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Open BIM and ISO/IEC and CEN Standardization Activities

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OPEN BIM™

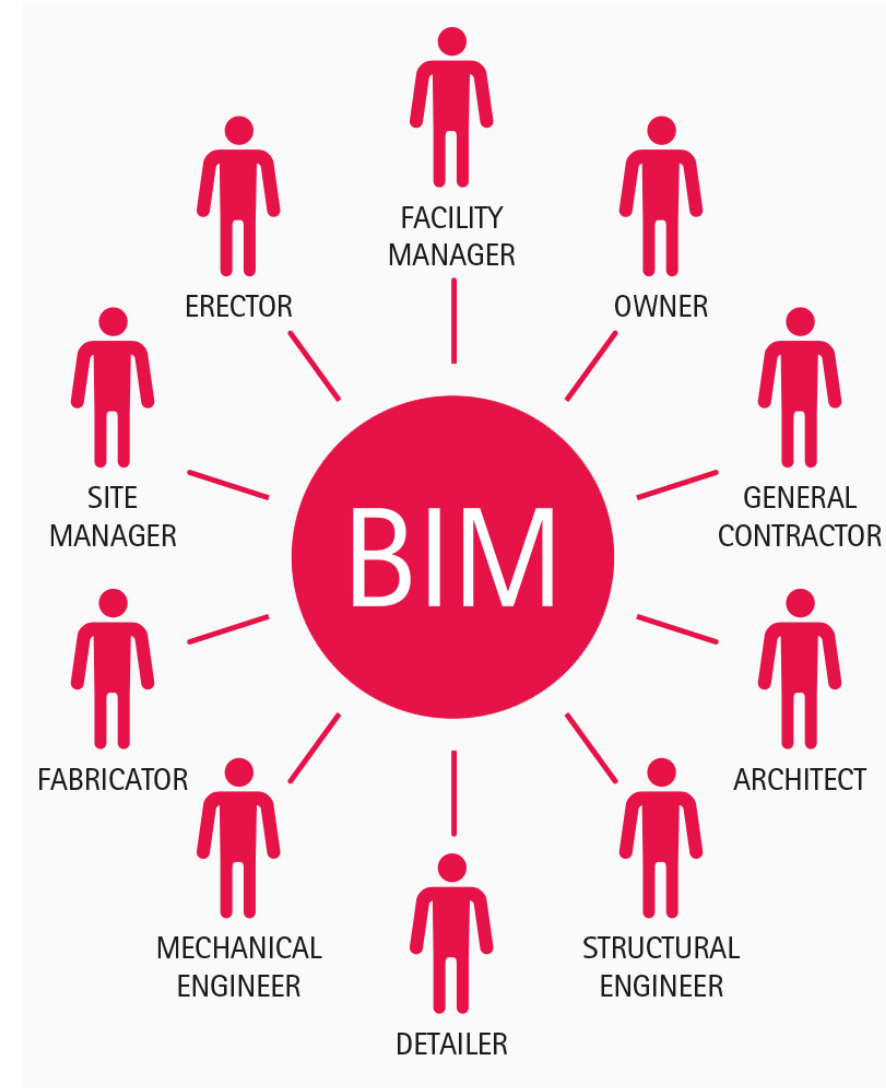
What is OPEN BIM?

OPEN BIM is a universal approach to the collaborative design, realisation and operation of buildings based on open standards and workflows. OPEN BIM is an initiative of buildingSMART International (bSI) and several leading software vendors using the open buildingSMART Data Model.



Why is it important?

- **OPEN BIM** supports a transparent, open workflow, allowing project members to participate regardless of the software tools they use.
- OPEN BIM creates a common language for widely referenced processes, allowing industry and government to procure projects in transparent commercial engagement, comparable service evaluation and assured data quality.
- OPEN BIM provides enduring project data for use throughout the asset life-cycle, avoiding multiple input of the same data and consequential errors.
- OPEN BIM enables small and large (platform) software vendors to participate and compete on system independent, 'best of breed' solutions.
- OPEN BIM energises the on-line product supply side with more exact user demand searches and delivers the product data directly into the BIM.



Why OPEN BIM Will Succeed

- **Best in Class, Fit for Purpose** With such a vast array of software products on the market, it is impossible to accept that any one vendor can produce the best solution to all problems. One open communication protocol means that products can be selected on their capability and not their source.
- **Competition** The software market is under continuous development and vendors are always looking to improve performance, scope and deliverables. In an open market, this will continue unabated as the quest for competitive advantage is the primary goal.
- **Application** In a major construction project, there are likely to be a significant number of stakeholders using a variety of software tools. It makes absolute business sense that each stakeholder can use their tools of choice providing it can exchange data with others. Only if a particular tool set does not have this communication capability should pressure be brought to change.





Standards

- buildingSMART promotes international consensus among stakeholders on specific standards to accelerate implementation and uptake. buildingSMART standards cover a wide range of process and information capabilities unique to the built environment industry, including:
 - An industry-specific data model schema - [Industry Foundation Classes \[IFC\]](#)
 - A methodology for defining and documenting business processes and data requirements - [Information Delivery Manual \[IDM\]](#)
 - Data model exchange specifications - [Model View Definitions \[MVD\]](#)
 - Model-based, software-independent communication protocols - [BIM Collaboration Format \[BCF\]](#)
 - A standard library of general definitions of BIM objects and their attributes - [buildingSMART Data Dictionary \[bSDD\]](#)
- buildingSMART also oversees formal reviews and publication of Technical Reports that result from technical activities in the [Rooms](#) that involve research, development or implementation and are of interest and benefit to the buildingSMART Community and the built asset industry. A buildingSMART SPEC is a document that can be produced by any organisation that wants to standardize best practice on a specific subject but is not yet ready to proceed with producing it as a bSI Standard.

The IFC certification process is crucial

The buildingSMART IFC software certification process:

- Is the only official IFC certification process
- Promotes consistent and reliable IFC specifications, regardless of vendor or application Improves quality of software interfaces

The certification process includes:

- Automatic IFC file checking
- High-quality test cases for export and import
- Certification award logo



Applications of BIM along the engineering and construction value chain

BIM is not just 3D modelling, it's the conversation

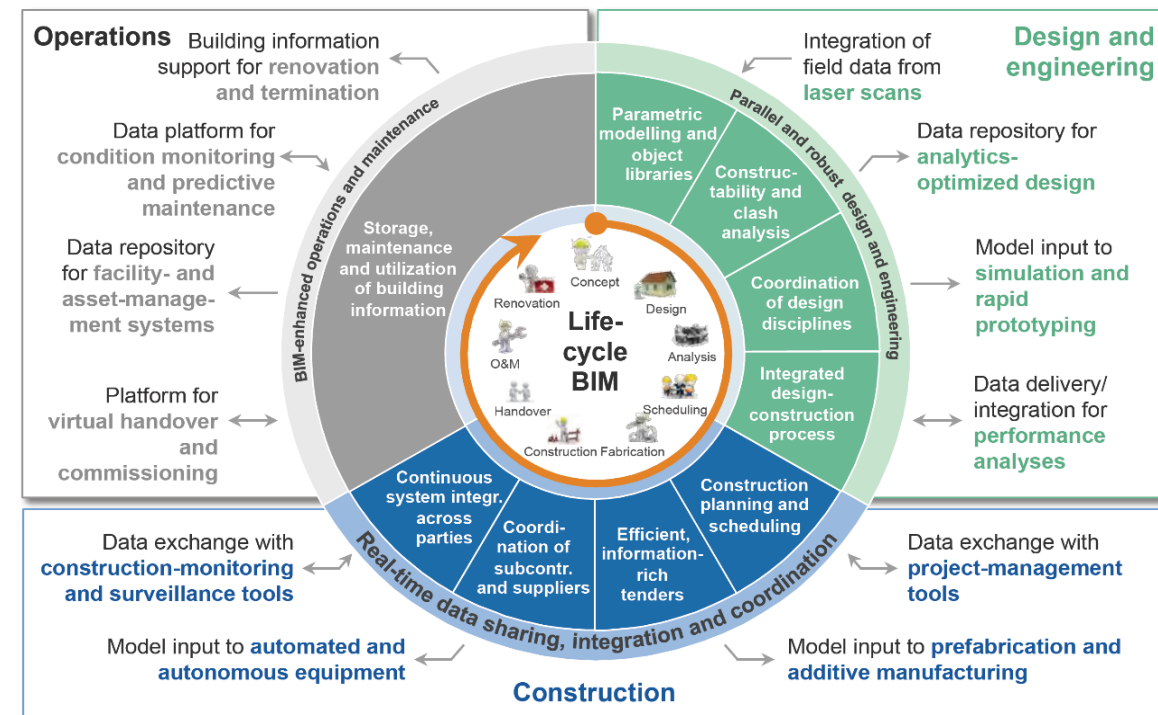
There is a common misconception about the **simplicity of BIM** /just 3D models and "Hollywood style" visualisations/

Building Information Modelling is a process of creating and managing the data of a building in **its whole life-cycle**.

BIM is a digital tool disrupting the construction industry as a **platform for central integrated design**, modelling, asset planning running and cooperation

BIM provides all stakeholders with a digital representation of a building's characteristics **in its whole life-cycle**, from early conception to demolition and form a **reliable basis for decision-making**

BIM facilitates **collaboration** among all stakeholders from early design to the decommissioning phase – **real time data sharing and coordination**, large efficiency gains.



(Source: „Shaping the Future of Construction“)

Collaboration is central on any BIM project.
“Better Information Management” 7

BIM maturity levels

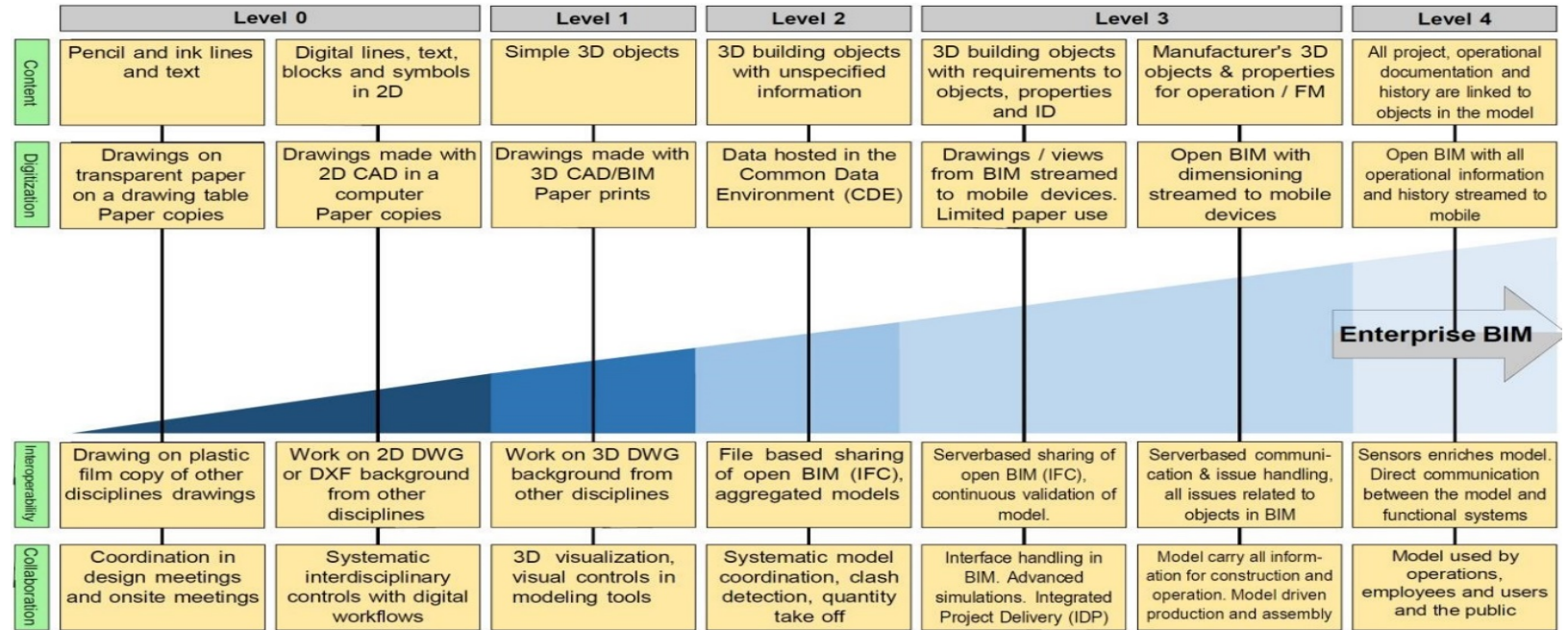
It not possible to move brutally from a traditional modelling approach towards an open BIM approach.

BIM is a gradual progression towards **greater collaboration**, and **greater sharing** of **increasingly standardised** project information

This progression is described by the four levels of BIM . /UK-3

The BIM maturity is presented as “wedge”

Levels 0 to 2 are clearly described.



BIM Level 2 - stakeholders use 3D CAD, exchange information **in common file formats** and share data electronically through a **centralized information management system** called a **Common Data Environment (CDE)**.

BIM Level 3 is not fully described yet, but it is going to be about :

- more integrated, centrally held project models that everyone on the team can access and modify.
 /also known as BIM in the cloud, all parties collaborate through digitally shared space/
- **full interoperability of software and open access to it.**
- It has a focus on **the lifetime management of a building**, not just its design.

Indicators measure four aspects of evaluation: content, digitalization, interoperability and collaboration for the project stages and for the asset g management-the level reached could be different for each aspect.

Positive effects of BIM:

BIM-enabled projects - more productive, predictable and profitable - less rework, fewer errors, enhanced collaboration, and design data that can ultimately be used to support operations, maintenance, and asset management.

- A US study discloses that **lack of access to information in Facility Management and Operation** of A 20.000 m2 building generates an extra cost over 30 years of almost EUR 2 mill.
- A British BIM report - discloses that BIM **increases competitiveness and the ability to export service ; 24.6% improvement in productivity** on UK Government projects using BIM; **capital cost savings of 19.6%** due to use of BIM, saving £840m on £3.5bn of construction spend in the 2013/2014 financial year.
- Savings as a direct result of BIM on several large international projects, 199 days and £65k worth of time was saved on the development Abu Dhabi Airport; a reduction of 30% in construction time of Shanghai Tower (Hoar, 2017).

In general, the digitization of the construction sector is expected to significantly **reduce** the total construction **costs** and completion **time**

- **10% productivity improvement** of the European construction sector would generate savings of **€130 billion**
- BIM contributes to meeting the objectives of **sustainable construction** and improving the energy efficiency of buildings; Digitalisation acts as an accelerator and **enabler of many of the SDGs**.

BIM as a strategic factor in achieving economic, environmental and social benefits

Governments and public contractors across Europe and around the world take proactive steps **to encourage the use of BIM in the public sector** (following the recommendations of the 2014 Public Procurement Directive)

UK: the world leader in the implementation of BIM

The UK Government's **BIM mandate** has been in place **since April 2016**. The mandate requires that all projects funded by central government be delivered with 'fully collaborative 3D BIM'- BIM Level 2

Germany: 2020 is the great challenge: The Federal Ministry of Transport and Digital Infrastructure - a national step plan for the BIM implementation was presented in 2015 - BIM will be introduced by **2020 as the new standard for transport infrastructure projects**. Similar plans are scheduled for other public works.

Spain : public infrastructures get BIM in **2018**

Denmark, there will be a mandate for all projects in **2022**

Similar rules already apply in the Netherlands, Finland and Norway.

What has the 2018 BIM Report shown?

UK Government strategic aims:

- 33% reduction in the **initial cost of construction and the whole life cost of built assets**;
- 50% reduction in the **overall time**, from inception to completion, for new build and refurbished assets;
- 50% reduction in **greenhouse gas emissions** in the built environment; and
- 50% reduction in the **trade gap** between total exports and total imports for construction products and materials.

- The majority of those surveyed believe BIM will help to reduce **both construction costs and completion times**

Slightly **fewer** agree that it will help **reduce greenhouse** gas emissions or reduce the trade gap, but overall there are clear and tangible benefits to BIM adoption.

- Almost two thirds of participants agree that the Government requires BIM on its projects.
14% of respondents believe the mandate has been 'not at all successful'.

- BIM usage has increased by 12% compared to last year

Now nearly **three quarters** of those surveyed are '**aware and using**' BIM, only 1% unaware. BIM has gone from a niche platform to the norm.

- The number of those who have adopted BIM, but who **use it only on a minority of projects** has dropped **from a third to around a quarter**

Extrapolating the growth that we've seen in BIM usage within organisation since 2015 suggests that we'll **reach 90% within the next three to five years**.

- **Lack of in-house expertise** is the main **barrier** to BIM adoption

Other factors include **lack of training**, lack of time to get up to speed and even **a lack of client demand**.

The UK Government BIM mandate requires projects to be at Level 2 BIM.

The Government is committed to Level 3 BIM, and in the 2016 budget policy paper, is told that: *'The government will develop the next digital standard for the construction sector – Building Information Modelling 3 – to save owners of built assets billions of pounds a year in unnecessary costs, and maintain the UK's global leadership in digital construction.'*

What is the 'next BIM'?

Firstly, getting true Level 2 BIM used in more projects.

Secondly, describing, agreeing on and implementing Level 3 BIM

Of course, there are other things on the horizon too: AI, generative design, offsite manufacture, 3D printing and the Internet of Things. All these items (and others) have the potential to transform the design and construction industries.

At the same time, they will all **rely on the fundamentals of BIM** being in place: **collaborative working, 3D design** and **rich, standardized design information**.

BIM Level 2 will increasingly be seen as a foundational step for the digitization of the industry.

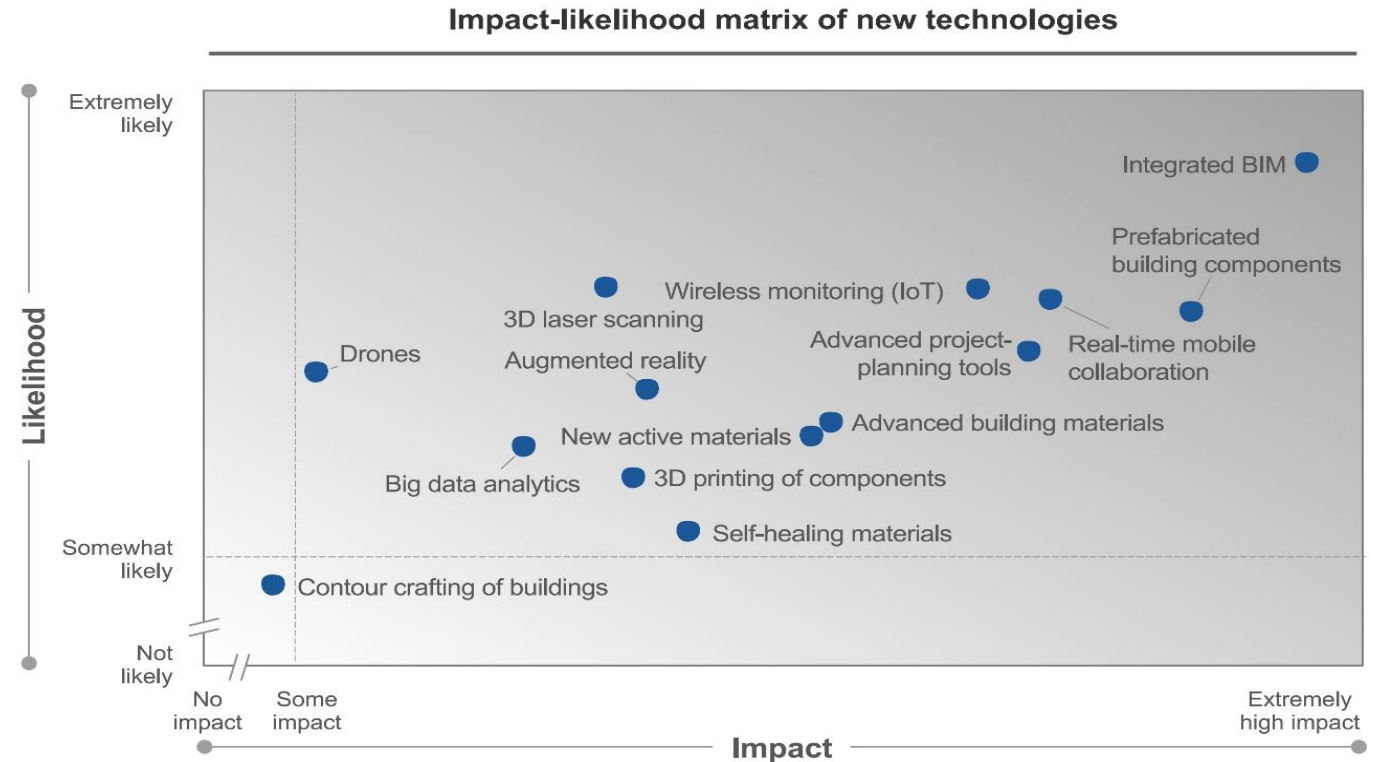
BIM is the centerpiece of Construction 4.0, but it is not the only element

What else is “Construction 4.0”?

The digitalization of the construction industry has many aspects and includes many advanced processes and technologies.

In the report of the World Economic Form “**A Breakthrough in Mindset and Technology**” several new technologies are identified together with their possible impact on the industry.

While most other industries quickly embraced the new technologies and opportunities, the construction sector responded hesitantly.



Future Impact and Likelihood of New Technologies
 (Source: „Shaping the Future of Construction“)

BIM is both happening now and has a pivotal effect on construction

BIM adoption has been slow, despite its many advantages. The recommended actions that companies, industry organizations and governments are advised to implement to accelerate BIM adoption / 9 key actions need to be implemented to accelerate BIM adoption

An Action Plan to Accelerate BIM Adoption

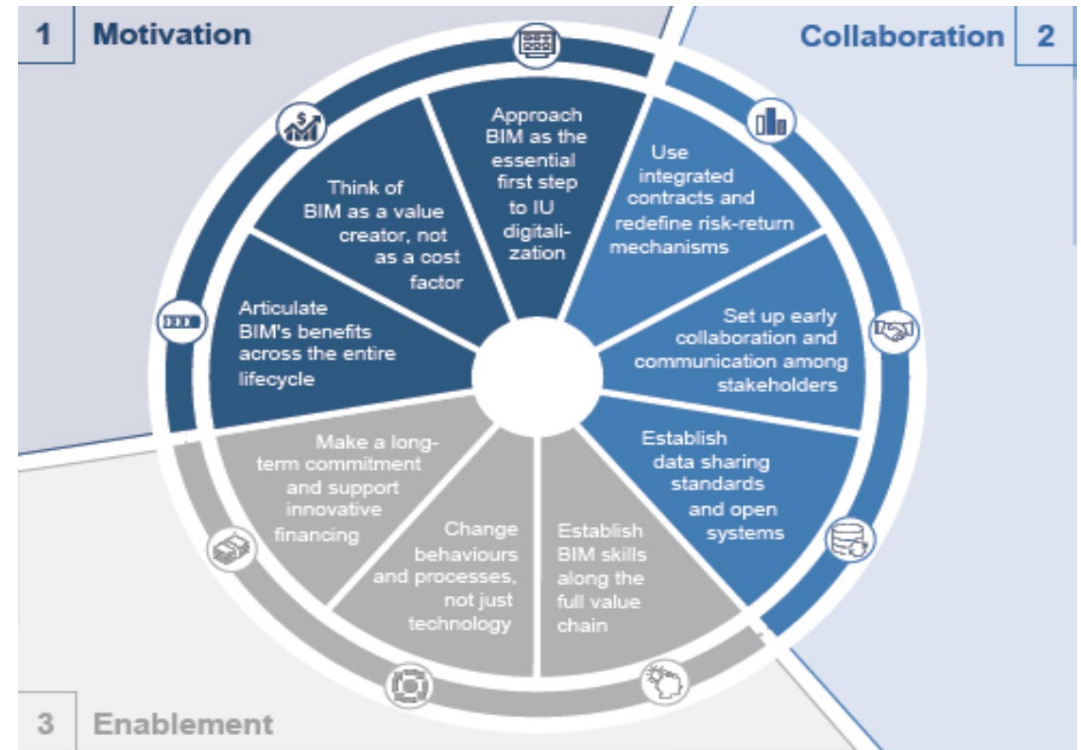
World Economic Forum (WEF) Initiative on the ‘Future of Construction’ have prioritized BIM adoption as a critical step toward transforming the construction industry.

- ✓ Set the right motivation for BIM adoption- understanding of BIM’s benefits
- ✓ Enhance collaboration on Projects
- ✓ Enable all stakeholders

Change behaviors and processes, not just technology

The European Engineering organizations must be proactive in:

- Achieving greater communication and BIM awareness raising;
- facilitating transfer of knowledge, expertise and capabilities at EU level.



BIM Adoption Circle
 (Source: „Shaping the Future of Construction“)

European Construction Industry Manifesto for Digitalisation

June, 2018



Strong **commitment** to **support** an inclusive **digital transformation** of the **construction sector**

1. **The European Union must take the political lead on digital construction**
Digitalisation of the construction industry should be a top political priority for all European institutions and should be part of the “Digitising European Industry” initiative
2. **We need an appropriate regulatory framework on data policy**
better data quality and data management, address challenges around intellectual property rights and cybersecurity
3. **The new EU budget must focus on digital skills, R&D and deployment of IT infrastructure**
the post-2020 Multiannual Financial Framework must focus on: digital skills, R&D and IT infrastructure



BIM standardization



Български институт за стандартизация



International
Organization for
Standardization

Standards – A Major Driver for Digitisation



World Standards Day 2018 ISO,IEC,ITU, 14.10.2018
CEN/CENELEC, 12.10.2018

- Standards powering the industrial revolution over time;
- Standards shape the present - the 4th industrial revolution in progress;
- Standards meet the future- towards the 5th Industrial Revolution (AI)

Just as standards were crucial during the first industrial revolution, over 250 years ago, today standards will once more play a key role in the transition to a new digital era.

Standardization issues are perceived as the most important **barrier for digitalization**, including both the **lack of standards**, and the use of **too many different standards**.

International Standards ensure:

- **compatibility and interoperability** of data, ensure spread of knowledge and innovation globally;
- **safety and minimize risk** for the new generation of smart technologies characterized by **big data, increased integration, cloud storage and open communication of devices** .

DEI priority: Promote the development of **Interoperability standards**

ICT Standardisation - five priority areas: **5G, cloud computing, IoT, data technologies and cybersecurity.**

BIM standardisation

To standardize or not to standardize



A process is only successfully standardized if it is executed each time in a predefined (**optimal**) way by processing **the same activities** in **the same order** and producing exactly **the same specified output**.

Standardization of workflows is desirable within manufacturing and prefabrication industries where the **same products are generated repetitively**, however **there is less clarity whether this definition is applicable to BIM processes within AEC industry**.

Today the larger contracting companies employ **standardized BIM-Manuals when procuring design services.**

The question is: **what is within** these so-called **organisation-specific BIM-Manuals** that **may be standardized** to the benefit of the wider industry?

Impact of discrete in-house BIM Manuals which are emerging in Europe as a response to a lack of leadership in BIM adoption **may have an adverse effect on the competitiveness.**

Furthermore, because many BIM practice procedures are hidden within **organisation's discrete BIM-Manuals**, with **restricted audiences**, a real risk of developing a constellation of fragmented Manuals is possible.

According to a survey Many industry practitioners consider **a lack of standards a major obstacle to the effective utilisation of ICT in construction.**

The same survey reveals **Architects invest the most amongst consultants** in BIM and drive comes mostly from enthusiastic individuals (bottom-up) as opposed to management (top-down).

The development of BIM is progressing rapidly and requires the application of **common standards** (CEN, ISO) to ensure future **interoperability** and **compatibility** of data sharing and use - **open Standards for interoperability and data management**

What the industry needs is **“big and open” BIM**, which integrates the entire value chain and is characterized by **full interoperability of software and open access to it.**

General framework for the management of digital data - quality data exchange between all participants in the value-chain - a common technical language for all European countries is needed

Area where standardisation on BIM is needed:

Exchange of information between **software applications** used in the construction industry. The leading organisation in this domain is **buldingSMART** which has developed and maintains **Industry Foundation Classes (IFCs)** as a **neutral and open specification for BIM data model** - a data schema, that allows **information to be exchanged** in a **consistent data format regardless of which software** was used to create the original information.

Data dictionaries

International Framework for Dictionaries Libraries

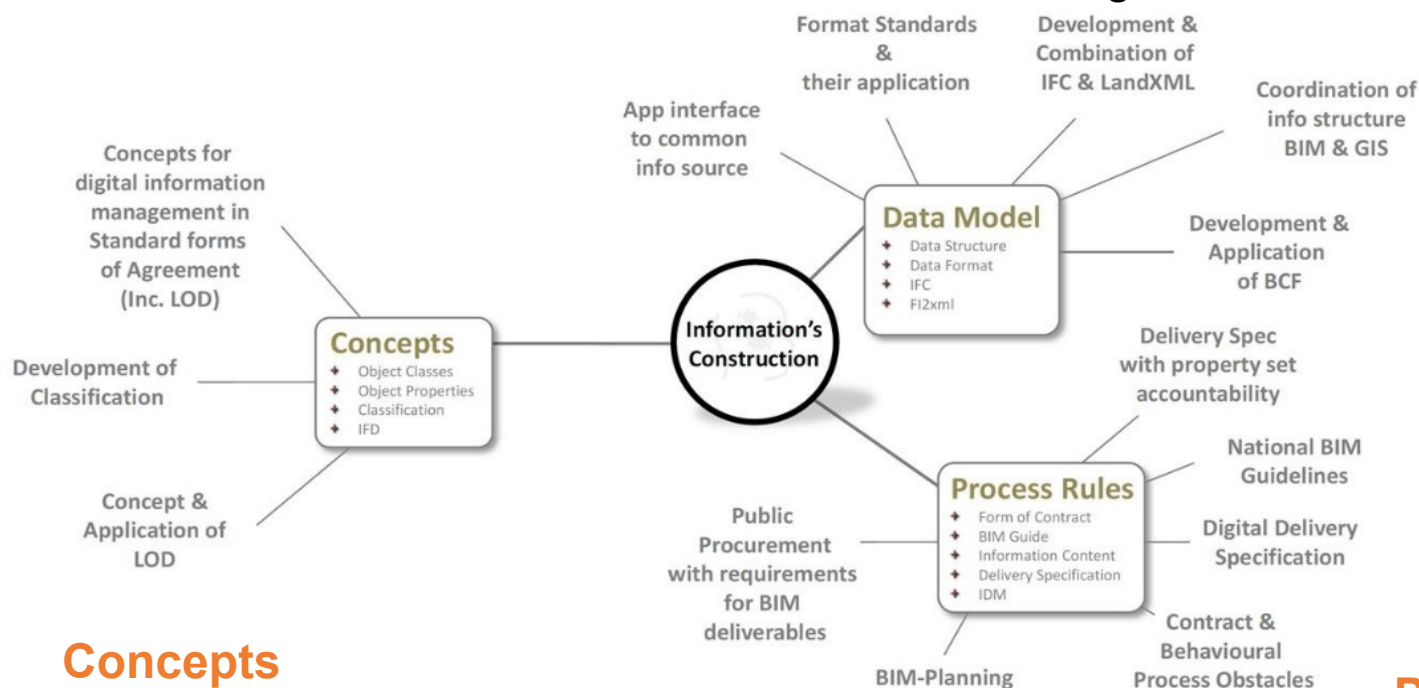
Processes

Data delivery manuals

It is important to categorize and understand the strategic difference between **branch or sector standards** and **organisation standards** (which may be even company secrets) in a BIM context.

BIM standardization platform

Around 3 divisions are arranged BIM standardization themes:



Concepts

Common concepts and classification of concepts are necessary for everyone to speak the same language

Data Model

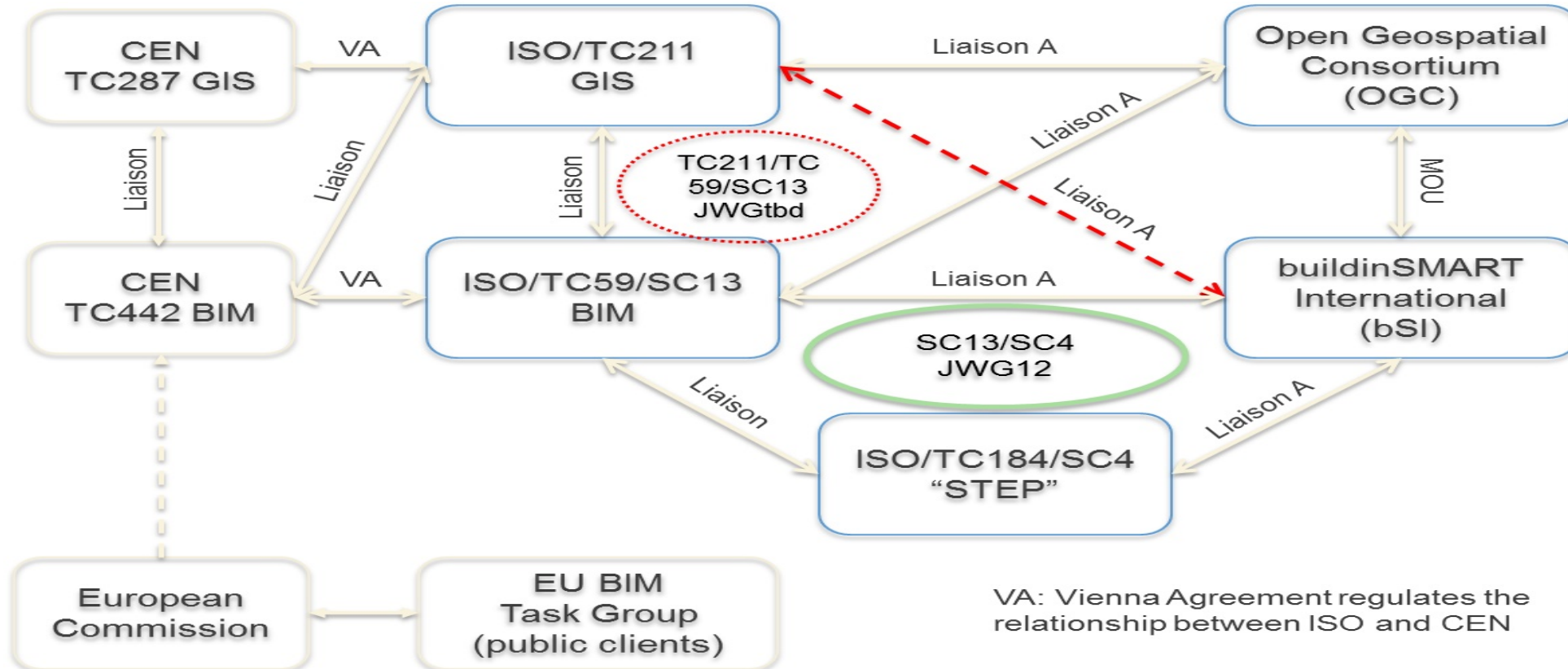
Neutral formats for data models required for systems and players to exchange information clearly.

Processes

a uniform processes for information delivery and **a common working methodology** is necessary

International BIM standardization

- A complex process involving many organizations.
- Liaisons with a plethora of different institutions ensure the completeness and inclusiveness of the process and the smooth acceptance of adopted standards



International BIM standardization

CEN TC442 BIM: Standardization in the field of structured semantic life-cycle information for the built environment.

CEN TC287 GIS: Standardization in the field of **digital geographic information** for Europe.

ISO/TC211 GIS: Standardization in the field of digital geographic information.

ISO/TC59/SC13 BIM: Organization of **information about construction works**.

ISO/TC184/SC4 STEP: Standards that describe and manage **industrial product data** throughout the life of the product.

Open Geospatial Consortium: International not for profit organization committed to making quality **open standards for the global geospatial community**.

buildingSMART: International organization which aims **to improve the exchange of information between software applications used in the construction industry** /has developed and maintains Industry Foundation Classes (**IFCs**) as a neutral and open specification for BIM data model/.

EU BIM Task Group: It's aim is to bring together national efforts into **a common and aligned European approach** to develop a world-class digital construction sector.

Liaisons are not only established between the relevant ISO and CEN technical committees but also with geospatial and industrial entities as well as with buildingSMART. There are many more liaisons but only those among the most important are presented here.

As geographic information system (GIS) is a key element in any infrastructure project there is the need to **integrate BIM and GIS**. Both technologies use standard and open data formats, but they are different and presently there is no direct translation.

CEN TC442 Building Information Modelling (BIM)

ISO/TC 59/SC 13 "Organization of information about construction works", International Organization for Standardization (ISO)

CEN/TC 442 "Building Information Modelling", European Committee for Standardization (CEN)

Standardization in the field of **structured semantic life-cycle information** for the built environment.

CEN/TC 442 in charge of the standardization work regarding all information in the built environment.

The committee will develop a structured set of standards, specifications and reports which specify methodologies to define, describe, exchange, monitor, record and securely handle asset data, semantics and processes with links to geospatial and other external data.

General framework for the management of digital data - quality data exchange between all participants in the value chain - a common technical language for all European countries

The **overall benefits** of the work of CEN/TC 442 are **through BIM** to support the visions for **sustainable growth** based on **better resource efficiency through data sharing** in the construction industry in Europe.

With the introduction of common standards and operating methods using BIM:

- **Reduce barriers** to operation and **trade** across the European market area and beyond.
- Reduce both **the capital and operating cost** of construction assets, reduce **construction time**.
- Improve the overall **coordination** of the construction works and **certainty** of the construction output including increases in **quality** and reductions in defects.
- Improve **resource efficiency** of construction products and materials, improving both operating and embodied **carbon performance**.
- Support improvements in **team working and collaboration**.



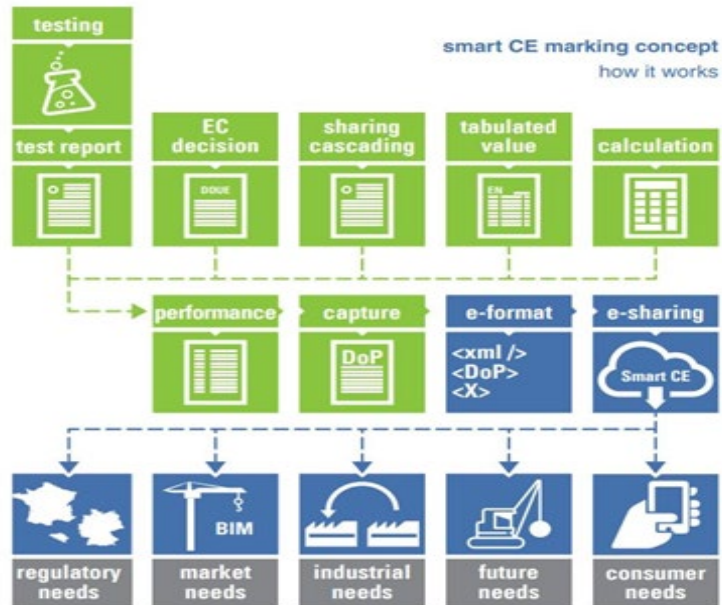
Building Information Modelling (BIM)

CEN/TC 442



Smart CE Marking and BIM Standardisation

CEN Workshop Agreement - CWA 17316:2018 - Smart CE marking for construction products



- Reference document - a basis for the **implementation** of the **smart CE marking concept** into **harmonised standards** under the CPR 305/2011
- **digitalise** construction **products information** provided in the Declaration of Performance **DoP** in **XML** (machine-readable digital) format, the **link included in the CE marking** - use of **"smart" devices**, connected to internet
- CWA on Smart CE marking provides a **link** between the **product** and its **DoP** in a **digital**, machine and human readable format (XML)
- Facilitate the use of current CE label and DoP in a **"smart"** way by creating the **digital connection** between the **construction product** and the **regulatory information related to it**.

Smart CE marking initiative is an **important piece** of the large **digital construction puzzle**.

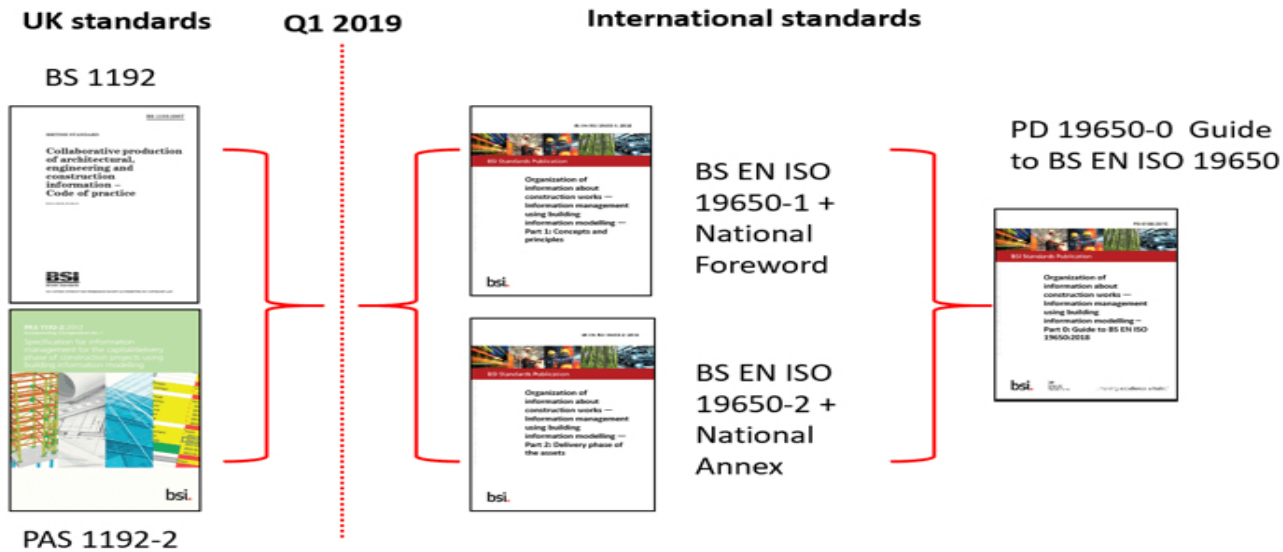
CEN/TC 442 Product Data Templates was used as input for the development of this document.

The CWA will now be considered by CEN Technical Committees (TCs), including TC442,

In alignment with the work done by ISO/TC 59/SC 13 and CEN/TC 442, the Smart CE Marking initiative will enable users to exploit the data provided by manufacturers according to the latest standards for interoperability and data management.

The UK move to international BIM standards

BIM, as practiced in the UK, has become the world's leading approach to digital built environment.



BIM-globalisation push towards international norms and standards.

Internationalisation of processes around information management

Both new international standards provide guidance on the organisation of information about construction works and information management using BIM.

BS EN ISO 19650-1 and 2 are founded on the UK's standards for information management using BIM - BS 1192:2007+A2:2016 and PAS 1192-2:2013

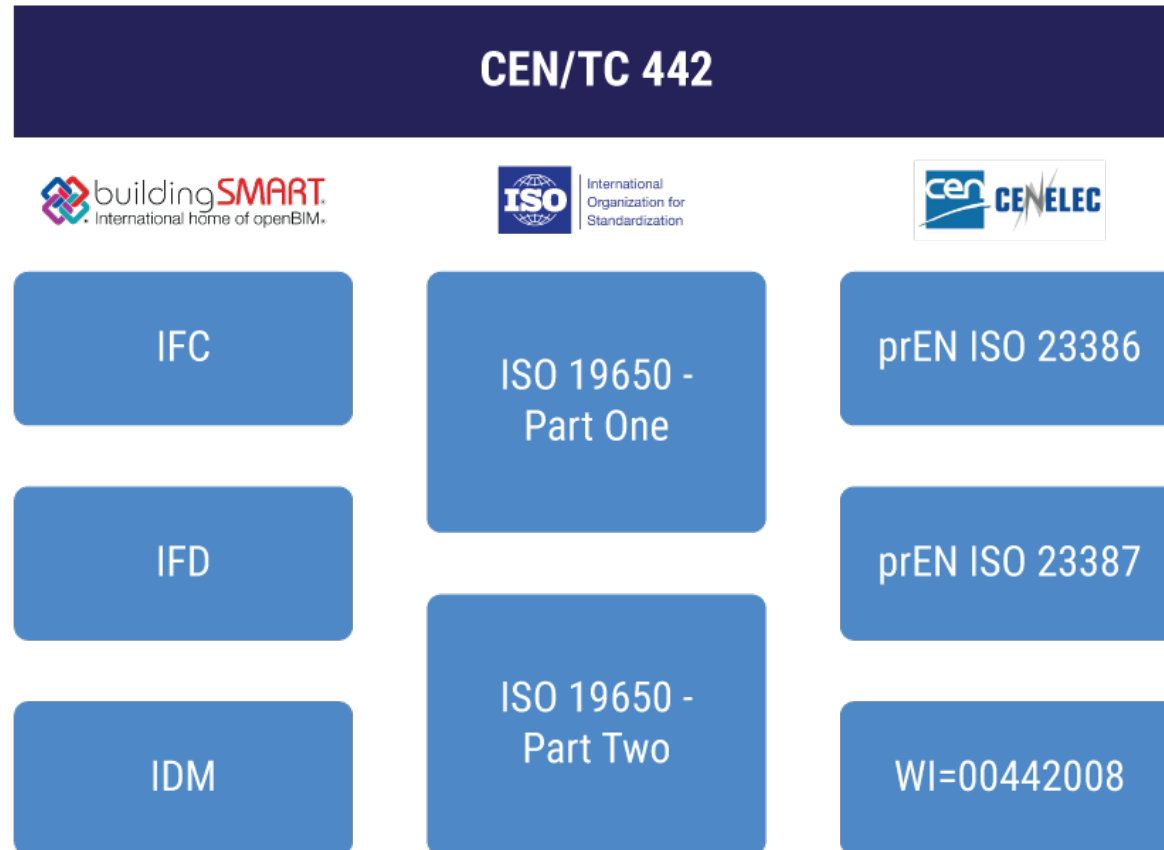
BS EN ISO 19650 is essentially an internationalisation of the UK's BIM Level 2 model and contains all the same principles.

British Standards Institution, Centre for Digital Built Britain and the UK BIM Alliance in addition to various institutional bodies - smooth transition to the ISOs

UK BIM Alliance - Working Towards a Joined-up Approach to BIM

CEN 442 – Bim Standards in the EU

process standards



Driven by the fast shifts towards digitalisation in the construction industry, the EU has set up a programme to develop and define standards for BIM (Building Information Modelling) across all European countries.

The technical committee 442 was established to take charge of the standardisation work regarding all information in the built environment.

The structure of the technical committee 442 is as follows:



Working group	Title
CEN/TC 442/WG 1	Terminology
CEN/TC 442/WG 2	Exchange information
CEN/TC 442/WG 3	Information Delivery Specification
CEN/TC 442/WG 4	Support Data Dictionaries
CEN/TC 442/WG 5	Chairperson's Advisory Group

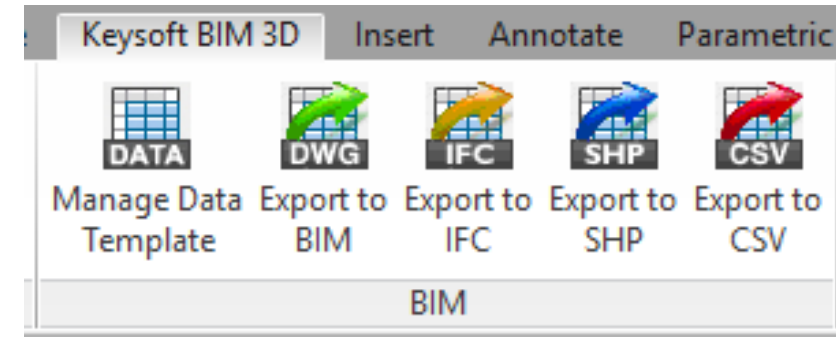
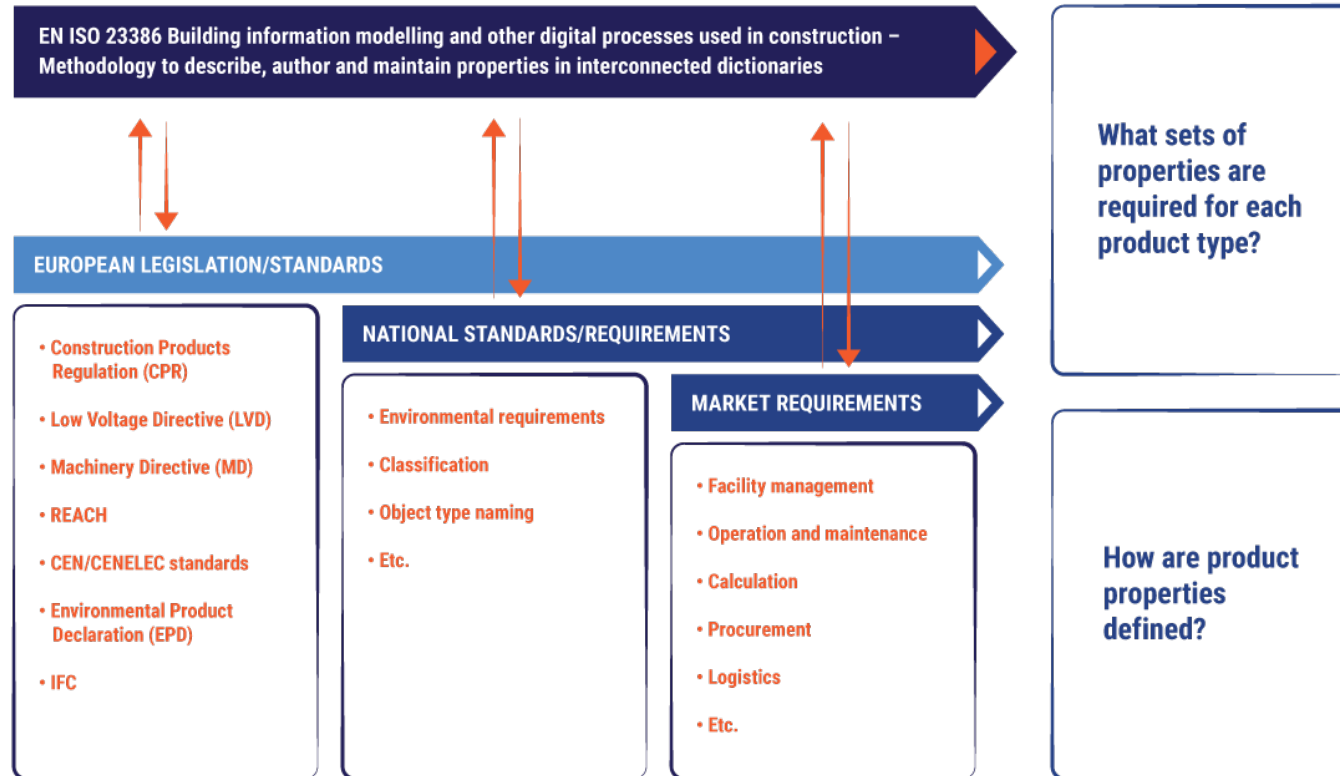
Among the first standards adopted by the European standardisation body CEN under the careful work of the technical committee 442 were the **three openBIM standards**. In October 2016 the **buildingSMART International** standards put forward by CEN/TC 442: IFD (ISO 12006-3:2007), IFC (ISO 16739:2013) and IDM (ISO 29481-2:2012) were officially adopted as EN standards.

The work programme of the CEN 442 committee includes, according to the Vienna agreement and where appropriate, to make current ISO standards for BIM valid as EN standards. That is why, their work is carried out in close cooperation with the ongoing BIM standardisation by ISO committees.

The recently published **ISO 19650 Organization of information about construction works – Information management using building information modelling parts 1 and 2** were also adopted as European standards earlier this year.

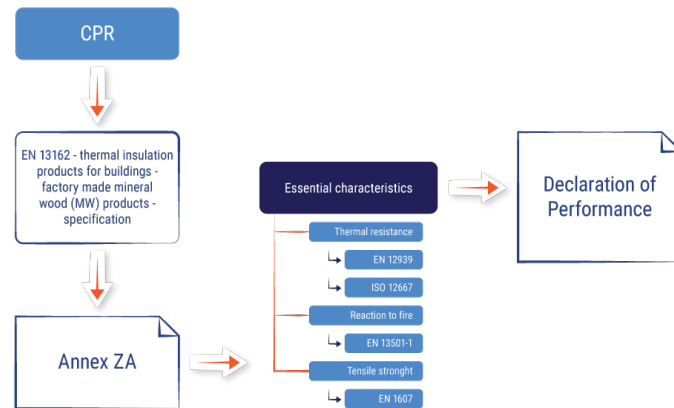
Collaboratively ISO and CEN have started working on standardising Data Templates. Being represented in CEN 442 work group 4. This standard is now at a drafting stage.

Creating the Data Templates Standard



Important assets that will have a great impact on the future of the Data Template standard are sourced from national BIM efforts.

Where does the content of the Data Template come from? *product standards/regulations*



- The Construction Products Regulation came into effect in 2011, as a major part of the European Union’s policy towards enabling and supporting the free circulation of construction products in the EU’s Single Market. The aim of the CPR is:
- to lay down **harmonised rules** for the marketing of construction products in the EU;
- to provide a **common technical language** to assess the performance of construction products;
- to ensure reliable information is available to professionals, public authorities, and consumers, so they can **compare the performance of products** from different manufacturers in different countries.

**Working Towards a Joined-up Approach to BIM is very important
There is need to be changed behavior and processes, not just technology.
There is a need for greater communication and awareness raising.**

Engineering organizations have a vital role to play for transferring lessons across national and regional boundaries and creating a more balanced understanding of digital transition across the construction sector in Europe



**Joint European approach is needed to
develop a world-class
digital construction sector.**

*Maria Stefanova
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Thank you for your attention