Building Information Modelling Impact on Contracts

Ilias Hafsi

ABSTRACT

Nowadays many Contractual Frameworks in the Construction and Building take in consideration BIM Life-Cycle within Projects; however, the problem is as there are some of the Contracts that work for BIM, there are others that complicate its use with some Regulations and Terms. That raises issues of enforceability and integration of BIM within projects. Hence, in this paper the authors will use Disjunctive Reasoning with non-compensatory methods of Multi-Attribute Decision Matrix to compare and analyze the different contracts that are favorable to the use of BIM: NEC 3 (New Engineering Contracts), JCT (Joint Contract Tribunal), PPC2000 (Project Partnering Contract) and CIOB (Chartered Institute of Building). The results of the comparisons and analysis will give insight about all the aspects considered in Contract Integration of BIM and what should Senior Managers choose in which situations.


INTRODUCTION

Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. Since its adoption in the 70s, Building Information Modeling Sub-Contractors have been happy and satisfied by the concept. Therefore, many research studies on how to improve Contract Management to better fit and integrate BIM have been conducted, and conversely there have been research on how to better develop BIM to adapt to the Contractual Frameworks of Construction and Building industry. Therefore, nowadays many Contractual Frameworks in the Construction and Building take in consideration BIM Life-Cycle within Projects; however, the problem is as there are some of the Contracts that work for BIM, there are others that complicate its use with some Regulations and Terms. That raises issues of enforceability and integration of BIM within projects.

The author will start by first defining crystal clear the problems in BIM and Contracts relativity and impact relationships and the outcomes estimated, which will give the author the possibility to propose, assess then choose the right alternatives, the author will then review the outcomes results and assess the benefits this research will bring to the organization.

1 Editor’s note: Student papers are authored by graduate or undergraduate students based on coursework at accredited universities or training programs. This paper was prepared as a deliverable for the course “International Contract Management” facilitated by Dr Paul D. Giammalvo of PT Mitratata Citragraha, Jakarta, Indonesia as an Adjunct Professor under contract to SKEMA Business School for the program Master of Science in Project and Programme Management and Business Development. http://www.skema.edu/programmes/masters-of-science. For more information on this global program (Lille and Paris in France; Belo Horizonte in Brazil), contact Dr Paul Gardiner, Global Programme Director paul.gardiner@skema.edu.
As many agree that BIM should not be integrated in the main contract documents, what are the main issues which incurred this decision? What can be changed in contracts to integrate BIM? What can be engineered in BIM to integrate contracts? Will integrating BIM in the main contract documents improve the project processes and delivery? The author will use this article to address the questions raised and provide findings with the appropriate tools.

The problem addressed here will be then about making a decision in choosing the best fit contract to integrate BIM with the help of Multi Attribute Decision Matrix tool.

**METHODOLOGY**

- **Feasible Alternative Solutions**
  - **Alternative Solutions**
    
    The following Contracts are the list of feasible alternative solutions for integrating BIM into contract documents:
    
    - NEC3 (New Engineering Contracts)
    - PPC2000 (Project Partnering Contracts)
    - JCT (Joints Contract Tribunal)
    - CIOB (Chartered Institute of Building) Contract

  - **Attributes to measure, assess and evaluate each Alternative**
    
    The following criteria will be considered while selecting the right contract that match the expectations of sub-contractors when considering BIM integration:
    
    - Clash detection
    - Collaborative working
    - Early Contract Involvement
    - Agreed Mutual Deadlines
    - Specific Activities
      
      Intellectual Property

- **Development of the Feasible Alternatives**
The author chose to illustrate the Development of the Feasible Alternatives with the help of SWOT Analysis as a tool. *(See Figure 1).*

### Figure 1: SWOT Analysis for the different contracts favorable to integrating BIM

- **Selection of the criteria**

The chosen way of undertaking the selection of the criteria for integrating BIM into contracts is the Disjunctive Reasoning of Multi-Attribute Decision Matrix tool. *(See Figure 2).*

### Figure 2: MADM for selecting the most important key aspect to integrating BIM in a contract

- After undertaking the MAD Matrix in Figure 1, we clearly conclude that the most important aspects to consider when integrating BIM in contract are: Early Contract Involvement and Specific (Technical) Activities.

**FINDINGS**

- **Analysis and comparison of the alternatives**

During this analysis phase, alternatives (the different contracts listed above in part 2) are compared upon what extent they respond to the criteria listed above in part 3.
- The comparison is done by rating each one of the contracts from 1 to 5. *(See Figure 3)*.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>NEC3</th>
<th>PPC2000</th>
<th>JCT</th>
<th>CIOB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clash Detection</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Collaborative Working</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Early Contract Involvement</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Agreed Mutual Deadlines</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Specific Activities</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
| Intellectual Property       | 1    | 2       | 1   | 2    | 2

*Figure 3: Criteria Versus Alternative Solutions Comparison*

- During the comparison, the importance scores obtained earlier in *Figure 1* and *Figure 3* are taken as inputs to weight the rated alternatives, and that is to obtain a clear visual about how the different contracts respond to the different criteria considering the importance rate of each. *(See Figure 4).*

<table>
<thead>
<tr>
<th>Attributes</th>
<th>NEC3 (Weighted)</th>
<th>PPC2000 (Weighted)</th>
<th>JCT (Weighted)</th>
<th>CIOB (Weighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clash Detection</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Collaborative Working</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Early Contract Involvement</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Agreed Mutual Deadlines</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Specific Activities</td>
<td>8</td>
<td>16</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Score</td>
<td>60</td>
<td>70</td>
<td>60</td>
<td>79</td>
</tr>
</tbody>
</table>

*Figure 4: Criteria Versus Alternative Solutions Analysis*

- **Formulas used**:
  - Weighted Alternative Solution per Attribute = Importance * Alternative Solution Per Attribute
  - Total Score per Weighted Alternative Solution = \( \sum \) Weighted Alternative Solution per Attribute

- **Selection of the preferred Alternative**
  - After comparing and analyzing the alternatives, the total score for each Alternative has been obtained, which gave us the insight about what is the preferred.
  - The best and preferred Alternative is then clearly CIOB with a score of 79. *(See Figure 5).*
## CONCLUSIONS

As many agree that BIM should not be integrated in the main contract documents, what are the main issues which incurred this decision? What can be changed in contracts to integrate BIM? What can be engineered in BIM to integrate contracts? Will integrating BIM in the main contract documents improve the project processes and delivery?

The author used this article to address the questions raised and provided findings with appropriate tools such as SWOT Analysis and Multi-Attribute Decision Matrix.

The author started by listing the alternative solutions that are favorable to integrating BIM in a contract.

Then the author selected the list of attributes to evaluate, compare and assess each feasible Alternative Solution.

After listing the attributes, the author developed on the feasible Alternative Solutions by using SWOT Analysis.

The author proceeded then on by using Multi-Attribute Decision Matrix Disjunctive Reasoning to assess the importance of each attribute considered in integrating BIM on contracts.
The author then compared each Contract with the list of attributes and rated from 0 to 5 each contract with the information obtained in the SWOT Analysis as an input.

Then the results in the Multi-Attribute Decision Matrix were transformed into Coefficients to weight on the contract rating relatively to each attribute, which allowed a reliable calculation of the impact of each contract relatively to the list of attributes in integrating BIM into contracts.

The calculations gave the author an insight about the most appropriate contract to choose in integrating BIM, which turned out to be CIOB Contracts.

Finally, the author gave recommendations to Senior Managers on how to use each contract depending on the needs and requirements of the different projects when considering the integration of BIM into contracts.

FOLLOW ON RESEARCH

As there are various contracts compatible and favorable in integrating BIM, they all without exception include and incur a great deal of risks and threats. What can be included in a contract to reduce the risks in integrating BIM in contract documents?

Integrating BIM into contracts is very practical and solves many problems, but that still raises one very important question. Is the effort to integrate BIM into contracts worth it? Is integrating BIM in contracts a Success Factor in the efficiency of Construction and Building Projects?

BIBLIOGRAPHY


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Ilias Hafsi is a Master of Science student in SKEMA Business School, major in Project and Programme Management & Business Development (PPMBD). He graduated from International Institute for Higher Education in Morocco (IIHEM) in Rabat, Morocco. He holds an Engineering degree in Industrial Engineering. In 2016, he wrote his Engineering Thesis *Waste Management Planning* on Fermented Yogurts in Centrale Danone Salé, a Moroccan subsidiary Factory of the French Multinational Food-Products Corporation Danone. He has both Project Management and Engineering background. He lives in Paris, France now, and can be contacted at iliashafsi@gmail.com.