BIM in a European Context

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* Reduced presentation

AIM

Do we have/need a European BIM Culture?

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cen

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common language shared goals

UK BIM ALLIANCE

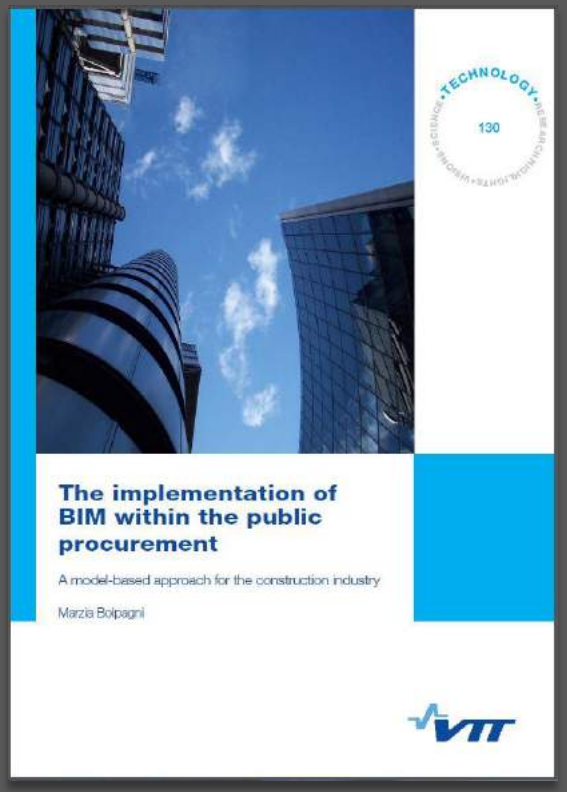
AGCMA
Building Excellence

MASTER THESIS

Public Procurement Methods

Building Information Modelling

Implementation of BIM in Tendering



http://www.vtt.fi/inf/pdf/technology/2013/T130.pdf

Angelo L. C. Ciribini

Markku Kiviniemi

Kristiina Sulankivi

1 | SHORT BIO


ENTE ITALIANO
DI NORMAZIONE
cen


BIM
INITIATIVE
BIM DICTIONARY
common language shared goals


UK BIM
ALLIANCE


AGCMA
Building Excellence

International Organization for Standardization

European Committee for Standardisation

Italian Standardisation Institute

Danish Standards Foundation

BIMe INITIATIVE

I. Introduction

BIM Excellence (BIMe) is a unique *research-based* approach to digital innovation in the construction industry. It provides an integrated methodology and a modular language for performance assessment, learning and process optimisation. The **BIMe Initiative** is *not-for-profit effort* guided by a set of **Principles**[1] undertaken by volunteer researchers from both industry and academia. The BIMe Initiative is supported by in-kind contributions, commercial services, and institutional/corporate sponsorship.

http://bimexcellence.org/

BIMe Initiative

General Principles

The BIMe Initiative is built upon a set of key principles:

1. **Commitment to Openness**

   BIMe Initiative guides and tools are released through open channels under a Creative Commons license allowing free use by individuals and organisations on their own projects (service providers require a license)

2. **Grown around a Knowledge Structure**

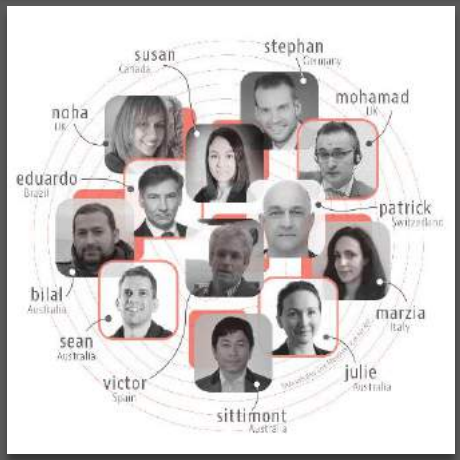
   The BIMe Initiative is built upon a clear structure for harvesting and organising knowledge. This structure allows the modular development of highly-interconnected guides and tools ...more info

3. **Peer-sourced and Peer-tested**

   The BIMe Initiative connects international subject matter experts – from academia and industry – through a high-intensity R&D network. Through this network, the best solutions are identified, incubated, tested and released

4. **Open Innovation across boundaries**

   The BIMe Initiative provides a *knowledge tool-kit* for anyone to use, customise, translate and continuously improve. Through Open Innovation, new solutions are collaboratively developed and shared across disciplines, industries and markets



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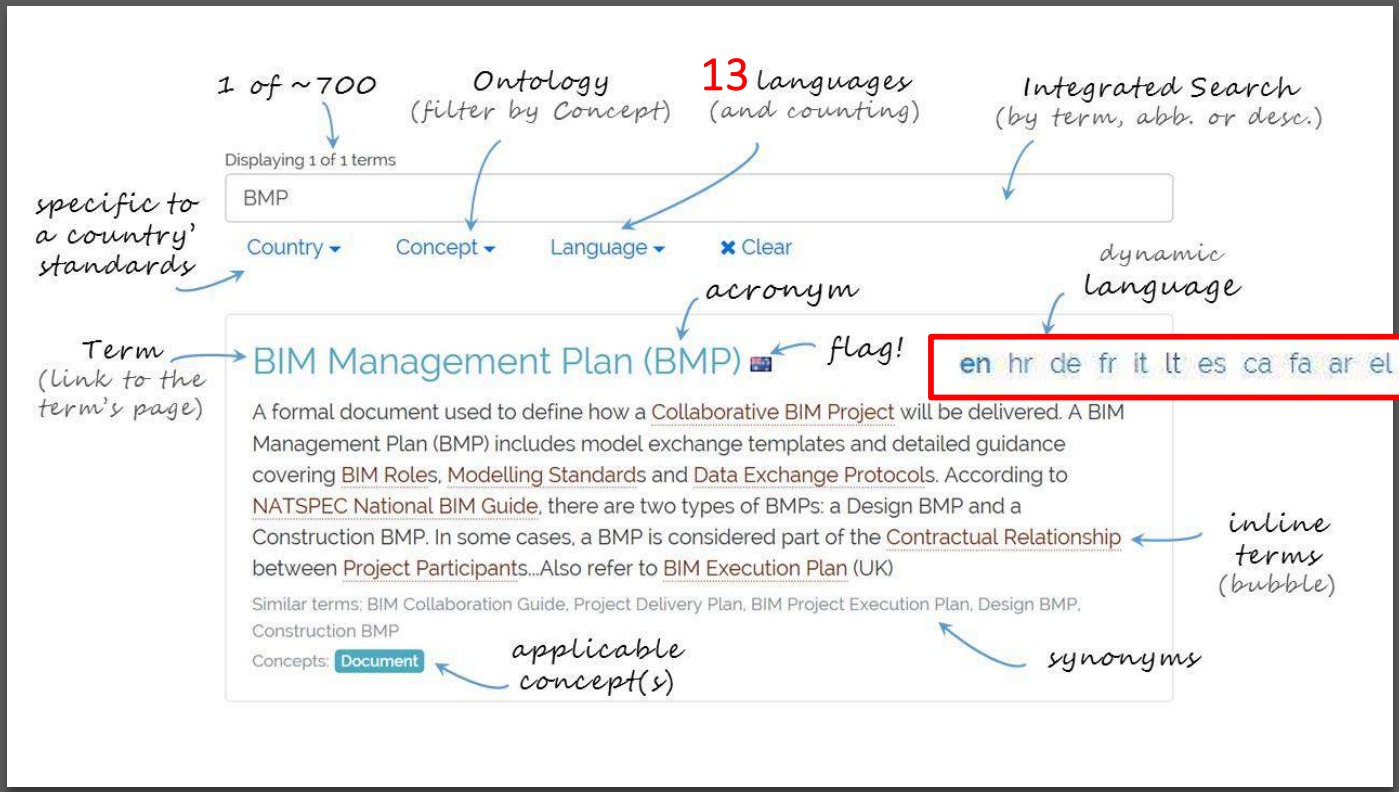
BIMDICTIONARY

common language shared goals

http://bimdictionary.com/



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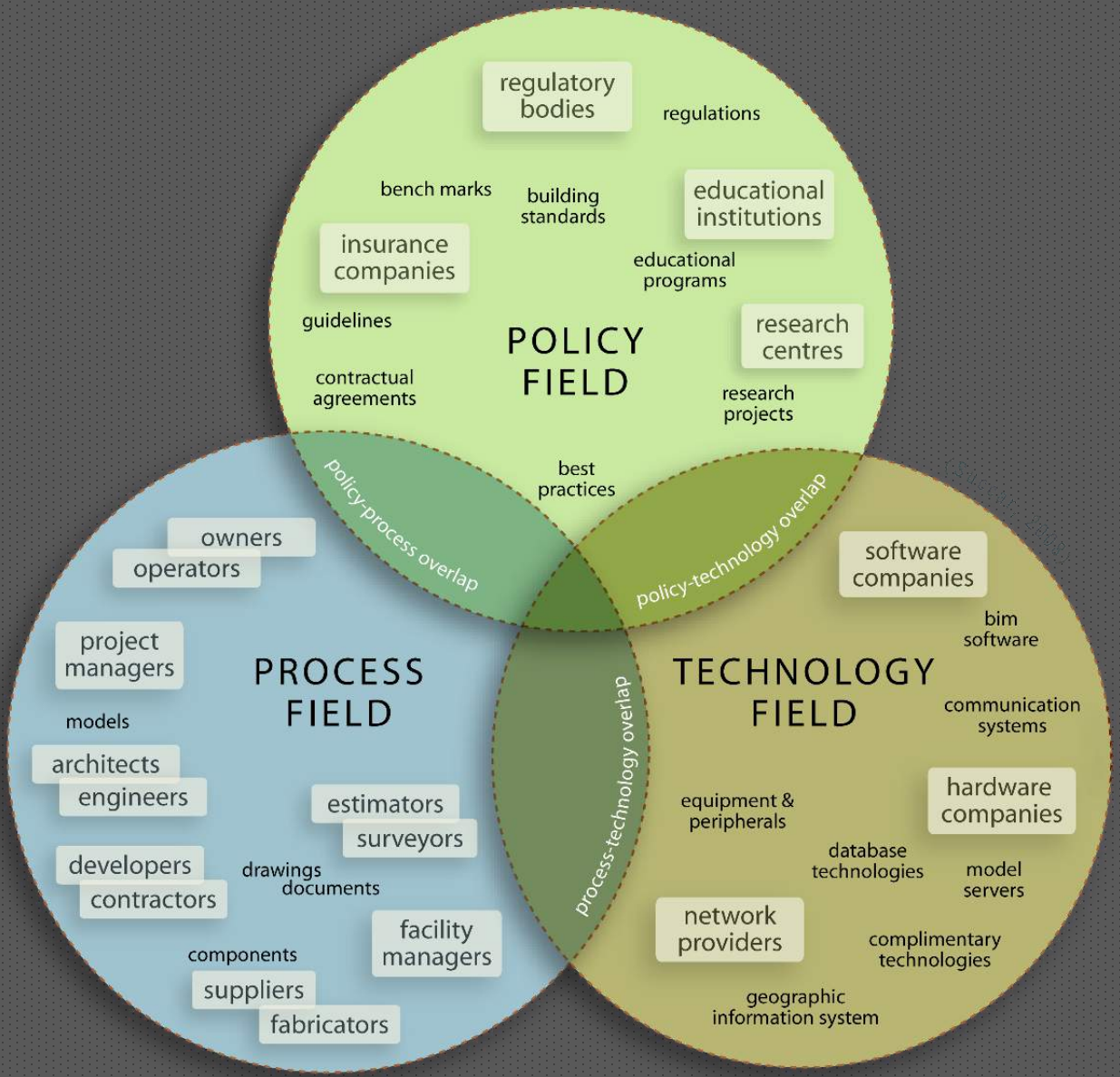
BIM and CULTURE

Influence of BIM on our work CULTURE



Source: BIM Framework

‘The nature of the (modern) construction industry is fragmented and adversarial’

COMMON DATA ENVIRONMENT

or

COMMON FILE ENVIRONMENT?

COLLABORATION

WHO
WHAT
WHY
WHEN
HOW

COMMUNICATION

SPECIFY our NEEDS

UNDERSTAND others' NEEDS

BIM INITIATIVE 301in BIM Maturity Matrix

http://www.bimframework.info/bim-maturity-matrix.html

BIM CAPABILITY SETS

TECHNOLOGY based on Capability Set v5

Key Maturity Areas at Granularity level 1	a INITIAL (score 0)	b DEFINED (max score 10)	c MANAGED (max score 20)	d INTEGRATED (max score 30)	e OPTIMIZED (max score 40)
Software: applications, deliverables and data	Usage of software applications is unmonitored and unregulated. 3D Models are relied on to mainly generate accurate 2D representations/deliverables. Data usage, storage and exchanges are not defined within organisations or project teams. Exchanges suffer from a severe lack of interoperability.	Software usage/introduction is unified within an organisation or project teams (multiple organisations). 3D Models are relied upon to generate 2D as well as 3D deliverables. Data usage, storage and exchange are well defined within organisations and project teams. Interoperable data exchanges are defined and prioritised.	Software selection and usage is controlled and managed according to defined deliverables. Models are the basis for 3D views, 2D representations, quantification, specification and analytical studies. Data usage, storage and exchanges are monitored and controlled. Data flow is documented and well-managed. Interoperable data exchanges are mandated and closely monitored.	Software selection and deployment follows strategic objectives, not just operational requirements. Modelling deliverables are well synchronised across projects and tightly integrated with business processes. Interoperable data usage, storage and exchange are regulated and performed as part of an overall organisational or project-team strategy.	Selection/use of software tools is continuously revisited to enhance productivity and align with strategic objectives. Modelling deliverables are cyclically being revised/ optimised to benefit from new software functionalities and available extensions. All matters related to interoperable data usage storage and exchange are documented, controlled, reflected upon and proactively enhanced.
	score	score	score	score	score
Hardware: equipment, deliverables and location/mobility	BIM equipment is inadequate; specifications are too low or inconsistent across the organisation. Equipment replacement or upgrades are treated as cost items and performed only when unavoidable.	Equipment specifications – suitable for the delivery of BIM products and services - are defined, budgeted-for and standardised across the organisation. Hardware replacements and upgrades are well-defined cost items.	A strategy is in place to transparently document, manage and maintain BIM equipment. Investment in hardware is well-targeted to enhance staff mobility (where needed) and extend BIM productivity.	Equipment deployments are treated as BIM enablers. Investment in equipment is tightly integrated with financial plans, business strategies and performance objectives.	Existing equipment and innovative solutions are continuously tested, upgraded and deployed. BIM hardware become part of organisation's or project team's competitive advantage.
	score	score	score	score	score
Network: solutions, deliverables and security/ access control	Network solutions are non-existent or ad-hoc. Individuals, organisations (single location/ dispersed) and project teams use whatever tools found to communicate and share data. Stakeholders lack the network infrastructure necessary to harvest, store and share knowledge.	Network solutions for sharing information and controlling access are identified within and between organisations. At project level, stakeholders identify their requirements for sharing data/information. Dispersed organisations and project teams are connected through relatively low-bandwidth connections.	Network solutions for harvesting, storing and sharing knowledge within and between organisations are well managed through common platforms (ex: intranets or extranets). Content and asset management tools are deployed to regulate structured and unstructured data shared across high-bandwidth connections.	Network solutions enable multiple facets of the BIM process to be integrated through seamless real-time sharing of data, information and knowledge. Solutions include project-specific networks/portals which enable data-intensive interchange (interoperable exchange) between stakeholders.	Network solutions are continuously assessed and replaced by the latest tested innovations. Networks facilitate knowledge acquisition, storing and sharing between all stakeholders. Optimisation of integrated data, process and communication channels is relentless.
	score	score	score	score	score

BIM e INITIATIVE
301in BIM Maturity Matrix

http://www.bimframework.info/bim-maturity-matrix.html

PROCESS based on Capability Set v5.0

Key Maturity Areas at Granularity level 1	a INITIAL (score 0)	b DEFINED (max score 10)	c MANAGED (max score 20)	d INTEGRATED (max score 30)	e OPTIMIZED (max score 40)
Resources: Physical and knowledge infrastructure	The work environment is either not recognised as a factor in staff satisfaction or may not be conducive to productivity. Knowledge is not recognised as an asset; BIM knowledge is typically shared informally between staff (through tips, techniques and lessons learned). score	The work environment and workplace tools are identified as factors affecting motivation and productivity. Similarly, knowledge is recognised as an asset; shared knowledge is harvested, documented and thus transferred from tacit to explicit. score	The work environment is controlled, modified and its criteria managed to enhance staff motivation, satisfaction and productivity. Also, documented knowledge is adequately stored. score	Environmental factors are integrated into performance strategies. Knowledge is integrated into organisational systems; stored knowledge is made accessible and easily retrievable. score	Physical workplace factors are reviewed constantly to insure staff satisfaction and an environment conducive to productivity. Similarly, knowledge structures responsible for acquisition, representation and dissemination are systemically reviewed and enhanced. score
Activities & Workflows: Knowledge, skills, experience, roles and relevant dynamics	There is an absence of defined processes; roles are ambiguous and team structures/dynamics are inconsistent. Performance is unpredictable and productivity depends on individual heroics. A mentality of 'working 'around the system' flourishes. score	BIM roles are informally defined and teams are formed accordingly. Each BIM project is planned independently. BIM competency is identified and targeted; BIM heroism fades as competency increases but productivity is still unpredictable. score	Cooperation within organisations increases as tools for cross-project communication are made available. Flow of information steadies; BIM roles are visible and targets are achieved more consistently. score	BIM roles and competency targets are imbedded within the organisation. Traditional teams are replaced by BIM-oriented ones as new processes become part of organisation/ project team's culture. Productivity is now consistent and predictable. score	BIM competency targets are continuously upgraded to match technological advances and align with organisational objectives. Human resource practices are proactively reviewed to insure intellectual capital matches process needs. score
Products & Services: Specification, differentiation and R&D	3D models deliverables (a BIM product) suffer from too high, too low or inconsistent levels of detail. score	A "statement defining the object breakdown of the 3D model" is available. score	Adoption of product/ service specifications similar to Model Progression Specifications, BIPS 'information levels' or similar. score	Products and services are specified and differentiated according to Model Progression Specifications or similar. score	BIM products and services are constantly evaluated; feedback loops promote continuous improvement. score
Leadership & Management: Organisational, strategic, managerial and communicative attributes; innovation and renewal	Senior leaders/ managers have varied visions about BIM. BIM implementation (according to BIM Stage requirements) is conducted without a guiding strategy. At this maturity level, BIM is treated as a technology stream; innovation is not recognised as an independent value and business opportunities arising from BIM are not acknowledged. score	Senior leaders/managers adopt a common vision about BIM. BIM implementation strategy lacks actionable details. BIM is treated as a process-changing, technology stream. Product and process innovations are recognised; business opportunities arising from BIM are identified but not exploited. score	The vision to implement BIM is communicated and understood by most staff. BIM implementation strategy is coupled with detailed action plans and a monitoring regime. BIM is acknowledged as a series of technology, process and policy changes which need to be managed without hampering innovation. Business opportunities arising from BIM are acknowledged and used in marketing efforts. score	The vision is shared by staff across the organisation and/or project partners. BIM implementation, its requirements and process/ product innovation are integrated into organisational, strategic, managerial and communicative channels. Business opportunities arising from BIM are part of team, organisation or project-team's competitive advantage and are used to attract and keep clients. score	Stakeholders have internalised the BIM vision and are actively achieving it. BIM implementation strategy and its effects on organisational models are continuously revisited and realigned with other strategies. If alterations are needed, they are proactively implemented. Innovative product/ process solutions and business opportunities are sought-after and followed through relentlessly. score

BIM e INITIATIVE
301in BIM Maturity Matrix

http://www.bimframework.info/bim-maturity-matrix.html

	Key Maturity Areas at Granularity level 1	a INITIAL (score 0)	b DEFINED (max score 10)	c MANAGED (max score 20)	d INTEGRATED (max score 30)	e OPTIMIZED (max score 40)
POLICY based on Capability Set v5.0	**Preparatory:** research, educational / training programmes and deliverables	Very little or no training available to BIM staff. Educational/ training mediums are not suitable to achieve the results sought. score	Training requirements are defined and are typically provided only when needed. Training mediums are varied allowing flexibility in content delivery. score	Training requirements are managed to adhere to pre-set broad competency and performance objectives. Training mediums are tailored to suit trainees and to reach learning objectives in a cost-effective manner. score	Training is integrated into organisational strategies and performance targets. Training is typically based on staff roles and respective competency objectives. Training mediums are incorporated into knowledge and communication channels. score	Training is continuously evaluated and improved upon. Training availability and delivery methods are tailored to allow multi-modal continuous learning. score
	Regulatory: codes, regulations, standards, classifications, guidelines and benchmarks	There are no BIM guidelines, documentation protocols or modelling standards. There is an absence of documentation and modelling standards. There is informal or no quality control plans; neither for 3D models nor for documentation. There are no performance benchmarks for processes, products or services. score	Basic BIM guidelines are available (ex: training manual and BIM delivery standards). Modelling and documentation standards are well defined according to market-accepted standards. Quality targets and performance benchmarks are set. score	Detailed BIM guidelines are available (training, standards, workflow, exceptions...). Modelling, representation, quantification, specifications and analytical properties of 3D models are managed through detailed modelling standards and quality plans. Performance against benchmarks is tightly monitored and controlled. score	BIM guidelines are integrated into overall policies and business strategies. BIM standards and performance benchmarks are incorporated into quality management and performance improvement systems. score	BIM guidelines are continuously and proactively refined to reflect lessons learned and industry best practices. Quality improvement and adherence to regulations and codes are continuously aligned and refined. Benchmarks are repetitively revisited to insure highest possible quality in processes, products and services. score
	Contractual: responsibilities, rewards and risk allocations	Dependence on pre-BIM contractual arrangements. Risks related to model-based collaboration are not recognised or are ignored. score	BIM requirements are recognised. "Statements defining the responsibility of each stakeholder regarding information management" are now available. score	There is a mechanism to manage shared BIM intellectual property, confidentiality, liability and a system for BIM conflict resolution. score	Organisation are aligned through trust and mutual dependency beyond contractual barriers. score	Responsibilities, risks and rewards are continuously revisited and realigned to effort. Contractual models are modified to achieve best practices and highest value for all stakeholders. score
STAGE 1	**Object-based Modelling**: single-disciplinary use within a Project Lifecycle phase	Implementation of an object-based tool. No process or policy changes identified to accompany this implementation score	Pilot projects are concluded. BIM process and policy requirements are identified. Implementation strategy and detailed plans are prepared. score	BIM processes and policies are instigated, standardised and controlled. score	BIM technologies, processes and policies are integrated into organisational strategies and aligned with business objectives. score	BIM technologies, processes and policies are continuously revisited to benefit from innovation and achieve higher performance targets. score

BIM e INITIATIVE

301in BIM Maturity Matrix

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	Key Maturity Areas at Granularity level 1	a INITIAL (score 0)	b DEFINED (max score 10)	c MANAGED (max score 20)	d INTEGRATED (max score 30)	e OPTIMIZED (max score 40)
STAGE 2	**Modelling-based Collaboration**: multi-disciplinary, fast-tracked interchange of models	Ad-hoc BIM collaboration; in-house collaboration capabilities incompatible with project partners. Trust and respect between project participants may be lacking.	Single-thread, well-defined yet reactive BIM collaboration. There are identifiable signs of mutual trust and respect among project participants.	Multi-thread proactive collaboration; protocols are well documented and managed. There are mutual trust, respect and sharing of risks and rewards among project participants.	Multi-thread collaboration includes downstream players. This is characterised by the involvement of key participants during projects' early lifecycle phases.	Multi-thread team included all key players in an environment characterised by goodwill, trust and respect.
		score	score	score	score	score
STAGE 3	**Network-based Integration**: concurrent interdisciplinary interchange of nD models across Project Lifecycle Phases	Integrated models are generated by a limited set of project stakeholders - possibly behind corporate firewalls. Integration occurs with little or no pre-defined process guides, standards or interchange protocols. There is no formal resolution of stakeholders' roles and responsibilities.	Integrated models are generated by a large subset of project stakeholders. Integration follows predefined process guides, standards and interchange protocols. Responsibilities are distributed and risks are mitigated through contractual means.	Integrated models (or parts of) are generated and managed by most project stakeholders. Responsibilities are clear within temporary project alliances or longer-term partnerships. Risks and rewards are actively managed and distributed.	Integrated models are generated and managed by all key project stakeholders. Network-based integration is the norm and focus is no longer on *how* to integrate models/ workflows but on proactively detecting and resolving technology, process and policy misalignments.	Integration of models and workflows are continuously revisited and optimised. New efficiencies, deliverables and alignments are actively pursued by a tightly-knit interdisciplinary project team. Integrated models are contributed to by many stakeholders along the construction supply chain.
		score	score	score	score	score
ORG SCALE MICRO	**Organisations**: dynamics and BIM deliverables	BIM leadership is non-existent; implementation depends on technology champions.	BIM leadership is formalised; different roles within the implementation process are defined.	Pre-defined BIM roles complement each other in managing the implementation process.	BIM roles are integrated into organisation's leadership structures.	BIM leadership continuously mutates to allow for new technologies, processes and deliverables.
		score	score	score	score	score
ORG SCALE MESO	**Project Teams** (multiple organisations): inter-organisational dynamics and BIM deliverables	Each project is run independently. There is no agreement between stakeholders to collaborate beyond their current common project.	Stakeholders think beyond a single project. Collaboration protocols between project stakeholders are defined and documented.	Collaboration between multiple organisations over several projects is managed through temporary alliances between stakeholders.	Collaborative projects are undertaken by inter-disciplinary organisations or multidisciplinary project teams; an alliance of many key stakeholders.	Collaborative projects are undertaken by self-optimising interdisciplinary project teams which include most stakeholders.
		score	score	score	score	score
ORG SCALE MACRO	**Markets**: dynamics and BIM deliverables *(only apply this topic if assisted by a trained assessor)*	Very few supplier-generated BIM components (virtual products and materials representing physical ones). Most components are prepared by software developers and end-users.	Supplier-generated BIM components are increasingly available as manufactures/ suppliers identify the business benefits.	BIM Components are available through highly accessible/searchable central repositories. Components are not interactively connected to suppliers' databases.	Access to component repositories are integrated into BIM software. Components are interactively linked to source databases (for price, availability, etc...).	Dynamic, multi-way generation and interchange of BIM components (virtual products and materials) between all project stakeholders through central or meshed repositories.
		score	score	score	score	score

3

BIM IN EUROPE

3 | Main Activities

3.1 EU Directive on Public Procurement

3.2 European Committee for Standardisation CEN/TC 442

3.3 EU BIM Task Group

3.4 European Builders Confederation (EBC)/Small Business Standards (SBS)

3.5 European Construction Industry Federation (FIEC)

- Architects' Council of Europe (ACE)

- European Federation of Engineering Consulting Association (EFCA)

3.1

EU Directive on Public Procurement

EU DIRECTIVE ON PUBLIC PROCUREMENT

*'For public works contracts and design contests, Member States may require the use of specific **electronic tools**, such as of building information electronic modelling **tools** or similar'*

European Parliament, 26 February 2014, art. 22 (4)

3.2

European Committee for Standardisation CEN/TC 442

CEN TC 442 Building Information Modelling

Øivind Rooth

Working Group 1	**Working Group 2**	Working Group 3	Working Group 4
Strategy and Planning	**Exchange Information**	Information Delivery Specification	Support Data Dictionaries

Richard Waterhouse

Thomas Liebich

Peter Kompolschek

Roland Dominici

Thomas Liebich
TC 442 WG2
Convenor

Marzia Bolpagni
TC 442WG2| TG1
Leader

Experts from 11 countries are working at CEN on 'LOD' Standardisation

Italy

Germany

UK

Sweden

Denmark

Belgium

Switzerland

Norway

France

Spain

Luxembourg

The Many Faces of LOD

http://www.bimthinkspace.com/2016/07/the-many-faces-of-lod.html

WHAT IS ‘LOD’?

LOD

Level of Development

Architectural Model LOD 300

Level of Detail

Level of Definition

LOI

Information Level

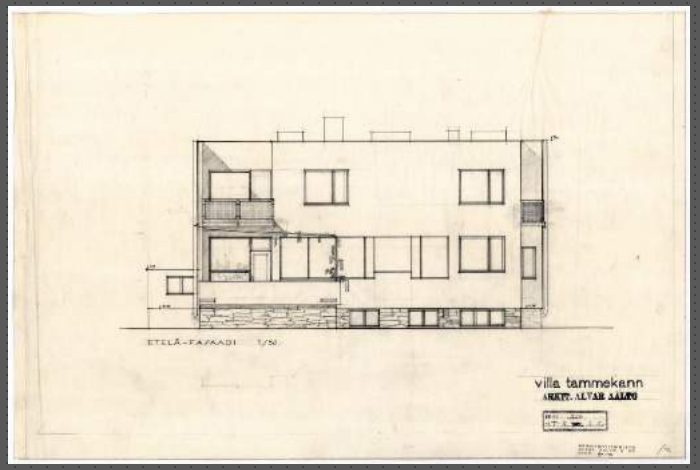
Grade

Level of Information

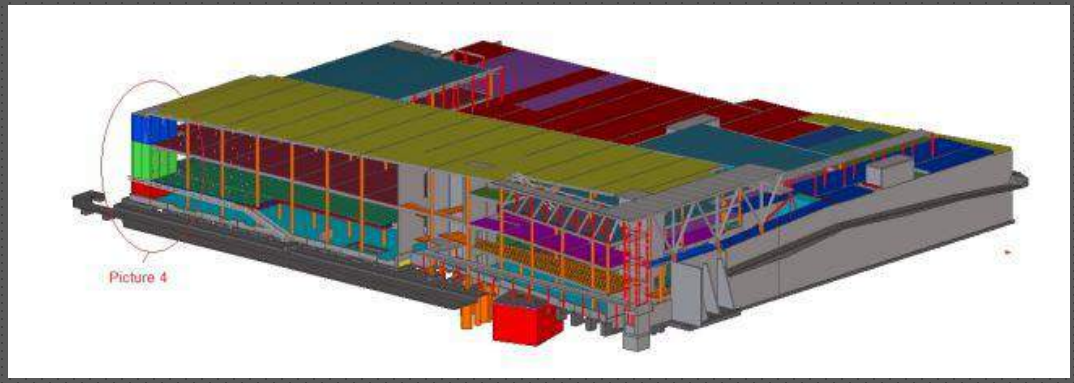
Wall LOD 300

Associated Attribute Information

FROM «SCALE»



TO «LOD»



Sources: ALVAR AALTO & COBIM2012

LEVEL of DETAIL

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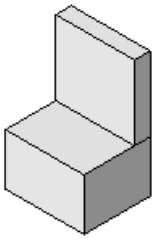
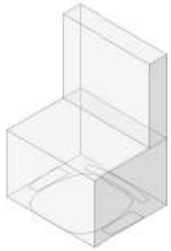
			
Schematic	Concept	Defined	Rendered
DESCRIPTION: Office Chair WIDTH: DEPTH: HEIGHT: MANUFACTURER: MODEL:	DESCRIPTION: Office Chair WIDTH: 700 DEPTH: 450 HEIGHT: 1100 MANUFACTURER: MODEL:	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 700 DEPTH: 450 HEIGHT: 1100 MANUFACTURER: Herman Miller, Inc MODEL: Mirra	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 700 DEPTH: 450 HEIGHT: 1100 MANUFACTURER: Herman Miller, Inc MODEL: Mirra

(based on AEC [UK] BIMprotocol v2.0 - Component Grade)

practicalBIM.net © 2013

LEVEL of DEVELOPMENT

LOD 100	LOD 200	LOD 300	LOD 400	LOD 500
				
Concept (Presentation)	Design Development	Documentation	Construction	Facilities Management
DESCRIPTION: **Office Chair** Arms, Wheels WIDTH: DEPTH: HEIGHT: MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **100**	DESCRIPTION: **Office Chair** Arms, Wheels WIDTH: **700** DEPTH: **450** HEIGHT: **1100** MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **200**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **700** DEPTH: **450** HEIGHT: **1100** MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **300**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **685** DEPTH: **430** HEIGHT: **1085** MANUFACTURER: **Herman Miller, Inc** MODEL: **Mirra** LOD: **400**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **685** DEPTH: **430** HEIGHT: **1085** MANUFACTURER: **Herman Miller, Inc** MODEL: **Mirra** PURCHASE DATE: **01/02/2013**

(Only data in **red** is useable)

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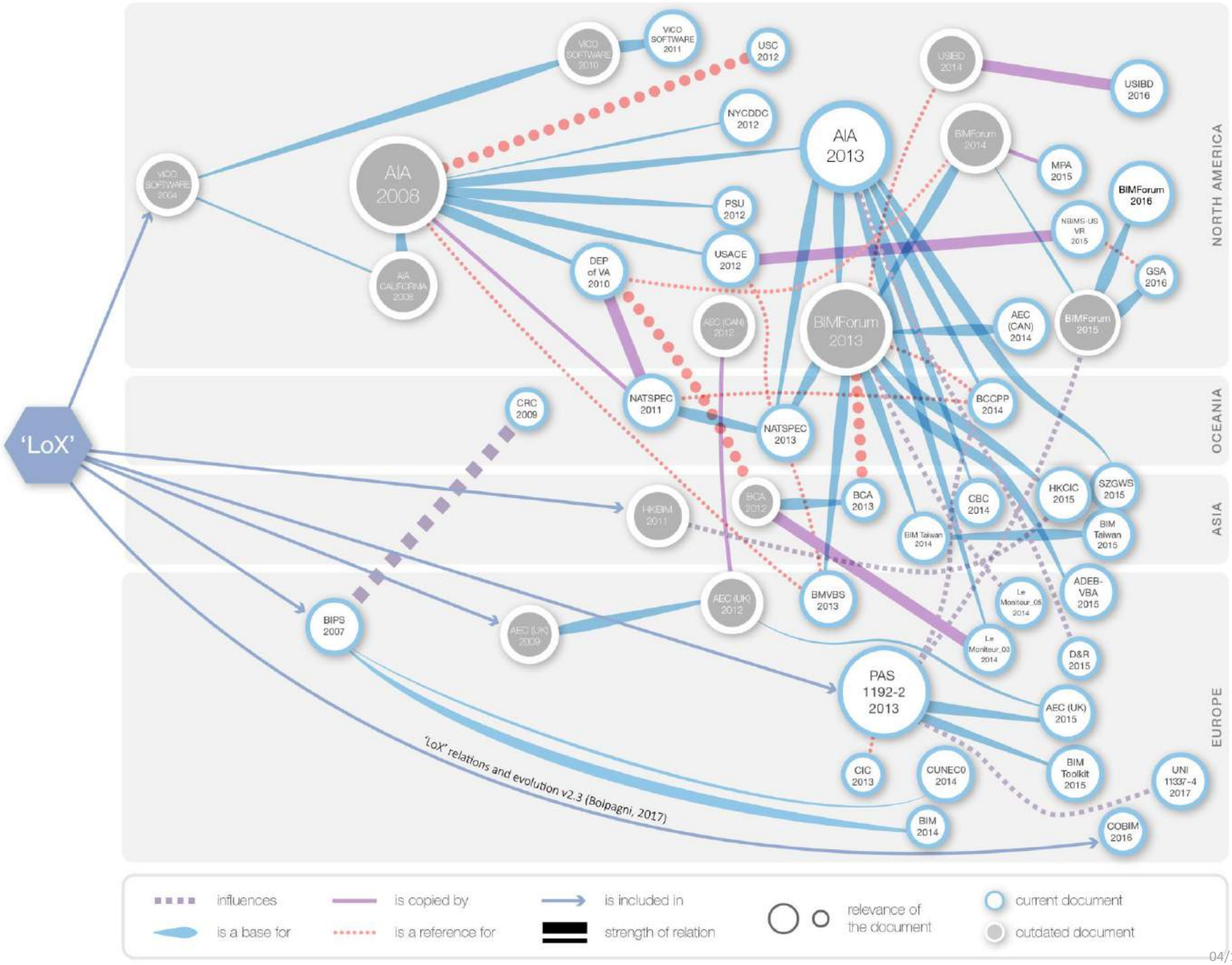
Source: PracticalBIM


'LoX'
VICO SOFTWARE 2004
VICO SOFTWARE 2010
VICO SOFTWARE 2011
USC 2012
AIA 2008
AIA CALIFORNIA 2008
NYCDDC 2012
PSU 2012
USACE 2012
DEP of VA 2010
AIA 2013
USIBD 2014
USIBD 2016
BIMForum 2014
MPA 2015
BIMForum 2016
NBIMS-US V3 2015
GSA 2016
AEC (CAN) 2012
BIMForum 2013
AEC (CAN) 2014
BIMForum 2015
NATSPEC 2011
NATSPEC 2013
BCCPP 2014
CRC 2009
HKBIM 2011
BCA 2012
BCA 2013
CBC 2014
HKCIC 2015
SZGWS 2015
BIM Taiwan 2014
BIM Taiwan 2015
BIPS 2007
AEC (UK) 2009
AEC (UK) 2012
BMVBS 2013
Le Moniteur_05 2014
ADEB-VBA 2015
Le Moniteur_03 2014
D&R 2015
PAS 1192-2 2013
AEC (UK) 2015
CIC 2013
CUNEC0 2014
BIM Toolkit 2015
UNI 11337-4 2017
BIM 2014
COBIM 2016
'LoX' relations and evolution v2.3 (Boipagni, 2017)
NORTH AMERICA
OCEANIA
ASIA
EUROPE
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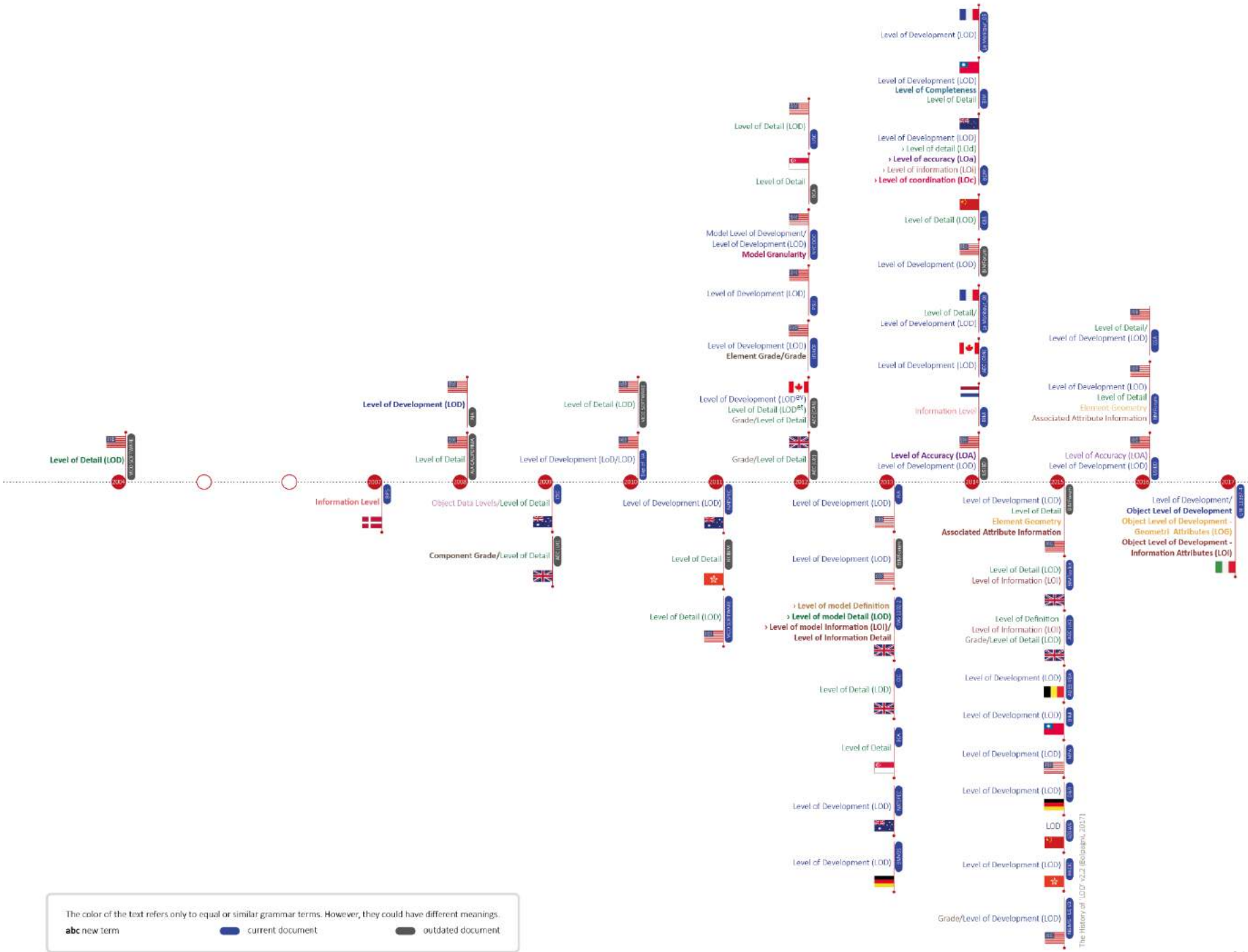
is a base for
is copied by
is a reference for
is included in
strength of relation
relevance of the document
current document
outdated document


2004
Level of Detail (LOD)
2007
Information Level
2008
Level of Development (LOD)
Level of Detail
Object Data Levels/Level of Detail
2009
Level of Development (LoD/LOD)
Component Grade/Level of Detail
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Level of Completeness
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› Level of accuracy (LOa)
› Level of information (LOi)
› Level of coordination (LOc)
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Information Level
2013
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› Level of model Detail (LOD)
› Level of model Information (LOI)/
Level of Information Detail
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2014
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2015
Level of Development (LOD)
Level of Detail
Element Geometry
Associated Attribute Information
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Level of Development (LOD)
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Level of Development (LOD)
Level of Detail
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Level of Accuracy (LOA)
Level of Development (LOD)
2017
Level of Development/
Object Level of Development
Object Level of Development -
Geometri Attributes (LOG)
Object Level of Development -
Information Attributes (LOI)
The color of the text refers only to equal or similar grammar terms. However, they could have different meanings.
abc new term
current document
outdated document
The History of 'LOD' v2.2 (Bolognini, 2017)

Source	LoX system	Whole Model	Model Element	Geometric data/info	Non-Geometric data/info
BIPS 2007	Information Levels	x	x	x	x

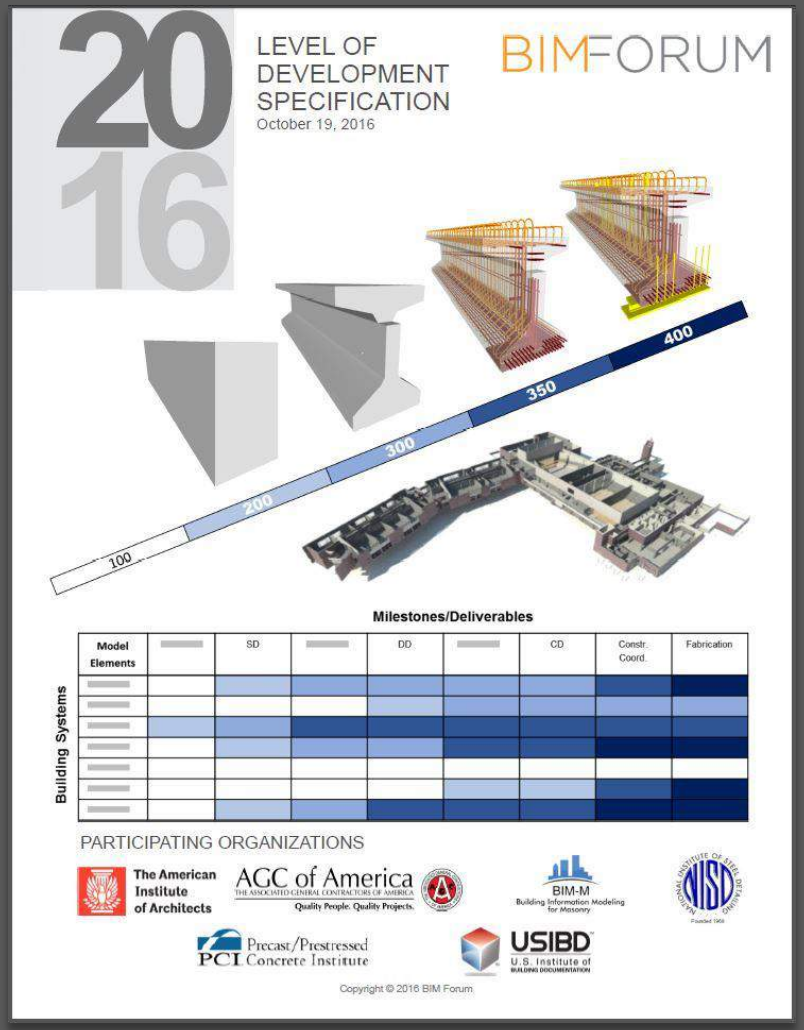
Source	Title	Authorship	LoX System	Levels									
BIPS 2007	3D Working method	Parties/ Responsibility	Information Level	-	-	0	1	2	3	4	5	6	-

Source	LoX system	Whole Model	Model Element	Geometric data/info	Non-Geometric data/info
BIPS 2007	Information Levels	x	x	x	x
CRC 2009	Object Data Levels/Level of Detail		x	x	x
Department of VA 2010	Level of Development (LoD/LOD)		x	x	x
Vico Software 2011	Level of Detail (LOD)	x	x	x	x
NATSPEC 2011	Level of Development (LOD)		x	x	x
NYC DDC 2012	Model Level of Development/ Level of Development (LOD)	x	x	x	x
	Model Granularuty		x	x	x
PennState University (PSU) 2012	Level of Development (LOD)		x	x	x
USC 2012	Level of Detail (LOD)		x	x	
US Army Corps of Engineers (USACE) 2012	Level of Development (LOD)		x	x	x
	Element Grade/Grade		x	x	x
AIA E203™ 2013	Level of Development (LOD)		x	x	x
BCA 2013	Level of Detail		x	x	x
PAS 1192-2 2013	Level of model Definition		x	x	x
	Level of model Detail (LOD)		x	x	
	Level of model Information (LOI)		x		x
CIC BIM Protocol 2013	Level of Detail (LOD)	x			
BMVBS 2013	Level of Development		x	x	x
BIM 2014	Information Level	x	x	x	x
AEC (CAN) 2014	Level of Development	x	x		
Le Moniteur_03 2014	Level of Detail/ Level of Development (LOD)		x	x	x
BCPP 2014	Level of Development (LOD)		x	x	x
	Level of detail (LOd)		x	x	
	Level of accuracy (LOa)		x	x	x
	Level of information (LOi)		x		x
	Level of coordination (LOc)				
CBC 2014	Level of Detail (LOD)	x	x	x	x
BIM Taiwan 2014	Level of Development	x	x	x	x
	Level of Completeness	x	x	x	x
	Level of Detail	x	x	x	x
Le Moniteur_05 2014	Level of Development (LOD)		x	x	x
ABEB-VBA 2015	Level of Development (LOD)		x	x	x
D&R 2015	Level of Development (LOD)	x		x	
NBS BIM Toolkit 2015	Level of Detail (LOD)		x	x	
	Level of Information (LOI)		x		x
AEC (UK) 2015	Level of Definition		x	x	x
	Level of Information (LOI)		x		x
	Grade/Level of Detail (LOD)		x	x	
SZGWS 2015	LOD	x		x	x
HKCIC 2015	Level of Development (LOD)		x	x	x
NBIMS - US V3 2015	Level of Development (LOD)		x	x	x
	Grade		x	x	x
USIBD 2016	Level of Development				
	Level of Accuracy	x	x	x	
BIMForum 2016	Level of Development		x	x	x
	Element Geometry		x	x	
	Associated Attribute Information		x		x
GSA 2016	Level of Detail/ Level of Development (LOD)		x	x	x
UNI 11337-4 2017	Level of Development/ Object Level of Development		x	x	x
	Object Level of Development – Geometric Attributes (LOG)		x	x	
	Object Level of Development – Information Attributes (LOI)		x		x

Comparison of the intended coverage of varied LoX systems, v2.2 (Bolpagni, 2017)

Source	Title	Authorship	LoX System	Levels									
BIPS 2007	3D Working method	Parties/ Responsibility	Information Level	-	-	0	1	2	3	4	5	6	-
CRC 2009	Object data levels	Responsibility	Object data levels/Level of Detail	-	-	-	A	B	C	-	D	E	-
Department of VA 2010	BIM Object/Element Matrix	Model Element Author	Level of Development (LoD/LOD)	-	-	-	100	200	300	-	400	500	-
Vico Software 2011	Model Progression Specification	-	Target Level of Detail/Level of Detail	-	-	-	100	200	300	-	400	500	-
NATSPEC 2011	NATSPEC BIM Object/Element Matrix (BOEM)	Model Element Author (MEA)	Level of Development (LOD)	-	-	-	100	200	300	-	400	500	-
NYC DDC 2012	Object Requirements	-	› Model Level of Development/ Level of Development (LOD) › Model Granularity	-	-	-	100	200	300	-	400	500 (?)	-
PennState University 2012	BIM Information Exchange - Level of Detail Matrix	Model Element Author (MEA)	Level of Development (LOD)	-	-	-	100	200	300	-	400	500 *	-
USC 2012	-	-	Level of Detail (LOD)	-	-	-	100	200	300	-	-	-	-
US Army Corps of Engineers 2012	USACE BIM Minimum Modeling Matrix (M3)	-	› Level of Development (LOD) › (Element Grade/Grade (A, B, C, +))	-	-	-	100	200	300	-	-	-	-
AIA E203™ 2013	Model Element Table	Model Element Author (MEA)	Level of Development (LOD)	-	-	-	100	200	300	-	400	500	-
BCA 2013	BIM Objective and Responsibility Matrix	Model Author Model User	Level of Detail	-	-	-	-	-	-	-	-	-	-
PAS 1192-2 2013	-	-	› Level of model Definition › Level of model Detail (LOD) › Level of model Information (LOI)	-	-	1	2	3	4	-	5	6	7
CIC 2013	Model Production and Delivery Table (MPDT)	Model Originator	Level of Detail (LOD)	-	-	A	B	3	4	-	5	6	7
BMVBS 2013	-	-	Level of Development (LOD)	-	-	-	-	-	-	-	-	-	-
BIM 2014	Matrix and Project Template	Aspect model	Information Level	-	-	0	1	2	3	4	5	6	-
AEC (CAN) 2014	Information exchange worksheet or modelling matrix	Responsibility	Level of Development (LOD)	-	-	-	100	200	300	350	400	500	-
Le Moniteur_03 2014	-	-	Level of Detail/ Level of Development (LOD)	-	-	-	100	200	300	-	400	500	-
BCPP 2014	-	-	Level of Development (LOD)	-	-	-	100	200	300	-	400	500	-
			Level of detail (LOd)	-	-	-	-	-	-	-	-	-	-
			Level of accuracy (LOa)	-	-	-	-	-	-	-	-	-	-
			Level of information (LOi)	-	-	-	-	-	-	-	-	-	-
			Level of coordination (LOc)	-	-	-	-	-	-	-	-	-	-
CBC 2014	-	-	Level of Detail (LOD)	-	-	-	100	200	300	-	400	500	-
BIM Taiwan 2014	-	-	Level of Development Level of Completeness Level of Detail	-	-	-	100	200	300	350	400	500	-
Le Moniteur_05 2014	-	-	Level of Development (LOD)	-	-	-	1	2	3	4	5	6	-
ABEB-VBA 2015	LOD Description	-	Level of Development (LOD)	-	-	-	100	200	300	350	400	500	-
D&R 2015	-	-	Level of Development (LOD)	100	0	-	100	200	300	-	400	500	-
NBS BIM Toolkit 2015	NBS BIM Toolkit	Responsibility	› Level of Detail (LOD) › Level of Information (LOI)	-	-	1	2	3	4	-	5	6	7
AEC (UK) 2015	-	-	› (Level of Definition) › (Level of Information (LOI) › Grade/Level of Detail (LOD)	-	-	1	2	3	4	-	5	6	-
SZGWS 2015	-	-	LOD	-	-	-	100	200	300	-	400	500	-
HKCIC 2015	LOD Responsibility Matrix	Model Author (AUT)	Level of Development (LOD)	-	-	-	100	200	300	350	400	500	-
NBIMS - US V3 2015	Minimum Modelling Matrix (M3)	-	Level of Development (LOD) Grade	-	-	-	100	200	300	-	-	-	-
USIBD 2016	-	-	Level of Development	-	-	-	100	200	300	-	400	500	-
			Level of Accuracy					10;20;30;40;50					
BIMForum 2016	LOD 2015 Element Attributes Tables	Model Element Author (MEA)	› Level of Development (LOD) › Level of Detail › Element Geometry › Associated Attribute Information	-	-	-	100	200	300	350	400	500	-
GSA 2016	Model Progression Matrix (MPM)	-	Level of Detail Level of Development (LOD)	-	-	-	100	200	300	350	400	500	-
UNI 11337-4 2017	-	-	Level of Development/ Object Level of Development Object Level of Development – Geometric Attributes (LOG) Object Level of Development – Information Attributes (LOI)	-	-	A	B	C	D	-	E	F	G

Comparison of the classification system used within different LoX systems v2.2 (Bolpagni & Ciribini, 2017)



BIMFORUM
The US chapter of buildingSMART International

What about Renovation & Restoration works?

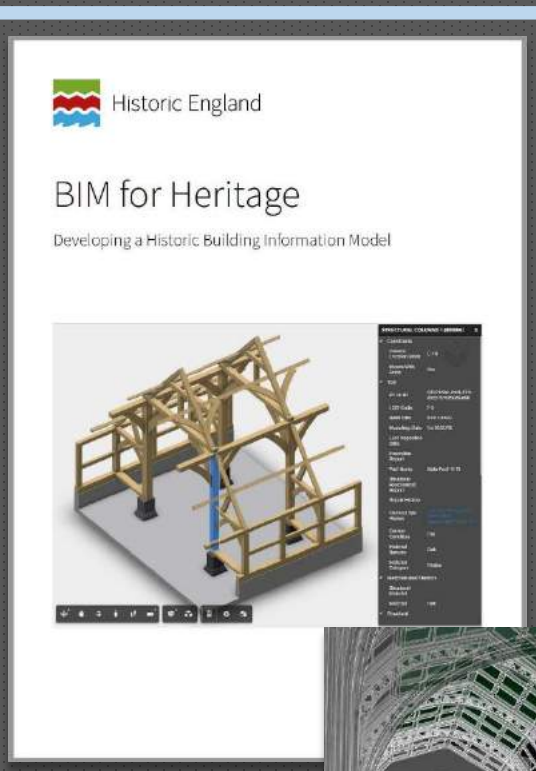
What about Operation and Maintenance (and Decommission)?

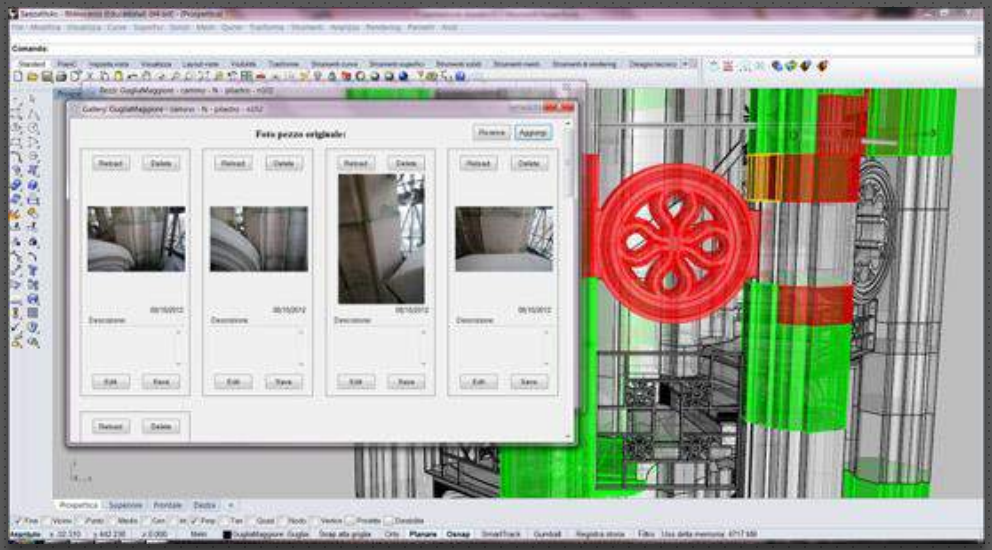
Source: BIMForum (2016) Level of Development Specification

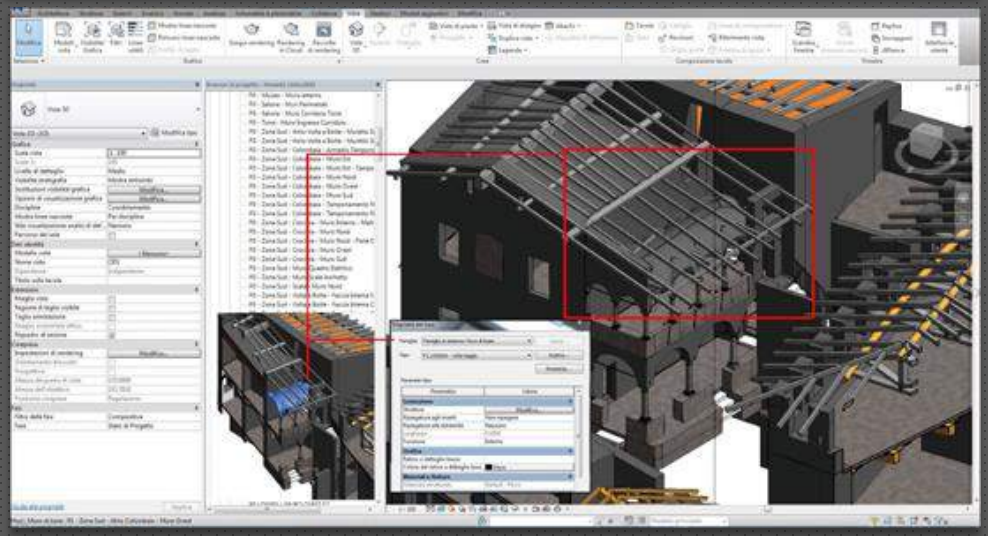
BRESCIA (Italy)

Source: Internet

HBIM: Historic Building Information Modelling
BHIMM: Built Heritage Information Modelling Management







Sources: Historic England and PoliMI

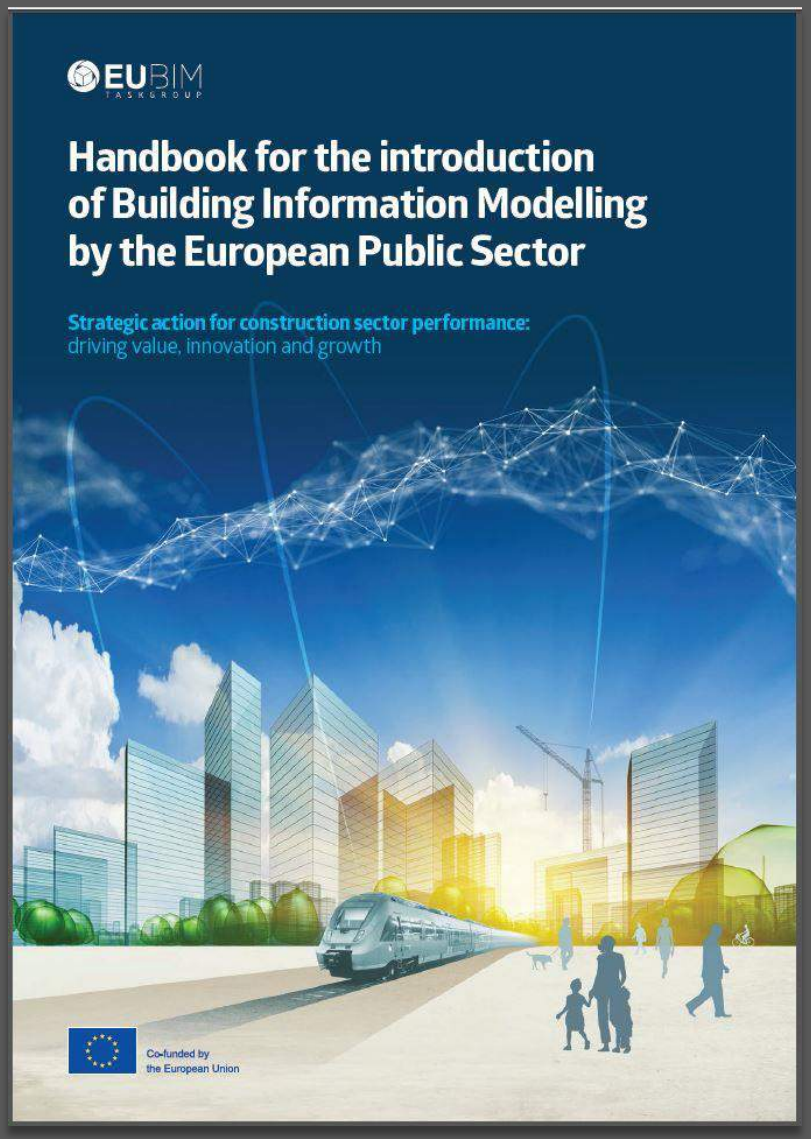
3.3

EU BIM Task Group

BIM IN EU

3.3

1. Austria
2. Belgium
3. Czech Republic
4. Denmark
5. Estonia
6. Finland
7. France
8. Germany
9. Iceland
10. Ireland
11. Italy
12. Lithuania
13. Luxembourg
14. Netherlands
15. Norway
16. Poland
17. Portugal
18. Slovakia
19. Slovenia
20. Spain
21. Sweden
22. UK



EUBIM TASKGROUP

'BIM is a strategic enabler for improving decision making for both buildings and public infrastructure assets across the whole lifecycle.

It applies to new build projects; and crucially, BIM supports the renovation, refurbishment and maintenance of the built environment – the largest share of the sector'

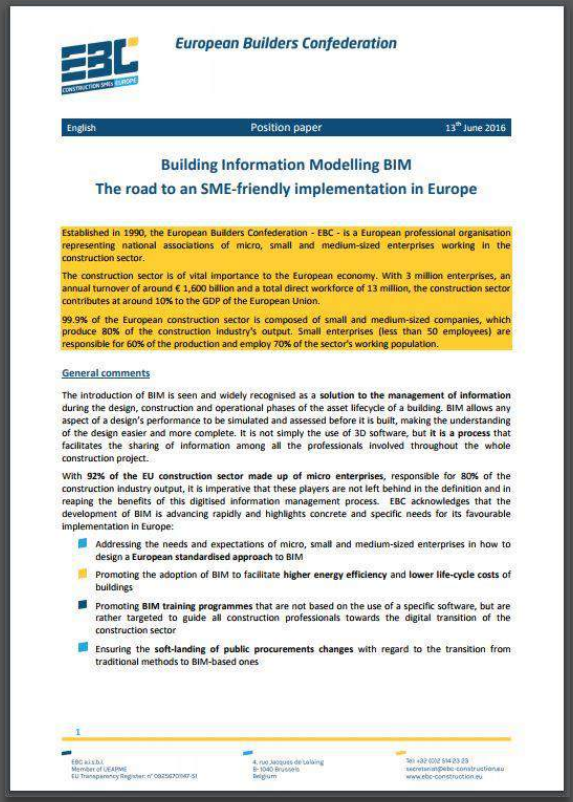
EU BIM TASKGROUP

3.4

European Builders Confederation

EBC

3.4



European Builders Confederation

English | Position paper | 13th June 2016

Building Information Modelling BIM
The road to an SME-friendly implementation in Europe

Established in 1990, the European Builders Confederation - EBC - is a European professional organisation representing national associations of micro, small and medium-sized enterprises working in the construction sector.

The construction sector is of vital importance to the European economy. With 3 million enterprises, an annual turnover of around € 1,600 billion and a total direct workforce of 13 million, the construction sector contributes at around 10% to the GDP of the European Union.

99.9% of the European construction sector is composed of small and medium-sized companies, which produce 80% of the construction industry's output. Small enterprises (less than 50 employees) are responsible for 60% of the production and employ 70% of the sector's working population.

General comments

The introduction of BIM is seen and widely recognised as a **solution to the management of information** during the design, construction and operational phases of the asset lifecycle of a building. BIM allows any aspect of a design's performance to be simulated and assessed before it is built, making the understanding of the design easier and more complete. It is not simply the use of 3D software, but **it is a process** that facilitates the sharing of information among all the professionals involved throughout the whole construction project.

With **92% of the EU construction sector made up of micro enterprises**, responsible for 80% of the construction industry output, it is imperative that these players are not left behind in the definition and in reaping the benefits of this digitised information management process. EBC acknowledges that the development of BIM is advancing rapidly and highlights concrete and specific needs for its favourable implementation in Europe:

- Addressing the needs and expectations of micro, small and medium-sized enterprises in how to design a **European standardised approach** to BIM
- Promoting the adoption of BIM to facilitate **higher energy efficiency** and **lower life-cycle costs** of buildings
- Promoting **BIM training programmes** that are not based on the use of a specific software, but are rather targeted to guide all construction professionals towards the digital transition of the construction sector
- Ensuring the **soft-landing of public procurements changes** with regard to the transition from traditional methods to BIM-based ones

1

EBC a.s.b.l.
Member of UEAPME
EU Transparency Register: n° 08258701747-51

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‘92% of the EU construction sector made up of micro enterprises, responsible for 80% of the construction industry output’

‘Simplification of existing tools, training’

‘Digital model tools will not be prescriptive in terms of commercial provisions’

‘avoid now professional roles such as BIM Manager’

‘Ensuring the soft-landing of public procurements changes’

‘Traditional buildings and renovation works’

‘Responsibilities and guarantees’

3.5

European Construction Industry Federation

FIEC

3.5

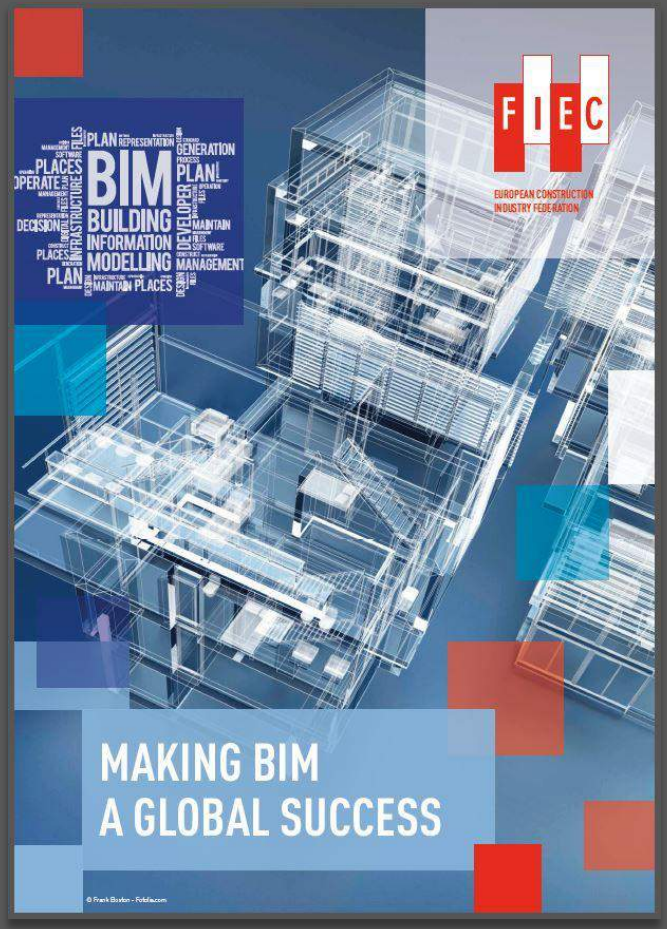
‘Recognise the construction sector as an important pillar of “Industry 4.0” and support BIM as a central part of it’

‘Standards for data transfer to enable open BIM’

‘Ensure that legislative requirements for contracts and public procurement are realistic and feasible also for SMEs’

‘BIM is not a revolution, but an evolution’

‘BIM to capture data on the whole life-cycle of buildings and infrastructure’



4

CONCLUSIONS

AIM

Do we have/need a European BIM Culture?

4 CONCLUSIONS

- *Different initiatives at EU level*
- *EU BIM Culture is based on*
  - *Process, Policy, Technology*
  - *Open standards*
  - *Cultural heritage/renovation*
  - *Life-cycle approach*
  - *Energy efficiency*
  - *Support to SME*
- *We need to focus more on Process and Policy*

Thank you

Get in contact!

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