“E-Collaboration and Information Management: An Inside View of Britain's Railway Market”

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Why information?

My inspiration...

"information is an unusual good: the more widely is shared, the more people benefit from it"  
(UK Government, 2013)

“There is a growing realisation that information is an organisation’s third capital asset and should be given the same level of focus as cash and human resources”  
(Hulme, 2012)

challelengge & opportunity:

- Wisdom
- Knowledge
- Information
- Data

business value
Objectives + Methodology

Quantitative analysis (Survey among the Rail Alliance members)

From the interviewees' sample & targeting of practitioners

Objective 2: BIM - Awareness, perceptions, expectations (Large firms & SMEs)

Objective 3: BIM - Barriers and actions to be overcome (Large firms & SMEs)

Qualitative analysis (Personal interviews to a number of the survey's participants/practitioners)
What is e-collaboration?

'...collaboration among individuals engaged in a common task using electronic technologies'.

Kock et al. (2001)
What is BIM?

BIM = technology + collaborative work process

(software + 3D models + collaborative work process + information management + asset management + more...)

“Building* Information Modelling (BIM): “the process of generating, building and managing data through the life of a project by using model-based technologies linked to a database of project information”

(Crossrail)

*Building = the verb not the noun, which describes the process of developing information models to improve the business performance.
Why BIM?

BIM = e-collaboration + information management = innovation = game changer
cost + change management

ability to impact cost and functional capabilities

MacLeamy Curve

'shift'

BIM

Traditional

cost of design changes

Project Phase

Ability to impact cost and functional capabilities
Cost of design changes
Traditional design process
BIM design process

Quality
Time
Cost
knowledge management

Knowledge Sources

Design | Cost | Construct | Operate

More

Less

Early | Design | Procure | Build | Manage | Late

BIM

Traditional process

Time

Source: P. Bernstein, Autodesk AEC Solutions

- Information capturing
- Information waste reduction
- Improved knowledge management
- Continuity of asset records
Transformation of stakeholders' relationships = opportunities

- transparency + simplicity
- early involvement
- better coordination
- role changes

'enabling BIM*

'a reminder of the old world'

'BIM world'

source:
technical core + social parts = a complicated process
disadvantages

- Not clear defined/perceived
- Various users’ purposes/expectations
- Incompatibility of software (large organisations using their own systems)
- Cultural shift is required
- Lack of legislation/standardisation
- Training costs
- High costs for implementation (especially for SMEs)
The UK Government Role

Level 2 - 2016: from 3D modelling to collaborative design
Level 3 - 2025: from collaborative tool to an integrated tool with social impact

Industrial Strategy: Building Information Modelling

Digital Build Britain


BIM LEVEL 2

‘Government will require fully collaborative 3D BIM...as a minimum by 2016.’

2013-14 achievements:
- 20% reduction in capital expenditures
- £840 million cost savings (construction industry)
- Global leader in digital economy

BIM LEVEL 3

‘BIM will enable citizens to make better use of the existing infrastructure’

Benefits for the construction sector and the society due to the developed ‘data assets’

Government Construction Strategy

Industrial Strategy: Construction 2025

Smart Cities: Background paper
Britain's railway: adoption of BIM + interest

Collaborative 3D environment = contractual requirement
Crossrail BIM 'academy' = interoperability
1 centralised set of linked databases

"We want to build, operate and maintain a virtual railway before we go anywhere near a shovel" (MacNaughton, 2015)

BIM Level 2
Appointment of BIM specialists
3D models transferred to 2D deliverables for the client progress monitoring

Network Rail
2014 Asset Management strategy working on its procurement strategy follow UK Government BIM strategy

BCRRE
Research interest

Rail Alliance
Support of firms (SMEs)
Appointment of BIM specialist
Support seminars + training

Rail BIM Summit
2015 conferences

ICE
Institution of Civil Engineers
BIM 2015 conference
Building Information Modelling (BIM):

*The process of creating, building, and managing data throughout the life of a project by using model-based technologies linked to a database of project information.*

(Crossrail)
Respondents Profile

Job position
- CEO: 4%
- Managing director: 22%
- Technical manager: 21%
- Division or department manager: 10%
- Project manager: 13%
- Project Engineer: 2%
- Other: 28%

Size of workforce
- SMEs (73.5%)
  - 1 to 10 employees: 13.2%
  - 11 to 50 employees: 35.3%
  - 51 to 250 employees: 25.0%
  - More than 250: 26.5%

Years of activity in the rail industry (organisation)
- 0 to 5 years: 14.7%
- 6 to 10 years: 20.6%
- 11 to 15 years: 13.2%
- 16 years or more: 51.5%

Field of operation
- Supplier: 27.7%
- Manufacturing: 24.8%
- Other: 15.8%
- Consultancy (Engineering or Environment): 13.9%
- Consultancy (Business): 6.9%
- Software and IT solutions: 5.9%
- Information systems: 5.0%

Diffusion of innovation (self-characterisation)
- Innovators: 38.2%
- Early adopters: 45.6%
- Early majority: 11.8%
- Late majority: 1.5%
- Laggards: 2.9%
BIM awareness

Are you aware of BIM?
- Almost three fifths (57%) of the participants are aware of BIM.
- The awareness of the respondents can be characterised as sufficient, because of the current conditions of BIM use in the rail industry.

BIM potentials

Do you believe that BIM could be beneficial for the company?*
* answers among the participants who are NOT aware of BIM
43% of the total sample

Note: The BIM definition and further information were provided before the question.

Almost the half of the BIM unaware respondents support that: ‘BIM could be beneficial for my company’.
## BIM awareness in depth

### Definition among the aware respondents (57%)

**Construction, digital model-oriented:**
A way of working and managing information in a team environment, enabling everyone to understand a building by using a digital model.

- 5.1%

**Do not know/cannot decide**

- 7.7%

**Project, 3D model-oriented:**
A process that involves creating and using an intelligent 3D model to inform and communicate project decisions.

- 15.4%

**Commercial, information sharing model-oriented:**
A process of business collaboration through shared information models.

- 33.3%

**Project whole lifecycle (asset), digital model-oriented:**
A process of designing, constructing or operating a building or infrastructure asset by using electronic object-oriented information.

- 38.5%

### Awareness of the Governmental target

(Use of BIM-Level 2 by 2016)

- 49% of the respondents (85% of the BIM aware) are aware of the Governmental target.

- **TOTAL**
  - Yes: 49%
  - No: 33%
  - BIM aware: 39%

- **BIM aware respondents**
  - 85%

- **Large**
  - 91%

- **SMEs**
  - 82%
Participation in projects that had adopted BIM

- 29% of the respondents (51% of the BIM aware) participated in a BIM project.

Average level of use among the participants in BIM projects (29%)

- The BIM projects’ participants are at an adequate level regarding the governmental strategy (use of BIM-Level 2), especially those from large firms.

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>30.0%</td>
<td>50.0%</td>
<td>10.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Large</td>
<td>12.5%</td>
<td>87.5%</td>
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<tr>
<td>SMEs</td>
<td>41.7%</td>
<td>25.0%</td>
<td>16.7%</td>
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Level 1: BIM only for 3D design by the consultants.
Level 2: BIM for design purposes; a collaborative approach was followed by the stakeholders and the information was shared among the participants in order to proceed with a federated BIM model.
Level 3: All the project parties were able to access and modify the information within the same BIM model.
BIM is a design tool only

- 22% Strongly Agree
- 10% Agree
- 23% Neither agree nor disagree
- 18% Disagree
- 24% Strongly disagree
- 3% Don't know/No opinion

BIM is only useful in complex projects

- 22% Strongly Agree
- 15% Agree
- 9% Neither agree nor disagree
- 31% Disagree
- 22% Strongly disagree
- 1% Don't know/No opinion

BIM adoption will be...

- 23% Strongly Agree
- 24% Agree
- 18% Neither agree nor disagree
- 22% Disagree
- 10% Strongly disagree
- 3% Don't know/No opinion
BIM is a process change rather than a software purchase.

- 23% Strongly Agree
- 19% Agree
- 12% Neither agree or disagree
- 6% Disagree
- 0% Strongly disagree
- 0% Don't know/ No opinion
BIM adoption will be beneficial for the rail industry

- Strongly Agree: 19%
- Agree: 37%
- Neither agree nor disagree: 26%
- Disagree: 3%
- Strongly disagree: 0%

Procurement strategy is crucial for effectiveness in BIM

- Strongly agree: 9%
- Agree: 28%
- Neither agree nor disagree: 19%
- Disagree: 40%
- Strongly disagree: 1%
- Don't know/No opinion: 3%
Micro-environment

BIM requires a high level of technological skills

BIM can be a useful tool for SMEs

BIM adoption will be beneficial for my company

My company is able to adopt BIM
**BIM SWOT**

**Major Strengths**
- Reduction of work duplication: 48.5%
- Early involvement in a project: 48.5%
- Reduction of errors: 38.2%
- Improved cost estimation and time planning: 33.8%
- Higher grade of transparency: 33.8%
- Don’t know/No opinion: 25.0%
- Reduction of cycle time: 22.1%

**Major Weaknesses**
- Industry structure does not allow for the effective adoption of BIM: 45.6%
- Software issues (i.e., incompatibility between partners’ systems): 41.2%
- Skilled personnel is required: 30.9%
- Don’t know/No opinion: 27.9%
- Liability risks: 14.7%
- Other*: 7.4%

*Other:
- Not clear defined/misunderstanding.
- Lack of understanding by the clients.
- Modelling of existing rail assets.
Major Opportunities

- Provision of better services and products to existing clients: 60.3%
- Introduction of new knowledge/skills into the industry by the SMEs: 32.4%
- Provision of new services and products to new clients: 32.4%
- Provision of new services and products to existing clients: 26.5%
- Don't know/No opinion: 23.5%
- Other*: 2.9%

Other:
- Use of created (existing) information for new projects.
- Better and more detailed specifications will be developed.

Major Threats

- Lack of support from larger organisations/partners: 36.8%
- Confidentiality of data and privileged information: 33.8%
- Long duration for standardisation: 29.4%
- Don't know/No opinion: 29.4%
- Market domination by software companies: 23.5%
- Other*: 5.9%

Other:
- Lack of resources/skills.
- Cost restrictions (SMEs).
- Loss of imaginative skills.
- The BIM adoption will affect the firm's strategy: 4.4%
BIM barriers

In your opinion which of the following are the main barriers for the BIM adoption by your company?

- Unfamiliarity with BIM: 54.4%
- Cultural change is required: 30.9%
- Lack of skilled personnel: 27.9%
- First cost of implementation is too high: 25.0%
- Our partners’ procurement policies are not encouraging adoption of BIM: 20.6%
- Not useful for company's area of work: 19.1%
- Implementation costs outweigh the potential benefits: 19.1%
- Implementation benefits are not tangible: 14.7%
- Don't know/ No opinion: 10.3%
- Risk due to liability reasons: 8.8%
- Other*: 4.4%

*Other:
- Not part of our clients' wider policy.
- Lack of team and client engagement with BIM.
Ways to overcome the barriers

“Development of sharing culture”

“Clients should give direction of which platform to choose”

“Improved education from the industry”

“Procurement shift”

“Standardisation”

“Better understanding of benefits (clients & large firms)”

“The end users need to be aware of the benefits of a supplier to become almost a consultative partner”

“A rail industry wide leadership forum is required”
Conclusion

long-term change

technology

interoperability software/ BIM Railway platform skilled personnel

culture/mentality

financial + commercial

better definition + understanding invest in BIM large firms + clients support SMEs standardisation

process

'BIM friendly' procurement non-adversarial contracts flexibility reassessment of confidentiality

sharing culture

collaboration & trust
Recommendations

- Further investigation of the firms’ innovative/BIM capabilities
- Comparative study (BIM in Railway vs BIM in AEC)
- Standardisation and regulations + clearer definition of BIM (Asset management + collaboration)
- Development of a BIM strategy for the industry - achievable & measurable targets
- Development of a collaborative ‘BIM friendly’ culture
- Creation of a multi-professional and cross-sectoral BIM panel
- Protection - Hazard of domination by software companies
  development of a common BIM railway platform widely available at low cost
  (BIM Task Group - supporting BIM software (COBie) is available for free)
- ‘Crossrail Academy’ paradigm
further opportunities

• New business area - SMEs opportunity
  creation and management of information models for the existing UK railway assets

• BIM for Asset Management
  information for the end-users (citizens, TOCs, FOCs), the network owner (NR) and the suppliers.

• 'Smart'/ Digital UK Railway
  Smart City concept, Digital Built Britain
Thank you!!