Towards a successful BIM implementation in Egypt construction industry

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BIM Specialist
Lecture Content

• What is BIM and why we should start now?
• History of BIM
• BIM processes & Definitions
• BIM benefits & Future Applications in construction industry
• Global BIM Adoption
• International BIM Guidelines
• The most important BIM process steps in Egypt construction Projects
• Wrong uses of BIM
• Strategic roadmap for BIM Implementation in Egypt construction industry
• EGY BIM GUIDE Software for a successful BIM implementation in Egypt construction industry
What is BIM

• BIM is the digital representation of physical and functional characteristics of a facility before, during and after construction. Under a BIM model, each project participant contributes their discipline specific knowledge into a shared project model. Importantly, BIM is not a new technology. Rather, BIM is a new approach to design development and project delivery.
Why we should start BIM now?

It’s a well-known fact now that construction is one of the least digitized industries. Spending on research & development in construction field runs well over the others by less than 1% of revenues, versus 3.5% to 4.5% for the auto and aerospace sectors. Large projects across asset classes typically take 20% longer to finish than scheduled and are up to 80% over budget, so new technologies like BIM will be needed.
Most technological changes (telephone, railroads, airplanes, computers) take multiple generations from introduction to acceptance. CAD took 12 years to replace hand drawing, BIM will less than half that time.

BIM Products: Revit, ArchiCAD, Digital Project (Catia), Bentley, VectorWorks, Tekla.
BIM processes & Definitions

BIM Dimensions

3D
- Existing Conditions Models
- Safety & Logistics Model
- Animation Renderings
- Walkthroughs
- BIM driven prefabrication
- Laser accurate BIM driven field layouts

4D
- Scheduling
  - Project Phasing Simulations
  - Detailed Simulation Installation
  - Visual Validation for Payment Approval

5D
- Estimation
  - Quantity Extraction to support cost Estimates
  - Trade Verification from Fabrication Models:
    - Structural Steel - Rebar
    - MEP
  - Value Engineering
    - What-if-scenarios
    - Visualizations
    - Quantity Extractions
  - Prefabrication Solutions

6D
- Sustainability
  - Conceptual Energy Analysis
  - Detailed Energy Analysis
  - Sustainable element tracking
  - LEED tracking

7D
- Facility Management Applications
  - Life Cycle BIM Strategies
  - BIM As-Builts
  - BIM embedded O&M manuals
  - BIM Maintenance Plans & Technical Support

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BIM processes & Definitions

BIM Levels

WHO ARE THE BIM COMPANIES?

LEVEL 0 BIM
(CAD) Computer Aided Design
is used to create drawings. Paper and prints are shared
with the team.

LEVEL 1 BIM
2D drafts are combined
with 3D models in a CDE
(Common Data Environment).
Limited collaboration.

LEVEL 2 BIM
Level 2 adds additional
dimensions such as
Time Management and
Budget Calculation.
Full collaboration and
partial interoperability
through the use of
distinct CAD models.

LEVEL 3 BIM
Full collaboration and
full integration in a cloud
based environment.
Includes Asset Life
Cycle Management (6D).

GENERATED DATA
The amount of data
generated increases
with each level.

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BIM processes & Definitions

BIM Workflow by Common Data Environment (CDE)

Traditional Information Sharing

Information Exchange using Common Data Environment (CDE)
### BIM processes & Definitions

#### Level of Details vs Level of Development (LOD)

<table>
<thead>
<tr>
<th>LOD 100</th>
<th>LOD 200</th>
<th>LOD 300</th>
<th>LOD 400</th>
<th>LOD 500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conceptual</strong></td>
<td><strong>Approximate Geometry</strong></td>
<td><strong>Precise Geometry</strong></td>
<td><strong>Fabrication</strong></td>
<td><strong>As Built</strong></td>
</tr>
<tr>
<td>The Model Element may be graphically represented in the Model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200.</td>
<td>The Model Element is graphically represented in the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation.</td>
<td>The Model Element is graphically represented in the Model as a specific system, object, or assembly accurate in terms of quantity, size, shape, location, and orientation.</td>
<td>The Model Element is graphically represented in the Model as a specific system, object, or assembly that is accurate in terms of quantity, size, shape, location, and orientation with detailing, fabrication, assembly, and installation information.</td>
<td>The Model Element is a field verified representation accurate in terms of size, shape, location, quantity, and orientation.</td>
</tr>
</tbody>
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BIM processes & Definitions

The information requirements to implement BIM

Organisational Information Requirements (OIR)
Information requirements at an organisational level.

generates

Asset Information Requirements (AIR)
Convey OIR to project-specific external contractors or in-house works teams, setting out the information requirements of the organisation in relation to an asset or assets.

informs

Employer’s Information Requirements (EIR)
Sets out the information to be delivered, and the standards and processes to be adopted for construction projects.

specifies

Asset Information Model (AIM)
The single source of information related to an asset or assets, at a level required to support an organisation’s asset management system.

specifies

Project Information Model (PIM)
The single source of information related to an asset or assets developed during the design and construction phase of a project.
BIM processes & Definitions
BIM project execution plan (BEP)

Uses and Goals
- Goals
- Analysis
- Roles and Responsibilities
- Decisions

Processes and Exchange
- Process Design
- Information Exchange

Supporting Infrastructure
- Data Requirements
- Collaboration Procedures
- Quality Control
- Technology Requirements
- Model Structures
- Documentation
- Processes

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BIM Benefits in Construction Industry

Design
Model building components, analyze and simulate systems and structures, and iterate designs. Generate documentation from Revit models.

Collaborate
Multiple project contributors can access centrally shared models. This results in better coordination, which helps reduce clashes and rework.

Visualize
Communicate design intent more effectively to project owners and team members by using models to create high-impact 3D visuals.

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BIM Benefits in Construction industry

MacLeamy BIM Curve

PD: Pre-design
SD: Schematic design
DD: Design development
CD: Construction documentation
PR: Procurement
CA: Construction Administration
OP: Operation

1. Ability to impact cost and functional capabilities
2. Cost of design changes
3. Traditional design process
4. Preferred design process
BIM Future Applications
BIM & Virtual Reality

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United Kingdom

BIM Strategy

BIM Level 0 | BIM Level 1 | BIM Level 2 | BIM Level 3
---|---|---|---
Maturity
1990s | 2000s | 2010s | 2020s
CAD | 2D, 3D | BIM (Point Solutions) | BLM (Building Lifecycle Management (BIM + PLM Platform))

 Formats
Drawings | Models, Objects, Collaboration | Transactable, Interoperable Data

 Standards
BS1192:2007 | BS1192:2 | BS1192:3 | IFC
BS7000:4
BS8541:2 | BS8541:1:3:4 | IDM | IFD

 Tools
Paper | Files | Files + Libraries | Dassault Systèmes

Integrated Web Services “BIM Hub”

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CPD Certified
The CPD Certification Service
United States
BIM Strategy

- **BIM Level 0**: CAD
  - Formats: Drawings
  - Paper
  - Visualization

- **BIM Level 1**: 2D, 3D
  - Formats: Models & Objects Collaboration
  - Files
  - File-Based Collaboration

- **BIM Level 2**: BIM
  - Formats: Interoperable Data
  - Files + Library
  - File-based integration

- **BIM Level 3**: BLM
  - Formats: Building Lifecycle Management
  - Integrated Web Services
  - Multidisciplinary Design Optimization

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The CPD Certification Service
Singapore
BIM Strategy

Challenges:
- Lack of demand
- Entrenched in two-dimensional computer aided design practices
- Steep learning curve
- Lack of ready pool of BIM users

Strategies:
- Public sector taking the lead
- Removing impediments
- Building BIM capability and capacity
- Promoting success stories
- Incentivising early BIM adopters

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CPD Certified
The most important BIM process steps in Egypt construction Projects

1. Define EIR & OIR
2. Determine CDE & Responsibilities
3. Agree LOD & BIM Dimensions
4. Define BEP & Templates
5. Create client information model
6. Adopt 3D, 4D in the project
7. Analyse environmental performance
8. Prepare technical data using COBie
9. Validate arch. spaces
10. Review data exchange & undertake meetings
11. Prepare tender documentation & make sure BIM included
12. Create detailed integrated model 4D, 5D deliver to the contractor
13. Determine the level of risk in the project
14. Prepare the final updated model
15. Determine the building assets for the operational phase
16. Use a secured minded system to manage the building information
17. Transfer the AIR data to the AIM
18. Analysis the BIM data for future projects
# BIM Process steps in Egypt construction projects

<table>
<thead>
<tr>
<th>Grand Egyptian Museum</th>
<th>Mall of Egypt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company:</strong> Besix-Orascom</td>
<td><strong>Company:</strong> BESIX-Orascom</td>
</tr>
<tr>
<td><strong>Architect:</strong> Henegan Peng</td>
<td><strong>Architect:</strong> Tarek Beshir</td>
</tr>
<tr>
<td><strong>Year of the project:</strong> 2012</td>
<td><strong>Year of the project:</strong> 2011</td>
</tr>
<tr>
<td><strong>Area:</strong> 471000 m²</td>
<td><strong>Area:</strong> 165000 m²</td>
</tr>
<tr>
<td><strong>Budget:</strong> 810 Million €</td>
<td><strong>Budget:</strong> 400 Million €</td>
</tr>
<tr>
<td>Detailed BIM museum model [Source, [24].]</td>
<td>Detailed BIM mall model [Source, [25].]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BIM Work Strategy</th>
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</table>
| **1-** Start the BIM model from the tender drawings and send all the RFI to the consultant to solve the design problems.  
2- Detect the clashes between architecture, structure and MEP models.  
3- Define CDE and team responsibilities.  
4- Update the LOD of BIM model and coordination drawings.  
5- Make workshop drawings with all details to serve the construction site.  
6- Use digital fabrication & maintenance strategy. |  |
| **1-** Define EIR and start the conceptual BIM model to take employer approval.  
2- Identifying project team capability and training them if needed.  
3- Identifying project team capability and initiate CDE for data exchange.  
4- Modeling procedures should follow LOD matrix.  
5- Run automated clash detection to monitor and solve the conflicts.  
6- Utilize BIM for model Prefabrication in order to significantly reduce the installation works duration. |  |

<table>
<thead>
<tr>
<th>Software</th>
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</table>
| - Revit Architecture  
- Revit Structure  
- Revit MEP | - Revit Architecture  
- Revit Structure  
- Revit MEP |
Wrong uses of BIM

BIM without Template

Change from BIM to CAD
## Strategic roadmap for BIM Implementation in Egypt construction industry

<table>
<thead>
<tr>
<th>Start Actions</th>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Target State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Engagement</td>
<td>2019</td>
<td>2025</td>
<td>2030</td>
<td>BRINGING THE WORLD OF CONSTRUCTION TO EGYPT</td>
<td></td>
</tr>
<tr>
<td>Prepare BIM Guidelines</td>
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<td></td>
<td></td>
<td>Make the Egyptian government lead the construction industry sector towards BIM.</td>
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<tr>
<td>Training &amp; Education</td>
<td></td>
<td></td>
<td></td>
<td>Unify our BIM practices and make protocols and standards.</td>
<td></td>
</tr>
<tr>
<td>Collaborative Worldwide Projects</td>
<td></td>
<td></td>
<td></td>
<td>Integrate BIM in the Egyptian educational program.</td>
<td></td>
</tr>
<tr>
<td>Measurement &amp; Evaluation</td>
<td></td>
<td></td>
<td></td>
<td>Make Egypt on of the BIM pioneers in the world.</td>
<td></td>
</tr>
<tr>
<td>Adaption &amp; Promotion</td>
<td></td>
<td></td>
<td></td>
<td>Ability to measure the level of BIM implementation in the Egyptian community.</td>
<td></td>
</tr>
<tr>
<td>Inputs</td>
<td></td>
<td></td>
<td></td>
<td>Maintain the level of BIM performance in the Egyptian community.</td>
<td></td>
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<tr>
<td>Outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• The government should adopt and fund the BIM technology in the construction sector.</td>
<td>• Establishing Egyptian BIM institutions to lead the community to a successful BIM implementation.</td>
<td>• Form more future BIM technology ideas to assist construction sector growth.</td>
<td>• Collaborate with international BIM institutions to get the best benefits.</td>
<td>Make the Egyptian government lead the construction industry sector towards BIM.</td>
<td></td>
</tr>
<tr>
<td>• Prepare Egyptian BIM guidelines which compatible with international guidelines.</td>
<td>• Divide the guidelines into three levels for (Juniors, Academics, Managers).</td>
<td>• Develop BIM toolkits for project validation and assessment.</td>
<td>• Develop standards and specifications for BIM and reviewing it permanently.</td>
<td>Unify our BIM practices and make protocols and standards.</td>
<td></td>
</tr>
<tr>
<td>• Developing awareness of the importance for applying BIM technology and include it in the Egyptian education curriculum.</td>
<td>• Establish certified training centers for the Egyptian community.</td>
<td>• Provide BIM certifications.</td>
<td>• Develop a BIM education curriculum and evaluate it permanently.</td>
<td>Integrate BIM in the Egyptian educational program.</td>
<td></td>
</tr>
<tr>
<td>• Indicators to measure the BIM performance and help in project assessment.</td>
<td>• Develop the contractual language for BIM and make sure it relevant with the international ones.</td>
<td>• Analyze international successful projects to get useful feedback.</td>
<td>• Develop a BIM work process steps and align it globally.</td>
<td>Make Egypt on of the BIM pioneers in the world.</td>
<td></td>
</tr>
<tr>
<td>• Make a BIM maturity measurement tool to assess the BIM models.</td>
<td>• Adapt the transition of the Egyptian community from the traditional practice to the BIM technology.</td>
<td>• Compare BIM maturity model with the international ones to make a compatible model.</td>
<td>• Maintain the best practice of BIM technology and develop it in the future of construction industry.</td>
<td>Ability to measure the level of BIM implementation in the Egyptian community.</td>
<td></td>
</tr>
<tr>
<td>• Promote and maintain the best practices of BIM.</td>
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</tbody>
</table>
EGY BIM GUIDE Software for a successful BIM implementation in Egypt construction industry
Using EGY BIM GUIDE Software on Grand Egyptian Museum
Thank You