

STANDARDISEERITUD JA MASINKÄSITLETAVAD
**ANDMED EHITUSE
ELUKAAREL**

22.10.2019

Ettekanne
Hendrik Park



- Asutatud 1991a.
- 20 spetsialisti ning konsultanti.
 - CAD/BIM ja äritarkvara lahendused;
 - Koolitused ja konsultatsioon;
 - Ehituse- ning tootmise andmete juhtimine ja visualiseerimine;
 - IT tugiteenused.



Specialization
Architecture, Engineering & Visualization

Value Added Services
Authorized Training Center
Authorized Certification Center



BIM konsultant
2018 -



**Projekteerimise
projektijuht**
2017 - 2018



Tootejuht
2018 -



**Objektijuht /
Projektijuht**
2013 - 2017



**õpingud, Infosüsteemide analüsüs
ja kavandamine (MSc)**
2019 - ...



www.emu.ee
Eesti Maaülikool
Estonian University of Life Sciences

õpingud, Maaehitus (MSc)
(Diplomeeritud ehitusinseneri esmane kutse
üldehituses, tase 7)
... - 2018

SISUKORD

TAUST

Tänane ehitussektor



22.10.2019 | BIM Seminar 2019

5

usesoft®

(DIGI-) TEHNOLOGIAD

ja selle tänased võimalused



22.10.2019 | BIM Seminar 2019

8

usesoft®

ANDMED

kõige digitaalse alus



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STANDARDISEERIMINE

„digi-koostöö“ võimaldaja



22.10.2019 | BIM Seminar 2019

20

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TAUST

Tänane ehitussektor

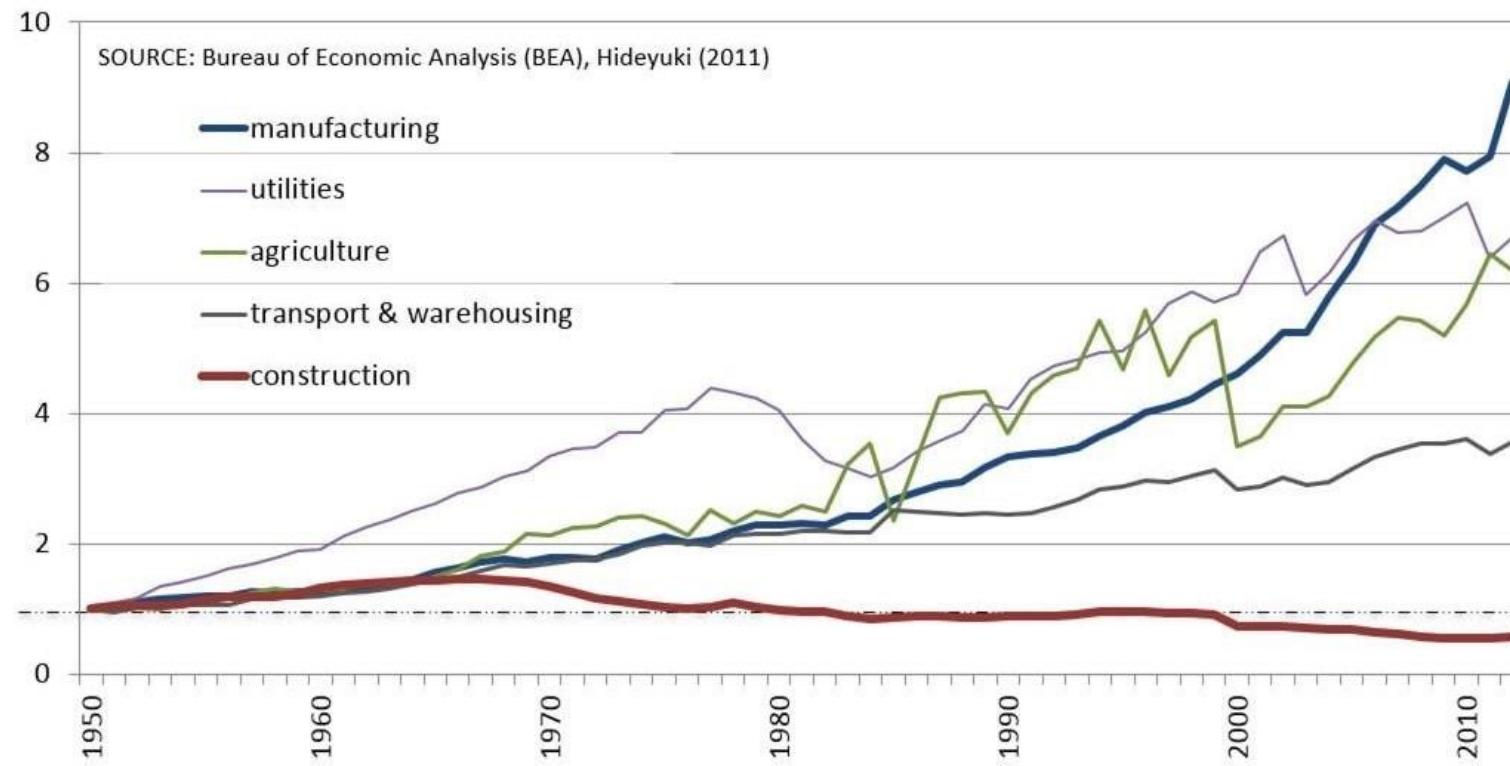


PROBLEEM

Construction productivity 1950-2012

Real productivity (GDP value-add per employee) by industry in the US

Indexed; 1950 = 1.0



PÕHJUSED?

- Regulatsioonid
- Koostöövormid
- Aegunud projektlahendused
- Optimeerimata ehitusprotsess
- Vähene tehnoloogia- ja innovatsioon
- Töötajate kompetents
- Tänased hanked ja tarneahel
- ...



...ja kõige selle juures vähene digitaliseeritus:



McKinsey Global Institute industry digitization index; 2015 or latest available data

Relatively low digitization Relatively high digitization
● Digital leaders within relatively undigitized sectors



Allikas: McKinsey & Company 2016

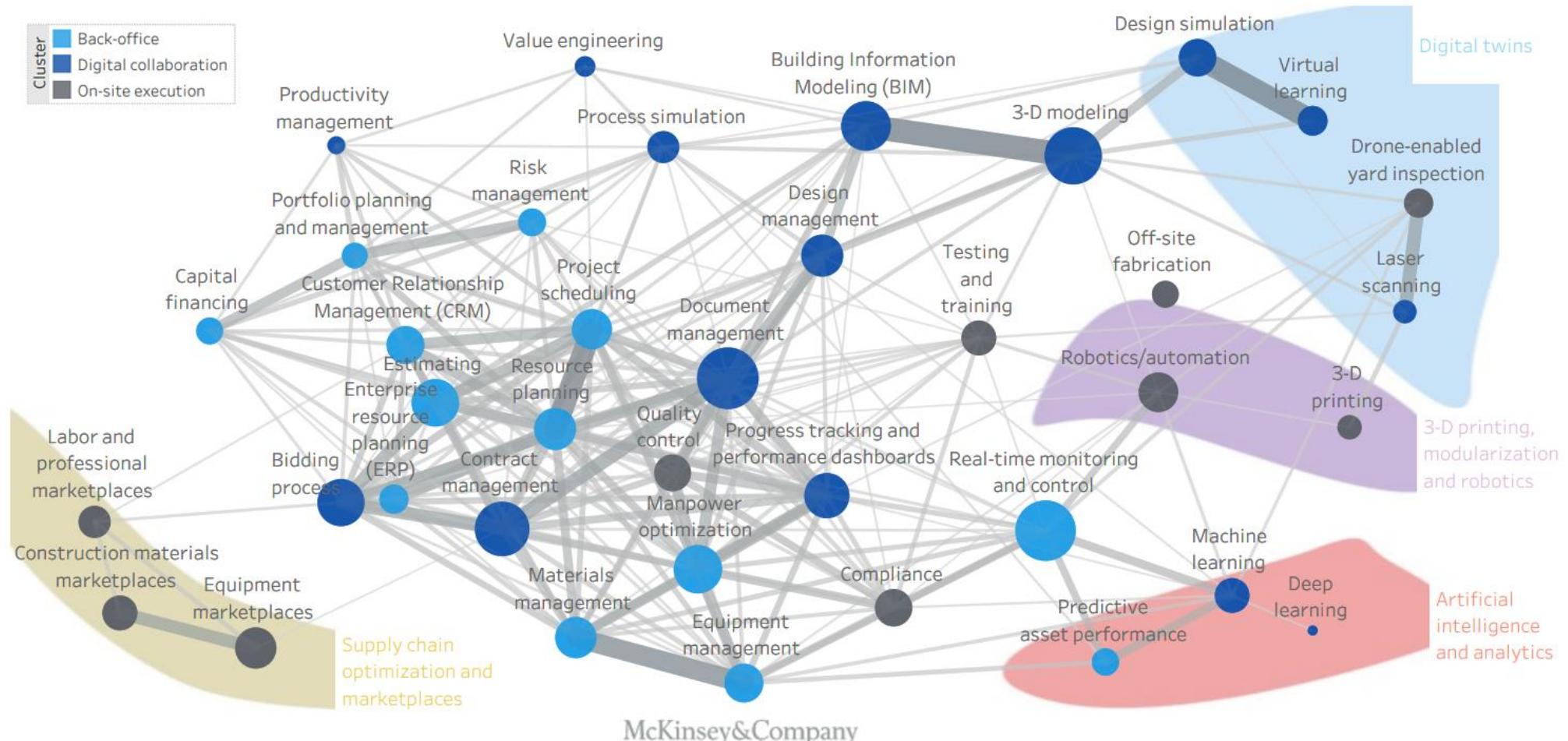


(DIGI-) TEHNOLOOGIAD

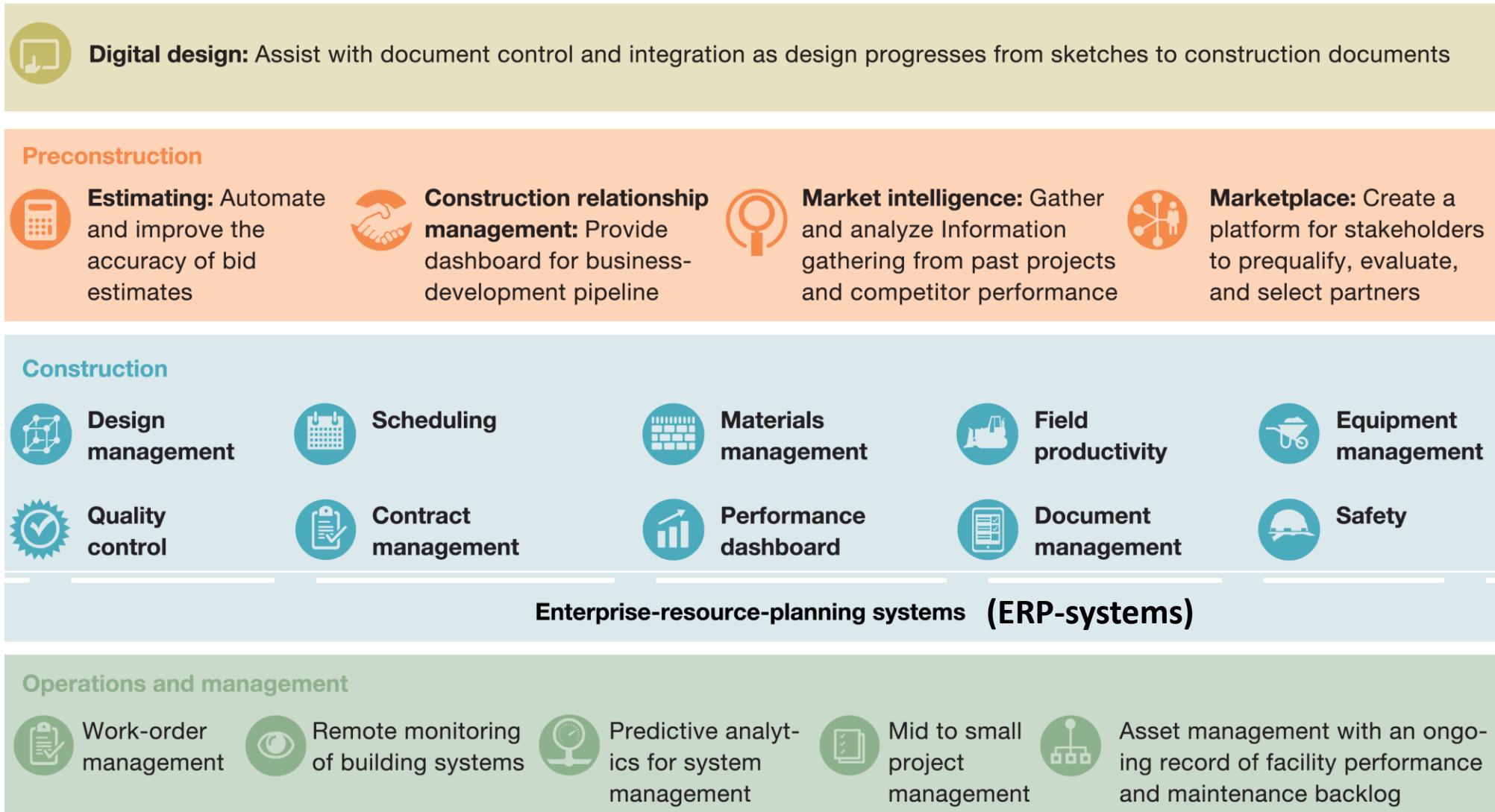
ja selle tänased võimalused

TEHNOOOGIAD

Allikas: [McKinsey&Company](#)

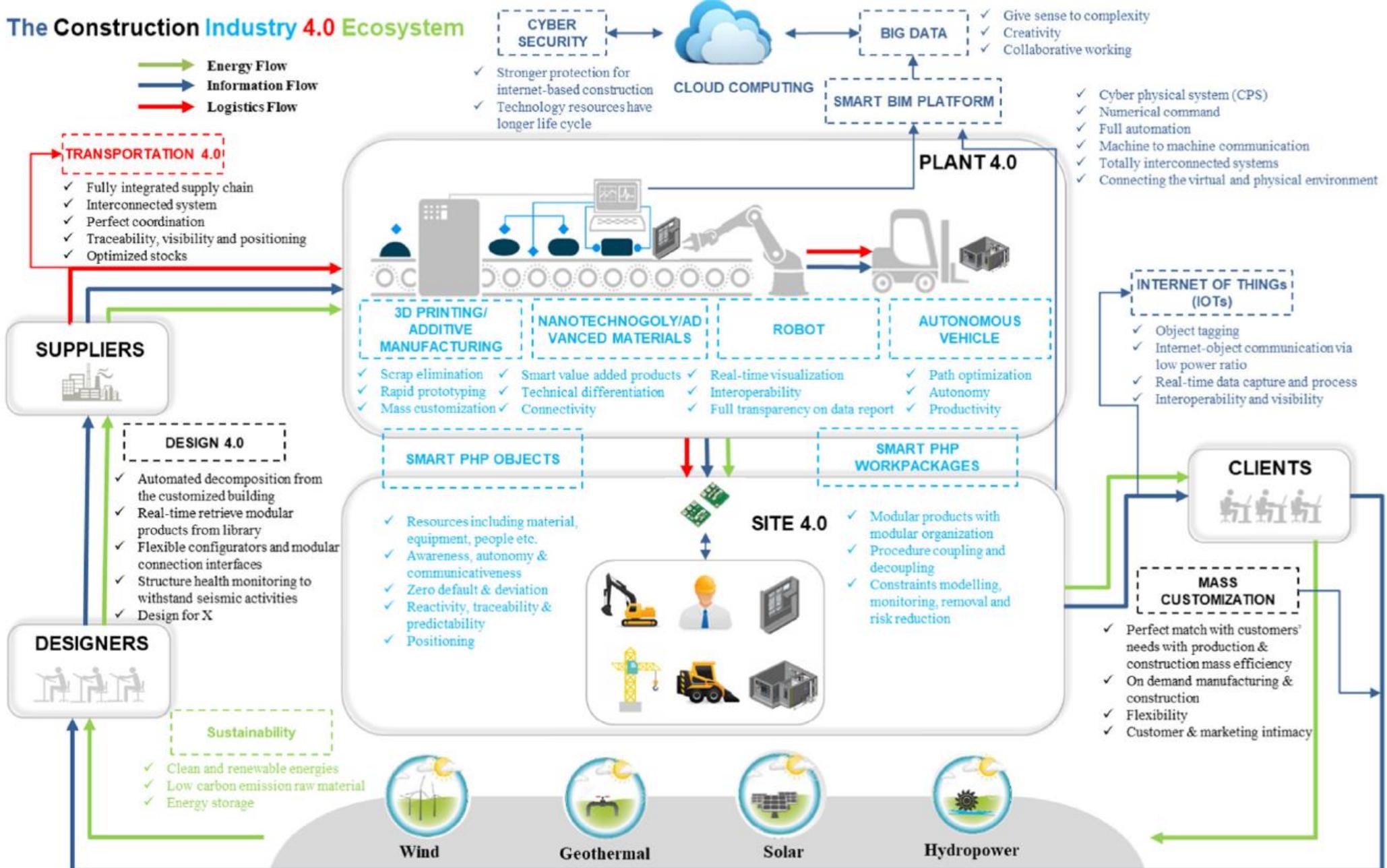


Ehitussektori analüüs selle tehnoloogia kasutamise aspektist, et leida omavahelisi trende ning seoseid. Jämedamatad jooned näitavad, et neid tehnoloogiaid kasutatakse [tõenäilisemalt] samaaegselt.

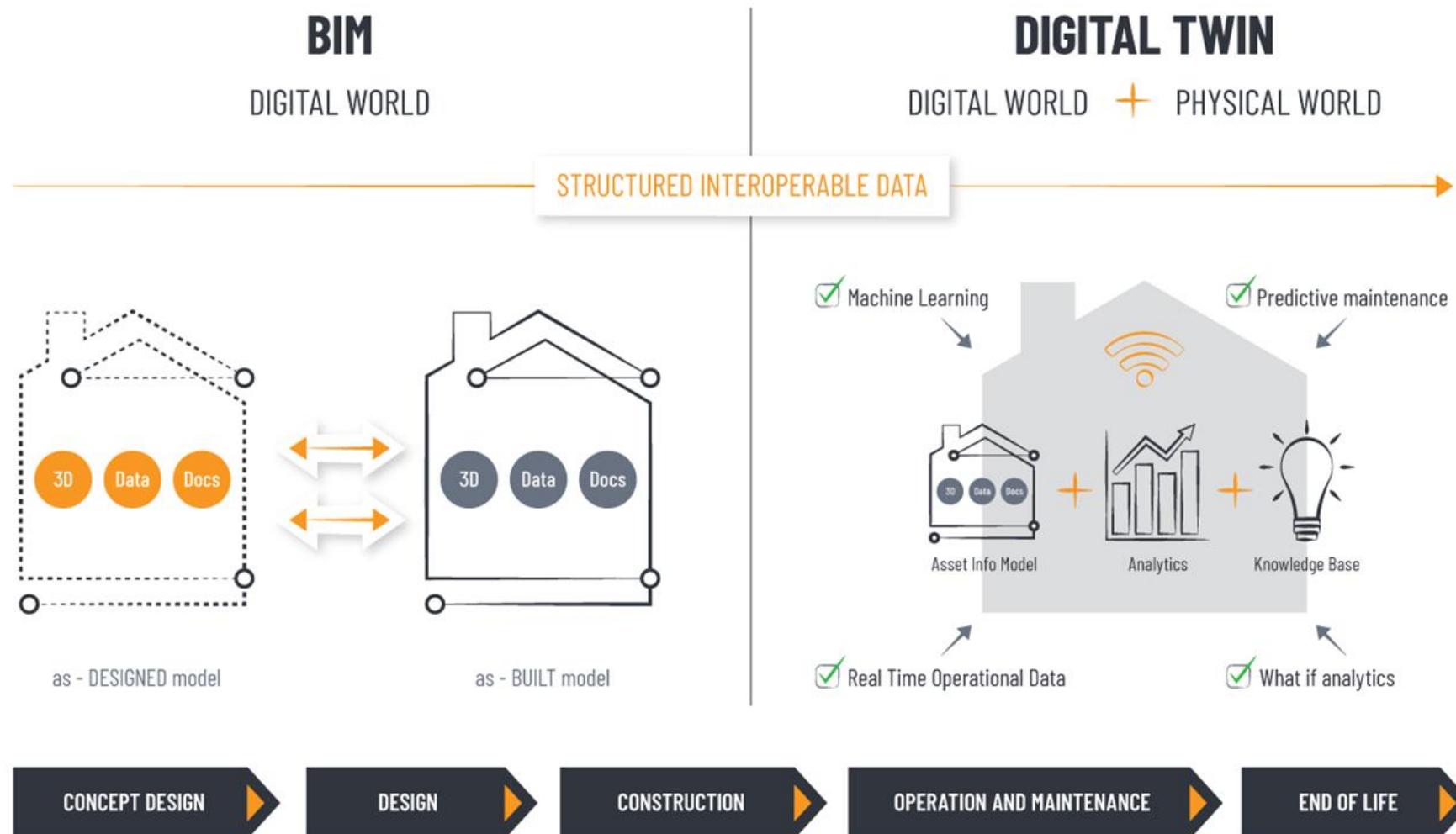


ÖKOSÜSTEEM

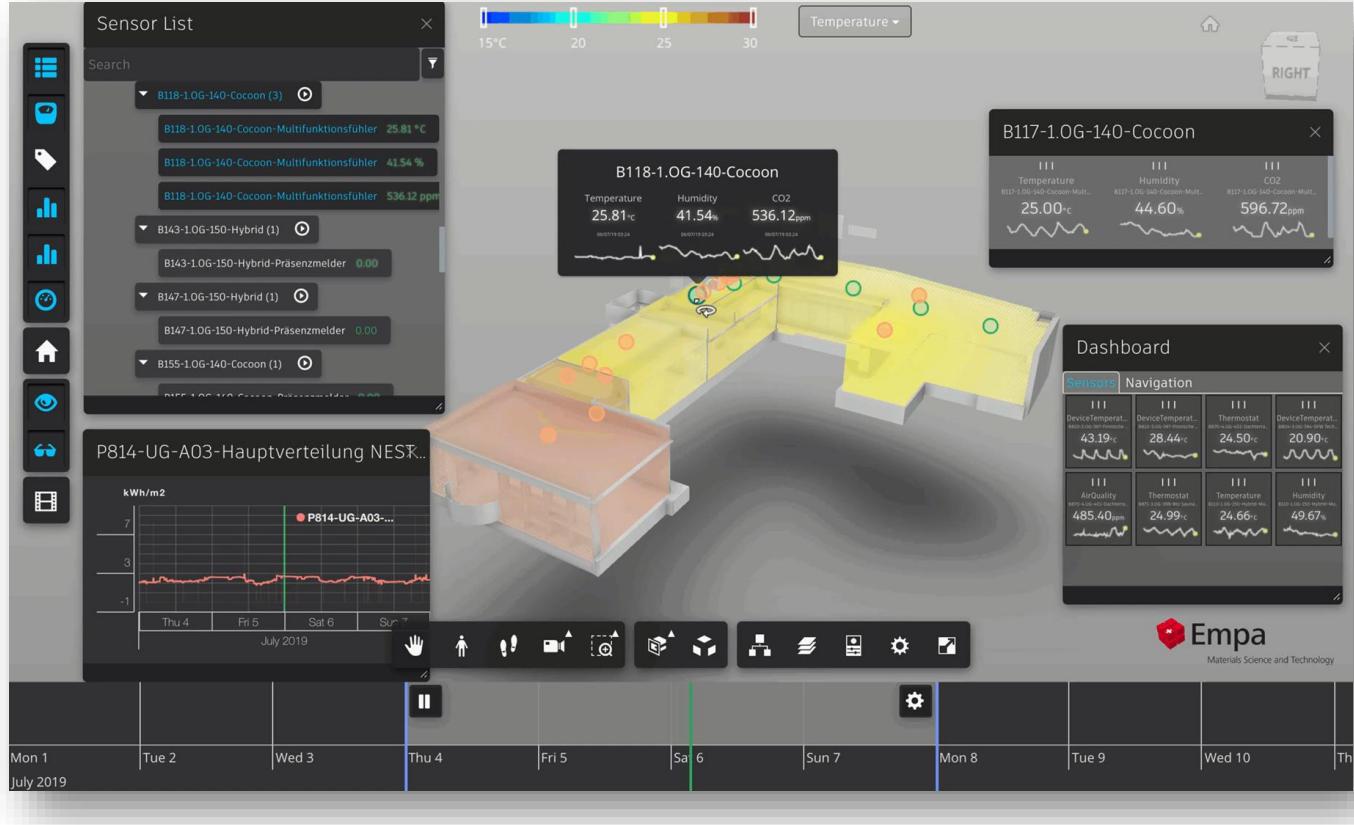
The Construction Industry 4.0 Ecosystem



DIGITAALNE JA FÜÜSILINE MAAILM



BIM, IoT JA DIGITAL TWIN



Allikas: [Dasher](#)



TRENDID

Aga
Teie?

- ✓ 1. *Building Information Modeling (BIM)*: 86%
- ? 2. Baastasemel andmeanalüüs: 83%
- ? 3. Projekti- ja **infojuhtimise süsteemid**: 79%
- ? 4. **Droonid**: 72%
- ? 5. **Mobiilsed platvormid**: 69%

PS! Uuringu järgi
innovatiivsema 20% sekka
jäävate ettevõtete seas.

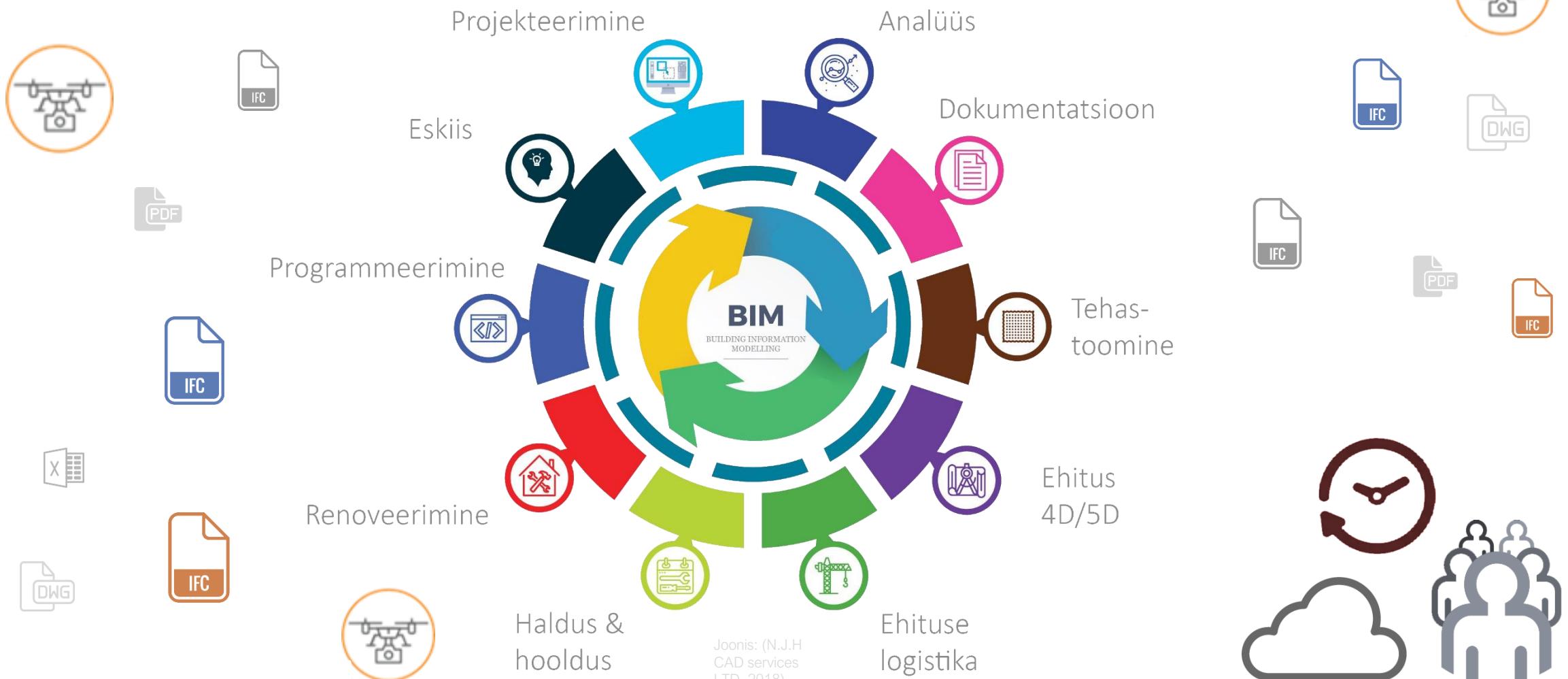
KPMG Future-Ready Index (2019)

ANDMED

kõige digitaalse alus

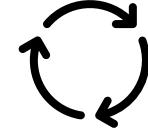
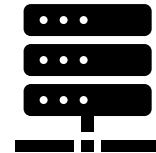
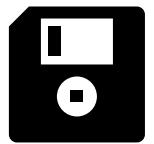


ANDMED EHITUSVALDKONNAS



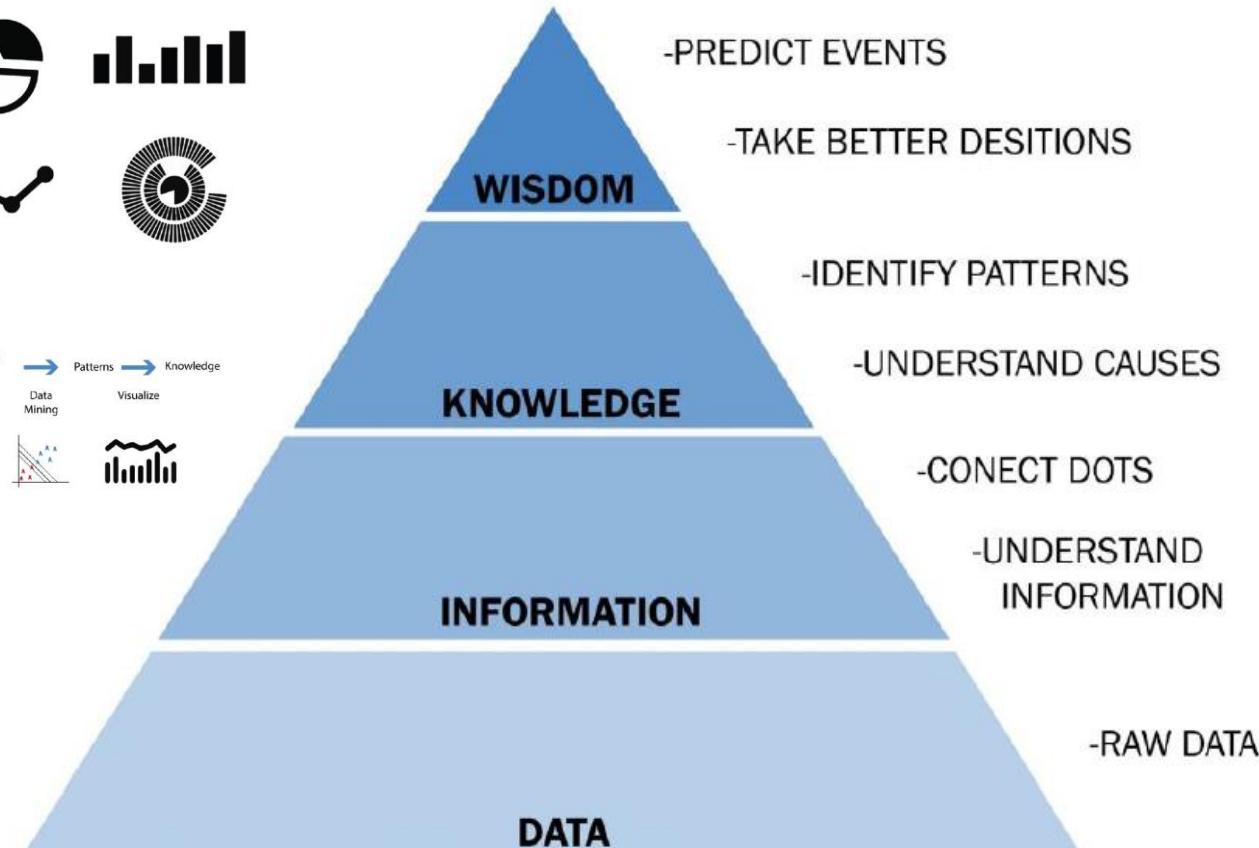
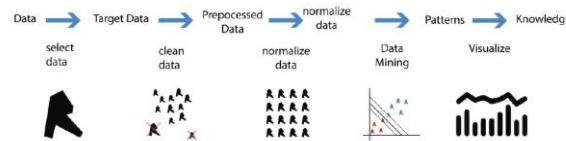
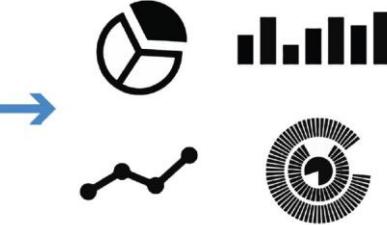
ANDMEMAHUD

*„According to an IBM Marketing Cloud study
90% of current data on the internet was
generated in the past 2 years.“*

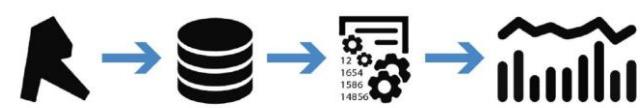
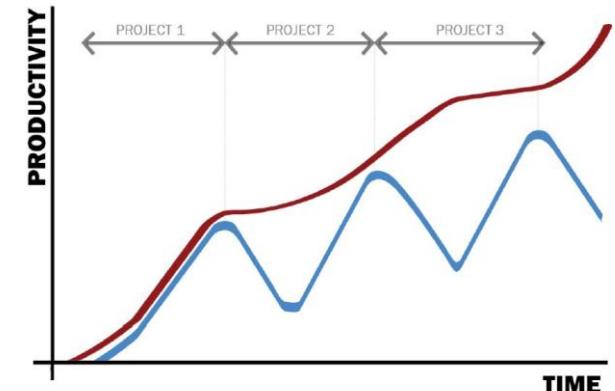
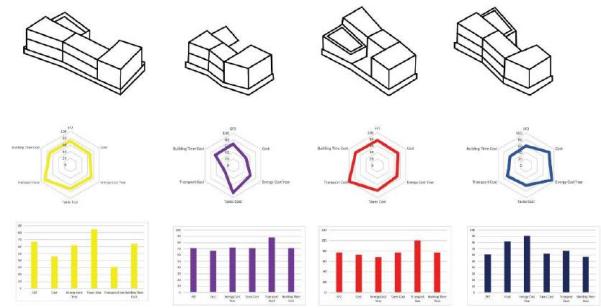


DIG-DATA / SUURANDMED

| | | | | | |
|---|---|---|---|---|---|
| 4 | 6 | 0 | 1 | 4 | 6 |
| 6 | 7 | 0 | 5 | 9 | 4 |
| 8 | 3 | 3 | 4 | 0 | 3 |
| 5 | 4 | 5 | 0 | 7 | 7 |
| 7 | 8 | 6 | 0 | 6 | 0 |
| 1 | 9 | 1 | 1 | 4 | 8 |
| 8 | 1 | 7 | 9 | 0 | 5 |

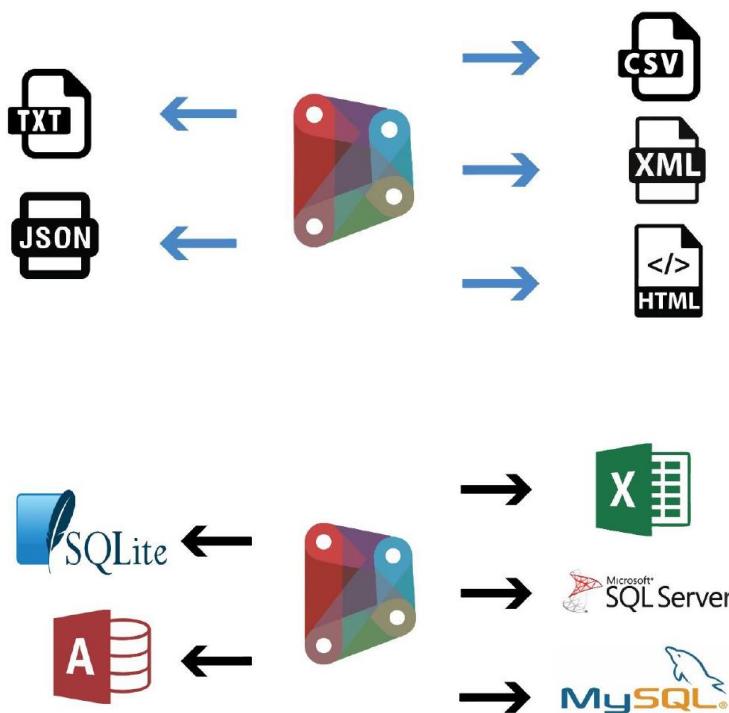


Allikas: Autodesk University



BIMist ANDMED?

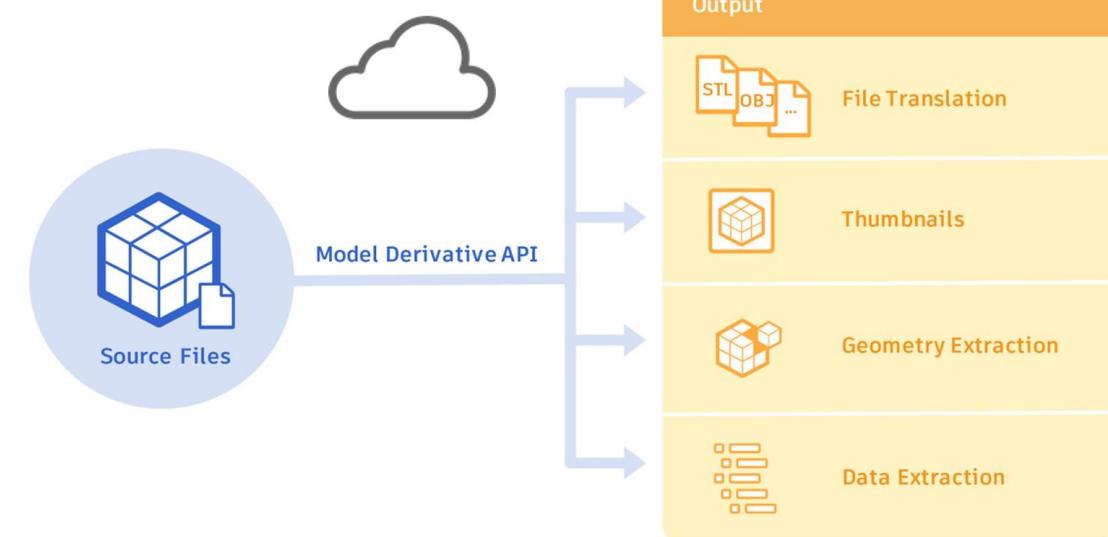
Desktop:



Cloud:



AUTODESK®
FORGE





STANDARDISEERIMINE

„digi-koostöö“ võimaldaja

INFOHALDAMISE PROTSESSIDE STANDARDISEERIMINE

2018+



2016+



UK BIM Level 2
juhendid ja praktika

ehk:



Tulekul:

ISO 19650-3 – Operational phase of the asset

ISO 19650-4 – Information exchange

ISO 19650-5 – Security-minded approach to information management.



MILLINE SEE EESTI JA ISO SEOS NÜÜD OLIGI?



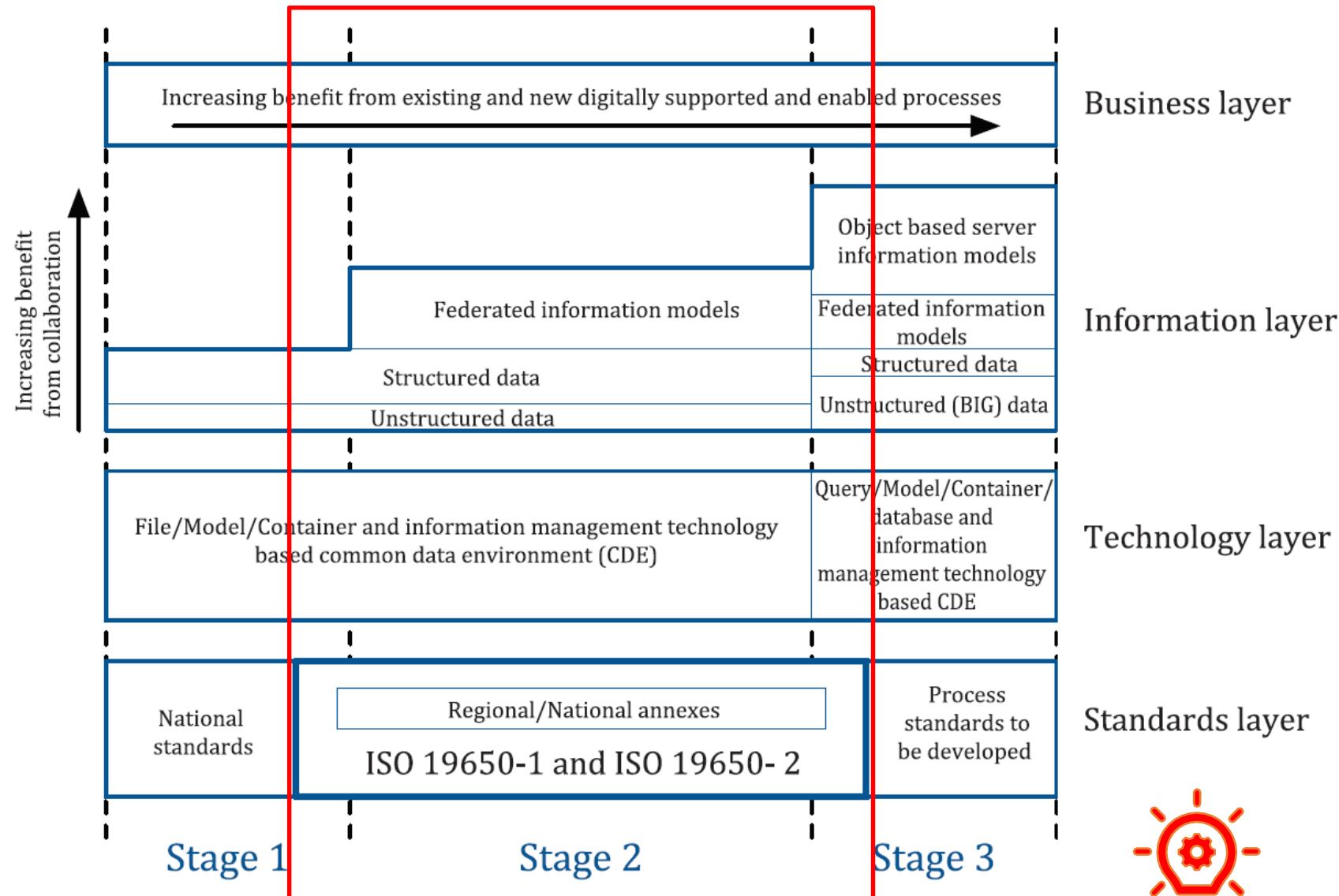
- **EVS/TK 50** - Osaleb vastava Euroopa komitee juures standardite koostamisega ja tegeleb valminud tõlkimisega eesti keelde.
- Mõtestav eesmärk:
 - **BIM ja selle kasutusvõimalused ehitise elukaare jooksul.**
- Tehniline komitee EVS/TK 50 „Ehituskonstruktsioonide modelleerimine (BIM)“ on:
 - CEN/TC 442 „Building Information Modelling (BIM)“ - Euroopa tehniline komitee
 - ISO/TC 59 “Buildings and civil engineering work” - rahvusvaheline tehniline peegelkomitee.



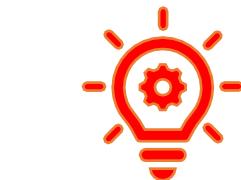
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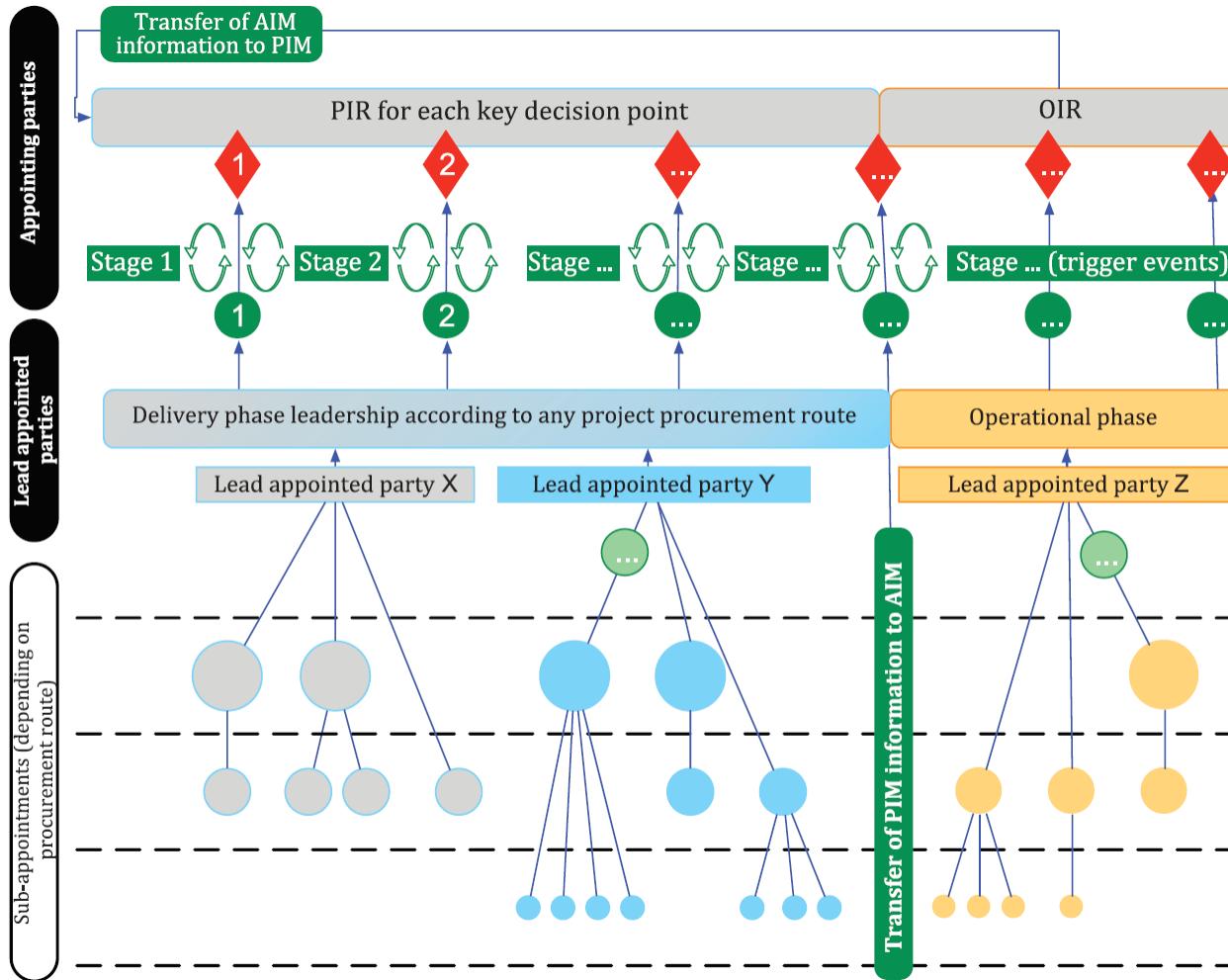




Joonis: ISO 19650-1:2018



OSAPOOLTE VAHELISTE INFOVOOGUDE KOONDUMISE NÄIDE



PIR - Project Information Requirements
 EIR - Exchange Information Requirements
 AIM - Asset Information Model
 PIM - Project Information Model
 OIR - Organizational Information Requirement

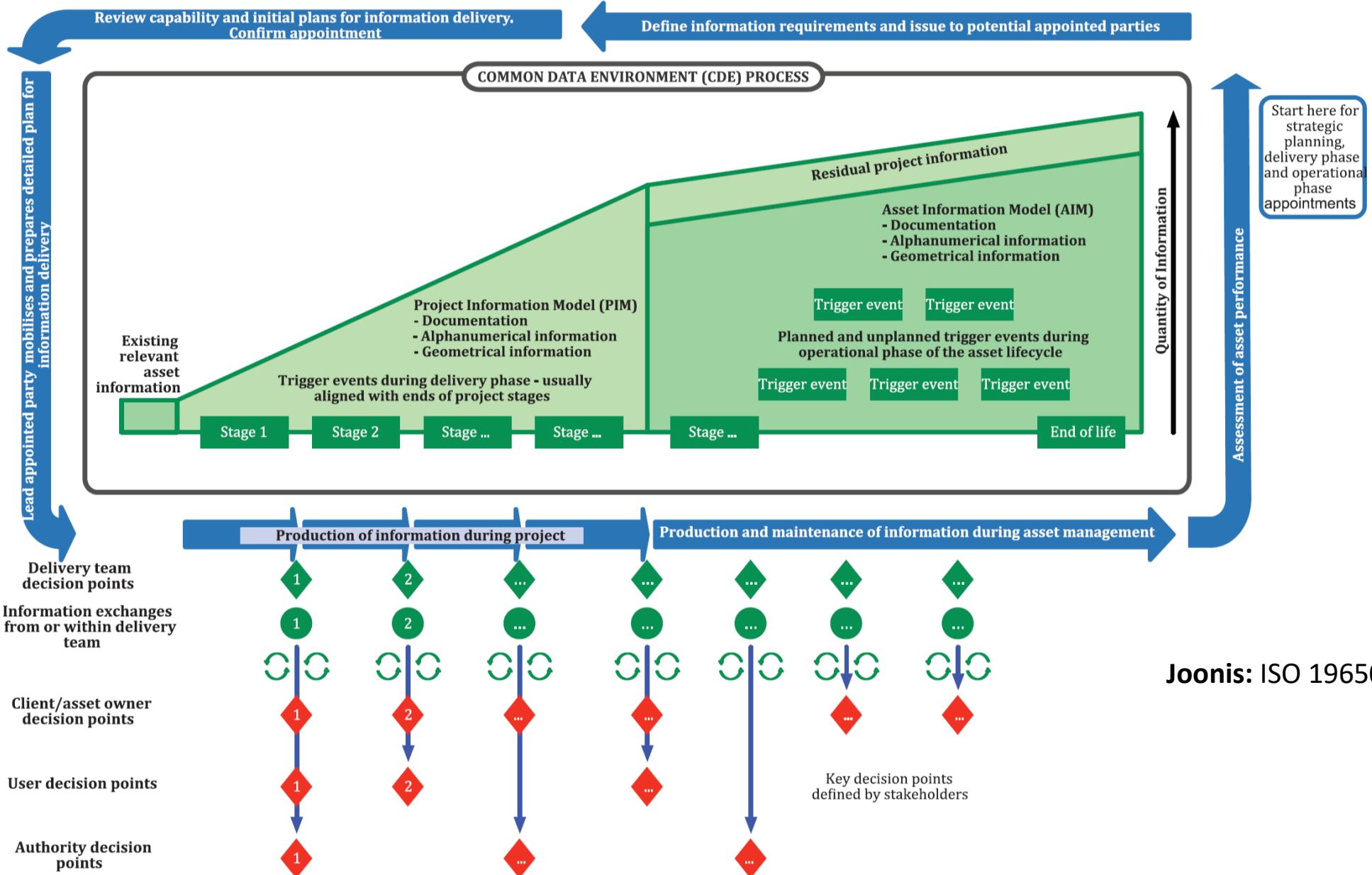
protip: BIM DICTIONARY

- Key**
- asset owner or project client key decision points
 - information exchange within delivery team, into PIM or AIM
 - lead appointed parties and appointed parties (task teams and delivery teams)
 - information verification and validation
 - flow of information deliverables
- NOTE** In certain situations information exchanges can also occur between appointed parties. For simplicity these have not been shown in the Figure.

Figure 9 — Example of information delivery through information exchange to support key appointing party decisions

Joonis: ISO 19650-1:2018

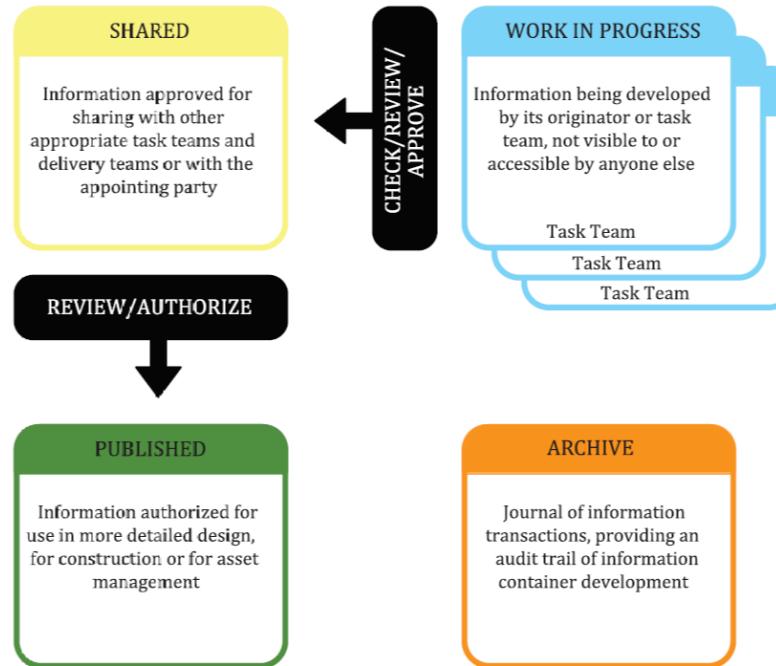
INFOLOOME PROTSESSE CDE'S



ANDMETE VALMIDUSE STAATUSED

Koostöö ühtses
infokeskkonnas?

Üks näide olulisest
põhimõttest



Joonis: ISO 19650-1:2018

Table 3 – Status codes in the CDE

| Status | Description |
|--------------------------------|--|
| Work in Progress (WIP) | |
| S0 | Initial status or WIP Master document index of file identifiers uploaded into the extranet. |
| Shared | |
| S1 | Issued for co-ordination The file is available to be "shared" and used by other disciplines as a background for their information. |
| S2 | Issued for Information |
| S3 | Issued for Internal review and comment |
| S4 | Issued for construction approval |
| S5 | Issued for manufacture |
| S6 | Issued for PIM authorization (Information Exchanges 1-3) |
| S7 | Issued for AIM authorization (Information Exchange 6) |
| D1 | Issued for costing |
| D2 | Issued for tender |
| D3 | Issued for contractor design |
| D4 | Issued for manufacture/procurement |
| AM | As maintained |
| Published documentation | |
| A | Issued for construction |
| B | Partially signed-off: For construction with minor comments from the client. All minor comments should be indicated by the insertion of a cloud and a statement of "In abeyance" until the comment is resolved, then resubmitted for full authorization. |
| AB | As-built handover documentation, PDF, native models, COBie, etc. |

NOTE 1 Additional codes S6 and S7 are highlighted.

NOTE 2 Status codes are provided by information originators to define how information may be used during different phases of the CDE. The SHARED suitability codes are stated as "Issued for..." but this does not infer any contractual or insurable purpose. Their purpose is to limit the reuse of the information at that stage. See also BS 1192 and Building Information Modelling – A Standard Framework and Guide to BS 1192, Richards, 2010.

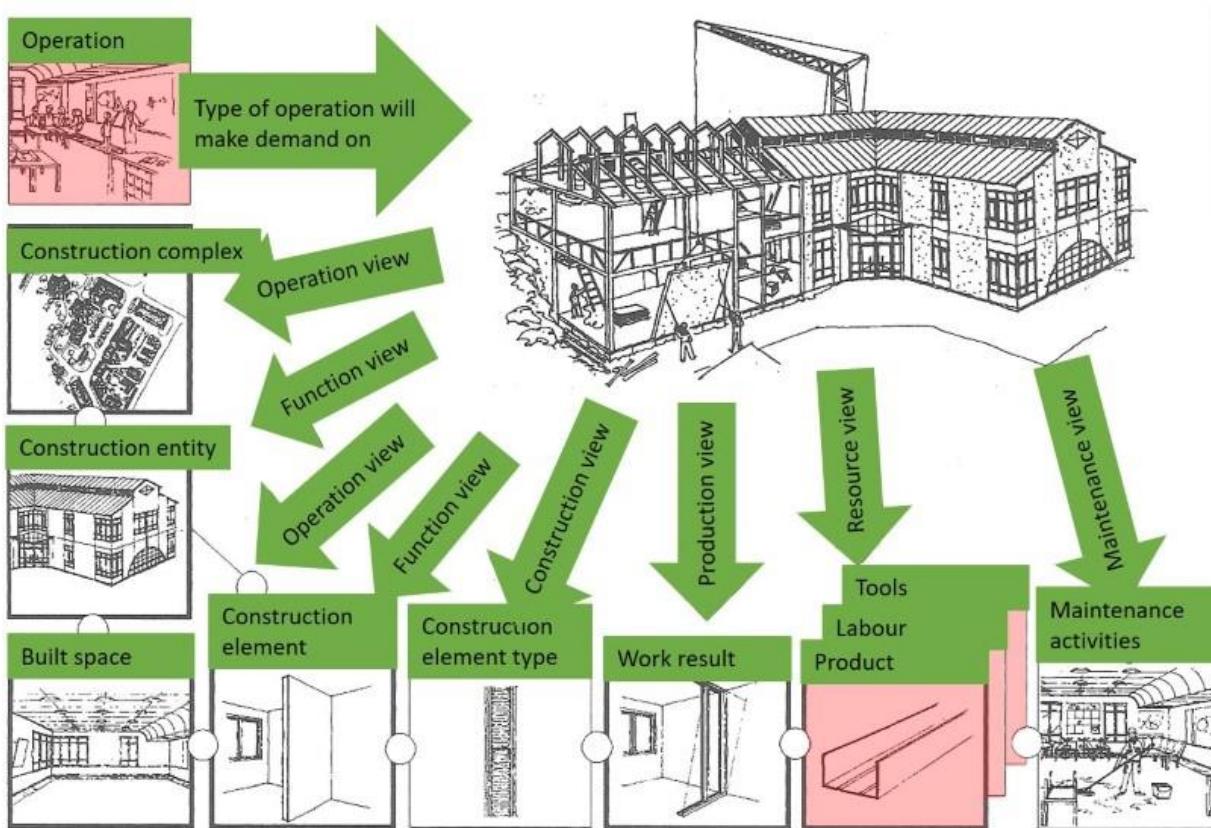
NOTE 3 Status codes are used in connection with the gateways in the CDE. They are not related to version numbering, the levels of detail or the stages in the plan of work.

Joonis: PAS 1192 järgselt andmete staatuse tunnused. Nüüd on need lisatud regionaalse lisana ISO külge.



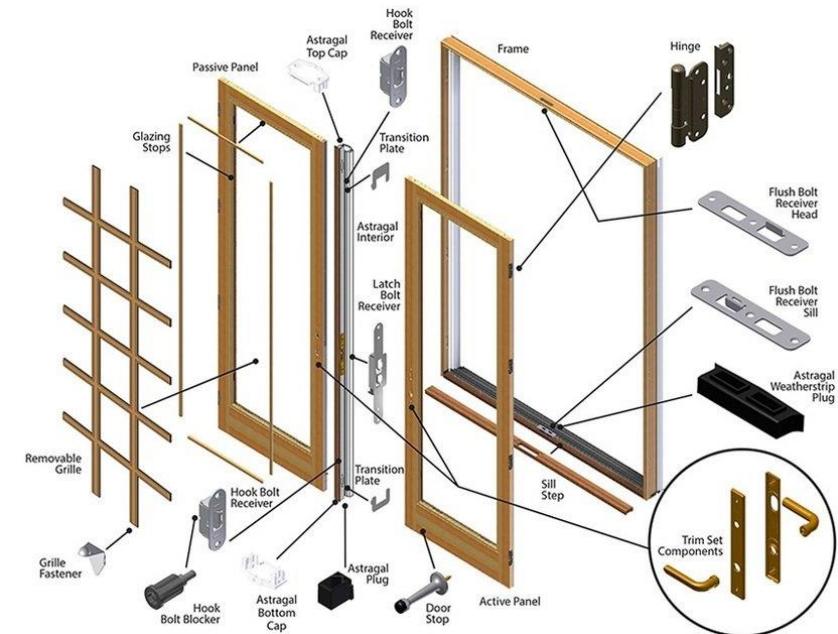
KLASSIFIKAATORID

Miks? Et „digimaailm“ ja „päris maailm“ räägiks üht keelt!



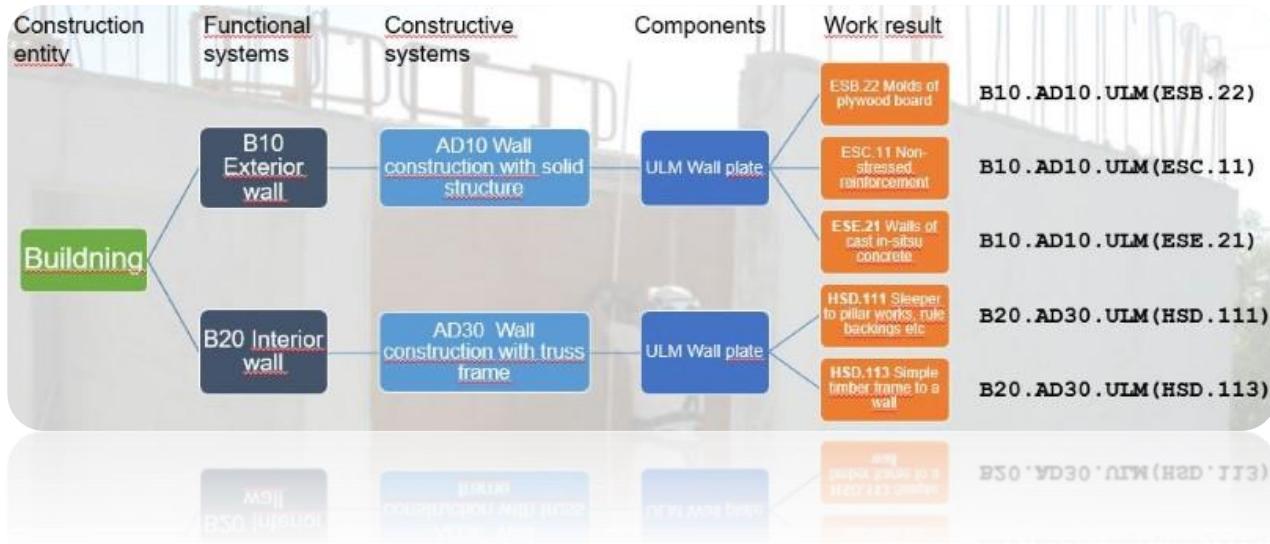
Björnsson 1997 12 17

Allikas: [CoClass](#)



KLASSIFIKAATORID

CoClass näitel:



Uniclass 2015 näitel:

| Code | Group | Sub group | Title |
|----------|-------|-----------|---------------------|
| EF_20 | 20 | | Structural elements |
| EF_20_05 | 20 | 05 | Substructure |
| EF_20_10 | 20 | 10 | Frames |
| EF_20_20 | 20 | 20 | Beams |
| EF_20_30 | 20 | 30 | Columns |
| EF_20_50 | 20 | 50 | Bridge abutments |
| EF_25 | 25 | | Wall and barriers |
| EF_25_10 | 25 | 10 | Walls |
| EF_25_30 | 25 | 30 | Doors and windows |
| ... | ... | ... | ... |
| EE_32_30 | 32 | 30 | Doors and windows |
| EE_32_10 | 32 | 10 | Walls |

DATA-TEMPLATES

GS1 standards & structured DATA TEMPLATES

Request product information (seven attributes):

1. GTIN
 2. Target Market
 3. Brand
 4. Company Name
 5. Label Description
 6. Medium Resolution Image
 7. Global Product Classification
-
8. Resistance to fire according to EN 13501-2 (EI 15; EI 30; EI 45)
 9. Resistance to wind load class according to EN 12211 (class 0; class 1)
 10. Burglar resistance according to EN 356 (P1A; P2A; P3A)
 11. Frame width according to EN 12519 (width of the frame in mm)
 12. Clear opening width according to EN 12519 (fire escape width in mm)
 13. Colour according to Natural Colour System (NCS 4055-R95B)
 14. Colour according to RAL classic system (RAL 1005)
 15. Global warming potential according to EN 15804 (kgCO₂ eq/piece)
 16. Warranty period (number of months)

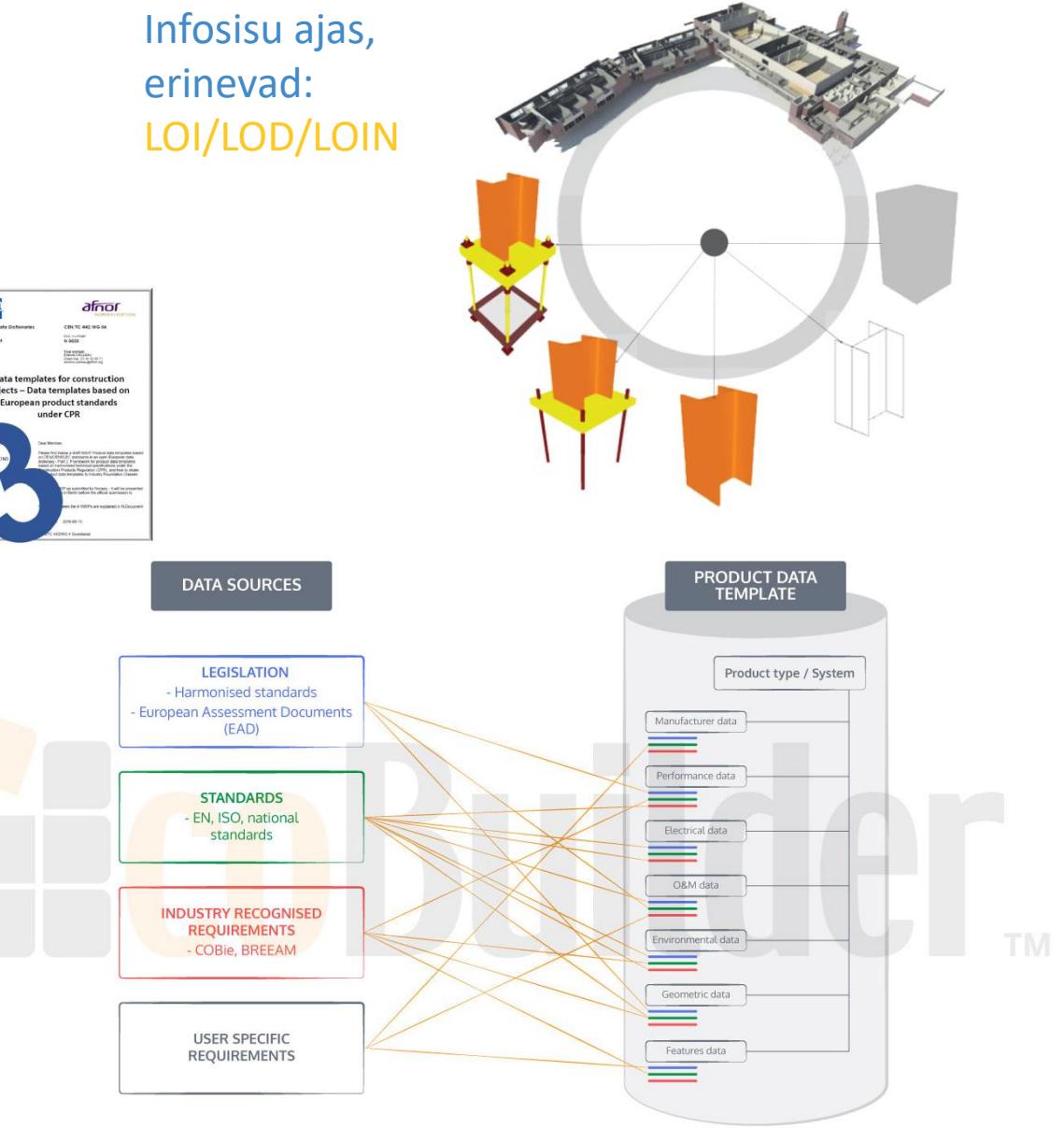
Standardiseeritud
kujul kirjeldatava
spetsiilised
andmekogud



Data Template

2 3

Infosisu ajas,
erinevad:
LOI/LOD/LOIN



| | | | |
|--------------------------|---|---|--------------|
| 00 PRELIMINARY | Information exchange | <u>ISO/AWI 19650-4</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 4: Information exchange | <u>20.00</u> |
| 10 PROPOSAL | Framework for object-oriented information | <u>ISO/WD 12006-3</u> Building construction — Organization of information about construction works — Part 3: Framework for object-oriented information | <u>20.20</u> |
| 20 PREPARATORY | GIS (Geospatial) / BIM interoperability | <u>ISO/WD TR 23262</u> GIS (Geospatial) / BIM interoperability | <u>20.20</u> |
| 30 COMMITTEE | Operational phase of assets | <u>ISO/DIS 19650-3</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 3: Operational phase of assets | <u>40.20</u> |
| 40 ENQUIRY | Security-minded approach to information management | <u>ISO/DIS 19650-5</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 5: Security-minded approach to information management | <u>40.60</u> |
| 50 APPROVAL | Data templates | <u>ISO/DIS 23387</u> Building Information Modelling (BIM) — Data templates for construction objects used in the life cycle of any built asset — Concepts and principles | <u>40.60</u> |
| 60 PUBLICATION | Dynamic semantics | <u>ISO/DIS 21597-2</u> Information container for data drop — Exchange specification — Part 2: Dynamic semantics | <u>40.99</u> |
| 90 REVIEW | | | |
| 95 WITHDRAWAL | | | |

| | |
|----|-------------|
| 00 | PRELIMINARY |
| 10 | PROPOSAL |
| 20 | PREPARATORY |
| 30 | COMMITTEE |
| 40 | ENQUIRY |
| 50 | APPROVAL |
| 60 | PUBLICATION |
| 90 | REVIEW |
| 95 | WITHDRAWAL |

| | | | | |
|----------------|--|--|-------|------------|
| 50 APPROVAL | Container | <u>ISO/FDIS 21597-1</u> Information container for data drop — Exchange specifaciton — Part 1: Container | 50.00 | 2/3 |
| | Properties in interconnected dictionaries | <u>ISO/FDIS 23386</u> Building information modelling and other digital processes used in construction — Methodology to describe, author and maintain properties in interconnected dictionaries | 50.00 | |
| | Framework for classification | <u>ISO 12006-2:2015</u> Building construction — Organization of information about construction works — Part 2: Framework for classification | 60.60 | |
| | Data schema | <u>ISO 16739-1:2018</u> Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries — Part 1: Data schema | 60.60 | |
| | Data structures for electronic product catalogues for building service | <u>ISO 16757-1:2015</u> Data structures for electronic product catalogues for building services — Part 1: Concepts, architecture and model | 60.60 | |
| | Data structures for electronic product catalogues for building service | <u>ISO 16757-2:2016</u> Data structures for electronic product catalogues for building services — Part 2: Geometry | 60.60 | |
| | Organization and digitization of information about buildings and civil engineering works | <u>ISO 19650-1:2018</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles | 60.60 | |
| | Organization and digitization of information about buildings and civil engineering works | <u>ISO 19650-2:2018</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 2: Delivery phase of the assets | 60.60 | |
| | Information delivery manual | <u>ISO 29481-1:2016</u> Building information models — Information delivery manual — Part 1: Methodology and format | 60.60 | |

| | | | |
|--------------------|-----------|--|--|
| 00 | | | |
| PRELIMINARY | | | |
| 10 | | | |
| PROPOSAL | | | |
| 20 | | | |
| PREPARATORY | | | |
| 30 | | | |
| COMMITTEE | | | |
| 40 | | | |
| ENQUIRY | | | |
| 50 | | | |
| APPROVAL | | | |
| 60 | | | |
| PUBLICATION | | | |
| 90 | | | |
| REVIEW | 90 | | |
| 95 | | | |
| WITHDRAWAL | | | |

| | | |
|--|---|------------------------------|
| Framework for object-oriented information | <u>ISO 12006-3:2007</u> Building construction — Organization of information about construction works — Part 3: Framework for object-oriented information | <u>90.92</u> |
| Framework for building information modelling (BIM) guidance | <u>ISO/TS 12911:2012</u> Framework for building information modelling (BIM) guidance | <u>90.92</u> |
| Guidelines for knowledge libraries and object libraries | <u>ISO 16354:2013</u> Guidelines for knowledge libraries and object libraries | <u>90.93</u> |
| Framework for management of project information | <u>ISO 22263:2008</u> Organization of information about construction works — Framework for management of project information | <u>90.93</u> |
| Information delivery manual | <u>ISO 29481-2:2012</u> Building information models — Information delivery manual — Part 2: Interaction framework | <u>90.93</u> |

WAIT, WHY, WHAT?:D

...standardite baasilt:

- **BIM juhendmaterjalid** - põhimõtteid kokku võtvad dokumendid
 - riik/ettevõtete juhendmaterjalid/nõuded
 - » Projektipõhised rakenduskavad
- **IT-süsteemide ülesehitamise võimalikkus**
 - Veebipõhised (koostöö-)platvormid aga ka *desktop* tarkvarad;
 - » Failid; Andmebaasid, API, CDE, etc...;
 - » Sisseehitatavad automatiseeritavad protsessid;



PÕHIMÕTTED

Standardiseeritud ja masinkäsitletavate andmete kogumine ehituse elukaarel:

- *All-digital* ;)
- Struktureeritud-masinkäsitletaval kujul andmed;
- Rahvusvaheliselt kokku lepitud põhimõtted:
 - » Avatud andmeedastusformaadid ja platvormid
 - » Protsessid.

KOKKUVÕTTEKS:

Digitaliseeri , Integreeri & Automatiseeri –

- Lähte- ja hetkeolukord
- Protsessid
- Projektiloome ja teostus
- ...

Analüüs & Ennusta!

TÄNUD TÄHELEPANU EEST!

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