



**CONSTRUCTION  
INDUSTRY COUNCIL**  
**建造業議會**

# **BIM Adoption Survey 2019**

# Table of Contents

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03	Executive Summary	.....
07	The BIM Adoption Survey	.....
08	BIM Adoption in Hong Kong	.....
10	Hurdles of BIM Adoption	.....
12	Recommendations	.....
16	Methodology	.....

# Executive Summary

## The BIM Adoption Survey

CIC commissioned Strategic Building Innovation (SBI) • bimSCORE to conduct the BIM Adoption Survey in 2019 for the Architecture, Engineering, Construction, Owner & Operator (AECOO) industry of Hong Kong to:

- Understand the BIM market in Hong Kong with a **baseline of BIM adoption**
- Identify **key hurdles** for BIM adoption
- Recommend **strategies and actions for CIC and the industry** to advance BIM implementation
- Establish a **benchmarking methodology** for Hong Kong's BIM adoption in the future

## One of the Largest Industry Surveys on BIM Adoption

This study obtains representative views of the industry using statistically rigorous methodologies to perform representative sampling on 7 stakeholder groups. Along with voluntary responses, this study is one of the largest and most rigorous industry BIM studies in the world, and the results have achieved a 95% confidence interval at a 7-9% margin of error.

### 7 stakeholder groups covered by the study

- Government Departments
- Statutory Bodies
- Main Contractors
- Design, Engineering, Surveying Consultants
- Subcontractors
- BIM Consultants
- Real Estate Developers and Asset Owners

**1400+**  
organisations  
reached

**700+**  
organisations  
responded

**21+**  
organisations  
interviewed

## Understanding the BIM Market in Hong Kong

44% of surveyed organisations are adopting BIM. The top 20% (or 9% overall) are identified as the **BIM Leaders** of the Hong Kong industry based on their BIM Diffusion & Maturity (the calculation of BIM Diffusion & Maturity is further elaborated in the Methodology section), while the remaining organisations are **BIM Adopters**. BIM Leaders are **substantially more proactive** in using BIM and can **more readily realise benefits** from their BIM use. BIM Leaders on average use BIM in more than 80% of their projects, and the average number of BIM uses that they adopt and benefit from is three times the BIM Adopters' average (Fig. 1). **BIM Laggards** (who do not have active BIM projects) account for 56% of the surveyed organisations.

**BIM consultants**, together with **government departments & statutory bodies**, are fully adopting BIM, while **main contractors** and **sub-contractors** consist of mostly BIM Laggards and have relatively lower BIM adoption rates.

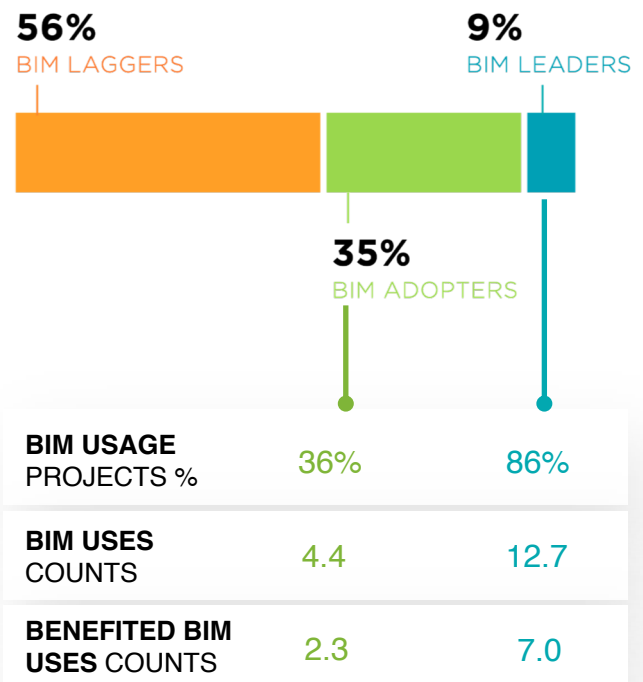


Fig. 1. Distribution of BIM Leaders, Adopters, and Laggards in the Hong Kong industry, and patterns of BIM usage. The BIM uses surveyed include the 20 BIM uses listed in DEVB Technical Circular (Works) on Adoption of BIM

# Executive Summary

The top BIM uses are consistent across 2018 and 2019, and the adoption rates among the top BIM uses are rising.

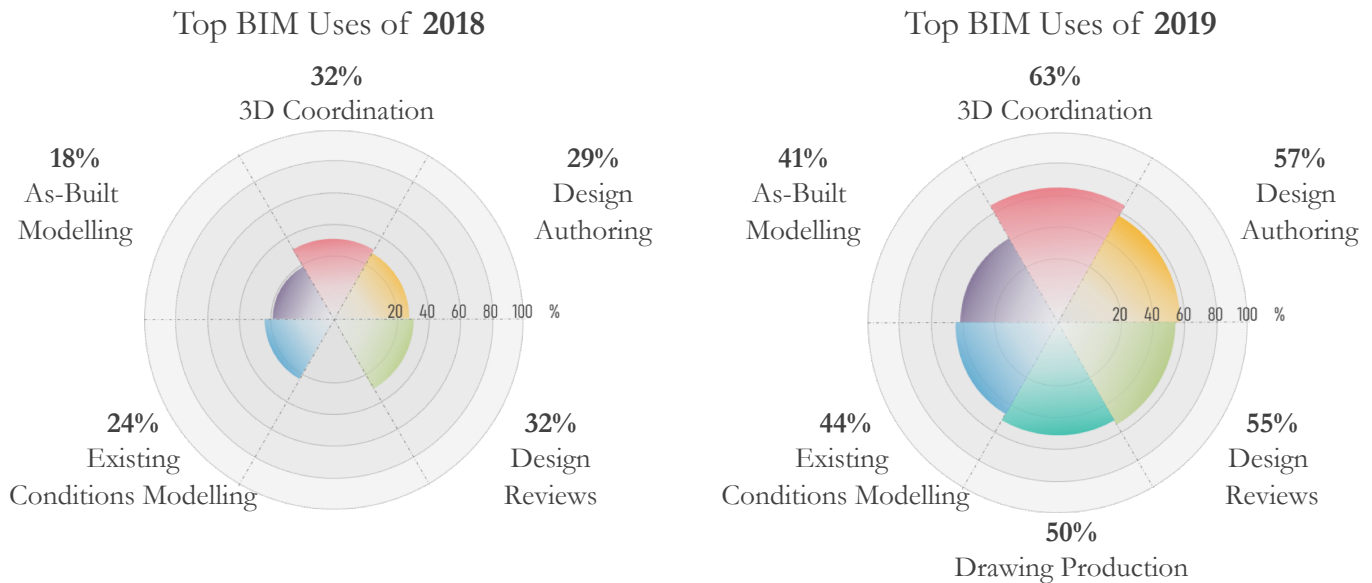


Fig. 2. Top BIM uses of 2018 (left) and 2019 (right).

## Top 5 Hurdles, Motivations, and Impacts of BIM Adoption

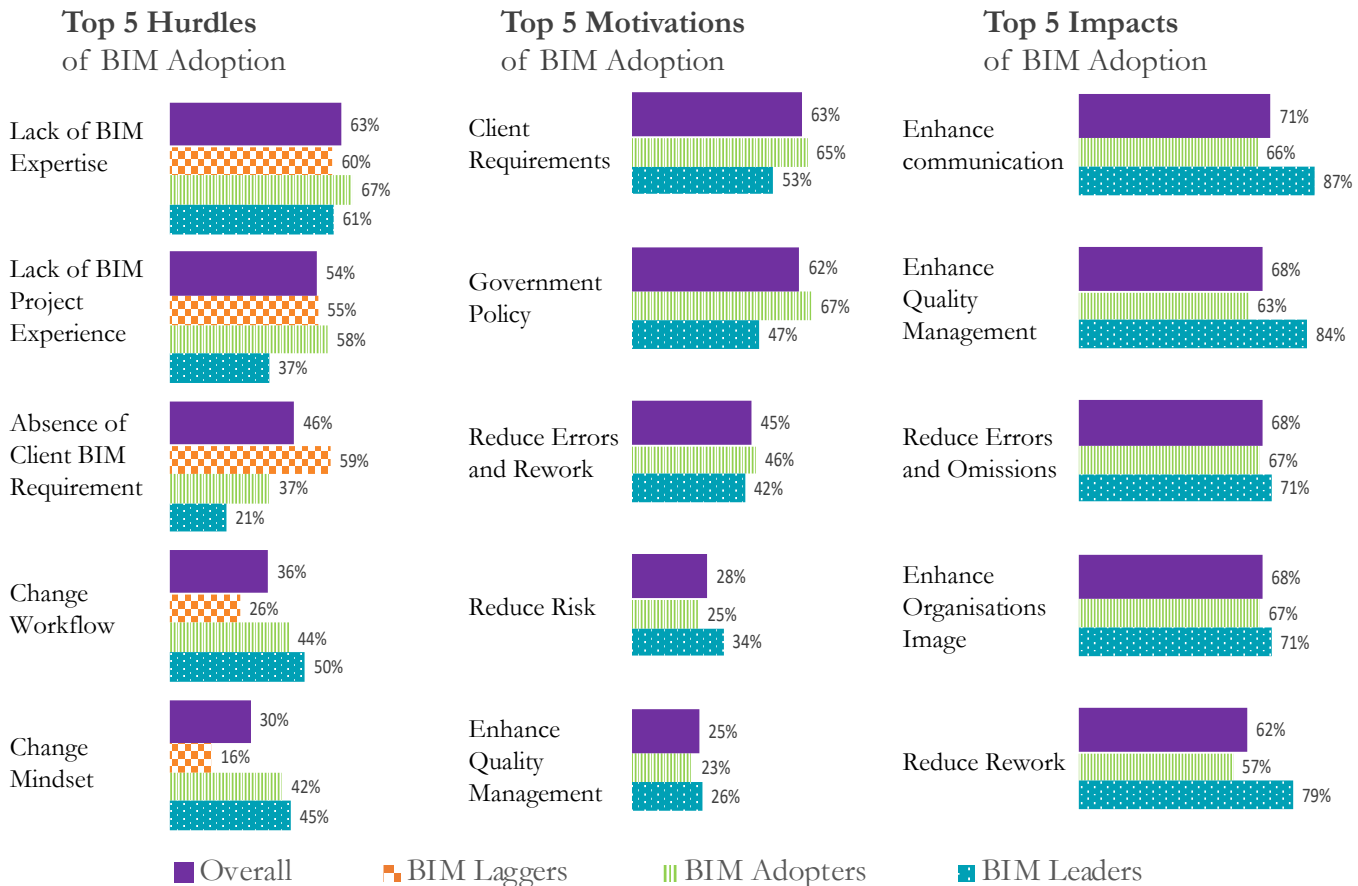


Fig. 3. Top 5 hurdles, motivations, and impacts of BIM adoption, sorted by the overall (combined) responses of BIM Leaders, Adopters, and (for BIM hurdles) Laggards.

# Executive Summary

## 3 Key Hurdles of BIM Adoption

Based on the 700+ survey responses and 20+ interviews, this study has identified 3 key hurdles of BIM adoption for the Hong Kong industry.

### 1 COMPLIANCE-DRIVEN MINDSET

Organisations are primarily driven to adopt BIM to **comply with client requirements**, while project benefits brought by BIM are less frequently seen as key motivations for BIM. **Locally-accepted practices** frequently employ an experience-based management style that lacks integration and sufficient productivity information, which encourages project teams to focus on fulfilling requirements without considering the value brought by their investment and effort of BIM. Project teams often have a **dismissive mindset** towards innovation, which further throttles the pace of BIM adoption.

### 2 DOUBLE-HANDLING

**Rigid workflows and stakeholder interfacing**, especially over-prescriptive contract/client requirements and the use of “for-reference BIM”, cause 2D drawings to still take precedence over BIM and lead to substantial **double-handling between 2D drawings and BIM**. The roles and responsibilities are often unclear among Authorised Persons (APs), CAD draftsmen, and BIM consultants, which further bottleneck collaboration using BIM.

### 3 INSUFFICIENT EXPERTISE

Organisations find that **insufficient BIM expertise and project experience** are key obstacles to furthering BIM adoption. In order to enable project teams to realise more BIM benefits with collaborative and integrated workflows, organisations need to build up their in-house BIM capability from technical to management levels.

#### HURDLE 1

#### COMPLIANCE-DRIVEN MINDSET



#### VALUE-DRIVEN MINDSET

Recommendation

#### HURDLE 2

#### DOUBLE-HANDLING



#### BIM-LED WORKFLOW

Recommendation

#### HURDLE 3

#### INSUFFICIENT EXPERTISE



#### ALIGNED EXPERTISE

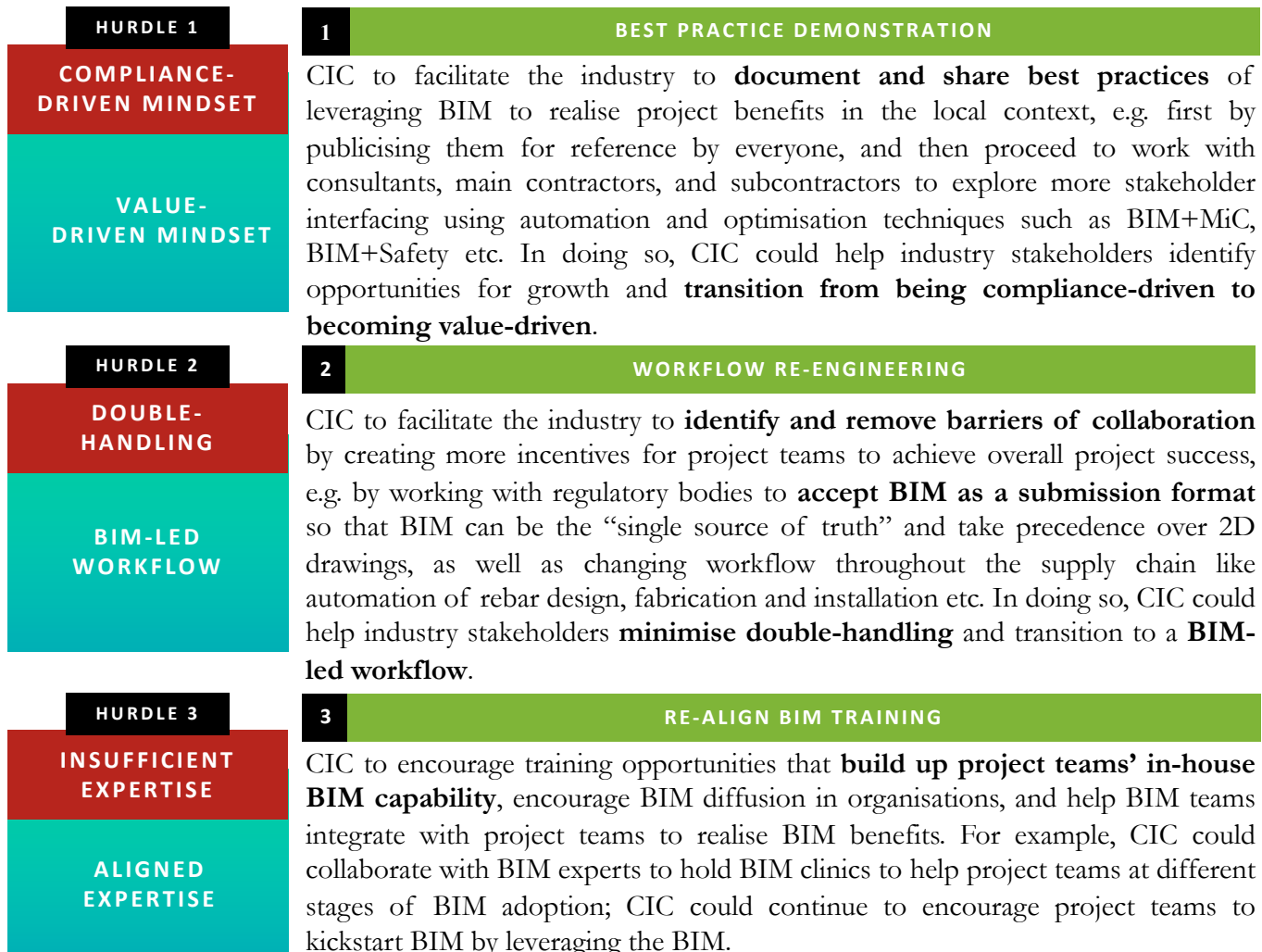
Recommendation



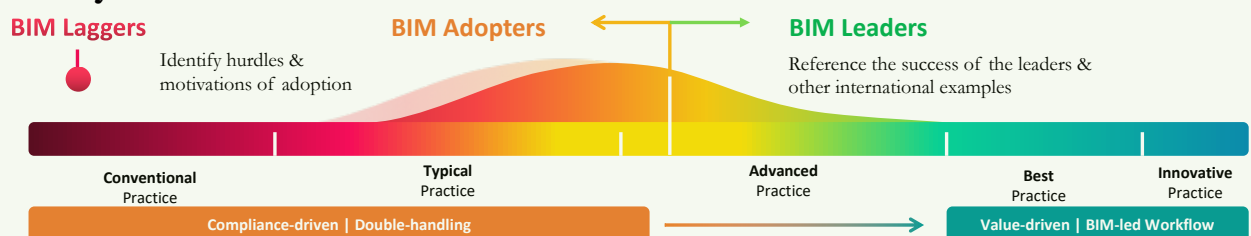
# Executive Summary

## Recommendations for CIC and industry stakeholders

CIC is recommended to work with industry stakeholders to accelerate the BIM adoption and maturity of the industry in **3 directions**:



## The Way Forward



Furthering BIM adoption and maturity creates synergy in the industry and helps stakeholders implement a BIM-led workflow with a value-driven mindset, thereby helping the industry realise greater productivity and returns in their projects. To this end, CIC will continue to support the industry in building up in-house BIM capability, adopting BIM-led workflows, and exploring and demonstrating best practices using BIM. At the same time, all stakeholders in the industry will need to be proactively involved in order to realise BIM benefits for their organisations and the industry overall.

# The BIM Adoption Survey

The Construction Industry Council (CIC) is dedicated to drive and promote the use of BIM technology in the Hong Kong construction industry. To make good use of resources and formulate effective strategies for promotion, it is important for CIC to establish a clear picture of the current BIM adoption situation in the local market.

In August 2018, CIC conducted a BIM Adoption Survey to gauge the local market BIM adoption situation. The survey results had provided CIC a preliminary overview of the attitude of different stakeholders towards the adoption of BIM technology in their projects.

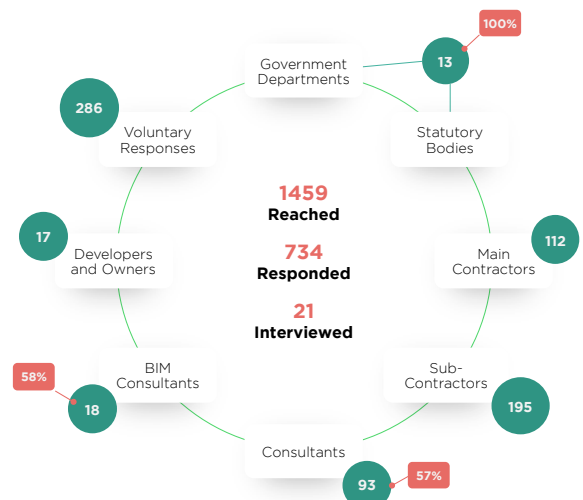
To establish a fuller picture of the current BIM adoption situation in the construction industry in Hong Kong and a baseline for comparison in future years, Construction Industry Council (CIC) commissioned SBI • bimSCORE to conduct the BIM Adoption Survey in 2019 to understand the Hong Kong BIM market with a **baseline of BIM adoption, assess the current maturity** of BIM adoption, **identify key hurdles** for BIM adoption, **recommend strategies and actions** for CIC and industry stakeholders to advance BIM implementation in Hong Kong, and **establish an objective and scalable methodology** to benchmark BIM adoption of Hong Kong in the future.

This study covers **7 stakeholder groups** in the Architecture, Engineering, Construction, Owner and Operator (AECOO) industry of Hong Kong (Fig. 4). With 1400+ organisations across 7 stakeholder groups reached, 700+ survey

responses, and 20+ interviews conducted, this study is one of the largest and most rigorous industry BIM studies in the world and achieves 95% confidence interval at 7-9% margin of error (as a reference, the Gallup Poll, an authoritative analytics agency most known for tracking US presidential elections, reports a margin of error of 4% by sampling around 1,000 responses from a voting population of 250 million<sup>1</sup>).

In the past 5 years, even leading authorities of the construction market conducting nation-wide or global BIM adoption surveys are only inviting voluntary responses on an individual basis with sample sizes ranging from 300 to 1,000. In contrast, this study rigorously samples and follows up with selected organisations to collect representative and unbiased views from all stakeholder groups, and successfully collects 700+ organisational responses. Yet, even with the rigorous methodology employed by this study, some sampled organisations did not respond to the survey invitation; thus the reader should take note that the views of organisations who are unwilling or unavailable to respond could be underrepresented by the study. For further details, please refer to the Methodology section.

Fig. 4. Stakeholder groups reached by the BIM Adoption survey. The numbers in teal circles indicate the number of responses collected from their respective groups, while the percentages in red rectangles indicate the percentages of the stakeholder population who responded to the survey.



<sup>1</sup><http://www.gallup.com/file/poll/125927/How%20Are%20Polls%20Conducted%20FINAL.pdf>

# BIM Adoption in Hong Kong

44% of organisations that are adopting BIM. The top 20% of them, evaluated in terms of their BIM Diffusion & Maturity, are identified as the **BIM Leaders** of the Hong Kong industry; the remaining organisations are defined to be the **BIM Adopters**. 56% of surveyed organisations are **BIM Laggards** who do not have active BIM projects as of 31 Mar 2019.

**BIM consultants** and **government departments & statutory bodies** are leading in BIM adoption, whereas **main contractors** and **sub-contractors** consist of mostly BIM Laggards and have relatively lower BIM adoption rates (Fig. 5).

Of the 20 BIM uses listed by CIC, the top BIM uses are for visualisation and coordination, with "3D coordination" and "design authoring" having the highest adoption percentage (among organisations that report to be currently using BIM) at 63% and 57% respectively. At the same time, many high-value BIM uses are under-adopted, especially those focused on optimisation and automation, and asset and facility management (Fig. 6).

BIM Leaders are found to be substantially more proactive in using BIM and more readily realise benefits from their BIM implementation (Fig. 7). BIM Leaders on average adopt BIM in 86% of their projects, compared with the average of 36% for BIM Adopters. BIM Leaders are using 12.7 BIM uses on average compared with the 4.4 uses for BIM Adopters. More importantly, BIM Leaders are able to report benefits from an average of 7 BIM uses compared to BIM Adopters' average of 2.3 uses, which demonstrates BIM Leaders' ability to realise benefits in their projects.

## OVERALL

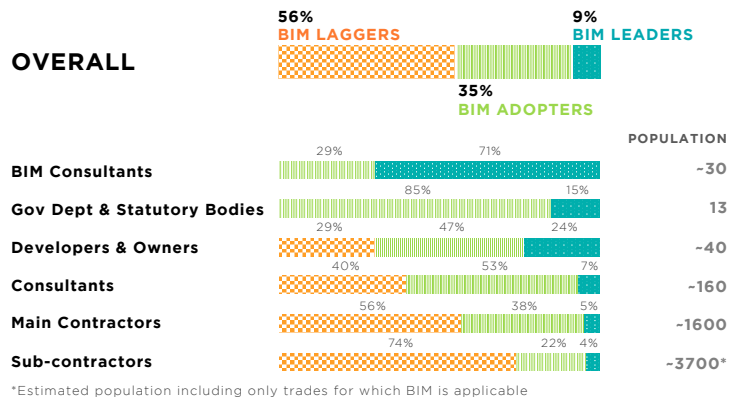


Fig. 5. Distribution of BIM Leaders, Adopters, and Laggards in the Hong Kong industry, and patterns of BIM usage. The BIM uses surveyed include the 20 BIM uses listed by DEVB Technical Circular (Works) on Adoption of BIM.

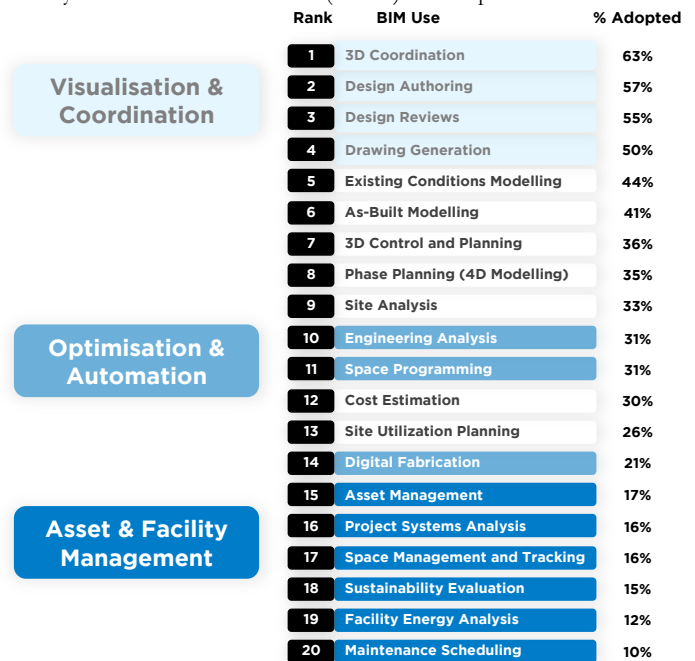


Fig. 6. Distribution of BIM Leaders, Adopters, and Laggards in the Hong Kong industry, and patterns of BIM usage. The BIM uses surveyed include the 20 BIM uses listed by DEVB Technical Circular (Works) on Adoption of BIM.

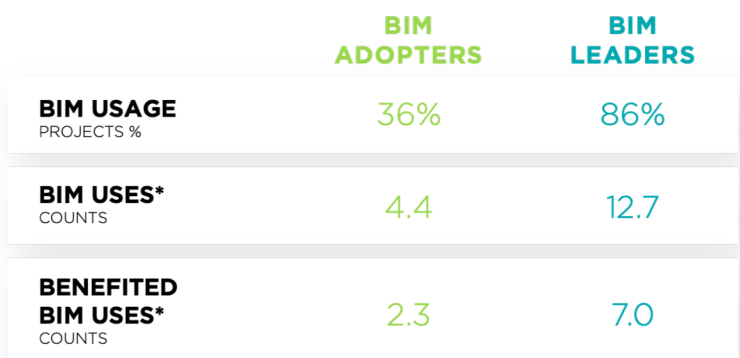


Fig. 7. Distribution of BIM Leaders, Adopters, and Laggards in the Hong Kong industry, and patterns of BIM usage. The BIM uses surveyed include the 20 BIM uses listed by DEVB Technical Circular (Works) on Adoption of BIM.



# BIM Adoption in Hong Kong

BIM Leaders and Adopters report whether BIM positively impacts their projects, and the **net positivity** is calculated for each of the 13 BIM impacts by taking the net percentage of positive responses (Fig. 8).

BIM Leaders find their BIM implementation to substantially benefit their projects across a broad range of project impacts, reporting a **net positivity of over 70% in 12 of the 13 BIM impacts**. The top 4 BIM impacts, which are **enhancements in communication, quality management, efficiency, and time management**, have net positivity of over 80%, showing BIM Leaders' overall confidence in the impact and contribution of BIM.

While BIM Adopters only report to benefit from an average of 2.3 BIM uses (Fig. 7), they report a **net positivity of over 50%** on **9 out of the 13 BIM impacts**.

BIM Leaders consistently report a higher net positivity in all 13 BIM impacts; the greatest gaps in net positivity are found in enhancement of **time management** and **cost management**, where BIM Leaders report a higher net positivity by 40 and 36 percentage points respectively. With time and cost being two critical performance aspects of a project, the results suggest that BIM Adopters may find considerable opportunities in realising more project benefits with BIM.

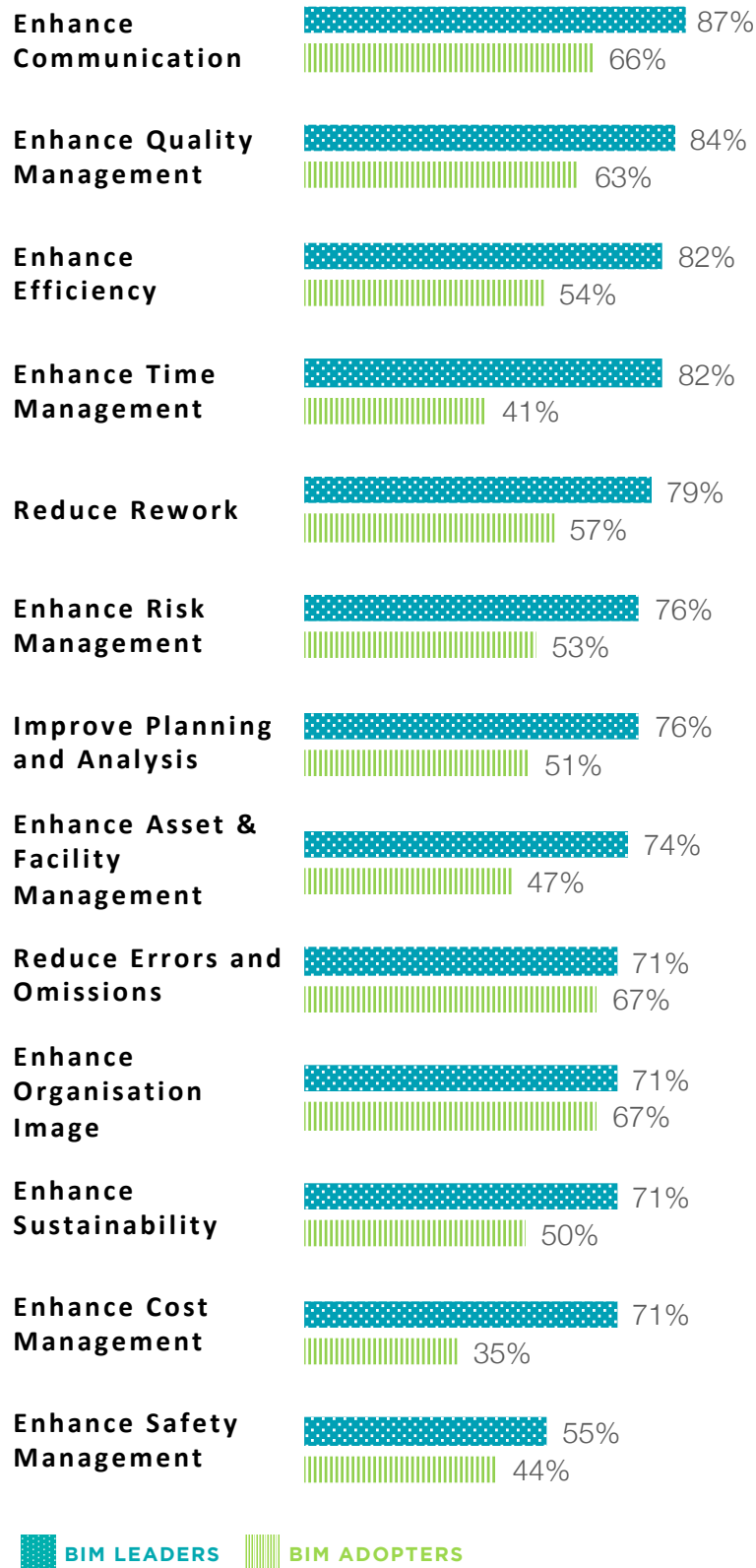


Fig. 8. Net positivity of BIM impacts sorted by BIM Leaders' responses.

# Hurdles of BIM Adoption

Based on the 700+ survey responses and 20+ interviews, this study has identified 3 key hurdles of BIM adoption for the Hong Kong industry.

## 1 COMPLIANCE-DRIVEN MINDSET

BIM Laggards and BIM Adopters are primarily driven to adopt BIM to **comply with client requirements** (Fig. 9); the majority of BIM Laggards find the lack of client requirements to be a key hurdle to BIM adoption (Fig. 10). In contrast, BIM Leaders are more motivated to **use BIM due to project benefits that BIM can deliver** (Fig. 11).

Commenting on the changes needed to motivate an organisation to further BIM adoption and realise its potential benefits, one interviewee remarked:

*“Some colleagues used to resist BIM, but their views on BIM became more positive after BIM was implemented to solve problems in a ‘mission-impossible project’ that cannot be solved using traditional methods.”*

- a contractor representative

Overall, the industry is commonly faced with a **compliance-driven mindset**. **Locally-accepted practices** frequently employ an experience-based management style that lacks integration and sufficient productivity information, and **BIM tasks are often performed in isolation in a lagging workflow**. This lack of integration and transparency encourages project teams to focus on fulfilling requirements without considering the value brought by their investment and efforts of BIM, as evidenced by the fact that BIM Adopters, on average, report benefiting from only 2.3 BIM uses while BIM Leaders benefit from an average of 7 BIM uses. Project teams also often have a **dismissive mindset** towards innovation, and local practices also tend to be more risk averse and lacks incentives to adopt innovative technologies.

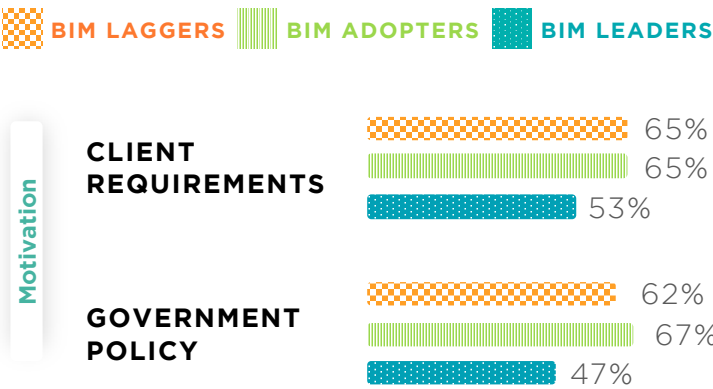


Fig. 9. BIM motivations relating to client requirements. The proportion of BIM Leaders who finds private or public client requirements to be key motivators of BIM adoption, though still substantial, is significantly lower than that of BIM Adopters and BIM Laggards.

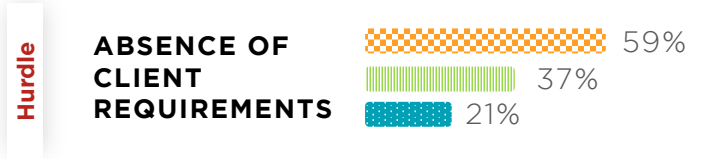


Fig. 10. BIM hurdle relating to the absence of client requirements. 59% of BIM Laggards find the lack of client BIM requirements to be an obstacle for their organisations to use BIM (bottom).

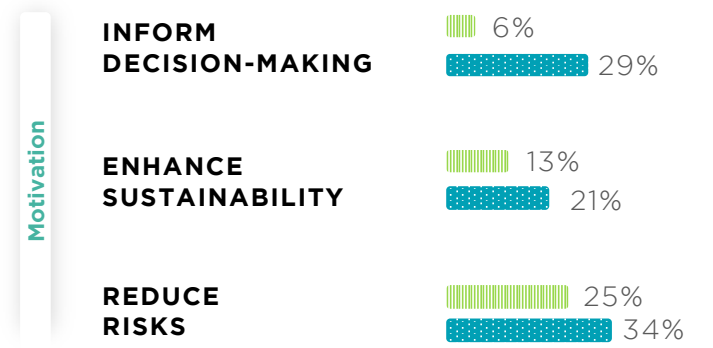


Fig. 11. BIM motivations relating to project benefit realisation. BIM Leaders are more motivated to use BIM due to project benefits that BIM can deliver, while BIM Adopters are less likely to regard these benefits as key motivations to adopt BIM.

# Hurdles of BIM Adoption

2

## DOUBLE-HANDLING

BIM Leaders, and to a certain degree, BIM Adopters, find obstacles in the current workflow, mindset, and practice in their BIM implementation (Fig. 12).

While some downstream stakeholders are equipped and ready for digital fabrication and BIM+MiC, and BIM+Safety etc., they **cannot fully leverage BIM until upstream partners can effectively pass on relevant data from BIM**. One interviewed subcontractor commented:

*"We are ready to take on data from BIM to our production ERP system, but often our project partners cannot provide the relevant data ahead of time."*  
- a subcontractor (steel-fixing) representative

Overall, **rigid workflows and stakeholder interfacing** are commonly observed in the local practice, for example, over-prescriptive contracts and client requirements, the use of "for-reference BIM", and the lack of software/data interfacing between upstream and downstream project partners. These rigid practices lead to substantial **double-handling between 2D drawings and BIM** and cause 2D drawings to still take precedence over BIM. The roles and responsibilities are often unclear among Authorised Persons (APs), CAD draftsmen, and BIM consultants, which further bottlenecks collaboration using BIM.

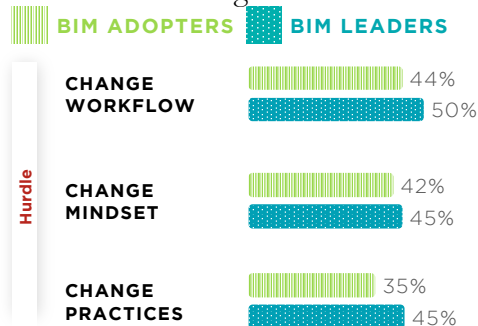


Fig. 12. BIM hurdles concerning workflow, mindset, and practices. BIM Leaders, and to a certain extent BIM Adopters, find the existing workflow, mindset, and practice of the industry to be key obstacles of BIM adoption.

3

## INSUFFICIENT EXPERTISE

Insufficient BIM expertise and project experience are being reflected as key obstacles to furthering BIM implementation: **over 60% of BIM Leaders and BIM Laggards cite the lack of BIM expertise as a key hurdle of BIM adoption**, and close to 60% of BIM Adopters also cite the lack of BIM project experience a key hurdle (Fig. 13).

Despite the observed shortage of BIM expertise in the market, one interviewed client pointed out the need to build up BIM capabilities within their project team:

*"BIM talents are scarce, and market demand for BIM talents is much greater in recent years. Even though BIM is currently mostly outsourced, we need to build up the BIM competency for our in-house project team."*  
- a client representative

The need to **train up organisations' in-house BIM capabilities** is strong for the industry overall and not just for clients alone. Having strong in-house BIM capabilities helps upstream organisations establish suitable BIM requirements and incentives, and helps downstream organisations effectively integrate BIM in projects and realise more BIM benefits.

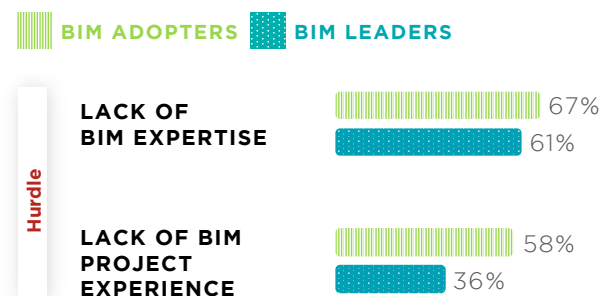


Fig. 13. BIM hurdles concerning BIM expertise and project experience. The majority of BIM Leaders and BIM Adopters regard the lack of BIM expertise as a key obstacle of BIM adoption, while BIM Adopters also cite the lack of BIM project experience as a key hurdle.

# Recommendations\*

## 1. Best Practice Demonstration

To document and share quantified successes and lessons learnt throughout the project lifecycle, which helps stakeholders identify opportunities for growth and transition to a value-driven mindset.

### 1.1. Recognise Exemplary Projects

CIC is recommended to facilitate the recognition of exemplary projects that demonstrate quantitative, auditable, and objective BIM benefits across different categories of impacts (e.g. time, cost, safety) throughout the project lifecycle. With other project stakeholders contributing their successful project cases, CIC can help document and showcase them to the industry, for example, through organising and/or sponsoring BIM awards.

### 1.2. Conduct Case Studies

CIC is recommended to facilitate and coach case studies to **explore best practice in stakeholder interfacing** at different project phases and points of collaboration in the project lifecycle in order to realise various aspects of BIM and project benefits. CIC should facilitate:

- consultants, main contractors, and subcontractors** to explore **automation and optimisation opportunities such as BIM + MiC, BIM + Safety etc.** and consider leveraging the CIC Research and Technology Development Fund (R&D Fund)<sup>2</sup> to support the explorations.
- public clients and private clients** to explore **contract integration** and **objective setting** to help clients plan and execute BIM-related tasks in alignment with their project objectives.
- consultants and main contractors** to explore **BIM-centric review and collaboration**.
- regulatory bodies and consultants** to explore **BIM-enabled statutory compliance** to smoothen the submission and approval process.
- case studies** for specific trades through working with trade associations and unions to select projects from interested organisations.



\* Subject to acceptance by the industry stakeholders

<sup>2</sup> [http://www.cic.hk/eng/main/research\\_data\\_analytics/\\_research\\_fund\\_application/](http://www.cic.hk/eng/main/research_data_analytics/_research_fund_application/)

# Recommendations\*

## 1.3. Establish Industry KPI and Benchmark

CIC is recommended to lead the development of industry KPI and benchmarking with inputs from **clients, consultants, main contractors, subcontractors, and BIM consultants**. The industry KPI (including leading indicators and outcome metrics) and benchmark provide a platform for the industry to share quantified, auditable, repeatable, and objective BIM and project performances. The industry can leverage this shared platform to track and manage their project performances, **benchmark with local, regional, and global peers**, and find opportunities for growth and improvement.

## 2. Workflow Re-engineering

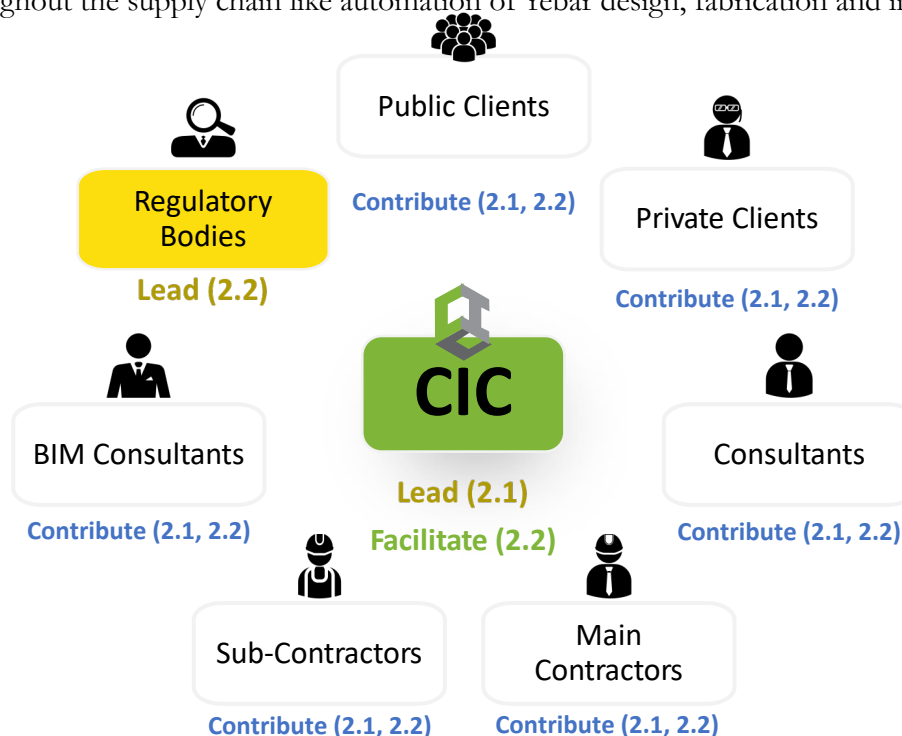
To identify and remove **barriers of collaboration**, and create more incentives for project teams to achieve overall project success:

### 2.1. BIM Contract Templates

CIC to lead the development of BIM-integrated contract templates with inputs from public clients, private clients, and main contractors to publish **performance-driven** contract clauses and specifications and/or guidelines that are specific for different BIM uses, goals, and stakeholders, while referencing and aligning with open standards and international trends (e.g., OpenBIM, Target Value Design, New Engineering Contract, Integrated Project Delivery, Integrated Form of Agreement, etc).

### 2.2. BIM as Central Submission Format and Supply Chain Automation Tool

CIC to facilitate regulatory bodies to formalise BIM as part of the **central submission format**, which helps establish BIM as the “single source of truth” (instead of competing with 2D drawings) among project stakeholders and minimises double-handling in design and construction, as well as changing workflow throughout the supply chain like automation of rebar design, fabrication and installation etc. .





# Recommendations\*

## 3. Re-align BIM Training

To build up project teams' in-house BIM capability, encourage BIM diffusion within organisations, and help BIM teams integrate with project teams to realise BIM benefits, referencing many BIM Leaders and globally leading BIM innovators who have built up in-house BIM capabilities to streamline their workflow and readily realise BIM benefits in their projects:

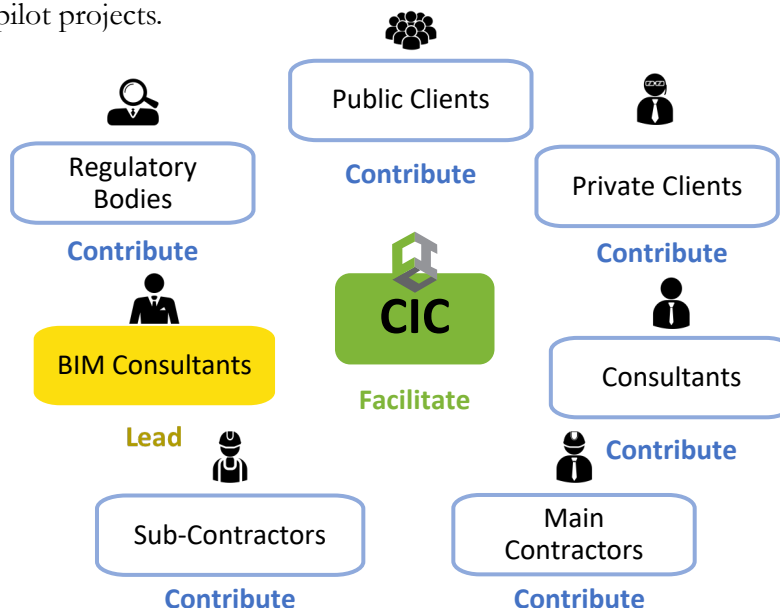
### 3.1. Management and Professional Education

CIC to encourage **BIM training providers** to design and deliver training courses and programmes to help the top management of industry organisations to understand **the timing and value** of BIM investment, so that top executives and management teams can direct project teams to apply appropriate depth and breadth of BIM uses according to the needs of their organisations, which in turn helps organisations to **maximise the Return on Investment (ROI) of their BIM investment**. The management-level training opportunities will also help top management develop the organisations' strategies of BIM adoption.

### 3.2. Project-based Training

CIC to encourage and recommend **BIM training providers** to add elements of **project-based training and coaching** to their training courses to help project teams **more effectively build up in-house BIM capabilities** by applying newly acquired knowledge and skills to their organisations' projects, and ultimately be able to manage and execute projects in a lean and integrated manner. For example, training providers may invite participants to bring their projects into "check-in" and "coaching" sessions.

- CIC to encourage and recommend BIM training providers to offer courses to **"train the trainers"** and help in-house BIM teams/champions realise benefits for the designers, engineers, and other project team members who are not part of the BIM team.
- CIC to **collaborate with BIM experts to hold BIM clinics** to help project teams at different stages of BIM adoption.
- CIC to continue to encourage project teams to leverage the BIM Experiential Use and Project Adoption funding scheme in **the Construction Innovation and Technology Fund (CITF)** to kickstart BIM in pilot projects.



# Recommendations\*

## Summary of Recommendations by Stakeholder

The recommendations and next steps in this section are summarised for each stakeholder:

### Legend

L: Lead

F: Facilitate

C: Contribute

	CIC	Public Clients	Private Clients	Consultants	Main Contractors	Subcontractors	BIM Consultants	Regulatory Bodies
<b>1. Best Practice Demonstration</b>								
1.1. Recognise Exemplary Projects	F	C	C	C	C	C	C	
1.2. Conduct Case Studies								
a) Explore <b>automation and optimisation opportunities such as BIM + MiC, BIM + Safety etc.</b> and consider leveraging the CIC Research and Technology Development Fund (R&D Fund) to support the explorations.	F			L	L	L		
b) Explore <b>contract integration</b> and <b>objective setting</b> to help clients plan and execute BIM-related tasks in alignment with their project objectives.	F	L	L					
c) Explore <b>BIM-centric review and collaboration.</b>	F			L	L			
d) Explore <b>BIM-enabled statutory compliance</b> to smoothen the submission and approval process.	F			L				L
e) <b>Case studies</b> for specific trades through working with trade associations and unions to select projects from interested organisations.	F			L	L	L		
<b>2. Workflow Re-engineering</b>								
2.1. BIM Contract Templates	L	C	C	C	C	C	C	
2.2. BIM as Central Submission Format	F	C	C	C	C	C	C	L
<b>3. Re-align BIM Training</b>								
3.1. Management and Professional Education	F	C	C	C	C	C	C	L
3.2. Project-based Training								
a) Offer courses to <b>“train the trainers”</b> and help in-house BIM teams/champions realise benefits for the designers, engineers, and other project team members who are not part of the BIM team.	F	C	C	C	C	C	C	L
b) <b>Hold BIM clinics</b> to help project teams at different stages of BIM adoption.	F	C	C	C	C	C	C	L
c) Leverage the BIM Experiential Use and Project Adoption funding scheme in <b>the Construction Innovation and Technology Fund (CITF)</b> to kickstart BIM in pilot projects.	F	C	C	C	C	C	C	L

# Methodology

## Population of Interest

To collect representative and unbiased views on BIM adoption from the industry of Hong Kong, the study involves 7 stakeholder groups:

1. **Government Departments** include the 9 departments under the Development Bureau.
2. **Statutory Bodies** include Housing Authority, Housing Society, Hospital Authority, and Urban Renewal Authority.
3. **Main Contractors** include organisations from CIC's levy payers list. Approximately 1,600 such organisations have been identified.
4. **Subcontractors** include organisations registered under the Registered Specialist Trade Contractors Scheme and Registered Subcontractors (RS). Approximately 3,700 such organisations have been identified, after accounting for trades that can be expected to use BIM, which includes all organisations registered under RSTCS and selected Structural and Civil, Finishing, and E&M trades from RS.
5. **Design, Engineering, and Surveying Consultants** include organisations in the Engineering & Associated Consultants Selection Board (EACSB), the Architectural & Associated Consultants Selection Board (AACSB), or the Buildings Department's Registers of Authorized Person and Structural/Geotechnical Engineers. Approximately 160 such organisations have been identified.
6. **BIM Consultants** include CIC's internal list of approximately 30 BIM consultants.
7. **Real Estate Developers and Asset Owners** include the asset office of 10 institutions (The University of Hong Kong, The Hong Kong University of Science and Technology, The Chinese University of Hong Kong, City University of Hong Kong, The Hong Kong Polytechnic University, Chu Hai College of Higher Education, Hong Kong Institute of Vocational Education (IVE), MTR Corporation (MTRC), West Kowloon Cultural District (WKCD), and Airport Authority), and an estimated 30 real estate developers in Hong Kong. In total, this stakeholder group comprises of approximately 40 organisations.

## Survey Sampling

To ensure the representativeness and unbiasedness of the responses collected from the surveys, organisations from each stakeholder are either all invited to participate in the survey or randomly selected. For groups 1, 2, 6, all organisations are invited to participate in the survey since the population sizes for these groups are relatively small. For groups 7, all 10 institutions are invited to participate in the survey. For real estate developers, the contact information for the organisations could not be obtained due to confidentiality reasons; a diverse set of developers comprising of both small-scale and leading developers are invited to participate in the survey. For groups 3, 4, 5, the

theoretical minimum samples sizes are calculated based on the population size estimated at the start of the study using the estimated population size at a margin of error no greater than 5% using a 95% confidence interval and the maximum standard error for estimating proportions. Additional organisations (about 20% of the minimum sample size) are sampled on top of the calculated sample sizes to ensure sufficient responses for analysis in case some sampled organisations choose not to respond. Voluntary responses are also collected from the industry through industry events and email invitations to industry members.

## Survey Distribution and Follow-up

A total of 1400+ organisations are reached, and 700+ responses are received. The research team used publicly available and CIC's internal contact databases to obtain emails for sampled organisations. In cases where only phone numbers are available, the research team called each of the organisations to obtain emails for suitable representatives to fill out the survey. The research team sent 2 rounds of email reminders, followed by 2 rounds of phone call reminders (1400+ calls in total) and 1 round of physical mail reminders (1100+ mails) to boost the response rate and ensure that the collected responses are representative of the industry's view on BIM adoption.

## Interviews

The research team conducted 20+ interviews including organisations from each of the 7 stakeholder groups and organisations with different levels of BIM adoption. At the interviews, the research team explored in-depth the challenges and opportunities faced by the organisations in their BIM adoption to complement the survey questions.

## BIM Diffusion and Maturity

Surveyed organisations are categorised by their BIM diffusion & maturity based on their response to the BIM Adoption Survey. An organisation is classified as a BIM Lagger if the respondent has not heard of BIM or does not have active BIM projects (as of 31 Mar 2019). Other BIM-adopting organisations are further evaluated by their BIM diffusion and maturity based on 3 metrics derived from their survey responses: (a) project BIM penetration (% of active projects in the organisation that involve BIM-based deliverables), (b) organisational BIM exposure (number of BIM uses that are implemented by the organisation), and (c) perceived BIM benefits (number of BIM uses that the respondent organisation are experiencing benefit and the net number of project aspects positively impacted by BIM).