

# Building Information Modeling (BIM)



Source: istock/Laurence Dutton / istock/fzkes

BIM manager verifying CAD solar panel design

## Relevance of this Tool Type within the Project Cycle



### Definition

Building information modeling (BIM) is a cutting-edge method for integrated design, construction, and operation of infrastructure projects, increasingly adopted in engineering, construction, and facility management (whether industrial or public civil work/structures). It is used to collaborate on a coherent set of digital representations of an asset's characteristics. It forms the basis for the consistent generation and management of information and data relevant to an asset's lifecycle. In essence, BIM software is a set of integrated computer-added files that can be extracted, exchanged, and amended to support decision-making regarding a built asset from its planning to its dismantling. The goal is improved building performance combined with transparent communication. Among many advantages, BIM affords a better overview and meeting remotely in the asset's "data space," thus visualizing the links in 3D between design, costs, and the time schedule.

### How BIM Works

BIM software is jointly used by architects, engineers, planners, suppliers and contractors, builders, operators, owners/clients, and financing partners, such as KfW. It follows a lifecycle approach, within which the following modules are included:

- ✓ Programming
- ✓ Conceptual and detailed design

- ✓ Analysis
- ✓ Documentation
- ✓ Fabrication
- ✓ Construction and its logistics
- ✓ Operations and maintenance, followed sometimes by demolition
- ✓ Renovation
- ... and going back to programming.

### Step 1: Select Data Solution Level

BIM can also be categorized according to their level of complexity (described by the number of dimensions "D" covered):

- **3D design and planning:** includes 3D laser scanning, computer-aided design modeling, visualization, clash detection, and 3D printing.
- **4D scheduling:** includes project phasing for the simulation/scheduling/planning of resources and payment scheduling.
- **5D estimating:** includes quantity extraction to support detailed cost estimates, multi-phased cost estimation, value analysis, and change management.
- **6D sustainability:** includes conceptual and detailed energy analysis, sustainable element tracking, and LEED tracking.
- **7D facility management:** includes life cycle BIM strategies, BIM as built, BIM embedded manuals, cost estimation, value analysis, and change management.

## Step 2: What Information Do I Need?

BIM software can provide various functionality and information:

- **view** information (see details of a building, show and hide parts, observe a 360 degree model, for example to be used for cost estimation)
- **edit** information (smart revision management, warnings, revision comparison)
- perform **comparisons** (merging, model checking, fusion, check for clashes)
- **plan** ahead by identifying and solving issues in the design phase
- support **functionalities**, such as a **carbon** assessment by informing designers on the **impact** of their decisions throughout the building's lifecycle or a robot simulation module, constraint-solver
- **design real-life objects** (structure, mechanical, electrical, plumbing, etc.) of any size using 3D and 2D annotations, for example
- **prepare construction site inspections** and fire safety assessments
- **document designs** (complex shape types)
- **export** the Industrial Foundation Class (IFC) files as ifcXML and ifcZIP files > [Interoperability Requirements](#)

## Step 3: What Do I Need to Consider When Acquiring a BIM?

The inclusion of BIM at project planning is a key to success and mandatory in a growing number of countries. KfW has already gained substantial expertise internally. Lessons from past experience underlined that proprietary vs. open-source BIM software is not a key factor as it should be integrated into Terms of Reference as a requirement along with the suppliers' expertise to properly use it. For remote monitoring purposes, KfW estimates that viewing rights are sufficient and can be granted more access through the process, if necessary.

In cases requiring acquisition, there is usually a distinction between large-scale, complex infrastructure projects mainly using sector-specific, proprietary BIM-software and smaller actors who use open-source BIM more frequently > [RMMV Guidebook Section 2.2.2](#).

## Interoperability Requirements

BIM information is only useful if it can be shared between all the relevant stakeholders involved in the project, hence interoperability is crucial in the industry:

- **Planning and construction phase:** buildingSMART is an international organization aiming to improve information exchange in the building construction industry by establishing IFCs as global open data standard formats (ISO 16739: 2013) for BIM.
- **Operation and maintenance:** the Construction Operations Building information exchange (COBie) is an international standard for asset management (equipment capture and record lists, product data sheets, warranties, spare parts lists, and preventive maintenance schedules). It is used once a built asset is in service.

## Legal Aspects

Use of BIM must be reflected in the project's construction and engineering **contracts**. Since the BIM tool is used by all engineers involved in the project, the respective responsibilities of the parties must be carefully defined. In bigger projects, contracts should define the role of a BIM manager. Further, since

all engineers use BIM, effective intellectual property rights management is necessary > [RMMV Guidebook Section 2.3.4](#).

The BIM tool must have adequate **security to protect the collected data** and to ensure that it is kept **confidential**. Data leaks and security breaches threaten the viability of using BIM software. All participating entities are required to ensure the ongoing confidentiality, integrity, availability, and resilience of processing systems and services. They need to ensure that their individual and collective IT security measures are adequate to withstand **cyber-crime** attacks.

> [RMMV Guidebook Section 2.3.2](#)

If KfW (or persons acting on behalf of it) are (also) processing personal data, the privacy check in

> [RMMV Guidebook Section 2.3.1](#) must be followed.

## Project Examples/Use Cases

- In the Harpo Hydropower Project in Gilgit-Baltistan, Pakistan (HHP; PN: 24692), BIM is used for part of the construction planning of the hydropower plant (34.5 MW).

## Links to Further Sources

- Review on BIM interoperability: <https://www.sciencedirect.com/science/article/pii/S2405896319311309>
- Overview of BIM software [https://www.g2.com/search?utf8=%E2%9C%93&query=Building+Information+Modeling&filters%5Bcategory\\_ids%5D%5B%5D=292](https://www.g2.com/search?utf8=%E2%9C%93&query=Building+Information+Modeling&filters%5Bcategory_ids%5D%5B%5D=292)
- buildingSMART/ IFC <https://technical.buildingsmart.org/standards/ifc/>
- Construction Operations Building Information Exchange (COBie) <https://www.bimpedia.eu/-/1390-cobie>

## Linkages to other tool types



Maintenance Management Systems



Geospatial Tools



Cameras



(Remote) Management Information Systems



Sensors/SmartMeters



Further information on how to use this tool type in an RMMV context can be found here: