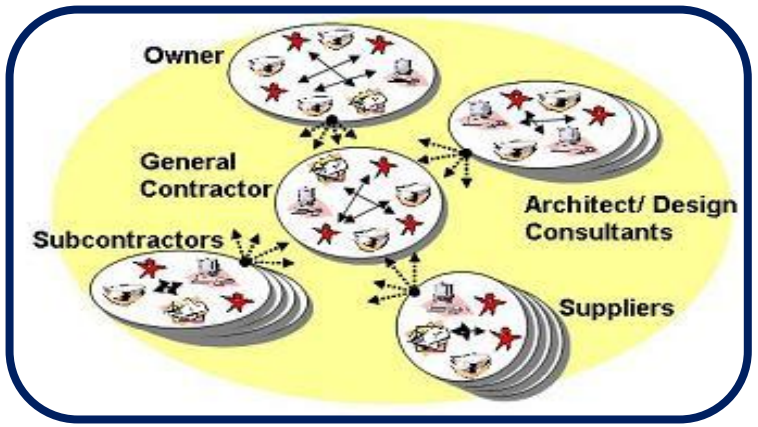
TRANSFORMING THE WAY WE BUILD WITH

INTEGRATED DIGITAL DELIVERY (IDD)

1 | Integrated Digital Delivery (IDD) Vision

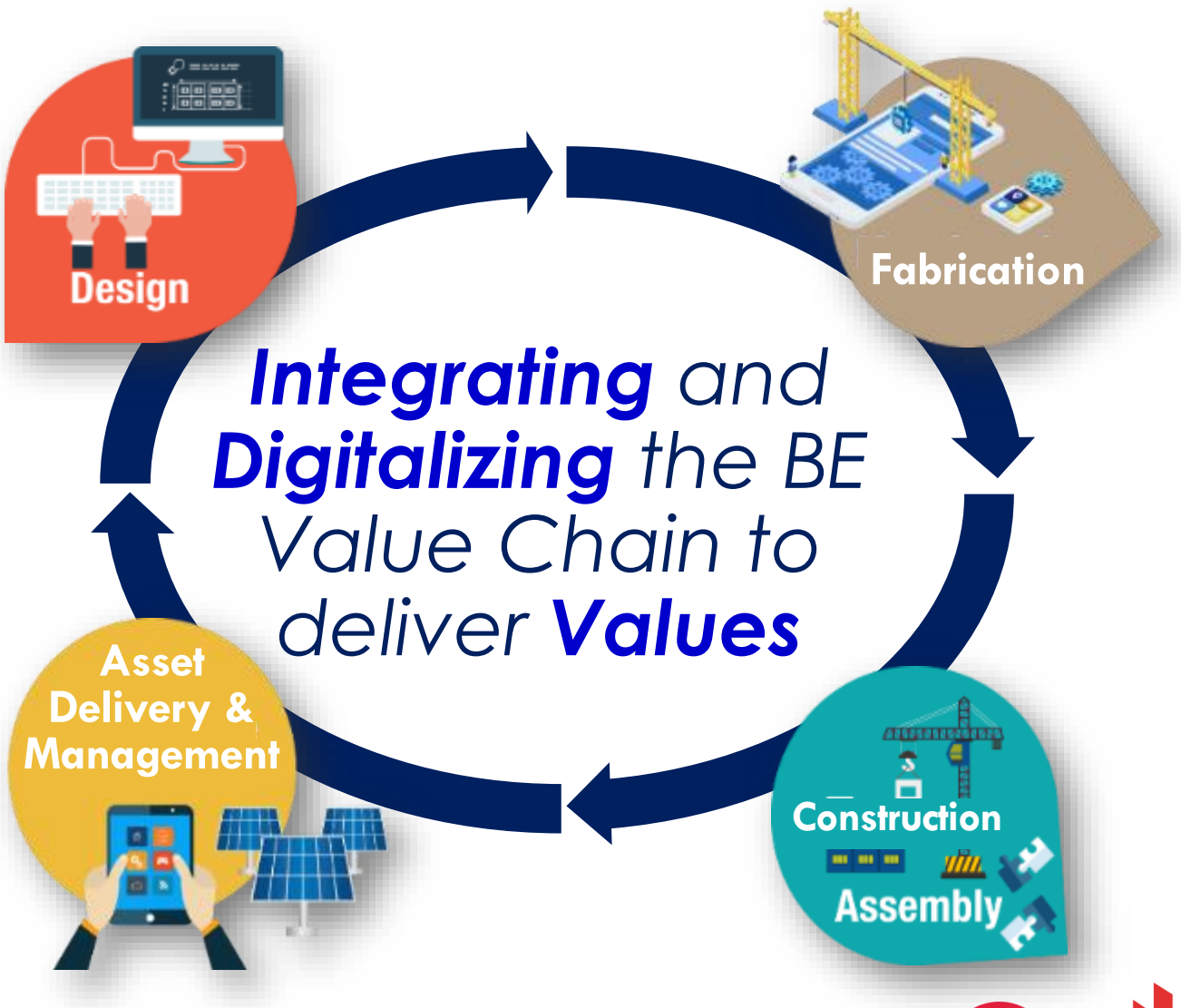
Need to integrate the BE value chain digitally to deliver values for the stakeholders



Fragmented value chain

Low level of digital adoption

**based on World Economic Forum report*



Digitalization plays a crucial role in integrating processes and connecting stakeholders across the value chain to improve overall productivity

Integrated – streamline work processes and connect stakeholders

Digital – leverage on digital data, innovation and technologies (*including BIM/VDC*)

Delivery – deliver better outcomes for users across the value chain from design to operations & maintenance

Digital Design

Engage stakeholders to achieve optimised and coordinated design that meets client's, regulatory and downstream requirements

Digital Fabrication

Translate design to standardised components for automating off-site production

***Integrating** and **Digitalising** the BE Value Chain*

Digital Asset Delivery & Management

Real time monitoring of operations and maintenance to enhance asset values

Digital Construction

Just in time delivery, installation and monitoring of on-site activities to maximise productivity and minimise rework

BuildSG BCA

Typical scope of IDD Project involves the implementation of IDD Use Cases, supported by CDE

14 IDD Essential Use Cases as a common baseline for projects embarking on IDD, based on industry practices by IDD demonstration projects

DESIGN	CONSTRUCTION & FABRICATION	ASSET MANAGEMENT
1. Digital Request for Information (RFI) 2. Integrated Concurrent Engineering (ICE) meetings 3. Visualisation and design checks 4. Digital submission & approval		
5. BIM-based documentation 6. BIM-based cost estimation		
	7. Digital logistics	
	8. Digital construction scheduling and sequencing	
	9. Digital progress monitoring 10. Digital QA/QC inspections	
	11. Digital defects management	
		12. Digital handover
		13. Real-time monitoring of assets performance 14. Digital operations and maintenance

Common Data Environment (CDE) refers to a digital platform used by project teams to store, share and manage data as a single source of truth for project collaboration and performance management purposes

Leading clients, contractors and consultants are already adopting IDD in their projects

Typical IDD benefits reported by projects include

Time Savings

- **75%** in design decision-making using VR
- **65%** for digital inspections
- **60%** in arriving at design decision-making through real-time rendering
- **50%** for identifying & documenting clashes
- **31%** for automated rebar modelling
- **28%** to produce shop drawings
- **21%** for RFI requests, decision-making, coordination and collaboration using CDE
- **21%** for progress payment claims using 5D BIM
- **13%** for construction documentation

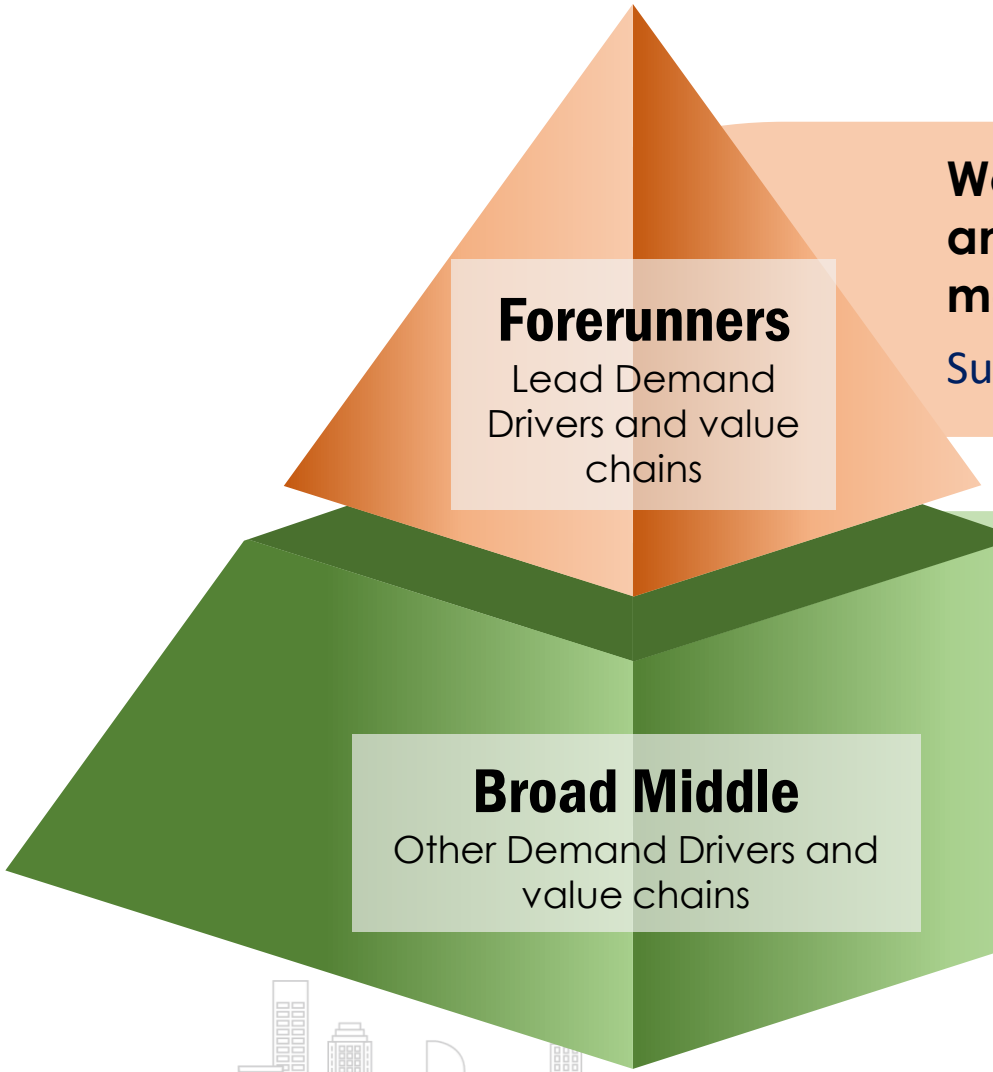
Cost Savings $$

- **70%** for material/ labour by using digital virtual mock-up
- **30%** for cutting down site reworks because of upfront design coordination
- **13%** for material wastage using model-based QTO
- **10%** in energy consumption due to real time feedback from Smart FM Platform

2 | Efforts to drive greater IDD adoption

through collaboration with leading GPEs and forerunner firms

IDD adoption to be value-driven and supported by deeper capabilities across value chain



Work with leading firms to demonstrate IDD values and set best practices to share with the rest of market

Supporting incentives/drivers: PGF/GFA/GLS

Proliferate learning from best practices established by forerunner firms, supported by technology and training providers

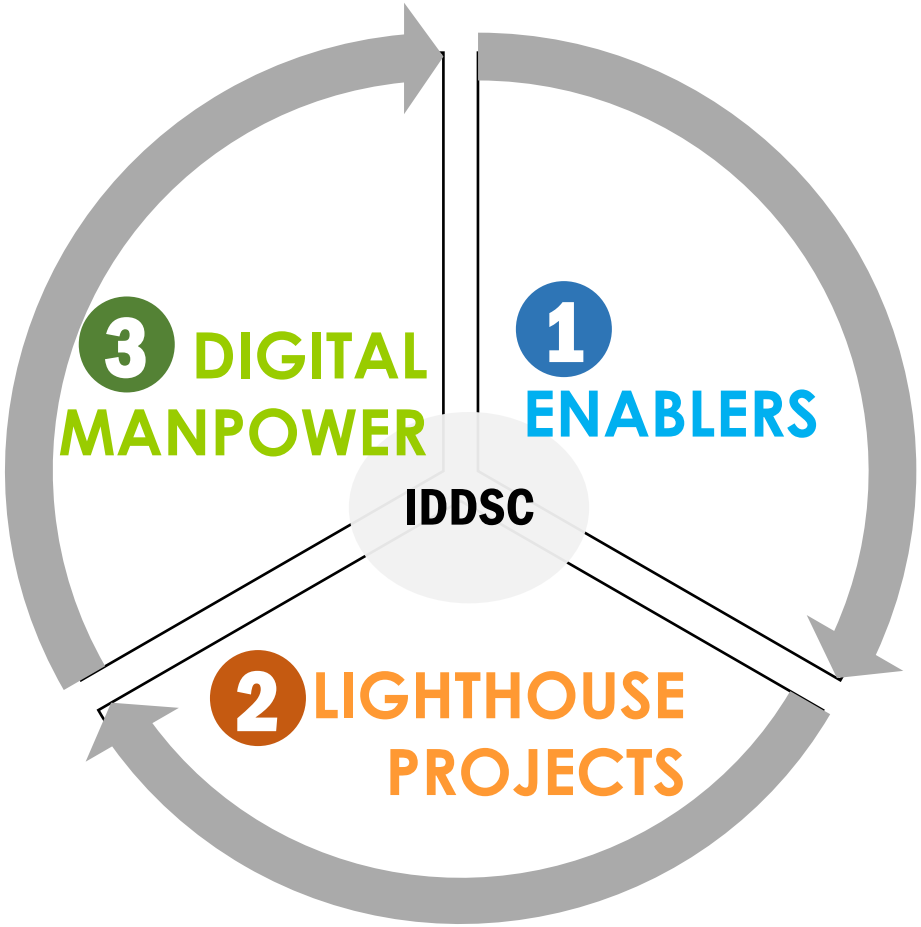
Supporting incentives/drivers: PIP, PSG

- *Productivity Gateway Framework (PGF)*
- *Bonus Gross Floor Area (GFA) Incentive*
- *Government Land Sales (GLS)*
- *Productivity Innovation Project (PIP)*
- *Productivity Solutions Grant (PSG)*

IDD Steering Committee (IDD SC) provides guidance on formulation of IDD strategies and action plans to drive greater degree of adoption in terms of breath and depth

IDDSC comprises 3 Workgroups with members from leading industry firms, TACs and IHLs

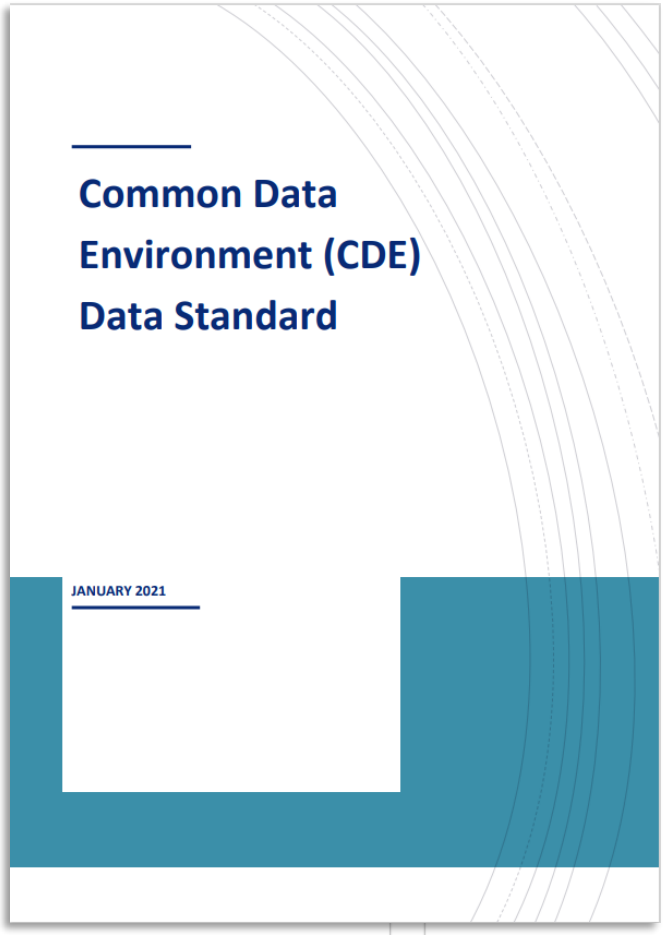
Key Efforts
- Trade-specific training
- New entrants and career conversion
- Digital Delivery Management (DDM) Accreditation



Key IDDSC Focus Areas
- CDE Data Standards
- IDD Essential Use Cases
- BIM Handover Guide
- Model Content Requirements

Key Efforts
- Best-in-class IDD practices
- Standard IDD project templates
- Client's IDD Requirements (CIR)

CDE Data Standards defines data needed for collaboration and performance management purpose over specific use cases along value chain



Common Data Environment (CDE) Data Standard*

comprises 3 components:

1. A set of **Digital Use Cases**
2. Data for performance management – **Performance Metrics**
3. Data for collaboration – **Model (BIM) Content Requirements** by building typology

** With reference to ISO19650*

Problem Statement – Today, 2D drawings still form the Contract Documents while BIM is for reference only. As a result, contractors have to recreate construction BIM from 2D drawings for tender preparation and subsequent construction purposes. This process is very inefficient.

Current Pain Points
(e.g., Build only Contract)

Pre-Tender

Tender Period

Post Tender

	Consultants Prepare and Issue 2D Tender Drawings	Tenderers Prepare Tender Proposal based on 2D Drawings	Consultants Issue 2D Construction Drawings and Contractor Create Construction BIM from 2D Drawings
Pain points	• BIM mainly for regulatory submission but not for tender • Duplicate 2D and BIM workflow • Lack of coordination • Discrepancies between 2D Drawings and BIM	• Additional time required to convert 2D drawings to BIM • Additional efforts required to clarify discrepancies between 2D drawings and BIM	• BIM issued for reference only • Consultants' BIM lacks coordination and key info • Lack of BIM handover and model quality control requirements

SCAL has requested to formalize the practice of releasing consultants' BIM to contractors as Contract Documents

To overcome the inefficiencies, there is a need to include BIM as Part of Contract Documents

Stages	Current 2D Drawings Practice	New Practice to Make BIM as Contract Documents
Pre-Tender	BIM mainly for regulatory submission and 2D drawings prepared separately for tender	Augment regulatory BIM* to form tender BIM and issue it as part of Contract Documents, supplemented by 2D details
Tender Period	Tenderers use 2D drawings for quantity calculation and construction planning; Or convert 2D drawings to BIM for quantity take-off (QTO) and construction planning purposes	Extract data from BIM for QTO and construction planning
Post Tender	Issue 2D construction drawings and contractor create their BIM from 2D drawings	Contractor further develop consultants' BIM for downstream use

Benefits

- Reduction in 2D drawings production which in turn would save time and cost
- Reduce inconsistency/discrepancy or increase accuracy
- Improve contractors understanding the scope of work clearly and better appreciate design intent
- Fully realise BIM as a Single Source of Truth for all stakeholders to collaborate

** Upcoming CORENET X will require coordinated BIM to be submitted for regulatory approval.*

BIM Handover Guide

BIM Handover Guide outlines clearly the, (1) scope of BIM that forms part of Contract Documents, and (2) a set of guidelines for preparing and issuing BIM

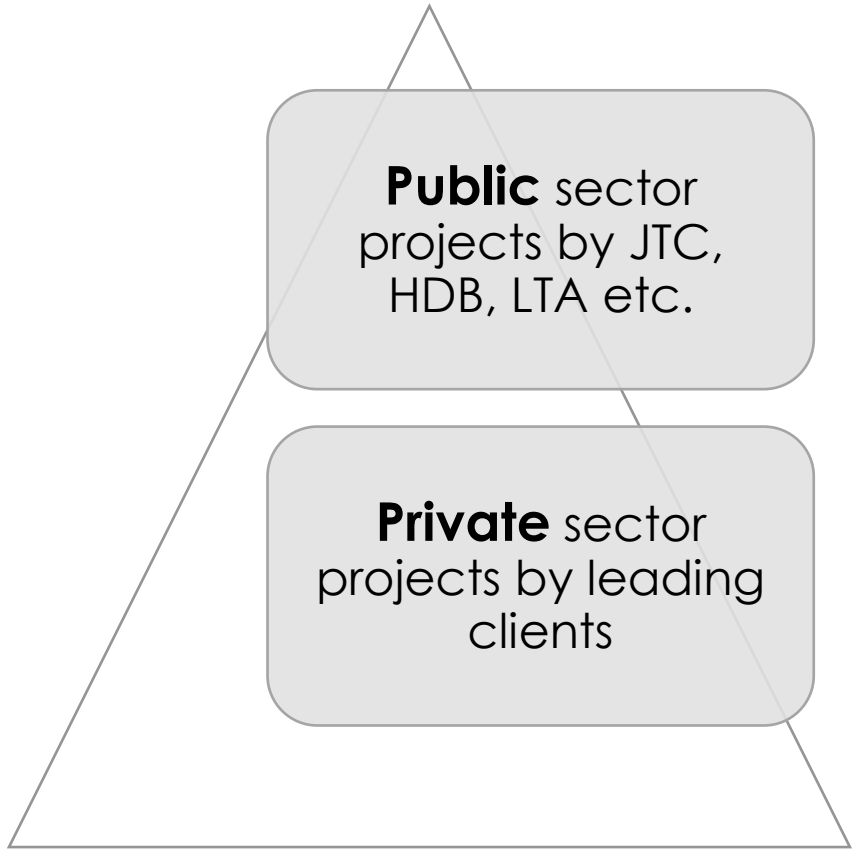
(1) Scope of BIM forms part of Contract Documents

- **Model Content –** a list of essential BIM elements and its attributes
- **2D drawings –** a list of 2D drawings generated from BIM, and non-BIM generated drawings

(2) A set of guidelines for preparing and issuing BIM

- **Modelling and Coordination Methodology**
- **Model Structure and File Format**
  - at tender stage: native or read-only format
  - at contract award: native format or OpenBIM format, if different authoring tools used by contractor
- **Model Handover Process**

Lighthouse Projects Workgroup aims to work with forerunners to demonstrate IDD values and set best practices to share with the rest of industry



1. **Best-in-class IDD practices** to proliferate learning for the rest of industry

2. **Standard IDD Templates** by commonly used CDE vendors *(Autodesk, Fulcrum, Bentley)* to allow industry to jumpstart IDD projects

3. **Client's IDD Requirements (CIR) templates** to guide clients to define their requirements

Programmes to address Digital Manpower Quality and Supply challenges

Digital Delivery Management (DDM) Accreditation

Career Pathway for Digital Professionals

- Chief Digital Officer
- Lead (Digital Delivery)
- Specialist (Digital Delivery)
- Assistant Specialist (Digital Delivery)

Programme 1

Upskill existing PMETs

↑ Quality

↑ Supply

1a. Modular BIM/IDD-based training

PMETs

1b. Redeployment Career Conversion Programme (RCCP)

2D Draftspersons

Programme 4

Improve & scale up shared services

Programme 2

Enhance domain knowledge of IHL Graduates

2a. Work-Study Diplomas

2b. Structured Internships

IHL Graduates

Mid-careerists

Programme 3

Augment supply with mid-careerists through Career Conversion Programmes (CCP)

In Summary

- Leading public and private sector clients are already stepping up to implement IDD requirements in their projects, they are focusing on deriving project benefits through IDD

- Firms should prepare themselves by developing digital capabilities, familiar with clients' IDD requirements. Funding support such as Productivity Innovation Projects (PIP) and Productivity Solutions Grant (PSG) are available

Thank you

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