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BIM GATHERING 2019



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A Qualitative Review of BIM, Sustainability and Lean Construction. *Is there a Future for Lean Construction?*



- ❖ Introduction and Background to the Research
- ❖ Research Methodology
- ❖ Qualitative results and analysis
- ❖ Advantages identified
- ❖ Disadvantages identified
- ❖ Economic Advantages
- ❖ Sustainability Advantages
- ❖ Corporate Advantages
- ❖ Lean Construction - Will it be subsumed by BIM?
- ❖ Conclusions and Recommendations



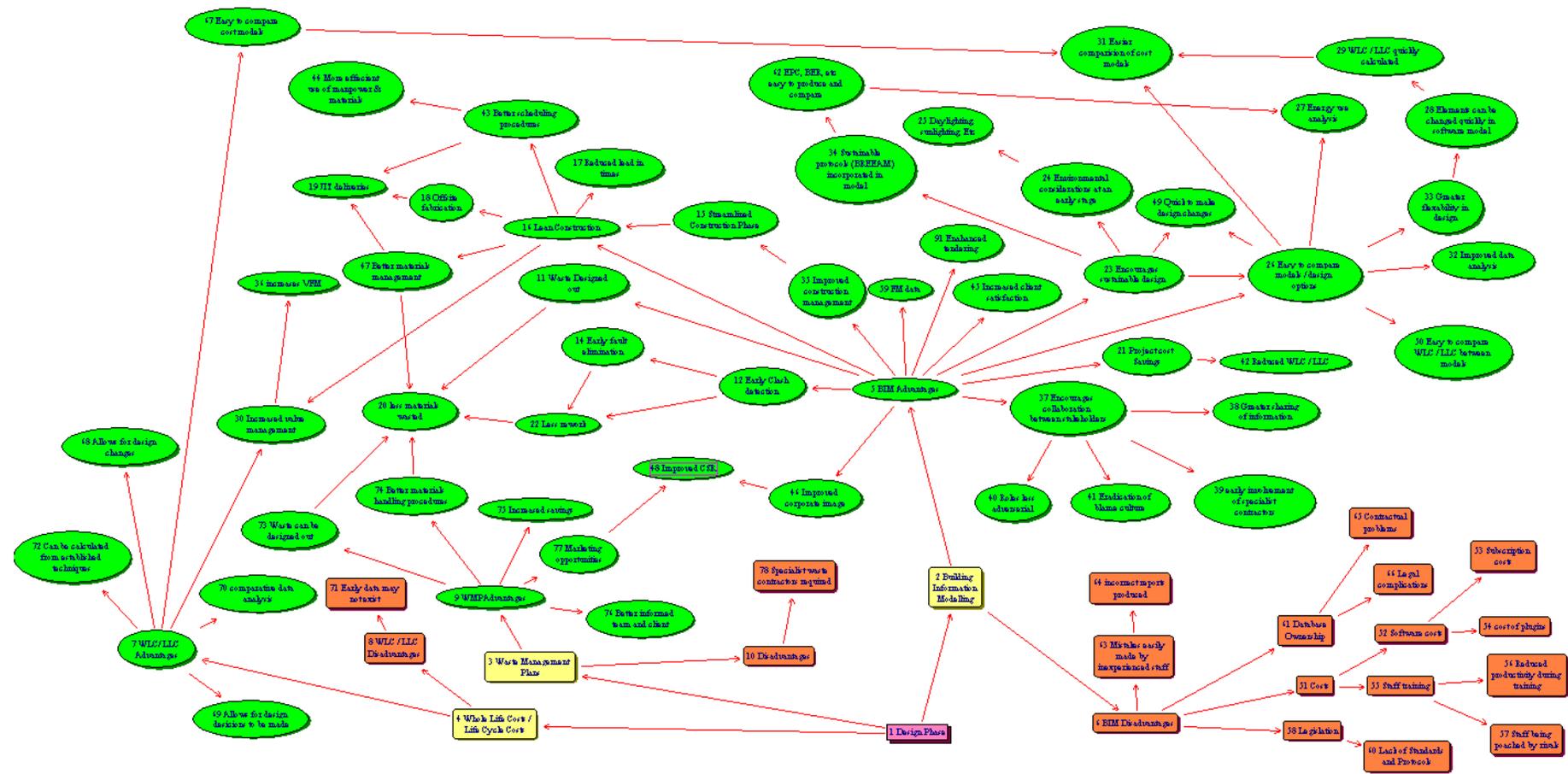
Research Title: *“Early Implementation of BIM in Architectural firms to promote Whole Life Costing and Lean Construction”*

Presented paper is based on preliminary research carried out for Ph.D.



Three tiers of research sequentially carried out;

- ❖ An in depth literature review
- ❖ Two semi structured interviews and a focus group
- ❖ Results from the interviews / focus group were then input into a qualitative mapping software package called ‘Decision Explorer’
 - Domain analysis
 - Central analysis





- ❖ Domain Analysis. ~ This shows concepts which may have several links
- ❖ Central Analysis. ~ This shows those concepts which will have the greatest effect
- Only the top five results were used for the paper



Domain Analysis.

- ❖ This form of analysis highlights concepts that the interviewees and focus group found interesting and discussed
 - Of the 23 concepts ranked in the top five within domain analysis only one was a disadvantage
 - Benefits far outweigh disadvantages



Central Analysis.

- ❖ This analysis identifies and orders each concept according to its effect or impact on the mapped model
 - Again the effect of advantages is greater than disadvantages
 - The first disadvantage was ranked 16th in interview A, it was then ranked 25th and 24th in interview B and in the focus group, respectively



Central Analysis.

- ❖ Within central analysis, sustainability ranked higher than project cost savings for all three groups
- ❖ However so did 'improved corporate image' and promotion of 'green credentials'
- ❖ These were also higher than concepts such as; less 'materials wasted', 'sustainable design', 'collaboration between stakeholders', 'client satisfaction' etc.

CitA Advantages identified

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	Interview A	Interview B	Focus Group
Allows for design changes to be made	✓		✓
Asset Management			✓
Attract new clients		✓	✓
Better informed team and client	✓		✓
Better materials management	✓	✓	✓
Better scheduling procedures	✓	✓	✓
Client can be involved earlier & better decisions		✓	✓
Comparative data analysis	✓		✓
Cost control		✓	✓
Digital 'O & M' Manual		✓	✓
Early clash detection	✓		✓
Early fault elimination	✓		✓
Early involvement of specialist contractors	✓	✓	✓
Easier comparison of cost models	✓	✓	✓
Easy to compare / models design options	✓	✓	✓
Easy to produce energy usage reports	✓	✓	✓
Efficient use of manpower and resources	✓	✓	✓
Elements can be quickly changed in design	✓	✓	✓
Encourages collaboration between stakeholders	✓	✓	✓
Encourages sustainable design	✓	✓	✓
Energy use analysis	✓		✓
Enhanced tendering	✓		✓
Environmental considerations at an early stage	✓		✓
Eradication of blame culture	✓		✓
Facilities Management		✓	✓
Grants to promote sustainability		✓	✓
Greater flexibility in design	✓		✓
Greater sharing of information	✓		✓
Improved Company image (CSR)	✓	✓	✓
Improved construction management	✓		✓
Improved data analysis	✓		✓
Incorporation of local environment data	✓	✓	✓
Increased client satisfaction & relationship	✓	✓	✓
Increased value management & savings	✓		✓
JIT deliveries	✓		✓
Lean Construction	✓		✓
Less materials wasted	✓	✓	✓
Less rework	✓	✓	✓
Marketing opportunities	✓		✓
More Efficient practice	✓		✓
Offsite fabrication	✓		✓
Open and transparent procedures	✓		✓
Project cost savings	✓	✓	✓
Promotion of green credentials	✓	✓	✓
Quick to make design changes	✓	✓	✓
Reduced lead in times	✓		✓
Retain existing clients	✓		✓
Roles less adversarial	✓		✓
Streamlined construction phase	✓		✓
Sustainable protocols integrated (BIM)	✓	✓	✓
Thermal modelling	✓		✓
Waste designed out	✓		✓

CitA Disadvantages identified

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	<i>Interview A</i>	<i>Interview B</i>	<i>Focus Group</i>
<i>Contractual problems</i>	✓		✓
<i>Costs of additional software (plugins)</i>	✓	✓	✓
<i>Database ownership</i>	✓		✓
<i>Incorrect reports / models produced</i>	✓		✓
<i>Initial hardware costs</i>	✓	✓	
<i>Initial software costs</i>	✓	✓	
<i>Lack of standards and protocols</i>	✓		
<i>Legal problems</i>	✓		✓
<i>Legislation</i>	✓		
<i>Mistakes easily made by inexperienced staff</i>	✓		✓
<i>Reduced productivity during training</i>	✓	✓	
<i>Software costs</i>	✓	✓	✓
<i>Staff being poached by rivals</i>	✓		
<i>Staff training</i>	✓		
<i>Subscription costs</i>	✓	✓	✓
<i>Uninformed client</i>		✓	✓



- ❖ Economic and cost control advantages of using BIM reach out across the life cycle of a building
- ❖ In the design phase BIM can enable the correct choice of design
- ❖ During the construction process, there are many areas where economic savings and advantages exist
 - Materials management, correct plant, increased trades productivity, reductions in project time, early clash and scheduling detections



- ❖ In the construction phase it aids in lean construction
 - Waste reduction, offsite fabrication, JIT, scheduling, Etc.
- ❖ Records handover data allows contractors to provide a digital owners' manual
- ❖ Asset management, facilities management and maintenance management



- ❖ The use of BIM is increasing as the demand for sustainable building with minimal environmental impact is increasing
- ❖ BIM can be a vital design tool for sustainability as it allows the comparison designs options and their impact on green building performance



- ❖ BIM can enable many energy-efficient and sustainable designs, such as passive design concepts, to be addressed early in a project
- ❖ BIM, when used in conjunction with lean construction shows sustainable development is achievable



- ❖ Advantages to utilising BIM feed back to corporate level, economic advantages such as; reduced project costs, lean construction, sustainable construction, better working practices, enhanced tendering, all benefit the organization
- ❖ BIM makes for a more efficient practice because the operations became more collaborative, open and transparent
- ❖ Leads to a better customer service and increased client satisfaction, which the organisation could use in its' marketing and promotion



- ❖ Will the increased use of BIM in all its levels, lead to the demise of Lean Construction?
 - Those involved admitted to knowledge of lean construction processes
 - Only one interviewee stated that they used lean construction practices
 - Those questioned could admit to carrying out a form of lean construction, albeit accidentally
 - BAM Ireland state that they adopted BIM as a “Lean Process”



- ❖ Lean construction was not included among popular tasks for which BIM is used in the USA
- ❖ A survey in 2007, demonstrates that lean construction ranked lowest on the factors for using BIM
- ❖ Little research that utilised both as a collective process



- ❖ BIM is not just a piece of software to produce a 3D/4D model but intrinsically it is a process
- ❖ BIM could be described as “whole life cycle management” of a project
- ❖ BIM is a vital sustainability design tool
- ❖ BIM makes previously laborious and ambiguous processes quicker, increases accuracy of design and reporting in an open and transparent manner



- ❖ BIM has been shown to; reduce the cost, time and uncertainty of design, improve quality, streamline construction and aid in the operation and maintenance of projects
- ❖ BIM can be a vital asset to a buildings' owner or Facilities Manager in the; management, operation, maintenance and asset management, where the data base becomes a 'digital owners' manual



- ❖ BIM provides a foundation for many of the outcomes that lean construction is expected to deliver
- ❖ BIM, when used in conjunction with lean construction shows sustainable development is achievable
- ❖ BIM is an integrated methodology can aid in the ‘value engineering’ of a project and lead to an increase in value for money for the client
- ❖ BIM may subsume lean construction



- ❖ There is a need for better promotion of BIM and the advantages it can bring to a project
- ❖ Its use in materials management, WLC / LCC, sustainability, operations and maintenance, scheduling, lean construction and value management requires further exploration and promotion



- ❖ BIM can help address the problems associated with the implementation and the use of lean construction and sustainability
- ❖ It can also aid in their advancement, therefore further research in this area is recommended

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Thank you

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