Digital Transformation through BIM:
Insights for a collective national and trans-European approach

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• Is BIM a ‘manifestation’ of digital transformation in construction?
• How are policy makers responding to opportunities brought by BIM?
• What are the key ingredients required in a market to achieve a BIM-enabled digital transformation?
• How does BIM diffusion unfold across a market?
• What are the approaches/actions available to policy makers to stimulate BIM adoption?
• Who to involve and how to share the BIM adoption effort across a market?
• Insights for a national and trans-European approach
A Proposed Approach To Comparing the BIM Maturity of Countries

Analyzing Noteworthy Publications of Eight Countries Using a Knowledge Content Taxonomy

Macro BIM Adoption: Conceptual Structures

Macro BIM adoption: Comparative Market Analysis
26 countries so far including input from +350 experts

Initial Benchmarking Data – collected in 2015 -2019

<table>
<thead>
<tr>
<th>Australia</th>
<th>New Zealand</th>
<th>Netherlands</th>
<th>Switzerland</th>
<th>Russia</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Brazil (thrice)</td>
<td>Portugal</td>
<td>UAE</td>
<td>Peru</td>
<td>Guatemala</td>
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<tr>
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<td>Qatar</td>
<td>United Kingdom</td>
<td>Argentina</td>
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<td>Uruguay</td>
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<td>Mexico (twice)</td>
<td>Spain (twice)</td>
<td>South Korea</td>
<td>Chile</td>
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2015 – 2019

Barcelona, Milan, Sao Paolo, Hannover, Cairo, Dublin, Montreal, Hong Kong, …
Is BIM a ‘manifestation’ of digital transformation in construction?
Digital transformation of construction sector

Cloud-based collaborative working
Industrialised construction
Smart buildings and cities
Automation, robot, & drones
Digital Twin
VR & AR
Sensing and IoT
DLT and smart contract

Building Information Modelling

Facilitate collaborative working
Enable offsite manufacturing and industrialised construction
Better asset management and maintenance
Automate repetitive tasks and reduces effort and costs
Better visualisation and coordination
Test designs options, test performances and value engineering
Improved scope, cost & time predictability
BIM is the current expression of digital innovation within the construction industry.

Adoption = (Implementation + Diffusion) x activities

Within projects, organisations, and by individuals

Macro Adoption = market/country level
How policy makers are responding to opportunities brought by BIM?
Mandates + Standards + Incentives

UK’s BIM Level 2
France’s BIM Plan 2022
Quebec’s Construction 4.0 Initiative
Construction Industry Council’s Initiative (Hong Kong)
Digital Transformation through BIM: Insights for a Collective National and Trans-European Approach

Dr. Mohamad Kassem | EU BIM Task Group, Brussels

- Public vs private sector
- Capacity building
- Engagement reach
- Lack of guidance
- Untested case studies
- Reality vs. hype
- Gaps/redundancy in policy
- Methodological approach
• Strong evidence for collective approach to accelerate adoption, reduce costs, and increase collective benefits

• Key attributes of BIM Adoption Policies
  o Provides a clear and purposeful vision
  o Demonstrates strong leadership
  o Engages with all relevant stakeholders and interest groups
  o Provides incentives
  o Prioritise learning, education and capacity building
  o Commit for a long term journey (maintenance, succession, or termination)
What are the key ingredients required in a market to achieve a BIM-enabled digital transformation?
There are

**8 Components**

that every market needs to develop to enable both holistic and systematic BIM Adoption
Macro Maturity Components Model
Macro Maturity Components Model
Macro Maturity Components Model
## Component I

### Objectives, stages and milestones

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>a</strong> <em>(low maturity)</em></td>
<td>There are no market-scale BIM objectives or well-defined BIM implementation stages or milestones</td>
</tr>
<tr>
<td><strong>b</strong> <em>(medium-low)</em></td>
<td>There are well-defined macro BIM objectives, implementation milestones and capability stages</td>
</tr>
<tr>
<td><strong>c</strong> <em>(medium maturity)</em></td>
<td>BIM objectives, stages and milestones are centrally managed and formally monitored</td>
</tr>
<tr>
<td><strong>d</strong> <em>(medium-high)</em></td>
<td>BIM objectives and stages are integrated into policies, processes and technologies and manifest themselves within all other macro maturity components</td>
</tr>
<tr>
<td><strong>e</strong> <em>(high maturity)</em></td>
<td>BIM objectives and stages are continuously refined to reflect advancements in technology, facilitate process innovation, and benefit from international best practices</td>
</tr>
</tbody>
</table>

*Other component-specific metrics include:* The Availability of Long-term Objectives to Guide Market Adoption; Availability of Capability Stages to Guide Market Adoption; The Availability of Maturity Milestones to Guide Market Adoption; ...
# Component V
## Learning and education

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a</strong> (low maturity)</td>
<td>BIM learning topics are neither identified nor included within legacy education/training programs; learning providers lack the ability to deliver BIM-infused education</td>
</tr>
<tr>
<td><strong>b</strong> (medium-low)</td>
<td>BIM learning topics are identified and introduced into education/training programs; BIM learning providers are available across a number of disciplines and specialties</td>
</tr>
<tr>
<td><strong>c</strong> (medium maturity)</td>
<td>BIM learning topics are mapped to current and emergent roles; BIM learning providers deliver accredited programs across disciplines and specialties</td>
</tr>
<tr>
<td><strong>d</strong> (medium-high)</td>
<td>BIM learning topics are integrated across educational tiers (tertiary, and vocational) and address the learning requirements of all industry stakeholders</td>
</tr>
<tr>
<td><strong>e</strong> (high maturity)</td>
<td>BIM learning topics are infused (not separately identifiable) into education, training and professional development programs</td>
</tr>
</tbody>
</table>

*Other component-specific metrics include:* BIM Infusion into Tertiary Curricula; Multi-disciplinary Integration of Curricula; Use of Simulated Design, Construction and Operation Environments; Expertise of Learning Providers; …
### Component VII

**Standardised parts and deliverables**

[latest version or additional information](#)

<table>
<thead>
<tr>
<th></th>
<th>a (low maturity)</th>
<th>b (medium-low)</th>
<th>c (medium maturity)</th>
<th>d (medium-high)</th>
<th>e (high maturity)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There no market-specific object libraries (e.g. doors and windows); service delivery model uses (e.g. clash detection) and operational data requirements (e.g. COBie)</td>
<td>Object libraries are available yet follow varied modelling and classification norms; service delivery model uses and operational data requirements are informally defined and partially used</td>
<td>Standardised object libraries are available and used; service delivery model uses and operational data requirements are formally defined and used across all project lifecycle phases</td>
<td>Standardised object libraries, service delivery model uses, and operational data requirements are integrated into, procurement mechanisms, project workflows and lifecycle facility operations</td>
<td>Standardised object libraries, service delivery model uses and operational data requirements are continuously optimised and realigned to improve usage, accessibility, interoperability and connectivity</td>
</tr>
</tbody>
</table>

**Other component-specific metrics include:** Availability of an Elemental Classification System; Availability of National Object Libraries; Availability of Standardised Model Uses; ...
<table>
<thead>
<tr>
<th>Objectives, Stages &amp; Milestones</th>
<th>Champions &amp; Drivers</th>
<th>Regulatory Framework</th>
<th>Noteworthy Publications</th>
<th>Learning &amp; Education</th>
<th>Measurements &amp; Benchmarks</th>
<th>Standardised Parts &amp; Deliverables</th>
<th>Technology Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish basic strategic objectives</td>
<td>Establish a high-level task group to develop a national strategy</td>
<td>Develop a framework that encourages process innovation, early involvement of contractors and integrated project delivery</td>
<td>Establish a list of noteworthy publications to be developed protocols and mandates that facilitate BIM adoption across the market</td>
<td>Develop a competency inventory, educational framework, and learning modules. Conduct awareness sessions across the supply chain</td>
<td>Develop metrics for assessing and prequalifying the capability of organizations and the competency of individuals</td>
<td>Develop a protocol for standardized components</td>
<td>Develop a protocol for min hardware specifications</td>
</tr>
<tr>
<td>Define min capability requirements for projects of Type X</td>
<td>Establish mid-level, regional or specialised satellite task groups to implement the national strategy and develop detailed protocols</td>
<td>Conduct pilot projects using the new framework. Refine the framework and establish a strategy for its market-wide adoption</td>
<td>Develop the development of the first set of guides, publications to be developed protocols and mandates that facilitate BIM adoption across the market</td>
<td>Develop learning modules for tertiary, vocational, and professional settings. Encourage the development of e-learning material covering all disciplines and roles. Educate the educators.</td>
<td>Develop a market-wide benchmark for project performance. Develop a performance pre-qualification framework</td>
<td>Generate standardized components for most-used architectural, structural and mechanical elements.</td>
<td>Develop a protocol for common data environments (for exchanging files and data)</td>
</tr>
<tr>
<td>Define minimum capability requirements and project deliverables for all other types and sizes of projects</td>
<td>Dissolve all regional satellite groups and encourage the formation of specialised Communities of Practice (CoPs)</td>
<td>Mandate the use of the new regulatory framework</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop a protocol for a whole life-cycle, integrated-data environment (covering all documents, models and data)</td>
</tr>
</tbody>
</table>
**BIM Roadmap:**

**Brazil**

<table>
<thead>
<tr>
<th>Results</th>
<th>2018</th>
<th>2021</th>
<th>2024</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase productivity of companies by 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce costs by 9.7%</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Increase BIM adoption by 10x (of GDP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase construction GDP by 23.9%</td>
<td></td>
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- **Governance:** Establish BIM management instance. Ensure BIM strategy implementation and analysis. Implement BIM strategy and align goals. Develop BIM strategy and encourage technological development.

- **Infrastructural Technology and Innovation:** Improve communication infrastructure and data dissemination in strategic regions and solutions to ICT. Incentivize interoperability through improved standards and practices.

- **Contractual Legal:** Establish BIM requirements for public procurement. Improve BIM legal and illegal practices regarding public procurement. Strengthen BIM legal and contractual practices.


- **Investment:** Promote favorable business environment for investment in BIM. Promote environment for investment in BIM.

- **Capacity:** Establish BIM objectives and professional courses. Promote BIM certification and training programs. Update BIM education and training.

- **Induction by the Government:** Establish BIM in the government. Adopt BIM in pilot programs. Adopt BIM in projects and new programs.

- **Communication:** Disseminate BIM concept and benefits. Promote BIM strategy and results. Promote BIM platform and library.

How does BIM diffusion unfold across a market?
There are **3 market dynamics**
that affect how BIM adoption is triggered and diffused
Diffusion Dynamics Model

TOP-down

Government

MIDDLE-out

Large Organizations

BOTTOM-up

Small Organizations
**Diffusion Dynamics Model**

**3 Diffusion Dynamics:**
Top-Down, Middle-Out & Bottom-Up.

**3 Pressure Mechanisms:**
Downwards, Upwards & Horizontal; and

**3 Pressure Types:**
Coercive, Normative, & Mimetic
At organisation level

Many dynamics affect how BIM adoption occur and top one can be identified
<table>
<thead>
<tr>
<th>Loop</th>
<th>Loop name</th>
<th>Interdependent factors</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Benefits of BIM innovation</td>
<td>Relative advantage of BIM (F6) → Willingness/ intention to adopt BIM (F1) → Organisational culture (F7) → Social motivations among organisation's members (F5) → Communication behaviour of an organisation (F2) → Observability of BIM benefits (F3) → Compatibility of BIM (F4) → Top management support (F8) → Organisational readiness (F9) → Relative advantage of BIM (F6).</td>
<td>BIM benefits can lead through its influence on a number of organisational characteristics (willingness to adopt BIM, organisational culture, social motivation, and communication behaviour) to an appreciation of the benefits of BIM and its compatibility, hence, inviting top management support which improve the organisation readiness and lead to the decision to adopt BIM.</td>
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What are the approaches/actions available to policy makers to stimulate BIM adoption?
Policy Actions Model
Digital Transformation through BIM: Insights for a Collective National and Trans-European Approach

Dr. Mohamad Kassem | EU BIM Task Group, Brussels

Ireland 2017

Ireland 2019
Who to involve and how to share/plan the BIM adoption effort across a market?
1 Policy Makers

Governmental players playing an active role in mandating or encouraging the adoption of BIM tools and workflows

e.g. the Task Group in the UK and BCA in Singapore
2 Educational Institutions
The universities and not-for-profit technical institutions developing and delivering learning programs and materials
3 Construction Organizations
Designers, contractors, owners, operators and other organizational players involved in deploying BIM tools and workflows, training their staff and delivering BIM-enabled outcomes
4 Individuals

The individual practitioner, researcher, lecturer and student involved in learning, or actively implementing BIM tools and workflows.
5 Software Developers
The large software houses responsible for developing and maintaining BIM software tools, network solutions and middleware e.g. Autodesk, Nemetschek and Trimble
6 Value-adding Resellers
The companies bridging and maintaining the relationship between software/network solution developers and end users
7 Industry Associations
Associations dedicated to represent the interests of their individual and organizational members
*e.g. AMCA in Australia*
8 Communities of Practice
The informal grouping of individuals with a shared interest in improving their own BIM performance
- e.g. Revit user groups
9 Technology Advocates
The associations involved in developing and promoting technology-centric solutions for industry problems
\textit{e.g. buildingSMART}
## Macro Maturity Components

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<th>Policy Makers</th>
<th>Educational Institutions</th>
<th>Construction Organizations</th>
<th>Individual Practitioners</th>
<th>Technology Developers</th>
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<tr>
<td>A</td>
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<td>B</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>A</td>
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### Diffusion-Role Matrix v1.0

*Sample shown at G1 and 1 (Succar, 2015)*

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<td>B</td>
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<td>A</td>
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</table>

[A] Leading, [B] Supporting, & [C] Participating roles
Insights for a national and trans-European approach?
Lessons Learned

• Mandate vs. no mandate?
• Mimic macro BIM adoption of other countries?
• Digital transformation like ‘network/coalition’ ecosystem
• Policy makers needs to lead by example, engage and incentivise industry stakeholders
• It takes a long time to achieve BIM adoption across a market. Commit for a long journey.
Trans-European Opportunities

- A **Collaboration Network** between policy makers to align strategies and roadmaps
- A **Coordinated BIM Education Framework** for all types of educational institutions
- A **Knowledge Hub** for sharing use cases, learning, materials, guides, and protocols
- An open **BIM Object Library** for products across the EU?
There is so much benefit from

**Coordinated efforts**
across the EU (EU BIM Task Group)

**Unified efforts**
across government departments

**Collective efforts**
by industry stakeholders
Change takes time, effort, perseverance, and patience.

Keep up the momentum!
A call for collaboration
THANK YOU

https://BIMexcellence.org