Methodology for cost-benefit analysis for the use of BIM in public tenders

Calculating Costs and Benefits for the use of Building Information Modelling in Public tenders

Presentation of the CBA Methodology
Section 1: Presentation of the CBA Methodology
BIM in Public Construction

**BIM** is not obligatory, but it is **suggested** in the **EU directive** for Public Procurement in 2014 *

The Commission is encouraging the use of BIM through “**soft policy**” and close collaboration with the EU BIM Task Group *

The Commission will provide a **recommendation** to promote BIM in public procurement for construction *

EISMEA has set up a tender to **develop a methodology for cost-benefit analysis for the use of BIM in public tenders**

* DG GROW, The Renovation Wave
Project Details

- **Title:** Methodology for cost-benefit analysis (CBA) for the use of Building Information Modelling (BIM) in public tenders
- **Contract No.:** GRO-SME-20-F-101, EASME/2020/MV/0001
- **Starting Date:** 1st September 2020
- **Duration:** 9 months
- **Main Contractor:** RINA Consulting S.p.A. (Italy)
- **Sub Contractors:** B1P Group (Italy)
- **Funded by:** European Commission (COSME Program)
- **Advisory Group:** EISMEA, DG GROW and EU BIM Task Group
Why a CBA Methodology?

BIM is a critical driver in the digitalisation of the construction sector in Europe. To foster its adoption...

...it is necessary to develop a consistent and replicable methodology for estimating BIM’s concrete impact on public tenders.
Target Groups of the CBA Methodology

- Public policy makers involved in the development of policy for infrastructure or construction sectors
- National or local public clients/procurers primarily concerned with service procurement
- Operators responsible for the ongoing management and operation of the built asset or environment
Main Objectives

**OBJ 1 - Cost-Benefit Model development**
the creation of a model that measures the costs and benefits of using BIM in public construction projects, taking into account expenditures, revenues and non-monetary benefits

**OBJ 2 – Model validation and case studies**
the validation of the CBA model, demonstrating its relevance and practical applicability through six case studies representing various types of projects

**OBJ 3 – Handbook creation**
the drafting of an informative and easy-to-consult handbook addressed to EU public entities who want to learn more about this analysis model
**OBJ 1 - Cost-Benefit Model development**

**Desk research phase**
- Identification of *existing models* of measuring costs and benefits in using BIM in public contract or construction works in general
- Definition of *monetary and non-monetary indicators* on the use of BIM and their weightings

**Consultation phase**
- **Online survey** addressed to 122 public entities at different administrative levels
  - (national, regional, local)
- **40 interviews** with public entities at different levels (ministry, agency, municipality)

**Development phase**
- Development of a methodology and Cost-Benefit Analysis (CBA) tool for measuring the costs and benefits (both monetary and non-monetary) of using BIM in public construction projects
OBJ 1 - Cost-Benefit Model development

Desk research – Literature Review (1/2)

• **Five main scientific papers** were selected to provide valuable information on other past cost-benefit analysis experiences.

• **Seven additional literature sources** were examined in order to define a suitable list of indicators for capturing the most significant costs and benefits for the adoption of BIM in public tenders.

• The key elements which emerged from the analysis of each resource were fundamental for the identification of indicators that a consistent CBA should involve.
The literature review results have been reinterpreted considering the public clients’ perspectives.

The research underlined that both a comprehensive database of BIM adoption experiences and a common baseline for evaluating BIM implementation impact are still missing.
<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>MEASURABILITY AND COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings related to early clash detection</td>
<td>These items are related to the reduction of costs from the creation of a high-quality model which enables the detection of interferences and errors during the design phase, preventing expensive changes during the construction stage of a project</td>
</tr>
<tr>
<td>Savings related to prevention of changes in construction phase</td>
<td></td>
</tr>
<tr>
<td>Savings associated with schedule reduction</td>
<td>These values are associated with the quantification of the time saved using BIM for a project</td>
</tr>
<tr>
<td>Savings associated with accuracy in quantity take-offs</td>
<td>This benefit is associated with more accurate estimates of the required material and the connected activities</td>
</tr>
<tr>
<td>Environmental benefits</td>
<td>The environmental benefit is associated with a reduction in the quantity of material wasted and so with the overall CO₂ emissions of the project</td>
</tr>
</tbody>
</table>
## OBJ 1 - Cost-Benefit Model development

### Desk research – List of Indicators (2/3)

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>MEASURABILITY AND COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings associated with lower risks (enhanced certainty)</td>
<td>This value is an advantage for the enhanced certainty in expenses. After careful consideration, this benefit was excluded from the CBA as it does not reflect the condition of a large set of public clients across Europe</td>
</tr>
<tr>
<td>Savings realized in FM and maintenance activities</td>
<td>Savings made through BIM adoption in the operations phase (once the asset has been completed) are often referred to as those largest in size and being realised over a longer period of time</td>
</tr>
<tr>
<td>Savings associated with lower number of litigations</td>
<td>These last two items are event-related benefits whose quantification is strictly dependent upon the occurrence of an event, e.g., a litigation, a claim or an accident, and the associated costs of settling the individual negative issue</td>
</tr>
<tr>
<td>Savings related to better H&amp;S</td>
<td></td>
</tr>
<tr>
<td>Enhanced communication and collaboration</td>
<td>These are the most mentioned benefits connected to BIM adoption and cited in the majority of literature sources reviewed. This indicator was excluded from the CBA, as a credible universal estimate of this advantage in monetary terms could not be calculated, especially considering the ‘ex-ante’ nature of the analysis provided by the CBA methodology</td>
</tr>
</tbody>
</table>
## OBJ 1 - Cost-Benefit Model development

**Costs**

### Desk research – List of Indicators (3/3)

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>MEASURABILITY AND COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware related investments</td>
<td>These three investment items were mentioned in various resources as the most relevant expenses associated to BIM adoption</td>
</tr>
<tr>
<td>Software related investments</td>
<td></td>
</tr>
<tr>
<td>Training related expenses</td>
<td></td>
</tr>
<tr>
<td>Design phase cost/ BIM model creation</td>
<td>This cost is associated with the BIM model creation expenses which are charged to the public entity</td>
</tr>
<tr>
<td>Consulting costs</td>
<td>This expense appears to be significant (especially in the early stages of BIM adoption)</td>
</tr>
</tbody>
</table>
OBJ 1 - Cost-Benefit Model development

On-site data collection

For accurately quantifying the indicators assessed through the literature review, an online survey was distributed to a list of public contractors and telephone interviews were conducted with selected stakeholders.

Countries involved in the surveys and interviews

40 Interviews
122 Questionnaires
Interviews

- 40 interviewed stakeholders (public authorities, national companies, research institutes and universities)
- individual and semi-structured interviews to identify costs, benefits, strengths and weaknesses of using BIM

BIM adoption in public procurements is a very long and complex process, more related to a deep cultural change towards digital thinking rather than simply the introduction of new software and hardware to support the regular work.
OBJ 1 - Cost-Benefit Model development

Interviews

SWOT

COSTS
**OBJ 1 - Cost-Benefit Model development**

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement in management and coordination</td>
<td>Few or no benefits at the beginning</td>
</tr>
<tr>
<td>Improvement in maintenance activities - operation phase</td>
<td>Low productivity and additional effort required</td>
</tr>
<tr>
<td>Reduction of contingencies through improvement of clash detection and quality check</td>
<td>Specific knowledge and expertise required</td>
</tr>
<tr>
<td>Improved time management and efficiency in time scheduling</td>
<td>High costs of adoption</td>
</tr>
<tr>
<td>Improvement in costs estimation and information management</td>
<td>Complexity and lack of flexibility</td>
</tr>
<tr>
<td>Reduction of total projects’ costs</td>
<td>Interoperability issues</td>
</tr>
<tr>
<td>Improvement in projects’ quality</td>
<td></td>
</tr>
</tbody>
</table>
**OBJ 1 - Cost-Benefit Model development**

<table>
<thead>
<tr>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regularisation and streamlining of the national AEC procedures</td>
<td>Lack of a clear regulatory framework and incentives for adoption</td>
</tr>
<tr>
<td>Digitalisation of the aec sector</td>
<td>Cultural and procedural obstacles</td>
</tr>
<tr>
<td>Specific studies on and analyses of costs and benefits associated with BIM</td>
<td>Monopoly of certain software companies</td>
</tr>
<tr>
<td>Development of a clear regulatory frameworks and introduction of incentives</td>
<td>High costs of adoption</td>
</tr>
</tbody>
</table>
**OBJ 1 - Cost-Benefit Model development**

- **Initial costs** of starting to use BIM are **higher than the immediate benefits** gained.
- **Estimate of return of investment** associated with BIM adoption can be assessed only after several years.

### Average Costs for BIM Adoption

<table>
<thead>
<tr>
<th>Training costs (cost/person)</th>
<th>Software licenses costs - modelling &amp; verification (person/year)</th>
<th>Hardware costs (cost/person)</th>
<th>Total costs (cost/person considering the first year of adoption)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 8 k€</td>
<td>8 – 10 k€</td>
<td>2 - 3 k€</td>
<td>15-20 k€</td>
</tr>
</tbody>
</table>
Survey Results

- Invitation sent to +500 stakeholders
- 122 completed questionnaires

- Association: 16%
- Local authority: 15%
- National authority: 21%
- Other: 23%
- Research Institute: 16%
- State-owned company: 7%
- University: 2%
Survey Results

BIM maturity level distribution of the sample

- BIM maturity level 0: 36%
- BIM maturity level 1: 33%
- BIM maturity level 2: 5%
- BIM maturity level 3: 26%
## OBJ 1 - Cost-Benefit Model Development

### Survey Results

Project phases in which BIM is mostly employed by public procurers

<table>
<thead>
<tr>
<th>Phase</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I don't know)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIM is not employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renovation projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations (including maintenance and facility management)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The survey results indicate the percentage of respondents who believe BIM is employed in various project phases.
BIM adoption associated costs for each phase

- Renovation
- Operations Phase (maintenance and facility management)
- Construction Phase
- Design Phase

Survey Results

[Bar chart showing cost distribution for each phase]
OBJ 1 - Cost-Benefit Model development

Survey Results

BIM adoption associated benefits for each phase

- Renovation
- Operations Phase (maintenance and facility management)
- Construction Phase
- Design Phase

0% 10% 20% 30% 40% 50% 60%

Low  Medium  High
OBJ 1 - Cost-Benefit Model development

Tool Development

- Analysis of financial viability of using BIM (NPV\(\geq 0\))
- Benefit cost ratio (BCR) measuring value for money of using BIM
- Economic analysis of using BIM (ENPV\(\geq 0\))
- Establishment of the list of benefits and cost indicators
- Benefits and costs allocation along the project phases
## OBJ 1 - Cost-Benefit Model development

### Indicators on the CBA Tool

<table>
<thead>
<tr>
<th>Costs</th>
<th>Benefit Model development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public entity personnel labour cost increase during pre-tendering phase</td>
<td>Costs related to lower productivity and additional effort required</td>
</tr>
<tr>
<td>Public entity personnel labour cost increase during tendering phase</td>
<td></td>
</tr>
<tr>
<td>Public entity personnel labour cost increase during post-award phase</td>
<td></td>
</tr>
<tr>
<td>Increased cost for consulting services to the public procurement process</td>
<td></td>
</tr>
<tr>
<td>BIM modelling activity cost</td>
<td></td>
</tr>
<tr>
<td>Public entity hardware upgrade investment</td>
<td></td>
</tr>
<tr>
<td>Public entity annual software license fee</td>
<td>BIM related investment costs - share allocated to the specific project</td>
</tr>
<tr>
<td>Personnel training costs</td>
<td></td>
</tr>
<tr>
<td>BIM coordination cost</td>
<td></td>
</tr>
</tbody>
</table>
## OBJ 1 - Cost-Benefit Model development

### Indicators on the CBA Tool

- Cost reduction due to early clashes and errors detection with subsequent reduction of changes necessary during construction phase
- Cost reduction associated to more precise quantity take-offs
- Cost reduction related to lower costs for claims/litigations
- Time savings in design and construction phases and associated project duration reduction
- Public entity personnel labour cost reduction due to faster document analysis for facility management and maintenance
- Cost reduction associated with more efficient annual maintenance
- Cost reduction attributable to the government/society due to better Health & Safety
- CO$_2$ emission reduction due to reduced material wasted
OBJ 1 - Cost-Benefit Model development

Approach 1 used to obtain the values of the following indicators:

- Public entity personnel labour cost increase during pre-tendering phase
- Public entity personnel labour cost increase during tendering phase
- Public entity personnel labour cost increase during post-award phase
- Increased cost for consulting services to the public procurement process

Diagram:

1. CBA Tool database
   - Project investment (Cost of Planning & Design) + (Cost of Construction)
   - Public procurement process cost represented as a fraction of the project investment

2. CBA Tool database
   - Pre-tendering phase cost represented as a share of the public procurement process cost

3. CBA Tool output
   - Cost increase during pre-tendering phase represented as a % increase of the pre-tendering phase cost
OBJ 1 - Cost-Benefit Model development

Approach 2 used to obtain the value of BIM modelling activity cost

User's input
- Asset architecture and structure (size, complexity, level of standardization)
- Asset systems (area served and complexity)
- Level of detail (LOD)
- BIM Specialist hourly cost

1. CBA Tool database
   - Asset modelling time
     a. Combination of user’s input with basic effort (time) per area and system
     b. Computation of total effort (time) adjusted for level of standardization and areas complexity

2. CBA Tool database
   - Additional activities
     +30% of the computed modelling time representing additional activities

3. CBA Tool output
   - BIM modelling activity cost
     Modelling and additional activities time priced with the BIM Specialist hourly cost
## OBJ 1 - Cost-Benefit Model development

Approach 3 used to obtain the value of BIM related investment costs

<table>
<thead>
<tr>
<th>User's input</th>
<th>CBA Tool database</th>
<th>CBA Tool output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees involved in BIM related activities needing to attend training and/or start to use BIM-related software</td>
<td>Hardware upgrade investment 1. Combination of the two user's input to obtain the number of employees affected by BIM introduction assigned to each project 2. Combination of the previous result with the average hardware upgrade cost per employee extracted from the survey</td>
<td>Hardware upgrade investment allocated to the project Considering an average cost per employee applied on every project</td>
</tr>
</tbody>
</table>
## OBJ 1 - Cost-Benefit Model development

### Tool for calculating the costs and benefits of adopting BIM in public tenders

### Inputs

The following list of questions is expected to capture a set of information that is necessary for computing the costs and benefits of adopting BIM in public tenders, by public organisations. The information collected refers to features of the public organisation involved in the construction project and of the project under analysis. The questions have been designed so that organisations with different levels of experience with BIM (even those with no experience) can employ this tool and obtain the necessary insights on costs and benefits.

*Please answer the following questions, entering what is requested in the blank spaces (please DO NOT COMPLETE the grey cells)*

*All questions are mandatory unless otherwise stated*

<table>
<thead>
<tr>
<th>1</th>
<th>Please indicate the information required below describing your organisation experience with BIM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Does your organisation have previous experience with BIM (has it started any pilot project or completed one adopting BIM)?</td>
</tr>
<tr>
<td>1.2</td>
<td>In how many projects is BIM adopted, every year, on average?</td>
</tr>
</tbody>
</table>

[Clear cells content button]
OBJ 2 – Model validation and case studies

Case Studies

- Practical usage of CBA methodology demonstrated through the analysis of the six case studies
- Small-scale infrastructures and buildings of various budgets and covered various phases of the life cycle (e.g., design, planning, construction and operation)

Location of 6 case studies
OBJ 2 – Model validation and case studies

Case Studies Objectives

• Supporting the development of the CBA tool by providing useful information on the definition of the ad hoc database estimating the time and the cost of the BIM modelling activity and feeding the dataset underlying the CBA tool

• Validating the usability of the CBA tool with respect to the two BIM maturity levels considered (level 1 and 2)
OBJ 2 – Model validation and case studies

Construction of a sport centre

Maintenance and renovation project of a road

New port construction project

Renovation project for a public building

Public administrative building construction

New residential building construction project
**Case Study 1: Construction of a sport centre**

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project category</td>
<td>New asset construction</td>
</tr>
<tr>
<td>Document phase</td>
<td>Detailed design</td>
</tr>
<tr>
<td>BIM maturity level</td>
<td>0</td>
</tr>
<tr>
<td>Estimated investment</td>
<td>Less than 1 million €</td>
</tr>
<tr>
<td>Gross Floor Area</td>
<td>Less than 1500 m²</td>
</tr>
</tbody>
</table>

**OBJ 2 – Model validation and case studies**
## Case Study 2: Maintenance and renovation project of a road

### Asset Category | Infrastructure
---|---
Project category | Work on an existing asset
Document phase | Detailed design
BIM maturity level | 0
Estimated investment | Between 10 and 15 million €
Infrastructural asset surface | About 40,000 m²
Case Study 3: Works on an existing port with new ancillary buildings

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project category</td>
<td>Work on an existing asset</td>
</tr>
<tr>
<td>Document phase</td>
<td>Basic design</td>
</tr>
<tr>
<td>BIM maturity level</td>
<td>0</td>
</tr>
<tr>
<td>Estimated investment</td>
<td>Between 1 and 5 million €</td>
</tr>
<tr>
<td>Infrastructural asset surface</td>
<td>Less than 5600 m²</td>
</tr>
</tbody>
</table>
### Case Study 4: Renovation project for a public building

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project category</td>
<td>Work on an existing asset</td>
</tr>
<tr>
<td>Document phase</td>
<td>Detailed design</td>
</tr>
<tr>
<td>BIM maturity level</td>
<td>1</td>
</tr>
<tr>
<td>Estimated investment</td>
<td>Between 15 and 20 million €</td>
</tr>
<tr>
<td>Gross Floor Area</td>
<td>Less than 5000 m²</td>
</tr>
</tbody>
</table>

**OBJ 2 – Model validation and case studies**
### Case Study 5: Public administrative building construction

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project category</td>
<td>New asset construction</td>
</tr>
<tr>
<td>Document phase</td>
<td>Detailed design</td>
</tr>
<tr>
<td>BIM maturity level</td>
<td>2</td>
</tr>
<tr>
<td>Estimated investment</td>
<td>Between 40 and 45 million €</td>
</tr>
<tr>
<td>Gross Floor Area</td>
<td>About 6000 m²</td>
</tr>
</tbody>
</table>
Case Study 6: New residential building construction project

- **Asset Category**: Building
- **Project category**: New asset construction
- **Document phase**: Basic design
- **BIM maturity level**: 0
- **Estimated investment**: Between 1 and 5 million €
- **Gross Floor Area**: Less than 2600 m2
OBJ 3 – Handbook creation

Calculating Costs and Benefits for the use of Building Information Modelling in Public Tenders

Methodology Handbook

Downloadable at http://www.eubim.eu/
# Handbook Chapters

## 1 Introduction

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Construction sector, Sustainability and BIM</td>
<td>2</td>
</tr>
<tr>
<td>1.2 Purpose of this handbook</td>
<td>4</td>
</tr>
<tr>
<td>1.3 How to use this handbook</td>
<td>5</td>
</tr>
<tr>
<td>1.4 Target groups</td>
<td>6</td>
</tr>
</tbody>
</table>
OBJ 3 – Handbook creation

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2.3 On-site data collection: interviews and online survey results 11
OBJ 3 – Handbook creation

Handbook Chapters

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Development of Cost-Benefit Analysis tool

3.1 Approach: CBA, BIM and public authorities 16

3.2 Methodology: model for identifying and measuring potential costs and benefits 17

3.3 Guide: step-by-step procedure to simulate cost-benefit analysis 27
OBJ 3 – Handbook creation

Handbook Chapters

5 Conclusions

6 Abbreviations
Step-by-step procedure to simulate cost-benefit analysis

The guide is organized in two sections:

A. **Inputs** required by the Cost-Benefit Analysis (CBA) tool

B. **Outputs** obtained
**Inputs Required by the CBA tool**

1. **Steps to complete the “Input sheet”**
   - **Preliminary General Information (questions 1 to 11)**
   - **BIM Model Creation Information (questions 12 to 14)**
   - **Category of Asset Information (questions 15 to 26)**

2. **Descriptions of the steps and the information to be completed in each section**

3. **Insights and examples on the inputs required**

   **Preliminary General Information (questions 1 to 11)**
   - Here you are required to answer a set of questions which serve to acquire general information on the use of BIM in the public organisation involved in the project, and on the characteristics of the projects where BIM is or might be adopted.
   - The user is required to provide information on:
     1. the organisation’s experience with BIM
     2. the number of tenders in which BIM is or is expected to be used every year
     3. the project costs and timing
     4. internal employees
     5. other specific data necessary for defining the main features of the project

   **BIM Model Creation Information (questions 12 to 14)**
   - This section is made up of three questions respectively on:
     1. the level of detail (LOD) of the model created in the tender
     2. the asset category (Building, Infrastructure and Water)
     3. the average cost of a BIM tranform in the country for enabling the tool to adapt to the specific user’s needs

   **Category of Asset Information (questions 15 to 26)**
   - Depending on the answer to the second of these questions, you will be required to fill in one, two or all subsequent sections as explained in the following point.
Outputs Obtained from the CBA tool

The Results sheet (BIM Level 1&2)

- Benefit-Cost Ratio
- Net Present Value
- Economic Benefit-Cost Ratio
- Economic Net Present Value

Description and explanation of the:

- Benefit-Cost Ratio
- Net Present Value
- Economic Benefit-Cost Ratio
- Economic Net Present Value

Presentation of all the features of the CBA sheets (e.g. switching on and off the cost and benefits indicators)
4.2 TENDER EXAMPLE 1
Conversion of an old building in a sport centre

MAIN PROJECT CHARACTERISTICS

**BUILDING**
- **Type**: Industrial
- **Area**: 1,172,000 m²

**Detaile Design**

**DESCRIPTION**
The building is an old and unused one-floor factory (around 2 metres high) on the edge of the city. The two
largest houses are made from metal poles, which gives an industrial look to the building, while the other two are
brick walls with a simpler aspect.

**PURPOSE OF THE PROJECT AND PLANNED INTERVENTIONS**
The project destination is a sports centre for the community, composed of three different parts: a large tennis court and a small
office and locker room with showers. All the rooms are situated in front of the low-risk area, where thelandslide for
the events is located.

The interventions required are summarised as:

- Demolition of the interior of the building
- Creation of spaces for the new risk building of service maintenance, electronic, printing and special
  systems
- Renovation of two rooms and the permanent grandstand

**Tender requirements**
The tender requires the detailed design for the interventions described for the renovation project.

The project is a BIM model is required in order to extract the drawings and the Quantity take-offs (QTO) from it.

**EXAMPLE OF 3D BIM model required detailed design representation of structural elevated

EXAMPLE OF 3D BIM model required detailed design representation of structural elevated

**OUTPUTS FROM THE TOOL**

**ECONOMIC IMPACT**
- **Project General Indicators**:
  - **Net Present Value (NPV)**: 42,414 €
  - **Benefit-Cost Ratio**: 1.48
- **BIM direct expenses**:
  - **BIM Model Cost**: 4,040 €
  - **BIM Coordination Cost**: 1,773 €
- **Phase Focus**
  - **Operation and Maintenance**
    - **SNPV**: -13,247 €
    - **ECC Ratio**: 0.67
- **Most Relevant Economic Indicator**: 54,370 €

**ENVIRONMENTAL IMPACT**
- **CO2 Emissions Reduction**: 900 €
- **Environmental Net Present Value (ENPV)**: 150,000 €

**CONSIDERATIONS**
- Despite the negative ENPV of the Operation and Maintenance phase, the overall project NPV is positive and the
  associated B/C ratio is slightly higher than 1. The adoption of BIM in this example is expected to be advantageous
  over the lifecycle of the project.
- The most relevant indicators chosen for this tender example are the benefits associated to enhanced accuracy of
  the quantity take off and improved efficiency in maintenance activities. The latter, people presenting a substantial
  value, does not offset the cost associated with a BIM modelling software licence, hence the ENPV of the maintenance
  phase appears to be negative.

**TIPS**
Each cost and benefit indicator could be weighted if its calculation is consistent not consistent with the project. In this
example, the full list of benefits and costs are calculated, so no indicator has been weighted off.