



European
Commission

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EU BIM
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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

CBA Tool Training Session

A wireframe architectural rendering of a city street scene. The image shows a perspective view of a street lined with tall, multi-story buildings. The buildings are represented by white wireframe lines on a dark gray background. A series of streetlights with curved poles line the left side of the street, receding into the distance. The overall aesthetic is technical and architectural.

Section 2: Training Session



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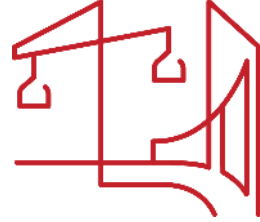
EU BIM
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CBA TOOL

“Cost-benefit analysis model
for the use of BIM in public
tenders”

Training Session



Presentation of the Cost-Benefit Analysis (CBA) tool through:

- Guidelines and insights to use the tool and simulate a cost-benefit analysis
- Video tutorial sections with a practical example

3.3 Guide: step-by-step procedure to simulate cost-benefit analysis

This section will guide you through the different steps required to create the tool (downloadable at <http://www.eubim.eu/>) for calculating the costs and benefits of adopting BIM in public tenders by public organisations.

INPUTS REQUIRED

Inputs

The following list of questions is intended to capture a set of information that is necessary for completing the tool and for calculating the costs and benefits of adopting BIM in public tenders. The questions reflect the objectives of the public organisations involved in the construction project and of the public bodies involved. The questions have been designed to help organisations with different levels of experience with BIM to use the tool and to obtain the necessary inputs to use the tool.

Please answer the following questions, entering either a requested value from the dropdown menu or the price of the project or the number of years.

1	Please indicate the information required below describing your organisation experience with BIM.	
1.1	Does your organisation have previous experience with BIM (has it started any pilot project or completed one already)?	<input type="checkbox"/>
1.2	In how many projects is BIM adopted, every year, on average?	<input type="text"/>

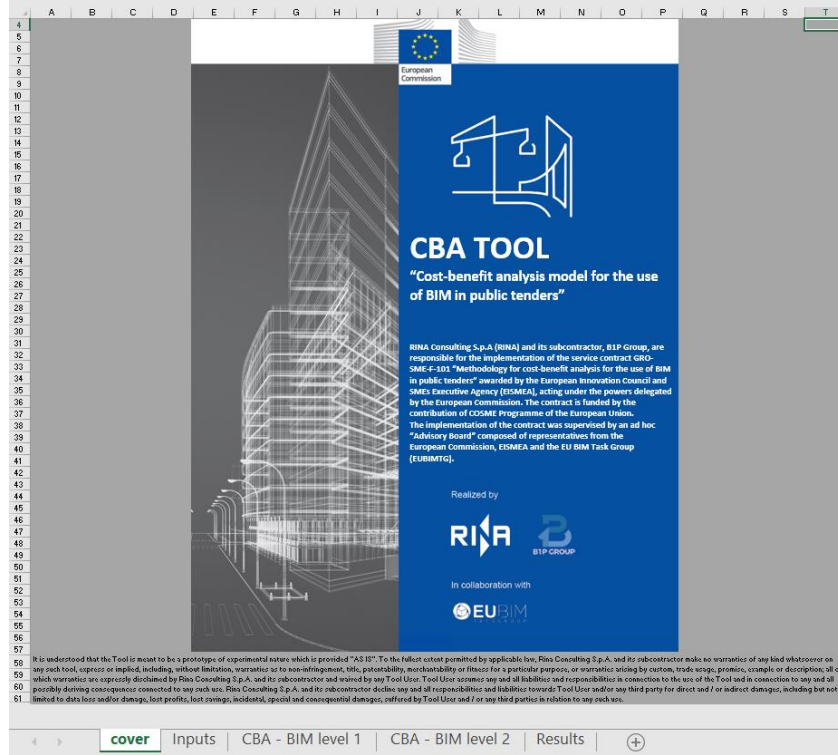
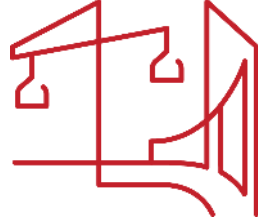
Clear cells content

The screenshot displays the CBA tool interface with a video tutorial overlay. The interface includes a sidebar with navigation links: Home, Inputs, CBA - BIM level 1, CBA - BIM level 2, Results, and Help. The main content area shows a series of questions and input fields. A large black play button icon is overlaid on the video tutorial section, indicating that a video tutorial is available for this part of the tool.

Questions and inputs visible in the screenshot:

- 1.2 In how many projects is BIM adopted, every year, on average? (Input: 10)
- 1.8 In how many projects per year, on average, might BIM be adopted (in the case where your organisation does not have previous experience with BIM)? (Input: 10)
- 2.1 Please select whether the project under analysis refers to a new asset construction or to work on an existing building/infrastructure (renovation, refurbishment, etc.). (Input: New asset construction)
- 2.2 In the case where the project refers to work on an existing building, is there a BIM model already available? (Input: No)
- 3 Please indicate below the actual or planned start and end dates of the project. (Input: 2023-01-01 to 2023-12-31)
- 4.1 Cost of planning (including BIM) (Input: 1000000)
- 4.2 Cost of construction (Input: 1000000000)
- 4.3 Please select the planned number of years of the project, from the start of the project to the end of the project. (Input: 10)
- 4.4 Please select the number of years of the project, from the start of the project to the end of the project. (Input: 10)
- 4.5 Please select the number of years of the project, from the start of the project to the end of the project. (Input: 10)
- 4.6 Please select the number of years of the project, from the start of the project to the end of the project. (Input: 10)
- 5.1 What is the number of employees of your organisation that are involved in BIM related activities? (These who needed and/or will need BIM training, and/or work with BIM software, technicians, architects, engineers, procurement specialists, etc.) (Input: 10)

The CBA Tool



WHAT?

Excel tool to evaluate whether the use of **BIM** in public works is expected to be advantageous and sustainable (small/medium projects: <50 M€)

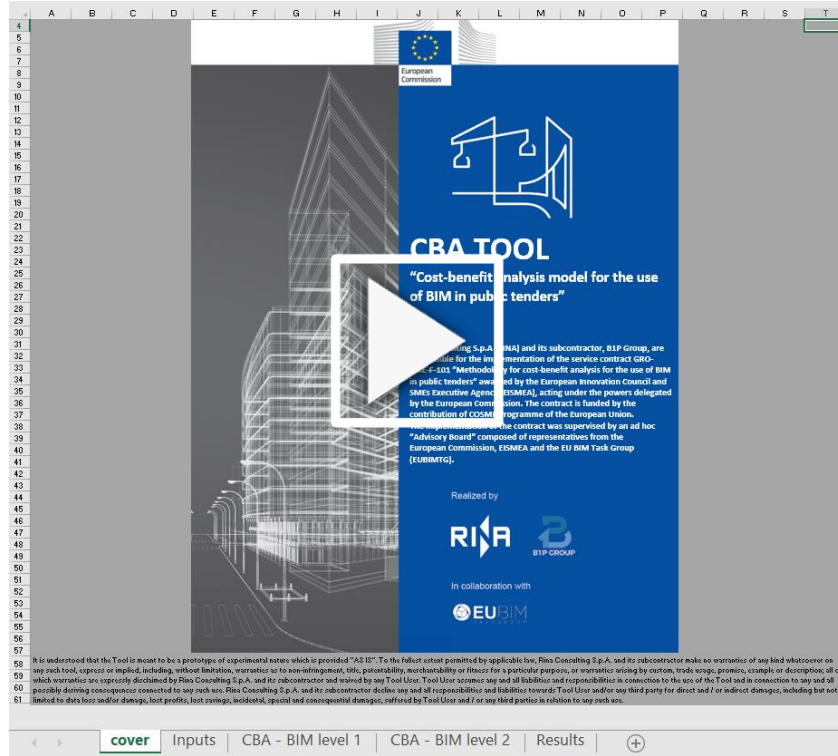
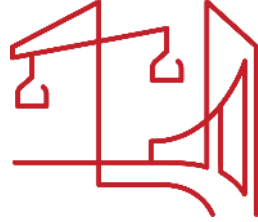
WHO?

European public entities at various administrative levels with varying degrees of knowledge and experience of BIM

HOW?

Considering both financial and economic analyses and providing qualitative and quantitative information starting from basic and limited inputs

The CBA Tool

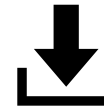


WHEN?

When a public entity needs to evaluate if it is feasible to use BIM for construction, renovation, operation and facility management **in a single specific project**


WHERE?

It can be applied **in every European country** with various contexts and diverse starting conditions



Downloadable at <http://www.eubim.eu/>

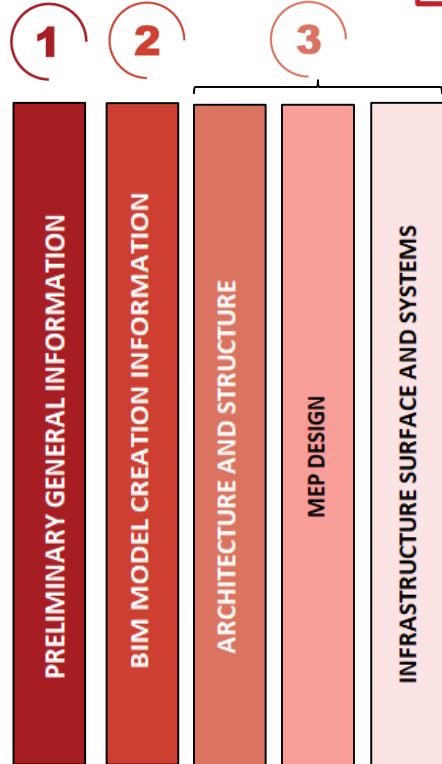
The Input sheet

Inputs		
<p>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.</p> <p><i>Please answer the following questions, entering what is requested in the blank spaces (please DO NOT COMPLETE the grey cells)</i></p> <p><i>All questions are mandatory unless otherwise stated</i></p>		
1	Please indicate the information required below describing your organisation experience with BIM.	Clear cells content
1.1	Does your organisation have previous experience with BIM (has it started any pilot project or completed one adopting BIM)?	
1.2	In how many projects is BIM adopted, every year, on average?	
1.3	In how many projects per year, on average, might BIM be adopted (in the case where your organisation does not have previous experience with BIM)?	
2,1	Please select whether the project under analysis refers to a new asset construction or to work on an existing building/infrastructure (renovation, refurbishment, etc.). <input type="text"/>	
2,2	In the case where the project refers to work on an existing building, is there a BIM model already available? <input type="text"/>	

Click here to clear
your inputs

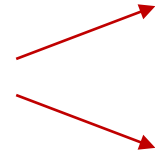
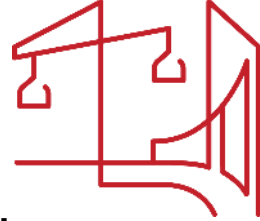
[Clear cells content](#)

cover **Inputs** CBA - BIM level 1 CBA - BIM level 2 Results



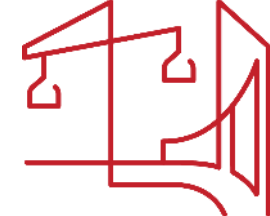
The Input sheet: General Rules

- The information must be entered in the white spaces
- All the white spaces must be completed unless otherwise indicated
- Some cells alternatively become greys based on your choice
- Do not complete the grey cells
- The inflation rate is the only value already included (2%), but it can be modified



Close-ended questions

Open questions



1 Preliminary General Information

Information Required

- the organisation's experience with BIM
- the number of tenders in which BIM is or is expected to be used every year
- Internal employees (e.g. average annual salary and BIM experience)
- Type of project (construction/renovation)
- Project costs and timing
- Specific data for defining the main features of the project

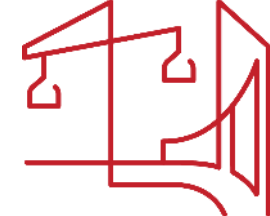
Organisation



For more
detailed
information

Project

PRELIMINARY GENERAL INFORMATION	3	Please indicate below the actual or estimated amounts (€) of the required cost items so as to compute the total project investment.	
	3.1	Cost of planning (including design)	69000 €
	3.2	Cost of construction	2238780 €
	4.1	Please select the planned number of years of the construction phase of the project, from the drop down menu. In the case where the actual phase period refers to fractions of years, please select the number of years that is the closest to the actual period.	
			1
	4.2	Please select the number of years from the start of the project planning activities to the completion of the design activities and the subsequent start of the construction phase, from the drop down menu. In the case the actual phase period refers to fractions of years, please select the number of years that is the closest to the actual period.	
		1	
5.1	What is the number of employees of your organisation involved in BIM related activities? (Those who needed and/or will need BIM training, and/or work with BIM software, technicians, architects, engineers, procurement specialists, etc.).		
5.2	What is the number of employees of your organisation that might be involved in BIM related activities in case BIM is implemented in projects? (Those who might need BIM training, those who will employ BIM software, technicians, engineers, procurement specialists, etc.).		
		39	
6	Please indicate the Gross Floor Area of the project asset (in m²) in the case where the project refers to a building or to an infrastructural asset that includes buildings in its perimeters, otherwise, please leave the space blank. The Gross Floor Area (GFA) is the sum of the floor areas of all the spaces within the building, with no exclusions; it essentially corresponds to the total area within the perimeter of the outside walls.		
		1800 m²	



1

Preliminary General Information: Insights

- 2.1 and 2.2. → Type of project: New asset construction or Work on an existing asset

2.1	Please select whether the project under analysis refers to a new asset construction or to work on an existing building/infrastructure (renovation, refurbishment, etc.).
	<input type="text" value="New asset construction"/>
2.2	In the case where the project refers to work on an existing building, is there a BIM model already available?
	<input type="text"/>

2.1	Please select whether the project under analysis refers to a new asset construction or to work on an existing building/infrastructure (renovation, refurbishment, etc.).
	<input type="text" value="Work on an existing asset"/>
2.2	In the case where the project refers to work on an existing building, is there a BIM model already available?
	<input type="text"/>

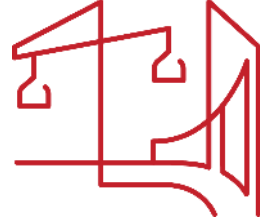
- 4.1 → For the duration of the construction phase 1 to 10 years can be chosen
- 4.2 → For the duration of the planning and design phase 1 to 5 years can be chosen
- 6 → The Gross Floor Area should not be completed for the infrastructural assets that don't include buildings

4.1	Please select the planned number of years of the construction phase of the project, from the drop down menu. In the case where the actual phase period refers to fractions of years, please select the number of years that is the closest to the actual period.
	<input type="text" value="1"/>
4.2	Please select the planned number of years of the planning and design phase of the project, from the start of the project planning activities to the completion of the design activities, from the drop down menu. In case the actual phase period refers to fractions of years, please select the number of years that is the closest to the actual period.
	<input type="text" value="1"/>

6	Please indicate the Gross Floor Area of the project asset (in m ²) in the case where the project refers to a building or to an infrastructural asset that includes buildings in its perimeters, otherwise, please leave the space blank. The Gross Floor Area (GFA) is the sum of the floor areas of all the spaces within the building, with no exclusions; it essentially corresponds to the total area within the perimeter of the outside walls.
	<input type="text" value="1800"/> m ²

2

BIM Model Creation Information

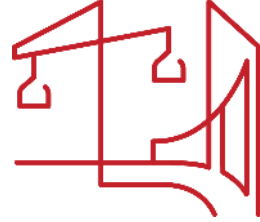


Information Required

- **Level of Detail/Development (LOD) required in the tender**
- **Category of asset**
- **The national hourly cost for a BIM specialist**

BIM MODEL CREATION INFORMATION	12	Please indicate the level of details/development required in the tender, from the options below (select from the available options the LOD referring to the corresponding option number, between 1 and 3). 1 - BASIC DESIGN - LOD 200 2 - DETAILED DESIGN - LOD 350 3 - DIGITAL TWIN - LOD 450 / 500 <input type="text" value="1"/>
	13	Please indicate, referring to the tender, the category of asset involved, from the options below (select the corresponding category number, either 1, 2 or 3). 1 - INFRASTRUCTURE 2 - BUILDING 3 - MIXED (an infrastructure including also buildings in its area that must be modelled) <input type="text" value="2"/>
	14	Please indicate the average national hourly cost for a BIM specialist (€). <input type="text" value="25"/>

2 BIM Model Creation Information: Insights



12 → Level of Detail/Development (LOD) required in the tender

**Basic Design
LOD 200**



**Detailed Design
LOD 350**



**Digital Twin
LOD 450/500**



13 → Category of Asset



Building



Infrastructure



Mixed

14 → The hourly cost of a BIM specialist for a public client:

If you don't know this cost

Example

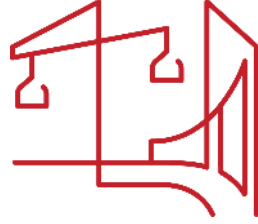
The average hourly gross wage of a "BIM Specialist" working in your country + 50%



assumed company mark-up for the hourly rate charged to the public client

3

Architecture and Structure/MEP Design/Infrastructure Structure and Systems



13 → Category of Asset



Building



ARCHITECTURE AND STRUCTURE

MEP DESIGN



Infrastructure



INFRASTRUCTURE SURFACE AND SYSTEMS



Mixed



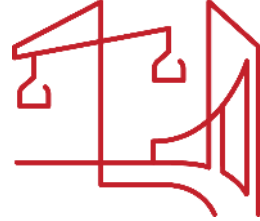
ARCHITECTURE AND STRUCTURE

MEP DESIGN

INFRASTRUCTURE SURFACE AND SYSTEMS

3

Architecture and Structure



Information Required

- Size of the building's areas: "area surface category"
 - Rooms
 - Façades
 - Roof
- Average level of complexity of each area category
- Number of areas belonging to each area category
- Average level of standardisation of the building's areas

Please indicate, in the section below, whether the asset is composed of areas of the proposed surfaces and select their related average level of complexity basing on the scale that appears by clicking on the "i" button. "Area" refers to either a room, a building facade or a roof.

15 Please, select Yes/No to indicate the presence of areas of the proposed surfaces and indicate the average degree of complexity for each category.

Area surface category	Choose: Yes / No	Indicate the level of complexity for each existing area category
Surface < 25 m ²	Yes	2
25 m ² < Surface < 150 m ²	Yes	2
150 m ² < Surface < 300 m ²	Yes	1
Surface > 300 m ²	Yes	1

16 Please, indicate the number of areas of each surface category.

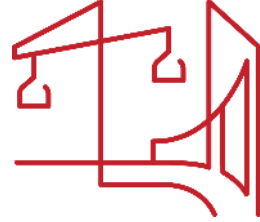
Area surface category	Number of areas
Surface < 25 m ²	125
25 m ² < Surface < 150 m ²	5
150 m ² < Surface < 300 m ²	4
Surface > 300 m ²	1

17 Please, indicate the average level of standardization (1,2,3) of areas of the asset, based on the scale that can be visualized by clicking on the "i" button.

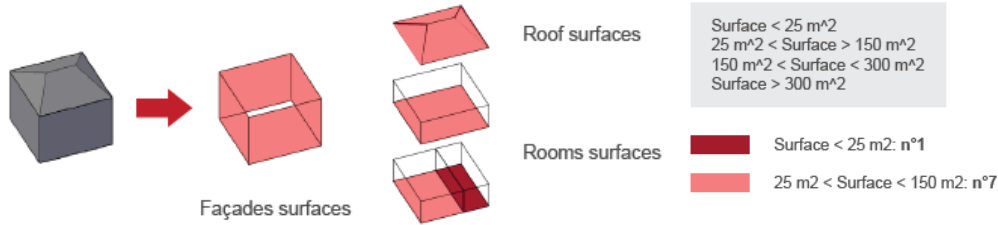
3

3

Architecture and Structure: Insights



- 15 → Area surface category

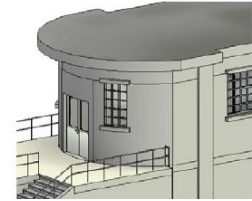


Level of Complexity

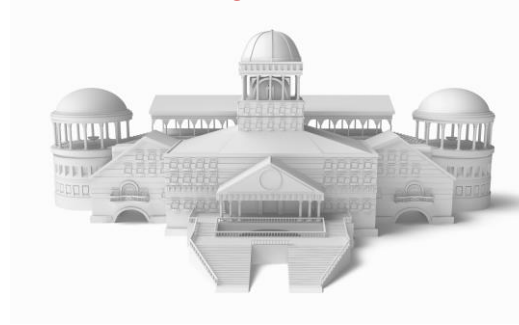
Low = 1



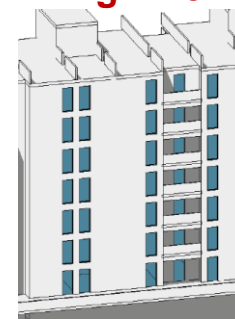
High = 3



Low = 1



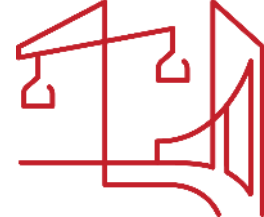
High = 3



- 17 → Level of Standardisation

3

MEP DESIGN ('Building' and 'Mixed' assets)



Information Required

- Indication of the presence of the system, e.g. mechanical, piping, etc.

18	Mechanical system	<input type="text" value="Yes"/>
19	Piping system	<input type="text" value="Yes"/>
20	Electrical and Lighting system	<input type="text" value="Yes"/>
21	Special systems (Firefighting and Safety systems, Medical Gas system, etc.)	<input type="text" value="Yes"/>

- Level of complexity of the system
- Area served by the system

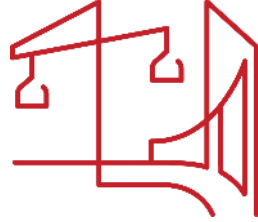
Please indicate, in the section below, referring to the project asset, the presence of the proposed systems (by selecting Yes / No) and the level of complexity of each system based on the scale provided by clicking on the "i" button.

In addition, please select the extension of the area served by each existing system, from the surface categories proposed (Please fill in only white cells).

18	Mechanical system	<input type="text" value="Yes"/>	Please indicate the level of complexity of the system. (i)
		<input type="text" value="1"/>	
		Please indicate the size of the area of the asset served by the mechanical system by selecting the corresponding number between 1 and 5.	
		1 - Surface < 400 m ² 2 - 400 m ² < Surface < 1500 m ² 3 - 1500 m ² < Surface < 3000 m ² 4 - 3000 m ² < Surface < 5000 m ² 5 - Surface > 5000 m ²	
		<input type="text" value="2"/>	
19	Piping system	<input type="text" value="Yes"/>	Please indicate the level of complexity of the system. (i)

3

MEP DESIGN: Insights



19 Piping system

☐ Yes

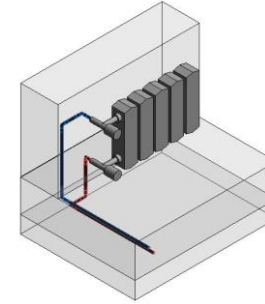
Please indicate the level of complexity of the system

Please indicate the size of the area of the asset served by the Piping system by selecting the corresponding number between 1 and 5.

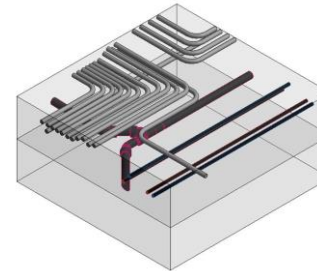
1 - Surface < 400 m²
 2 - 400 m² < Surface < 1500 m²
 3 - 1500 m² < Surface < 3000 m²
 4 - 3000 m² < Surface < 5000 m²
 5 - Surface > 5000 m²

MEP DESIGN

System level of Complexity



Low = 1



High = 3

Area served by the system

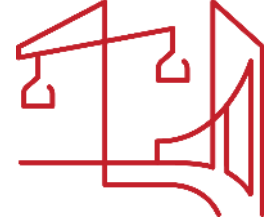
Example: the piping system serves these two rooms



Area served by the system (m²): Area (m²) of Room 1 + Area (m²) of Room 2

3

Infrastructure Surface and Systems



Category of asset: Infrastructure or Mixed

INFRASTRUCTURE SURFACE AND SYSTEMS	22	<p>Please indicate, in this section, dedicated solely to assets that have been indicated as "INFRASTRUCTURE" or as "MIXED", the required information. Please, remember to avoid entering any number/information in grey cells.</p> <p>Please, indicate the infrastructure total surface (m²).</p> <p><input type="text"/> m²</p> <p>Please, select the level of complexity of the infrastructural asset based on the scale available by clicking on the "i" button. <input type="button" value="i"/></p> <p><input type="text"/></p> <p>Please, select Yes/No to indicate the presence of the following systems, their level of complexity, based on the scale that is displayed by clicking on the "i" button, and the area of the infrastructure served by each system (please, remember to not fill out grey cells).</p>
	23	<p>Mechanical system</p> <p><input type="text"/></p> <p>Please select the level of complexity of the mechanical system. <input type="button" value="i"/></p> <p><input type="text"/></p> <p>Please indicate the size of the surface served by the mechanical system (m²).</p> <p><input type="text"/> m²</p>
	24	<p>Piping system</p> <p><input type="text"/></p> <p>Please select the level of complexity of the piping system. <input type="button" value="i"/></p> <p><input type="text"/></p> <p>Please indicate the size of the surface served by the piping system (m²).</p> <p><input type="text"/> m²</p>
	25	<p>Electrical and Lighting system</p>

Information Required

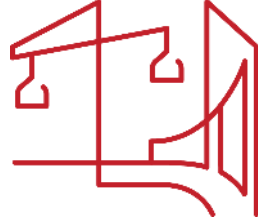
- Infrastructure total surface
- Level of complexity of the infrastructural asset
- Level of complexity
- Size of the surface served by Mechanical, Piping, Electrical and Lighting and Special systems

Structure

MEP Systems

3

Infrastructure Surface and Systems: Insights



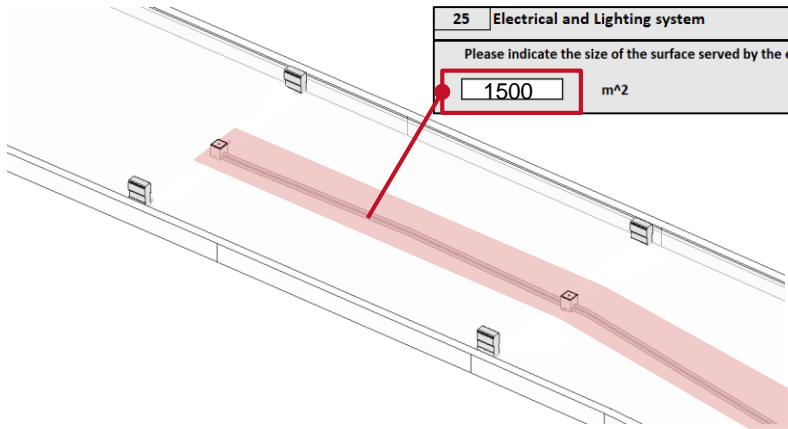
- The size of the surface served by MEP systems



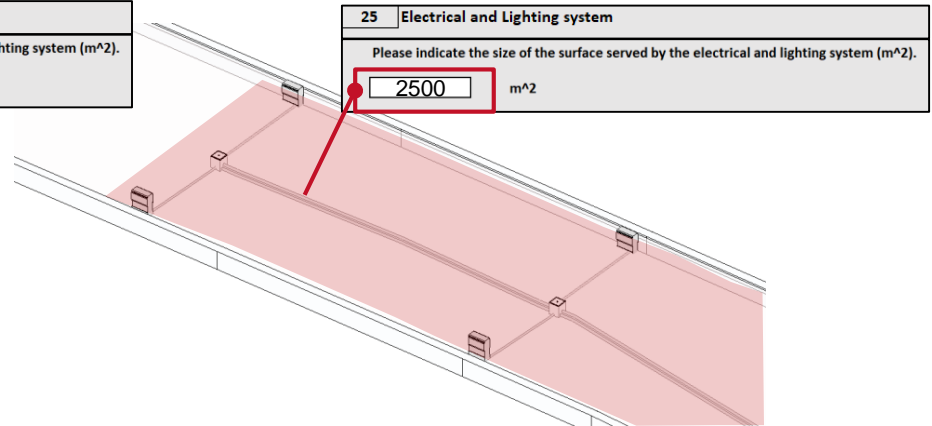
Calculate the area served by MEP systems as a geometric projection (only for the specific zones where there are systems) and repeat it for all the systems present

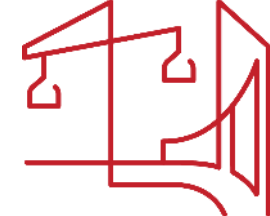
Examples

Electrical and Lighting System



Electrical and Lighting System



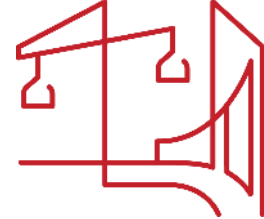


The Results sheet - Introduction

- The Results sheet summarizes the main outputs of the CBA automatically performed by the tool.
- The page has a simple structure allowing to be easily consulted by the user.
- It contains only one cell whose content can be modified by the user.

BIM LEVEL 1	
Benefit-Cost Ratio (i)	1.60
Net Present Value (€) (i)	58,758
Economic Benefit-Cost Ratio (i)	2.83
Economic Net Present Value (€) (i)	178,576

BIM LEVEL 1	
Benefit-Cost Ratio (i)	1.60
Net Present Value (€) (i)	58,758
Economic Benefit-Cost Ratio (i)	2.83
Economic Net Present Value (€) (i)	178,576



The Results sheet - Main indicators

- Two essential indicators represent the CBA Tool key outputs:

1. Benefit-Cost Ratio / Economic Benefit-Cost Ratio

It describes the relationship between the benefits and the costs associated to the adoption of BIM in the project.

Benefit-Cost Ratio = 1 → Value of benefits brought by BIM are equal to the associated costs.

Benefit-Cost Ratio < 1 → Costs connected to BIM adoption outweigh the related benefits.

Benefit-Cost Ratio > 1 → Benefits arising from BIM adoption exceed the required costs.

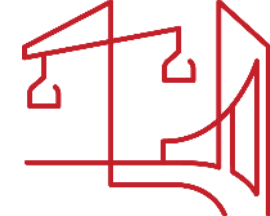
2. Net Present Value / Economic Net Present Value

It evaluates the profitability of an investment over a period. In the case of BIM, the profitability is expressed as achievable savings.

Net Present Value = 0 → Adopting BIM does not provide any relevant gain (or loss).

Net Present Value < 0 → Savings generated by BIM adoption do not justify the investment.

Net Present Value > 0 → The adoption of BIM is expected to be advantageous and sustainable.



The Results sheet - BIM direct expenses

- BIM direct expenses at BIM maturity level 1 (level 2 does not foresee a “BIM model cost” item)

Inputs sheet

1 - BASIC DESIGN - LOD 200
2 - DETAILED DESIGN - LOD 350
3 - DIGITAL TWIN - LOD 450 / 500

1

Results sheet

BIM direct expenses during design phase:

BIM model cost (€)	7,883
BIM coordination cost (€)	2,223

Impact on CBA indicators

Inputs sheet

1 - BASIC DESIGN - LOD 200
2 - DETAILED DESIGN - LOD 350
3 - DIGITAL TWIN - LOD 450 / 500

2

Results sheet

BIM direct expenses during design phase:

BIM model cost (€)	11,115
BIM coordination cost (€)	3,135

Impact on CBA indicators

Inputs sheet

1 - BASIC DESIGN - LOD 200
2 - DETAILED DESIGN - LOD 350
3 - DIGITAL TWIN - LOD 450 / 500

3

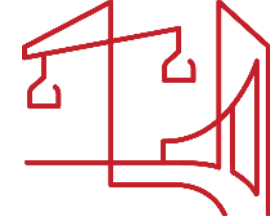
Results sheet

BIM direct expenses during construction phase:

BIM model cost (€)	23,737
BIM coordination cost (€)	6,695

Impact on CBA indicators

* Expenses tend to be low in this case as the building is characterized by low complexity levels of areas and an overall high level of standardization



The Results sheet - Phase focus

BIM maturity level 1

Phases focus:

Planning & Design	
Economic Benefit-Cost Ratio	-
Economic Net Present Value (€)	- 39,813

Construction	
Economic Benefit-Cost Ratio	24.11
Economic Net Present Value (€)	232,342

Operation and Maintenance	
Economic Benefit-Cost Ratio	0.90
Economic Net Present Value (€)	- 5,425

Basing on options in the CBA sheet, it may occur that no benefit is allocated in this phase.

The ENPV of this phase is negative due to the fact that many BIM related costs are allocated in this phase.

BIM maturity level 2

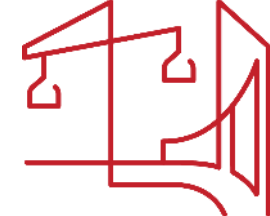
Phases focus:

Planning & Design	
Economic Benefit-Cost Ratio	-
Economic Net Present Value (€)	- 34,649

Construction	
Economic Benefit-Cost Ratio	14.85
Economic Net Present Value (€)	226,068

Operation and Maintenance	
Economic Benefit-Cost Ratio	1.78
Economic Net Present Value (€)	40,894

The ENPV of the Planning & Design phase is still negative but the one from the Operation and Maintenance phase becomes positive.



The Results sheet – Estimate scenarios

- CBA Tool incorporates the option to select three different scenarios that provide different estimate values.

Select the scenario to be considered in the analysis (Baseline Estimate, Optimistic Estimate, Pessimistic Estimate)

Default option

Baseline Estimate

Benefit-Cost Ratio ⓘ	1.60
Net Present Value (€) ⓘ	58,758
Economic Benefit-Cost Ratio ⓘ	2.83
Economic Net Present Value (€) ⓘ	178,576

Pessimistic Estimate

Benefit-Cost Ratio ⓘ	1.40
Net Present Value (€) ⓘ	40,341
Economic Benefit-Cost Ratio ⓘ	2.57
Economic Net Present Value (€) ⓘ	160,159

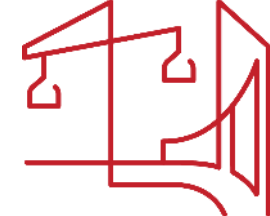
The different estimate scenarios are provided changing the value of key variables included in the computation of a set of benefits and costs.

Variables affecting benefits

investment reduction (%) associated with enhanced accuracy of BIM-based quantity take-off
investment reduction (%) associated with early clashes and error detection
investment reduction (%) associated with time savings during the design and construction phases of a project
Annual expenses reduction (%) associated with the operations phase related to enhanced efficiency in asset maintenance activities

Variables affecting costs

Value of the public organisation procurement process cost
Value of the annual BIM-related software investment allocated to the project
Value of the BIM-related investment in training allocated to the project
BIM modelling and coordination costs (the modelling activity cost refers solely to BIM maturity level 1)



The CBA - BIM level 1/2 sheets - Introduction

- CBA Tool includes two pages entirely devoted to show the Cost and Benefit analysis and the annual values of the benefit and cost indicators considered.
- The user can interact with a set of cells selecting different options and subsequently consulting how changes affected results.
- This page (both in case of BIM maturity level 1 and 2) is made up of three main sections.

		1	2	3	4	5	6
All phases		1	1.02	1.04	1.06	1.08	1.10
2%	Maturity level 1	Planning and Design					
	Benefits	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1
On	Cost reduction due to early clashes and error detection and subsequent reduction of changes necessary in construction phase						19,319
On	Cost reduction associated with more precise quantity take-offs						76,105
On	Cost reduction related to lower costs for claims/litigations	4,050	4,131	4,213	4,298	4,384	4,471
On	Time savings in design and construction phases and associated project duration reduction	7,418	7,566	7,718	7,872	8,029	8,190
On	Public entity personnel labour cost reduction due to faster document analysis for facility management and maintenance						
On	Cost reduction associated to more efficient annual maintenance						
On	Cost reduction attributable to the government/society due to better Health & Safety						66,829
On	CO2 emission reduction due to reduced material wasted						613
	Tot. benefits	11,468	11,697	11,931	12,170	12,413	175,527

blio entity personnel labour cost reduction due to faster document analysis for facility management and	
ist reduction associated to more efficient annual maintenance	
ist reduction attributable to the	Health & Safety
2 emission reduction due to	reduced material wasted
st. benefits	
t. benefits (adjusted for form)	
total benefits for actualization	
	Cost
blio entity personnel labour c	st infor... during pre-tendering pha
blio entity personnel labour c	st infor... case during tendering phase
blio entity personnel labour c	st infor... during tendering phase
reased cost for consulting services to the public procurement process	
VI modelling activity cost (assumed to be outsourced)	

The CBA - BIM level 1/2 sheets - Features

Top of the CBA- BIM level 1/2 sheets (years necessary to adjust values basing on inflation rate)

1	2	3	4	5	6	7	8
1	1.02	1.04	1.06	1.08	1.10	1.13	1.15

Inflation rate

2%	
On	Cost reduction du
On	Cost reduction as
Off	Cost reduction rel

Automatic allocation of costs and benefits values

Example 1

Maturity level 1	Planning and Design					
Benefits	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1
Cost reduction due to early clashes and error detection and subsequent reduction of changes necessary in construction phase						6,235
Cost reduction associated with more precise quantity take-offs						82,903
Cost reduction related to lower costs for claims/litigations	2,181	2,224	2,269	2,314		2,360
Time savings in design and construction phases and associated project duration reduction	4,438	4,527	4,617	4,710		4,804
Public entity personnel labour cost reduction due to faster document analysis for facility management and maintenance						
Cost reduction associated to more efficient annual maintenance						
Cost reduction attributable to the government/society due to better Health & Safety						14,560
CO2 emission reduction due to reduced material wasted						133
Tot. benefits	6,619	6,751	6,886	7,024	0	110,996

Example 1

- Planning & Design period: 4 years
- Construction period: 9 years

Example 2

Planning and Design					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 1
					10
					79
4,050	4,131				4
8,242	8,407				8
					25
12,292	12,538	0	0	0	128

Example 2

- Planning & Design period: 2 years
- Construction period: 5 years



- The page interface is divided into three project phases, all visible by selecting the option “**All phases**” at the top-left of the page.
 1. Planning and Design
 2. Construction
 3. Operation and Maintenance



Planning and Design

[illegible]

Construction

Operation and Maintenance

[illegible]



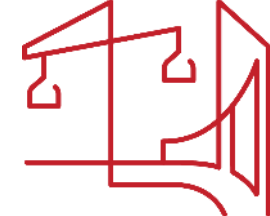
The CBA - BIM level 1/2 sheets – Features

- Each cost and benefit indicator follow different rules for its allocation along the project periods (either “one-shot” at the beginning or end of a phase or distributed over one or more phases).

On	Public entity personnel labour cost increase during pre-tendering phase	1,035	1,117	1,133	1,162		
On	Public entity personnel labour cost increase during tendering phase				3,533		
On	Public entity personnel labour cost increase during post-award phase						435
On	Increased cost for consulting services to the public procurement process	139	203	207	212		216
On	BIM modelling activity cost (assumed to be outsourced)	1,371	2,010	2,050	2,031		
On	Public entity hardware upgrade investment (share allocated to the specific project)	4,842					
On	Public entity annual software license fee (share allocated to the specific project)	5,000	5,100	5,202	5,306		5,412
On	Personnel training costs (share allocated to the specific project)	15,744					
On	BIM Coordination Cost	556	567	578	590		
	Tot. costs	23,407	8,398	9,178	12,954	0	6,123

- Cost and benefit indicators can be switched on and off basing on the user's preference and needs.


On	Public entity personnel labour cost increase during pre-tendering phase	1,035	1,117	1,133	1,162		
On	Public entity personnel labour cost increase during tendering phase				3,533		
On	Public entity personnel labour cost increase during post-award phase						435
Off	Increased cost for consulting services to the public procurement process						
On	BIM modelling activity cost (assumed to be outsourced)	1,371	2,010	2,050	2,031		
Off	Public entity hardware upgrade investment (share allocated to the specific project)						
On	Public entity annual software license fee (share allocated to the specific project)	5,000	5,100	5,202	5,306		5,412
On	Personnel training costs (share allocated to the specific project)	15,744					
Off	BIM Coordination Cost						
	Tot. costs	23,810	8,227	8,392	12,153	0	5,907



The CBA - BIM level 1/2 sheets – Features

- The key row to be consulted reporting the cashflow reflecting the adoption of BIM in the project:

Cash Flow for ENPV	-	43,956	245,562	-	324	-	331	-	337
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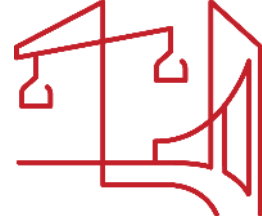


Discount rate	4%
Economic Net Present Value	171,958
Actualized Economic Benefits	268,177
Actualized Economic Costs (Actualized Costs)	96,219
Economic B/C Ratio	2.79
Yield	1.79

This discount rate can be changed by the user, it is set at 4% as default value.

Discount rate	7%
Economic Net Present Value	167,207
Actualized Economic Benefits	250,799
Actualized Economic Costs (Actualized Costs)	83,593
Economic B/C Ratio	3.00
Yield	2.00

The CBA - BIM level 1/2 sheets – Last sections

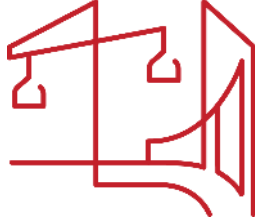


Section devoted to ENPV and Economic B/C Ratio computations per project phase

	Planning and Design									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Year of the phase										
Benefits accrued during the phase	7,170	7,314	7,460	7,608	-	112,456	113,143	113,830	114,517	115,204
Costs accrued during the phase	23,810	8,227	8,332	12,153	-	5,307	6,025	6,743	7,460	8,178
Net Income (phase related)	- 16,639	- 914	- 932	- 4,543	-	106,548	107,118	107,087	107,057	106,926
Actualized benefit (phase related)	27,864					304,006				
Actualized costs (phase related)	50,283					44,197				
B/C Ratio (phase related)	0.55					6.88				
NPV (phase related)	- 22,418					253,809				

Financial benefits	Year	Year 1	Year 2	Year 3
	Benefits (financial only)	7,170	7,314	7,460
	Benefits adjusted for cashflow (financial only)	7,170	7,314	7,460
	Benefits adjusted along years (financial only)	7,170	7,314	7,460
	Actualized benefit (financial only)	217,654		
Financial costs	Year	Year 1	Year 2	Year 3
	Costs (financial only)	23,810	8,227	8,332
	Costs adjusted along years (financial only)	23,810	8,227	8,332
	Actualized cost (financial only)	127,832		
Financial NPV	Year	Year 1	Year 2	Year 3
	Net Income	- 16,639	- 914	- 932
	Free cashflow	- 16,639	- 914	- 932
	Free cashflow adjusted over the years	- 16,639	- 914	- 932
	Net Present Value (financial only)	83,822		
	B/C Ratio	1.70		

Section devoted to NPV and B/C Ratio computations
(excluding social and environmental benefits from the computation)



Conclusions

- Fostering BIM adoption in the construction industry is a key issue to address, in order to pave the way toward digitalization
- This study showed that there is still a limited awareness about the benefits of using BIM and how these benefits could in part, or totally, compensate the costs of its adoption
- The developed methodology enables public procurers to estimate, ex-ante, the benefit-cost ratio of the adoption/decision for a specific foreseen investment
- Focus on measuring not only the financial benefits but also economic benefits more related to the socio-environmental field