BUILDING INFORMATION MODELLING

António Aguiar Costa
Professor Auxiliar Instituto Superior Técnico
Presidente da Comissão Técnica de Normalização BIM – CT197

A virtually new world
World, largest listed companies by market capitalisation, $bn

<table>
<thead>
<tr>
<th>Sector</th>
<th>Exxon Mobil</th>
<th>General Electric</th>
<th>Gazprom</th>
<th>Microsoft</th>
<th>Citigroup</th>
<th>Bank of America</th>
<th>Royal Dutch Shell</th>
<th>BP</th>
<th>PetroChina</th>
<th>HSBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>End 2006</td>
<td>0</td>
<td>200</td>
<td>400</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company</th>
<th>2016*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>0</td>
</tr>
<tr>
<td>Alphabet</td>
<td>200</td>
</tr>
<tr>
<td>Microsoft</td>
<td>400</td>
</tr>
<tr>
<td>Berkshire Hathaway</td>
<td>600</td>
</tr>
<tr>
<td>Exxon Mobil</td>
<td>0</td>
</tr>
<tr>
<td>Amazon</td>
<td>200</td>
</tr>
<tr>
<td>Facebook</td>
<td>400</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>600</td>
</tr>
<tr>
<td>General Electric</td>
<td>0</td>
</tr>
<tr>
<td>China Mobile</td>
<td>600</td>
</tr>
</tbody>
</table>

Source: Bloomberg

*At August 24th 2016
December 17, 2016

Software to transform standard industry robots into autonomous 3D printers

Focus on metals using Wire-Arc Additive Manufacturing

Multi-disciplinary team collaborating with several industry players

"The first step was to make everybody want this project.

Gijs van der Velden, COO"
Smarter & safer construction.

Get actionable data, minimize costs, and make smarter business decisions using the Site Scan™ construction drone platform.

The DAQRI Smart Helmet concept proved professional-grade augmented reality can change how people work.
MASSIVE ASSETS GENERATE MASSIVE AMOUNTS OF DATA. CAN YOU HANDLE IT?

Right now, construction data is siloed and getting lost throughout the project life cycle.

Uptake's products improve the orchestration of your construction business by using all your data to boost equipment productivity and reduce safety risks.

- Predictive analytics software for construction and other heavy equipment industries
- Optimize unscheduled downtime, lifespan, maintenance cycles, etc.
- Forbes' hottest start-up of 2015 and now valued at over $2bn

Liverpool Street - How Crossrail interfaces with the City, via BIM
Malcolm Taylor, Crossrail "If you're smart about BIM you can hit 15%-20% savings in infrastructure and efficiency in the longer term"
By 2025, “full-scale digitalization... will lead to annual global cost savings of 13% to 21% in the design, engineering and construction phases and 10% to 17% in the operations phase”

BIS (The Boston Consulting Group)

Implementação BIM no setor público


4. For public works contracts and design contests, Member States may require the use of specific electronic tools, such as building information electronic modellng tools or similar. In such cases the contracting authorities shall offer alternative means of access, as provided for in paragraph 5, until such time as those tools become generally available within the meaning of the second sentence of the first subparagraph of paragraph 1.
Algumas Normas já publicadas como ENs:

- EN ISO 16739 – Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries;
- prEN ISO 19650-2 – Information Management using Building Information Modeling - Part 2: Delivery Phase of the assets;
<table>
<thead>
<tr>
<th>People &amp; Skills</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal &amp; contractual</td>
<td>Procurement</td>
</tr>
<tr>
<td>Procurement</td>
<td>Specified data requirements</td>
</tr>
<tr>
<td>Specified data requirements</td>
<td>Delivery plan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data exchange</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative working &amp; coordination</td>
<td>Security</td>
</tr>
<tr>
<td>Information management</td>
<td>Technical information</td>
</tr>
<tr>
<td>System engineering</td>
<td>Validation</td>
</tr>
<tr>
<td>Use</td>
<td></td>
</tr>
</tbody>
</table>

---

**Handbook for the introduction of Building Information Modelling by the European Public Sector**

**Strategic action for construction sector performance: driving value, innovation and growth**

---

**Mission Numérique Bâtiment**

**Rapport**

Bertrand DESCAMPS

---

**Plan Transition Numérique dans le Bâtiment**

**20 M € d'euros pour 3 priorités**

1. **Connaître et dégager une priorité**
   - Plan d'actions
   - Formation / Exécution

2. **Maîtriser les compétences**
   - Plan de progression
   - Certification / Audit

3. **Installer la confiance**
   - Plan d'accompagnement
   - Communication / Sensibilisation
Reform Committee „Major Projects”

The main objectives of the committee are:
- Project delivery on time & budget and increased transparency whilst meeting quality and performance criteria [...] This includes a fundamental review of our processes, policies and guidelines.
Site da CT197 (www.ct197.pt)
PARTE I
REQUISITOS DE INFORMAÇÃO DA ENTIDADE CONTRATANTE

11. Introdução
12. Definição dos requisitos de informação da Entidade Contratante
13. Regulamentos e Directivas
14. Instrumentos jurídicos e técnicos
15. Normas e Estudios
16. Procedimentos de Avaliação

Comercial
Objetivos e âmbito BIM; usos BIM; direitos de propriedade;

Gestão
Funções e atribuições; processos de colaboração;
parâmetros de informação e sistemas de autorizações;
segurança; gestão da qualidade; entrega e aprovação da informação;

Técnica
Software e plataformas; formatos para troca de informação;
levantamentos, cadastros e informações existentes;
sistemas de coordenadas e referenciais; níveis de desenvolvimento da informação (em inglês, Levels of Development (LOD)); tolerâncias de modulação; nomenclaturas de ficheros e peças desenhadas; necessidades formativas.

STD/BIM/P004.3 - Performance Attribute Data

<table>
<thead>
<tr>
<th>Categoria</th>
<th>Fornecedores</th>
<th>Aptidão</th>
<th>Respostas</th>
<th>Sensibilidade</th>
<th>Custo</th>
<th>Impacto</th>
<th>Durabilidade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acabamento e Constructura</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sistemas de água e esgoto</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sistemas de energia</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sistemas de ventilacion</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sistemas de comunicação</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Equipamento</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Outros</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
"This Government's four year strategy for BIM implementation will change the dynamics and behaviours of the construction supply chain, unlocking new, more efficient and collaborative ways of working. This whole sector adoption of BIM will put us at the vanguard of a new digital construction era and position the UK to become the world leaders in BIM."

Francis Maude
Minister for the Cabinet Office

UK BIM Levels
Level 2 BIM “Package”

- PAS1192:2 Capital Delivery
- PAS1192:3 Operational Delivery
- BS1192:4 Data Structure
- Data Classification
- Digital Plan of Works (Levels of Data Detail)
- PAS1192:5 Security
- BIM Contract Protocol
- Government Soft Landings
Atenção aos inúmeros desafios!!!

→ Será que o modelo digital representa mesmo a realidade que se pretende?

→ Que informação o modelo deve incluir e como deve ser estruturada?

→ Quem gera estes modelos? Será a cadeia de produção da construção capaz de os desenvolver de forma fluída?

→ Quem contrata estes modelos digitais da realidade? E como garante a sua fiabilidade?

Data to share
Obrigado!

aguiar.costa@tecnico.ulisboa.pt