

Professional Practice Forum  
PAM East Coast Chapter  
Hotel Perdana Kota Bharu Kelantan  
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# IBS and BIM - Disrupting The AEC Industry.

Speaker  
Ar Abu Zarim Abu Bakar  
PAM Deputy President/Principal AZ Rekatelier

# The Principal of AZ REKATELIER

Upon graduation, he worked for 4 years at two of London's established architectural firms - Llywellyn Davies Weeks and Clifford Tee + Gale before returning to Malaysia to join the private sector.

Soon after, he set up AZ Rekatelier in 1993. Now, over accumulated 30 years of experience in commercial, residential, condominium and institutional development, he has devoted much of his time at Pertubuhan Akitek Malaysia. Serving at various positions since becoming a council member in 2004. and he is currently PAM Deputy President.

Ar. Abu Zarim bin Abu Bakar together in collaboration with several other design professionals is now able to offer many years of experience - locally and abroad - in the design and building professions.



## Ar. Abu Zarim Abu Bakar

Deputy President, Pertubuhan Akitek Malaysia – 2019/2020  
President, Balai Ikhtisas Malaysia (BIM) -2019/2020

## AZ REKATELIER

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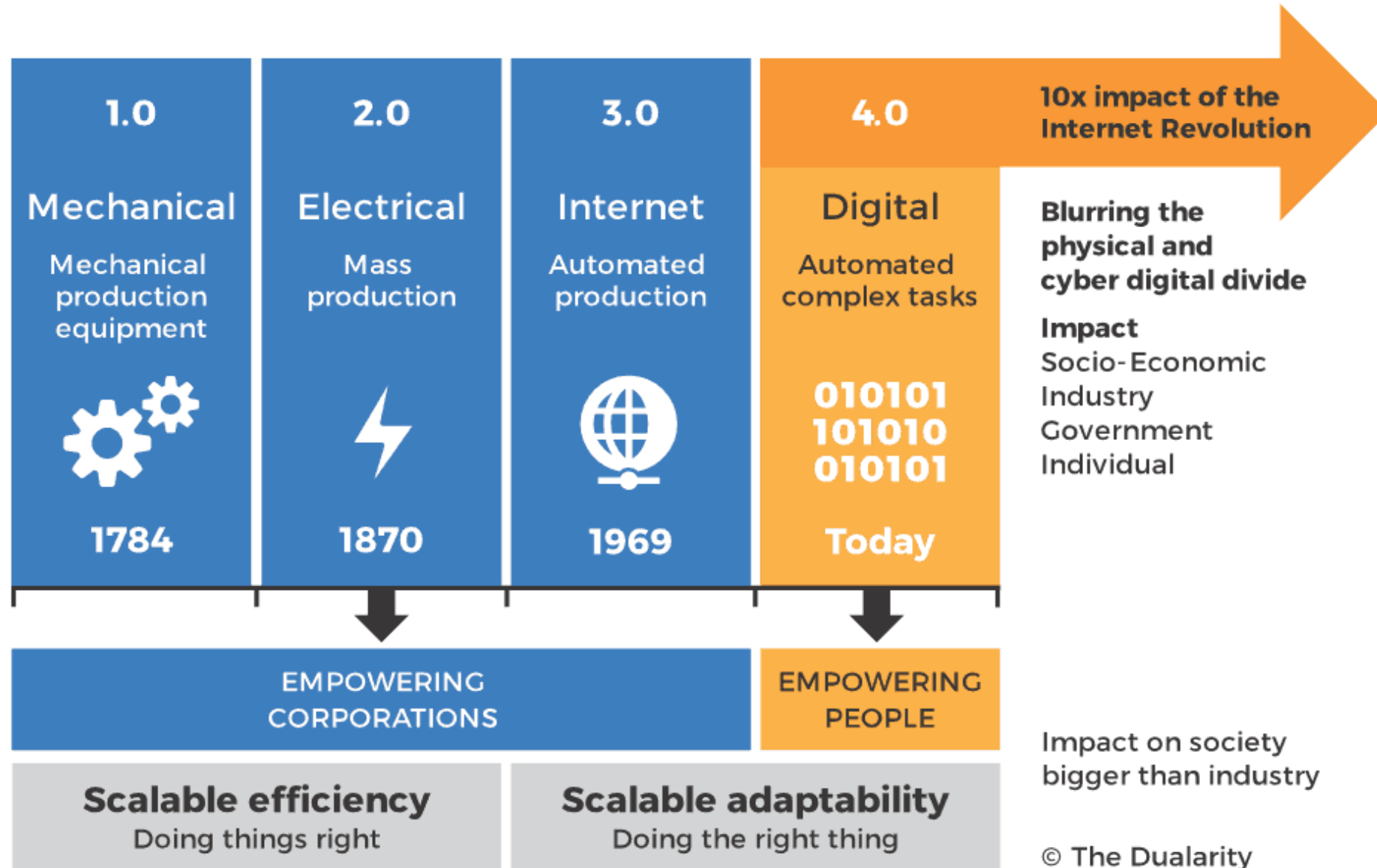
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# INDUSTRY

- (IR 4.0) is expected to change
  - how we live, work, and communicate,
  - the things we value,
  - the way we value them in the future,
  - changing business models and employment trends



# Background of the Industrial Revolutions



# The Industry 4.0 Environment

## The Industry 4.0 Environment

**Automation and artificial intelligence** are change agents in IR 4.0 that will make certain groups of employees redundant, replacing them with new workers with the needed skills or with machines that do the job cheaper.

Gone are the days where students go to college or university to study for a degree that will set them up with a job for life.



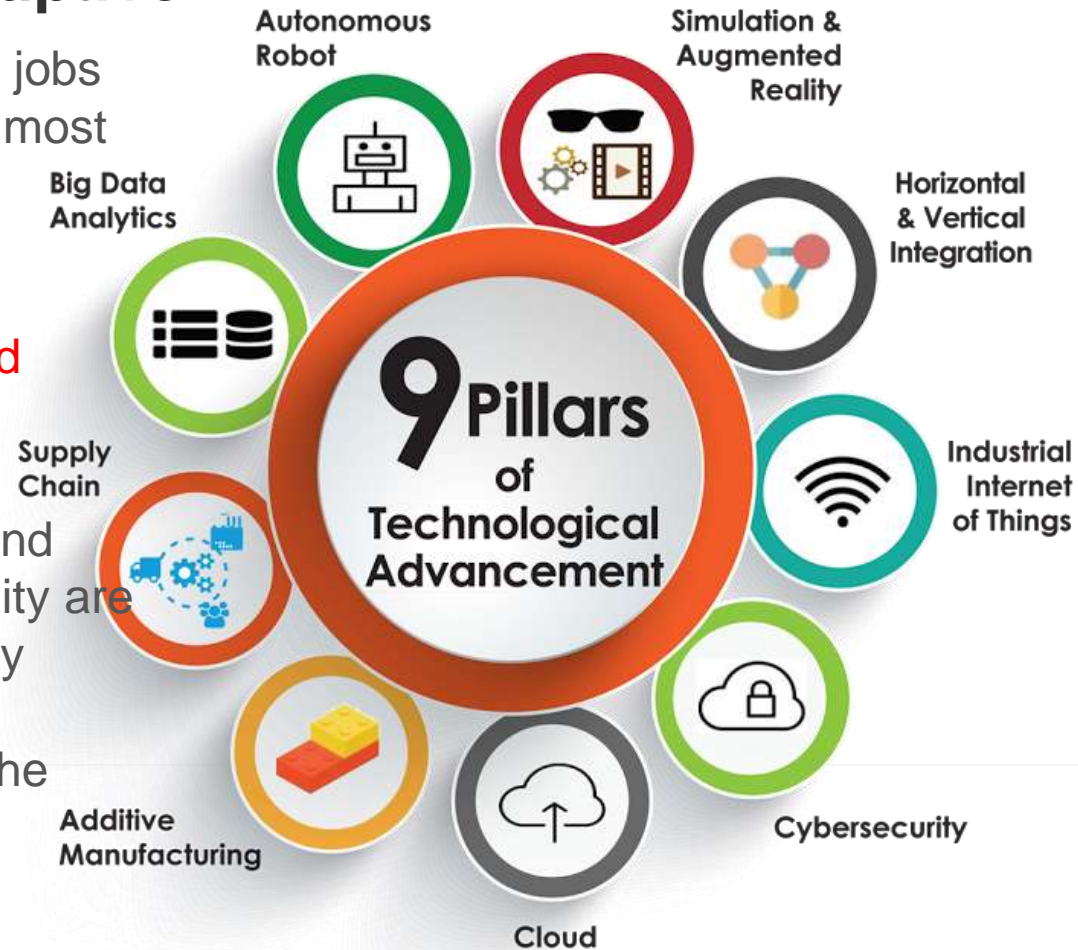
## 9 Technology Pillars – Industry 4.0

### Revolutions are disruptive

With technological advances, jobs with these three qualities are most likely to be automated:

- repetitive
- based on rules
- involve limited or well-defined physicality

So if jobs that are repetitive and which involve limited physicality are most likely to be taken over by robots, which type of jobs will continue to be in demand in the world of 4IR?



three key areas where humans beat machines that are key to future job creation:

- creative endeavours**—everything from scientific discovery to creative writing and entrepreneurship
- social interaction**—robots just don't have the kind of emotional intelligence that humans do
- physical dexterity and mobility**—millennia of hiking mountains, swimming lakes and dancing practice gives humans extraordinary agility and physical dexterity

## Industry 4.0: Why we need it?

With the availability of cloud computing and the sophistication of analysis, all of that 'big data' can be used to make better informed decisions.

### Cost

- Eliminate waste & losses
- Eliminate hidden cost
- Cost reduction

### Complexity

- Sub-Nano technology
- Cyber Physical System
- Exponential technologies



- Personalize
- Fast, Cheap, Quality
- Total Customer Satisfaction

### Customer

- Digitalization
- Increase competitiveness
- Globalization

### Competition

In USA alone, value of Industry 4.0 at \$15 trillion of global GDP by 2020

## Industry 4.0: Workforce Transformation (Malaysia)

### CURRENT

High Skilled Technical (Engineer)

Mid Skilled  
(Technician)

Low Skilled  
(Operator)

Local

Foreign

Local

Foreign



### INDUSTRY 4.0

High Skilled Innovator (Engineer)

Local (Existing)

Local (Upgrade)

Robotics

Automation

Mid Skilled  
(Specialist)

Low Skilled  
(Operator)

- Industry 4.0 will eliminate our dependency on Foreign labour workforce
- Industry 4.0 will provide platform for job upgrade on existing local workforce



# Construction 4.0

Construction 4.0 is the construction industry's version of Industry 4.0. It represents the digitization of the construction industry.

Technologies like robotics, 3D printing, machine learning, and AI are gradually being introduced to the sector, which while exciting, represents changes that teams will need to understand.

# Construction 4.0



Procurement teams will need to consider pre-fabrication and 3D printing along with traditional sourcing methods.

Virtual and augmented reality and connected equipment will enter the mix. And, like every other industry, big data will become mandatory.

# Construction 4.0

Pre-fabrication & modular construction 1

Advanced building materials 2

3D printing & additive manufacturing 3

Autonomous construction 4

Augmented reality & virtualization 5

Big data & predictive analytics 6

Wireless monitoring & connected equipment 7

Cloud & real time collaboration 8

3D scanning & photogrammetry 9

Building Information Modeling 10



# Industrial Building Systems, Prefabrication & Modular Construction

## Modularisation

Modularisation is a construction method where an entire unit of a building is constructed off-site, rather than smaller, structural components as with panelisation.

## Prefabrication

Prefabrication, or “Prefab” for short, is a broad category that refers to a construction process where some building elements are built off-site and when completed, shipped to a construction site for installation on that site.



# Design on system & components of IBS

## **IBS Definition**

*The system or method of construction of buildings whose components are produced in **controlled conditions** (in factories or on construction sites), transported and installed in construction works with a minimum use of workers on site.*

*- CIDB 2003*

## **IBS Explanation**

*Building construction system whereby components are manufactured at its production premises and later installed on site.*

# Design on system & components of IBS

## ***Open IBS Construction***

*All components of IBS can be used from a variety of IBS manufacturers to build a building.*

## ***Closed IBS Construction***

*Manufactured building components which are proprietary components for a building is produced from a IBS manufacturer.*

# Design on system & components of IBS

## *IBS Categories*

*IBS is divided into 6 categories:*

- 1. Precast Concrete*
- 2. Block*
- 3. Steel Framing*
- 4. Timber Framing*
- 5. Reusable Formworks*
- 6. Innovative / Composite Systems*

## Components of IBS

### Materials

Concrete

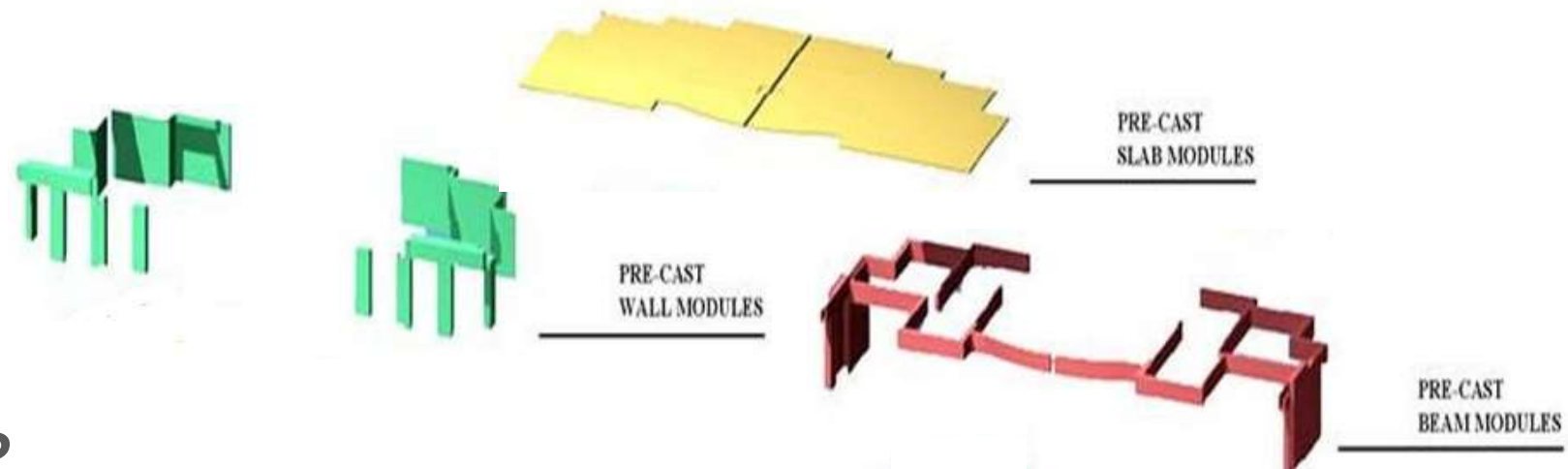
- Precast structure component
- Column
- Beam
- Slab
- Staircase
- Precast concrete connection

Timber

- Tangga
- Penyambung konkrit pratuang

Steel

Composite

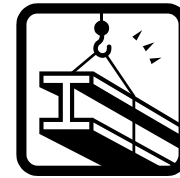




## *What is IBS Score?*



*A structured and systematic assessment system.*



*Used for measuring usage content of IBS component utilisation in a building project.*






## *Content of CIS 18 : 2018*

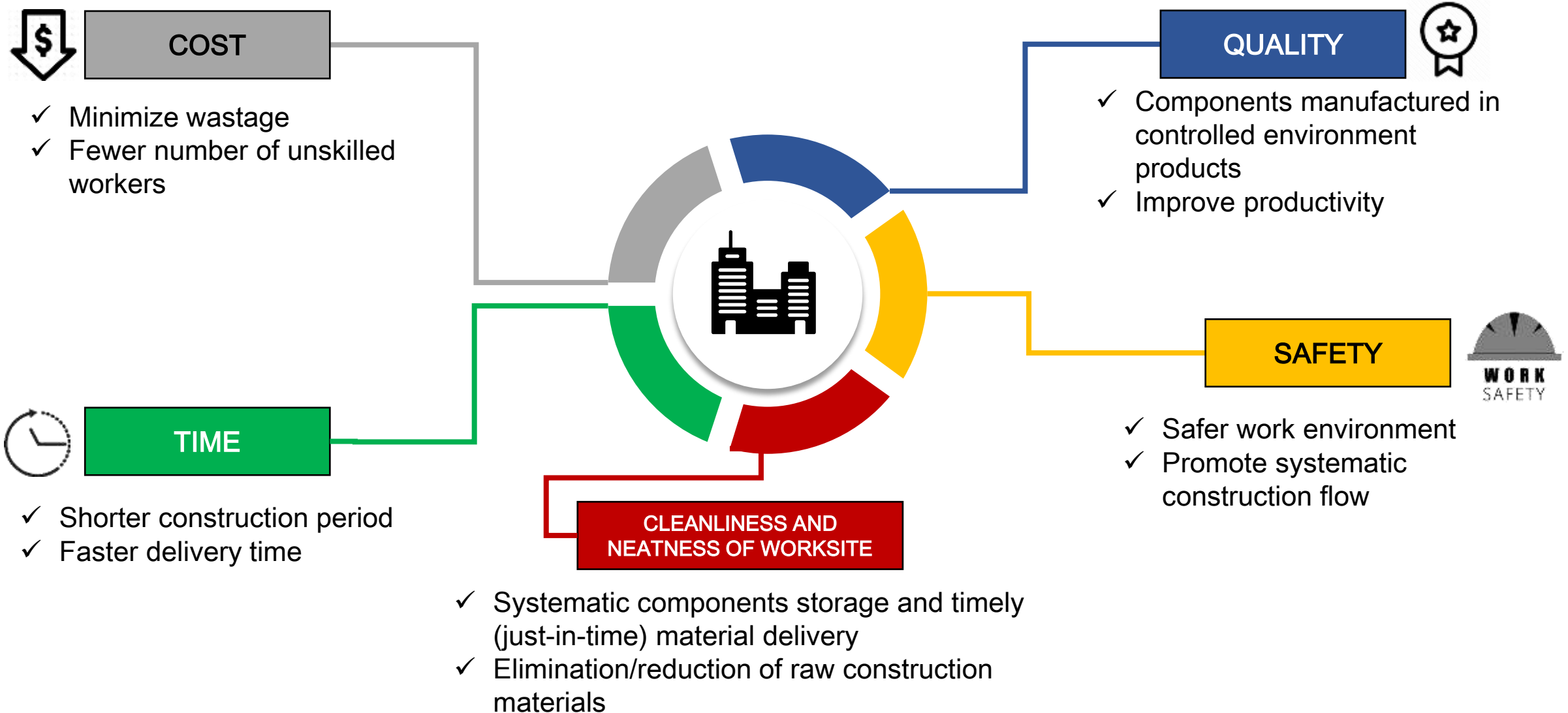
- *The IBS Score formula;*
- *The IBS Factor for each of the elements used in the building;*
- *Methods for calculating the IBS Score;*
- *Explanatory notes; and*
- *Sample calculations.*

# Architectural Design: Compatibility

## *IBS Score Principles*

-  *The usage of prefabricated components*
-  *Usage of standard components based on sizes in Malaysia Standard MS 1064*
-  *Repetitive design*

# BENEFITS OF IBS



# IBS POLICY

## GOVERNMENT SECTOR

-Surat Pekeliling  
Perbendaharaan Bil.  
7 tahun 2008

## PRIVATE SECTOR

- Pekeliling KSU  
KPKT – Mewajibkan  
Penggunaan  
Kaedah IBS  
Sebagai Salah Satu  
Syarat Kelulusan  
Pelan  
Bangunan Oleh PBT

Projek kerajaan yang  
bernilai **RM10 Juta**  
dan ke atas wajib  
mencapai minimum  
**70 IBS Skor** sejak  
dari 2008

Projek swasta yang  
bernilai **RM50 Juta**  
atau **50,000m<sup>2</sup>** dan  
ke atas wajib  
mencapai minimum  
**50 Skor IBS**



# HISTORY OF IBS PROJECTS IN MALAYSIA

KLIA



KLCC



1967

1993

1996

1997

2014



PEKELILING FLATS

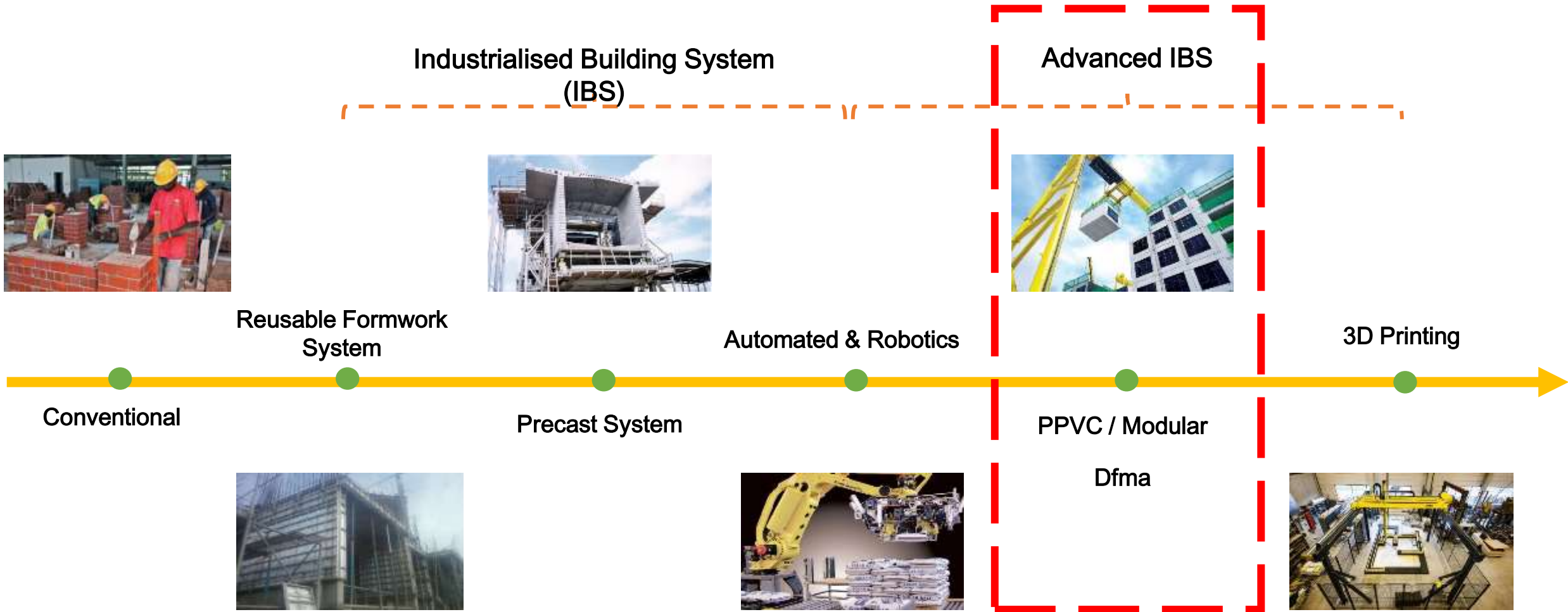


STADIUM BUKIT JALIL



KLIA2

# REVOLUTION OF CONSTRUCTION TECHNOLOGY IN MALAYSIA



# DFMA : Beyond IBS

**Industrialized Building System (IBS) is the driver that brings the Malaysian construction industry towards modernization which could contribute to the economy and productivity. This transformation can be achieved through the evolution of IBS process.**

**IBS method has been practiced in Malaysia for quite some time and there are a lot of local IBS producers that have moved towards Prefabricated Prefinished Volumetric Construction (PPVC) manufacturing.**

**This method is faster and more productive compared to conventional construction that uses component method. The construction evolution has been developed into modular and PPVC which are useful in transforming Malaysia construction industry.**



# DFMA : Beyond IBS

The main objective of the talk is to inform the industry stakeholders – developer, manufacturer, contractor, consultant, MEP, architect – of Design for Manufacturing and Assembly (DfMA) as well as to encourage the use the DfMA concept in house manufacturing.

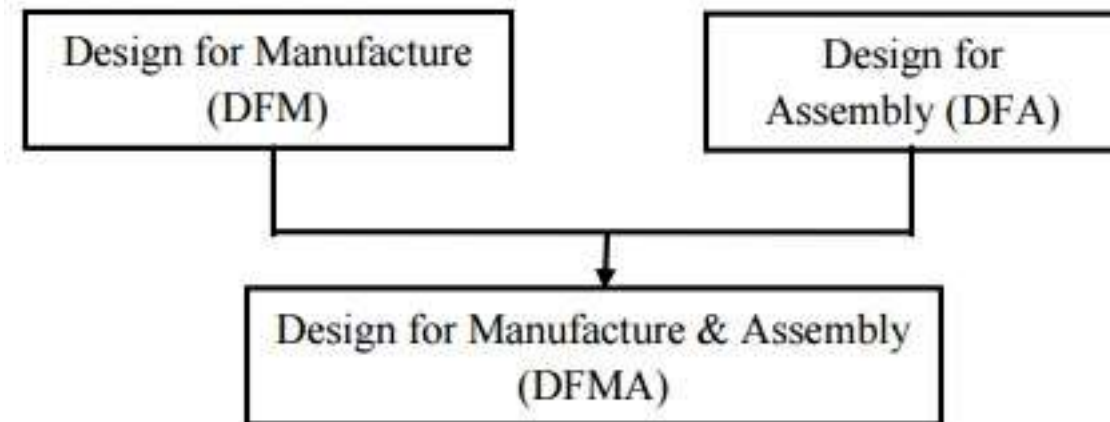
# Design Philosophy: Design for Manufacture and Assembly (DFMA)

**DFMA** stands for **Design for Manufacture and Assembly**.

is the combination of **2**  
**methodologies**;

**1. Design for Manufacture**,  
which means the **design** for ease  
of **manufacture** of the parts that will form a  
product, and

**2. Design for Assembly**,  
which means the **design** of the product for  
ease of **assembly**



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

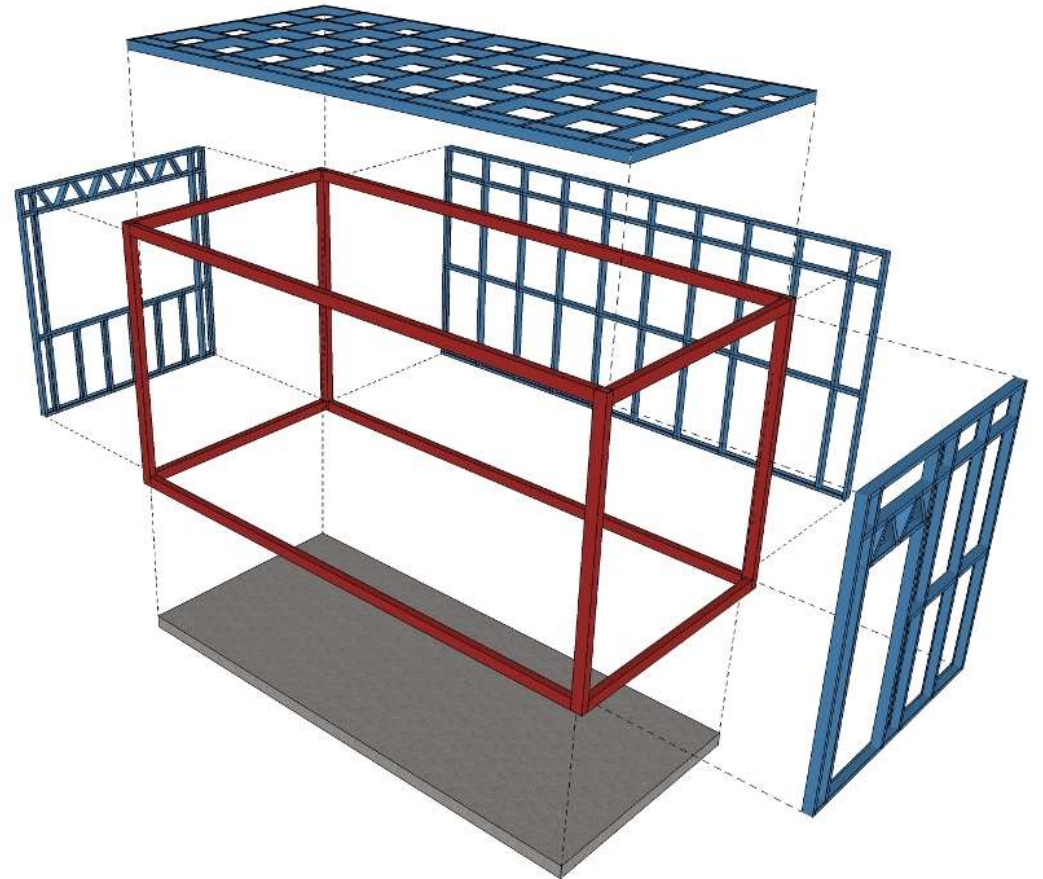
What are the **key principles of design** for manufacturing and assembly?

## 1. Minimise the number of components:

Thereby reducing assembly and ordering costs, reducing work-in-**process**, and simplifying automation.

## 2. Design for ease of part-fabrication:

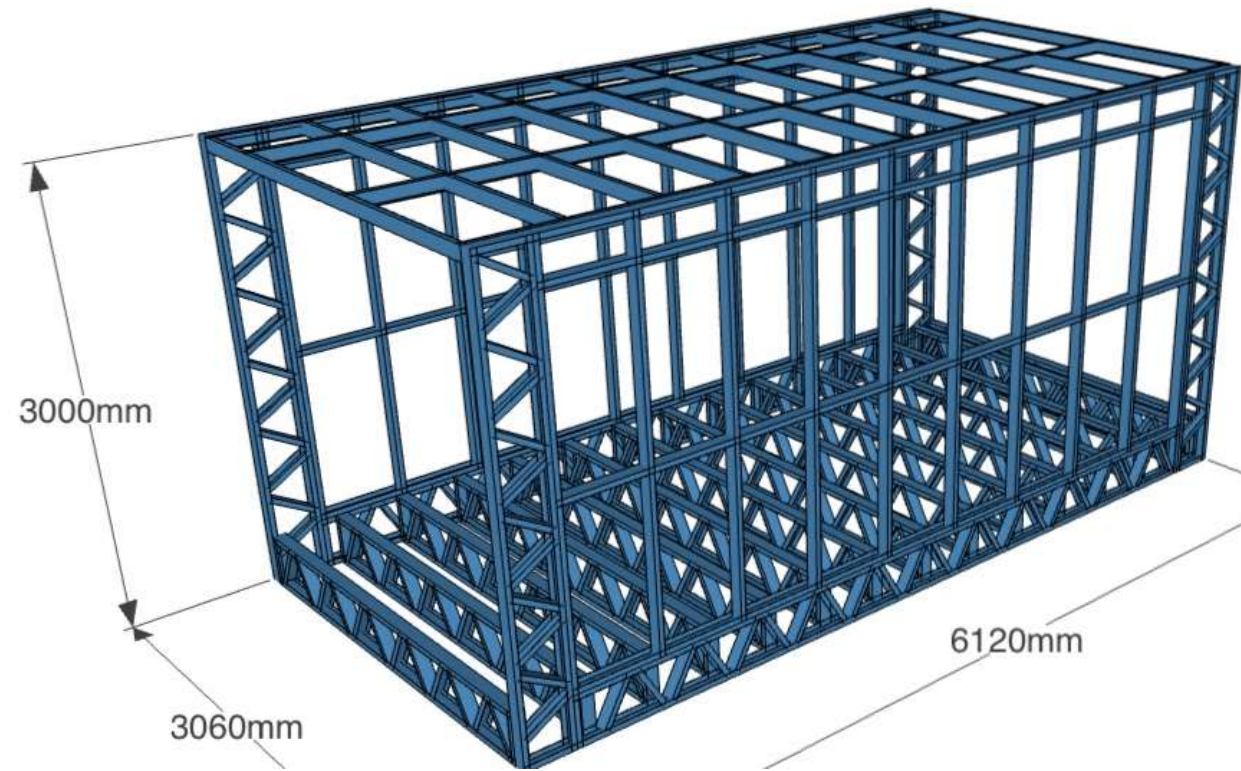
The geometry of parts is simplified and unnecessary features are avoided.



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## The main principles of DfMA are:

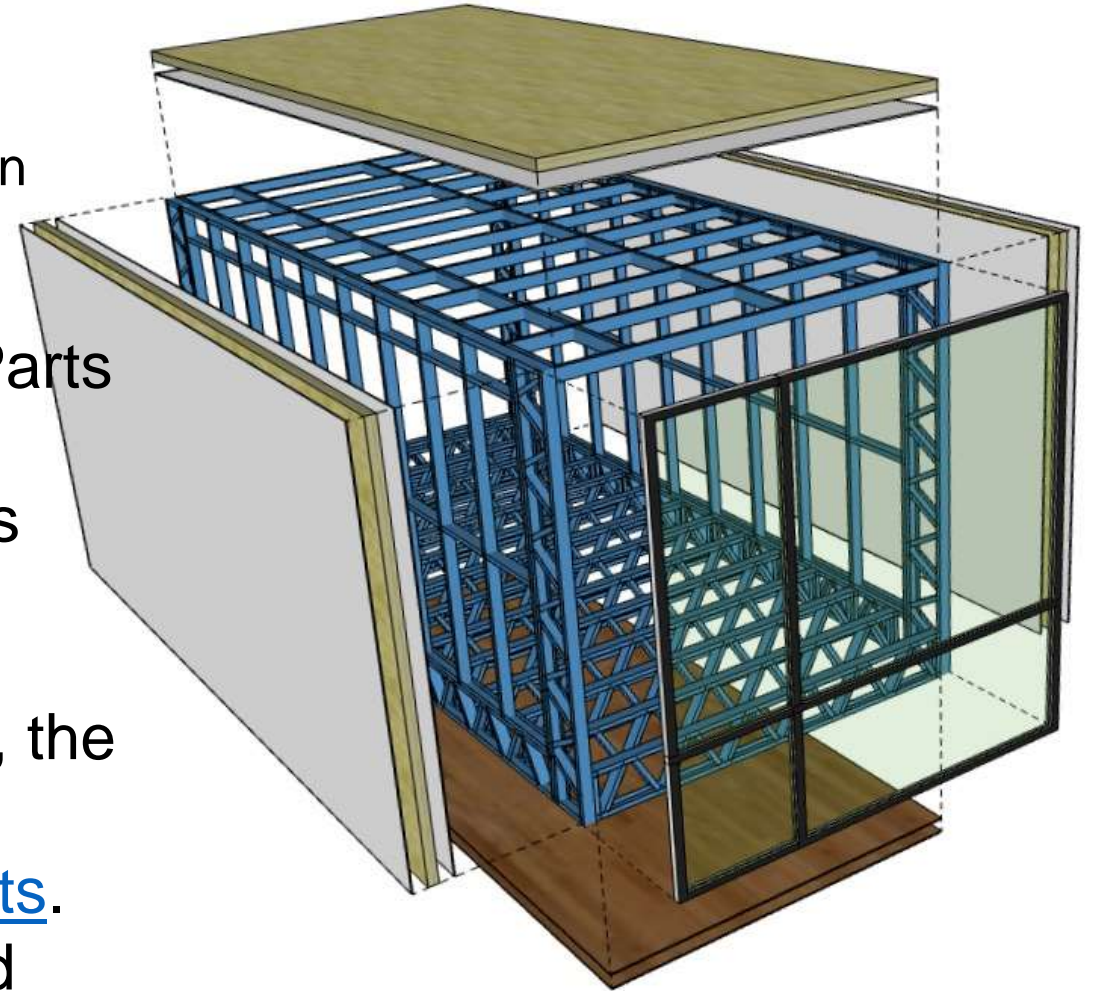
- 1 Minimise the number of components:  
Thereby reducing assembly and ordering costs, reducing work-in-process, and simplifying automation.
- 2 Design for ease of part-fabrication: The geometry of parts is simplified and unnecessary features are avoided.
- 3 Tolerances of parts: Part should be designed to be within process capability.



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## The main principles of DfMA are:

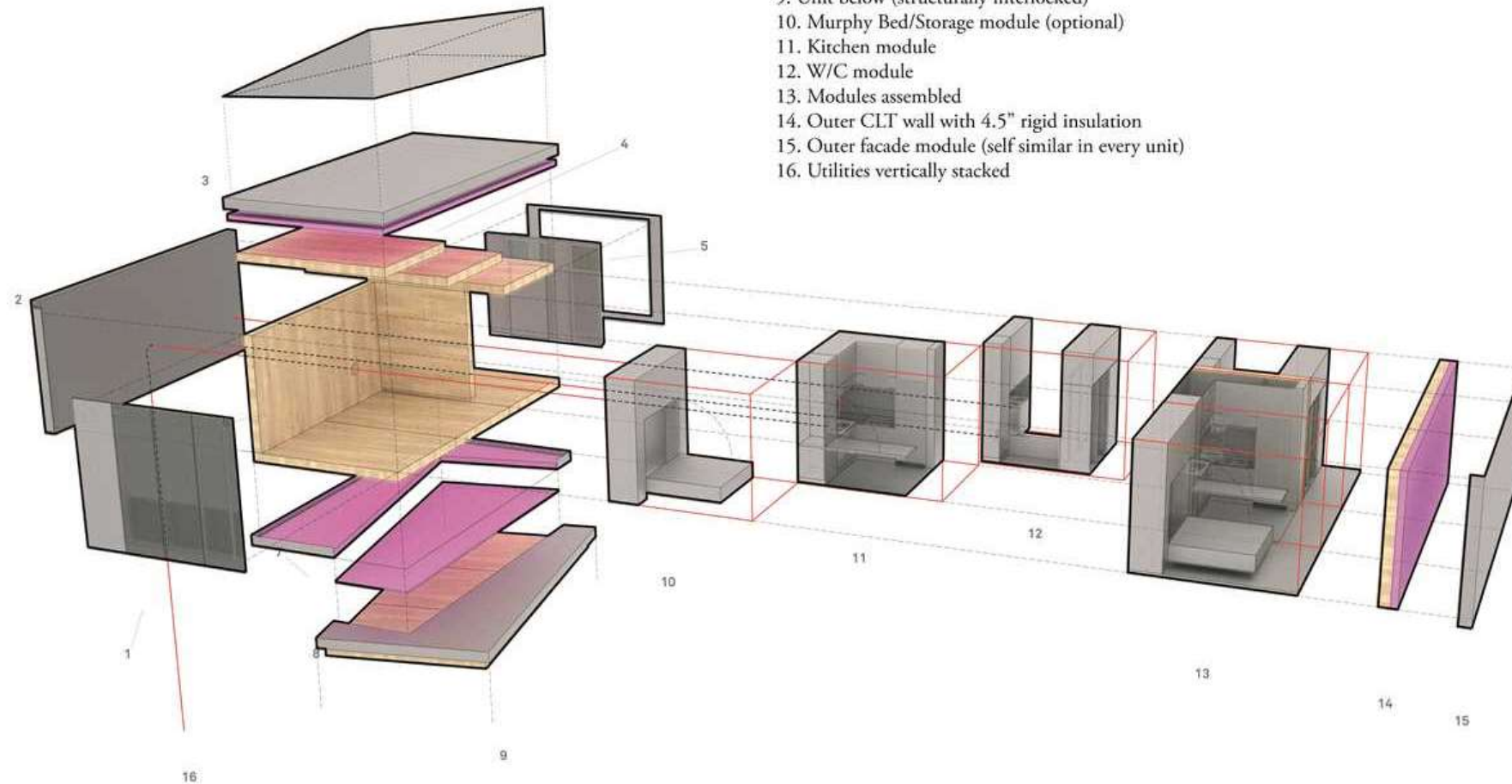
- 4 Clarity: Components should be designed so they can only be assembled one way.
- 5 Minimise the use of flexible components: Parts made of rubber, gaskets, cables and so on, should be limited as handling and assembly is generally more difficult.
- 6 Design for ease of assembly: For example, the use of snap-fits and adhesive bonding rather than threaded fasteners such as nuts and bolts. Where possible a product should be designed with a base component for locating other components quickly and accurately.



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

following is an explosion of the Bachelor unit.

2. Utility Core
3. Roof pan with 4.5" rigid insulation (this piece is altered if attached to a unit above)
4. CLT Timber ceiling panels
5. Entry Facade module
6. Structural Mass Timber cell
7. Soffit pan with 4.5" rigid insulation (this piece is altered if attached to a unit below-as drawn)
8. Vibration pad isolating interlocked units
9. Unit below (structurally interlocked)
10. Murphy Bed/Storage module (optional)
11. Kitchen module
12. W/C module
13. Modules assembled
14. Outer CLT wall with 4.5" rigid insulation
15. Outer facade module (self similar in every unit)
16. Utilities vertically stacked



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## The main principles of DfMA are:

- 7 Eliminate or reduce required adjustments: Designing adjustments into a [product](#) means there are more opportunities for out-of-adjustment [conditions](#) to arise.



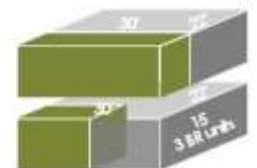
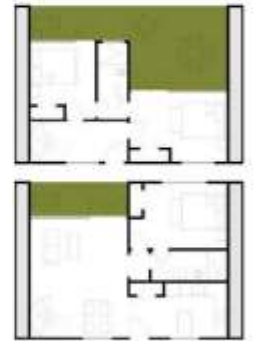
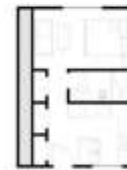
**clt shear wall**  
the vertical structure of the residences allows for modular building and layout in addition to vertical growing walls.



**clt floor slab**  
spanning in between the shear walls, a clt floor slab allows for a uniform floor sandwich and encourages the modular residences.



**waffle slab**  
in order to increase spanning widths, the waffle creates spans ideal for the open plans of shop production and is a great interest as a storefront.



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## Advantages of DfMA

Some of the main advantages of DfMA include:

### 1. Speed

One of the primary advantages of DfMA in construction is the significantly reduced programme on-site through the use of prefabricated elements.

### 2. Lower assembly cost

By using fewer parts, decreasing the amount of labour required, and reducing the number of unique parts, DfMA can significantly lower the cost of assembly.

### 3. Higher quality and sustainability

A highly automated approach can enhance quality and efficiency at each stage. There may be less waste generation in the construction phase, greater efficiency in site logistics, and a reduction in vehicle movement transporting materials to site.



# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## Advantages of DfMA

Some of the main advantages of DfMA include:

### 4. Shorter assembly time

DFMA shortens assembly time by utilising standard assemblypractices such as vertical assembly and self-aligning parts. DFMA also ensures that the transition from the design phase to the production phase is as smooth and rapid as possible.

### 5. Increased reliability

DfMA increases reliability by lowering the number of parts, thereby decreasing the chance of failure.

### 6. Safety

By removing construction activities from the site and placing them in a controlled factory environment there is the possibility of a significant positive impact on safety.

# Design Philosophy: Design for Manufacture and Assembly (DFMA)

## System

Regular parts, irregular assemblies



Bachelor  
timber: 32.2 m<sup>3</sup>



1 BR.  
timber: 55 m<sup>3</sup>



2-3 BR.  
timber: 79 m<sup>3</sup>

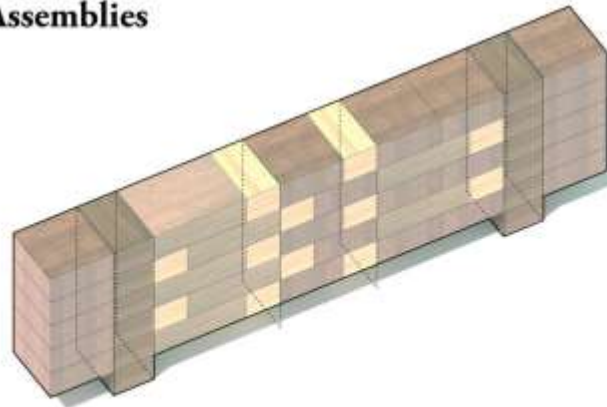


Core  
timber: 27.2 m<sup>3</sup>

01  
Timberlink  
System

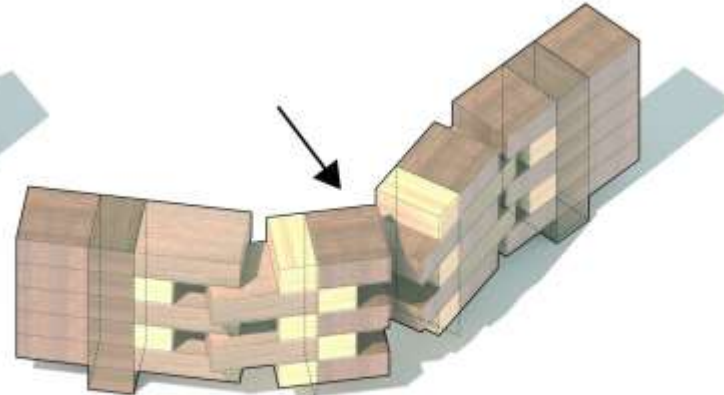
## Parts

### Assemblies



**Increase**

Constructional regularity through modularization.



**Decrease**

Spatial regularity by deforming arrangement to site.

\* 900kg CO<sub>2</sub> / m<sup>3</sup>. Measuring Impregnated and Embedded CO<sub>2</sub> within Cross Laminated Timber (CLT) - Alliance for Sustainable Building Products, 2013.

**128 room hotel  
assembled in just 6 days.**



# PREFABRICATED PREFINISHED VOLUMETRIC CONSTRUCTION (PPVC)

"Prefabricated Prefinished Volumetric Construction (PPVC)" means a construction method whereby **free-standing volumetric modules** (complete with finishes for walls, floors and ceilings) are:

- a) constructed and assembled
- b) manufactured and assembled

in an accredited fabrication facility, in accordance with any accredited fabrication method, and then installed in a building under building works (BCA, 2014)



Source: Alter, 2014



Source: BFT International (2015)



Copyright CIDB, CREAM & EJA (2018)

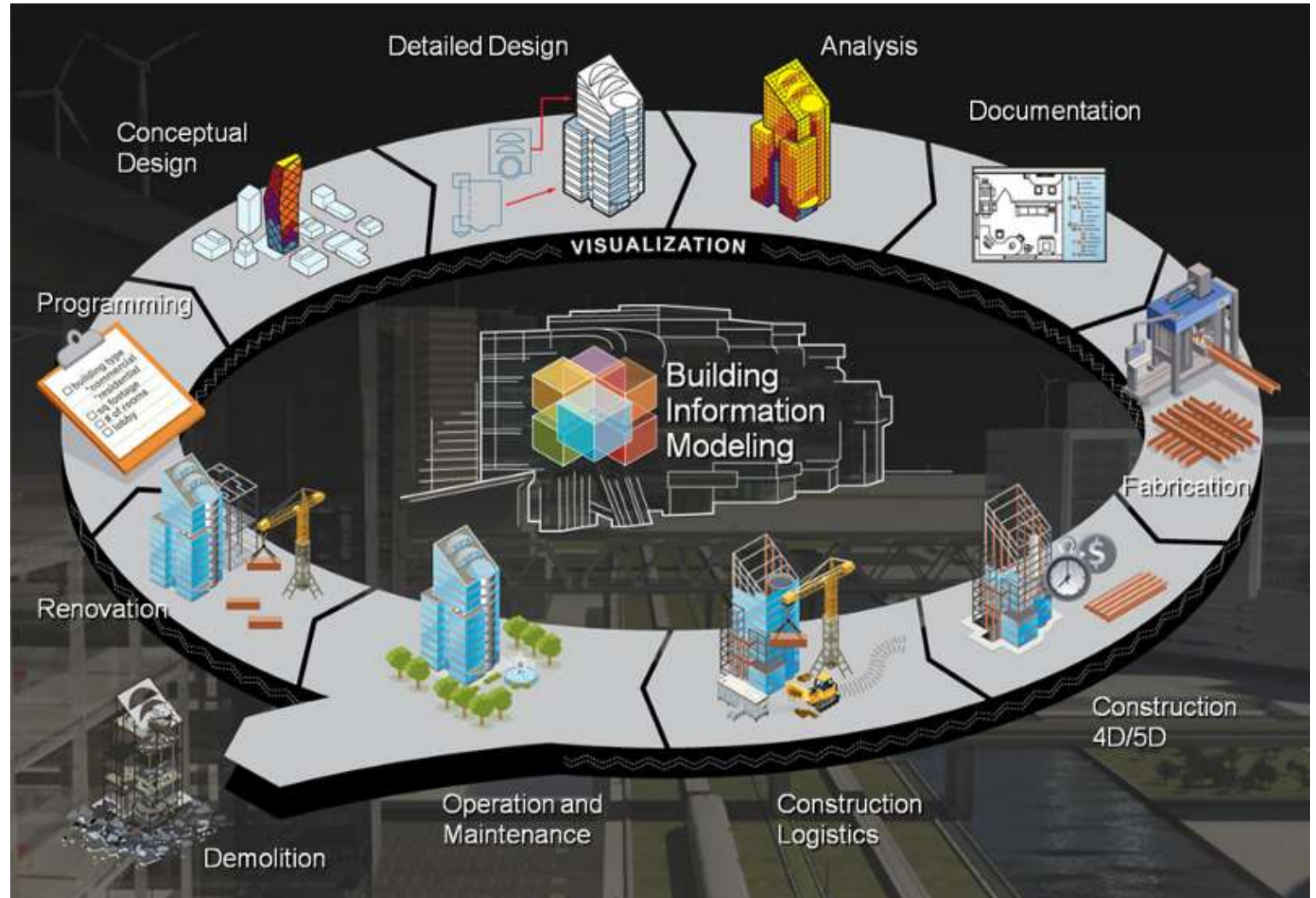
# BUILDING INFORMATION MODELLING (BIM)



# OVERVIEW OF BUILDING INFORMATION MODELLING (BIM)

BIM is a way of doing business; a method of collaboration between architects, engineers, manufacturers, developers and contractors that improves the efficiency and accuracy of the design, construction and management of construction projects.

A project life-cycle system that results in a virtual information model passed from the design team (architects, surveyors, engineers, etc.) to the contractor, to the subcontractor and then on to the owner, BIM's strength lies in its ability to identify conflicts upfront, which in turn eliminates cost prohibitive changes required later on in the construction process.



- **BIM is a process where digital tools are used to design, or develop where tasks are virtualised efficiently and with minimal errors**

**To summarise**

**BIM is a process where digital technologies are used to improve in what we loved doing most ie ARCHITECTURE**

# What is BIM?

- **BIM is a process where information drawings & technical elements are initially, stored generated from a template & schedule**

BIM, where are we,  
globally?



# Current BIM adoption around the world



## MALAYSIA

- BIM Level 2 project implementation by 2020
- Government project over RM100 million to implement BIM by 2020
- Contractor to adopt BIM for private projects over RM100 million
- BIM model building plan submission (NBeS) approval by 2020
- BIM model BOMBA submission (NBeS) approval by 2020
- Integrated GIS & BIM in design and construction implemented for Pan Borneo Highway
- JKR BIM standards, specification, facility management in place since 2016
- CIDB BIM guides, sample BEP , object libraries available for download

Planning on BIM adoption



# BIM – digital data

BIM is the first step in this evolution by attempting to create a central repository to collate digital information about a project or asset.

## **The value of digital data**

A key component of BIM 4.0 is digital data. With increased access to accurate, real-life data throughout all stages of an asset's lifecycle – from design through to construction and maintenance – time and cost efficiencies can be found and errors reduced. The benefits of digital data are already being seen to a degree through initial adoption of BIM.

The Big BIM issue:

**The output of the design is not drawings. It is the information that is represented on the drawings. The 'drawings' are a representation of multiple information models that support the design and construction workflow.**

### **Trust & Collaboration**

The availability of digital data, whilst significant, is only a small step in bridging the gap between the analogue ways of working of the past and the construction industry's digital future.

A common understanding of how the potential of BIM can be maximized and a joint effort to implement it will have a dramatic impact in bringing forward Industry 4.0.

In practice this means all parties involved in a project – from design, planning, construction and maintenance – are working from and feeding into the same BIM data environment rather than working with segregated models or collecting data that is used in isolation.

This requires an unprecedented level of collaboration and trust.

# The Importance of BIM

- Building Information Modeling (BIM) is a building design method that uses a database of coordinated, graphically rich, internally consistent, computable information in three-dimensional models for design, engineering, construction and construction.
- ***BIM will permanently change the AEC professions***
- Including universities, clients, design codes, contracts, insurance policies, global recruitment of staff, work process and many other aspects.

- Develop BIM office BNA condition for projects form

## How to BIM your office?

- Develop your office BIM Evaluation metrics (COE) for collaboration & file management

# How to select a suitable BIM authoring tool

# BIM authoring tools

- What are the basic selection criterias?
  - Are the capabilities of the software sufficient with the experience and training of the staff?
    - Do I need to buy other collaboration tools or do I need to buy other addon tools?



What are the CDE  
selection options for  
collaboration & file  
management?



# CDE

- **CDE** is the single source of information used to collect, manage and disseminate documentation, the graphical model and non-graphical **data** for the whole project team (i.e. all project information whether created in a BIM **environment** or in a conventional **data** format)
  - What are the options? Local host server or Cloud server?
  - How do I access my BIM model remotely?
  - Does my authoring tool come with collaboration functions and which CDE options support these functions?

# CDE

- Examples of Cloud Storage service providers



- Google drives comes with free usable collaboration tools
- One drive works with Microsoft products which requires yearly subscription
- Dropbox requires yearly subscription for team collaboration tools

# How to develop your office BIM collaboration and work processes

# BIM collaboration & work processes

- Select a BIM software that comes with team collaboration functions
  - The Architects are able to collaborate and work on one BIM model file therefore minimise design & drawing errors

## BIMcloud – Teamwork for Architects



To develop your  
BIM project execution  
plan



# BIM project execution plan

- BIM PEP are a life document executed during the course of the design and construction to ensure all stakeholders follow the written plan

A standard document shall outline the following framework:-



1. Project information
2. Project personnel contacts & roles
3. Project BIM goals and uses
4. BIM role definition & responsibilities
5. Level of development
6. Information & model sharing
7. Model & information quality control

# BIM staff training, evaluation & training resources

# BIM staff training, evaluation and training resources

- Conduct a BIM competency review at least twice a year either by the BIM project architect or individual self assessment
- Create a BIM Staff Assessment & Evaluation Form
- Conduct BIM training as required to improve BIM authoring tool skills, teamwork & management skills, knowledge on BIM related technologies
- Compile training materials, youtube training links & faq database for staff training or reference when they are unable to resolve some modelling issues
- Lastly, identify BIM champion in the office and potential BIM champions so there are BIM succession in the event that the champion resign



# Competition

**‘Look around you. The architects, surveyors and engineers that you know so well are trying to take the food off your table. They may be your friends, but they are also your competitors.’**

Justin King

‘The most meaningful way to differentiate your company from your competition...is to do an outstanding job with information.

**How you gather, manage and use information will determine whether you win or lose’**

Bill Gates



In ~~CLOSING~~

- We are at the start of the DIGITALISATION journey
- The technology will change many existing processes
- The culture of the industry will resist this change
- Global standards will lead to low cost delivery
- A combination of offsite and 3D printing will lead to new methods of assembly



“acquired knowledge  
without positive action  
is absolutely useless”

Q&A Session

THANK YOU



Ar. Abu Zarim Abu Bakar

Deputy President, Pertubuhan Akitek Malaysia – 2019/2020  
President, Balai Ikhtisas Malaysia (BIM) -2019/2020