



CONSTRUCTION
INDUSTRY COUNCIL
建造業議會

Project Clients Summit :
Development of BIM
Implementation Strategies
Summit Report for
Project Clients from
GOVERNMENT SECTOR

Disclaimer

Whilst reasonable efforts have been made to ensure the accuracy of the information contained in this publication, the CIC nevertheless would encourage readers to seek appropriate independent advice from their professional advisers where possible and readers should not treat or rely on this publication as a substitute for such professional advice for taking any relevant actions.

Important Note

The information, views, and opinions collected in this report represent the personal views of individual participants and they did not represent the government sector in the industry and/ or their organisation.

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Table of Contents

1.0 Summary Recommendations.....	4
1.1 Planning – Establish objectives and protocols	5
1.2 Adoption – Prepare the market and develop the processes.....	6
1.3 Technology – Further leveraging the tools.....	7
1.4 Performance – Track impact and progress.....	7
2.0 Recommended 1, 3 and 5-year Action Plans for BIM Implementation	8
3.0 Survey Data and Analysis	12
3.1 Summary of Survey Results	13
3.2 BIM Funding	14
3.3 BIM Adoption and BIM-capable Staff	14
3.4 BIM for Visualisation.....	15
3.5 BIM for Documentation	15
3.6 BIM for Analysis	15
3.7 BIM for Automation	16
3.8 BIM-enabled Benefits	16
3.9 BIM Motivations.....	17
3.10 Factors for Late BIM Adoption.....	17
3.11 Cost and Benefit of BIM	18
3.12 BIM-enabled Project Phases.....	18
3.13 Challenges in BIM implementation	19
3.14 Measure of success for BIM implementation.....	19
3.15 Obstacles in implementing BIM.....	19
4.0 Observations and Reflections	20
5.0 Participants’ Established BIM Objectives.....	21
5.1 Established Objectives and Recommendations for Improving Objectives and Metrics Setting	22
Appendix A: Organisations Participated in the Project Clients Summit.....	25
Appendix B: Experience Sharing from Participants.....	26
Appendix C: Keynote Speakers and Organisation Profiles	27
Feedback Form	28

1.0 Summary Recommendations

This report begins with a summary of eighteen (18) selected recommendations resulting from a 2-day Project Clients Summit focused BIM organised and facilitated through collaboration of Construction Industry Council (CIC), SBI.bimSCORE, and Center for Integrated Facility Engineering (CIFE), Stanford University in September 2014, plus information gathered during preliminary interviews and surveys.

These recommendations are categorised in four (4) Areas:

Planning: Aligning goals and business outcomes with measurable objectives and targets, selecting standards, technologies, and resources to be deployed.

Adoption: Ensuring the organisations involved have sufficient capabilities and processes to achieve the objectives.

Technology: Providing and wisely using diverse and interoperable applications dispersed throughout the team.

Performance: Reliably measuring and reporting progress, and demonstrably achieving the objectives.

For each Area, the recommendations are further categorised by two (2) types:

Strategic Recommendations, which are a high level and primarily related to strategy, and

Tactical Recommendations, which are at an operational level and primarily related to implementation.

The summary table below shows the distribution of these recommendations in the four Areas and two types.

Table 1 - Distribution of Summary Recommendations

4 Areas	Strategic Recommendations	Tactical Recommendations	Total
Planning	1 <i>Expedite</i>	4 <i>Expand, Facilitate, Guide, Popularise</i>	5
Adoption	2 <i>Lead and Encourage</i>	5 <i>Integrate, Train, Educate, Transform, Involve</i>	7
Technology	2 <i>Integrate and Advance</i>	1 <i>Engage</i>	3
Performance	1 <i>Measure</i>	2 <i>Share, Progress</i>	3
Total	6	12	18

Strategic Recommendations and Tactical Recommendations are outlined on the following three pages. In those tables, the Strategic Recommendations are shown on a lightly coloured background, and Tactical Recommendations are shown on a white background. The tables also highlight benefits expected to result from following the recommendations in each Area.

In **Section 2.0**, recommendations are organised, further detailed, and sequenced to formulate **Action Plans** generalised for applicability to all Summit participants, yet specific enough to guide implementation. The plans are subdivided for Actions to be initiated in Year one (for two years), Year three (for two years), and Year five of BIM adoption. These plans can form the basis from which to customise BIM Action Plans for the various participants in the Summit, and also for other organisations.

1.1 Planning – Establish objectives and protocols

Planning Recommendations	CIC	Client
<p>Expedite - Condense the planned timeframes for BIM adoption :-</p> <p>Accelerate strategic and action planning from the typical 3-year cycle to shorter cycle by actively implementing: pilot projects, training programmes, standards development, contract language amendment, and performance target identification in parallel and through iterative cycles.</p> <ul style="list-style-type: none"> • Encourage 3-6 month Action plans for BIM adoption. • Compress timeframe through parallel efforts and achievements. • Executive / government agencies must establish strong visions that are mutually supportive, clearly articulated, and published. • For pilot and proof-of-concept projects: broadly incorporate feedback and selected improvements into a holistic roadmap with milestones for significant adoption within 1 year. 	X	X
<p>Expand - Increase the number of projects, and number of stages during project life cycles, for BIM implementation :-</p> <ul style="list-style-type: none"> • Ensure pilot projects are establishing focused and in-depth BIM objectives with mature targets for performance and seeking significant improvement over more traditional projects. Encourage objectives focused on <i>improving</i> project performance rather than just reducing project performance shortfalls. • The leadership of Government and Public sectors understands the value of BIM. They should provide clear mandates and generate support for their internal team to develop both short-term and long-term strategies in a prioritised manner. 		X
<p>Facilitate - Encourage and facilitate planning of measureable and achievable objectives :-</p> <p>For pilot projects, and collaboration between piloting organisations, establish mechanisms through which CIC can be the centralised collector of performance data, and also report best practices and common risks to avoid from various pilot projects. Consider publishing and distributing results (without exposing exact project or company sources) for industry-wide benefit.</p>	X	X
<p>Guide – Develop BIM Standards to provide process and planning guidelines, share nomenclature and methodologies for project teams :-</p> <p>Understand and document the planned data exchanges, responsibilities, inputs/outputs, formats, software applications, and critical information to be maintained in each exchange across platforms. CIC's BIM Standards, several international and US BIM standards made available to the public provide more detail on BIM process planning and methods.</p>	X	X
<p>Popularise - Raise general knowledge of BIM in Hong Kong marketplace :-</p> <p>Consider offering a certificate programme to raise general knowledge of BIM in Hong Kong marketplace. Consider joining CIFE, Stanford University as a member to be in contact with leading international BIM stakeholders. These programmes can expose professionals to new processes and technologies as well as strengthen their leadership knowledge and skills.</p>	X	
Planning Benefits		
<ul style="list-style-type: none"> • Realise attainable “quick wins” to rapidly recognise and reward efforts, and promote continual improvement. • Encourage focus on making better projects rather than simply reducing project performance shortfalls. • Establish feedback loops to inform decisions with actual experience. • Empower organisations to implement BIM without waiting for detailed and all-encompassing planning. • Reduce the need for speculative capital investment. 		

1.2 Adoption – Prepare the market and develop the processes

Adoption Recommendations	CIC	Clients
Lead – Craft clear statements and provide visible support for innovation from the top levels :- <ul style="list-style-type: none"> Top Leaders must understand how BIM can best benefit their organisation or company, articulate clear high-level strategies to obtain value, and actively support implementation to achieve performance objectives enterprise-wide and throughout entire life-cycles. Consult experts to assist with detailed decisions and planning. Support strategies to emphasise development of human capital and BIM related capabilities. 	X	X
Encourage - Consider incentives and other programmes to support BIM adoption :- <ul style="list-style-type: none"> Clients drive BIM adoption in many economies by providing motivation for development of BIM capabilities in the project supply chain. CIC can provide programmes to teach professionals through hands-on experiences such as collaboration among many disciplines using live BIM in “Big Room” environments. Hands-on training can build professionals’ confidence when applying skills in real work situations. 	X	X
Integrate – Hold BIM integration workshops for all sectors of the construction industry :- <ul style="list-style-type: none"> Hold workshops focused on methods to integrate all sectors of the construction industry including various combinations of designers, contractors, and clients. Also consider holding workshops focused on BIM-empowered collaboration at different stages of project development such as design, construction, commissioning, and, facility management and operations. 	X	
Train - Establish BIM implementation, integration and collaboration programmes :- Quickly raise BIM competence of the project delivery supply chain through practice-focused training. Include owners, designers, contractors, and facility managers.	X	X
Educate – Pair seasoned professionals with BIM-capable staff to develop holistic understanding :- Establish knowledge sharing processes between professionals with deep design/construction/management experience and less-experienced professionals who are quite BIM-capable. The goal of such partnering is to blend expertise and develop holistic understanding of the processes, benefits, and challenges inherent in moving from traditional to BIM-empowered practice.		X
Transform - Prepare industry to manage a change to BIM-enabled integrated project delivery :- <ul style="list-style-type: none"> Embrace BIM-enabled culture and procurement by fully involving all stakeholders. Hold workshops engaging designers, engineers, contractors, owners, and legal professionals to learn from innovative project delivery methods such as Integrated Project Delivery (IPD). Collectively explore how concepts like 'best for project' mentality, cultural and procurement changes based on BIM, and risk/profit-sharing arrangements may influence contracts and business relationships. 	X	X
Involve - Involve maintenance and operation team :- During design and construction stages, solicit input from those who will occupy, operate, and maintain facilities to explore BIM-related opportunities to improve asset management, and facility management and operations.		X
Adoption Benefits <ul style="list-style-type: none"> Provide visible and meaningful leadership to promote improvement. Achieve full value and potential from BIM throughout the entire project lifecycle. Actively mentor the next generation of industry leadership while maintaining and refreshing the value of today’s experts. Reduce resistance and fear which often inhibit process improvement and advancement. Realise BIM-empowered benefits during design, construction, and operation of built environment and infrastructure, and in the project delivery ecosystem. 		

1.3 Technology – Further leveraging the tools

Technology Recommendations	CIC	Clients
Integrate- Integrate BIM-empowered processes into daily practice and projects :- <ul style="list-style-type: none"> Leverage the skills and knowledge already acquired in the professional force introducing appropriate BIM uses to improve results of daily workflows and projects. Leverage the full potential of technologies already in place to maximise return on investments. 		X
Advance – Use more mature, powerful BIM applications for increased benefits :- <p>Most respondents employ simple BIM uses for visualisation (renderings, walk-throughs) and documentation. More sophisticated BIM Uses (BIM-enabled collaboration, constructability review, cost estimation, performance analysis) provide greater value, and truly innovative uses (Multidisciplinary Design Optimisation (MDO), BIM-driven prefabrication, and automated production can provide even more.</p>		X
Engage - Establish direct communication channels with software development team :- <p>In addition to engaging architects, engineers, and builders in driving industry BIM adoption, also engage with software developers and vendors to help them understand product shortcomings, and to request enhancements and new features.</p>	X	X
Technology Benefits		
<ul style="list-style-type: none"> Create better, more effective, results-oriented and collaborative processes. Fully leverage the potential of BIM investments 		

1.4 Performance – Track impact and progress

Performance Recommendations	CIC	Clients
Measure - Develop success metrics and processes to meaningfully and reliably inform decisions :- <p>Focus on outcomes most important to the organisation or company, and accurate reporting on actions leading to those outcomes. e.g. these metrics for <i>communication</i>:</p> <ul style="list-style-type: none"> % of disciplines collaborating in BIM % of meetings supported by BIM Satisfaction of requests for information and trends in issue resolution (count, time) Regulatory agency approval time and latency Overall duration and quality compared with traditional delivery of similar projects 	X	X
Share Knowledge - Invite clients to team with design consultants and general contractors :- <p>To share their integrated BIM experiences in future client summits. Conduct an objective industry-wide survey to measure BIM maturity across the broader Hong Kong market, and benchmark to global BIM maturity and standards of best practice. Use these reports to pinpoint areas for further action.</p>	X	X
Progress – Continue momentum of this Summit and on-going focus on BIM :- <p>Build upon the good participation from the government and industry by continuing these efforts, and expanding throughout the industry to enrich professionals from different sectors with BIM knowledge.</p>	X	X
Performance Benefits		
<ul style="list-style-type: none"> Leverage BIM technology to meet increasing market demands for affordable, quick, safe, high quality buildings and infrastructure works. Showcase exemplary projects to the new generation of young professionals, who are excited to be part of the industry, to inform them about new technologies and highlight opportunities to contribute in the processes that will help Hong Kong construction industry maintain competitiveness and foster innovation. 		

2.0 Recommended 1, 3 and 5-year Action Plans for BIM Implementation

YEAR 1

<u>Action</u>	<u>Recommendation</u>
Formulate Objectives and Metrics	<p>Establish performance oriented objectives for BIM implementation that serve business values and end user requirements. Objectives must be discussed and formalised among project stakeholders (developers, owners, designers, contractors, and end users), representing design, construction, and operations interests.</p> <ol style="list-style-type: none"> 1. Improve communication and reduce decision latency and approval time between project stakeholders, including Public Sector, end users, and regulatory agencies. Consider metrics to track BIM communication effectiveness, including: <ul style="list-style-type: none"> - % of meeting time supported by BIM and other visualisation mediums, e.g. 3D renderings, 2D drawings, or text documents and reports. - % of consultants coordinating in BIM - % of coordination issues resolved by using BIM 2. Improve BIM proficiency among internal staff. Consider metrics to measure organisation or project staff proficiency with BIM applications and processes, e.g. % of staff with working knowledge of specific BIM processes or applications 3. Reduce project changes and cost overruns. Consider metrics to quantify the value of BIM in reducing costs (e.g. estimated value of conflicts prevented with BIM) and optimising value (e.g. # of design alternatives analysed with BIM) 4. Reduce discrepancies between constructed conditions and documented as-built conditions, and reduce time to document as-built conditions through use of laser scanning. Consider tracking the latency of performing laser scans once construction in an area is complete, and the time required to document and validate as-built conditions in BIM. Compare overall time required to more traditional processes (e.g. redline mark-ups of construction documents for as-built documentation).
Pilot Projects	<p>Select pilot projects to reflect the diversity of projects in type, scale, and delivery method (e.g. design-bid-build vs. design-build), and target specific benefits to achieve from processes or tools being piloted. Identify and select candidate pilot projects based on the estimated costs and benefits of BIM implementation. Learn from existing pilot projects and refine BIM objectives and performance targets for new projects as appropriate. Evaluate pilot projects by comparing them against traditional (non-BIM) projects or similar historical BIM projects.</p> <ol style="list-style-type: none"> 1. Select pilot projects with different delivery methods, e.g. design-bid-build, design-build, or more innovative collaborative and integrated forms of project agreement. Document and share the best practices, challenges, and lessons learned with implementing BIM in the different delivery environments.

<u>Action</u>	<u>Recommendation</u>
	<ol style="list-style-type: none"> 2. Develop standards and requirements for pilot projects to require BIM use from external design consultants and contractors 3. Pilot different software for targeted BIM processes or uses, and test interoperability and information loss in information exchanges with other software tools.
Training	<p>Encourage or incentivise staff and project participation in BIM knowledge sharing, e.g. regular meetings to review and discuss BIM best practices and lessons learned, or industry conferences and webinars. Identify BIM experienced staff that may serve as BIM leaders or knowledge resources that maintain active membership in industry organisations and attend industry events.</p> <p>Create a qualification framework and individualised training programmes for different BIM roles, e.g. BIM managers, BIM modellers/authors, and/or those performing only BIM analysis. Assign the trained personnel on BIM enabled projects within 3 months after training to reinforce learning. Collaborate with universities to develop BIM training for students and young professionals.</p>
BIM Uses	<p>Expand adoption of BIM uses to fully leverage BIM benefit and value. Survey industry BIM tools and processes to identify and target potential BIM uses or benefits that may assist in achieving enterprise goals and vision. Perform analysis to determine the gap between current technology infrastructure and targeted capabilities, and prioritise among potential BIM uses by assigning measures of potential cost/investment and benefit. Engage BIM consultants or vendors for pricing, training, and technical requirements.</p> <p>Expand BIM uses beyond renderings, walkthroughs, documentation and clash detection, to more advanced model-based analyses to help inform early design decisions while the cost of change is relatively low. For example:</p> <ul style="list-style-type: none"> - Energy analysis at the conceptual design stage to compare energy use among design alternatives. - Laser scanning technologies to document as-built conditions in BIM and verify conformance to design. - Model-based quantity extraction for major building systems to compare early design options on cost and programme conformance. BIM quantities can be referenced at regular intervals to track estimated costs against targets.
Performance Tracking	<p>Regularly track project performance to monitor success, inform resource and staff distribution, and predict progress and final outcomes. Metrics can be tracked by internal staff or external consultants, and may rely on project team surveys, automated extraction from data management systems, or manual tracking. Performance may be shared with the broader project team to motivate performance improvement. Review objectives, metrics, and performance targets for pilot projects, and refine as necessary to ensure piloted tools and processes are being accurately and objectively evaluated.</p>

YEAR 3

<u>Action</u>	<u>Recommendation</u>
BIM Guideline	<p>Formalise and consolidate best practices and lessons learned from BIM pilot efforts to develop enterprise-wide and project-specific BIM standards and guidelines. Standards can include BIM Execution Plan templates, and/or Minimum BIM Requirements for projects of a certain type or size. Reference international or regional BIM standards and contract documents as points of departure, and include guidelines for:</p> <ul style="list-style-type: none"> - Objectives, metrics, and performance tracking methods - Roles and responsibilities and team organisation - BIM use selection - Quality control and assurance - BIM scope and Level of Development (LoD) definitions and progression - Hardware and software requirements - BIM-enabled meeting types, frequency, technology, and required attendees - Naming conventions (objects, files, etc.) - Interoperability requirements, information exchange processes, and file formats - Training and knowledge management - Archiving and data management - Deliverable and submission requirements - References to other documents, protocols, or contract documents
Level of Development (LoD)	<p>Referencing industry standard LoD definitions and progression requirements, identify the required LoD of model objects to perform various BIM uses and achieve objectives (e.g. required LoD for energy analysis will differ from LoD required for construction coordination). Review project BIMs, past and current, to understand the typical LoD progression and model scope, and identify opportunities for improving model reliability at each phase of a project. Include LoD definitions, progression standards, and responsible parties in BIM Guidelines, BIM Execution Plan, and/or contract documents.</p>
Request for Proposal (RFP) Requirements	<p>Clearly state BIM requirements and expectations in RFP for external consultants, including expected experience and required BIM tools, analyses, deliverables, and Level of Development (LoD). Require proposers to describe BIM experience, standards and guidelines, quantitative and qualitative benefits, applications and software, LoD, and experience with integrated and collaborative forms of project delivery. Review BIM experience of team members who will be assigned to the project and to assess the degree to which BIM has diffused throughout their organisation. Perform objective evaluations to assess BIM proficiency and experience of prospective consultants.</p>
Performance Tracking	<p>Continue to regularly track project performance against established objectives, and benchmark results against other projects or industry published performance data. Review objectives, metrics, and performance targets for pilot projects, and refine as necessary to ensure piloted tools and processes are being accurately and objectively evaluated. Perform objective evaluations of project BIM maturity to identify common strengths and weaknesses in BIM implementation strategy, and inform investment decisions and resource allocation.</p>
Training	<p>Continue to regularly evaluate staff BIM proficiency and conformance to standard</p>

<u>Action</u>	<u>Recommendation</u>
	BIM processes. Leverage pilot project experiences to inform enterprise-wide BIM training courses, and customise training for different levels and roles of staff (e.g. BIM authors v. BIM managers v. project executives). Set performance targets for % of staff participating in BIM knowledge sharing (e.g. by attending industry conferences or webinars, subscribing to industry publications, or participating in BIM training), and % of newly hired project management employees with BIM experience or qualifications. Update hiring guidelines and employee qualification requirements to include BIM qualifications. Analyse gaps between the current level of in-house BIM proficiency and standard levels of proficiency achieved through regional or local BIM training and certification programmes.

YEAR 5

<u>Action</u>	<u>Recommendation</u>
Contract Documents	Update project contract documents and project delivery standards to include minimum BIM requirements and standards governing processes and tools. Include provisions for different project delivery methods (e.g. design-bid-build v. design-build) and different project types. Based on best practices and lessons learned from pilot projects with integrated forms of project delivery, standardise contract language and requirements for integrated forms of project delivery, with shared risk and reward clauses and performance incentives agreed by project stakeholders.
Performance Tracking	Standardise objectives, metrics, and tracking methods across BIM projects, and establish enterprise performance benchmarks for certain project types or sizes. For objectives and metrics standardise specific definitions of required data inputs, responsible parties, frequency of tracking and evaluation milestones, and methods of evaluation. Based on requirements set forth in the RFP for each stakeholder, establish criteria and protocols to evaluate BIM design deliverables at key stages of model development. Continue to evaluate maturity of BIM practice, and update objectives and targets as BIM technologies and industry best practices mature.

3.0 Survey Data and Analysis

In a collaborative effort between the Construction Industry Council, SBI.bimSCORE, and Center for Integrated Facility Engineering, Stanford University, a 2-day Project Clients Summit was held at the Century Novotel Hotel in Wan Chai on September 11th and 12th, 2014. Attendees represented key industry sectors, with representatives from private and public developers and government agencies. The Summit included a plenary session to enrich participants' understanding of BIM benefits with theoretical knowledge and practical examples, followed by three sessions of group workshops to guide them in developing measurable objectives and action plans for improved performance in BIM adoption. 23 organisations comprised of 103 representatives (14% more than expected) participated in the workshop, representing three client sectors, and CIC internal staff. Prior to the 2-day Summit, an online survey and pre-workshop interviews were used to solicit participants' responses regarding their attitudes towards BIM and BIM adoption.

58 client summit participants responded to the pre-workshop survey, consisting of total 14 questions. Among the participants, 86% of them were from the Government sector, see *Figure 1.1*.

The 58 online survey responses indicated that 55% (37% of respondents had 1-18 months of BIM experience, 9% had 19-36 months, and 9% had more than 3 years) of the respondents knew their organisation had used BIM in practice; of these, most were within their first 18 months of BIM experience (*Figure 1.2*). Among the 55% of respondents with BIM experience, 68% of them had 1-18 months of participation, see *Figure 1.3*.

Figure 1.1 – Number of Survey Responses

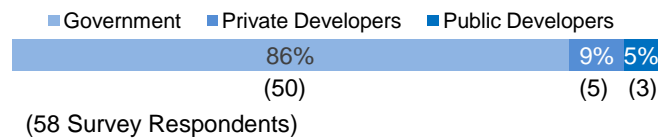


Figure 1.2 - Participants' BIM Experience

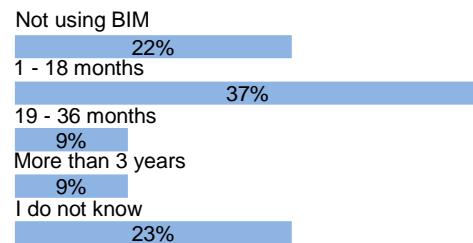
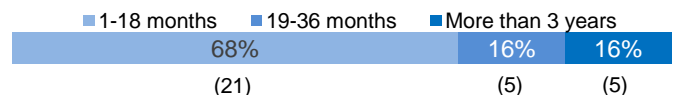


Figure 1.3 – BIM Experience duration



(Out of 58 Survey Respondents, 31 Respondents have BIM experience)

3.1 Summary of Survey Results

- Most of the respondents' organisations had used BIM in project(s) and invested in hardware, software and BIM training to prepare for BIM adoption, but not all of these respondents had actual hands-on project experience. One of the greatest factors delaying BIM adoption among organisations was lack of internal BIM capabilities and/or BIM-capable staff. The lack of BIM capabilities in external stakeholders was also delaying BIM adoption, as many organisations were not required to use BIM in data exchanges with external parties.
- Based on respondents' previous BIM projects experience, most of them found that the cost spent and benefits gained were as expected. However the expected benefits, e.g. improved productivity, reduced errors & omissions, were mainly supported by BIM-enabled documentation and 3D coordination/clash detection use cases.
- Respondents were comfortable with using BIM for visualisation and documentation, but might be still looking at it as a more-advanced or all-in-one replacement of other CAD or 3D modelling & rendering solutions. Less than 20% of respondents used BIM for mode-based quantity take-off to enhance cost estimation process, or to enhance construction safety planning and training.
- Although 90% of respondents expected benefit in the reduction of errors, omissions & abortive works, there were less than 20% of respondents who actually used 3D multidisciplinary coordination or constructability review as shown in the "BIM for Analysis" section above. This might imply that the respondents did not demand that project design or construction team execute these uses cases, which likely were listed as part of the scope in the RFP, and/or participate in these processes themselves. In fact only 37% of respondents had or were using BIM in construction documentation phase, when the team can virtually build the project, make mistakes and resolve them before constructing on site. Otherwise much of the previous modelling efforts which go to waste and diminish the return on investment and project team's satisfaction.

3.2 BIM Funding

Among the respondents that had experience in BIM, 35% to 67% of respondents' organisations committed funding to Software, Hardware, BIM training for their internal staff and employment of BIM consultants. Only 28% of respondents' organisations invested in having dedicated in-house BIM personnel. Most of these organisations are in early stage adoption where they are aware of the value or trend of BIM and are ready to "buy" BIM, see *Figure 2*.

And most respondents expected to have 1-30% of their staff to be BIM-capable by year 2016 (see *Figure 3*). This may explain why "BIM consultants" is one of the top BIM-related efforts with committed funding – organisations are still highly reliant on external support.

Similar to running an airline, it takes more than procuring the latest airplanes to enhance the operation; it also requires developing and training the crew on tailored procedures and protocols that best leverage the aircraft's configurations and functions. Organisations need to invest in the development of BIM standards, requirements, libraries and templates. Currently, less than 20% of the participants have committed funding in these areas, see *Figure 2*.

3.3 BIM Adoption and BIM-capable Staff

Considering most of the respondents' organisations invested funding in BIM training, see *Figure 3*, 73% of respondents' organisations have at least 1-30% of their current staff with BIM capability. In fact, 84% of the participants foresee that at least 1-30% of their staff will be BIM-capable by 2016.

In terms of the % of current projects using BIM, 74% of respondents' organisations had at least one project using BIM, and by 2016 90% of them planned to have at least one project using BIM in their organisations.

While 22% of respondents believed that by 2016 more than 30% of their staff will have BIM capability, only 12% of respondents plan to have more than 30% of their projects using BIM by 2016. Apart from training of internal staff, organisations should also strategise on their project adoption roadmap to leap from piloting to implementation stage, see *Figure 3*.

Figure 2 – BIM Funding

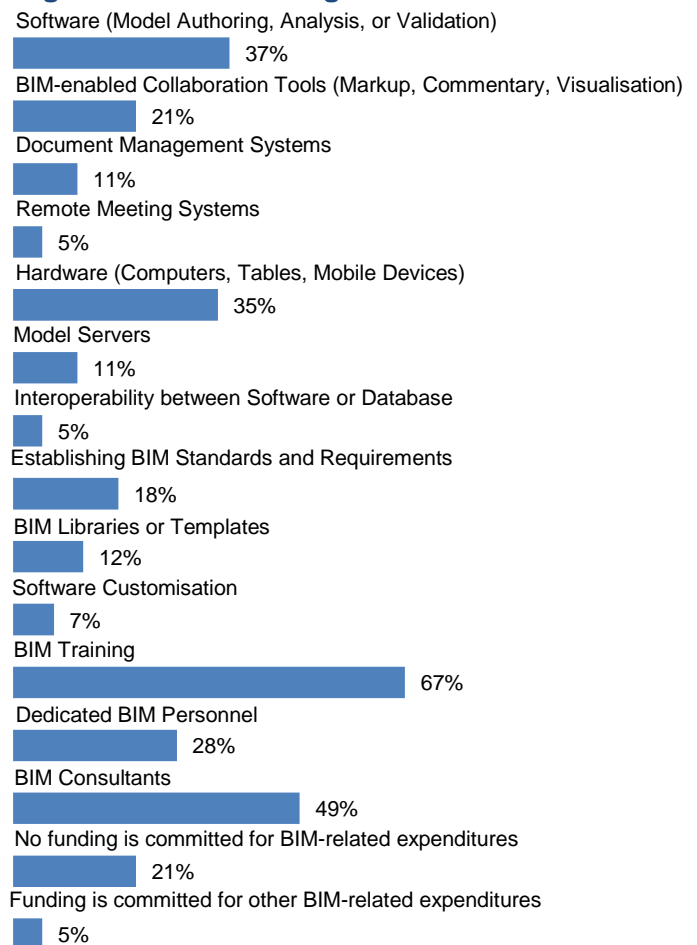
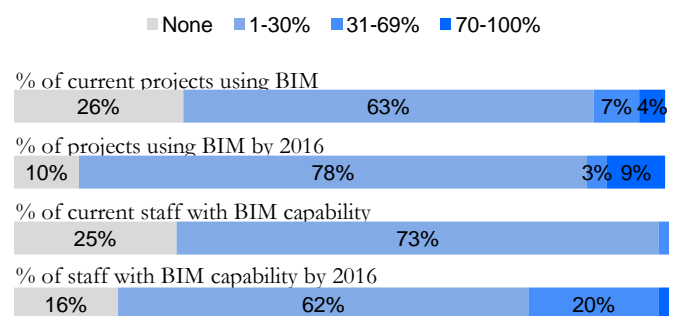


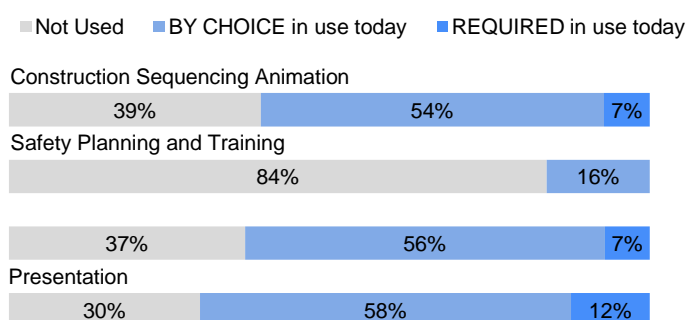
Figure 3 – BIM Adoption and BIM-capable Staff



3.4 BIM for Visualisation

In terms of using BIM for visualisation, more than 60% of the respondents had used or required to use BIM for “Construction Sequencing Animation”, “Walkthroughs” and “Renderings” which are the low hanging fruit that most new adopters can easily leverage, see *Figure 4*.

Figure 4– BIM for Visualisation

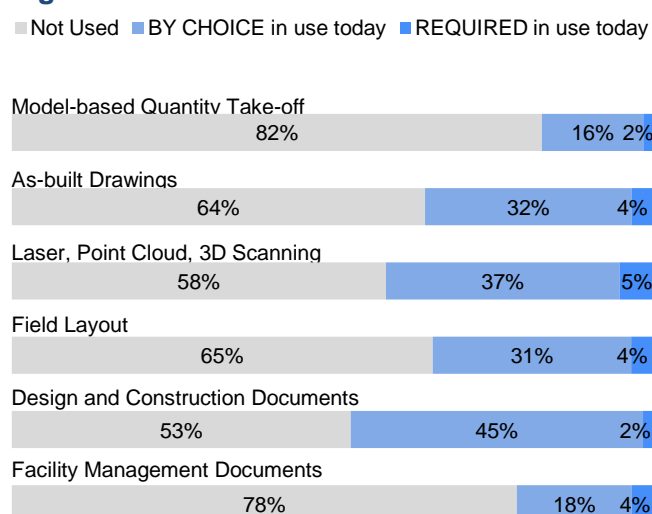


3.5 BIM for Documentation

47% of respondents had used BIM for design and construction documentation, and 42% of respondents used laser, point cloud, or 3D scanning for documentation of existing and/or as-built conditions. Less than 5% of respondents' organisations required the use of BIM for documentation as most of them adopted it by choice.

Less than 22% of the respondents used BIM for model-based quantity take-offs and facility management documentation, which requires more stringent data structures and naming convention standardisation, while offering high levels of return-on-investment, see *Figure 5*.

Figure 5– BIM for Documentation

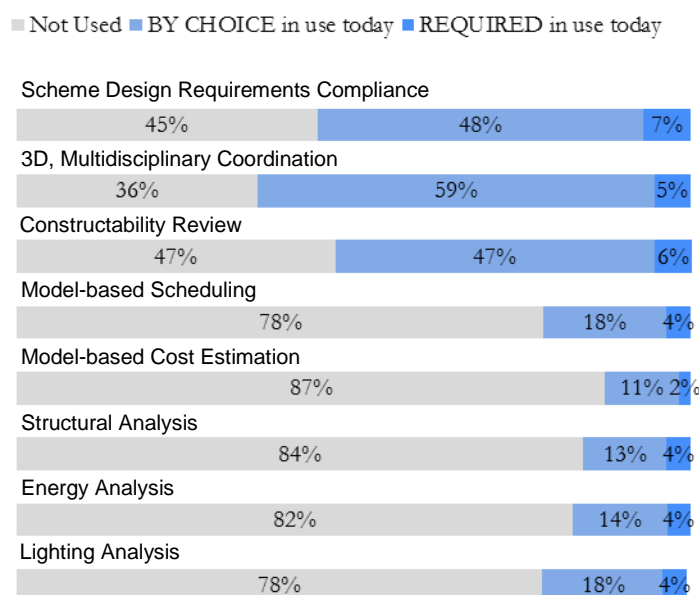


3.6 BIM for Analysis

47% to 59% of respondents had used BIM for design requirements compliance, multi-disciplinary coordination and constructability review. This may relate to changes in process and stakeholders' adoption to proactive conflict avoidance collaboration rather than reactive problem solving.

The lower percentages of respondents that had used BIM for model-based cost estimation and scheduling may be due to the more cumbersome data migration workflows. Less than 20% of respondents had experience in BIM enabled structural, energy or lighting analysis. This may be due to data integration challenges between BIM authoring platform and simulation solutions, which hinder seamless workflow from designing in BIM to analysis in BIM, see *Figure 6*.

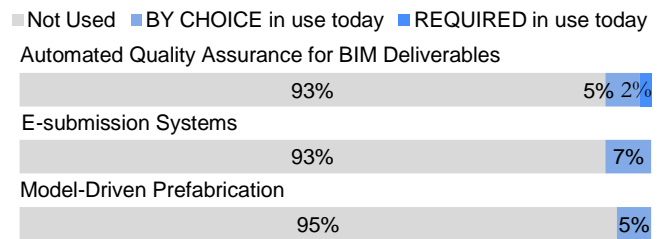
Figure 6– BIM for Analysis



3.7 BIM for Automation

BIM for Automation represents innovative uses of BIM that require more initial time, efforts and capital investment, thus over 90% of respondents' organisations had not used this before, see *Figure 7*.

Figure 7– BIM for Automation



3.8 BIM-enabled Benefits

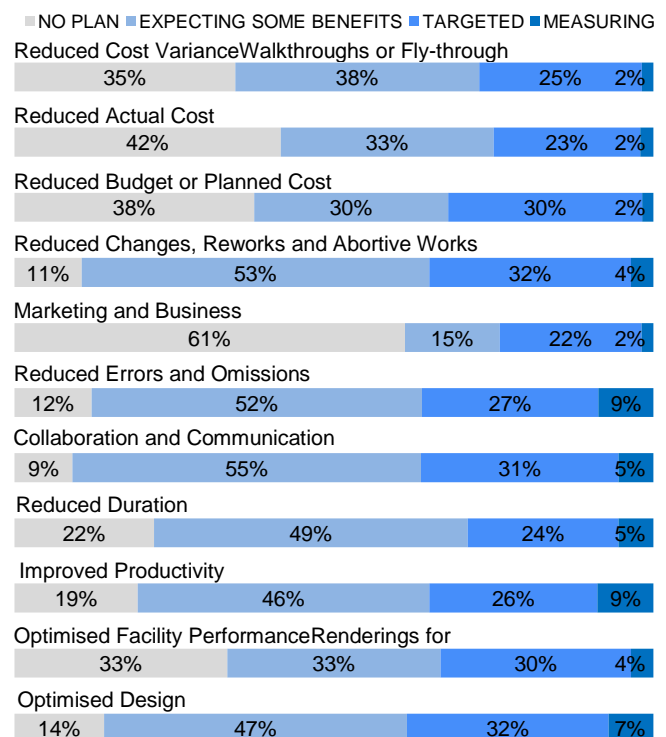
Most respondents expected some BIM-enabled benefits in these top six performance improvement categories:

- Collaboration and Communication;
- Reduced Changes, Reworks and Abortive Works;
- Reduced Errors and Omissions;
- Optimised Design;
- Improved Productivity; and
- Reduced Duration.

These benefits can be realised through the use of BIM in 3D multi-disciplinary coordination, constructability review and various model-based simulations, e.g. structural and energy, see *Figure 6*, also BIM generated design & construction documentation, and 3D laser scanning of as-built condition, see *Figure 5*.

However, less than 70% of respondents (see *Figure 8*) saw the benefit of BIM in the reduction of budget or planned cost, actual cost, and cost variance, which are more leading/proactive cost control approaches during design/pre-construction, or optimising facility performance during operation phase.

Figure 8– BIM-enabled Benefits

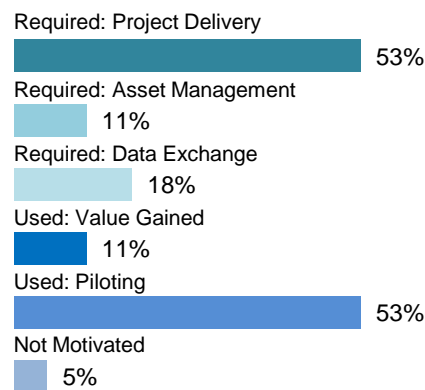


3.9 BIM Motivations

In the case where BIM was within the organisation's requirements, 53% of respondents expressed that the goal was to enhance project delivery instead of facility/asset management or data exchange process.

53% of respondents were in the piloting stage of BIM adoption: testing and measuring the value of BIM to determine the most beneficial BIM applications and use cases. Only 11% used BIM based on value seen in past experiences, see *Figure 9*.

Figure 9– BIM Motivations



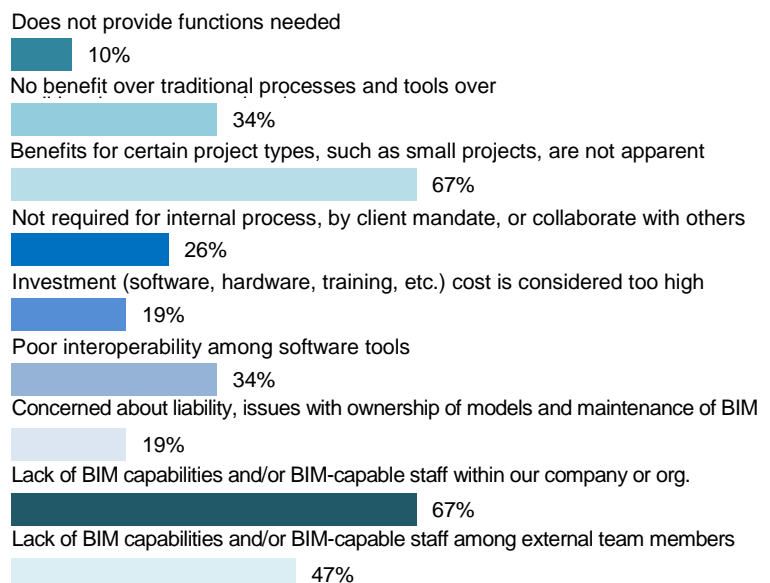
3.10 Factors for Late BIM Adoption

67% of the respondents delayed their BIM adoption due to the benefits not being apparent for certain project types they developed, e.g. small projects.

In addition, 67% of the respondents stated the lack of internal BIM capabilities as one of the factors delaying BIM adoption. But according to the survey results of "BIM Adoption and BIM-capable staff", about 75% of the respondents currently have 1-30% of internal staff with BIM capabilities and BIM training and BIM consultants ranked high in terms of investment as per survey results of "BIM Funding". In fact, 84% of respondents expected to have at least 1-30% or more of their internal staff be BIM capable by 2011, see *Figure 10*.

There seems to be a misalignment between these survey findings, and this may be due to the assignment of staff resources after BIM training and whether they were able to get hands-on project experience to strengthen their skills foundation.

Figure 10– Factors for Late BIM Adoption



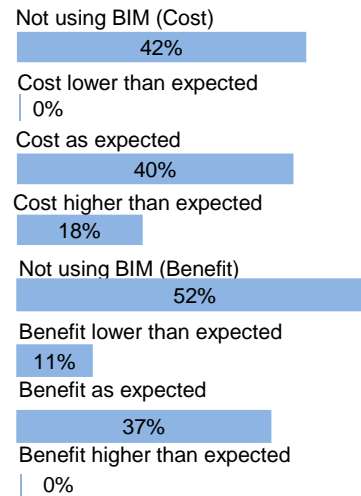
3.11 Cost and Benefit of BIM

While the goal of these questions was to understand the respondents' perspective on the return on investment of BIM, it is interesting to see the percentages of "Not using BIM" differ by 10% when asked about the cost vs. the benefit – 52% vs. 42%.

These results also conflicted with the question addressing the project(s) using BIM, in which case 74% of respondents claim that they have at least 1-30% of projects in their organisations using BIM, see *Figure 3*. This implies that many of respondents' organisations had projects using BIM but not all of the respondents were involved in them.

Among those respondents who used BIM in their projects, around 40% of them agreed that both the cost and benefits were as expected, see *Figure 11*.

Figure 11– Cost and Benefit of BIM

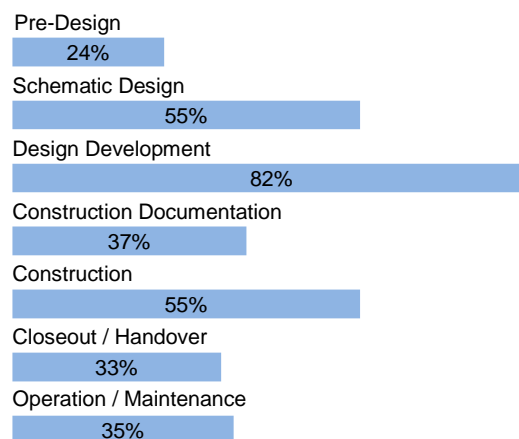


3.12 BIM-enabled Project Phases

Considering most respondents found that costs and benefits were within their expectations, it is important to understand the context by looking at what project phases BIM was used in. It was encouraging to see that 55% of respondents used BIM in both construction and schematic design phases, which meant that BIM adoption was not limited to general contractors' courts but also design consultants and engineers responsibilities as well.

However, the substantial declination from design development to construction documentation – 82% down to 37% – may be due to difficulties with using BIM to generate drawings that comply with current drawings standards and convention, especially for building services discipline. This can be categorised under one of the factors of late BIM adoption, "no benefit over traditional processes and tools", which was selected by more than 30% of respondents, see *Figure 12*.

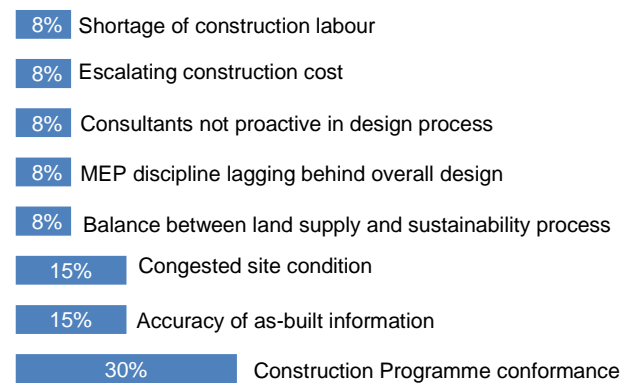
Figure 12– BIM-enabled Project Phases



3.13 Challenges in BIM implementation

The participants were asked about the challenges that they encountered while implementing BIM in their organisation. *Figure 13* shows the different challenges and the percentage of organisations encountering those challenges. It can be seen that 30% of the organisations facing conformance to Construction Programme as one of the biggest challenges in implementing BIM. Congested site conditions and accuracy of as-built information is considered as the second biggest challenge with 15% of organisations considering it to be a challenge while implementing BIM.

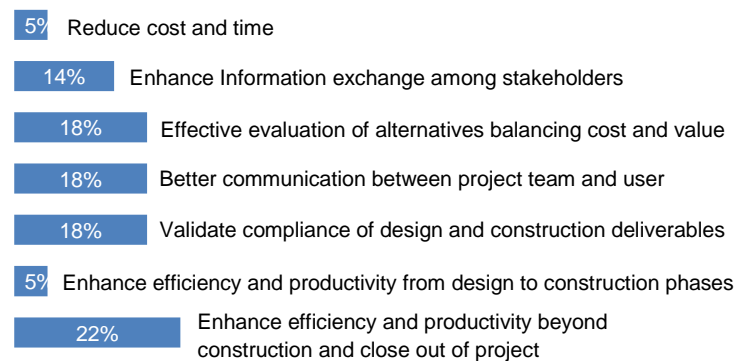
Figure 13 – Challenges in BIM implementation



3.14 Measure of success for BIM implementation

The participants were asked regarding the criteria for measuring the success of BIM implementation in their organisation. *Figure 14* shows the different measures of success and the percentage of organisations measuring BIM implementation on similar criteria. It can be seen that 22% of organisations consider enhancing efficiency and productivity beyond construction and close out of project as an important criteria for measure of success. Surprisingly only 5% of the organisations consider enhancing efficiency and productivity from design to construction as a criteria for measure of success.

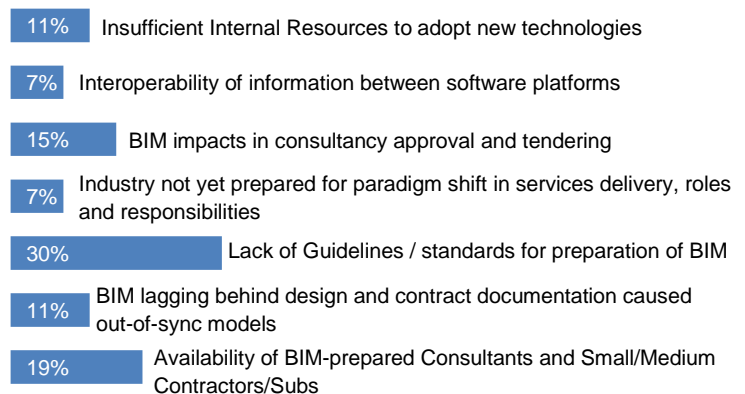
Figure 14 – Measure of success for BIM implementation



3.15 Obstacles in implementing BIM

The participants were asked about the obstacles they encountered while implementing BIM in their organisation. *Figure 15* shows the different obstacles and the percentage of organisations encountering those obstacles. Around 30% of organisations consider lack of proper guidelines and standards for preparing BIM as the biggest obstacle while implementing BIM. Interoperability of information between software and change in delivery process is not considered as the biggest obstacle with only 7% of the organisations considering it to be an obstacle.

Figure 15 – Obstacles in implementing BIM



4.0 Observations and Reflections

	Observations	Reflections
BIM Readiness	Participating organisations openly shared a legitimate concern with the BIM readiness and capabilities of general contractors in Hong Kong.	In addition to Client Summits, conduct additional BIM workshops focused on integrating different sectors of the construction industry, e.g. designers and contractors, clients and designers, and/or clients and contractors. Also consider workshops focused on integrating and collaborating with BIM in different project stages, e.g. during design, construction, or during delivery and transition to operation and maintenance.
	Participants were sceptical of BIM readiness in the Hong Kong Market, were fearful to rely upon anecdotal assessments, and believed the Hong Kong market is behind global markets in BIM adoption.	Consider incentives and other programmes to support BIM adoption. CIC can provide programmes in which the professionals who are being trained can have hands on experience; for e.g. Collaboration in Big Room wherein the professionals can conduct meetings through Live BIM. Such hands on experiences can help professionals who are being trained to execute their BIM knowledge in a confident manner in actual projects. Such intermediate programmes conducted between trainings and actual project execution can help the professionals to gain confidence in implementing their learning.
Knowledge Sharing Events	Many found the Integrated Project Delivery (IPD) case studies of Sutter Hospital Castro Valley very informative and inspiring.	Prepare Hong Kong industry to manage a change to BIM-enabled integrated project delivery. Hold forums to involve designers, engineers, contractors, owners, and legal representatives to learn from innovative project delivery methods, including Integrated Project Delivery (IPD), and explore how BIM and 'best for project' mentality will impact contractual relationships and risk/ profit sharing arrangements.
Future BIM Collaborative Workshop	Over 100 participants from 23 organisations committed 8 hours to participate in the clients' summit.	Invite clients to team up with design consultants and general contractors to share their integrated BIM experiences in future client summits, and conduct an objective industry-wide survey to get a measure of the BIM maturity across the broader Hong Kong market, and benchmark to global BIM maturity and standards of best practice. Use these reports to pinpoint areas for further action.
BIM Objectives	While most teams were able to establish objectives with quantified measures and targets, most of these were focused on single dimensions such as cost avoidance, reduced contingency use, or reduced latency.	Encourage focus on making better projects rather than simply reducing project performance shortfalls. Develop better understanding of BIM uses to optimise project design, construction, and operations.
BIM Action Plan	Many participating organisations were planning to include pilot projects in action plans.	Encourage and facilitate planning of measureable and achievable objectives for pilot projects, and collaboration between piloting organisations.
	Action plans indicated participants were ready to improve BIM capabilities and provide BIM training to enhance CAD skills.	Assist in developing strategies to emphasise development of human capital and BIM-related capabilities. Target senior professionals and managers to increase their BIM familiarity, and define knowledge sharing processes between senior professionals and young BIM users. This will help create an environment where expectations are aligned within a project team, and there is an understanding of practical and theoretical obstacles to implementing BIM.
BIM Uses	Participating organisations already believed appropriate BIM use could improve communication, reduce design errors and omissions, and reduce change, rework, and abortive work on site.	Develop more mature measures of success to assist in measuring and quantifying communication and integration among departments and project team members: <ul style="list-style-type: none"> • Regulatory agency approval time and latency • % of disciplines collaborating in BIM • % of meetings supported by BIM

5.0 Participants' Established BIM Objectives

The following sections summarise the objectives formulated by Government Sector during the 4-hour workshops. During the workshop, participants working in small groups with others from their own sector were guided through the development of measurable objectives for BIM adoption and performance improvement. Objectives from all groups are consolidated in this section to provide collective listings by sector.

Each group developed objectives in the seven categories of BIM's benefit to project performance:

- **Communication:** Improving the interaction between project participants. Example: Improve communication between design team and client, operations team.
- **Cost:** Optimising total cost and cost variance. Example: Contain cost variance to 5% of budgeted cost.
- **Programme:** Optimising programme duration, sequencing, and resources, and controlling programme variances. Example: Accommodate late-breaking change by client without incurring overall project delay.
- **Built Asset Performance:** Improving the level of service and total energy consumption. Example: Total energy consumption in 2024 to be reduced by 50% (based on 2014 benchmark) through BIM-enabled energy analysis and optimisation.
- **Safety:** Improving the safety of construction and operation and maintenance personnel. Example: Reduce instances of serious injury to 0.
- **Project Delivery:** Reliable, timely delivery of high quality service. Example: Reduction in request for information and submittal latency.
- **Management:** Contributing to enterprise health, productivity, and competitiveness. Example: Provide reliable performance data and analysis to inform design scheme selection.

The objectives for each sector were compiled into the following *Table 5.1*, and organised the objectives by the seven categories.

1. Communication, Cost, Built Asset Performance, and Project Delivery objectives were developed by all sectors.
2. Programme and Safety objectives were developed by Government and Private sectors only.
3. Management objectives were developed by Government and Public sectors only.

Recommendations for improvement of objectives developed by the participating groups are also presented in *Table 5.1*.

5.1 Established Objectives and Recommendations for Improving Objectives and Metrics Setting

Category	Established Objectives	Recommendations for Improving Objectives and Metrics Setting
Communication	<ul style="list-style-type: none"> Planning stage optimal design, communicate to stakeholders, convince them, reach consensus in half of the time Improve communication of the road alignment between engineer and surveying staff, reduce turnaround time by engineers to consider the detailed alignment by 40% for a job of medium size (6 days) Deliver the ideas from designer to Facility Managers (e.g. uses) Design Build (DB) project, facilitate discussion, faster process, approval <ul style="list-style-type: none"> Measure of Success: compare with the schedule, reduce time overrun, on-time design approval Measure of Success: reduce time by 10%, percentage of shortening the time Better understanding by the Public Sector <ul style="list-style-type: none"> Measure of Success: approval Use BIM to facilitate discussion between Public Sector and Government Sector. Communication of design intent so that community understands our intent Perfect or clean designing Reduce variability in interpretation of models, thus reduce chance of error 	<p>Focus on outcomes most important to the organisation or company, and accurate reporting on actions leading to those outcomes. e.g. these metrics for communication:</p> <ul style="list-style-type: none"> % of disciplines collaborating in BIM % of meetings supported by BIM Satisfaction of requests for information and trends in issue resolution (count, time) Regulatory agency approval time and latency Overall duration and quality compared with traditional delivery of similar projects.
Cost	<ul style="list-style-type: none"> Within budget, % of over-budget minimised, % of saving 100% of project cost variance within 5% established budget Reduce variation order, reduce cost overrun <ul style="list-style-type: none"> Measure of Success: project contingency by 50% Achieve saving in cost: BIM can help to identify clashes. Reduce clashes between different disciplines and minimise the abortive works Hong Kong typically lacks concept of cost control. BIM gives opportunities to increase cost-efficiency and do more with the same investment 	<p>Analyse historical cost data to establish and benchmark (typical) values for cost variance metrics. These benchmarked values can be used to calculate improvement in cost performance with BIM.</p> <p>Success measures for cost performance focus on reducing total costs and cost variance. Expand measures to capture how BIM optimises value during design and construction:</p> <ul style="list-style-type: none"> Reduction in life cycle cost. Increased Construction Efficiency Improved estimation, decreased contingency use and waste # of design alternatives analysed.
Programme	<ul style="list-style-type: none"> Delivery in time, no delay in project, 100% project delivered on time Pre-fabrication, 4D BIM for visualisation directly related elements Visualisation of method of construction feasibility and duration Buildings Department is responsible for plan approval; BIM reduces delivery time cost 	<p>Consider requirements to track and report schedule change and variance from baseline/original projections, including specific schedule variance metrics with established frequency of reporting and root cause analysis when performance doesn't meet targets.</p> <p>Focus success measures on reducing total</p>

Category	Established Objectives	Recommendations for Improving Objectives and Metrics Setting
		<p>duration and schedule variance. Expand measures to capture how BIM optimises schedule duration and sequencing:</p> <ul style="list-style-type: none"> • Number of work zone conflicts (more than two disciplines working in same zone) • Number of work stoppages • Just-in-time delivery (delivery of components within one week or less of installation on-site)
Built Asset Performance	<ul style="list-style-type: none"> • Asset assessment, coverage of assets, 50% of highway structure assets built via BIM • Info needed for repair available within 8 hours • Quality of finished product: improve compliance with specifications • # of man-hours lost 20% reduced by 2016 • # of variations – 10% contingency reduced to 5% • Maintenance important defects where to locate # of hours 100% defects fixed within 48 hours • Utility installation, resolve the conflict, time to resolve conflicts: reduce coordination time from 30 days to 15 days • Buildings department is responsible for plan approval; BIM reduces delivery time cost • Project delay is common in IT industry due to unforeseen technology challenges and human resources allocation 	<p>Track establishment of BIM delivery requirements for facility and asset data, including naming conventions, object attributes, and links to equipment information (developed by facility owners and operators). Track compliance with these requirements for the delivered BIM. Track actual compatibility of BIM-derived data with facility and asset management systems.</p> <p>Consider qualitative measures of facility performance, including interior comfort, way finding effectiveness, and quality of common spaces.</p> <p>Determine baseline (typical) performance of facility management with traditional methods, such as work order latency and turnaround time, and time to retrieve asset information. As BIM is adopted to support facility management, track improvement over traditional processes and compare with historical benchmarks.</p>
Safety	<ul style="list-style-type: none"> • # man-hours lost 20% reduced by 2016 • Enhance on-site safety through animation, related to communication, facilitate understanding • Reduce damage to utilities 	<p>Assess safety metrics, tracked both during construction and facility operation, against industry published benchmarks for construction and operation safety performance.</p> <p>Consider requirements for integrated safety reviews using BIM with construction animations and visualisation to identify hazards.</p>
Project Delivery	<ul style="list-style-type: none"> • # of variations – 10% contingency reduced to 5% • Design decision earlier • Virtual validation of installation with on-site measurement • Avoid delay due to temporary structure 	<p>Develop metrics to assist in measuring and quantifying project delivery performance:</p> <ul style="list-style-type: none"> • Decision or issue resolution latency • Compliance with BIM quality standards • Compliance with BIM deliverable requirements • Effectiveness of meetings in resolving issues and facilitating

Category	Established Objectives	Recommendations for Improving Objectives and Metrics Setting
	<ul style="list-style-type: none"> On-schedule and high quality delivery is essential; BIM enables 3D models and checks for potential errors as well as more innovative designs. Allows end-users to preview products before they are built. BIM enables earlier detection of problems and reduces delays Lack of manpower, escalating cost 	<p>collaboration</p> <ul style="list-style-type: none"> Frequency of project programme and estimate update Compliance of actual work to project programme and estimates
Management	<ul style="list-style-type: none"> Maintenance important defects where to locate # of hours 100% defects fixed within 48 hours Utility installation, resolve the conflict, time to resolve conflicts: reduce coordination time from 30 days to 15 days Enhance productivity and efficiency of maintenance activities BIM enhances overall competitiveness. BIM helps convince end-user of the expected final product and simulate construction sequence (error detection). BIM also enables quick fixes to recognised problems due to improved communication among stakeholders 	<p>Management objectives and metrics are focused on facility management. Consider additional objectives and metrics focused more on contributing to enterprise health, productivity, and competitiveness:</p> <ul style="list-style-type: none"> % of staff competent in BIM % of projects using BIM Frequency of BIM knowledge sharing or training

Appendix A: Organisations Participated in the Project Clients Summit

Aedas Beijing Limited
Airport Authority Hong Kong
Architectural Services Department
Buildings Department
Civil Engineering and Development Department
CLP Power Hong Kong Limited
Development Bureau
Drainage Services Department
Electrical and Mechanical Services Department
English Schools Foundation
Government Property Agency
Hang Seng Management College
Henderson Land Development Co. Limited
Highways Department
Hong Kong Housing Authority
Hong Kong Housing Society
New World Development Co. Limited
Office of the Government Chief Information Officer
Purcell Miller Tritton Hong Kong Limited
Swire Properties
Water Supplies Department
Walt Disney Imagineering
Yau Lee Holdings Limited

Appendix B: Experience Sharing from Participants

Post the workshop session with the each of the 3 Sectors: Government, Public and Private; participants were asked to give feedback, recommendations, advice on the session. Below are few excerpts from the participants:

“Quite impressed by collaboratively developing the objectives and preparing the Action Plans”

“This workshop helped to visualise the construction world from a holistic perspective. It would be good to share the BIM resources and learning experience with other organisations”

“BIM will change the game just like the Swiss watches”

“Bringing clients from Government, Public and Private sectors together in this workshop to share dialogues was very helpful. We understand that all of us share the similar problems and risks; it is comforting to go ahead in this BIM process”

“Sutter Health case study was very informative. It showed BIM can provide benefit other than clash detection”

“Such initiatives in future should be more like a forum than a workshop setting”

“BIM development requires strong leadership. There are many senior professionals who must innovate and change”

“Request CIC to involve contractors in such Summit in the future just like how it is done for clients”

“It was interesting to prepare the Action Plans and Roadmaps during the workshop. Will try out and experience in actual projects”

“Greatest challenge for client is that contractors who actually build are not in the room while developing BIM. We will miss a big opportunity for BIM if contractors are less involved. Bring contractors to design phase as early as possible and set BIM targets with inputs from contractors”

“This workshop enabled knowledge sharing conversations between different consultants”

“Lot of time and efforts are spent in getting all the consultants to board and also bringing designers and contractors to same level. Recognition of such concerns was observed through this workshop”

Appendix C: Keynote Speakers and Organisation Profiles

The Chairman of CIC, Mr. LEE Shing-see, delivered the opening speech for the CIC Project Clients' Summit. Distinguished professionals in construction domain were invited as keynote speakers. They were Ir Kevin Poole, Acting Executive Director, Third Runway, of Airport Authority Hong Kong and Ms. Ada FUNG Yin-suen, Deputy Director of Housing (Development and Construction), of Hong Kong Housing Authority, as well as collaborative organisations of CIC, SBI.bimSCORE, and Center for Integrated Facility Engineering (CIFE) of Stanford University. The four speakers highlighted the vast market potential of BIM adoption in Hong Kong, and delivered advanced and in-depth perspectives concerning the theme of the summit - *Development of BIM Implementation Strategies*.

Feedback Form

2014 CIC Project Clients Summit – Summit Report for Government Sector

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

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

1. As a whole, I feel that the publication is:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Informative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Practical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Does the publication enable you to understand more about the subject?	Yes	No	No Comment		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
3. Have you made reference to the publication in your work?	Quite Often	Sometimes	Never		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4. To what extent have you incorporated the recommendations of the publication in your work?	Most	Some	None		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5. Overall, how would you rate our publication?	Excellent	Very Good	Satisfactory	Fair	Poor
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Other comments and suggestions, please specify (use separate sheets if necessary).					
Personal Particulars (optional):*					
Name:	<u>Mr. / Mrs./ Ms./ Dr./ Prof./ Ir / Sr ^</u>				
Company:	_____				
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