Whitepaper Part 2

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Goal of the whitepaper

Facility Managers are becoming more and more familiar with what BIM can do, especially after working with BIM in the context of a renovation or a new-construction project. Because most Facility Managers use a Facility Management Information System (IWMS or CAFM) to stay in control of their facility processes, they would like to make optimal use of the information available in BIM. Supported by FMN, the FMIS suppliers mentioned above have taken the initiative to write this document to support the optimal use of BIM for facility managers.

This whitepaper follows on from part 1, in which we described 10 starting points how to integrate BIM in the maintenance phase. In part 2, we discuss the phase after the handover and focus on the actual use of BIM in in the maintenance & operations-phase.

We will do so by answering several Frequently Asked Questions for this phase:

- Why would you keep using a BIM model if the most relevant data are already managed in an FMIS?
- What does bidirectionality mean when we talk about the exchange of data between an FMIS and BIM?
- How do the costs of maintaining a BIM (i.e. updating all physical changes) relate to the benefits?
- What can you do with existing buildings that were not designed in BIM? Should you change your procedures if this would only benefit about 5% of total portfolio?
- What are the advantages of 'BIM-ifying' your existing buildings?

One important goal of this whitepaper is to help our clients/FMIS users to describe better what they intend to do with BIM, for example in tender documents or RFPs. With this whitepaper, FMIS suppliers may be able to provide a better answer or share their vision on the solution.

We know that the points of view described in this document are based on the current possibilities of the technology and that there is still little experience in this phase. Nevertheless, we can see that many of our clients base their decision to adopt BIM on its practical benefits and successes in this phase.

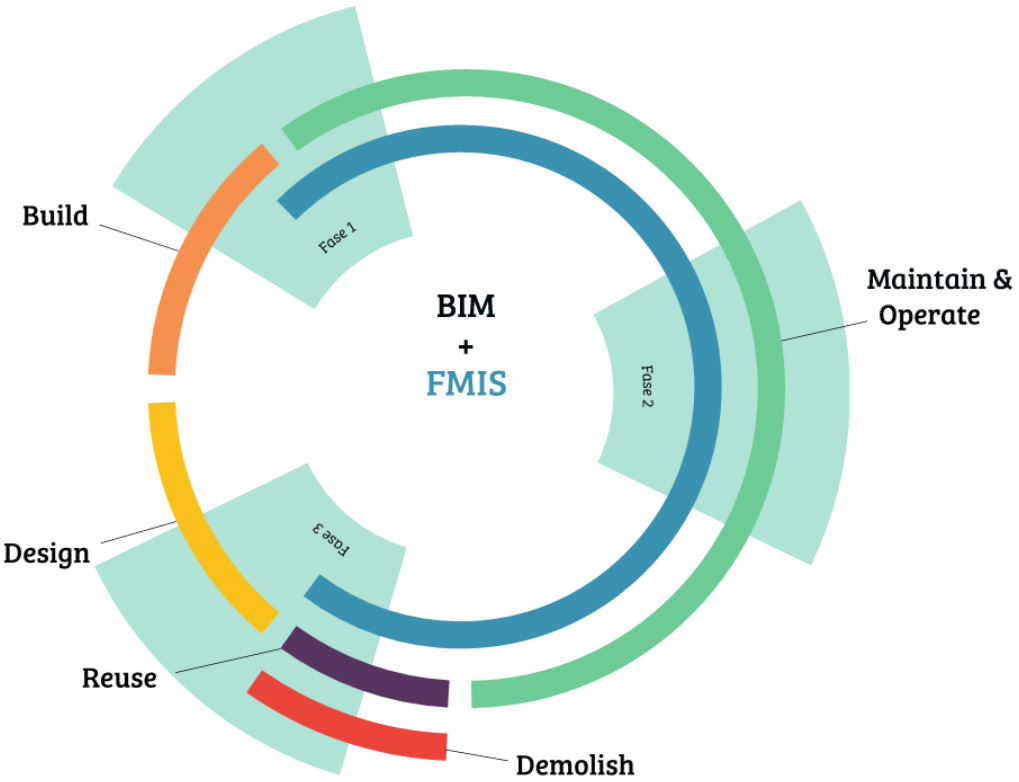
Why do we believe that FMIS and BIM should be integrated?
As FMIS suppliers, we are convinced that integrating BIM with our solutions has much to offer. In a nutshell:

- It improves information management processes for facilities, making information more reliable and more strategically useful
- It makes the handover of a project to the maintenance phase more efficient, which means that relevant information is available at a much earlier stage.

- It improves the visualization of facility data, which is useful for building managers, service desk employees, and maintenance engineers as well. Besides, it will give management better insight into physical properties and process information, such as the number of reservations, occupancy rates, and faults & defects. For maintenance engineers, it will become much easier to see which systems have to be repaired and which equipment needs to be fixed.
- The level of detail and fixed structure of BIM data will make it easier for an FMIS to respond to future developments, such as Augmented/Virtual Reality, Artificial Intelligence, and the Internet of Things

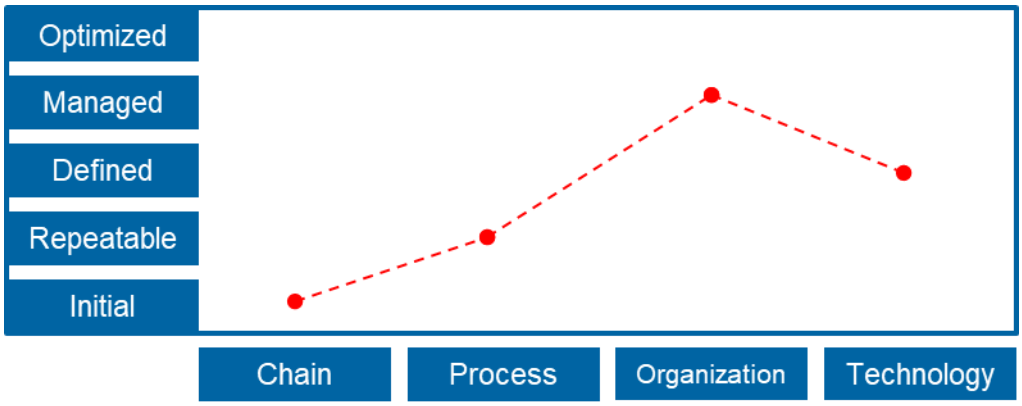
Scope

This whitepaper is about the second step of the process of integrating BIM data into an FMIS, or actually using BIM in the Maintenance & Operations (Phase 2). The first step consisted of the handover from the construction phase to the maintenance phase (Phase 1). Following on from this step, the third step will be re-using BIM and FMIS data when demolishing, selling, or refurbishing the building in question (Phase 3).



1 FMIS starting points for BIM

1.1 Are you ready?



There are many things to consider and do before the exchange between a BIM and an FMIS can be successful. Different organizations will have different levels of maturity and we recommend that organizations assess their current situation to determine whether integrating BIM and FMIS is the right step for them to take. Apart from the fact that this move requires a certain degree of ambition and that adopting BIM will not necessarily translate to tangible benefits in the future, we have also seen many organizations been disappointed by the absence of short-term advantages.

Organizations with little experience in managing property data will find it challenging to manage BIM data.

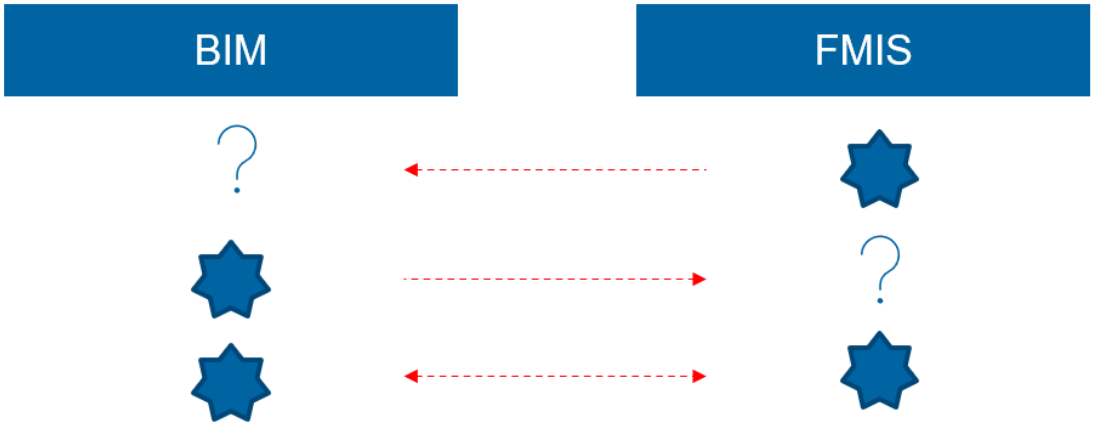
A few examples:

- To use BIM properly, you need to be able to work with multiple software applications, which must also be integrated;
- Agreements must be made to define relevant data. Reaching and verifying these agreements will take time and effort;
- Changes must be entered into the system immediately. If this is not done, the data will become obsolete right away;
- Organizations have to choose whether to manage BIM themselves or whether to outsource it, which will require the necessary agreements/contracts

For certain organizations, our advice would be to keep managing data in the 'old-fashioned' ways, as keeping the data in a FMIS up to date can be a challenge in and of itself. In some cases, it is better to hold off integrating BIM data for a while, or to opt for a more limited scope.

We have outlined the various BIM maturity levels in greater detail in chapter 3. This framework can be used to assess their current position of an organization, can serve as an ambition plan, or can be part of a roadmap.

1.2 Define bidirectionality

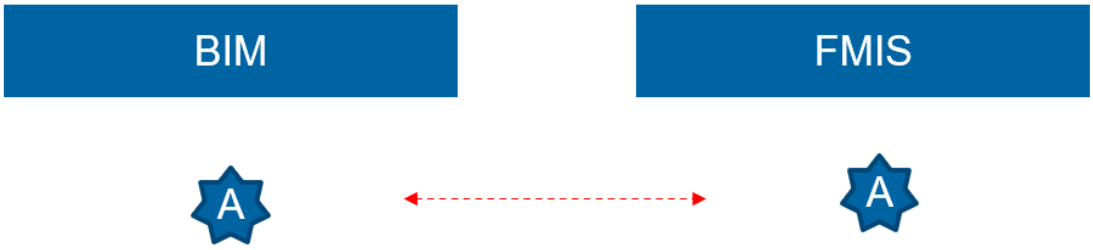


In Tenders or Requests For Proposal (RFP), we often see requests for bidirectional exchange between BIM and FMIS. Before we can give an answer, however, we always have to find out what this actually means. For us, there are three main options, which will require a different set of solutions.

#	Option	Example
1	Is bidirectionality needed in order to synchronize missing data in BIM or the FMIS? We recommend avoiding data duplication (see chapter 1.3).	In the construction phase, the Brand/Model of a Boiler are recorded in BIM. After the handover, these data are copied to and updated in the FMIS.
2	Is bidirectionality needed in order to manage managing physical/operational changes (revisions) between BIM and the FMIS?	If a modular wall is moved within a building, this change is first recorded in BIM, before the spatial information about the wall and rooms in question is updated in the FMIS.
3	Is bidirectionality needed in order to present data, e.g. visualizing IWMS data linked to BIM objects in a 3D viewer?	Any installation added to the FMIS can be visualized in a BIM by clicking on a hyperlink or used an integrated viewer.

We can provide distinctive solutions for all these options in our FMIS, provided we know exactly what we are being asked to do.

1.3 Avoid duplicating data



When exchanging data between a BIM and FMIS, it is important that users are not able to change the same data in both systems. Usually, usage characteristics are also recorded in a BIM during the design & construction phase, in addition to physical asset and space characteristics, which must also be available in the FMIS after the handover. After the handover, these data should no longer be updated in the BIM and, ideally, should be deleted.

Only unique characteristics that can help identify the link between a BIM and an FMIS object should be exchanged. Unique keys, such as GUIDs[1], are a valuable tool, as they make it possible to find any linked object in either the BIM or the FMIS.

1.4 Request both 3D and 2D views

BIMs are often expected to be huge repositories of data that can even be shown in 3D, adding even more value for end users. In an FMIS, however, many processes are managed using 2D views.

Examples include:

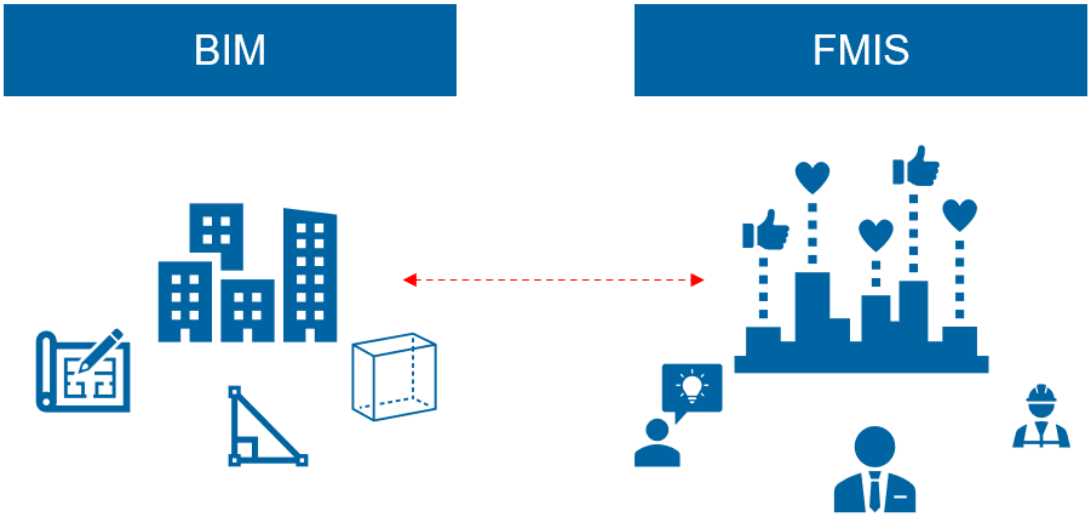
- When transitioning from 2D to 3D visualizations, an organization's entire portfolio of buildings will not be available in 3D straight away. For uniform views of and reports on all your buildings, you will still need 2D views, based on a BIM model, until the transition to 3D is complete.

[1] A globally unique identifier, or GUID, is a pseudo-random number that is used in software tools and should be project-independent and unique. In theory, such a number can be used throughout the entire lifecycle of a building.

- Processes such as Space and Relocation Management and Reservations, in which apps and information terminals are used to search for vacant spaces, typically use 2D floor plans.
- To be compliant with EN15221-6 or NEN2580 , we need calculated spaces or floor dimensions that are not extracted easily from a 3D view. These dimensions are easier to view or add in 2D.
- During the decoration or furnishing process, many changes will have to be made. Current BIM tools are not very well suited to these processes, and 2D tools are much more efficient.

We recommend using 3D views in as many new processes as possible, whilst also using 2D views to answer queries about existing information. If you decide to do away with 2D views and end up needing them, you will be forced to spend a considerable amount of time to model them from scratch. To be clear, these 2D views should be based on original BIM data, so we suggest implementing integrated procedures.

1.5 Differentiate between physical data and usage data



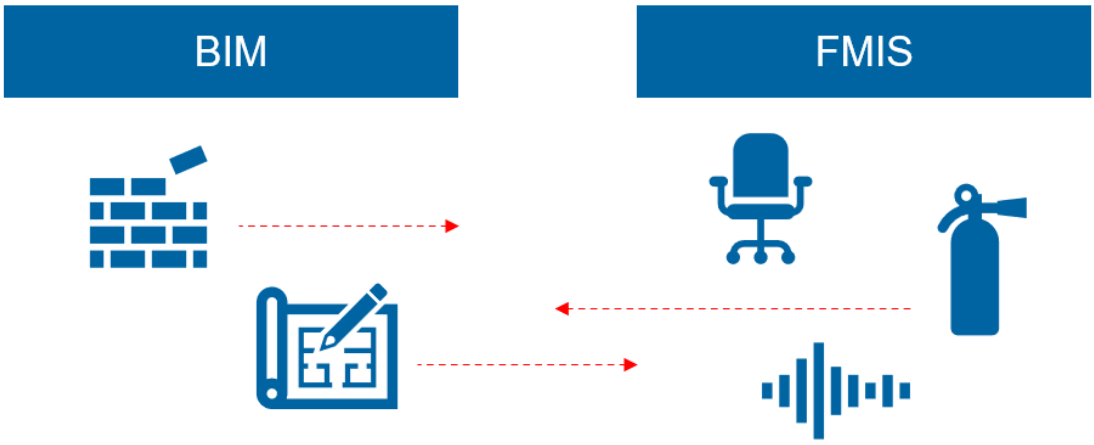
After the handover from BIM, usage data for the building in question will be managed in an FMIS. At this point, it is important to differentiate between physical data and usage data, so that each can be managed in their own logical place. An FMIS is used by authorized users to access certain data for the sake of specific procedures. Physical data are usually enriched with process data, such as statuses, documents, photo's, and user comments at various stages of the lifecycle. BIM tools are specifically designed to model the physical reality and to highlight spatial relationships. Use your FMIS for its intended purpose and do not mis-use the functionalities of a BIM in the maintenance phase.

Examples:

- Dimensions, volume, and finishing details are physical characteristics of a room that should be recorded in a BIM. Who is using the room, what the room is called, who is leasing the room, and which workplaces have been assigned to which department are examples of data that should be recorded and managed in an FMIS.
- A technical asset also has certain characteristics, such as dimensions, a location, and connections to other assets. BIMs are perfect for these data. Maintenance history, replacement prices, and warranty details should be managed in an FMIS.

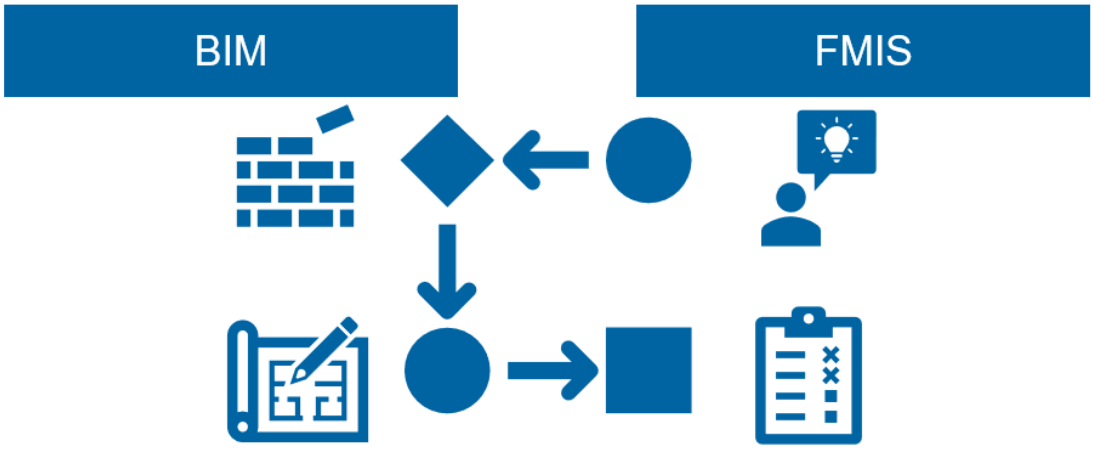
All usage data related to spaces and assets should be recorded and managed in an FMIS, whereas all physical data can remain in a BIM. If these two types of data are distinguished correctly, fewer data will have to be exchanged between a BIM and an FMIS.

1.6 Designate master systems for all change types



In some cases, it can be less than clear whether to use a BIM or FMIS to record a change throughout a building's lifecycle. We have drawn up a list of frequent changes, outlining: how often they occur, what their impact is, and which system should be the source or master of a change. We have highlighted these changes in chapter 4.

1.7 Define procedures for changes



Define who should initiate a change, who should check the data, and who should accept the eventual change in all of the systems. It is very important that this procedure is completed before any changes between a BIM and FMIS are processed. Make clear agreements with other departments, contractors, and suppliers on matters such as the frequency with which changes are reported, deadlines for reporting changes, formatting, and who will be responsible for sharing data.

These procedures are quite similar to those used with traditional methods, but they can be slightly more complex when you have only just started working with BIM. Instead of the traditional CAD manuals, we recommend creating BIM manuals or protocols, specifying the various agreements which we suggested in the first whitepaper.

1.8 Consider a Common Data Environment

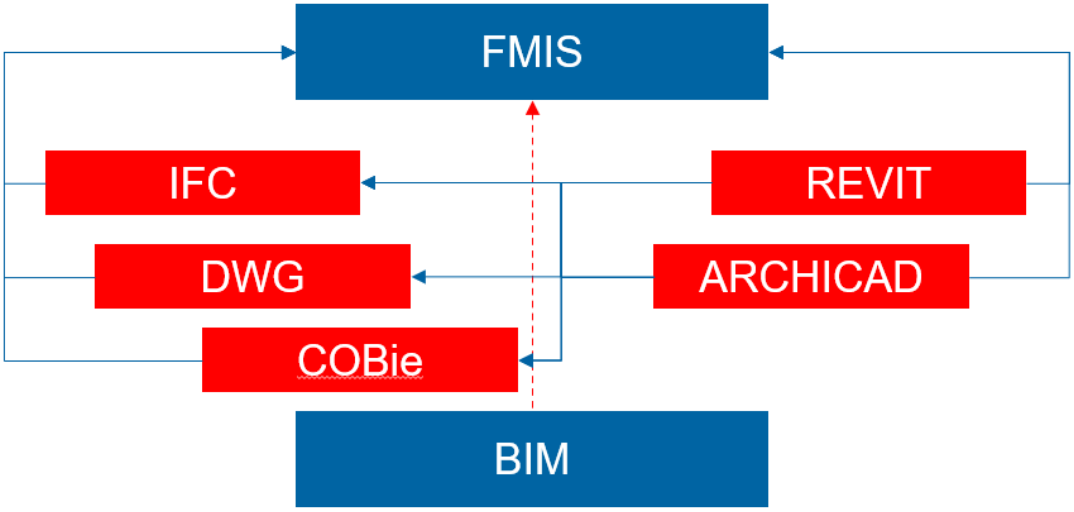
As the quantity of change information exchanged between your FMIS and BIMs will be vast, we recommend creating an intermediate, central layer. This layer can be used to manage all the changes in question, making sure that they comply with procedures and are properly formatted. Some FMIS or BIM tools let you do this as well, but we believe it is better to create consistency and set a logical hierarchy before data are exchanged. As Common Data Environments (CDEs) are becoming

ever more popular in the construction industry, we recommend using these platforms as an intermediate layer between the construction and maintenance phase as well.

Here are some use cases:

- BIM data needs to be linked to certain libraries or clustered to make them more compatible with the structure of the FMIS. In this case, the CDE can classify elements and improve their fit with the data structure of the FMIS.
- Some types of specific usage data in an FMIS have be updated and assigned to different BIM models. In this case, CDE can decide which models need to be updated and create jobs or issues, link them to the models and manage any communication about the issues.
- Planned moves or changes in the physical layout have already been created in BIM, but will have to be activated on certain dates so as to update the FMIS, creating different versions of the same room at different times. A CDE can be used to temporarily store a planned change and activate it on a certain date.

1.9 Consider exchange or data standards



When considering whether to link BIM data and FMIS data, it is important to look at the formats of or systems used to produce BIM models, which will also be used to exchange data. We see two situations, which have their pros and cons:

- Point-to-point exchange, between a BIM source system (Revit or ArchiCAD) and the FMIS

- Exchange based on open or public standards, such as IFC, DWG, or COBie. The source system will then need to export a file in the format in question so that it can be read/imported by the FMIS.

The advantages of both possibilities are described in Chapter 2. For the maintenance phase, this is a very relevant question to ask, and having a clear strategy will benefit all contractors, suppliers, and Viewer platforms (e.g. CDEs). In practice, we can see that both situations will continue to occur in parallel for some time to come

1.10 Bring in external experts or consultants

Not all FMIS processes are the same and were not designed solely for the purpose of recording and managing BIM data. Similarly, BIM data can also serve other purposes in the maintenance phase. As a result, we expect there to be certain gaps in the knowledge of FMIS and BIM consultants alike.

There is a growing need for experts specialized in the interface between both systems, who can help design workflows, advise on keeping systems up to date, and suggest new use cases to make optimal use of both systems. We recommend bringing in external experts or consultants to answer these questions.

2 BIM exchange standards

In the figure below, we have outlined the differences between source systems and IFC. IFC is an international format for the exchange of data and 3D views. Commonly used source systems in the Netherlands include ArchiCAD, Tekla, Allplan, and Revit. These systems can usually import and export DWG, IFC, or COBie-files, as well as using them as reference files.

Main aspect	Sub-aspect	Source system	IFC
File format	Vendor-specific	Yes	No
	Standardized	No	Yes
	Transparant, readable	No	Yes
	File size	Huge	Compact
Lifecycle	Version-dependent	Short	Long
Compatibility	Vendor-specific	Yes	No
	Exchangeability	Bad	Good
File content	3D model	Yes	Yes
	2D floorplans / vertical views / sections	Yes	No
	Product libraries	Many	Few
Suitable as	Source file	Yes	Limited
	Reference file	Yes	Yes
	Publication file	No	Yes
	a way to view/consult model	Hard	Easy
	a way to check/monitor model	Hard	Easy
Changes[2]	Major refurbishments/re-developments	Change	Publish/Share
	Minor refurbishments	Change	Publish/Share
	Replacements (1 on 1)	Change	Publish/Share
	Replacements (different type/model)	Change	Publish/Share
	Data enrichment	NA	Via CDE
	Layout changes (room changes)	Change	Publish/Share
	Furniture and cubicles	Change	Publish/Share
	Moveable equipment (non- furniture)	Change	Publish/Share
	Fire-fighting equipment	Change	Publish/Share
	Sensors	Change	Publish/Share

[2] For change processes, source systems will be needed in both situations to actually submit the physical changes.

3 Maturity levels

This overview is based on the levels of the Capability Maturity Model and the supply chain management, process, organization. and datastructure/technology axes. Organizations may have good tools (technology), but may not be the best at collaboration within the supply chain to deliver good BIM models. Similarly, an organization may have excellent manuals, methodologies, and BIM processes, but the people in the organization are not convinced of the added value, new investments may be withheld.

Dimension	Supply Chain	Process	Organization	Data structure/Technology
Level 1: Initial **(Chaotic and ad hoc)**	Suppliers deliver on-demand. BIM models have been made available but were not discussed beforehand.	No agreements have been made about who will make BIM data available and of what quality such data should be.	A few stakeholders know about BIM, the organization is not particularly interested.	Useful BIM data are found on an ad-hoc, unstructured basis. Data are fitted into existing processes manually.
Level 2: Repeatable **(Knowledge structured)**	Agreements have been made about the BIM data delivery as part of the contract.	It is clear which data should be available in BIM and who will be responsible for the quality.	Key users of the FMIS have tested the delivery of BIM data. Knowledge and skills are not aligned.	A standard import is used via a document-oriented exchange standard.
Level 3: Defined **(Standardized)**	Suppliers are committed to the BIM protocol that they have drafted together with the client.	Based on previous projects, there is a generic delivery plan, BIM protocol or IDM, detailing who will provide which data, in which format, and with what quality.	Both the Real Estate and the Facilities department recognize the value of BIM. Time is spent to share knowledge and develop skills.	BIM data are imported in FMIS semi-automatically via documents and object-oriented exchange standards like IFC.
Level 4: Managed **(Measure quality)**	Suppliers are involved in drawing up BIM agreements that also optimize their own processes.	The maintenance process is structured according to ISO standards, which make the whole process transparent in terms of costs, time, and quality.	BIM contributes to Key goals of the organization and has become a vital instrument. This results in clear goals for suppliers and internal departments.	Clear requirements are in place regarding the structure and authorization of BIM data to ensure that only the relevant part is exchanged. A Common Data Environment handles the exchange.
Level 5 Optimized **(Refinements)**	Knowledge is shared with competitors and various potential suppliers to discuss new solutions and optimize the use of BIM data.	The process is fully automated. Evaluations are carried out to make minor improvements and make BIM data more valuable.	Organization has a clear vision on the wider possibilities of BIM. New resources become available to unlock BIM data in a better way (sensors/VR/AR).	Data exchange is part of the Digital Twin, where multiple tools like FMIS, BIM and IOT are linked and update automatically.

4 Change management for BIM and FMIS

This table outlines common changes, along with their frequency and impact. We differentiate between hard, technical assets such as installations/building elements and soft, facility assets such as furniture, fire-fighting equipment and sensors.

						Impact for FMIS	
Aspect	**Type of change**	**Master**	**Freq**	**Process**	**Responsible party**	**Relevance**	**When to process**
Technical/ Installations	Major refurbishments/re-developments (*1)	BIM	Rare	CAPEX project	Architect, contractors, consultancy	Medium	After delivery
(Fixed equipment, SfB codes starting with 5, 6, 7)	Minor refurbishments (*1)	BIM	Occasional	Internal project	Interior designer, installer	Medium	After delivery
	Replacements (1 on 1)	FMIS	Occasional	Work ticket	FM provider, installer	Low	After replacement
	Replacements (different type/model)	BIM	Occasional	Work ticket	FM provider, installer	Low	After replacement
	Data enrichment	FMIS	Regular	FMIS change	FMIS process owner	High	Immediately
	Interior changes (adjust rooms)	BIM	Occasional	Work ticket	Interior designer, installer	High	Before physical change
Facilities	Furniture and cubicles	FMIS/BIM (*2)	Regular	Work ticket	FM provider	Medium	ASAP
(Variable equipment, SfB codes starting with 8)	Moveable equipment (no furniture)	FMIS/BIM (*2)	Regular	Work ticket	FM provider	Medium	ASAP
	Fire-fighting equipment	FMIS/BIM (*2)	Occasional	Work ticket	FM provider, installer	High	Before physical change
	Sensors	FMIS/BIM (*2)	Occasional	Work ticket	FM provider, installer	Medium	Before physical change

*(*1) assuming BIM data is available*
*(*2) dependent where the data is primarily managed, in BIM or FMIS*

This table is a suggestion only. The changes types, frequency, and relevance may differ from one organization or building to another. Changes will be more frequent in hospitals, airports, and factories than in office buildings or museums. It is important to describe all possible changes and to define which system is the master system and which is the slave (BIM or FMIS). The use of BIM for FM depends on the possibility to store data permanently and have it updated after each change. It also requires a culture change, as all stakeholders will have to move away from a one-off-delivery approach and adopt a continuous management philosophy instead.