



CONSTRUCTION
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顧問報告 Consultancy Report

香港建造業**綜合生產力檢視**

A Comprehensive Productivity Appraisal
of the Hong Kong Construction Industry

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1 BACKGROUND 背景

Productivity measures the output to input ratio and provides valuable insights into the long-term potential of an economy. The construction industry is one of the most important industries in Hong Kong, and makes a substantial contribution to the gross domestic product (GDP) of the city. This industry also significantly supports the growth of employment in other related economic activities to secure a sustainable future of Hong Kong. However, the construction industry is facing severe challenges, such as an ageing workforce and a lack of new entrants, coupled with a shortage of skilled manpower fuelled by requirements for new skills sets, and very high construction cost, the problems turn from severe to acute. There have been a few seminal publications reviewing the overall performance of the Hong Kong construction industry. For example, the Construction Industry Review Committee (CIRC) Report published in 2001 proposed different approaches to improving the safety, quality and competitiveness of the industry. More recently, the Construction Industry Council (CIC) Report “Building for a Better Future – Vision 2030” published in 2016 sets the vision 2030 for the Hong Kong construction industry. However, there is still a lack of focused appraisal of construction industry productivity in Hong Kong, with a significant gap in the knowledge of the strategies and measures for capitalising on the drivers for, and addressing the constraints to, productivity enhancement. Therefore, it is both urgent and crucial to understand and address these concerned issues so as to enhance the construction industry’s productivity and competitiveness, in order to sustain Hong Kong’s economic growth.

The CIC commissioned the Centre for Innovation in Construction and Infrastructure Development (CICID) of the Department of Civil Engineering, The University of Hong Kong (HKU) (the ‘Consultant’) for the consultancy study entitled "Consultancy Services for A Comprehensive Productivity Appraisal of the Hong Kong Construction Industry" (hereinafter referred to as the Project). This study commenced on 1st December 2015, and the project duration was 18 months.

生產力衡量產出與投入的比率，是判斷地區經濟長期增長潛力的重要參考指標。建造業是香港最重要的行業之一，對香港本地生產總值（GDP）貢獻重大。該行業亦對其它相關經濟活動的就業增長提供重要支持，從而確保香港未來的可持續發展。然而，建造業目前面臨嚴峻挑戰。勞動力老齡化嚴重，青年入行者匱乏；新技術、新技能及技術工人持續短缺；更要面對升勢驚人的建造成本。業內重要文獻曾對香港建造業的整體表現進行了回顧。2001 年建造業檢討委員會報告提出多種策略和措施，以圖全面提升建造業的安全、質量和競爭力。2016 年香港建造業議會發表了題為《建造更美未來》（2030 版）的報告，為香港建造業界制定了 2030 年的願景。但是，目前仍缺乏針對香港建造業生產力的深入研究。有關對建造業生產力提升的驅動力及制約因素的認知模糊，導致有關策略和措施的制定難以有的放矢。因此，要提升建造業的生產力和競爭力，保持香港經濟的持續增長，就務必對這些有關問題進行深入了解，並迅速加以解決。香港建造業議會委託香港大學土木工程系建造及基建創新研究中心（CICID）（以下簡稱“諮詢顧問”）進行題為「香港建造業綜合生產力評估」（以下簡稱“評估”）的研究。本項目於 2015 年 12 月 1 日開始，為期 18 個月。

2 PROJECT AIM AND OBJECTIVES 評估目的和目標

This Project comprises a comprehensive and rigorous investigation on the practices, procedures and standards adopted in the industry with the aim to recommend strategies and an action plan to enhance the productivity and efficiency of the Hong Kong construction industry.

The objectives of the Project are:

1. to identify the drivers and constraints of construction productivity in five strategic areas, namely (a) policy formation; (b) regulatory requirements; (c) planning and design; (d) project management and administration and (e) site construction;
2. to analyse the relative levels of impact of the identified productivity drivers and constraints to the Hong Kong construction industry;
3. to explore measures, both locally and internationally, for improving productivity levels of the industry; and
4. based on the findings in Objectives (1) to (3) above, to formulate strategies and action plan to improve the productivity and efficiency of the Hong Kong construction industry.

是項評估對香港建造業採用的操作、程序和標準進行全面及嚴謹的調查研究，旨在制定策略及行動計劃，以提高香港建造業的生產力和效率。

評估目標包括：

1. 鑑定並確認在五個策略層面，推動和制約建造生產力提升的因素。這五個策略層面包括政策制定、法規要求、規劃設計、項目管理和執行、以及現場施工；
2. 按已確認的推動及制約因素，分析因素對香港建造業的相對影響水平；
3. 探討香港本地和國際上為提升建造業生產力水平所採取的措施；
4. 根據（1）至（3）目標中的研究結果，制定策略及行動計劃，以提升香港建造業的生產力和效率。

3 AN OUTLINE OF METHODOLOGY 方法論概要

The project objectives have been achieved through adopting the combination of a number of research methods including (1) a comprehensive literature review, (2) two rounds of interviews with 52 established professionals and stakeholders representing ten stakeholder groups in Hong Kong, (3) Total Factor Productivity (TFP) modelling, (4) three project case studies in Hong Kong covering infrastructure construction, public building and private building, (5) interviews conducted in two overseas countries namely Singapore and UK, (6) five focus group meetings (FGMs) with

105 informed professionals and stakeholders, and (7) two consultation forums, having attracted over 470 registered participating professionals and stakeholders.

諮詢顧問通過一系列研究方法實現本項目的目的和目標。具體研究方法包括(1) 綜合文獻綜述研究；(2) 與代表香港建造業十類主要企業、組織和團體的五十二位專業人士進行兩輪訪談；(3) 全要素生產力(TFP)建模；(4) 進行涵蓋基礎設施建設，公營房屋及私人樓宇項目的三個案例研究；(5) 在兩個海外國家(即新加坡和英國)進行訪談；(6) 組織五次焦點小組研討會，研討會得到一百多名資深專業人士的積極回應和參與，出席者亦來自建造業主要企業、組織和團體；(7) 舉辦兩次國際諮詢論壇，獲四百七十多名來自建築業各領域的資深專業人士踴躍出席。

The Consultant adopted a theoretical framework which posits that construction productivity research should concern three levels, i.e. the industry, project and activity levels, and five strategic areas, namely, (1) policy formation, (2) regulatory requirements, (3) planning and design, (4) project management and administration, and (5) site construction. From this theoretical perspective, and through undertaking a range of research activities, the Consultant systematically identified and analysed the key drivers for and constraints to as well as strategies and measures for construction productivity enhancement in Hong Kong.

諮詢顧問提出的建造業生產力研究理論框架包括三個方面和五個策略層面。三個方面是指建造行業、項目統籌以及地盤運作。五個策略層面包括(1) 政策制定、(2) 法規要求、(3) 規劃設計、(4) 項目管理和執行、以及(5) 現場施工。諮詢顧問以此理論框架為基礎和出發點，通過一系列研究步驟，系統地分析和確認了影響香港建造業生產力提升的主要推動及制約因素，從而制定提高生產力的策略和措施。

The literature review covered academic literature as well as government and industry sources. The first-round interview-based survey sought to identify the drivers and constraints in the five strategic areas, and to reveal the relative importance of the drivers and the relative significance of the constraints. The project case studies contextualised the assessment of the drivers and constraints' impacts on construction productivity. The overseas interviews explored the drivers and constraints associated with the construction sectors in Singapore and the UK.

文獻綜述涵蓋了學術文獻及政府和行業資料。第一輪在香港以訪談形式進行的問卷調查確定了在五個策略層面，影響建造業生產力提升的推動和制約因素，並且揭示了這些因素對生產力提升的相對重要性。案例研究對建造項目實際運作環境內的推動和制約因素進行分析，並評估其對建造生產率的影響。海外訪談則探討了有關新加坡和英國建造業生產力提升的推動以及制約因素。

The strategies and measures were developed drawing on the comprehensive literature review as well as the practices and experiences both locally and internationally. Their development was substantiated by the local and overseas interviews, the second round interview-based survey, the project case studies, the

five FGMs and the two consultation forums. Based on the verified strategies and measures, an action plan was developed and proposed for improving construction industry productivity in the short, medium and long-term.

諮詢顧問根據文獻綜述研究結果，並借鑒香港本地以及國際經驗，提出了提升建造業生產力的策略和措施。諮詢顧問採用了一系列研究方法，以鑑別和確認有關策略和措施。研究工作包括在香港本地和海外進行訪談，在港進行第二輪以訪談形式進行的問卷調查，開展項目案例研究，組織五次焦點小組研討會，及舉辦兩次國際諮詢論壇。在研究結果的基礎之上，根據得到確認的策略和措施，諮詢顧問制定了促進建造業生產力提升的短期、中期和長期的行動計劃。

4 CONSTRUCTION PRODUCTIVITY ENHANCEMENT DRIVERS AND CONSTRAINTS

提升建築業生產力的推動和制約因素

The key drivers for construction industry productivity enhancement were identified in the following five strategic areas:

- **Policy Formation** - including initiatives on labour training, flexibility in labour and capital markets and transparent policies concerning the construction industry.
- **Regulatory Requirements** - including qualification of contractors, meeting the legal, quality control, aesthetic and functional requirements, and implementation of health, safety and environment (HSE) regulations.
- **Planning and Design** - including improved buildability, increased collaboration between project partners, effective planning and scheduling and integration of design with supply chain.
- **Project Management and Administration** - including good coordination with multi-layer sub-contractors, effective and efficient supervision system, good management control of project team and good communication networks.
- **Site Construction** - including better management of concurrent operations at site, use of automated production, quality of craftsmanship, quality control and quality assurance practices and effective labour time utilisation.

以下分別列出，在五個策略層面提升建造業生產力的最重要推動因素：

- 在政策制定層面：積極的勞工培訓、靈活的勞動力和資本市場、以及透明的政策舉措。
- 在法規要求層面：承包商的資質、滿足法律要求、質量控制、美學和功能要求以及對健康、安全與環境（HSE）法規的實施。
- 在規劃設計層面：提升項目可建性，加強項目協作，提高規劃效率，以及設計與供應鏈的整合。
- 在項目管理和執行層面：多層次承建商的良好協調、高效監管體系、出色的項目團隊管理控制、以及良好有效的溝通網絡。

- 在現場施工層面：更好的現場操作管理、自動化生產的使用、工藝質量的保證、質量控制和質量保證措施、以及勞動時間的有效使用。

The TFP modelling results reveal that, in Hong Kong, the overall tendency for construction real output increased from 2003 to 2014, whereas, construction industry productivity had been declining over the same period. The results suggest that government policy on infrastructure construction is one of the powerful enablers to boost construction output; whilst, the higher output does not necessarily indicate higher productivity growth. Moreover, the high labour intensiveness of the industry is also confirmed by the study findings. The analysis finds that intermediate (e.g. technologies and materials) and labour inputs are negatively correlated with productivity growth. The findings indicate that the essential issues include the further quality improvement of skilled workers as well as the adoption of new construction technologies and materials, which need to be addressed by the industry. In line with the TFP modelling results, the findings derived from the interview-based surveys, three project case studies and FGMs in Hong Kong identified twelve major constraints to construction productivity enhancement in Hong Kong. Most of the constraints are also shown in the construction industries of Singapore and the UK as revealed by the overseas interview findings. The 12 major constraints are outlined below.

TFP 建模結果顯示，2003 年至 2014 年期間，香港的實際建造產值呈上升趨勢，而建造業生產力逐漸下降。分析證明政府基礎建設政策對建造產值的提高具強有力推動作用，同時也指出產值高並不一定意味著生產力高。建造業的高勞動力密集狀況也在分析中得到證實。分析發現包含技術和材料的資源投放以及勞動力投入與生產力的增長呈負相關性。該結果表明進一步提高技術工人的質量，和對新型建造技術及材料的採用，對建造業生產力的進一步提高至關重要，應受業界重視。以訪談形式進行的問卷調查，三個項目案例研究以及五次焦點小組研討會，鑑別出十二個制約香港建造業生產力提升的主要因素。該研究結果與 TFP 建模的分析結論相符合。海外訪談證明，這十二個制約因素中的大部分，也出現在新加坡和英國建造業。現將這十二個制約香港建造業發展的主要因素羅列如下。

1) *Lack of a strategic plan for productivity enhancement with no commonly accepted conceptualization and measurement frameworks*
缺乏提高生產力的策略規劃

There is no strategic plan for construction productivity enhancement in the private sector in Hong Kong. Also, there are no commonly accepted conceptualisation and measurement frameworks for construction productivity in Hong Kong, which imposes difficulties in evaluating construction productivity. Furthermore, the experience and best practices for productivity enhancement have been shared less effectively than they could be within the construction industry.

香港缺乏指導建造業生產力提升的全行業策略規劃。此外，香港建造業尚未對有關生產力的定義和測量框架形成共識，因而難以對建造業生產力進行評估。同時，業內促進生產力提升的經驗和最佳範例亦未得到應有的宣傳和有效共享。

2) *Lack of information and communication on the detailed plan of infrastructure projects*

缺乏有關基礎設施項目的詳細規劃信息

There is a lack of information and communication on the detailed plan of infrastructure projects. As a result, it is hard for construction firms to formulate their strategic plan and mobilise resources for tendering. This situation often becomes more difficult when the funding approval process drags on for longer than normal and is sometimes blocked by the Legislative Council (LegCo).

由於缺乏有關基礎設施項目詳細規劃資料，承建商難以制定策略規劃，調動投標資源。尤其，當撥款審批過程過長，或被立法會拖延時，企業規劃往往變得更加困難。

3) *Constraints on redeveloping old urban areas*

重建舊區的限制

There are constraints imposed in already built-up environments, in particular for the redevelopment of old urban areas.

香港的建造環境對於施工操作形成局限，體現在舊區重建尤為明顯。

4) *New construction technologies are less developed and insufficiently used*

新型建設施工技術未得到充分開發應用

There is a lack of development of robotic technologies specifically for high-rise buildings and high-risk construction tasks, which are both features of construction in Hong Kong. Also, mobile technologies are less developed to facilitate site construction works. Furthermore, there is higher initial cost associated with the application of new construction technologies, rendering the private sector less motivated to invest in new technologies.

高層樓宇和高風險施工工序乃香港建造施工的特點，然而本港建造業缺乏針對此特點開發的自動化技術。而且，對於支持現場施工的移動通訊技術的開發也欠缺。新型建造技術（例如機器人）應用的初始成本較高，因此私營機構在投資新技術方面欠缺積極性。

5) *Insufficient support for design innovation, and declining design quality*

對設計創新支持不足、設計質量下降

Design is often driven by Gross Floor Area (GFA) concession rather than by design quality. Design quality has been in decline, due to low design fee and short time frame. Design standardisation remains at a low level, which hampers the further development of prefabrication. Available incentive mechanisms are also less effective in encouraging standardisation. There are limited archaeological surveys being undertaken before construction.

設計思想以充分爭取總樓面面積減免優惠（GFA concession）為主導，設計質量並非設計工作的主要考量。由於設計收費低、工期短，導致設計質量持續下降。同時，標準化設計程度低，對組合房屋配件製造的發展形成制約，而現有激勵機制在鼓勵設計標準化方面成效並不顯著。另外，項目施工前的考古調查非常有限。

6) *Innovation is insufficiently encouraged and supported*

創新激勵不足

The present government approval processes provide less than optimal support for innovations produced by the private sector. Also, factors such as the high cost and risk associated with innovative tender designs, slow approval processes and low chance of receiving approval, demotivate contractors from proposing alternative designs. Furthermore, there is a lack of supporting schemes to encourage construction enterprises to work together for developing innovative solutions for sustainable construction. In addition, it is difficult for the government to develop and deploy comprehensive incentive mechanisms that encourage standardised design, use of precast, green construction, and a wide range of new construction technologies.

目前的政府審批流程對私營機構的創新未能提供有力的支持。創新投標設計成本高、風險大，而政府有關審批程序緩慢，獲批機率低，這些困難和風險削弱了承建商提出替代方案設計的積極性。此外，業界還缺乏鼓勵建造企業共同合作開發可持續建築創新解決方案的支持機制。政府也難以制定和部署綜合激勵機制，以鼓勵標準化設計，擴大預製構件應用範圍，推廣綠色建築以及普及新型施工技術。

7) *Precast and prefabrication is insufficiently promoted*

預製吊裝和模塊化建設的推行不夠充分

Prefabrication has not been used to its full potential in Hong Kong. There is a lack of in-depth understanding of the supply chain of precast and prefabrication in and around Hong Kong. The private sector has not been fully motivated to use precast in construction. Planning and design for prefabrication is less optimised. High transportation cost also hampers the adoption of prefabrication. Site constraints, especially in the old urban areas of Hong Kong, present challenges to precast construction. Furthermore, there is little exploration into advanced prefabrication and

modular integrated construction (MiC) for upcoming projects in Hong Kong.

預製吊裝在香港尚未發揮其應有潛力。對香港及其周邊的預製構件和組合房屋構件的供應鏈缺乏深入了解。私營機構在建設中採用預製件的積極性沒有得到充分發揮。預製房屋構件的規劃和設計尚未充分優化。同時，運輸成本高也對採用預製房屋構件形成阻礙。建設場地的各種局限在香港普遍存在，舊區尤為明顯，對於使用預製構件形成挑戰。此外，香港尚欠缺對未來先進裝配式建築和模塊化建設的探索。

8) BIM application encounters difficulties

建築信息模型 (BIM) 應用推廣困難

The use of Building Information Modelling (BIM) has been limited primarily to visualisation purposes, but not yet widely for project management, particularly from the perspective of whole project life-cycle. The responsibilities for BIM investment and implementation for the organisations involved in a project's life-cycle are not clearly allocated. There is a lack of comprehensive incentive mechanism for promoting BIM application. Construction engineering and management professionals lack BIM competence. Small and medium-sized contractors (SMCs) have financial constraints on adopting BIM, and there is therefore a low level of BIM application. The BIM system is less user friendly within certain contexts, in particular site construction.

目前，BIM 主要用於可視化方面，其在項目管理方面的優勢尚未得到充分發揮。尤其是在整體工程項目生命週期管理上，BIM 並沒有發揮其應有的作用。參與項目生命週期的各方在 BIM 投資和應用上責任分工不明確。政府部門尚未推出促進 BIM 應用的綜合激勵機制。建造工程和管理專業人員缺乏應用和管理 BIM 的能力。中小型承建商 (SMC) 在採用 BIM 技術上存在資金困難，BIM 應用程度不高。BIM 系統在某些情況下，尤其是在現場施工中使用不便。

9) Declining labour productivity partly due to skilled labour shortage, ageing workforce and an industry image that is less attractive to young people

熟練技工短缺、勞動力老齡化、行業形像對青年缺乏吸引力造成了人工生產率下降

The human resource problems in the construction industry are not only reflected by a skilled labour shortage and ageing workforce, but are also indicated by the shortage of on-site technical supervisory staff. Young people in Hong Kong are reluctant to join the construction industry; majors in construction engineering and management attract comparatively less students than do other majors. Even fewer young people are willing to pursue careers as technicians, site supervisory staff, and in particular skilled workers. While it has been well known to the industry that productivity decline is partly due to labour shortage and an ageing labour force, there still lacks a clear understanding of the full scope of labour shortage.

建築行業的人力資源問題，不僅體現在熟練技工短缺和勞動力老齡化方面，而且表現為現場技術監督人員的短缺。香港青年投入建造業的意願不高。建築工程和

管理專業學生人數少於其它熱門專業。而願將技術人員、現場監督人員、特別是熟練工人作為職業追求目標的青年就更少。雖然業內眾所周知，勞動力短缺及老齡化是導致生產力下降的主要原因之一，但對勞動力短缺的程度仍然缺乏明確認識。

10) Value engineering has not been fully promoted to the whole construction industry

價值工程法尚未向全行業推廣

It is noted that a value management study was conducted for major PWP projects with an estimated cost exceeding \$200M (ETWB TC(W) No. 35/2002). However, value engineering (VE) is little applied in the Hong Kong construction industry, in particular in the private sector.

價值工程法尚未在香港建造業中廣泛推廣，特別是私營項目中應用不足。

11) Collaborative procurement approaches are difficult to be applied

協同採購方式難以推廣

Collaborative procurement models have not been used to a large degree in Hong Kong. There is room for improvement in the competence of applying collaborative procurement models. Conventional contract clauses are often added into New Engineering Contracts (NEC) for project delivery. As a result, the collaborative spirit of an NEC contract is partially lost in practice.

協同採購模式在香港建造業尚未得到充分的推廣應用。業界應用協同採購模式的能力有待提高。常規合同條款經常被添加到新工程合約（NEC）中，有礙 NEC 合約中協同合作精神的充分發揮。

12) Underground utilities are not effectively and efficiently managed

地下公共設施管理效率低

It takes a long time and much manpower to search and collect information about underground utilities. The procedures associated with the search are also complicated. The present structures housing underground utilities in the old urban areas need to be upgraded so as to make maintenance more efficient.

調查和收集地下公共設施的相關信息，不僅過程複雜，而且耗費大量時間和人力。有必要對現有舊區地下設施的結構進行升級，從而提高維護效率。

5 ACTION PLAN AND ITS UNDERPINNING STRATEGIES AND MEASURES FOR ENHANCING CONSTRUCTION PRODUCTIVITY

提升建造業生產力的行動計劃及策略與措施

An action plan has been developed for leveraging the drivers for, and addressing the constraints on, the enhancement of construction productivity in Hong Kong. The action plan is composed of 12 major strategies specifically addressing the 12 major constraints. The major strategies are grouped into four themes which represent the important aspects concerning productivity enhancement of the industry. The four themes are plan construction strategically; encourage innovation in construction; develop a sustainable workforce; and enhance project administration and management.

Each major strategy is underpinned by a set of operational strategies and their underlying specific measures for implementation. In total, the 12 major strategies are supported by 37 operational strategies and 77 specific measures for implementation. These strategies and measures were identified through two rounds of interviews in Hong Kong, three project case studies as well as the five FGMs, and verified by the findings of the two questionnaire surveys distributed at the two International Consultation Forums. Furthermore, the strategies and measures adopted by the Singapore and UK construction industries for enhancing productivity were revealed by the overseas interviews and the presentations of the guest speakers of the consultation forums. These overseas practices and experience were also used to reflect the strategies and measures included in the action plan. The 12 major strategies, in descending order of importance within each theme, are outlined below:

在研究結果的基礎上，諮詢顧問制定了一項行動計劃，旨在充分發揮促進生產力提升的推動因素，同時突破制約因素。該行動計劃包括十二項主要策略，分別針對克服十二個主要制約因素。主要策略根據有關本港建造業生產力提升的重要主題分成四組。這四個主題是建造業策略規劃，鼓勵建造創新，建設可持續建造隊伍，及加強項目管理。每項主要策略的執行，都受到一系列操作性策略和具體措施的支持。十二項主要策略共計包含了三十七項操作性策略和七十七項具體措施。以訪談形式進行的問卷調查、三個項目案例研究、以及五次焦點小組研討會的研究結果，為這些策略及措施的制定提供了堅實的基礎。兩次國際諮詢論壇中進行的問卷調查，又對所提出的策略和措施進行了驗證。海外訪談及國際諮詢論壇中的發言，提供了新加坡和英國為提升其建造業生產力，所採取之策略及措施的有關信息。這些海外的操作和經驗亦為行動計劃中策略和措施的制定提供了參考。以下按照四項重要主題劃分，按照相對重要順序，羅列十二項主要策略。在每個主題下，按其重要程度順序列出。

Theme 1: Plan construction strategically

主題一：建造業策略規劃

1) Plan construction productivity enhancement strategically

進行建造業生產力提升策略規劃

This major strategy aims to provide a strategic framework for productivity enhancement in the Hong Kong construction industry. The framework covers the important areas such as to establish the Government's leadership role in enhancing the productivity of the industry, incentivise productivity improvement practices, build up knowledge sharing mechanisms, create productivity measurement system, and review productivity in different sectors.

該策略旨在為香港建造業生產力的提升提供策略框架。其措施明確特區政府在促進建造業生產力提升方面的領導作用，激勵促進生產力提升的行業操作，建立相關知識分享機制，開發建造業生產力測量系統，並對業內各行業的生產力進行評估。

2) Stabilise the supply of public infrastructure projects

穩定基礎建設項目招標量

This major strategy aims to stabilise the supply of public infrastructure projects primarily through more detailed and transparent infrastructure development planning and rationalisation of the funding approval process with LegCo. There is room for enhancement in communicating the information about the developed long-term plans for infrastructure construction projects with industry stakeholders, in particular construction contractors and consultants so as to facilitate and support long-term strategic planning of construction organisations. It is also fairly important to further expand the partial privatisation of infrastructure development in Hong Kong.

該策略主要通過周密而透明的基礎建設發展規劃，以及改進立法會對公營項目撥款的審批程序，達到穩定基礎建設項目招標量的目的。特區政府有必要對香港基礎設施建設項目做出詳細的長期規劃。規劃內容應與建造業有關組織及團體，尤其是承建商和顧問公司進行分享，以協助業界組織開展長期策略規劃。與此同時，有必要拓展私營機構投資基礎設施及進行相關研究和探討。

3) Increase the flexibility of grouping projects in urban redevelopment

加強城市發展的靈活性

This major strategy denotes that the Urban Renewal Authority (URA) might consider grouping projects and combining sites to provide more flexibility for redevelopment, as well as negotiating with local private parties to get more land. This is a fairly important strategy whilst its implementation requires relative longer time to plan and demands more complex coordination, and need to be implemented with caution.

市區重建局可以考慮合併項目和施工場地，從而提高市區重建的靈活性；並與私人業主協商取得更多可供開發的地皮。雖然這是一項較為重要的策略，但其執行準備時間較長，協調工作複雜，因此在具體實施時務必謹慎。

Theme 2: Encourage innovation in construction

主題二：鼓勵建造創新

4) Increase the application of new construction technologies in construction processes

加強新型建築技術的應用

This major strategy is essential for sustaining the long-term development of the industry. It aims to increase the industry's capability of leveraging the advantages of new construction technologies for improving productivity. The Government agencies should provide incentives for new technology adoption to construction enterprises. Public and private sector clients should drive the development of mobile technologies and robotics technologies. The new technologies should be developed to suit construction practices within the Hong Kong context.

該策略旨在強化建造業借助新科技和新技術提高生產力的能力，對建造業的長期發展至關重要。有鑑於此，其重要性僅次於策略規劃。特區政府機構應建立激勵機制，鼓勵建造企業採用新科技和新技術。公營和私營項目的業主應引領移動通訊科技和機器人在施工中的應用。同時，新科技和新技術的開發應適合香港本地施工操作的實際需要。

5) Encourage design innovation and improve design quality

鼓勵設計創新、提高設計質量

This major strategy aims to improve design quality via rationalising design services procurement, and encouraging design innovation through more comprehensive incentive system. Public and private sector clients should review and revise fee-bidding mechanisms for consultancy tenders to improve design quality. Profit and loss-sharing models could be considered to encourage better quality design. The government agencies should review the present GFA concession's impact on design quality; modify the present incentive mechanisms to shift the paradigm from being GFA-driven to design quality-driven, driving a step change to design quality in the industry. The government agencies also need to formulate incentives to further encourage standardisation in Hong Kong thereby paving a solid foundation for further applications of construction automation, robotics and modular integrated construction (MiC). It is also necessary to promote pre-construction archaeological survey in the industry.

該策略旨在透過改進設計採購模式提高設計質量，並藉助更全面的綜合激勵機制鼓勵設計創新。公營和私營項目業主均應對設計採購招標方式進行評估，改進目前以設計費為主要考慮的採購模式，以促進和推動設計質量的提高。可以考慮採用損益分享採購模式，激勵設計方提出質量更高的設計方案。政府有關部門要評

估 GFA 減免優惠對設計質量的影響，通過改進現行激勵機制，轉變目前 GFA 主導設計的局面，倡導以設計質量引領工作。同時有關政府部門還應建立激勵機制，進一步鼓勵標準化設計在香港的實施，為建設施工自動化（例如模塊化建築的應用）和預製件的推廣打下更堅實的基礎。另外，有必要在業界對施工前考古調查的重要性進行宣傳。

6) *Enable innovation in whole project life-cycle* ***促進創新工作在全項目生命週期的開展***

This major strategy aims to promote innovation from the early stage of project life-cycle on in a strategic perspective. The strategy seeks to review and rationalise submission responsibilities of project stakeholders. It is imperative to identify which stakeholder organisation/s at which stage of project life-cycle should be responsible for which type of submission. The objective of the rationalisation is to complete the submissions and approvals as many as possible in the early stage of project life-cycle and to reduce the pressure on project schedule and potential delays during the construction phase. It is also important to establish the key roles of both public and private sector clients in driving innovation through the project life-cycle. The government departments need to increase the flexibility of approving construction programme, accelerate the approval processes, and develop comprehensive innovation incentive schemes that integrate both monetary and non-monetary approaches. The URA can use major urban redevelopment project(s) to pilot the regulatory and administration requirements and incentives which encourage prefabrication, standardised design, BIM and sustainable construction. The experience and lessons learned from pilot project(s) should be used to develop similar mechanisms which can be applied to the whole construction industry. It is also necessary to study the feasibility of third-party approval.

從策略角度出發，該策略旨在盡量使創新融入項目生命週期的初期階段。該策略對項目各方提交創新申請的責任進行評估，從而使責任分配更加合理。對業界來說，目前明確項目參與各方，在項目生命週期的哪個階段，負責呈遞創新的具體類別，至關重要。優化創新申請呈遞和審批的目的在於，盡可能在項目發展初期提出創新，並融入項目，從而減少對施工工期的壓力和拖延。明確公營和私營業主在項目生命週期引領和倡導革新的重要職能非常重要。政府部門不但應改進審批程序，使審批行政步驟更為合理，從而加快對創新申請的審批進程；而且要整合財務性和非財務性的激勵方法，建立更全面的創新激勵機制。市區重建局可嘗試在主要城市發展項目上實驗推行鼓勵創新的法規、行政措施、和激勵機制，以促進預製件、標準化設計、BIM 以及可持續性建築在試點發展項目上的應用。在試點項目上積累的經驗和教訓可以用於完善有關法規和激勵機制，以便今後向全行業推廣。同時有必要探討第三方審批的可行性。

7) *Increase precast and prefabrication and explore modular integrated construction (MiC)* ***加強預製構件生產和運用，開發組裝合成模塊化建築***

This major strategy aims to increase precast and prefabrication in Hong Kong. It is

imperative to review prefabrication manufacturing and construction practices in Hong Kong in order to comprehend the position of the local prefabrication supply chain and formulate effective measures to promote prefabrication. In addition, the Government should review the existing codes and standards used by the government departments to see if any revision should be made in order to encourage prefabrication. It is fairly important to use both monetary and non-monetary measures (e.g., programme concession) to encourage prefabrication and precast application, and integrate the measures with buildability incentives. Local prefabrication production should be further supported. Land could be provided to build more prefabrication yards so as to form an integrated prefabrication supply chain. The competence of construction engineering and management professionals should be further developed to manage the construction operations involving precast components and prefabrications. Advanced prefabrication technologies such as MiC should be explored and supported.

該策略旨在加強香港對預製構件的生產和運用。對現有預製構件的生產和施工操作進行調查和評估，增進對本港預製件生產供應鏈的全面了解，對進一步制定促進預製件生產和應用的措施很有必要。同時政府部門也應對相關標準進行評估分析，以甄別修改有關標準，鼓勵預製件的生產和應用。同時，應結合財務性和非財務性（例如項目計劃優惠）的激勵方法來鼓勵預製件的生產和應用，並且將有關激勵措施和鼓勵可建性的措施相結合。要加強對本港預製件生產的支持，為建設更多的預製場提供土地，從而在本港建立完整的預製件生產供應鏈。發展培養工程管理人員在工程項目中運用預製構件的施工管理能力也很重要。組合建築（MiC）等先進預製技術也應該得到進一步的開發和應用。

8) Promote BIM applications

推廣應用 BIM

This major strategy promotes BIM applications in whole project life-cycle, develops incentive mechanisms to encourage BIM application, reinforces BIM education and training, and standardises BIM technologies within the Hong Kong context. Both public and private sector clients should drive BIM application, in particular at the early stage of project planning and design, and promote to use BIM as a common project management platform throughout the whole project life-cycle. The Government can combine BIM application incentive with those for design innovation and sustainable construction, e.g., precast application and '3S' concept (i.e. Standardisation, Simplification and Single integrated element); and provide financial incentives for SMEs to use BIM. BIM training should be incorporated into the syllabus of the tertiary and vocational institutions. The institutions should provide BIM training to construction engineering and management professionals. The CIC and other institutions should incorporate BIM training into skilled workers training programmes, and provide on-job training for using BIM tools. The industry should standardise BIM services and practices.

該策略倡導運用 BIM 進行整體項目生命週期管理；建立激勵機制，鼓勵對 BIM 的應用；強化 BIM 教學和培訓；進行 BIM 技術標準化，為香港工程實踐服務。公營和私營項目業主應引領 BIM 的應用，尤其要主導 BIM 在項目規劃和設計初期階段的運用，更要倡導將 BIM 發展成項目生命週期的管理平台。政府部門應嘗試整合激勵機制，採用綜合激勵機制鼓勵 BIM 的應用，推廣設計創新和可持續性建設

(例如預製件應用以及標準化、簡單化和單一綜合元件的 3S 概念)。政府部門也應考慮為中小建造企業採用 BIM 提供補貼。大專院校應將 BIM 的教學編入教學大綱。有關專業機構和團體要為建造工程管理專業人士提供 BIM 培訓服務。香港建造業議會及其它有關機構應將 BIM 教學內容編入技術工人培訓大綱，並為在職技術工人提供有關 BIM 輔助施工操作的培訓。BIM 的服務和操作亦有必要標準化，從而使 BIM 技術更好地服務於工程實踐。

Theme 3: Develop a sustainable workforce

主題三：建設可持續建造隊伍

9) Develop a sustainable construction workforce

保證建造業人力資源發展的可持續性

This major strategy provides a holistic set of measures for developing a sustainable workforce. It encompasses necessary training measures for professionals, technicians and skilled workers; projection of new images for the industry through promoting new construction technologies and mega projects to society; improvement of site working conditions; and demographic survey on construction workers to identify the scope of labour shortage. The study findings also highlight that to certain degree, labour importation could reduce the pressure of labour shortage in the short or medium-term. Whilst the complex political background associated with labour importation indicates that the Supplementary Labour Scheme (SLS) should be reviewed, and labour importation flexibility should be increased with caution based on further study and thorough consultation with industry stakeholders.

該策略涵蓋了發展可持續建造業建設隊伍的全面配套措施。重點包括加強對專業人士、技師和技術工人的培訓；通過向社會宣傳新型建築科技和大型建設項目塑造建造業的新形象；改善地盤施工環境；進行技術工人和普通工人人員統計調查，以明確勞動力短缺規模。研究結果亦顯示，引入外勞對緩解中短期勞動力緊缺有一定幫助。然而，有鑑於外勞引入之政治背景複雜，增加外勞引入靈活性的舉措在操作上必須審慎。有必要先對現有補充勞工計劃（SLS）進行評估，並對目前勞動力市場進行研究，同時徵求建造業主要有關企業、組織、和團體的意見和建議。具體措施的制定應以此準備工作為基礎。

Theme 4: Enhance project administration and management

主題四：加強項目管理

10) Enhance value engineering

推廣價值工程管理

This major strategy aims to apply the successful experience of VE gained from public sector projects to private sector ones, and to embed VE principles in relevant government schemes to a greater extent. CIC is recommended to promote value engineering and lean construction in private sector projects.

該策略的主要目的在於，將公營項目開展價值工程管理的成功經驗，向私營項目推廣，同時增加價值工程原則在政府工程項目管理規定中的應用。

11) Improve underground utilities management

提高地下公共設施管理水平

This major strategy aims to improve underground utility management in Hong Kong via developing a digital utility information management system and constructing Common Utility Enclosures (CUEs) to achieve systematic utility management. The Government and CIC should study the issues and opportunities of CUEs in both built-up and new development areas.

該策略力圖通過建立地下公共設施信息管理系統，和建設公共設施綜合管道結構，實現對地下公共設施的系統管理。

12) Encourage collaborative procurement

倡導採用協同採購模式

This major strategy promotes the adoption of collaborative procurement approaches, in particular NEC3 contracts, and improves the performance of Design and Build (D&B) projects. The public sector clients should consult on potential tenderers on the preferred form of contract at early project stages. The Government should continue to use administrative requirements to facilitate the wider use of NEC form in public works projects, and CIC will promote the adoption of NEC form in private sector projects. The Government should also discourage adding conventional clauses into NEC3 contracts so as to keep the collaborative spirit of NEC3 contracts. The government agencies need to review the submission procedures for D&B contracts to reduce the pending time for contractors for approval. Public and private sector clients should develop guidelines for compensating contractors' bidding cost in D&B projects to attract best possible design and construction plan. Consultants, contractors and suppliers should reinforce cost control system in D&B projects. Construction organisations including clients, consultants and contractors should provide training for construction engineering and management professionals on the collaborative procurement models.

該策略倡導協同採購模式，尤其是 NEC3 合約在本港的應用，同時力圖改善設計和建造 (D&B) 項目的績效。公營和私營項目業主，應嘗試與潛在投標企業就合約形式進行諮詢和探討，以確定最適合項目管理的合約形式。政府部門應繼續採用行政措施鼓勵 NEC 合約在公營和私營項目中的應用，同時不鼓勵將傳統工程合約的條款加入 NEC 合約，從而保持 NEC 合約所倡導的協作精神。政府部門要對與 D&B 合約有關的呈遞和審批程序進行檢討，盡量減少承建商等待批復的時間。公營和私營項目業主應針對 D&B 項目招標，制定有關補貼承包商投標成本的原則，以吸引最佳的設計及施工方案。顧問公司，承建商和供應商應強化 D&B 項目的成本控制系統。包括業主、顧問公司和承建商在內的建造企業和組織，要對建築工程管理專業人員進行協同採購模式的培訓。

6 OVERALL CONCLUSIONS AND WAY FORWARD 結論和展望

In recent years, the government policies on infrastructure development have supported the heavy investment in infrastructure construction, thereby sustaining the growth of construction output in Hong Kong. Transparent policies for the construction industry, flexibility in labour and capital markets, and active labour training are considered by the industry stakeholders to be the key drivers for sustaining construction productivity.

近年，香港特區政府的基建發展政策支持了對基礎建設的重大投資，從而保持了本港建造業產值的持續上升。業界普遍認為，透明的建造業政策、靈活的勞工和資本市場、以及積極的勞工培訓是保持建造業生產力水平的重要推動因素。

However the increase of construction output has not been matched by the desired productivity growth. The industry is labour intensive, whilst facing severe challenges of skilled labour shortage and ageing workforce. The investment into new technology development is insufficient. The present labour quality and technologies applied are inadequate to sustain productivity growth. Meanwhile, despite good practices and useful initiatives particularly in the public sector, the industry in general has been addressing productivity enhancement through an *ad hoc* approach without thorough strategic planning. The information about infrastructure development is less effectively shared and communicated with industry stakeholders. This causes difficulties for construction firms in formulating their own strategic plans. In the meantime, declining design quality is also a major constraint on productivity enhancement.

但是，建造業生產力並未和產值同步上升。建造業勞動密集程度高，並面臨技術工人短缺和勞動力老齡化的嚴重挑戰，亦欠缺對新型技術的投入。目前的勞動力質素和技術應用水平不足以支持生產力的增長。同時，建造業一直採用隨機而分散的方式和措施來推動生產力，忽視策略規劃。有關基建發展的信息亦未充分地與業內企業，組織和團體進行分享，由此對建造企業自身的策略規劃帶來困難。與此同時，設計質量下滑也對建造業生產力的進步造成障礙。

Although the industry is facing a range of challenges in further productivity enhancement as reflected in the 12 major constraints identified by the study, the stakeholders have reached a strong consensus on accelerating the modernisation process of the construction industry. In fact the industry is experiencing a paradigm shift from a conventional fragmented project delivery to supply chain integration powered by new technology development. Building upon the findings of the study, the Consultant proposes an action plan for enhancing productivity in the Hong Kong construction industry. The strategies and measures of the action plan are designed to keep the momentum going of integrating design, construction and manufacturing, and to fully leverage the advantages of new construction technologies.

研究鑑定了提升生產力的十二個主要制約因素，從而反映出建造業目前面臨的一

系列挑戰。雖然如此，業內企業、組織和團體對加速建造業現代化的進程已達成堅實的共識。事實上，本港建造業正在經歷生產模式的根本轉變，在新技術發展的推動下，傳統支離分割的項目經營模式，正在朝著供應鏈整合的方向轉型。

From a strategic perspective, the industry particularly the private sector needs to plan construction productivity enhancement strategically and set up productivity evaluation system. In the short-term four essential strategies should be implemented, namely, applying new construction technologies in construction processes, developing a sustainable construction workforce, stabilising the supply of infrastructure projects, and encouraging design innovation and improving design quality. In addition, the strategies of promoting innovation through whole project life-cycle, encouraging BIM application, adopting standardised design, and increasing precast and prefabrication are interrelated and interdependent for the productivity enhancement of whole project life-cycle. The encouragement of collaborative procurement seeks to provide conducive project governance structures to facilitate the integration of design and construction and enable the adoption of new construction technologies, in particular BIM, robotics and MiC. Moreover, the action plan also includes strategies which address specific issues of urban redevelopment within the local context, e.g., improving the management of underground utilities. Finally, the Consultant suggests that the relevant strategies and measures should be applied to major urban development projects as soon as possible, which would be conducive to demonstrating the ground breaking development of the modern construction industry. Meanwhile, the Consultant recommends that, in the future, it is necessary for the relevant government departments and the CIC to undertake focused appraisals on construction workforce structures, prefabrication supply chain and new technology applications. The appraisals are needed to facilitate in-depth understanding on these matters, and support further refining of the relevant strategies and measures.

在研究結果的基礎上，諮詢顧問提出了提升香港建造業生產力的行動計劃。行動計劃中執行策略的制定，意在保持建造業已有的發展勢頭，深化設計、建造和製造的整合，並充分發揮新型建造技術的優勢。從策略角度考慮，本港建造業亟需對生產力的提升進行規劃，並建立生產力評估系統。在建設過程中應用新型建造技術，發展和培養可持續的建設隊伍，穩定基礎建設項目招標量，以及鼓勵設計創新和提高設計質量，乃四項重要策略，應在短期內加以實施。另外，倡導在全項目生命週期進行創新，鼓勵 BIM 應用，採用標準化設計，強化預製件的生產和使用，是幾項相互關聯和依賴的策略。這幾項策略實施的綜合相應，將促進生產力在全項目生命週期得到提升。對協同採購模式的鼓勵，旨在營造一種項目管理架構，從而為設計和建造的整合、新型建造技術的採用、尤其是 BIM 和機器人的應用，創造有利的條件。此外，行動方案也包括了有關城市發展的具體策略，例如，提高地下公共設施管理水平。最後，諮詢顧問建議有關策略措施應盡快以試點的方式應用在主要城市發展項目上，這將有利於展示現代建造業的突破性發展。同時，諮詢顧問建議，政府有關部門在未來有必要進行專項調查，對香港的建造業隊伍結構、裝配模塊化生產供應鏈以及新技術應用狀況進行進一步的了解，以便細化有關策略和措施。

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