BIM REPORT

Executive Summary

The report provides a detailed understanding of the Building Information Modelling which has a wider role in the digitalization of the construction sector, not only in the UK but in the overall European Union. Furthermore, the case study of a leading hotel chain, as well as the summary of different requirements and roles mandatory at several stages of the BIM Modelling, are also added in the report for the provision of a comprehensive overview of the overall usage of BIM.

Table of Contents

Table of Figures

1 Introduction

With the continuous improvement in the construction sector across the globe due to urbanization, globalization and the better policy approaches of governments, digitalization of it is mandatory in the age of digital revolution. As the digitalization of the overall processes involved in the infrastructure and construction industry requires comprehensive and detailed modelling, where all the major organizations are involved per se, so the UK government is also utilizing the digital potential that it has in the construction sector. This report is written specifically for Building Information Modelling, by gathering all the information and details related to it. It includes the procedures, protocols, standards, stakeholders, and other requirements for BIM. Furthermore, it also provides a detailed understanding of the process flow charts and maps for the BIM that is extensively being used by multinational contractors and sub-contractors to reduce the cost of construction and to speed up the process of construction.

2 Building Information Modelling (BIM)

BIM is basically the digital form of construction & asset operations. It encompasses improvement, digital technology, and asset operations. BIM acts as a strategic enabler to improve decision making for both public infrastructure and buildings. It applied to all types of projects and it crucially supports the refurbishment, maintenance, renovation and approval of large-scale public-sector building projects (CITB, 2018). UK BIM Framework includes multiple ISO standards and guidance like PAS 1192-8:2015, PAS 1192-3:2014 and PAS 1192-6:2018.

As most of the construction projects are long term so the UK BIM Framework involves the PAS and ISO (Framework, 2019). There are multiple levels of BIM that are to be achieved for different types of projects. Each level indicates a different set of procedures. BIM level starts with 0 and top up to 4D, 5D, and even 6D BIM levels (GOV.Uk, 2018). UK has adopted BIM Level 2 since the publication of the report titled 'Report for the Government Construction Client Group-BIM Strategy Paper'. Greater encouragement and the adoption of different BIM standards was encouraged in public sector organizations since then.

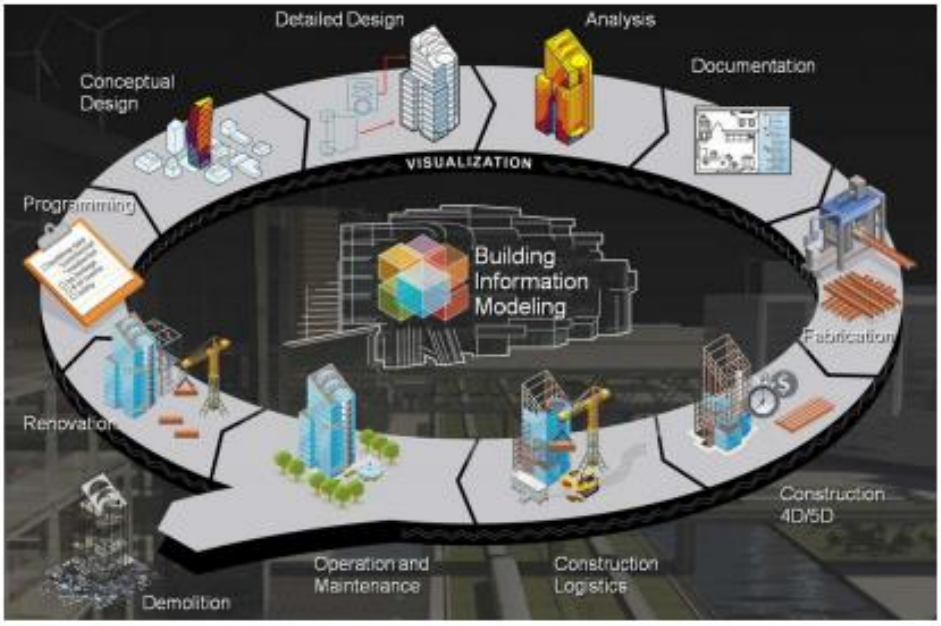

Figure 1 BIM Model (Bolpagni, 2013)

It was hinted the Building Information Modelling would pose a great impact on the public sector projects and would become disruptive as well as innovative with the passage of time (Office, 2016). Hence, at the time of setting protocols and procedures for BIM, a consensus was developed amongst all that the UK BIM program must be in line with the BIM-Globalization efforts (Alliance, 2019). So, to fulfil it, UK cooperated with the academia, industry, construction networks, and other related organizations to develop a set of patterns and standards which aided the effective adoption and utilization of such standards (Etenders.gov.ie, 2017).

2.1 Importance of BIM

BIM is not something new, it is a global trend, growing for many years all over the world. Data suggests the wider scale adoption of the Building information modelling would improve the global savings in construction by 15-20%. UK's economy is the most digitalized one all across Europe with increasing productivity. Just conceive that if the BIM will save only 10% all across Europe, then, about USD 150 billion will be generated to be invested in a USD 1.5 trillion economy (MacLeamy, 2018).

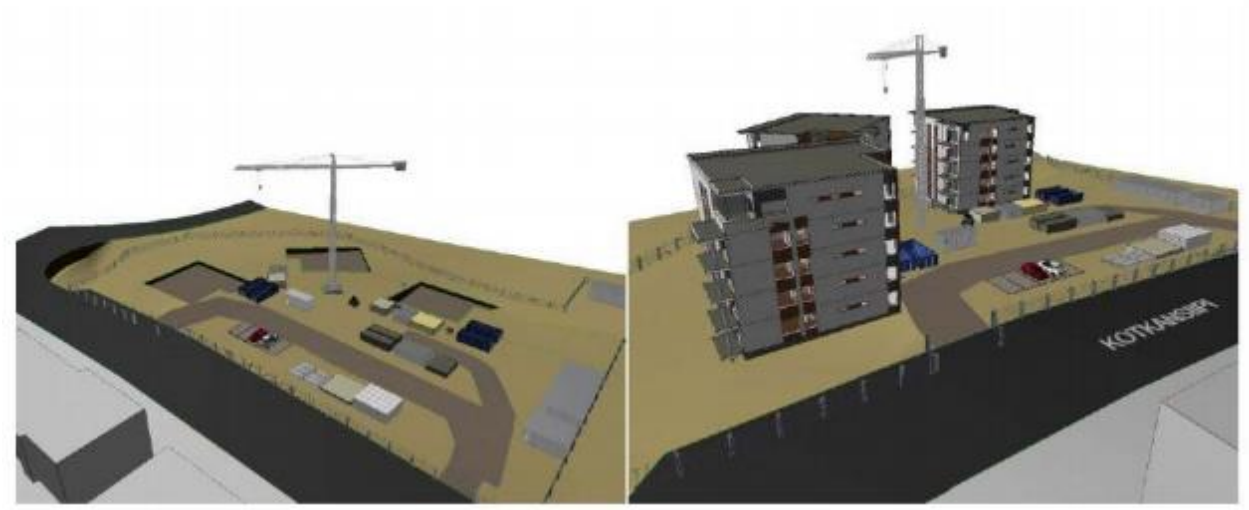

Figure 2 BIM 3-D Model (EUBIM Taskgroup, 2019)

Apart from this, potential environmental savings are far more than this. The introduction of BIM indicates the potential of digitalization potential in the construction sector of any economy. There is no denying to the fact that digital processes, wider use of technology, higher-skilled workers, and automation greatly contribute to the economic and social development of any economy. In short, the introduction of BIM in the construction sector depicts the digitalization of the construction sector (Framework, 2019).

2.2 Applications in Different Projects

There are wide applications of BIM in the construction industry. It saves a large sum of public money and improves transparency and make sure the greater stakeholder engagement. Some major applications of it are as follow:

- Design visualization & coordination
- Automated design production of documents
- Construction coordination and approval
- Clash Detection
- Construction Scheduling
- Construction Management
- Facility Management applications
- Automated Commissioning

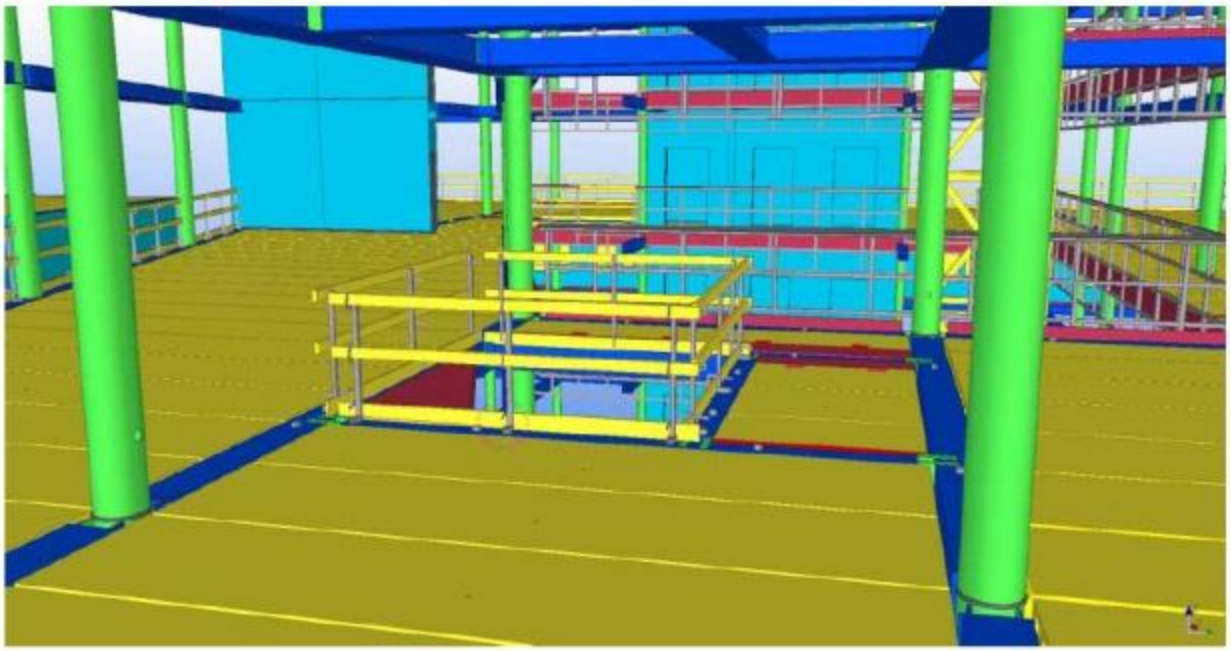

Figure 3 Building Information 3-D Modelling (Sulankivi, 2011)

As every project involves the concept stages, detailed designing as well as construction, so all these stages can be viably modelled in 3D BIM (Stephanie Kosandiak, 2018). One can easily monitor the different stages of the project development and can make the relevant changes wherever required with efficient design concepts and procedures. In short, it resolves all the clashes with a well-coordinated approach at different stages of the project (Anderson, 2018).

2.3 Deliverables in BIM

Milestones	Deliverable
Contract Award	Final BIMPxP
Conceptual Schematic Phase	Architectural Massing Model Preliminary Energy/ Solar Orientation Analysis
Advanced Schematic Design Phase	Architectural Model Schematic Energy Model Program & Space Validation Massing Model Civil Model COBie Data
Design Development	Architectural Model Civil Model(s) MEP Model(s) Structural Model Program Validation Report Discipline Interference Reports Sustainable Design & LEED Credit Documentation COBie Data
Construction Documents	Architectural Model Civil Model MEP Model(s) Structural Model Pre-bid Collision Report Phasing Models (if applicable) COBie Data
Bidding	Federated Model Design BIMPxP
Construction Phase	Coordination Models Collision Reports Architectural MEP/ FP Models
	Structural Models Fabrication Models (if applicable) Phasing Models COBie Data
Project Close-out	Record Model - Architect As Built Model - Contractor Record Documents Project Drawings O &M Manuals COBie Data

Figure 4 BIM Deliverables (University, 2016)

2.4 Key Components of BIM

Following are some key elements of BIM to be ensured before starting work on a BIM Project:

- Overview of the BIM Project Execution Plan
- Project Information and Contact
- BIM Uses and Organizational Goals
- BIM Process Design
- BIM Information Exchange
- Collaborative protocols and Quality Control
- Technological Infrastructure and Model
- Project Deliverables and Delivery Strategy (Penatagon, 2018)

2.5 Advantages and Disadvantages

2.5.1 Advantages

- BIM is considered a global language for the construction and infrastructure industry.
- It enables the wider collaboration, and movement across the borders
- BIM is being considered as the parameter for delivering global infrastructure projects. Greater use of it in various metro schemes all over the world is a testimony to this claim.
- Improves the transparency, problem resolving techniques and handling of different projects.
- Ensures better value for public services and public money. Greater productivity of the sectors which are delivering more assets at compromised expenditures.
- Enhanced quality of the public sector projects
- Increased adaptability to more sustainable solutions and the availability of digitally more skilled sector attracting investment
- Social benefits of BIM can be delivered to the public by using the public planning and consultation quite effectively like in water containment features, public building refurbishment, and highway placement.

Figure 5 Benefits of BIM (Office, 2016)

2.5.2 Disadvantages

There are several disadvantages of BIM due to which it is discouraged in developing countries. Major disadvantages include:

- This BIM model is not being used universally amongst the construction companies and professionals due to legal hurdles. Hence, there come compatibility issues.
- Then comes the legal aspects as the BIM software is not universally tested to check the viability of it.

- BIM software is expensive and small construction owners cannot afford it easily. Advantages of Building Information Modelling are worthy when its usage is one full capacity.
- Experts of BIM are minimum and the extra costs will be incurred on the training of the experts (Albayari, 2019).
- Cooperation at the highest echelon of the project is required in BIM Modelling. Routine matters like tendering, staffing and execution of the project will have to be sequenced for better performance of the software.
- Project specifications will demand the BIM framework (Engineering, 2019).

3 Why Prefer BIM for the Public Sector?

Reason for leadership	Description of the driver
Better value for public money	The public sector procurer has responsibility to gain the most economically advantageous value for public money. The introduction of BIM can offer more accurate and lower construction costs, and the reduction of delays for project delivery of public built assets.
Public procurement as a motivator for innovation	Governments, as the single largest procurers of construction with public sector spending approximately 30% of construction total output, can influence and encourage innovation. This is one of the stated aims for the European Union Public Procurement Directive (2014).
Network effect of adoption: support for SMEs	As the construction industry is highly fragmented with 95% of the industry defined as Small to medium sized Enterprises (SMEs), it is not easily able to organise itself and align on one single direction. Only through the wider adoption of BIM across the value chain will full economic benefits be achieved.
Digitalisation agenda	Governments, policy makers and industry are recognising the benefits of encouraging the digitalisation of industrial sectors. This is an especially important agenda in Europe with the European Commission's Digital Single Market initiative.

Benefit of a European approach	Description of the benefit
Accelerate national efforts	Through collaborative working and sharing of best practice, nations can accelerate their own BIM initiatives by learning from others.
Minimise costs	Wasted effort and investment can be minimised through the reuse of existing developments and knowledge.
Impactful and robust programmes	By drawing upon existing knowledge and practical experience of what makes programmes successful, individual nations can be informed to create and implement effective initiatives.
International critical mass	Taking a similar approach to neighbouring countries for the encouragement of BIM will increase the strength and effectiveness of each individual national programme.
Reducing trade barriers to growth	Alignment of a European approach will encourage trade and opportunity for growth across borders. Creating national specific approaches will likely confuse the construction sector, discourage cross border working and add a cost burden to the industry when complying with national different approaches.
Encourage international standards developments and software integration	Europe has the opportunity to collectively encourage the development of standards for use in international markets. This ensures open competition in the supply chain and the open sharing of information across software platforms.

Figure 6 Strengths of BIM for the Public Sector (Perera, 2016)

3.1 What the UK Government and Agencies Already Achieved?

- Established a Government delivery team to collaborate with the industry, Cabinet office, and all the Government departments.
- A wider number of working groups are established to work out the key themes for BIM execution.
- Multiple trade bodies and structures ensure the smooth transition to BIM enablement for engaging all the SME's and construction sector
- Private clients are also involved in greater cooperation and to aware of BIM benefits.
- Robust standards like BS 1192-2 and PAS 91 are established.
- The digital plan made available
- Focus on the development of core competencies and skills and an Enthusiast group of 2050 is established.
- Incorporated Government Soft Learnings to BIM Program (MacLeamy, 2018)

3.2 Future Layout

Challenges in the public sector are very many to handle with BIM and hence, future layout for the BIM modelling, particularly in the UK is progressive and sounds good. Urbanization and housing crises, resource scarcity, globalized market, ageing infrastructure, and climate change as well as circular economy presents a challenging situation but hints at the opportunity framework also (Liu, 2014). BIM offers a diverse set of environmental, social, economic and another kind of benefits to different public stakeholders. The public sector transforms a different kind of benefits to the economic one. In the age of Infotech and Biotech digitalization of the construction sector is inevitable (Framework, 2019).

4 Case Study: Premier Inn Luxury Hotel

Premier Inn Luxury Hotel is an international hotel chain operating in several countries. This hotel chain is working in approximately 80 countries. As the conventional procedures are time demanding, hence, the authorities wanted the construction to be done as soon as possible. So, the management has utilized BIM Modelling to construct the hotel in minimum budget and on time. Steven Belaire, CEO of the hotel chain, said that BIM allows us to explore multiple options. This process is expected to decrease the overall cost of the project by 30%. Overall time from start till completion will also reduce by 50%.

Figure 7 Balfour Beatty Luxury Hotel BIM Modelled Project (Olatunji, 2014)

Furthermore, the management considers that the usage of BIM can effectively reduce the interferences between the systems, help in the fast decision-making process and can help to manage the information between different components. Even though the design was started using 2D tools but the management considered that Building Information Modelling must play a central role in it as the BIM can help to manage the 3D Models to keep the project on track. For the management, BIM delivers the project on expected promises (Bolpagni, 2013).

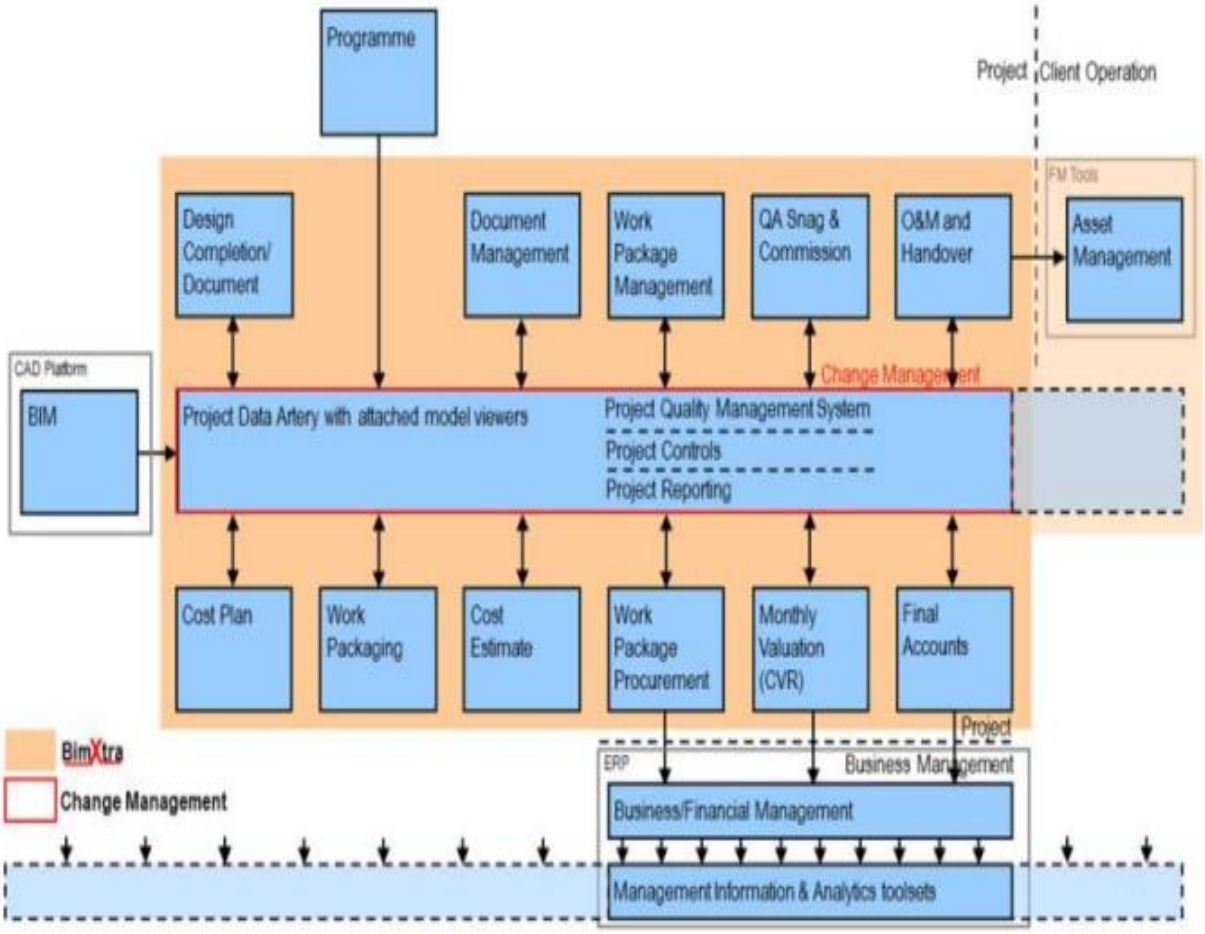

Figure 8 BIM Modelling Phase of a Construction Project (Olatunji, 2014)

All the processes and set of documentation is interconnected and it leverages on multiple options. At the start, the team started building the basic design, and then started towards the detailed model and focused on several intricate portions of the project (Liu, 2014). Major components of the BIM are as shown below:

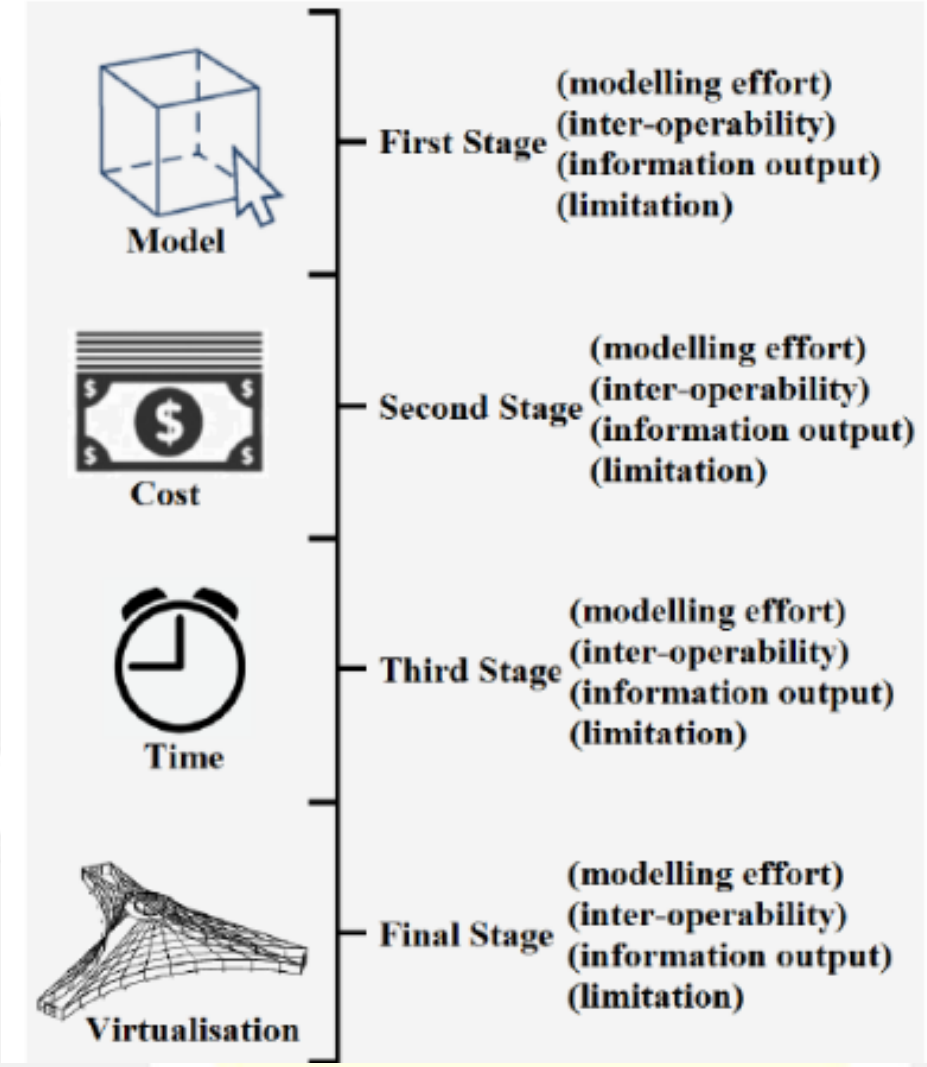

Figure 9 BIM Major Components (Lee Xia Sheng, 2016)

Previously, the construction specialists were realizing that the ceiling clearance might create issues, but after appropriate optimization and the induction of various mechanical and electrical components, issues arising in the project were addressed. BIM allowed seeing the overall model with design (Perera, 2016).

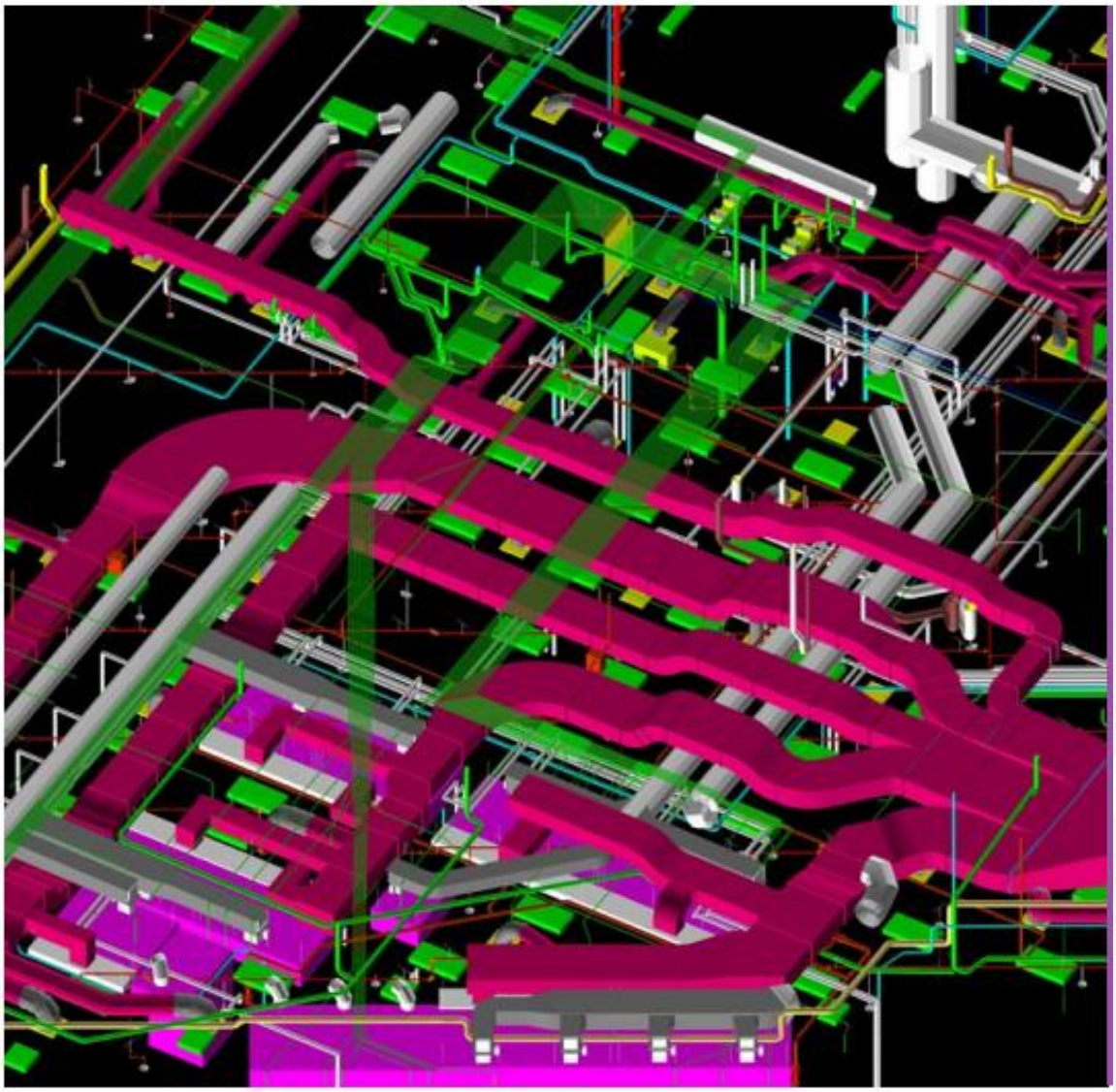

Figure 10 3D Design Model using BIM (Click, 2016)

Many contractors who were involved in the construction of buildings used extensive BIM modelling and it facilitated the overall process. The project was completed two months before the final deadline. The contractors were involved using 3D models, and pre-fabricated material was used at off-site to advance the performance of the overall project (Bolpagni, 2018). Off-site fabrication helps in advancing the construction but it is possible only once the things are aligned with the help of BIM.

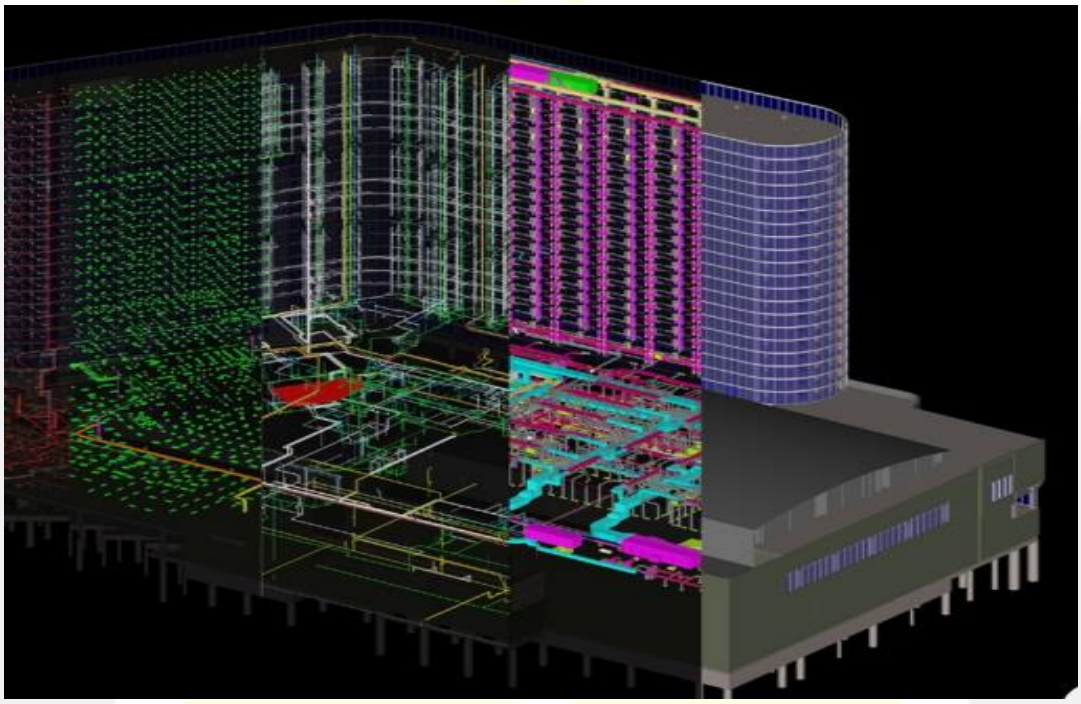

Figure 11 BIM Modelling of the Premier Inn Hotel Project (CITB, 2018)

Project Flow chart using the BIM would look like as given in the chart, where all the parties concerned will be involved to execute the different phases of the project timely and appropriately.

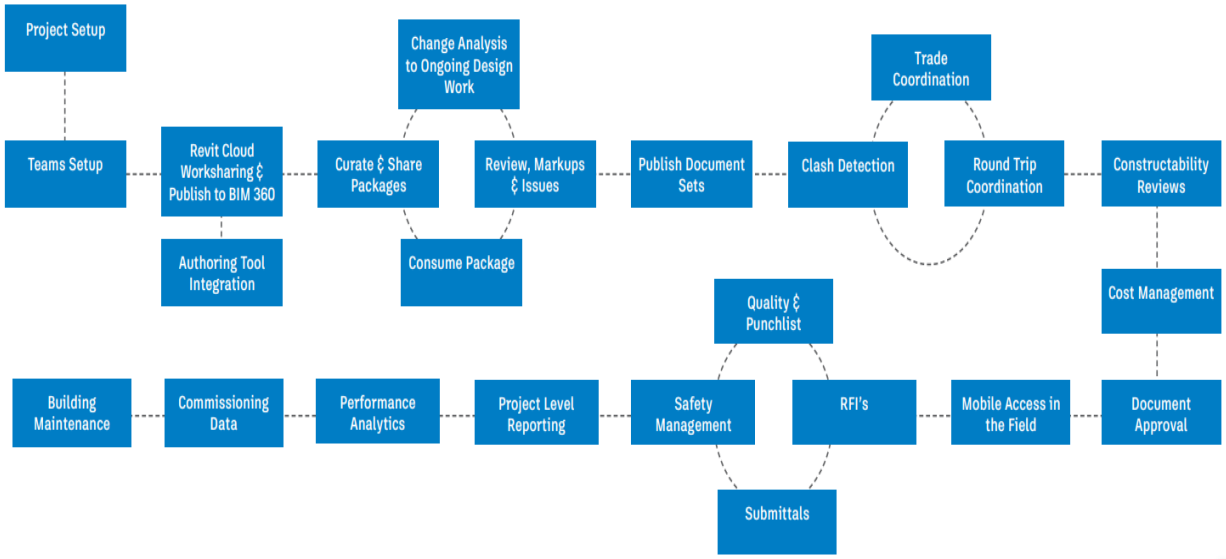

Figure 12 Project Flow Chart using Building Information Modelling (Penatagon, 2018)

5 Major Objectives of BIM

With the development of the BIM Project, the following benefits can be achieved as follow:

- Everyone will be in a better position to communicate the goals for the implementation of BIM project.
- The organization will understand the responsibilities of implementation.
- With the help of Building Information Modelling, every team member comes to a better position to address organizational flaws.
- Core competencies are better highlighted and addressed.

6 BIM Execution Plan Procedure

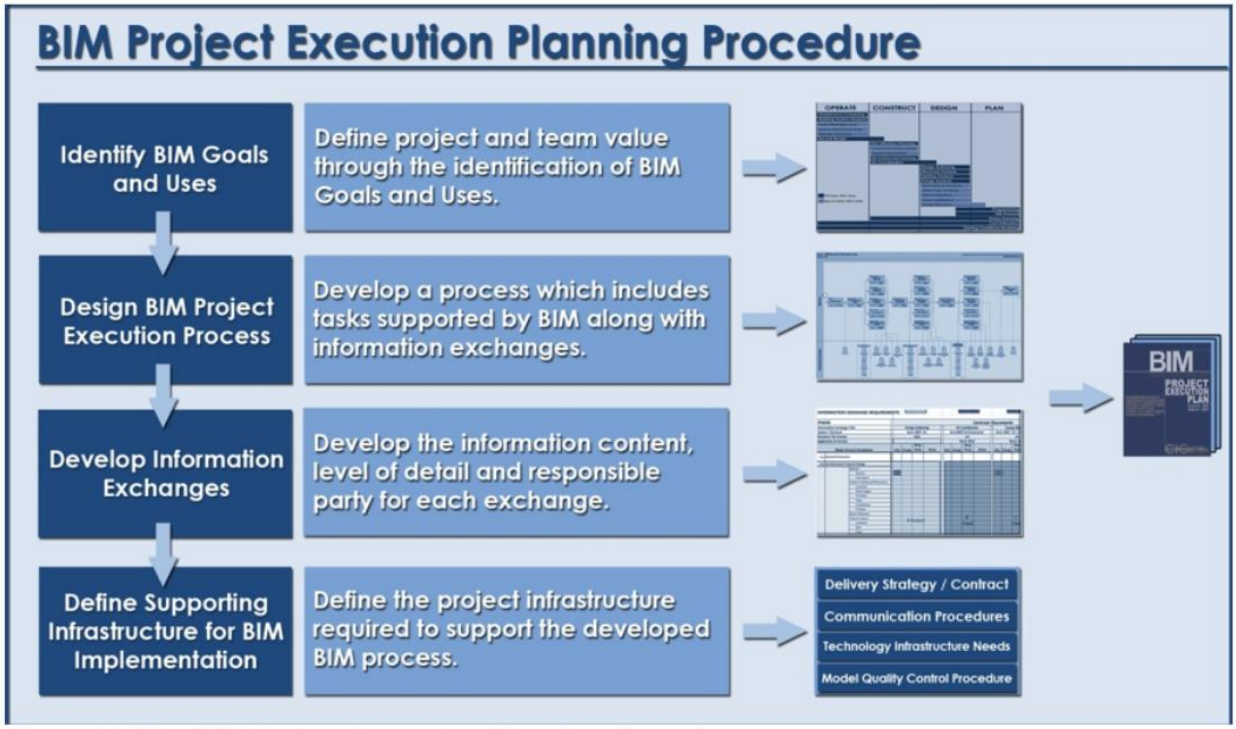

Figure 13 BIM Project Execution Process (IFM, 2018)

6.1 Requisites for Starting a BIM Project

For keeping the BIM system in line with the standards, some design service agreements are required which fulfils the necessary conditions and documentation before starting a BIM Project which is as:

BIM Execution Plan: Prepared by the BIM Team includes the detail that through what ways the BIM will be implemented

BIM Level: Extent to which the BIM model information and development will be made and implemented. The level of BIM is determined by the Owner. Multiple factors that are included in it are Scoping, scheduling, cost, availability of existing BIM Models, and previous BIM Data.

Building Automation System: System to supervise and control the overall infrastructure system and facilities.

Building Information Modelling: Process of managing the data using the 3-D real-time approach.

BIM Team: Working team comprised of consultants, contractors, owners, etc. This team is dedicated to the BIM Execution Plan.

Computerized Maintenance Management System: Computer software that is deployed to manage the overall data.

Construction Documents: These documents contained the Project Information Matrix and the Building Model

Depth of Detail: Amount of information to be provided with the Building Model. The model of the building shall be deployed and developed.

6.2 Roles and Responsibilities of BIM Team

Owner’s Role and Responsibilities: Specifications related to project information matrix, the extent of BIM to be used and approval of BIM Execution plan as well as the Contractor's schedule are some of the important roles to be played by the owner's representative.

Roles and Responsibilities of Design Team: Overall development & delivery of BIM, compliance with BIM Execution Plan are the main roles. Nonetheless, coordination, publication & verification

of different design and construction projects are also taken into account. The team further prepares, assembles, set-up shared file servers and facilitate the use of the BIM Model.

A/E's Role & Responsibilities: Presence in BIM Team meetings, incorporate all BIM Activities, Owner's approval, and the review of the Contractor's approach (Rodriguez, 2018).

Contractor's Role & Responsibilities: BIM Execution Plan, Building Model, and the Project Information Matrix are some of its core activities, however, it administers the Baseline schedule and Work Progress Schedule (Anderson, 2018).

6.3 BIM Process Maps and Layout

BIM usage required at the FIU is highlighted in green in this below table. In order to make the coordinated progress, the BIM use matrix must be incorporated into the final BIM process design flow charts.

Y	Plan	Y	Design	Y	Construct	Y	Operate
	PROGRAMMING	Y	DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING SYSTEM ANALYSIS
	SITE ANALYSIS	Y	PROGRESS REVIEWS	Y	CONSTRUCTION SYSTEM DESIGN		ASSET MANAGEMENT
	CAMPUS MASTER MODEL INTEGRATION	Y	3D COORDINATION AND CLASH DETECTION	Y	3D COORDINATION AND CLASH DETECTION		SPACE MANAGEMENT AND TRACKING
	NAMING CONVENTIONS		STRUCTURAL ANALYSIS		DIGITAL FABRICATION		DIASTER PLANNING
			ENERGY ANALYSIS	Y	RECORD MODEL	Y	BIM2MAXIMO
			LIGHTING ANALYSIS		FIELD AND MATERIAL TRACKING		
		Y	PROGRAM VALIDATION		DIGITAL LAYOUT – BIM2FIELD		
			MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS SUSTAINABILITY (LEED) EVALUATION		LASER SCANNING AND POINT CLOUD INTEGRATION		
			PROGRAM / CODE VALIDATION				
			PRELIMINARY CONSTRUCTION SCHEDULING (4D)		CONSTRUCTION SCHEDULING (4D)		
			COST ESTIMATION (5D)		COST ESTIMATION (5D)		
			AS BUILT MODEL	Y	AS BUILT MODEL		
	EXISTING CONDITION MODELING	Y	EXISTING CONDITIONS MODELING		EXISTING CONDITION MODELING		EXISTING CONDITION MODELING
			CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)

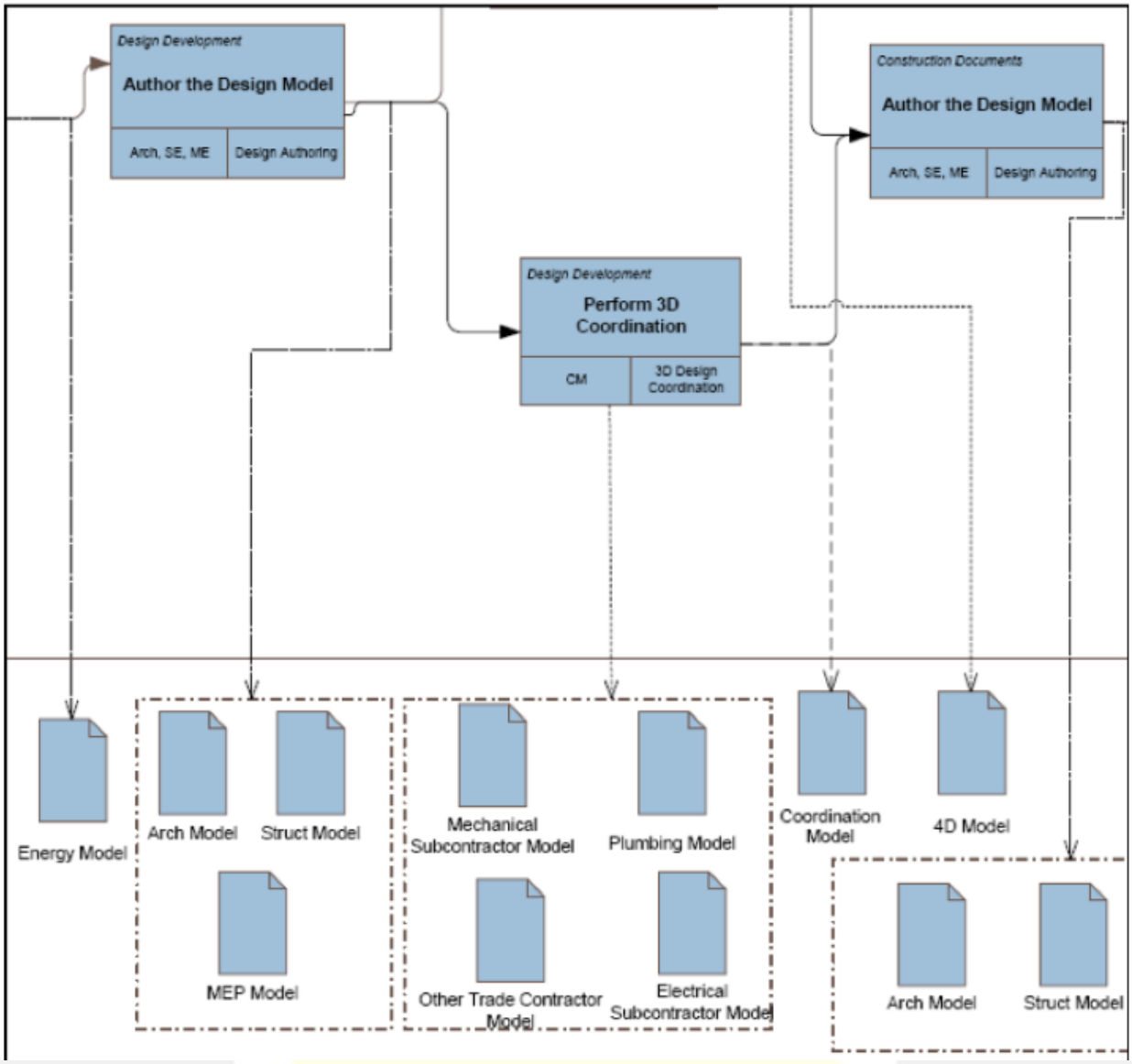

Figure 14 BIM Process Map (Perera, 2016)

Meeting Type	Host	Required Attendees	Notes
Design Meeting	Architect or Design Discipline	Design Team	Meeting to review BIM Progress and Project Design Development.
Design Presentations	Owner/ User Group	Owner, Design Team, CM, User Group, BIM Consultant	BIM Presentation to Project Team for approval and reviews.
Design Team Coordination	Architect or Design Discipline	Design Team Owner at request CM at request	BIM Coordination / Clash Detection. Constructability and Value Engineering review
Design4Maintenance	Architect or Design Discipline	Owner, Facility Managers, Design Team, CM, BIM Consultant	BIMs to review equipment maintainability and "soft clash" for clearances.
COBie Data Meeting	Owner / IT	Owner/ IT, Design Team, CM, BIM Consultant	Review BIMs for data compliance and test import.
Model Handover Meeting	Owner / Design Team, CM, GC	Owner/ IT, Design Team, CM, BIM Consultant	Meeting to discuss and test interoperability and file exchange.
JBIMPxP	Prime Contractor	CM, GC, Design Team, Owner, BIM Consultant	Meeting to further develop the BIM Project Execution Plan upon contractor selection.
Contractor / CM Team Coordination	CM, GC, Owner	Owner, CM, GC, Trades, Architect, BIM Consultant	Review of BIMs for Clash Detection and Trade Coordination.
Contractor Handover / Close-out	CM, GC, Owner	Owner, CM, GC, Architect, BIM Consultant.	Meeting to finalize Record BIMs and As-built BIMs for close-out.

Figure 15 BIM Progress Models and Reviews (ACA, 2013)

7 Assessment of BIM

Financial Burden in the UK has compelled the authorities in there to explore new ways of controlling the cost of construction, hence, modernization of the infrastructure sector was planned by the government. Now, since 2016, all the projects in the UK require Level 2 BIM. The BIM Development Assessment Tool has clearly set the performance measurement practices with the help of BIM Maturity measures and the BIM Maturity Assessment Tool. Hence, the nature and grouping of different adopted measures, information delivery at various levels, alignment with the

established standards, collection of project information, endorsement of BIM value generation, and the presentation of BIM Development performance data (Gokcen Yilmaz, 2019).

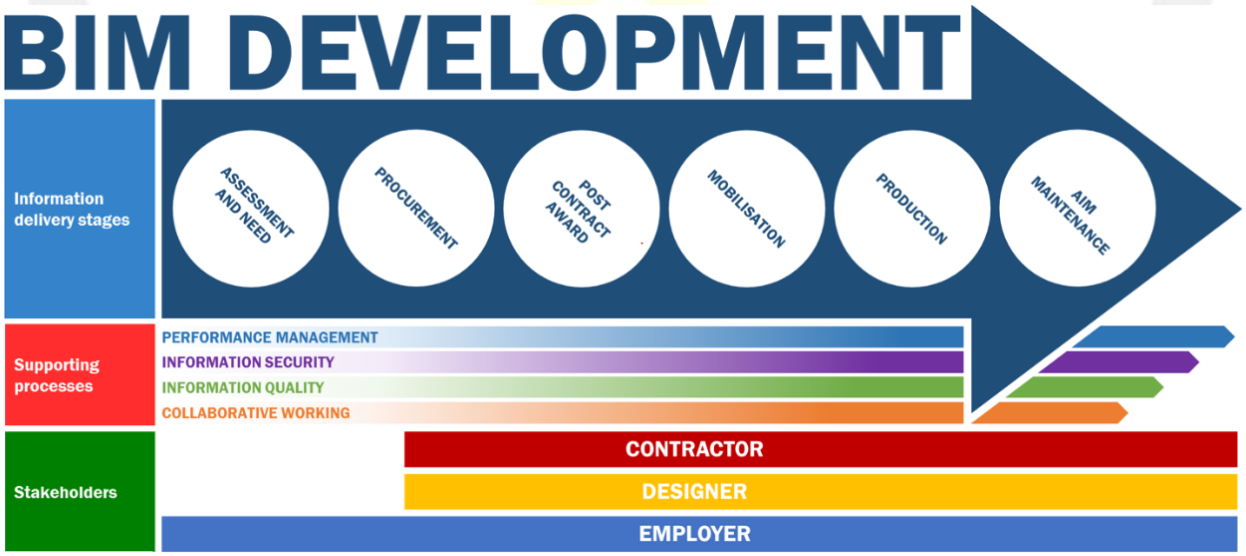

Figure 16 BIM Development Stages and Assessment (IFM, 2018)

8 Conclusion

BIM is not a novel approach but still, its usage in developing countries is not very much prevalent due to certain financial, human and legal hurdles. But overall BIM has significantly eased the concerns of the construction sector, particularly in the public sector where large scale funding is directed for the services sector. BIM has reduced the cost of various construction projects and now the digitalization of this sector is being supported across the European Union. Hence, it can be concluded that if the set procedures, standards, and protocols are followed in BIM, then this can be of great help for the construction sector and in the present times, the developing countries need to follow this digitalization.

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Appendix

Discipline	Asset Types:
M	1. Air Handling Unit
M	2. VAV box
M	3. Variable Frequency Drive
E	4. Generator
M	5. Boiler
A	6. Elevator
M	7. Air Compressor
M	8. Vacuum Pump
	9. Freezer (Walk in) (If applicable)
	10. Air Cooled Chiller (If applicable)
M	11. Condenser Unit
M	12. Fan Coil Unit
M	13. Exhaust Fan (Laboratory Exhaust Fans) (If applicable)
	14. Fume Hood (If applicable)
P	15. Fire Pump
M	16. Chilled Water Pump
P	17. Booster Pump
P	18. Domestic Water Pump
	19. RO Water Pump/Skid (If applicable)
	20. Water Softener (If applicable)
E	21. Fire Alarm Panel
P	22. Back Flow Preventer
	23. Water Heater (If applicable)
	24. Rack Cage Washer (If applicable)
	25. Bulk Sterilizer (If applicable)
	26. Chilled Beam (If applicable)
E	27. Building Automation System (BAS) Panel
E	28. Electrical sub meter
E	29. BTU meter

Figure 17 BIM Assets

Y	Plan	Y	Design	Y	Construct	Y	Operate
	PROGRAMMING	Y	DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING SYSTEM ANALYSIS
	SITE ANALYSIS	Y	PROGRESS REVIEWS	Y	CONSTRUCTION SYSTEM DESIGN		ASSET MANAGEMENT
	EXISTING CONDITION MODELING	Y	3D COORDINATION AND CLASH DETECTION	Y	COORDINATION AND CLASH DETECTION		SPACE MANAGEMENT AND TRACKING
	NAMING CONVENTIONS		STRUCTURAL ANALYSIS		DIGITAL FABRICATION		DISASTER PLANNING
	CAMPUS MASTER MODEL INTEGRATION		ENERGY ANALYSIS	Y	RECORD MODEL	Y	BIM2MAXIMO
			LIGHTING ANALYSIS		FIELD AND MATERIAL TRACKING		EXISTING CONDITION MODELING
		Y	PROGRAM VALIDATION		DIGITAL LAYOUT – BIM2FIELD	Y	CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)
			MECHANICAL ANALYSIS		COST ESTIMATION (5D)		
			OTHER ENG. ANALYSIS SUSTAINABILITY (LEED) EVALUATION		LASER SCANNING AND POINT CLOUD INTEGRATION		
			CODE VALIDATION				
			PRELIMINARY CONSTRUCTION SCHEDULING (4D)				
			COST ESTIMATION (5D)				
		Y	AS BUILT MODEL				
		Y	EXISTING CONDITIONS MODELING				
			CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		

Figure 18 BIM Use

Prime Contractor	Date
Prime Architect	Date
Mechanical Subcontractor	Date
Electrical Subcontractor	Date
Plumbing Subcontractor	Date
Fire Protection Subcontractor	Date
Construction Manager	Date
Owner Project Manager	Date

Figure 19 BIM Execution Plan

DATE									
RP = RESPONSIBLE PARTY	MODEL PROGRESSION SCHEDULE								
	300 / DSG INTENT BIM		350 /CONSTRUCTABILITY COORD		400 / 2D SHOP-DWGS		500 / As-BUILT		
PROJECT CONTROL	LOD	Y/N	LOD	Y/N	LOD	Y/N	LOD	Y/N	COMMENTS
References									
Grid									
Levels									
Location									
Origin									
Spatial									
Occupancy									
Regions									
Rooms									
Spaces									
Project Information									
SITE	LOD	Y/N	LOD	Y/N	LOD	Y/N	LOD	Y/N	COMMENTS
Hardscape									
Existing Conditions									
Temporary Conditions	300								
Curbs & Gutters	300		350				500		
Fencing	300		350				500		
Paved Areas	300		350				500		
Pergolas & Canopies	300		350				500		
Ramps	300		350				500		
Retaining Walls	300		350				500		
Roads	300		350				500		
Services Structures	300		350				500		
Sidewalks	300		350				500		
Site Element Demolition									
Site Element Relocation									
Site Element Remediation									
Special Features	300		350		400		500		
Softscape									
Existing Conditions									
Planting	300				400		500		
Topography	300		350				500		
Trees	300				400		500		
Water Features	300		350		400		500		
Markings & Signage									
MOT (Maintenance of Traffic)	300								
Existing Conditions									
Temporary Conditions	300								
Monument Signs	300						500		
Parking Signage									
Parking Spaces									
Paving Markings									

CIVIL	LOD	Y/N	LOD	Y/N	LOD	Y/N	LOD	Y/N	COMMENTS
Features									
Existing Conditions									
Temporary Conditions	300								
Airfields									
Earthwork	300						500		
Recreation Areas									
Site Clearing									
Site Development									
Site Preparation									
Tunnels									
Services									
Existing Conditions									
Temporary Conditions	300								
Communication Systems	300		350		400		500		
Electrical	300		350		400		500		
Fire Protection	300		350		400		500		
Fuel	300		350		400		500		
Gas	300		350		400		500		
Sewer	300		350		400		500		
Site Lighting	300		350		400		500		
Specialty	300		350		400		500		
Storm	300		350		400		500		
Water	300		350		400		500		
ARCHITECTURAL	**LOD**	**Y/N**	**LOD**	**Y/N**	**LOD**	**Y/N**	**LOD**	**Y/N**	**COMMENTS**
Interior									
Existing Conditions									
Drop Ceilings	300		350				500		
Flooring	300		350				500		
Furring and Build-outs			350				500		
Glazing	300		350				500		
Interior Doors	300		350				500		
Interior Walls	300		350				500		
Non-Bearing Columns	300		350				500		
Pilasters	300		350				500		
Railings	300		350				500		
Soffits	300		350				500		
Toilet Accessories	300		350				500		
Toilet Partitions	300		350				500		
Trim Elements	300		350				500		
Exterior									
Existing Conditions									
Entry Canopy	300		350				500		
Curtain Walls	300		350				500		
Doors	300		350				500		
Gutters and Spouts	300		350				500		
Non-Bearing Walls	300		350				500		
Reveals	300		350				500		
Specialty Features	300		350				500		

All piping to be modeled (LOD 300 = 2" & Larger) (LOD 350 = 1" & Larger)

Figure 20 BIM Model Progression Schedule

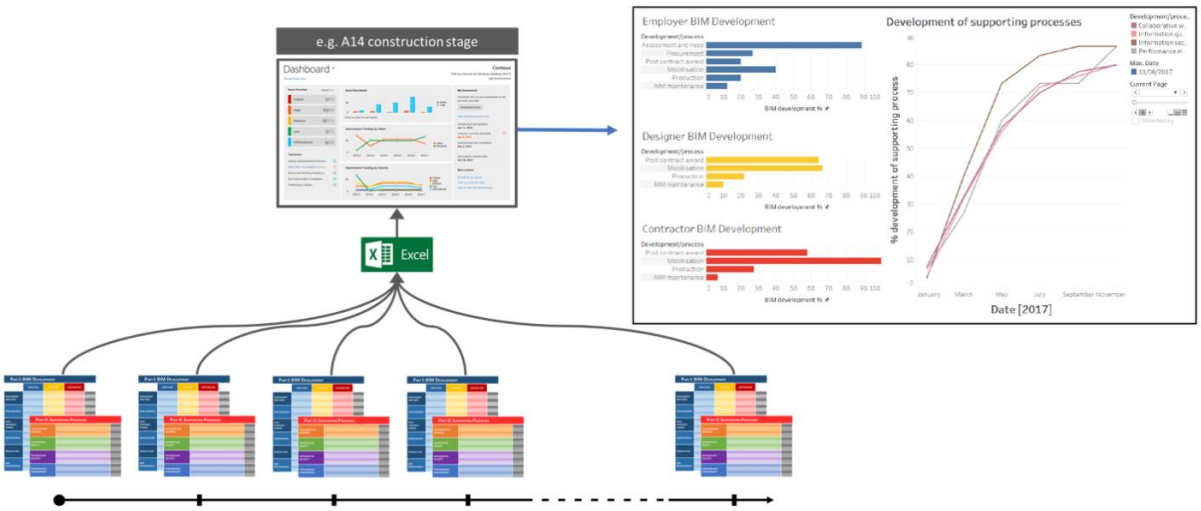

Figure 21 BIM Development Dashboard