行BIM的方式更能影響到項目的推行、風險與回報的分享、以及中標過程，因此推行方式也是一個重要考量。

BIM可減少尋找資料的時間，亦能製作更好的設計，而配合指標和主要表現指標（KPIs）使用，更有效提高生產力。甘博士認為BIM為創意創造了條件，減少設計時間從而生產多個不同設計。這裏談的已不僅是降低成本或縮短時間，而是兩者兼得，同時減少排放量，製作更優良的設計。

甘博士認為只集中於BIM的形像和市場銷售亦不能實踐其真正的商業價值。BIM可把主要表現指標、資產管理系統以及預製組件等整合使用，這是傳統方法所不能比擬的。

談到中國內地的BIM發展進程，甘博士表示中國內地已開始發展自己的一套BIM準則。至於談到BIM開源的可能性，甘博士指全球創新科技將不再存在疆界。

BIM should reduce time to find information and come up with better designs and by aligning the use of metrics or KPIs users can realise greater productivity. He said BIM empowers innovation. It allows for faster design and to be able to generate more alternative designs. It is not just about lower costs or faster scheduling, it is about getting both, as well as being able to reduce carbon emissions and come up with better designs.

He said if the focus was just on the image or marketing of BIM, the true business value of it would not be realised. BIM allows for integration with KPIs, asset management systems, and prefabrication which cannot be done with the traditional practice.

Dr. KAM also referred to the BIM drive in Mainland China which is now developing its own national BIM standard. Referring to the open source potential of BIM, Dr. KAM concluded by saying that global innovation is becoming borderless.







Professor CHEUNG Bing-leung, Anthony

Secretary for Transport and Housing
Transport and Housing Bureau
Hong Kong Special Administrative Region

張炳良教授

香港特別行政區運輸及房屋局局長

Keynote Address 專題演講

Conference Luncheon 研討會午宴

Professor CHEUNG told delegates there is no better time than now for the construction sector in Hong Kong to invest in productivity and technology. Since the last five years, the Government's capital works expenditure has increased from HK\$20.5 billion in 2007/08 to an estimated HK\$70 billion in the financial year 2013/14.

He outlined the major infrastructure projects now underway in Hong Kong including bridges, rail and the proposed airport expansion. He said the *Review of the Railway Development Strategy* will shape the Government's policy blueprint for railway development beyond 2020. To help meet housing needs and improve the living space of the community, a new town of the scale of Sha Tin will need to be built every 10 years in the coming few decades.

Professor CHEUNG identified four challenges that the local construction sector must address. The first one is safety. It concerns both safety on-site, and the perception of safety by the local communities affected by construction works.

The second challenge is time. One of the innovative methods being used by Hong Kong Housing Authority to speed up production is prefabrication, in particular, the use of more steel mesh reinforcement to reduce steel bar fixing works and the use of prefabricated bathrooms. He said the pursuit of speedier construction should not be at the expense of safety and quality and this is where innovation can help to reduce delivery time without sacrificing safety and quality.

張炳良教授表示，目前是香港建造業投資於生產力和科技的最好時機。過去5年，政府的工務工程開支由2007/08年度的205億港元增加至2013/14年度預計的700億港元。

他提到香港目前進行的主要基建項目，包括橋樑、鐵路以及計劃中的機場擴建，又表示政府在檢視《鐵路發展策略》時將會勾劃出及至2020年的鐵路發展政策藍圖。而為了應付房屋需求和改善市民住屋情況，未來每十年就必須有一個等同沙田規模的新市鎮落成。

張教授又提到本地建造業需要應對的四項挑戰。首先是安全，包括工地安全以及受建築項目影響的地區社羣對安全的認知。

其次是時間。採用預製組件是香港房屋委員會加快生產的創新方法之一，尤其是在採用更多鋼絲網以減少紮鐵工序以及使用預製浴室方面。張教授亦提醒，在加快建築進度的同時亦不可忽略安全和質量。使用創新科技就能做到一石二鳥。

其三是透過立法提高環保要求，以及加深社會大眾對建築項目在環境及長遠可持續發展方面影響的認識。

港珠澳大橋香港口岸人工島工程所使用的不浚挖式填海方法正是利用科技減少建築工程對環境影響的絕佳例子。這是香港首次採用創新科技以完全不浚挖的方式填海並興建150公頃的人工島，不但避免棄置大量海洋沉積物，同時大大減少了填海物料和天然沙，以及在工程期間釋放到海洋環境的懸浮物。

建造業面對的第四個主要挑戰是人力資源。雖然註冊工人的人數由2007年底的225,000人增加約40%至2013年4月的314,000人，但工人平均年齡為46歲，其中四成更在50歲或以上。張教授表示，必須致力鼓勵和啟發更多年輕人加入建造業，讓他們明白建造業不一定是砌磚或「油灰水」，現在已有愈來愈多工種使用先進技術，例如BIM和運作流程計劃等，均有助改善我們的生活質素。

他補充，業界亦應採用「更聰明」的建築方法以減少對人手的依賴，確保工作流程更有效率。

The third challenge is improving environmental requirements by law, as well as increase awareness amongst the general public of the environmental impacts and the long-term sustainability of construction projects.

An example of technology being used to mitigate the environmental impact of construction processes is the use of the non-dredge reclamation method for the Artificial Island of the Hong Kong-Zhuhai-Macao Bridge Project Hong Kong Boundary Crossing Facilities. The first of its kind in Hong Kong in respect of reclamation, an innovative, fully non-dredge reclamation method has been developed in building the 150-hectare artificial land. This avoids the need of disposal of a large volume of dredged marine sediments. It also reduces substantially the amount of backfilling material and natural sand as well as the release of suspended solids into the marine environment during construction.

The fourth challenge to the construction industry is manpower. While the number of registered construction workers has increased by around 40% from about 225,000 as at the end of 2007 to about 314,000 in April 2013, the average age is now about 46, and 40% of them are aged 50 and above. Professor CHEUNG said there is still a lot more to do to encourage and inspire more new blood to join the construction industry. Being in the construction industry is not just working on bricks and mortar but increasingly with advanced technology such as BIM and operation-flow planning to bring about improvements in our quality of life.

He said the challenge is also to adopt smarter building methods, to free some of the processes from manpower dependence, and to enable more efficient workflows.




Dr. Calvin KAM

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甘嘉恒博士

美國史丹福大學綜合設施工程中心
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Ways to Maximise the Value of Building Information Modelling 如何充分利用建築資訊模型



The tremendous promise of *BIM Start-up Guide* can only be realised with the right people, processes, mindset, investment and technology in alignment. Dr. KAM said the expectation of BIM was often higher than the performance so therefore it is important to connect the vision with the initiative through the application of Key Performance Indicators (KPIs).

Dr. KAM said that without these factors BIM can result in expensive failure, and offer little or no return on investment. He said it was necessary to remove any 'emotional attachment' from the use of BIM and approach it as a management science. While BIM offers great detail, project managers need to ask if it is the right level of detail at the right time for a particular process. Based on 150 case studies across 12 countries, Dr. KAM said the successful implementation of BIM depended on having the people, processes, expectations, budget and technology all aligned.

He said it is important to define under the broad umbrella of productivity what the performance targets for a project are. Once the performance targets have been set, then a BIM execution plan needs to be defined. He said it is important to have the right metrics in place and good quality control systems. Next is to work out how you are going to enforce them to ensure consistency. Dr. KAM said another challenge to ensure BIM can realise its potential as a communications tool is the need for interoperability between BIM systems similar to how various email systems operate or talk to one another.

Dr. KAM is working with Asia-Pacific Economic Cooperation (APEC) to develop a *BIM Start-up Guide* to assist member countries who are at different levels of development in their economies and levels of adoption of BIM. Countries need to determine how they are to use this management process from a country performance goal perspective, for example to cut their carbon footprint or to increase labour productivity.

In the United States (US) where there is now 70% adoption in the industry, he is starting to see many companies use new types of contracts which are integrated forms of agreements that share the risks and rewards among the collaborative parties. A new BIM language is emerging to assign responsibility at the various levels of a project.

He said there was a lot to learn from the technology being used in Europe and North America. In Norway, Finland and the Netherlands he is starting to see a trend with BIM of free uploads and downloads to analyse BIM to do energy simulations and energy requirements. The information will be able to be accessed globally. Dr. KAM is working in the US to develop an open source model server for BIM. He said there is now the need for objective global benchmarks for productivity and BIM to ensure the true value of the technology is realised.



甘嘉恆博士表示，要獲得BIM的最大回報需要適當的人、適當的程序、適當的心態、適當的投資和適當的科技等因素配合起來才能兌現。他說，人們對BIM的期望往往高於其實際表現，因此需要藉由主要表現指標（KPIs），把願景和計劃扣連。

甘博士表示，缺乏上述因素則不能成功採用BIM，高昂的投資成本只會帶來很少甚至沒有回報。因此採用BIM時必須排除一切「情感依賴」，只把它當作管理科學。由於BIM可以提供大量細節，項目經理必須確保在適當的程序中適時獲取適量的資訊。根據在12個國家進行的150項個案研究，甘博士認為要成功實踐BIM，必須做到人、程序、期望、預算和技術均配合良好。

由於生產力涵蓋的範圍廣闊，因此甘博士認為必須為個別項目訂定表現目標。訂立了表現目標之後，就要制定BIM的執行計劃。他認為適合的量度工具和良好的質素控制系統十分重要，然後就是如何執行及確保一致性。甘博士指出，要確保BIM可以發揮作為溝通工具的潛力，就是加強不同系統之間的相互操作性，就像不同的電郵系統可互相操作和對話一樣。

甘博士正與亞太經濟合作組織（APEC）合作擬備《建築資訊模型啟用指南》，協助組織中經濟發展以及BIM應用程度均有不同的各成員國。各國需要從國家層面的表現目標角度出發來決定如何應用這套管理程序，例如減少碳足跡或提升勞動生產力。

甘博士表示，目前美國建造業的BIM應用率有70%，而部分企業開始採用類似綜合協議的新合約，與合作的企業分享風險與回報。新興的BIM語言可協助在項目的各個層次上分配責任。

甘博士認為歐洲和北美洲現正使用的技術均值得學習，又看到在挪威、芬蘭和荷蘭一個新趨勢，就是免費上載和下載BIM進行分析，以及進行能源模擬和能源要求。有關的資訊將於全球自由流通。甘博士正在美國研究為BIM開發開源式伺服器。他表示，現在需要為生產力和BIM訂立客觀的全球基準，以確保該技術的真正價值得以實現。



Mr. CHENG Tai-fatt

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鄭再發先生

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**Challenges in the National Wide
Implementation of Building Information
Modelling and Resolutions in Singapore**

**在新加坡國內廣泛推行
建築資訊模型的挑戰及相應措施**



Mr. CHENG provided an overview of the strategy taken in Singapore towards BIM which is targeted to be widely used in the industry as part of a broader national agenda to raise productivity. Under the country's Construction Productivity Roadmap, a target has been set to have an advanced, skilled workforce by 2020 that is competent in BIM.

The Singapore Government provided SG\$250 million in initial funding to improve productivity in the construction industry, focused on three main thrusts: work force development; technology adoption; and capability development.

In terms of technology development BIM was identified as a key driver or 'game changer' technology to transform the industry. Mr. CHENG said the key challenges to realising the strategy were: the entrenched behaviour in the construction industry; the lack of a ready pool of skilled manpower; and the need for additional resources to build up BIM expertise. Five strategic thrusts were developed as part of the strategy for the adoption of BIM in Singapore: the public sector taking the lead; promoting success stories; removing impediments; building BIM capability and capacity; and incentivising early BIM adopters.

From 2012 all public sector projects in Singapore were required to use BIM. In order to get the private sector on board it was mandated that from early July 2013 all architecture submissions for all new building projects more than 20,000 sqm must include a BIM model.

From July 2014 engineering submissions for all new building projects more than 20,000 sqm will be required to use BIM and from July 2015 architecture and engineering submissions for all new building projects more than 5,000 sqm must submit a BIM model to the government agency to get their plans approved.

To promote success stories, the Building and Construction Authority (BCA) produces publications, organises conferences and stages a yearly BIM competition for students and industry practitioners to share and create awareness of the potential of BIM.

鄭再發先生指推動建造業廣泛採用BIM是新加坡政府提高生產力的全國性策略之一。根據政府的建造業生產力路線圖，2020年新加坡將培訓出大批掌握先進技術的BIM人才。

新加坡政府撥出了2億5千萬新加坡元資助建造業提高生產力，主要投資在三項工作：人才發展、採用先進科技和能力發展。

在採用先進科技方面，BIM被視為是關鍵推動力甚或是「改變遊戲規則」的技術，帶領建造業轉型。鄭先生表示，推行這個策略的主要挑戰包括：建造業根深蒂固的行動模式、缺乏足夠的技術人才、以及培訓BIM專才所需要的額外資源。為驅使業界廣泛採用BIM，新加坡政府提出了五項工作：公共部門先行、宣傳成功個案、消除障礙、建立BIM能力和潛力、以及獎勵早期採用BIM的人。

由2012年開始，新加坡所有工務工程必須採用BIM。為了推動私人企業參與，由2013年7月開始，所有超過20,000平方米的新建築物提出建築申請時，必須按規定同時遞交BIM模型。

由2014年7月起，所有超過20,000平方米的新建築物提出工程申請時，亦規定要使用BIM。而由2015年7月起，所有超過5,000平方米的新建築物，提交建築和工程申請時，也必須提交BIM模型予當局審批。

在宣傳成功個案方面，新加坡建設局不但製作宣傳刊物及舉辦研討會，更每年舉辦BIM比賽讓學生和業內人士參加，共同發掘BIM潛力並提高意識。

鄭先生表示，在業界提倡之下，新加坡成立了BIM督導委員會，成員包括各政府部門和解決方案供應商，旨在提供策略性方向和應對推行上的問題。另外亦有工作小組檢視BIM的標準以及處理法律和合約方面的問題。

在建立能力和潛力方面，新加坡政府成立了建造業資訊科技中心，舉辦外展計劃，為有興趣採用BIM的企業提供培訓和輔導。建設局也和當地的理工學院和大學緊密合作。企業可從政府的撥備中獲得\$200,000新加坡元財政資助，用於購買軟件和硬件、培訓、或聘請BIM專家協助實施BIM。直至現在新加坡政府已撥出了\$26,000,000新加坡元資助。

鄭再發先生表示，計劃推行初期旨在提高人們對BIM的認識和購買軟件，而現在是時候在企業和項目層面檢視流程的改變。建設局會繼續跟當地大學合作，成立BIM卓越中心。他又表示，未來的發展將包括雲端技術和流動解決方案。

Mr. CHENG said a BIM Steering Committee was set up in Singapore that is driven by the industry with participation from various government agencies and solution providers. The intent of the committee is to provide strategic direction and to address implementation issues. There are also working groups looking at BIM standards, and legal and contractual aspects.

To build up capability and capacity, a centre for construction information technology was set up to organise outreach programmes, trainings and 'chaperone' companies who want to implement BIM. The BCA also works very closely with polytechnics and universities on having BIM training as part of their curricula. From the initial funding pool, a company may receive support of up to SG\$200,000 to buy software or hardware, for training or engaging a BIM consultant to help them implement BIM. So far SG\$26 million has gone towards such support.

Mr. CHENG said when the plan started it focused on getting people aware and to buy software now it is time to look at process changes within firms and at project level. The BCA will continue to work with local universities to set up centres of excellence for BIM. He also said the future trend will include cloud technology and mobile solutions.



Mr. Vincent CONNOR

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康文生先生

品誠梅森律師事務所合伙人、
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Legal Implication and Intellectual Property Right Issues Associated with Building Information Modelling 與建築資訊模型相關的法律及知識產權事宜



With the high demand for infrastructure and other projects in Hong Kong now, there is a corresponding demand for BIM skills and the winning of those projects may depend on having the technology such as BIM. Given the tight time frame for the tender process and project completion in Hong Kong, having that technology gives a competitive edge.

Mr. CONNOR said while many appreciated the rewards of utilising BIM, there are risks involved in this transformation and the situation is different for different participants in a project.

Contractors do not universally see that there is additional financial advantage in having a BIM proposition in their tender. So far in Hong Kong consultants do not see extra fees coming their way with the adoption of BIM.

The key legal risks facing employers and consultants include duty of care, ownership of design, intellectual property right, and insurance. 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.

In the short term, it increases an employer's expectation in the duty of care. Professionals who do not adopt BIM will be left behind in Hong Kong when the tool moves from state of the art to the norm.

However, in the long term it may decrease the standard that is delivered as designers try to cascade down their obligation to others (e.g. subcontractors, subconsultants) through joint venture or subconsultation, 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 centralised BIM model. 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 of a design has traditionally been the property of the designer subject to a licence, given to the owner, to use that design

for 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.

In regards to insurance, Mr. CONNOR said that 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.

In terms of intellectual property rights 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 detailed design information can easily end up in the hand of his / her competitor when he / she transfers the BIM model over to the owner. He advises 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 intellectual property rights are handed over in a project. The UK has set up some protocols regarding intellectual property rights 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.



現時香港對基礎設施和其他項目的大量需求同時帶來了對BIM技術的相應需求，而要投得這些項目關鍵似乎在於是否具有像BIM這類的技術。考慮到香港緊逼的招標過程和項目完工時間，擁有這類技術絕對是一種優勢。

康文生先生指許多人認為採用BIM能帶來很多好處，但這種轉變同時也帶來風險，而項目的不同參與者均要承擔不同的風險。

承建商一般並不認為在標書內加入BIM建議能帶來額外的財政優勢。香港的顧問至今也未看到採用BIM可帶來的額外收費。

業主和顧問面臨的主要法律風險包括謹慎責任、設計的擁有權、知識產權及保險。業主一般期望顧問交付設計和專業服務的時候採用適當的技能和責任。儘管BIM好處很多，卻有可能改變謹慎責任及服務的交付。

從短期來看，BIM增加了業主對謹慎責任的期望。當BIM從頂尖科技逐漸演化成普通工具時，在香港未有採用BIM的專業人士將被淘汰。

然而從長遠來看，BIM也可以可能令交付的水平下降，設計師可能在合營或顧問分判等經營模式中把自己的責任大量轉移至其他人（例如分包商、分判顧問），尤其是在聘用大量諮詢服務的大型而複雜的項目中。集中整合一個BIM模型後，各項資訊能在彼此間自由傳播，檢視錯誤的責任就會變得模糊不清，最終構成了服務交付上的風險。因此在BIM的演化過程中，各顧問必須對此提高警覺。

傳統上認為，一項設計的所有權屬於設計師，之後可經由許可證等模式轉移至持有人作特定用途。然而BIM所能提供的大量資訊除了包括最初的項目外更涵蓋至資產的長期運作和保養。為了防止紛爭，模型在項目中的開發過程、誰人將甚麼加入設計之中、誰人持有哪種知識的所有權等問題均需要澄清。項目交付後的最終BIM將是許多資訊結合的產物，放棄其控制和擁有權必是一項重大決定。

而在保險方面，康先生說保險行業尚未得出一致的政策應對BIM的可投保和不可投保部分。考慮到BIM的協作性質，其中的保險仍然存在大片灰色地帶。每每當設計出現問題，追溯問題的根源和解決方案同樣令人費神。

而在BIM的知識產權方面，因為不同來源的資訊可自由流入模型，爭議也油然而生。當分包商把自己的BIM模型交給持有人的時候，他詳盡的設計資訊亦很容易流入競爭者手中。他建議在合同中規定追蹤設計的輸入，因為項目中一些知識產權的移交可能會產生額外費用。英國已經針對知識產權擬備了一些條款，香港亦可根據實際情況作出參考。

香港的承建商在處理BIM的問題上首要是識別設計中的衝突。許多合同規定在指定時間承建商有義務識別及處理衝突，以確保能把握索償機會。

關鍵問題是各方必須理解他們需要交付甚麼、誰負責BIM發展過程的各個階段，以及BIM是否僅用作交付這個項目，還是用於其後的操作和維護。



Ms. FUNG Yin-suen, Ada

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Hong Kong Housing Authority

馮宜萱女士

香港房屋委員會副署長（發展及建築）

**Integration of Building Information Modelling
in Public Housing Development – Lessons
Learnt from Hong Kong Housing Authority**

**邁向建築資訊模型 —
香港房屋委員會的經驗**



Hong Kong Housing Authority develops and implements a public housing programme to meet the housing needs of people who cannot afford private rental housing. Approximately 30% of the Hong Kong population is now living in public rental housing units. Hong Kong Housing Authority has an existing stock of about 730,000 rental flats.

Ms. FUNG said currently BIM is applied in Hong Kong Housing Authority's projects for planning and design including feasibility studies, sustainable designs, and detailed design. It is also utilised for cost control and construction. It is used for site planning which allows for quick design changes to accommodate complicated terrain modelling and to create a visual impact assessment of the buildings.

BIM also allows for sustainable design by analysing sunlight and daylight footprints to optimise the planning for planting areas and playgrounds, and for sheltered communal outdoor areas. It can also create efficient lighting designs to maximise energy savings. As a value management tool, BIM is used to quickly configure different floor plans and estate layouts.

As a cost control tool, cash flow simulation can be created by the integration of extracted quantities from the BIM model, the construction programme and cost information. It can reveal actual and predicted cash flow of the project.

She said building services co-ordination can be improved as clashes can be identified at the model stage. Site safety planning can be carried out to plan, for example, for a demolition. Site planning allowed for the best placement of cranes and precast storage yards.

It is the goal of Hong Kong Housing Authority to apply BIM to all new projects from design stage by 2014/15. However, Ms. FUNG said Hong Kong Housing Authority has identified five challenges to its goal: shifting of the work flow; a gap in the software customisation; a gap in the guidelines and standards; a gap in the model's interoperability; and the impact to local industry.

香港房屋委員會（房委會）正在發展和落實一套公共房屋計劃，為未能負擔私人住宅租金的市民提供居所。目前全港約30%市民租住公共房屋，而房委會現有大約730,000個公屋單位。

馮宜萱女士表示，目前房委會把BIM應用於規劃和設計工作，包括可行性研究、可持續發展設計以及細節設計，以及用於成本控制和建築方面。另外，BIM亦曾應用於地盤規劃，讓設計師可以快速修改設計以配合複雜的地形，以及進行建築物的視覺影響評估。

BIM也有助可持續發展的設計，既可用於分析陽光和日光足跡，優化園林、遊樂場和有蓋戶外公共場所的規劃，亦可協助設計高效能的照明系統以大幅節能。而作為一種價值管理工具，BIM也可用於快速配置不同的平面圖和物業布局。

而作為成本控制工具，BIM可以透過整合BIM模型讀取用料、建築計劃和成本資訊等資料製作模擬現金流，從而反映項目真實和預計的現金流。

她又表示，使用BIM能從模型階段開始識別各項衝突，有助改善建築物服務的統籌工作。另外，BIM亦可以進行地盤安全規劃，應付例如遷拆等情況，並協助尋找最適當的位置設置起重機和預製組件庫。

房委會計劃在2014/15年度，在所有新項目的設計階段中應用BIM。然而，馮女士指房委會正面對五大挑戰：工作流程的變更；自訂軟件的差距；指引和標準的差距；模型互用性的差距；以及對本土建造業的影響。

由於目前大多數軟件都是按美國的做法而設計，房委會需要開發一套自己的軟件和模型模板。房委會發展了一套內部應用指引和標準，為56%的員工進行培訓，期望到2015年可以增加至超過85%。

馮女士表示，模型不能在不同軟件之間轉移，而軟件廠商亦不了解實際需要和實際項目的工作流程，這些都是困難所在。房委會正尋求解決方法，例如整合BIM和地理訊息系統（GIS）。

她表示，本地建造業對全球BIM的趨勢仍然缺乏認識，亦欠缺本地標準和模型製作專才。這亦是建造業議會目前正在應對的問題。

作為建造業議會實施建築資訊模型路線圖工作小組的主席，馮女士提出了三項即時行動：為建造業採用BIM制定一套通用的標準或良好作業方式或參考文件；針對仍未透徹了解BIM及其好處的持分者進行更多宣傳；以及鼓勵學術機構修訂與建築和電腦科學相關的課程以提供BIM培訓。

Hong Kong Housing Authority has to develop its own software and model templates as most available on the market are developed for US practice. Likewise, Hong Kong Housing Authority has developed its own in-house user guides and standards, and has provided training for 56% of its staff and aims to increase that to more than 85% in 2015.

Ms. FUNG said the inability to transfer a model between different software is a problem and that software vendors do not understand the practical needs and actual project workflow. Hong Kong Housing Authority is exploring their own solutions, including integrations of BIM and Geographic Information Systems (GIS).

She said there was still in the local industry a lack of awareness of the world BIM trend, a lack of local standards, and a lack of modellers. This was something that was now being addressed by the CIC.

Ms. FUNG, who is also chairperson of the CIC's Working Group on Roadmap for BIM Implementation, outlined three areas of immediate action: to devise a set of common standards or good practice or reference document for the use of BIM in construction projects; to carry out more promotional activities targeting those industry stakeholders who are not familiar with the usage and benefits of BIM; and to build up BIM capacity by driving curricular change in construction related programmes and computer science programmes of academic institutes and provide BIM training.

CIC CONFERENCE 2013

CONSTRUCTION INNOVATION, PRODUCTIVITY AND TECHNOLOGY

建造業議會研討會「建造業新領域：生產力與科技」

29.11.2013

Co-Organisers 協辦機構



發展局
DEVELOPMENT BUREAU



Panel Discussion 討論環節

- Will the adoption of BIM give rise to unfair competition in the Architecture, Engineering and Construction (AEC) family?
- Will there be monopolistic market advantage for vendors?
- How to address the perceived problem of “Unfair Play”?
- 實施建築資訊模型會否引起建築、工程及建造服務業內出現不公平競爭？
- 會否出現個別服務供應商壟斷市場的可能性？
- 如出現擬「不公平競爭行為」應如何應對？

馮宜萱女士 香港房屋委員會副署長（發展及建築）

馮女士指BIM是與預製技術一樣是提升生產力的新工具，其帶來的工作模式轉變有如20年前設計過程從人工轉至電腦輔助設計（CAD）製圖。

為了促進公平參與和競爭，必須為BIM訂定標準，讓不同的系統可以與其它系統「對話」。馮女士認為，如要強制採用BIM技術，則必須要有多於一個能提供這種技術的供應商，才能保證公平競爭。

在香港房屋委員會推動下，BIM將會成為一項必備技術。我們現在生活在「三維」世界，設計師能輕易把BIM視像化讓前線工人使用。將一切開放予公眾能鼓勵他們參與採用BIM，而建立公開的系統則能保證香港的公平競爭。



Ms. FUNG Yin-suen, Ada Deputy Director of Housing (Development & Construction) Hong Kong Housing Authority

Ms. FUNG said BIM was another new tool to improve productivity alongside pre-casting. It was, she said, similar to the paradigm shift 20 years ago when the design process migrated from manual to Computer Aided Design (CAD) drafting.

To promote fair play and competition it is important that there is a BIM standard so different systems can talk to one another. Ms. FUNG said 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 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.



康文生先生 品誠梅森律師事務所合伙人、 香港辦公室主管暨行業（亞洲區）總代表

康先生指，雖然過去幾年香港已廣泛討論反競爭行為，但至今尚無任何有效的法例或普通法規阻止反競爭行為。期望2014年年底《競爭條例》的行為守則生效後，這個情況將會改變。

《競爭條例》將包括兩條行為守則。第一行為守則即反競爭協議、決定及經協議做法，例如企業間合謀定價，或同一集團屬下企業訂定同一價錢。第二行為守則即濫用相當程度的市場權勢。

他表示在法律意義上，反競爭和純粹的不公平有著顯著差別，在行為守則約束下辨別反競爭行為將非常具有挑戰性。就市場上可用的BIM技術而言，香港的情況良好，亦未見有明顯不公平行為的證據。

他說隨著BIM在市場上普及，可能會有參與者在市場上佔主導地位，這正是可能發生壟斷行為及違反行為守則的時候。他建議要保證機會平等則必須保證BIM的資訊、指引和培訓均為公開而容易獲取的。

Mr. Vincent CONNOR

Partner, Head of Hong Kong Office, Head of Sectors – Asia, Pinsent Masons

Mr. CONNOR said anti-competitive practices in Hong Kong had 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. First conduct rule prohibits anti-competitive agreements, decisions and concerted practices. Examples are price collusion between businesses and price fixing by companies under the same group. Second conduct rule prohibits the abuse of a substantial degree of market power.

He said 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 there is no evidence of unfair practices.

He said that as 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.

鄭再發先生 新加坡建設局專業學院副總裁

鄭先生說新加坡在與BIM方面沒有任何不公平競爭，因為新加坡採用了公開的BIM方法，允許自由交流資訊，更有政府支援，他稱之為公正的競爭環境。他說只要BIM的標準和資料的流動是公開的，即使市場上有參與者佔主導地位，也不太可能發生不公平競爭。

他說新加坡一直以來的策略都是，不論解決方案供應商是否佔有主導地位，均與他們共同協作。而通過與供應商的緊密合作，他們已經能夠得出恰當的BIM計畫及解決技術問題。他說不公平競爭在新加坡不是問題，因為政府架構不容許它存在。



Mr. CHENG Tai-fatt Deputy Managing Director, BCA Academy, Singapore

Mr. CHENG said that Singapore had 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. He described the situation as a level playing field. He said that 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.

He said 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. He said that unfair competition was not an issue in Singapore as the government structure does not allow for it.



甘嘉恒博士

美國史丹福大學綜合設施工程中心工業課程總監

甘博士分享了美國的經驗。10年前在工務工程引入BIM時曾遭到業界的強烈反對。然而，一年前的調查顯示，逾70%的公司現正採用BIM。

他說情況就與電郵的眾多供應商類似，不管採用的是哪一種BIM產品，市場都期望不同供應商的產品能相容。

在標準公開的基礎上採用BIM提升了生產力和智能樓宇技術。他指自己參與了一項國際合作計劃，共同研發一種由不同國家開發不同部件的模型伺服器，而他正在吸取國際上更多這方面的資訊。甘博士說中國的BIM標準正朝著類似的方向發展。

Dr. Calvin KAM

Director of Industry Programs, Center for Integrated Facility Engineering Stanford University, the United States

Dr. KAM spoke on the experience of the United States. 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.

He said that similar to the various providers of emails, there is the same expectation with BIM that whichever product is used it needs to be compatible with other vendors' products.

Adopting BIM on an open standards basis improves productivity and smart building technology. He said he has been involved with an international network to collaborate and develop a model server approach with different countries working on different components. He is looking for more international uptake on this. Dr. KAM said China's national BIM standards were heading in a similar direction.



Ir Kevin POOLE

Chairman
Committee on Environment and Technology
Construction Industry Council

潘嘉宏工程師

建造業議會環境及技術委員會主席

Closing Remarks 閉幕辭

After expressing thanks to all the participants for their commitment and participation in the event on behalf of the Organising Committee of CIC Conference 2013, Ir Kevin POOLE said that the annual CIC Conference had become the leading event for Hong Kong's construction industry with speakers from different parts of the world sharing their insights and valuable experiences.

In the first half of the conference, there were speakers from the United Kingdom, Australia, the United States, and our local industry to share how to increase productivity through innovation and technology, and how to benchmark that productivity.

Wider BIM adoption needs to be led from the top and the presentation making the case of BIM for senior executives should have removed any lingering doubts of its business value.

Productivity can be increased through lean construction practices and with new technologies and construction methods such as the greater use of prefabrication and pre-assembled materials. Challenges have been identified in achieving a lean construction process and there is no doubt BIM will play a major role in helping to tackle those challenges increasing productivity and reducing waste.

Innovative technology adopted in other sectors, such as Radio Frequency Identification (RFID) coupled with sensing devices, can be applied to asset creation and management in the construction industry.



潘嘉宏工程師首先代表是次研討會的籌委會感謝研討會的所有參加者。他表示，有賴來自世界各地的講者在建造業議會研討會上分享他們的見解和寶貴經驗，令這個一年一度的研討會成為香港建造業界的盛事。

在研討會的上半部分，來自英國、澳洲、美國和本地業界的講者分享了如何透過創新科技提高生產力及為之訂標。

更廣泛應用BIM須由管理層作主導，而向高級管理人員介紹BIM則可消除他們對其商業價值的疑慮。

精益施工、創新技術及施工方法，例如使用更多預製組件和預先組裝的建築材料等，均能有效提高生產力。雖然實踐精益施工存在不少挑戰，然而採用BIM則能應對這些挑戰，在提高生產力和減廢方面均扮演著重要角色。

現時應用於其他行業的創新科技，例如配備無線射頻科技(RFID)和感應裝置，亦可應用於建造業的資產創造及管理。

在研討會的下半部分，來自美國、新加坡及本港的BIM專家分享了他們的真知灼見，並談及如何最大限度地發揮BIM的價值、新加坡在全國實施BIM時面對的挑戰、法律含義和知識產權問題、以及BIM如何配合現時香港公共房屋的發展。

BIM除可解作「建築資訊模型」，其實更可稱為「建築資訊管理」，因為BIM的精髓更在於「資訊管理」而非單一模型。BIM是一個管理建築項目資訊的新工具，能應用於提高生產力、降低成本、進行更好的程序管理和輸出保證、以及更好的項目風險和財務風險管理。

這次研討會只是眾多聚焦BIM的活動之一，因為議會計劃在2014年與BIM持分者合作舉行更多活動。潘嘉宏工程師表示，BIM活動包括研討會、工作坊、簡介會及專家小組論壇等，進一步引起業內人士，尤其客戶層面的決策者對BIM的關注。他誠意邀請各位與會人士支持。

In the second half of the conference, experienced BIM experts from the United States, Singapore, and Hong Kong shared their insights on ways to maximise the value of BIM; globally the challenges faced by Singapore in its nation-wide implementation of BIM; the legal implication and intellectual property right issues; as well as its integration in current public housing developments in Hong Kong.

"Building information modelling" - BIM may better be termed as "building information management" as the gist of BIM is "information management", not only a model. BIM is a new management tool to manage information relating to construction projects aiming to achieve higher productivity, more cost saving, better process control and output assurance, and better project risk and financial risk management.

The focus on BIM in this conference is not an isolated event. The CIC is planning a series of events in collaboration with BIM stakeholders for 2014. Ir POOLE said that the BIM related events would include seminars, workshops, briefing sessions, and expert panel forums, to further raise awareness of BIM within the industry especially decision makers on the client side. He invited participants to support these initiatives.



www.hkcic.org/conference2013

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