



# Digitalization of the construction industry - European Initiatives and BIM Standardization



## Digitalization of the Construction Industry – European Initiatives and BIM Standardization

***Maria Stefanova***  
***Dimitar Natchev***

*Bulgarian Institute for Standardization*  
*Chamber of Engineers in the Investment Design*  
*Union of Civil Engineers in Bulgaria*  
*European Council of Civil Engineers*



# Digitalization of the construction industry - European Initiatives and BIM Standardization



## Industry 4.0

Digitizing European Industry Initiative  
a key element of the Digital Single Market Strategy

## Construction 4.0

BIM - at the heart of the digital transformation of  
construction sector

European policies and initiatives in support of  
digitalization of the construction sector.

**BIM standardization**

Creating a #DigitalSingleMarket

### DIGITISING EU INDUSTRY

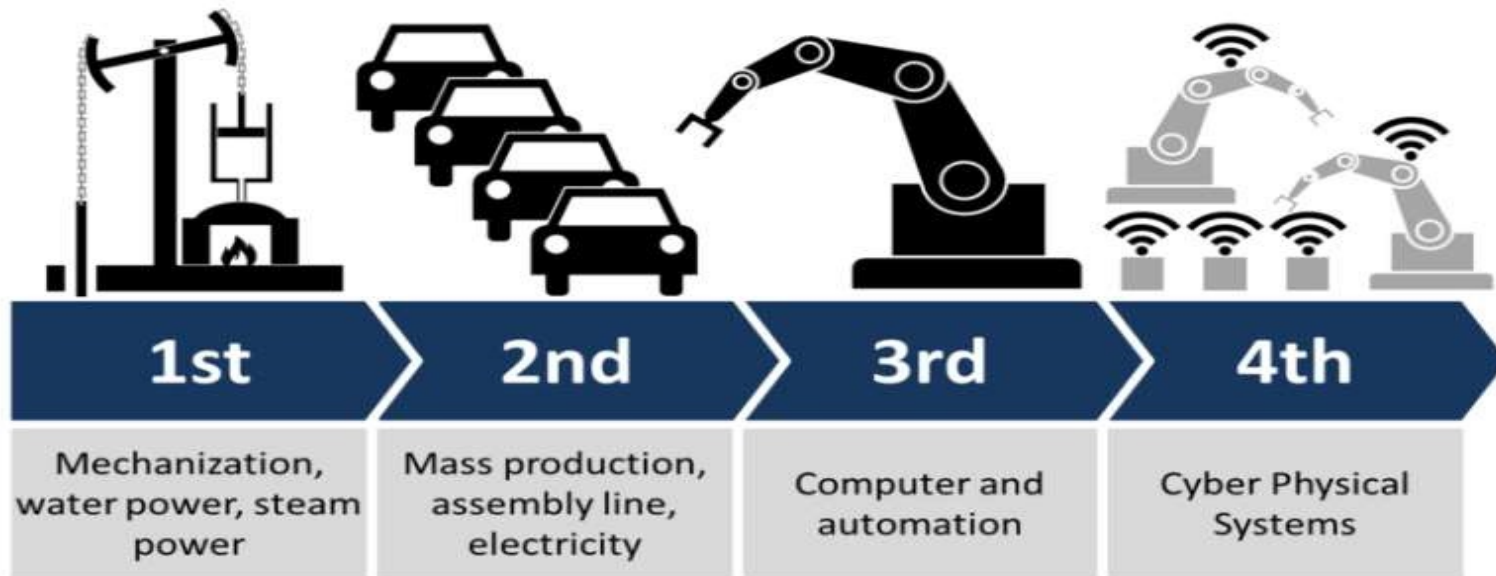
EU CLOUD  
Digital public services  
Standards

European Commission #DigitiseEU



# Digitalization of the construction industry - European Initiatives and BIM Standardization

„**Industry 4.0** " - Fourth Industrial Revolution – the digitization of industry in general



**4th Industrial Revolution** links intelligent factories with every part of the production chain, next generation automation that has started to occur since about 2010.

**Cyber-physical production systems (CPPS)**





# Digitalization of the construction industry - European Initiatives and BIM Standardization

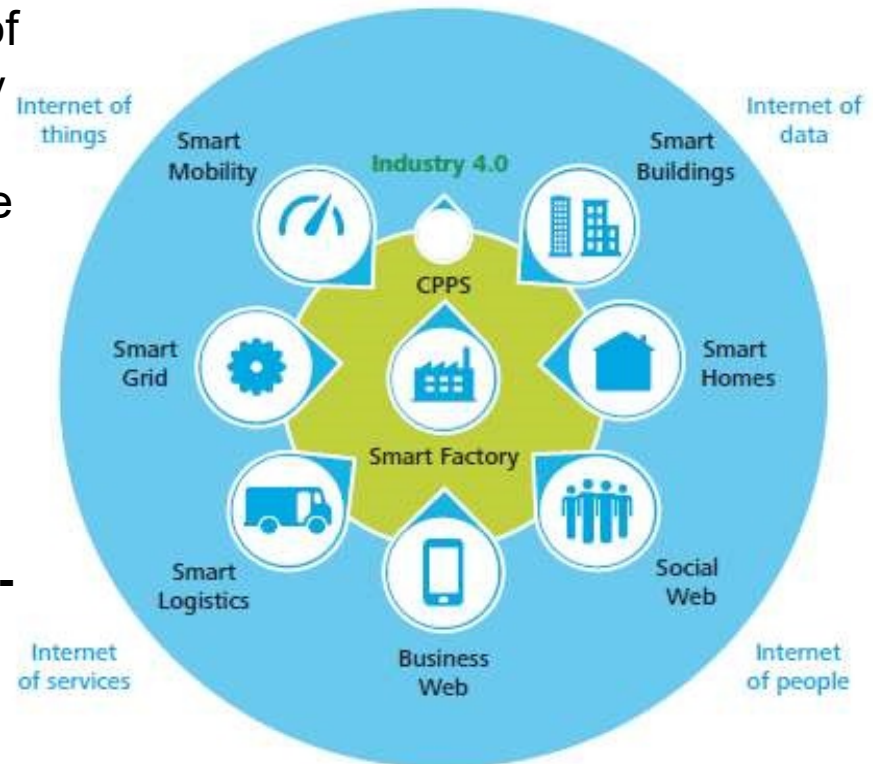
## What is Industry 4.0?

*„Industry 4.0“ was initially developed by the German government (2012) to create a coherent policy framework to maintain Germany’s global industrial competitiveness.*

**Industry 4.0** - describes the organization of production processes based on technology and devices **autonomously communicating with each other** along the value chain in **virtual computer models**

**Industry 4.0** - series of **disruptive innovations** in production and **leaps** in industrial **processes** resulting in **significantly higher productivity**.

Based on technological concepts of **Cyber-physical production systems (CPPS)**, **Internet of things**, **Internet of data** and **Internet of services**, Industry 4.0 helps to realize the vision of **the Smart Factory**.





## Main features of Industry 4.0:

**Interoperability:** cyber-physical systems allow humans and smart factories to connect and communicate with each other;

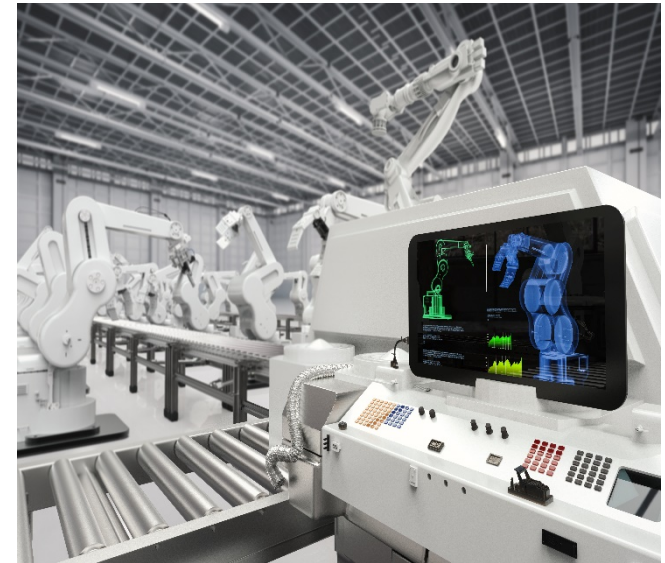
**Virtualization:** a virtual copy of the Smart

**Decentralization:** ability of cyber-physical systems to make decisions of their own;

**Real-Time Capability:** the capability to collect and analyze data and provide the derived insights immediately;

**Service Orientation;**

**Modularity:** flexible adaptation of smart factories to changing requirements.





## Digitalization of the construction industry - European Initiatives and BIM Standardization

### Challenging preconditions for successful implementation of Industry 4.0 :

- **standardization** of systems, platforms, protocols;
- changes in work organization reflecting **new business models**;
- **digital security/cybersecurity** and protection of know-how;
- availability of appropriately **skilled workers; research and investment**;
- a common **EU legal framework** to support the dissemination of Industry 4.0 in the Internal Market.

The implementation horizon is to have pilots running in 2016 and full implementation as of about 2025.

- Front runners: Germany, Sweden, Austria, Ireland, Finland
- Potentialists: include Belgium, Denmark, the Netherlands, the UK and France
- The Traditionalists: mainly East European-the Czech Republic, Slovakia, Slovenia, Hungary and Lithuania
- The Hesitators are a mixture of southern and eastern European countries (Italy, Spain, Estonia, Portugal, Poland, Croatia and Bulgaria)

*Bulgaria - Regional leader - ICT sector with the highest growth in recent years, one of the first places on the number of certified IT specialists, No. 1 in the world in number of women employed in the new technologies.*



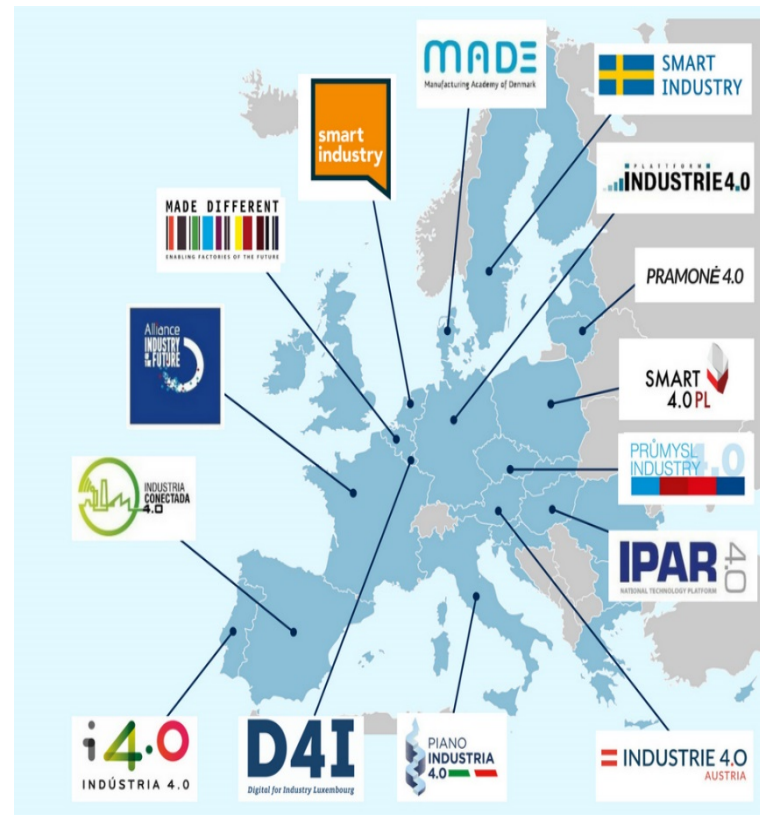


# Digitalization of the construction industry - European Initiatives and BIM Standardization

## Policies about Digitizing European Industry

### A Digital Single Market Strategy for Europe, 2015

### Coordination of European, national & regional initiatives-Digitizing European Industry strategy (DEI)



**COM(2016) 180** Digitizing European Industry-Reaping the full benefits of a Digital Single Market (DEI) April, 2016  
**The Initiative is a key element of the Digital Single Market strategy.**

**The purpose** - to reinforce the EU's competitiveness in digital technologies and to ensure that **every business in Europe - whichever the sector, wherever the location, whatever the size** - can draw the full benefits from digital innovations.

The initiative introduces a set of **measures that build on and complement the various national initiatives** on digitizing industry as well as measures to increase investment through strategic partnerships and **networks.**



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## Digitizing European Industry Initiative (DEI) - five main pillars:



- **The European Platform of national initiatives** is the core part of the overall **coordination framework** of DEI
- **Digital innovations for all: Digital Innovation Hubs (DIHs)** - research and technology center or an innovation-oriented university department, where SMEs and mid-caps **test the latest digital technologies** and get **training, financing advice**, market intelligence and **networking** to improve their business.  
**Strengthening leadership through partnerships and industrial platforms** - Supporting **Public-Private Partnerships** (Digital PPPs),  
**Mobilising €3 billion EU investment** (2018 – 2020) for Public-Private Partnerships that support: • 5G, the IoT, High Performance Computing, robotics and data technologies.
- **A regulatory framework fit for the digital age**- regulations in **key fields for industry** such as **cybersecurity and free flow of data**

- **Preparing Europeans for the digital future** – . **Upskilling** the workforce and piloting EU- wide initiatives to show how **education systems** could respond to the digital needs of Europeans.





# Digitalization of the construction industry - European Initiatives and BIM Standardization

## Innovation Radar Initiative



### #InnovationRadar Declaration 21 Signatory Countries

17 Countries – Austria, Belgium, Bulgaria, Czech Republic, Finland, Germany, Hungary, Ireland, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia and Norway – signed in April 2018.

Since then four more countries have signed: Croatia, Greece, Romania and Spain

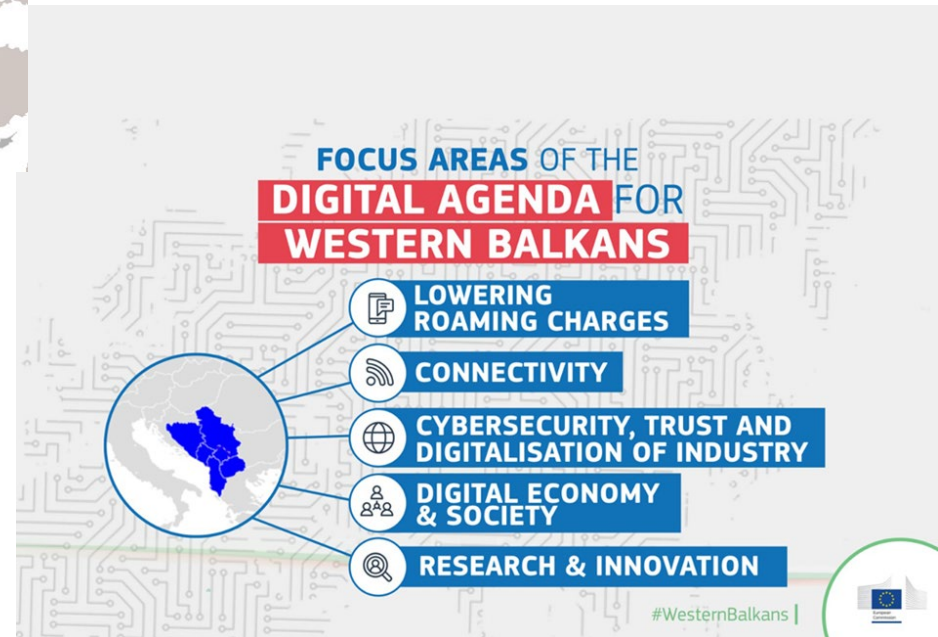


## Innovation Radar data-driven platform

- Easy **access to innovations** supported by EU funding - research and innovation projects funded Horizon 2020 programme
- Greece has become the twenty-first country to sign the Innovation Radar declaration, 17 October 2018 in Athens

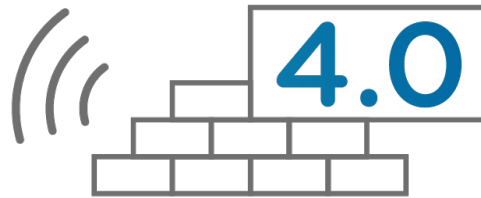
## Digital Agenda for the Western Balkans

- Joint effort of the six Western Balkans partners and the European Commission
- Support the transition of the region into a digital economy and bring the benefits of the digital transformation, 27 June, Sofia





# construction



***“Construction 4.0” - “branch” of Industry 4.0 - digitalization of the construction industry.***

***BIM – centerpiece of Construction 4.0 but it is not the only element. What else is “Construction 4.0”?***

***European policies and initiatives in support of digitalization of the construction sector.***



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## I. The construction sector is very important to the EU economy:

- 9% of EU's GDP and 42 million jobs (29% of total employment across EU) and 3.1 million enterprises, 95% SMEs).
- Energy efficiency in buildings - a key for the transformation of the EU's energy system.
- important impact on **energy, climate change and the environment** - It uses about 50% of the raw materials taken from the earth and generates about 40% of all greenhouse gas emissions in Europe.
- Impact on **users' convenience and welfare** (accessibility, safety & security, indoor air quality, etc.).
- **even more important** - various **global megatrends**: the **population** of the world's urban areas is **increasing**, **migration** into urban areas, **climate change** and a **new global push for infrastructure**

*Construction is at the very heart of smart and sustainable growth and jobs and achieving the SDGs.*

## II. Similar to other sectors, **construction is already experiencing its own "digital Revolution"**.

But, like other **traditional sectors**, the construction **sector is lagging behind** significantly in terms of its **digitization**.

**Reasons:** - **traditional technological processes** - the sector's difficulty in adopting and adapting to the new technologies (risks and costs); **fragmentation of the sector, information problems in communication** along the asset creation chain, the challenges related to **standardization**.





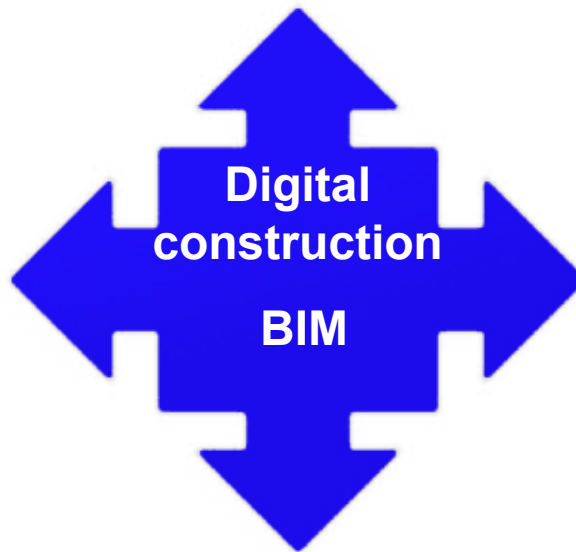
# Digitalization of the construction industry - European Initiatives and BIM Standardization

## What is digitalisation?

BIM - centerpiece of Digital transformation of Construction sector

Improve planning, construction and renovation processes  
Robots, 3D printers, 3D scanners, satellite imaging, drones

Sustainable  
energy and  
environment  
Smart materials,  
Circular economy



Improve  
operation and  
maintenance of  
buildings  
Sensors, IoT

Smart analysis  
Big data



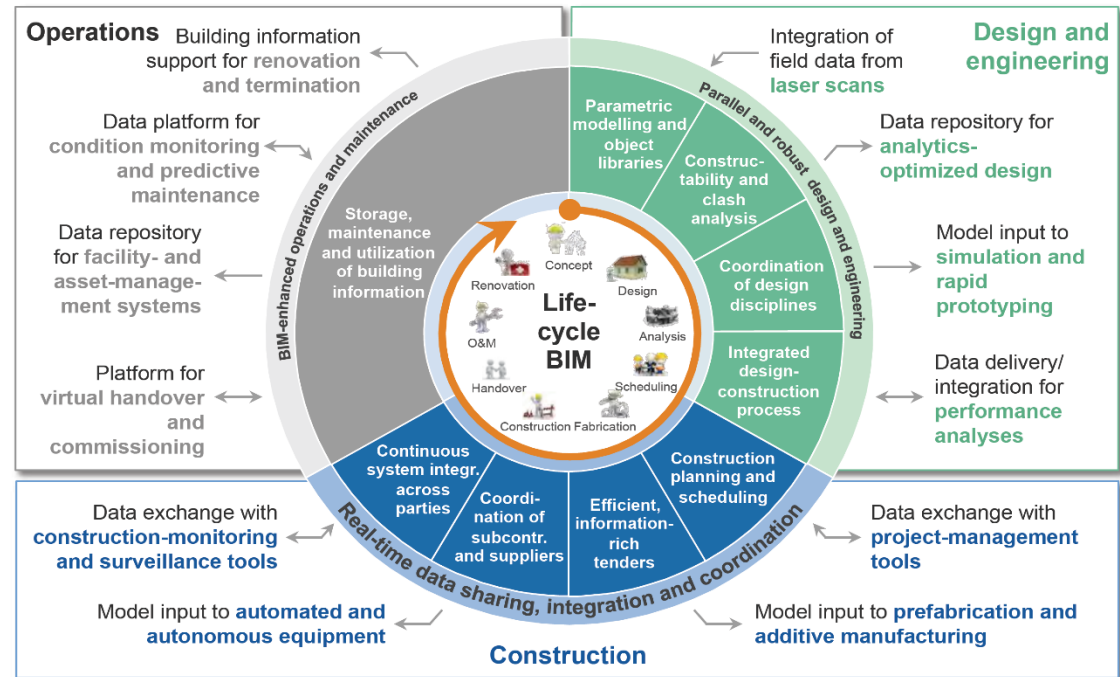
# Digitalization of the construction industry - European Initiatives and BIM Standardization

## Applications of BIM along the engineering and construction value chain

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

**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



(Source: „Shaping the Future of Construction“)

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

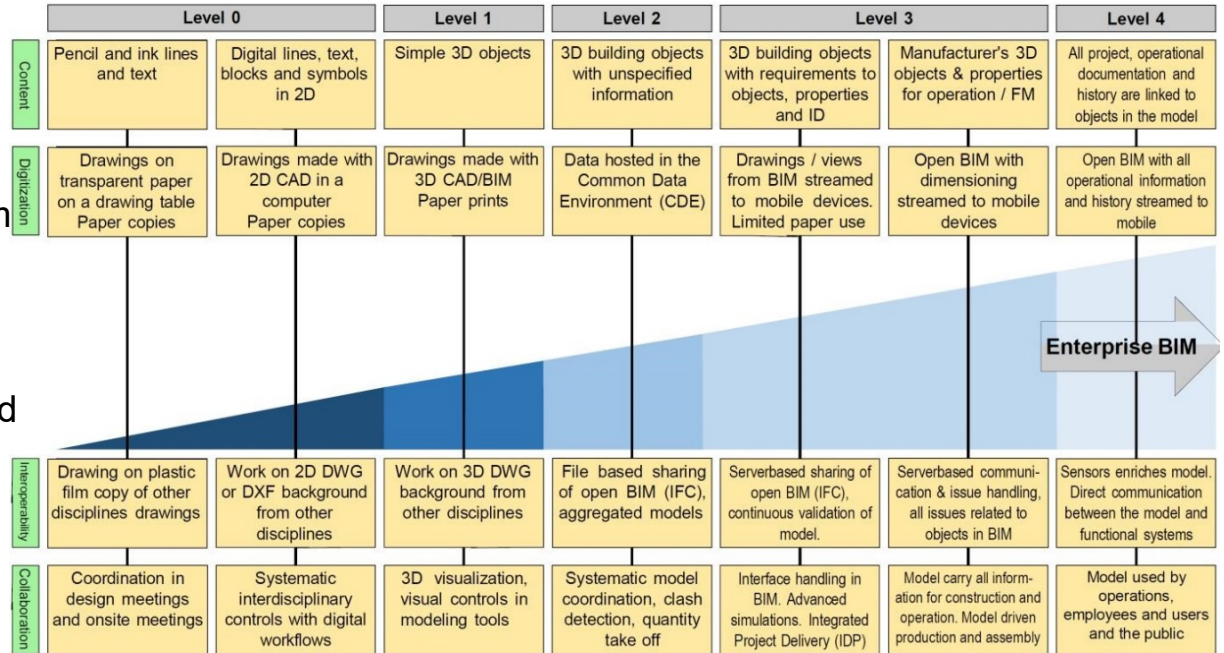


# Digitalization of the construction industry - European Initiatives and BIM Standardization

## 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



Levels 0 to 2 are clearly described.

**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/
- 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 management.





## Digitalization of the construction industry - European Initiatives and BIM Standardization

### Positive effects of BIM:

#### **BIM-enabled projects - more productive, predictable and profitable**

- A US study discloses that **lack of access to information in Facility Management and Operation** of A 20.000 m<sup>2</sup> 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**

- BIM contributes to meeting the objectives of **sustainable construction** and improving the energy efficiency of buildings.



## Digitalization of the construction industry - European Initiatives and BIM Standardization

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.



# Digitalization of the construction industry - European Initiatives and BIM Standardization

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

### What else is “Construction 4.0”?

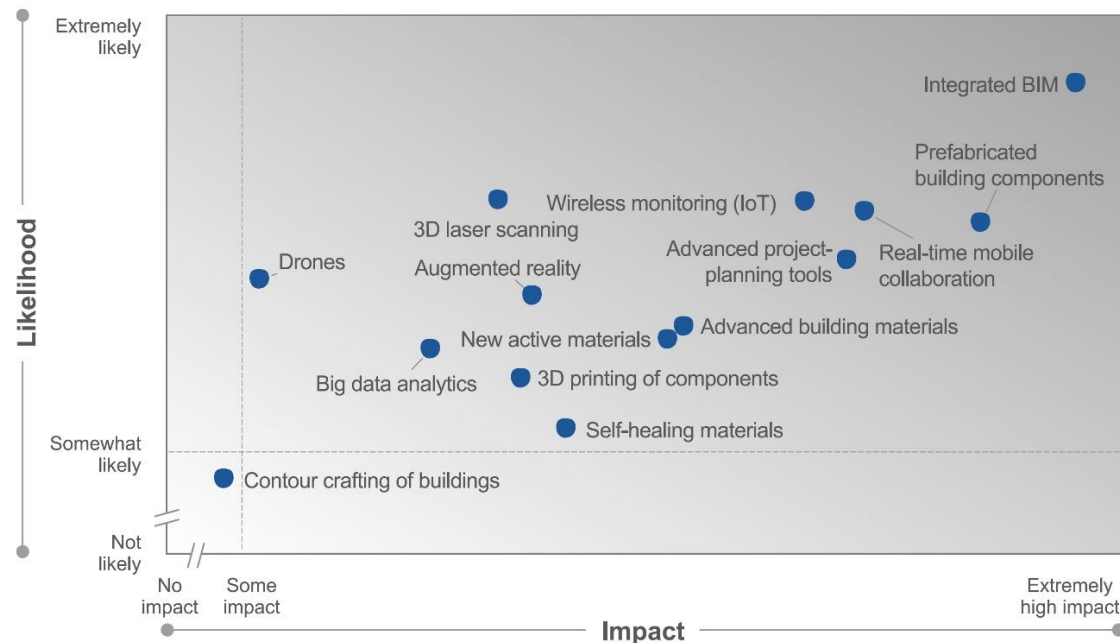
The digitalization of the construction industry has many aspects and includes many advanced processes and technologies.

In the report of the World Economic Forum “**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.

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

Impact-likelihood matrix of new technologies



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





# Digitalization of the construction industry - European Initiatives and BIM Standardization

## New technologies and digitalization set the future skills demand

COM(2016) 381 **New Skills Agenda for Europe**, 10 June 2016

**Blueprint for Sectoral Cooperation on Skills** Initiative for selected sectors

### **Blueprint for Sectoral Cooperation on Skills – Construction Sector**

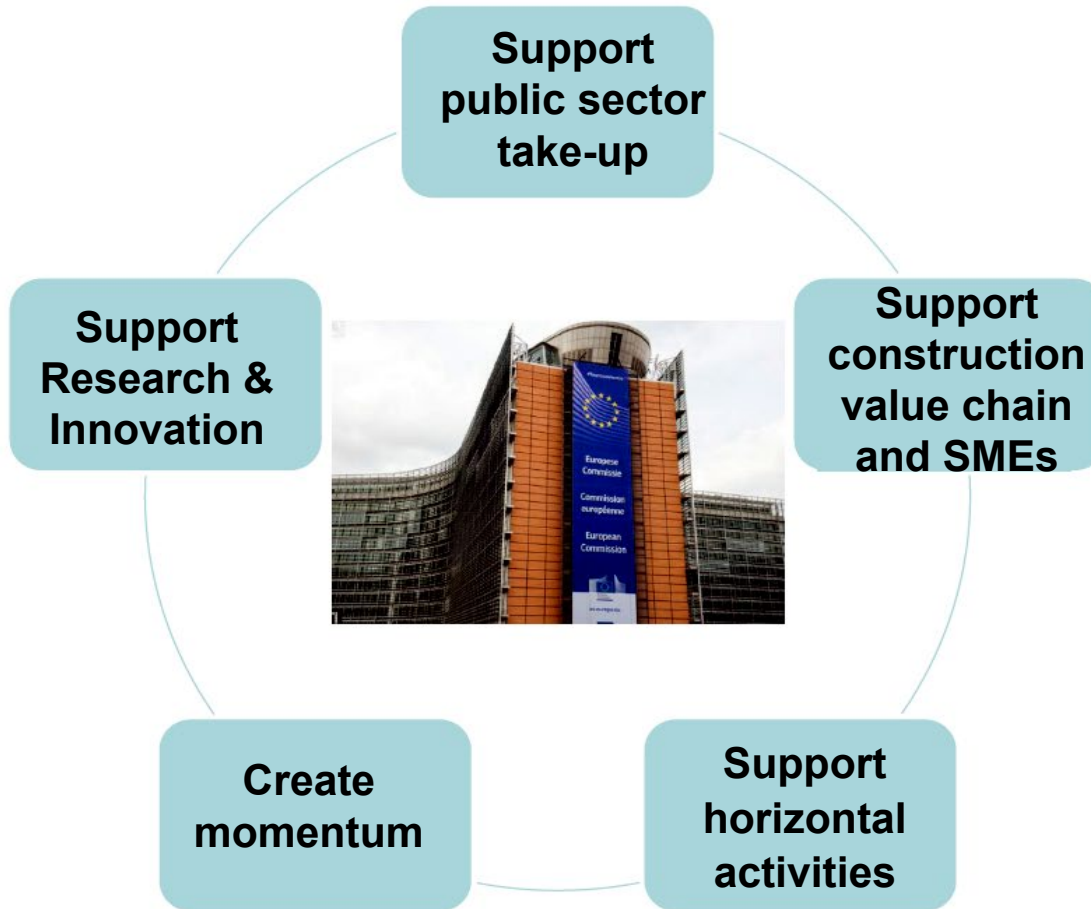
- ✓ **supported area:** energy efficiency; digitalization; circular economy including bio-based and secondary recycled products
- ✓ **project supported by EUR 4 million (80%), 4-years long;** Erasmus+ funding  
*FUNDACION LABORAL DE LA CONSTRUCCION /ES/ € 3.999.665*
- ✓ **sectoral strategy for skills intelligence** and labor-market relevant skills development

**European Construction Sector Observatory**, launched in 2015 • individual country profiles, fact sheets on individual national and/or regional policy measures and analytical reports - **Improving the construction sector human capital basis**

**15%** of the EU investment in **Digital Innovation Hubs** is dedicated to **skills development and training.** 18



# Digitalization of the construction industry - European Initiatives and BIM Standardization



**Commission initiatives & support**



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## Commission initiatives in support of digital evolution of Construction



### Support public sector

- EU BIM Task Group, 2016
- 21 EU countries: Handbook for the Introduction of Building Information Modelling by the European Public Sector, 2017, (in 18 languages). *Encourage alignment on the understanding of BIM*

### Support construction value chain and SMEs

- Study: support digitalisation of construction and its SMEs: Ongoing call
- Smart CE marking for construction products, CEN Workshop Agreement, 2018 CEN, CPE

### Create momentum /Monitoring the progress of digitization of construction/

- High Level Tripartite Strategic Forum
- Thematic group1: Digitalization of the construction sector
- LinkedIn Group: Construction 4.0 Europe

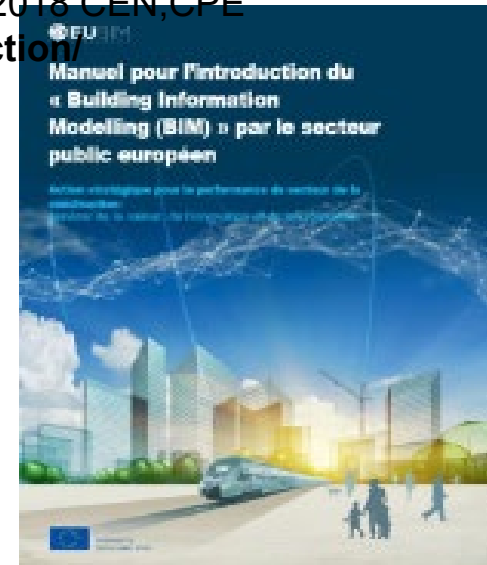
### Support horizontal activities

- BIM standardization: CEN/CENELEC TC 442
- *Digital industrial platform for Construction sector: ongoing Call*
- BIM Dictionary

### Support Research & Innovation

- Smart buildings, “big data”, IoT, AI, robots in construction
- technology-oriented PPPs, research “smart” materials, BIM in improving the energy efficiency of buildings, prefabricated building components...

**Investment for digital education, learning and developing digital competences and skills;**



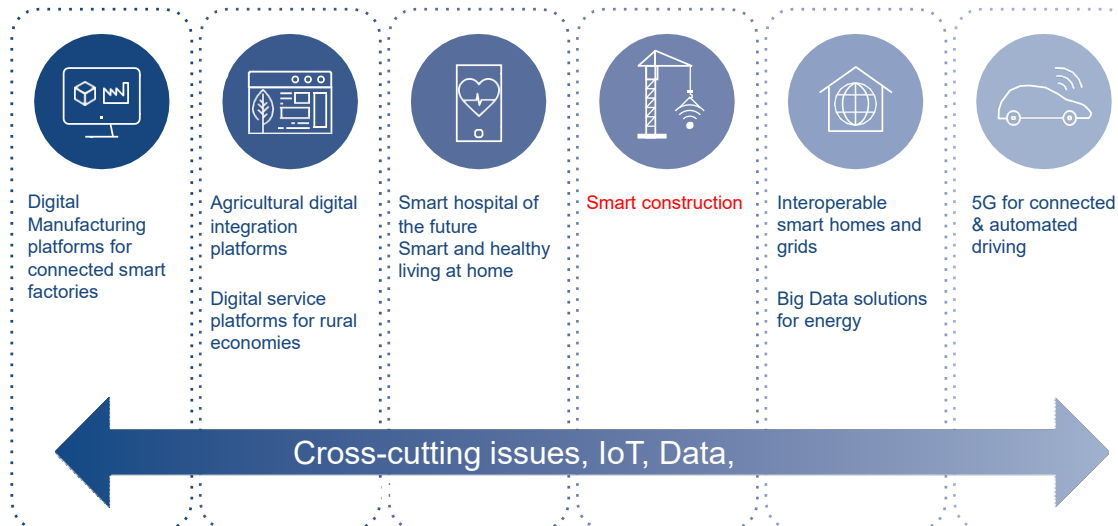




# Digitalization of the construction industry - European Initiatives and BIM Standardization

## European digital industrial platform in support of the digital evolution of the Construction industry

**European digital platforms** are operating systems that **integrate** different **technologies and various applications and services** in specific industrial sectors. The European **digital platform for construction** is intended to serve the purpose of facing the main challenges related to the **uptake of digital tools in support of the digital evolution of the sector**.





# Digitalization of the construction industry - European Initiatives and BIM Standardization

## European digital industrial platform for the Construction sector

### **HORIZON 2020 / WP 2018-2020**

Call: Digitizing and transforming European industry and services: digital innovation hubs and platforms

### **DT-ICT-13-2019: Digital Platforms/Pilots Horizontal Activities**

#### Preparation of digital industrial platform for construction sector

- Define reference architecture for digital industrial platform for construction sector
- Take into account Level(s), the recently developed framework to assess environmental performance of buildings, including circular economy aspects \*
- Take stock of ongoing initiatives, promote mutual learning and coordination, and identify knowledge and intervention gaps
- Building Information Modelling and building passports are part of scope

1 M€ • Deadline: 14th November 2018 • At least one CSA will be supported



## 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*









# Digitalization of the construction industry - European Initiatives and BIM Standardization

## 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.**



## Digitalization of the construction industry - European Initiatives and BIM Standardization

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.





## 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 **buildingSMART** which has developed and maintains **Industry Foundation Classes (IFCs)** as a **neutral and open specification for BIM data model**.

### **Data dictionaries**

International Framework for Dictionaries Libraries

### **Processes**

Data delivery manuals

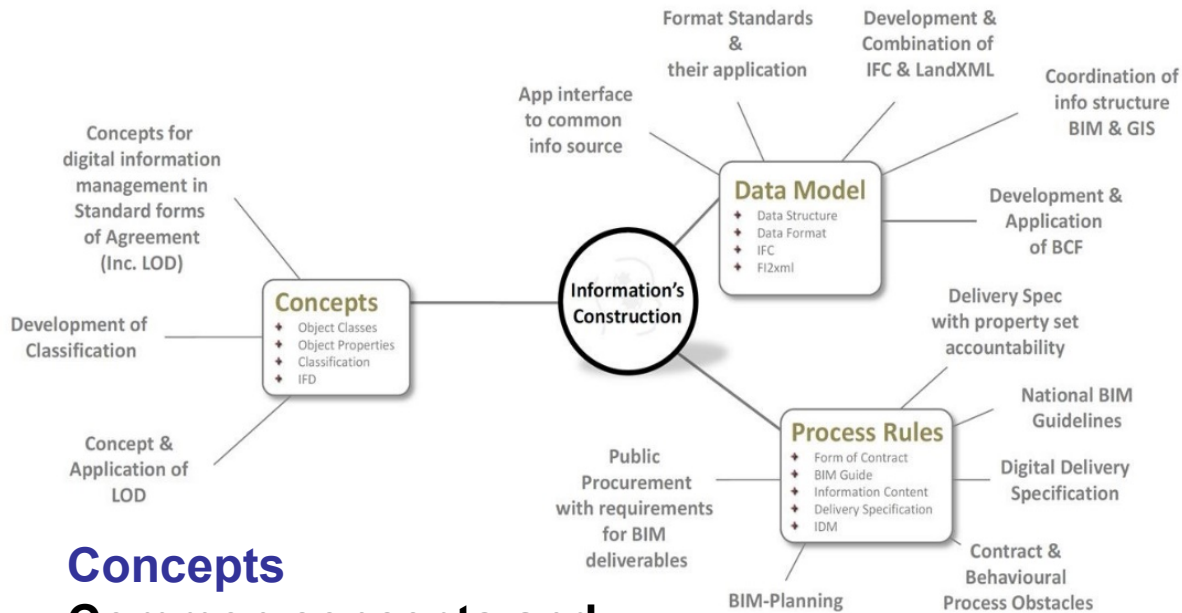
It is important to categorize and understand the strategic difference between **branch or sector standards** and **organisation standards** (which may be even company secrets) in a BIM context.



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## BIM standardization platform

Around 3 divisions are arranged BIM standardization themes:



## Data Model

**Neutral formats for data models.**

## Concepts

**Common concepts and classification of concepts are necessary**

## Processes

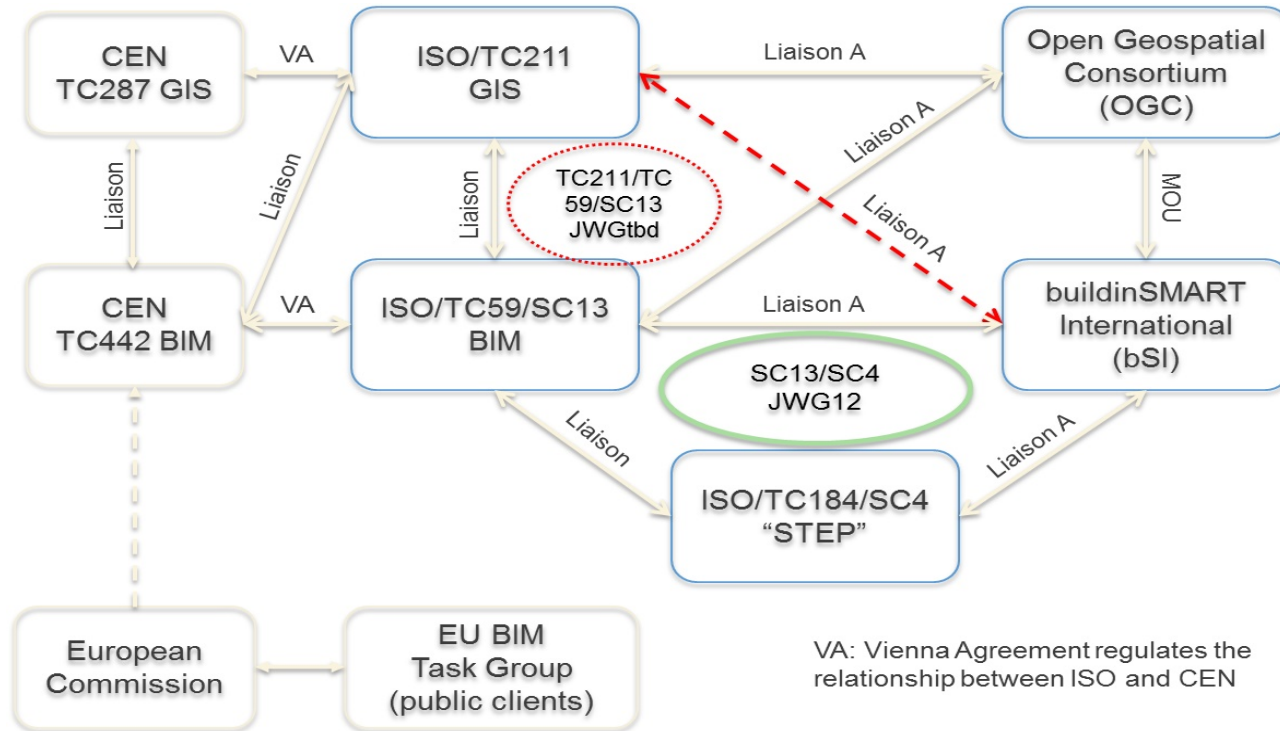
**a uniform processes for information delivery and a common working methodology is necessary**



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## 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**







# Digitalization of the construction industry - European Initiatives and BIM Standardization

## 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**

**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.

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.

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.

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.

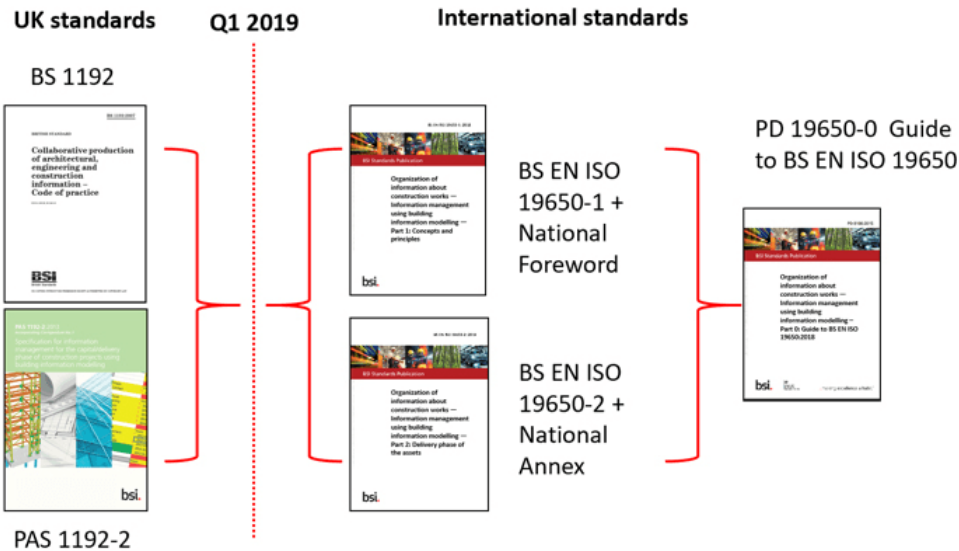
**With the introduction of common standards and operating methods using BIM:**

- **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**.



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## The UK move to international BIM standards



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





## **BDS - Bulgarian Institute for Standardization** **BDS TC 101, „Sustainability of Construction Works “**

Participation in the development of European standards and their implementation as National in the field of **CEN/TC 350 “Sustainability of construction works”** and **CEN/TC 442 “Building Information Modelling (BIM)** (since 2017);

Introduced as National Standards: БДС EN ISO 12006-3, БДС EN ISO 29481-2, БДС EN ISO 29481-2 и БДС EN ISO 16739, from the scope of CEN/TC 442 „Building Information Modelling (BIM) ”.

These are the first approved International standards as European ones, they have been introduced by BDS in 2017. They are essential for the development of the future BIM standardization work.



## Introduced as national standards:

**БДC EN ISO 16739:2017**

**EN ISO 16739:2016**

**Industry Foundation Classes** (IFC) for data sharing in the construction and facility management industries; 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  
(ISO 16739:2013)

**БДC EN ISO 12006-3:2017 Data Dictionaries**

**EN ISO 12006-3:2016**

Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information (ISO 12006-3:2007)

**БДC EN ISO 29481-2:2017**

**EN ISO 29481-2:2016**

Building information models - Information delivery manual - Part 2: Interaction framework (ISO 29481-2:2012)

**БДC EN ISO 29481-1:2018**

**EN ISO 29481-1:2017**

Building information models - Information delivery manual - Part 1: Methodology and format (ISO 29481-1:2016)



# Digitalization of the construction industry - European Initiatives and BIM Standardization

## [prБДC EN ISO 19650-1:2018](#)

### **prEN ISO 19650-1**

Organization of information about construction works – Information management using building information modelling – Part 1: **Concepts and principles**(ISO/DIS 19650-1:2018)

## [prБДC EN ISO 19650-2:2018](#)

### **prEN ISO 19650-2**

Organization of information about construction works – Information management using building information modelling – Part 2: **Delivery phase of assets**(ISO/DIS 19650-1:2018)

## [prБДC EN ISO 19650-5:2017](#)

### **prEN ISO 19650-5**

Organization of information about construction works – Information management using building information modelling – Part 5: Specification for security-minded building information modelling, digital built environments and smart asset management.

## [prБДC EN ISO 21597-1:2017](#)

### **prEN ISO 21597-1**

Information container for data drop - Exchange specification - Part 1: Container (ISO/DIS 21597-1:2018)

## [prБДC EN ISO 21597-2:2017](#)

### **prEN ISO 21597-2**

Information container for data drop - Exchange specification - Part 2: Dynamic semantics (ISO/DIS 21597-2:2018)

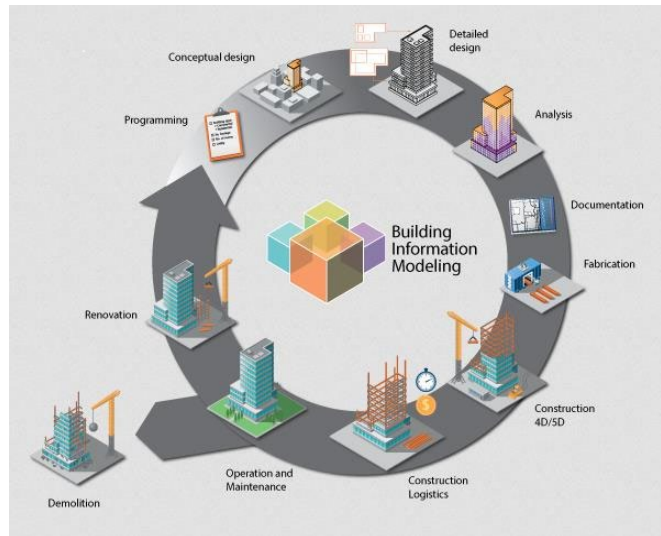




# Digitalization of the construction industry - European Initiatives and BIM Standardization

*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**

**Thank you for your attention**