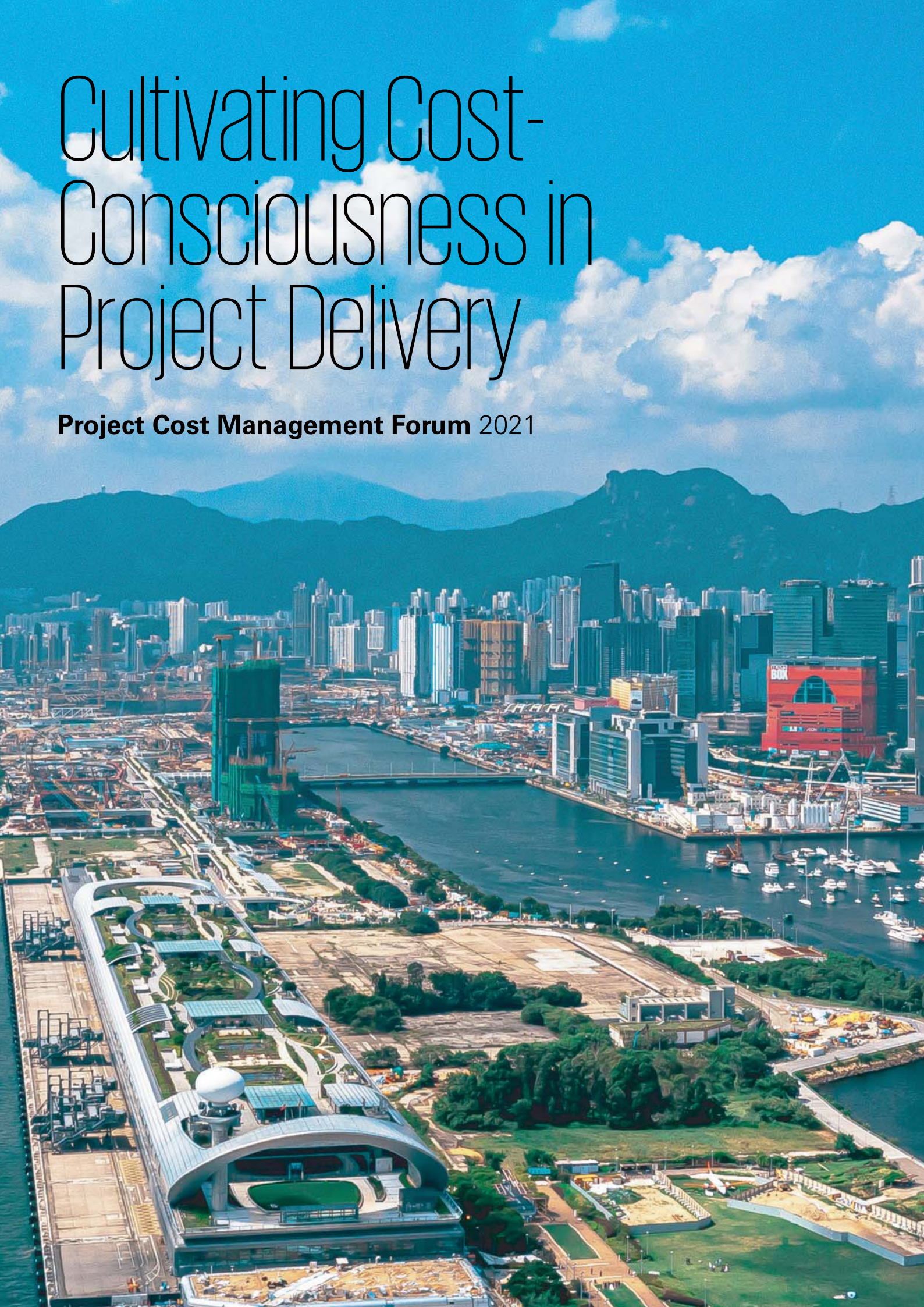
Cultivating Cost-Consciousness in Project Delivery

Project Cost Management Forum 2021



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PROJECT STRATEGY AND GOVERNANCE OFFICE

Project Cost Management Forum, 23 June 2021

The Hon Paul CHAN Mo-po
GBM, GBS, MH, JP
Financial Secretary

It is a great pleasure to join you for today's Project Cost Management Forum. And my thanks to the Development Bureau and its Project Strategy and Governance Office for organising this important event. For bringing us together this morning.

When it comes to public works, the Forum's theme - "cultivating cost-consciousness" - is Hong Kong's theme: today and tomorrow. And for good reason.

Infrastructure and the construction industry have long played critical roles in the economic development of Hong Kong. And I can tell you they will also be essential to our post-pandemic economic revival.

Up to last week, the Public Works Subcommittee endorsed around HK$200 billion for some 80 new capital works projects. Subject to the approval from the Finance Committee, that, ladies and gentlemen, amounts to record-high funding for new public projects within a single LegCo (Legislative Council) session. A fine start, I would say.

In the next few years, our annual capital works expenditure will exceed HK$100 billion.

Coupled with private development projects, Hong Kong's overall construction volume will increase to some HK$300 billion a year. That, I believe, makes a clear and compelling statement about this Government's commitment to infrastructure, to the construction industry and to the people of Hong Kong.

Commitment at that level calls for responsible, and innovative, management of resources.

With that in mind, I was pleased to hear Francis, just a few minutes ago, speaking about the Arcadis 2021 International Construction Cost Index. Even more pleased to hear that Hong Kong had dropped from third all the way to eighth in the annual ranking of 100 of the world's major cities and their construction costs.

This isn't the Premier League table. The lower the better, as long as we maintain our high level of public works funding. And we are, and we will. So my thanks to the industry. I can only hope that Hong Kong will continue to tumble down the Arcadis table.

Since its creation in 2019, the Project Strategy and Governance Office has played a valuable role in the cost management of projects prior to their funding application stage.

Indeed, the Office, guided by "fitness for purpose" and "no frills" principles, has helped achieve savings of HK$70 billion to date, that from more than 340 projects and a total estimated cost of HK$640 billion.

The "no frills" and "fitness for purpose" guidelines work hand-in-hand with cost benchmarking during the planning and design stage of a project. Before significant resources have been committed.

They allow us to consider whether the project is value for money or whether, in fact, it should be reconsidered.

Building a supply chain conducive to cost-effective public projects is no less important.

Photo shows (from left to right): Ir WH Luk; Mr Daniel Cheung; Ir Michael Leung; Mr Michael Camerlengo; Mr Michael Wong, Secretary for Development;Mr Paul Chan, Financial Secretary; Ir Lam Sai-hung, Permanent Secretary for Development (Works); Mr Francis Au; Dr Anne Kerr; Ir Prof Albert Chan; and Ir Danny Hung.

That means strengthening project governance and employing such innovative construction strategies as Modular Integrated Construction and digitalisation. It also means working to ensure better productivity, sustainability and safety in our public projects.

These guiding principles emanate from *"Construction 2.0"*, the Development Bureau's comprehensive analysis of the industry. *Construction 2.0* spotlights innovation, professionalisation and revitalisation as vital to ensuring the construction industry's success through this 21st century of unbounded opportunity.

Underlying it all is the critical importance of building a cost-conscious culture. Ensuring that Hong Kong's resources and public funds are used smartly, effectively and efficiently - for the good of the industry and our economy, and for the well-being of our community.

I wish you a rewarding Project Cost Management Forum, and the best of business, and health, in the coming year.

Ir LAM Sai-hung
GBS, JP
Permanent Secretary for Development (Works)

From its early days as a small fishing village, Hong Kong's cityscape has changed substantially and rapidly since the 1970s. The multiple waves of infrastructure and housing construction coupled with the development of new towns, highways, railways, and an airport has allowed Hong Kong to go a long way in meeting the social needs of this great city and helped propel its economic growth. For these feats, we have the generations of construction professionals before us to thank.

There is rising public aspiration to perform better when it comes to managing project costs and delays. If we are to deliver on the public's expectations, closer collaboration is needed between the Government and industry practitioners, to cultivate cost-consciousness in project delivery.

The Government, as the biggest client in the construction industry, has a duty to lead and drive industry-wide transformation. Since 2015, the Development Bureau has been promulgating changes through policies and initiatives for better cost-effectiveness in public works. Apart from initiating changes within the Government, we have been proactively collaborating with major public-funded clients in Hong Kong who are responsible for delivering a considerable volume of building and engineering projects using public funds to exchange insights and best practices in project cost management.

Throughout the project delivery cycle, the principles of "fitness for purpose" and "no frills" must be embedded into the decision-making processes. At the planning and design stages, we advocate and drive for cost effective design and solutions through various means. In particular, modular integrated construction (MiC), prefabrication and precast operations off-site have to be thoroughly considered to help enhance productivity, quality and safety. Digitalisation is clearly another irreversible and impactful approach enabling the construction industry to advance and to work smartly and efficiently.

We promote wider use of NEC and cost-based procurement approaches with a view to encouraging cost-effective solutions and fostering better collaboration and risk sharing. This enables project teams to procure in ways which can best deliver the intended outcomes of projects.

To capitalise on the positive impacts from the actions listed above, all parties in the construction industry should keep an open mind to innovative ways of working and technologies, which can uplift productivity and deliver maximum value from our infrastructures and projects.

Project cost management excellence cannot be attained by the Government alone. Consultants, contractors and other parties in the infrastructure supply chain all have roles to play. Through this Project Cost Management Forum, we are one step closer to aligning our efforts in driving a cost-conscious culture and building a sustainable industry for future generations to come.

Government led initiatives to enable cost-effective project delivery

2021

Project Cost Management Forum

Held on 23 June 2021, the Project Cost Management Forum facilitated knowledge and best practice exchanges on project cost management between project leaders in the public and private sectors in Hong Kong.

2020

MiC and DWSS Directives

Provided high-level policy direction on Modular Integrated Construction (MiC) and Digital Works Supervision System (DWSS) initiatives to enhance the efficiency, quality assurance, productivity and cost-effectiveness of project delivery.

2019

Centre of Excellence for Major Project Leaders

Established in July 2019, the Centre of Excellence for Major Project Leaders (CoE) offers high-level project management and leadership development programmes to government officials. The objective is to equip major project leaders with world-class leadership skills to further enhance their project delivery capabilities, leading to enhanced project performance.

2019

Project Strategy and Governance Office

The PCMO was upgraded and renamed as the Project Strategy and Governance Office (PSGO) and adopted a wider focus that now includes implementing project strategies, reinforcing capability requirements in project governance and monitoring cost performance of projects.

2018

Construction Innovation and Technology Fund

In the 2018-19 Budget, the Financial Secretary set aside HK$1 billion for the establishment of the Construction Innovation and Technology Fund to provide impetus to transform the local construction industry through automation, industrialisation and digitisation, as a means to enhance the cost-effectiveness of project delivery.

2018

Construction 2.0

Construction 2.0 was launched to spearhead the transformation of the Hong Kong construction industry across three pillars: "Innovation"; "Professionalisation"; and "Revitalisation". *Construction 2.0* also served as the launching pad for reforms and change across Government and the construction industry.

2017

Civil Engineering Works Tender Price Index

Formulated the Civil Engineering Works Tender Price Index (CEWTPI) for civil engineering works under the Capital Works Programme, for the purpose of evaluating project cost estimates and pre-tender estimates, as well as monitoring tender price trends.

2016

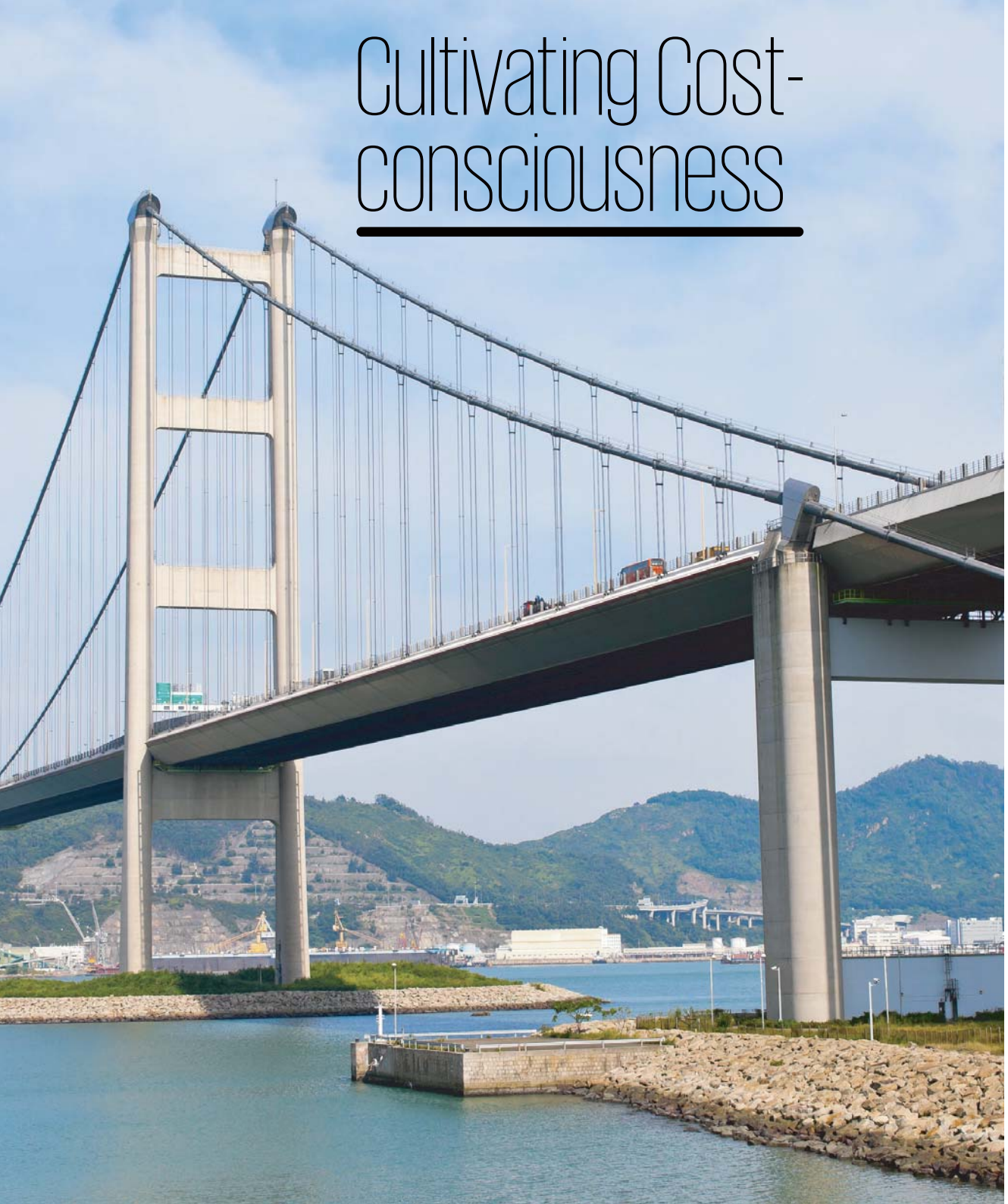
Project Cost Management Office

As announced in the 2016 Policy Address and the 2016-17 Budget, the Development Bureau set up the Project Cost Management Office (PCMO) in June 2016 with a mandate focused on achieving Industry-wide improvements in relation to cost and project management of capital works projects by drawing up cost control measures, cost reduction initiatives and steering and monitoring related work undertaken by bureaux and works departments that are responsible for project delivery.

2015

Task Force on Managing Cost of Public Works

In order to strengthen cost controls for public works, the then Financial Secretary set up a Task Force in 2015 to examine the causes behind escalating construction costs and to formulate corresponding measures.



Cultivating Cost-consciousness

Background

Officiated by the Financial Secretary, the Project Cost Management Forum 2021 (the Forum) brought together CEOs and their senior management teams from the Hong Kong construction industry (the Industry) and senior officials from the Government of the Hong Kong Special Administrative Region (Government) responsible for public works projects, to discuss and share project cost management best practices and insights.

The key message coming out of the Forum was: For the long-term prosperity and growth of Hong Kong, the Industry needs to further accelerate the principles of *Construction 2.0* (Innovation, Professionalisation and Revitalisation)[1] in addressing the 6 identified key challenges:

- Significant Future Construction Volumes
- High Costs
- Unsatisfactory Mega-project Performance
- Unsatisfactory Site Safety Performance
- Declining Productivity
- Lack of Creativity & Innovation

One of the identified challenges, High Costs, is intrinsically linked with all other challenges and remains one of the most complex issues. To address the challenges stemming from the management of costs, the cultivation of cost-consciousness across the entire supply chain of the Industry is essential.

In order to raise cost-consciousness in all project professionals, this publication aims to highlight key messages from the Forum, to summarise Industry best practices and outline the way forward in enabling better ways of working and cultivating cost-consciousness in project delivery.

Objectives

The objectives of this publication are as follows:

1. To highlight the importance of cost management and optimisation in project delivery and their relevance in addressing the challenges identified in *Construction 2.0*
2. To capture knowledge shared and insights from speakers and participants at the Forum
3. To set out the way forward in enabling the Industry to cultivate and adopt a cost-conscious culture, through changes in practices, innovation and collaboration between the Government and the private sector

1. https://www.psgo.gov.hk/assets/pdf/Construction-2-0-en.pdf

Project Cost Management Agenda

The presentations, insights and discussions from CEOs, public sector officials and other Industry leaders at the Forum can be consolidated as follows:

1. Cultivating Cost-consciousness

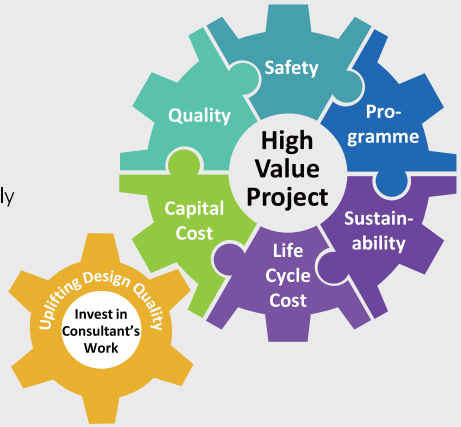
Cost-consciousness is the awareness of the costs of delivering other similar projects – to avoid budgeting more than necessary. The budget shall be taken as one of the key constraints and we should strive to deliver the project within the budget.

In the context of public spending, the principles of "fitness for purpose" and "no frills" shall be adopted throughout the lifecycle of public projects. This requires embracing an "ownership mindset" in project budgeting (akin to spending your own money!), whilst seizing every opportunity to minimise costs and maximise value from our projects.

We should also ensure that the project spending meets the aspirations of the general public. With cost-consciousness, if the cost is materially high, it warrants a comprehensive review of the project to address possible public challenges.

2. Procuring for Value

Procuring for Value is the philosophy of focusing on the project value in consultancy procurement. It entails a value-based mindset by placing greater emphasis on the value and benefits[2] a consultant team will bring to a project, instead of merely considering how much the consultancy service costs.



To maximise the project value, it necessitates decision makers to embrace a value-driven mindset from the outset. It may be worthwhile to invest more in consultant's work to uplift design quality resulting in better asset performance and significant cost savings in terms of construction and asset operation.

A core element of Procuring for Value is the adoption of a wider array of procurement models, ranging from fixed-price lump sum to cost reimbursement, to ensure high value outcomes.

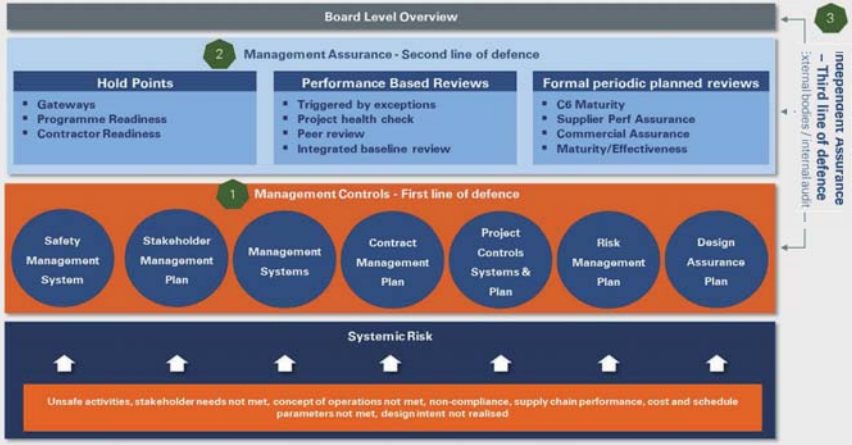
2. The value and benefits which can bring by a consultant team include greater economic impact, reduced whole of life cost, shortened construction programme and lower delivery risks.

3. Strengthening Project Governance

A heightened focus on **Project Governance** at all stages of our projects is needed to ensure a successful and satisfactory project performance.

At the front-end of projects this means designing the right frameworks that address key risks, interdependencies and lines of responsibility. During project delivery this means embracing smart data technology and robust procedures that motivate the right behaviours, identify failures before they occur and provide effective information for executives and on-site decision makers.

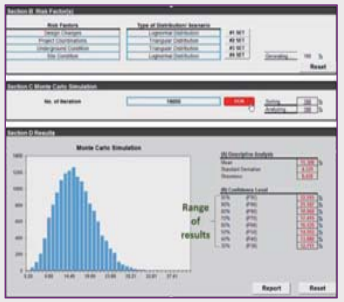
Proper project governance necessitates having sufficient people with the right skills, experience and expertise throughout the different stages of the project life-cycle.



4. Evolving to Smart, Safe and Productive Construction

The complexity and scale of Hong Kong's capital projects pipeline is increasing every year. We have a rapidly ageing construction workforce with diminishing levels of productivity. There are accelerating demands from the public for **Smart** and more advanced built-assets.

Consistent with the Innovation pillar of *Construction 2.0* and to address the complex dynamics as mentioned above, the Industry needs to adopt new methods of construction, data driven ways of working and technology to ensure cost-effectiveness and enhanced **Safety** and **Productivity** in delivering our projects.



Introduction by the Forum Facilitator

Mr Francis Au
Growth Director, Greater China
Arcadis Hong Kong Limited

Effective cost management is a critical ingredient in the delivery of any successful project or programme. We seek to deliver positive business results through the management of costs from planning, design, procurement, construction, operation and renewal where we are able to influence decision making to maximise the value created and deliver commercial outcomes in a predictable manner.

According to Arcadis' annual research for International Construction Cost (ICC), Hong Kong was ranked top 3 most expensive cities to build since 2015. In 2021, Hong Kong **dropped from the 3rd to the 8th position**.

Despite the encouraging change of ranking, Hong Kong remains the most expensive place to build in Asia. There is still room for improvement in terms of project cost management efficiency and value co-creation effectiveness, in areas including:

1. Geneva (#4)
2. London (#1)
3. Copenhagen (#6)
4. Oslo (new entry)
5. Zurich (#8)
6. New York City (#2)
7. San Francisco (#5)
8. **Hong Kong (#3)**
9. Dublin (#9)
10. Macau (#11)

number in bracket represents the ranking in 2020

The focus on whole-of-life value in decision-making

The enhancement of the design process

The adoption of knowledge-based risk management

The use of technology in accelerating necessary changes

To facilitate knowledge exchange in the areas mentioned above, the Forum was structured into two main sections, namely **Budget Optimisation** and **Expenditure Control**, for the purpose of cultivating cost-consciousness in both the planning and design stages as well as the construction and delivery stages of a project. Key messages in the presentations by different speakers in the Forum are summarised in the sections that follow.

Pathways to Success

Rethinking Project Value

Mr Michael Camerlengo
Head of Infrastructure, Hong Kong
& Head of Government, Asia Pacific
KPMG China

Existing barriers to delivering value

A core issue for major construction projects is how we assess value. We always want more value, but strive to reduce cost – opposing forces that lead to increased risk and conflict.

A typical mindset of project professionals is one that focuses heavily on upfront costs – **overlooking the whole-of-life value that can be realised from public infrastructure assets – such as lifecycle cost efficiencies; enhanced financial earnings; and positive impacts to the community, economy and environment**. In other words, short term wins prioritised over long-term benefits to asset users and the wider communities impacted by our projects. This mindset also commonly applies to the appointment of project consultants – procurement based on minimising consultancy costs.

Procuring for Value is an alternative approach towards the procurement of consultants – it involves project decision makers embracing a value-driven mindset from the outset. Early stage investment in thorough, high quality designs backed by innovative solutions lifts the potential for enhanced community benefits, relative to projects that adopt high-level, low detail design schemes and strategies – including significant cost savings during construction and asset operations.

1. **Procurement:** Consultants often face pressure in **being highly cost-competitive** when submitting proposals
2. **Quality:** The delivery of design consultancies are **more administratively focused than outcome based**
3. **Resources:** Mobilising resources for the best outcomes of a project is challenging **due to cost containment needs** under lump sum consultancy contracts
4. **Risk sharing:** Consultancies typically last **longer than originally intended**

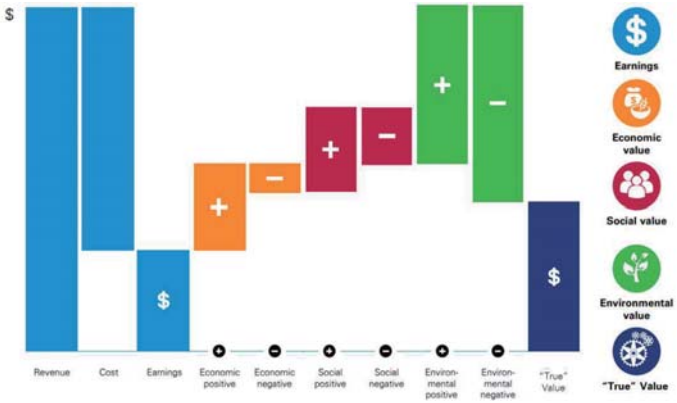
Lessons from other jurisdictions provide a guide to best practice

Other markets are testing and adopting new practices to enable **value-based procurement.** This includes the UK, Australia and Singapore which have adopted **new procurement methods** (multi-stage tender processes, bundling of projects etc.), **progressive tender evaluation approaches** (Value for Money and Most Economically Advantageous Tender methods) and **commercial approaches** (collaborative contracting and contracts) to increase the emphasis on value – not just cost.

Multi-dimensional thinking

Whole-of-life considerations are also core to the concept of Procuring for Value.

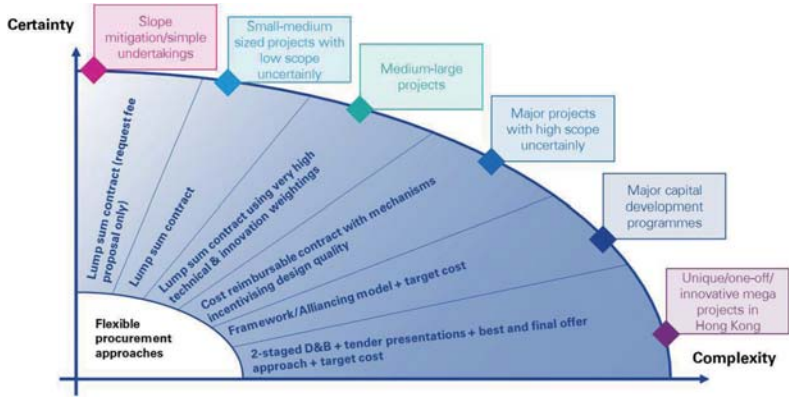
This includes project decision makers taking the time to understand the different dimensions of long-term value (such as potential impacts to the Economy, Society and Environment) from a project and how realising maximum value from these drivers can be embedded in project strategies, business cases and procurement methodologies.



One size does not fit all

Consultants' procurement has traditionally been delivered through the fixed-price lump sum model. Procuring for Value strives to recognise the differences in our projects (or categories of project), allowing project decision makers greater flexibility in the range of procurement methods at their disposal.

Projects that are strategically important and have the potential to deliver significant public value are well-suited to sophisticated procurement models geared towards appointing groups with high technical competence.



In contrast, simple straightforward projects are more amenable to procurement models driven by price and a minimum level of technical capability. In other words, "one size does not fit all" when it comes to procurement, and a wider range of flexible models represents a mindset shift to drive increased value in the way consultants are procured.

Value Creation Through Purposeful Design

Dr Anne Kerr
Managing Director for Greater China
Mott MacDonald Hong Kong Ltd

Challenges for realising value

In Hong Kong we enjoy some of the most convenient, innovative, reliable and in some cases record breaking infrastructure and buildings in the world. From these projects we should consider their value to the community and society, and turn our attention to value rather than cost.

Based on our research, future delivery of projects need to consider the feedback and concerns facing Hong Kong including:

- **Pricing** strategies
- Lack of **innovation** and use of off the shelf designs
- High reliance on **code compliance**
- Focus on **deliverables not outcomes**
- **Lack of experienced staff** in particular sectors and disciplines

We also have to contend with several global megatrends influencing project design and delivery, including:

- **Skills shortages** across the globe and the need to do things differently
- The **need to decarbonise** the construction industry to work together to achieve Net Zero Emissions
- The **formation of new partnerships** including those manufacturers for the **MiC and MiMEP** components
- **Leadership** both at the individual organisation level as well as across industry
- **New skills and ways of thinking** about delivery of projects.

Considerations for purposeful design

By considering bespoke, innovative and purposeful designs, as opposed to providing code compliant, off the shelf or conservative designs we can create value for money in terms of projects, and enhance social outcomes. This may require a change in thinking in terms of procurement and delivery, partnerships or models for development of skills, in areas including:

Projects are for people's benefits, so the **social outcomes are important**. Defining these from the outset is critical if there is to be clarity in the purpose of the design.

The experience of the people delivering the projects, and **the creation of the teams to deliver the project is critical at each and every stage**. But consideration should also be given to selection of the right teams. Often on large and complex projects team members are brought together for the first time, and this can lead to steep learning curves.

At the **design stage** with the high number and schedule of deliverables the common desire is to fast track the critically important early stages of the development. Fast tracking may not permit adequate time to **think through construction details** especially on complex highly individual projects.

International approach to partnerships for value

When considering adding value to projects, this is effectively served by the creation of **Partnerships** or **Alliances** between client and consultant. Alliances rely on strong relationships and **trust** and a **shared vision and outcome.**

(source: Cabinet Office, UK)

The UK Government has been considering various ways to improve the procurement and delivery of projects across the construction industry, given the significance of this sector to the economy, and launched "The Construction Playbook". The approach adopted focuses on "**getting it right from the outset**", and while there is recognition that this might take more time, this will be repaid many times over in the delivery phase.

This requires **alliances between the Government and the construction industry and its supply chain as a whole**, to create the environment and ecosystem for change. This approach intends to drive a different approach to procuring projects / services focusing on long term outcomes, digital solutions, purposeful designs and collaborative approaches; and with the intention of **making capital programmes more affordable, less risky and more sustainable**.

The New South Wales (NSW) Government's **10-point commitment** also upholds collaboration and fair risk allocation.

Point 5 - *Reduce the cost of bidding* and Point 6 - *Establish a consistent NSW Government policy on bid cost contributions* in the *commitment* are particularly important, as they show a clear **recognition of the effort and money invested by unsuccessful bidders**. The purpose of these commitments is to safeguard the **long-term sustainability of the professional services market** through commercial means, to ensure that it can deliver against the highest standards of integrity, quality, innovation, diversity and inclusiveness, which are all metrics in measuring value.

(source: Infrastructure NSW)

Creating value through purposeful design

The key challenges faced will continue to drive a focus on value – with **value created through the definition of outcomes, considering the purpose of the project and a truly collaborative approach.**

Creating Value through **purposeful design not only drives quality, innovation and cost effective solutions** but also results in **resilient infrastructure which delivers positive social outcomes.**

Fostering Innovation for Better Solutions

Ir Michael Leung
Project Manager (East)
Civil Engineering and Development Department

Foster innovation – breaking the mould for better approaches

More than 50 years ago at the 1968 Mexico City Summer Olympics, a Civil Engineer student, Dick Fosbury, shocked the world by winning the gold medal using an unorthodox high jump technique that he invented.

The technique, known as the "Fosbury Flop", is now used by all high jump competitors around the world. The Fosbury Flop epitomises innovation – breaking the mould of existing ways of doing things and looking for better, more efficient and innovative approaches.

At Civil Engineering and Development Department (CEDD), innovation is recognised as one of the key pillars underpinning the strategy to drive Hong Kong's long-term and sustainable development, to maintain our commitment to continuous improvement, and to better serve the community.

Fostering innovation and adopting new ways of working for better cost-effectiveness has been CEDD's priority in the development process of many ongoing and upcoming projects. In so doing CEDD works to contribute towards the realisation of *Construction 2.0* - "Time to Change."

Over the years, CEDD has made great strides to "break the mould" and embraced innovation and novel approaches in delivering its projects. These efforts have produced measurable productivity, safety and cost benefits, whilst minimising negative social and environment impacts.

Benefits realised through innovation in recent projects

Rectangular Tunnel Boring Machine (RTBM)

RTBM was adopted for the first time in Hong Kong for the construction of a 140m-long pedestrian subway connecting the Kai Tak Development with Choi Hung. Compared with conventional subway construction methods, the RTBM eliminated the need for manual digging and underground in-situ construction, thus **greatly enhancing works safety, and reducing risks and potential impacts** to major trunk roads, water bearing culverts and viaduct foundations, in close vicinity of the subway.

Installation of RTBM cutterheads

RTBM

Precast segment

The innovative technology also **significantly increased production rates, reduced environmental impact and enhanced works quality assurance** by using off-site prefabricated tunnel segments.

Welding

Erection of arch rib

Using new high strength steel materials

Grade S690QL high-strength steel was, for the first time, adopted in the Cross Bay Link (CBL) project for the marine viaduct double arches – the key structural elements of the steel bridge. The much higher yield strength led to 50% slimmer member sizes, as well as significantly lighter foundations. Using conventional grade steel would have added 4400 more tonnes to the arches, which would increase the difficulty in adopting the floating-over erection method.

All of the above contributed to sizeable cost savings. The use of high strength steel, extensive prefabrication and sophisticated erection technologies for the steel bridge have also resulted in a 40% in carbon footprint reduction when compared with a conventional steel construction approach.

Collaboration is key – with Government as the main driver

In taking forward new approaches – and to allow us to build a cost-conscious culture across the Industry – close collaboration with all parties, including the operation and maintenance authorities, the supply chain and academia, is the key. Without the authorities being open-minded to new approaches, we face an uphill battle in fostering innovation and incentivising the supply chain to adjust to new ways of working.

As the largest owner of infrastructure in Hong Kong, the Government plays a pivotal role in shaping the Industry and enabling market players to embrace innovative solutions. Riding on the success of recent projects, CEDD will, through concerted efforts with key stakeholders, help cultivate a cost-conscious Industry, and drive up Industry productivity.

There is no doubt that we will be seeing more revolutionary advancements in construction in the years to come – and we all need to keep an open mind so that we can capitalise on these opportunities.

Visit to Chinese National Engineering Research Centre for Steel Construction (Hong Kong Branch)

Experience sharing with counterparts

22

Case Study - Smart Automated Parking System at Science Park to Advance Smart City Vision

Hong Kong Science and Technology Parks Corporation (HKSTP) has introduced the city's first smart automated parking system at the Hong Kong Science Park, the city's largest research and development campus. Located across Buildings 17W and 19W. *"This parking system will showcase Hong Kong's leading edge smart city innovation and advance the city's vision for smarter living and smarter mobility."* according to Mr Felix Tang of HKSTP.

Hong Kong is a city where car parking is in limited supply and space is at a premium, whilst construction costs of carparks can also be substantial. Automated parking enabled by advanced artificial intelligence (AI) and robotics provides a vision for improved customer experience and sustainability.

This cutting-edge system enables drivers to:

- Drop off their cars on a pallet inside a designated chamber, before confirming at the kiosk to initiate the parking process with a one-time passcode
- Rely on an automatic guided vehicle (AGV) to transport the pallet carrying the car to a vacant parking space
- Retrieve their cars by inputting the one-time passcode into the kiosk, whilst the car will be transferred by the AGV to the designated chamber for pick up
- Use the smart automated parking system mobile application to schedule car retrieval, to check parking availability and the status of their cars

HKSTP reveals Hong Kong's first smart automated parking system

AGV transports the pallet with the car to a vacant parking system

With the adoption of this system, it is estimated that achievable increases in car parking capacity is up to:

13% by retrofitting an existing carpark

40% in new developments

From a construction perspective, the time and cost of developing carpark structures and other provisions can be substantially reduced as the required parking space is optimised. Moreover, the automatic parking system can reduce operational costs and offer a smarter and enhanced car parking experience by leveraging AI and robotics, when compared with conventional car parks. User convenience will be brought to a new level as users can have their vehicle automatically parked within a few minutes with no time spent searching for a space and parking manually.

Case Study - The Beauty of Cost Benchmarking for Enhanced Cost Management

Cost benchmarking is a process that involves the establishment of cost references independent of bottom-up project estimates through the analysis of data from similar projects. This enables objective comparisons with the costs of proposed projects before arriving at a cost target with requisite acceptability. *"The use of cost benchmarking as a cost management tool has gained popularity in various jurisdictions for cost comparison of similar projects."* according to Mr Hayman Choi of Mott MacDonald Hong Kong Ltd.

Some Overseas Applications by……

Cabinet Office, UK

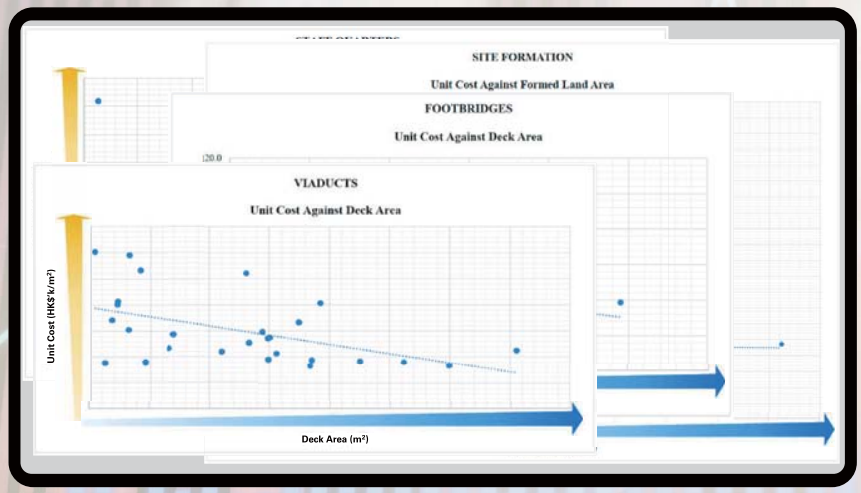
Infrastructure and Projects Authority (IPA), UK

Royal Institution of Chartered Surveyors (RICS)

(source: Please see footnote[3])

To support strategic decision-making and cost assurance, particularly at the early stages of a project where there is limited design information, a high-level and top-down approach can be adopted to compare the all-inclusive project costs against appropriate benchmarks with adjustments (e.g. inflation). With proper benchmarking methodologies and the availability of a project cost database, the results of cost benchmarking can enable better understanding of potential cost drivers and inaccuracies, thereby improving the cost-effectiveness and value for money from a project.

Examples of cost benchmarks……



3. From left to right: Cabinet Office, UK; IPA, UK; RICS; International Cost Management Standards Coalition; IPA, UK; and RICS.

Megaproject Delivery Strategy for Success

Mr Daniel Cheung
Director – Strategic Lead, South China
& Head of Infrastructure, North East Asia
Turner & Townsend

What are "mega" projects?

There is no hard and fast rule in defining megaprojects – they are categorised by their high value, long duration, high profile and complexity. Additionally, a megaproject is not necessarily a single, large project, but could be a portfolio of smaller projects delivered in stages. Megaprojects also tend to involve complex technologies and stakeholder dynamics.

There is no shortage of ongoing and upcoming capital projects which fit the description of megaproject in Hong Kong. The success of these projects hinges directly on the long-term prosperity of Hong Kong.

Challenges and risks in megaprojects

The delivery of megaprojects face a similar set of challenges globally due to their inherent risks, **even when they are split into small contracts / projects…**

- Increasing scale and complexity
- Conventional construction approach
- Increasing spend
- Limited supply chain capability and capacity
- Greater environmental challenge
- Misaligned procurement and delivery models

…delivering megaprojects using a "conventional" approach is simply setting them up for failure, in terms of time, cost and quality performance.

What is observed globally

51% fail to fully meet business case

69% fail due to improper project delivery methodology

90% fail to meet time / cost / quality targets

and in Hong Kong…

80% chance of cost overrun if value over HK$20bn

300% higher risk of cost overrun if duration over 6 years

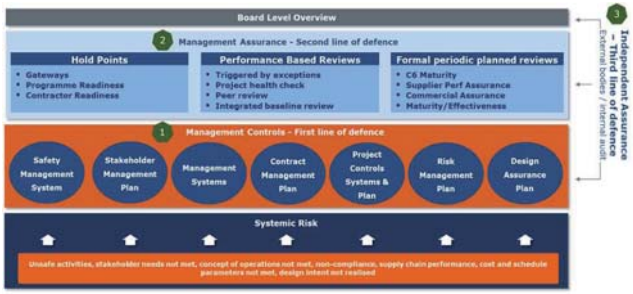
Key success criteria in delivering megaprojects – mindset & approach

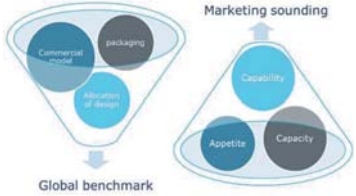
Project governance – Having a proper project governance structure such as the "3 lines of defence (LOD) model" is crucial in managing both systemic and emerging risks in megaprojects:

1st LOD: integrated approach for effective control via consistent process and single source of truth

2nd LOD: provide check and balance of the status of the project by a project management office

3rd LOD: independent assurance by internal audit / external bodies for the executive board



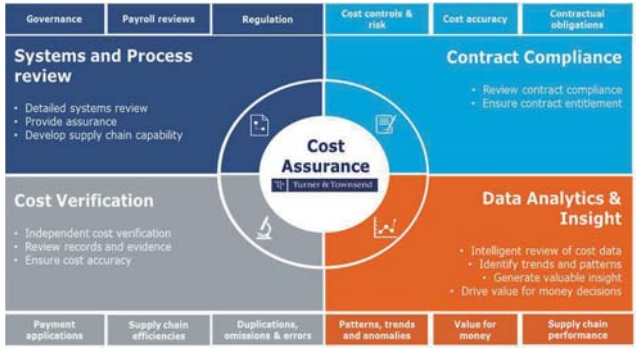


Packaging strategy – employing both "top-down" and "bottom-up" approaches in determining the optimal strategy of how the supply chain should be aligned and how a project can be packaged into different services/works contracts:

Top-down: benchmarking against global project examples

Bottom-up: analysing the readiness of the market

Delivery team – setting up the right project management team which has an appropriate team size and optimal mix between in-house and external personnel, aligning with procurement strategy, project delivery approach and client expertise.



Cost assurance – where a cost-based contract is adopted for better risk sharing and to incentivise contractors to deliver value, it is vital to implement a cost assurance model to confirm that every dollar spent by the client will deliver value to the project, by ensuring robustness of the contractors' cost system, leveraging data analytics, verifying costs applied and verifying contract compliance.

Underpinning all the above is having flexible mindset and approach, from project set-up to delivery. Accordingly, megaproject delivery focuses on delivering objectives (rather than outputs) such as capital cost efficiency, demonstrating value, reducing & managing risks, improving predictability, satisfying stakeholders, enhancing reputation, realising sustainability goals, complying with regulatory requirements, creating legacy, improving operational efficiency and ensuring the project is fit for purposes. This requires all management functions to be aligned with the overall objectives of the project. The question we need to ask ourselves is – **are we ready to deliver "mega" projects?**

Expect the Unexpected: Smart Risk Management

Ir Prof Albert Chan

Head of Department of Building and Real Estate & Chair Professor of Construction Engineering and Management

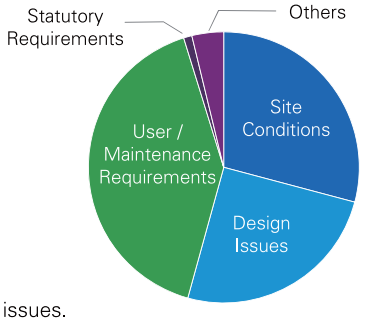
The Hong Kong Polytechnic University

Is the "unexpected" really unexpected?

According to the Project Management Institute's PMBOK® Guide, risk and risk management are defined as:

Risk - "an uncertain event or condition, that if it occurs, has a positive or negative effect on a project's objective"

Risk management - "the systematic process of identifying, analysing, and responding to project risks"



Contract variations are often a reflection of the materialisation of project risks associated with time and cost implications. According to a study on government contracts, changes in user / maintenance requirements is the most common reason for contract variations, followed closely by site conditions and design issues.

This raises the question – **are all the risks as we come to know them today really unexpected and cannot be anticipated**?

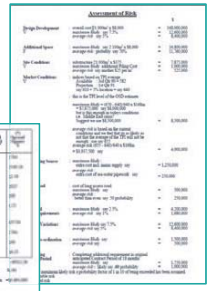
The need for SMART tools in Risk Management

For better appreciation of the impacts of project risks, which is the pre-requisite for having effective scope change management / mechanisms (SCM) and accurate cost and schedule estimates, there is the need for **SMART** (Specific, Measurable, Attainable, Relevant, Time-based) **risk management**, with the aid of **quantitative tools in estimation and project performance monitoring**.

Project planning with quantitative & risk-based estimations

Currently the technique called Estimating Using Risk Analysis (ERA) is adopted in the contingency estimation for Public Works Projects. Whilst it is certainly a step above "simply adding 10% contingency" to deal with cost risks in a blanketed approach like we did in the past, there are also number of limitations:

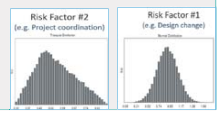
- Point estimation is still the underlying principle
- The effects of distribution / probability are not accounted for
- Cost adjustment for risks are deterministic
- Unknown or unidentified risks are not covered

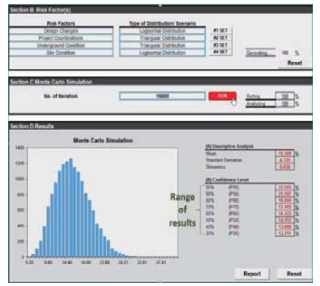


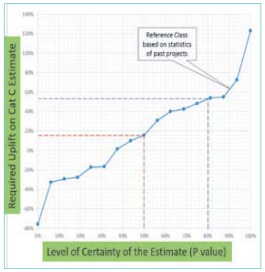
There are a number quantitative tools available to generate accurate and risk-adjusted cost and schedule estimates, with probabilistic approaches and using real world projects as benchmarks – some of which have gained the favour of project users across the globe:

Bottom-up estimation: Monte-Carlo Simulation (MCS) – Commonly used in jurisdictions such as the UK, US, Canada, Australia and New Zealand, MCS can be considered an enhanced version of the ERA, as they share similar objectives in adjusting cost estimates with known risk factors using a bottom-up approach. The MCS approach is capable of:

- Both point and range estimation
- Generating probabilistic & graphical results
- Sensitivity analysis & scenario analysis
- Correlating risk factors







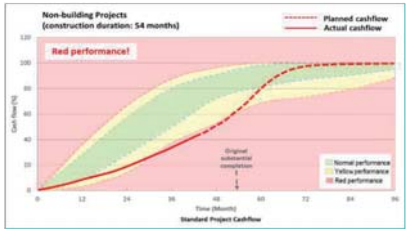
Top-down estimation: Reference Class Forecasting (RCF) – Made popular by Prof. Bent Flyvbjerg in megaproject planning and management, there are 3 steps involved in using RCF to eliminate the exposure to optimum bias and/or misrepresentation in project cost and schedule estimation:

- Identify relevant reference class of past, similar projects of the same organisation (minimum 15-25 projects)
- Establish probability distribution for the selected reference class
- Compare the specific project with the distribution to establish the most likely outcome

Project monitoring for early identification of challenges

Identifying early signs of budget overruns and programme delays for timely intervention during the delivery stage is equally important. Recognising this, Government established the Project Surveillance System (PSS) - **a predictive cost and schedule monitoring tool** powered by cashflow data of more than 600 past projects.

With the use of big data analytics, correlations can be established between project duration and cashflow, in order to generate early warning signals of potential challenges in Public Works Projects, enhancing the effectiveness of project monitoring and enabling intervention as early as possible. The Government is also working towards enhancing the PSS by:



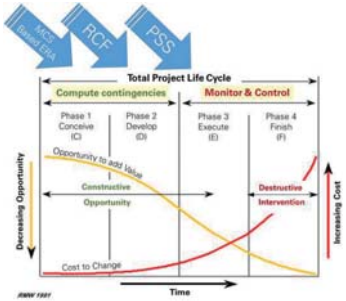
- Addressing the specific characteristics of cashflow patterns of different project types under different contract forms
- Formulating a series of standardised project cashflow profile specific for different projects types (e.g. hospital & railway etc.)
- Supporting the development of artificial intelligence for advanced predictive analysis

Key takeaways

Expect the unexpected – implement project risk management in a SMART manner

Using **information-based risk management approaches** to enable better appreciation of time and cost impacts of risks and the effectiveness in monitoring projects

Effecting necessary changes early on to maximise the opportunity to add value and minimise cost to change



(R.G. Boznak, Project Management Journal, September 1991, p13.)

Cost-based Procurement: A Lighthouse or a Myth?

Ir WH Luk
Project Manager/Major Works
Highways Department

Price-based vs. Cost-based procurement models

Price-based procurement differs from cost-based procurement mainly in how construction supply chain parties are **remunerated** for their services, how they are **motivated** commercially and hence how they **behave** during the delivery of their services.

Price-based procurement

- Paid based on how they price their services (e.g. traditional lump sum contract based on General Conditions of Contract (GCC))
- Require higher "risk premium" to be paid on top of actual costs for risks that may not materialise
- Can be motivated to "cut corners" for cost saving
- Inclined to undercut each other on price
- More likely to develop adversarial relationships
- Not conducive to mutual trust, collaboration and innovation

Cost-based procurement

- Renumerated with payments which are reflective on the actual costs incurred in delivering the services (e.g. Target Cost Contract, cost-plus contract)
- Require a lower "risk premium"
- More risks are owned by the client
- Motivated to drive toward cost-effectiveness and common objectives
- Inclined to price reasonably and realistically
- Less likely to develop adversarial relationships with the client
- Conducive to mutual trust, collaboration and innovation

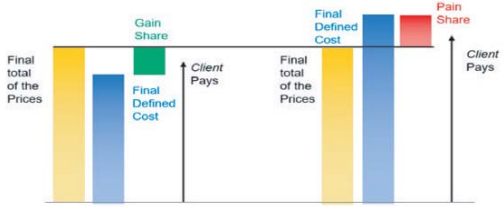
As an example of cost-based procurement, the use of Target Cost Contracts incentivise contractors to **provide value enhancement proposals** and **cost-effective solutions** in terms of **cost, time** and **risk** through its pain / gain sharing mechanisms. This contract form is also capable of encouraging realistic pricing, as well as promoting **equitable sharing of risk** between contractual parties.

Cost, time and risk benefits from using NEC Target Cost Contracts

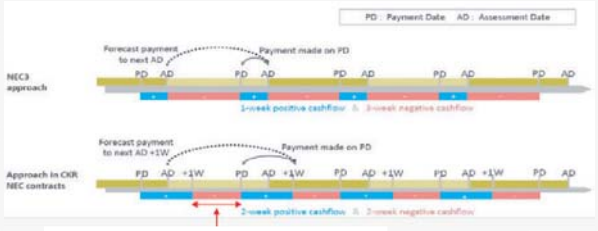
Cost

A key feature of Target Cost Contracts is the **Open Book Accounting** approach, where the cost ledger of the contractor is made transparent to the client. Under this approach, the project team has better visibility into the cost structure of a contract, enabling better cost management.

Pain / Gain Sharing Mechanism encourages contractors to propose cost saving designs and innovative construction methods to optimising construction cost. These also facilitates greater alignment between clients and contractors through commercial means, which increases the efficiency of formulating optimal solutions for mitigating risks.



Unlike traditional price-based procurement contracts, the payment mechanisms under New Engineering Contract (NEC) Target Cost Contracts **better mirror the cashflow of the contractors** as they are paid the actual amount of "Defined Cost" incurred and therefore enable them to perform optimally with less financial constraints.



Target Cost Contracts under the ongoing Central Kowloon Route development are piloting a 5-week advanced forecast payment approach.

Time

With its focus on fostering collaborative relationships between contractual parties, Target Cost Contracts:

- Encourage **regular programme updates** and acceptance
- Promote **proactive responses** from all parties within specified time limits
- Provide **collaborative management tools** such as early warning register and risk reduction meeting

There are optional **incentive** clauses in the NEC Engineering and Construction Contract (ECC) which encourage timely delivery, such as:

- X6 - Bonus for Early Completion
- X12 - Multiparty Collaboration in NEC4
- X20 - Key Performance Indicator

Contractors may submit a quotation for **acceleration** under NEC Clause 36 to achieve completion before the project completion date. This enables a project to leverage the contractor's innovation and expertise in cost-effective design and/or construction methods to accelerate progress.

Risk

Under Target Cost Contracts, more **equitable risk allocation** and sharing between the client and the supply chain are promoted, as clear definition and demarcation of risks between the client and the supply chain is encouraged.

As an example, time and cost risks associated with unforeseen physical conditions and extreme weather conditions are normally borne by the client under Target Cost Contracts. This supports realistic pricing and **avoids embedding excessive "risk premium"** for the contractor's acceptance of risks into priced activities / items.

Cost-based procurement: A Lighthouse or a Myth?

Target Cost Contracts and NEC, as embodiments of cost-based procurement, bring about many benefits in cost, time and risk for infrastructure projects. For Hong Kong's enormous pipeline of upcoming projects, cost-based procurement is without a doubt the beacon of light for collaborative and value-maximising project management, which will ensure the objectives of all future projects are better achieved with certainty and openness.

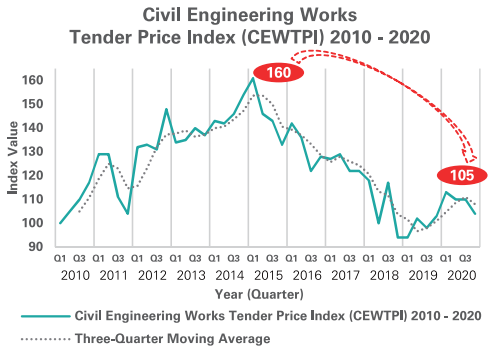
Smart Construction for Cost Control

Ir Danny Hung
Executive Director & President
China State Construction Engineering (Hong Kong) Limited

Industry facing pressure to be cost-efficient

Tender Price Indices for the building construction sector (both private and public development) have been on a downward trend since Q1 2017, whilst construction costs have remained relatively constant over the same period. This confirms the challenge faced by construction groups in delivering cost efficient outcomes in an environment where tenderers are bidding lower and lower price proposals.

For Civil Engineering Works, bid competition is even more severe than the building construction market, despite the fact that Hong Kong has moved down from being ranked 2nd in the International Construction Cost Index by Arcadis in 2017 to the 8th in 2021 (refer to page 13). Both the Civil Engineering Works Index and Highways Department Construction Cost Index have seen notable increases between Q2 2015 and Q4 2020, whilst the Tender Price Index has declined by almost 35% over the same period.



The need for smarter & more innovative ways of working

For players in the Industry, increasing price pressures coupled with challenges around resource capabilities leads to growing competitive tension; let alone the ever-present challenges of delivering against time, cost and quality objectives. Notwithstanding this, many continue to be reluctant to adopt innovative solutions to overcome obvious challenges in the Industry such as fluctuating construction volumes, declining productivity, ageing manpower, safety and quality control issues – all of which put construction players' ability to maintain cost-efficiency to the test.

The Industry is in urgent need of smarter and more innovative ways of working to overcome the aforementioned challenges. This cannot be achieved unless we are all willing to learn, share and collaborate with one another.

Productivity is key in optimising construction cost

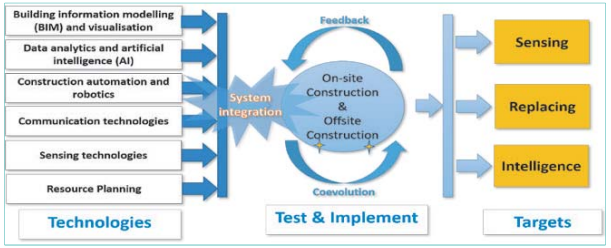
Having examined the cost data of a number of high-rise and high-end apartment building construction contracts (excluding basement construction) in Hong Kong, it was discovered that labour costs, which are a function of manpower input and construction time, account for between 44% and 61% of total construction costs, surpassing the 40% and 55% caused by material costs.

The priorities in optimising cost of construction would therefore be reducing manpower input and construction time while maintaining EHS (Environment, Health & Safety) and quality standards – in other words, increasing productivity.

Multi-pronged approach towards technology adoption for productivity

There are 3 stages of technology adoption for productivity in CSHK's[4] model of Smart Construction:

1. **Sensing** - to collect different types of data and signals from site.
2. **Replacing** - to address the labour shortage and replace existing manual-type processes through automation and robotic technology.
3. **Intelligence** - to generate knowledge, intelligence and take actions.



We are adopting a multi-pronged approach in enhancing productivity – enabled by the use of digital tools, AI and Internet of Things (IoT) across multiple functions, including:


Workflow management

Design coordination


Reporting


Construction (MiC & MiMEP)



Quality management


Construction planning


Safety management

Training


Logistic management


Machinery & equipment management


Workforce management

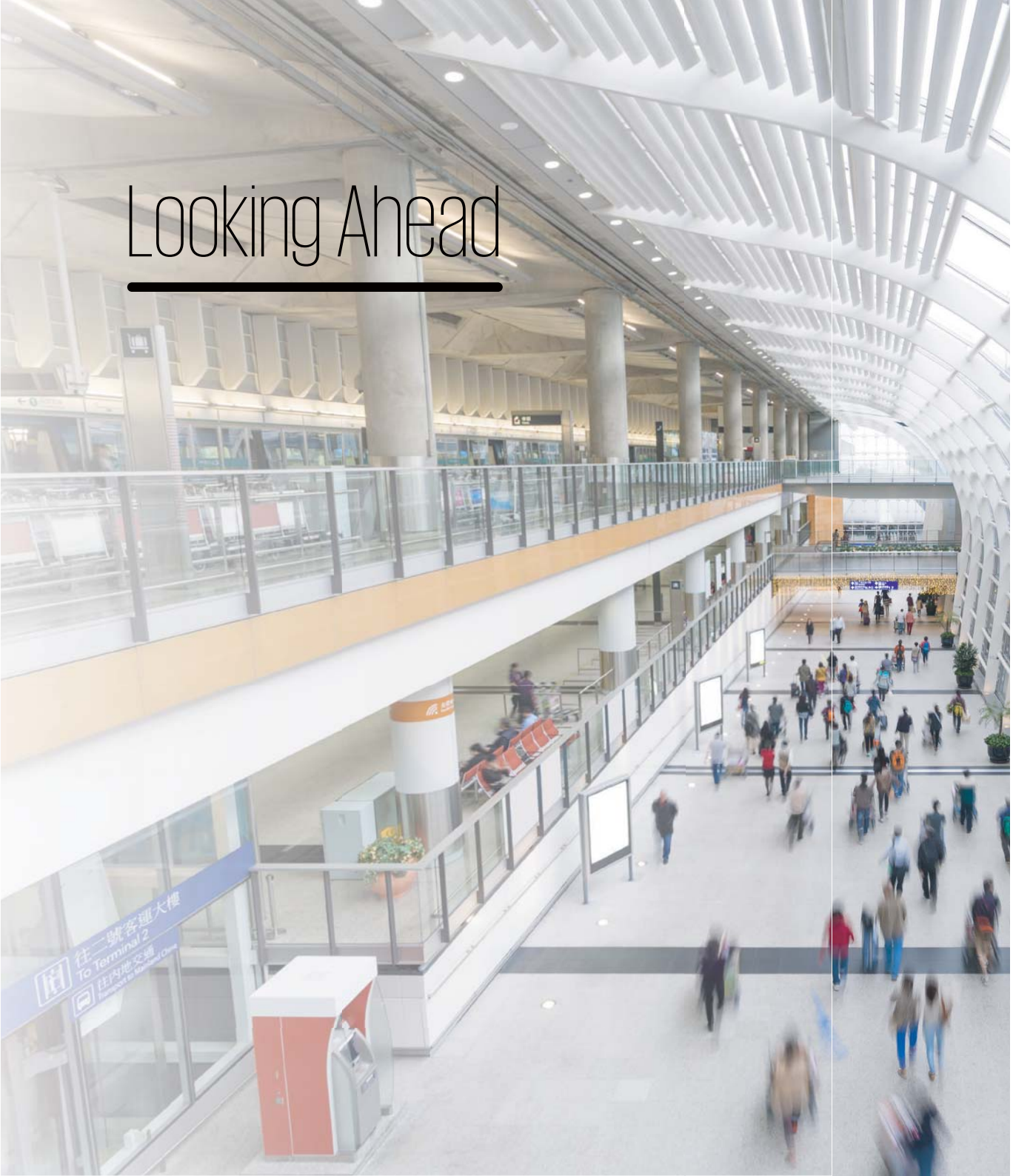

Benefits observed & next step

By enabling innovation and adopting Smart Construction models, we observed performance improvements across a number of metrics in our projects:

- Overall labour productivity increased over **100%**
- Overall labour costs reduced by about **50%**
- Overall time for design & build shortened by **100%**
- On site waste disposal reduced more than **70%**
- On site power and water consumption reduced by **65%**
- On site noise and air pollution reduced by approximate **20%**
- On site vehicle traffic reduced by about **50%**
- **Training opportunity** provided to most professions & labour
- The **image** of both the community and CSHK are **enhanced**

Going forward, it is imperative for **all private and public sectors players to come together and collaborate on research and development** of not only innovative ways of working, but also advanced and smart materials which are fit for developing future-proofed infrastructure for Hong Kong.

4. CSHK stands for China State Construction Engineering (Hong Kong) Limited



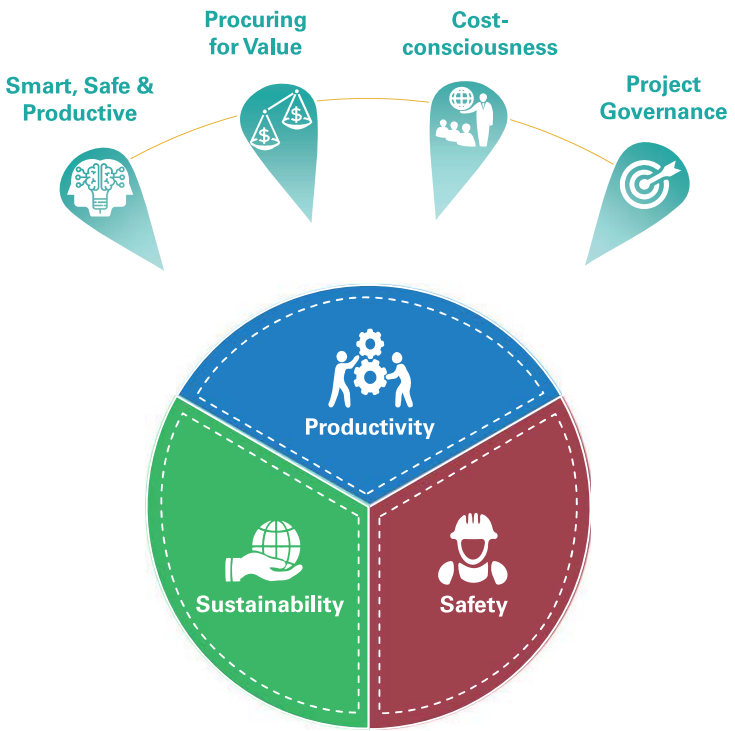
Looking Ahead

Looking Ahead

The Project Cost Management Agenda that has emerged from the Forum represents key areas for the Industry to focus on, which are crucial to enhance the performance of and the value generated from public projects.

Against the backdrop of increasing construction volumes, an ageing workforce and continuing productivity challenges[5], the Industry has reached a juncture where reforms are necessary to ensure the needs of Hong Kong's next generation can be met.

It requires increasing engagement from the Industry to underpin a bright and prosperous future for our Industry and Hong Kong. The immediate overarching action for the Industry is to explore three directions: **Productivity**, **Sustainability** and **Safety**.



5. https://www.psgo.gov.hk/assets/pdf/Construction-2-0-en.pdf

Appendices

Highlights from the Forum

List of attendees

The Government of HKSAR

- Development Bureau
- Financial Services and the Treasury Bureau
- Home Affairs Bureau
- Transport and Housing Bureau
- Architectural Services Department
- Civil Engineering and Development Department
- Drainage Services Department
- Electrical & Mechanical Services Department
- Environmental Protection Department
- Highways Department
- Housing Department
- Transport Department
- Water Supplies Department

Major Public Clients

- Airport Authority Hong Kong
- Hong Kong Science and Technology Parks Corporation
- Hong Kong-Shenzhen Innovation and Technology Park Limited
- Hospital Authority
- MTR Corporation Limited

Professional Institutions & Associations

- Hong Kong Institute of Architects
- Association of Architectural Practices
- Association of Consultant Quantity Surveyors
- Association of Consulting Engineers of Hong Kong

Industry Stakeholders

- AECOM Asia Company Limited
- Arcadis Hong Kong Limited
- Atkins China Limited

List of attendees (cont.)

- Binnies Hong Kong Limited
- C.S. Toh & Sons & Associates Limited
- Chau Ku & Leung Architects & Engineers Limited
- China State Construction Engineering (Hong Kong) Limited
- Currie & Brown (China) Limited
- DLN Architects Ltd
- Gammon Construction Limited
- Hip Hing Construction
- KPMG
- Leigh & Orange Limited
- Mannings (Asia) Consultants Limited
- Meinhardt Infrastructure and Environment Limited
- Mott MacDonald Hong Kong Limited
- Northcroft Hong Kong Ltd
- Ove Arup & Partners Hong Kong Limited
- P&T Architects and Engineers Limited
- Paul Y Management Limited
- Rider Levett Bucknall Limited
- Ronald Lu & Partners (Hong Kong) Ltd
- Simon Kwan & Associates Ltd
- TFP Farrells Limited
- Turner & Townsend
- Wong Tung & Partners Ltd
- WSP (Asia) Limited
- WT Partnership (HK) Limited

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