

# EHITUSSEKTORI TARNEAHEL

digitaliseerimise võimalustest

**ETTEKANNE**

**Hendrik Park**

24.04.2020

DIGIEHITUSE TÖÖVÕOD



- IT konsultatsiooni ja müügi ettevõte
- 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

# MINA

Linked 



**Digitaalehituse konsultant**  
2018 -

INTELSYS  BUILD

**Tootejuht**  
2018 - 2020

**TAL  
TECH**

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



**Projekteerimise  
projektijuht**  
2017 - 2018



**Objektijuht /  
Projektijuht**  
2013 - 2017



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

# SISUKORD

## PROBLEEM

Kas, kus, mis?

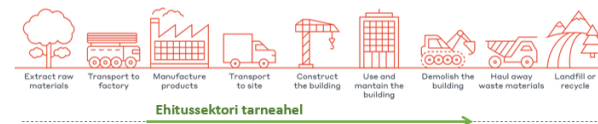


24.04.2020 | Digiehituse töövood 2020

5



## TARNEAHELA DIGITALISEERIMINE



24.04.2020 | Digiehituse töövood 2020

8



## STANDARDISEERIMISEST

„digi-koostöö“ võimaldaja



24.04.2020 | Digiehituse töövood 2020

23



# PROBLEEM

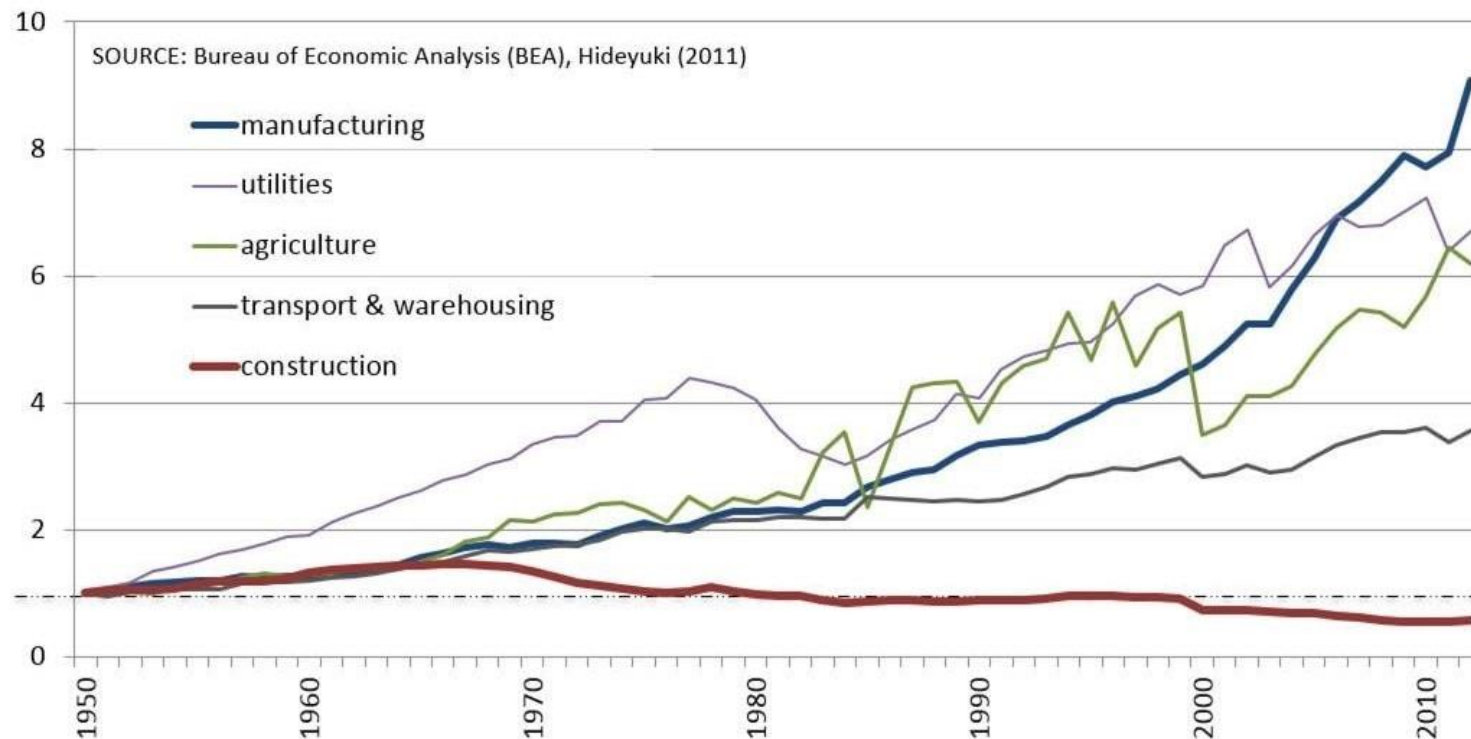
Kas, kus, mis?



# PROBLEEM

## Construction productivity 1950-2012

Real productivity (GDP value-add per employee) by industry in the US  
Indexed; 1950 = 1.0



**Construction matters for the world economy**  
... but has a long record of poor productivity

Construction-related spending  
accounts for  
**13%**  
of the world's GDP

...but the sector's annual productivity  
growth has only increased  
**1%**  
over the past 20 years

**\$1.6 trillion**  
meeting half the world's infrastructure need

of additional value added could be  
created through higher productivity,

Allikas: McKinsey & Company 2017

# PÕHJUSED?

- Koostöövormid?
- Aegunud projektlahendused?
- Optimeerimata ehitusprotsess?
- Töötajate kompetents?
- Tänapäevaste süsteemide?
- Regulatsioonid?
- Vähene tehnoloogia- ja innovatsioon?
- ...
- **Ebaefektiivne tarneaahel tervikuna?!**



...ja kõige selle juures vähene digitaliseeritus:



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

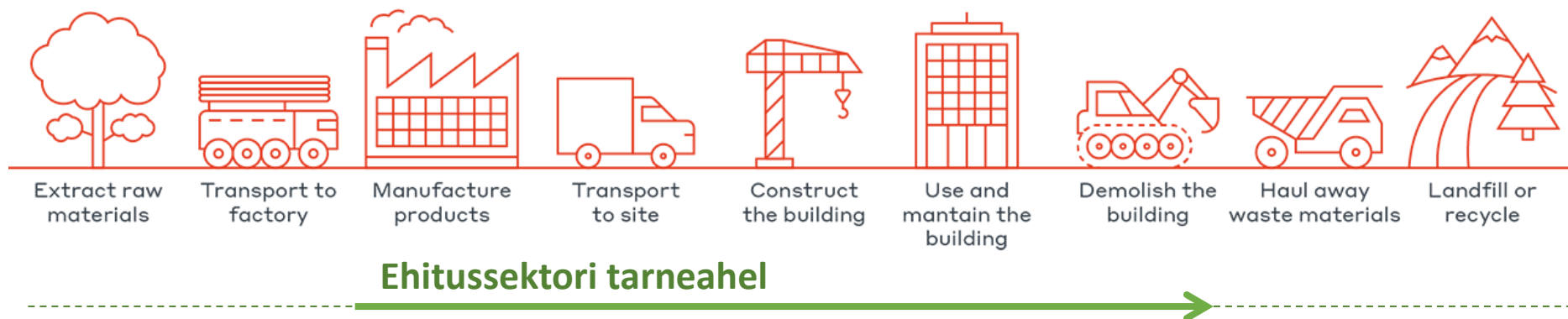
Relatively low digitization  Relatively high digitization

● Digital leaders within relatively undigitized sectors



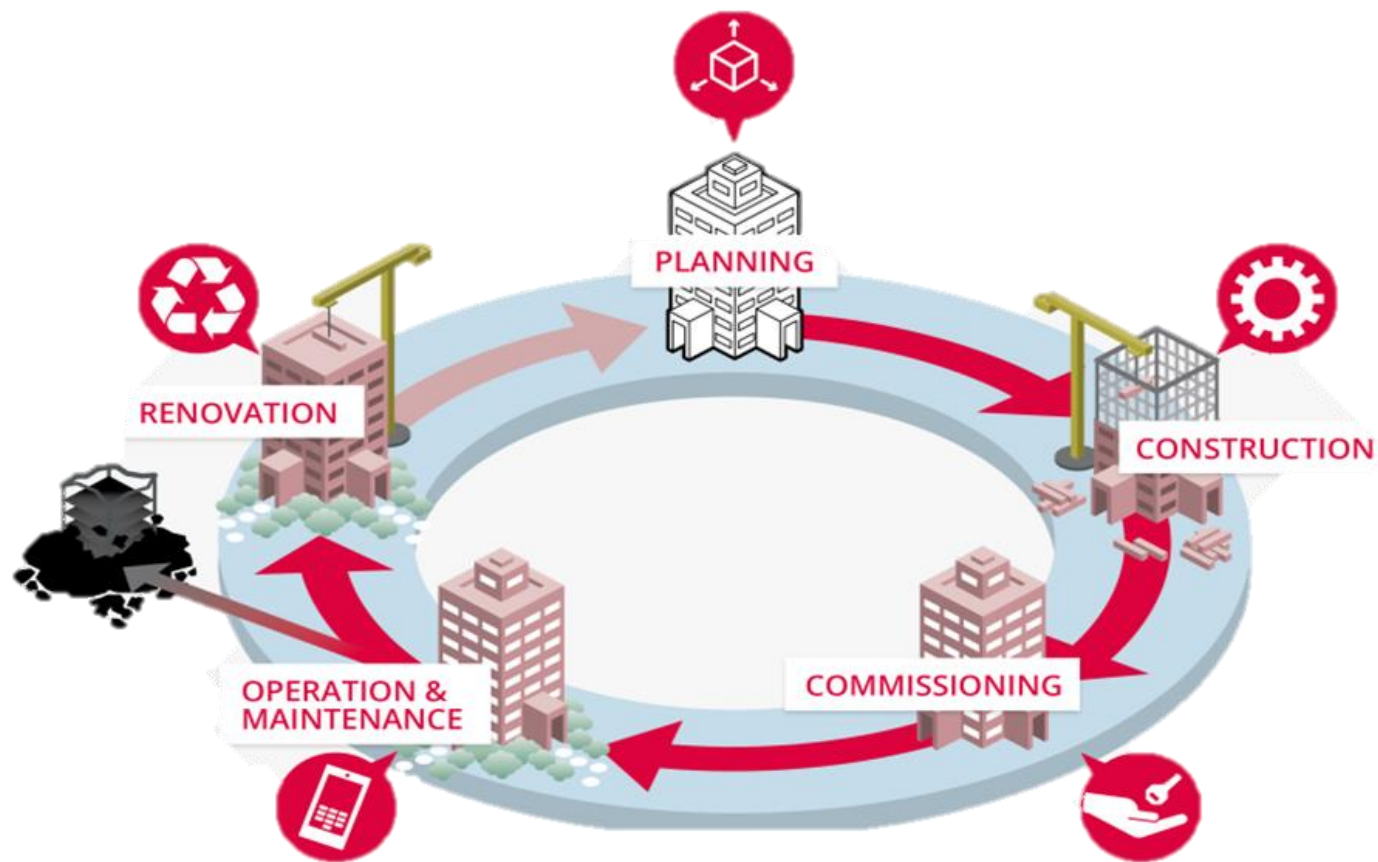
# TARNEAHELA

## DIGITALISEERIMINE

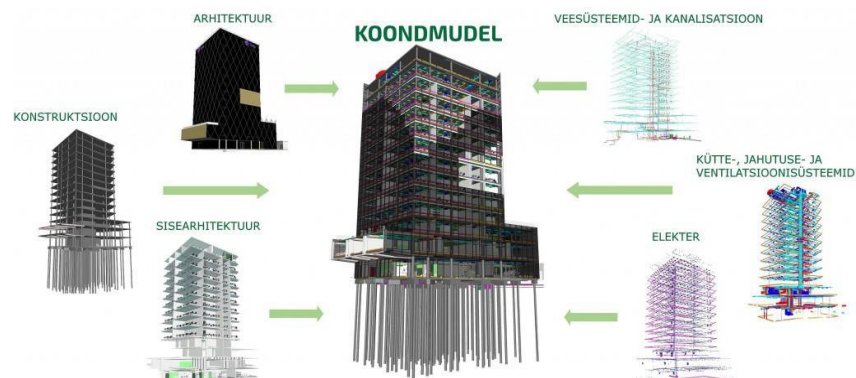




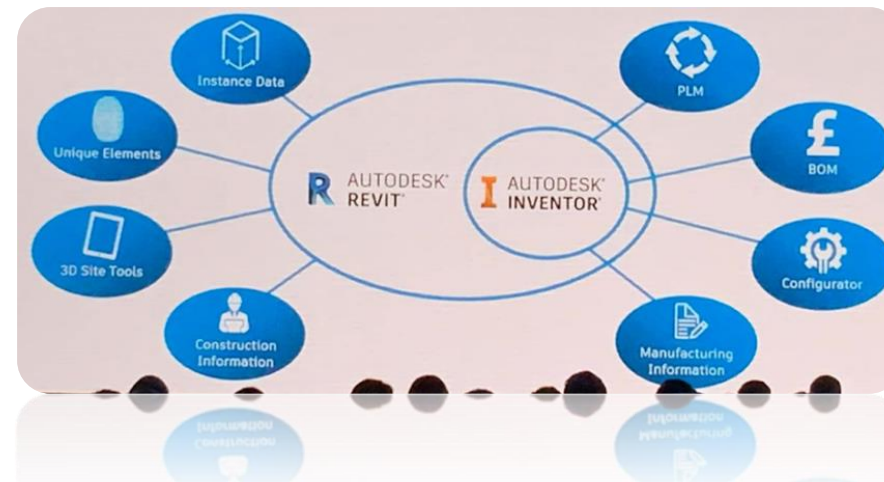
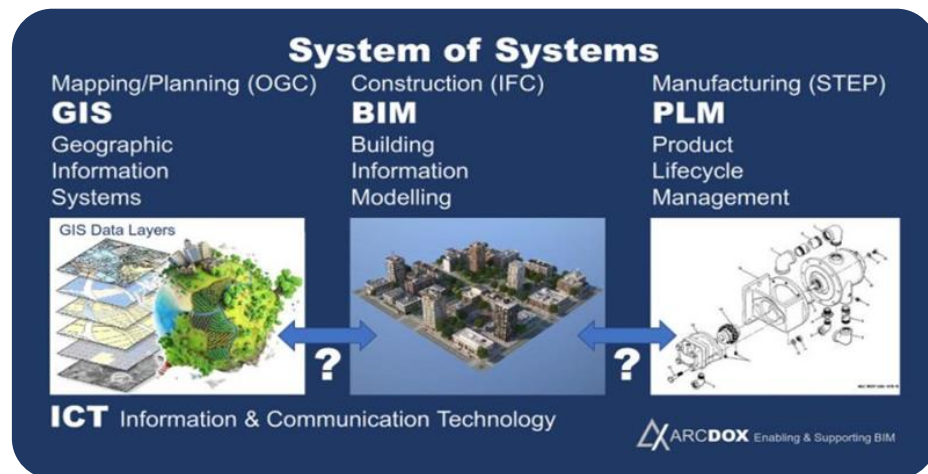
# HOONE ELUKAAR



# DIGITAALNE TEISIK

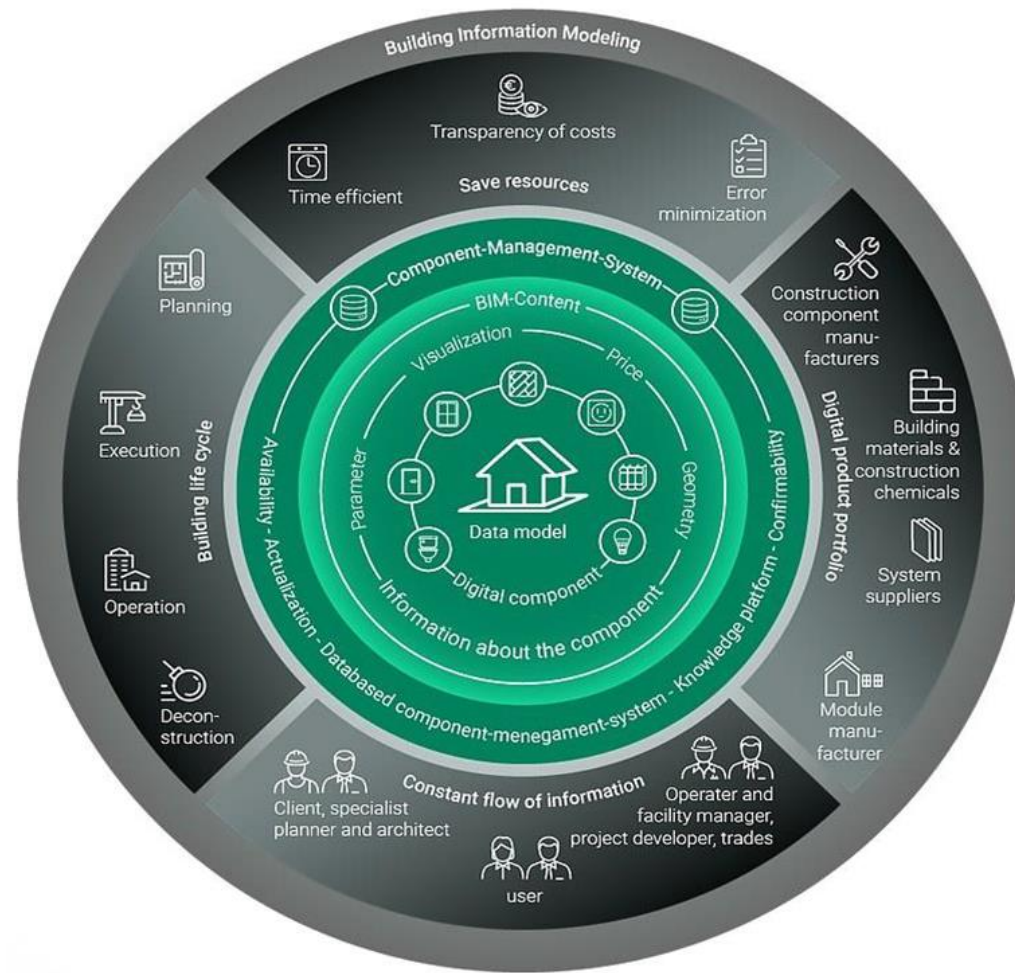


Joonis: Merko ehitus



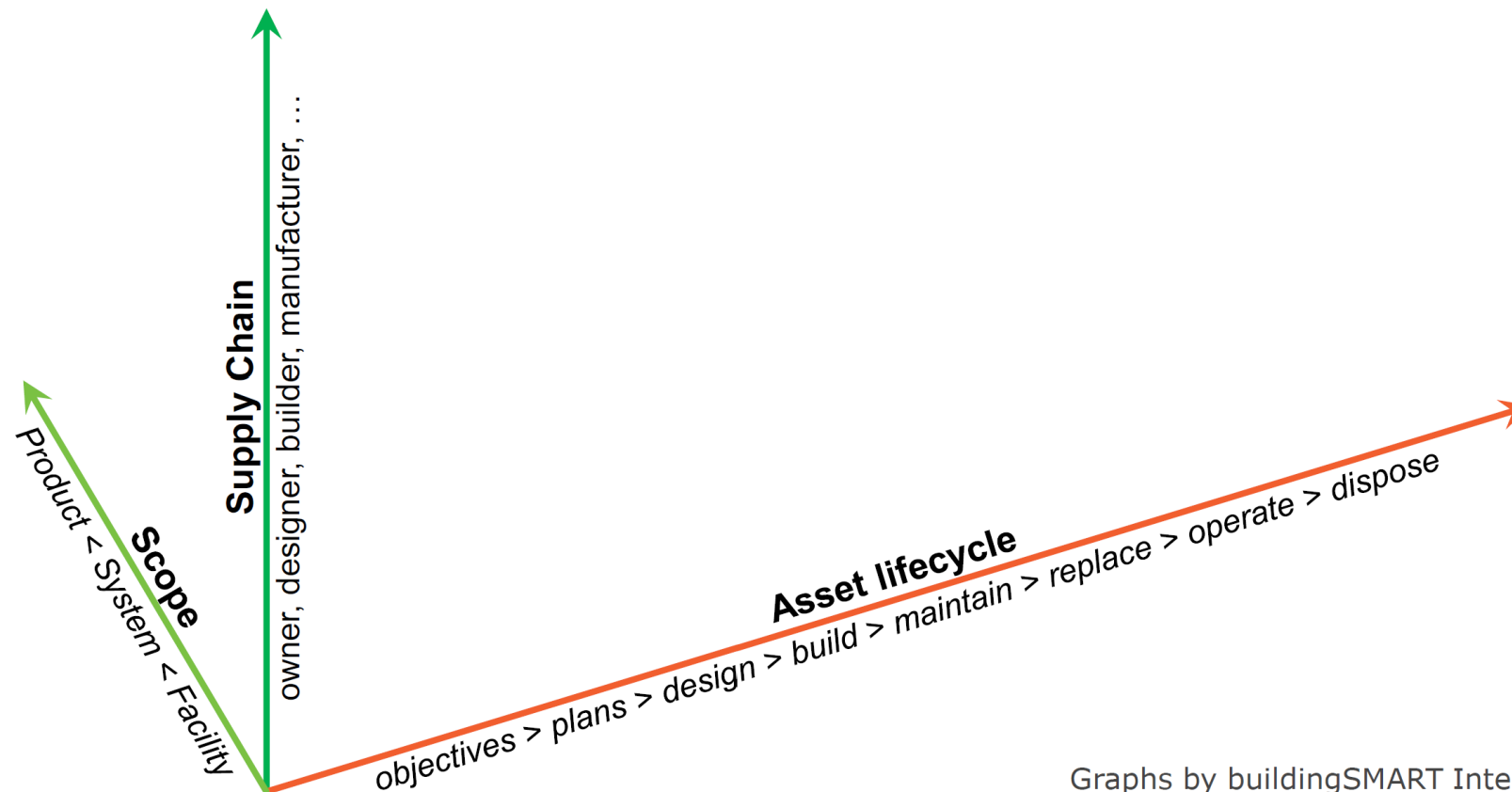
# BIM? Building Information Modelling / Model / Management

digitaalne  
teisik ehitatavast  
koos selle  
geomeetriasse  
struktureeritud  
andmekoguga...



... mis saaks olla  
aluseks protsesside  
automatiseeritumaks  
läbiviimiseks  
digitaliseeritud  
keskkonnas.

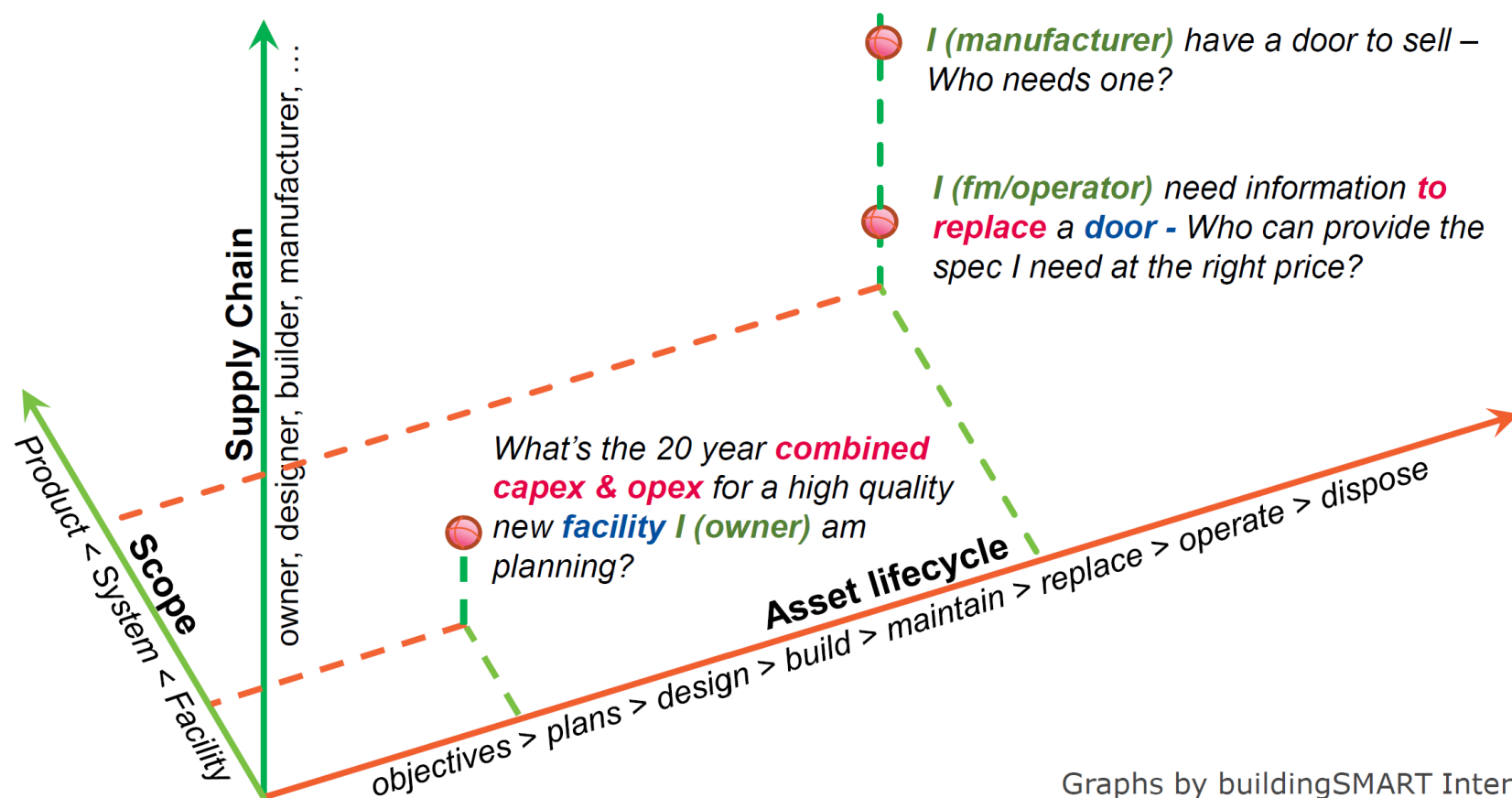
# DIGITAALSE KESKKONNA 3 DIMENSIOONI



Graphs by buildingSMART International

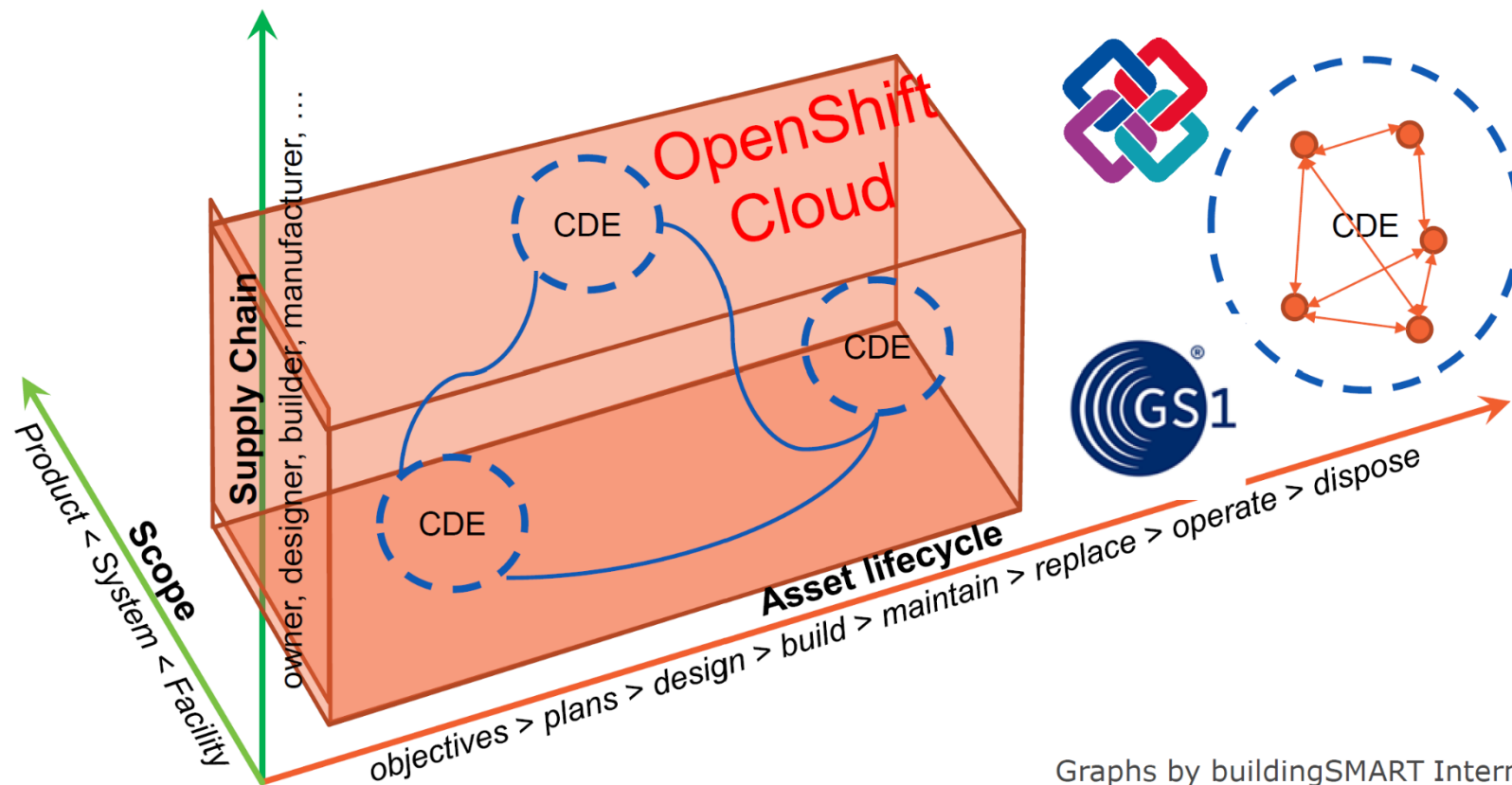


# DIGITAALSE KESKKONNA 3 DIMENSIOONI



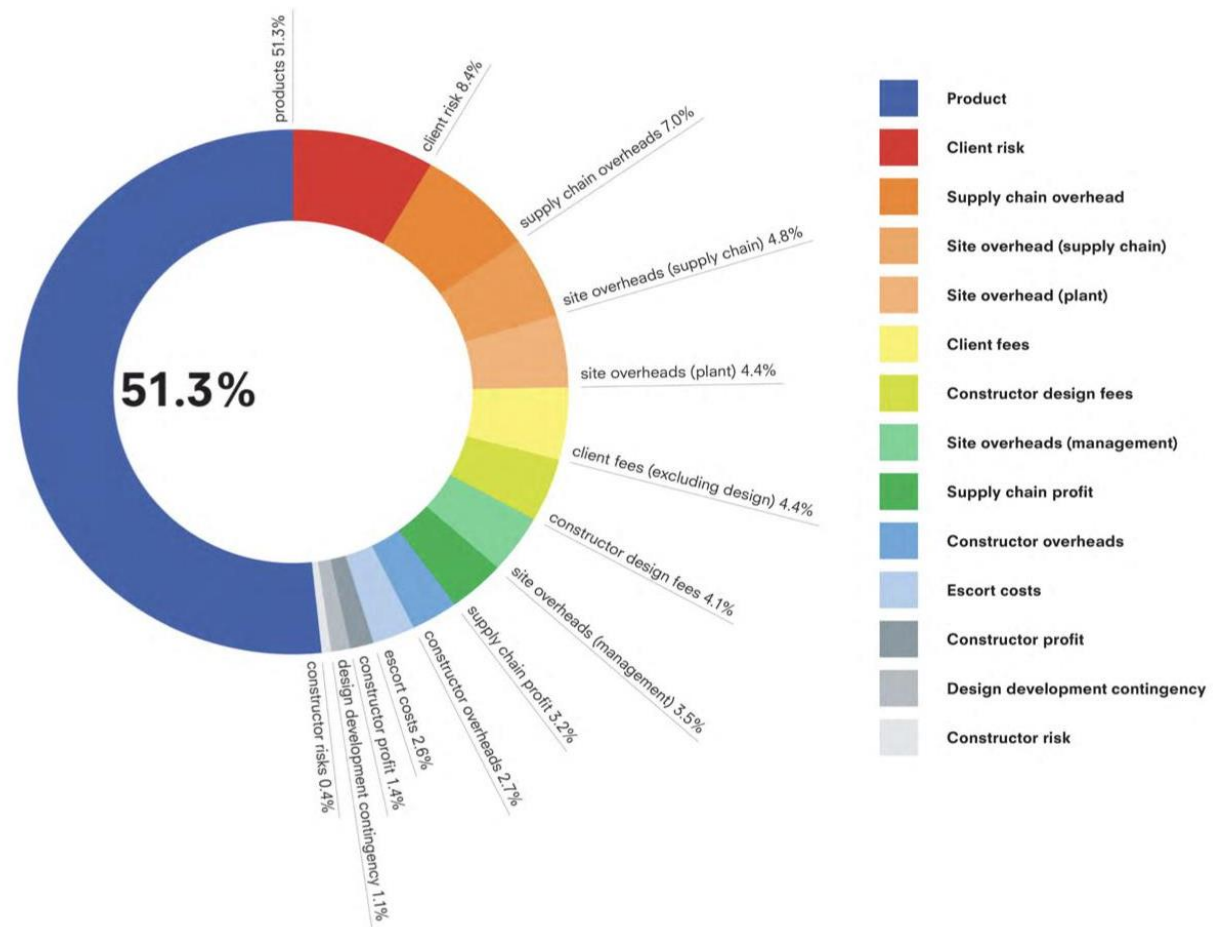
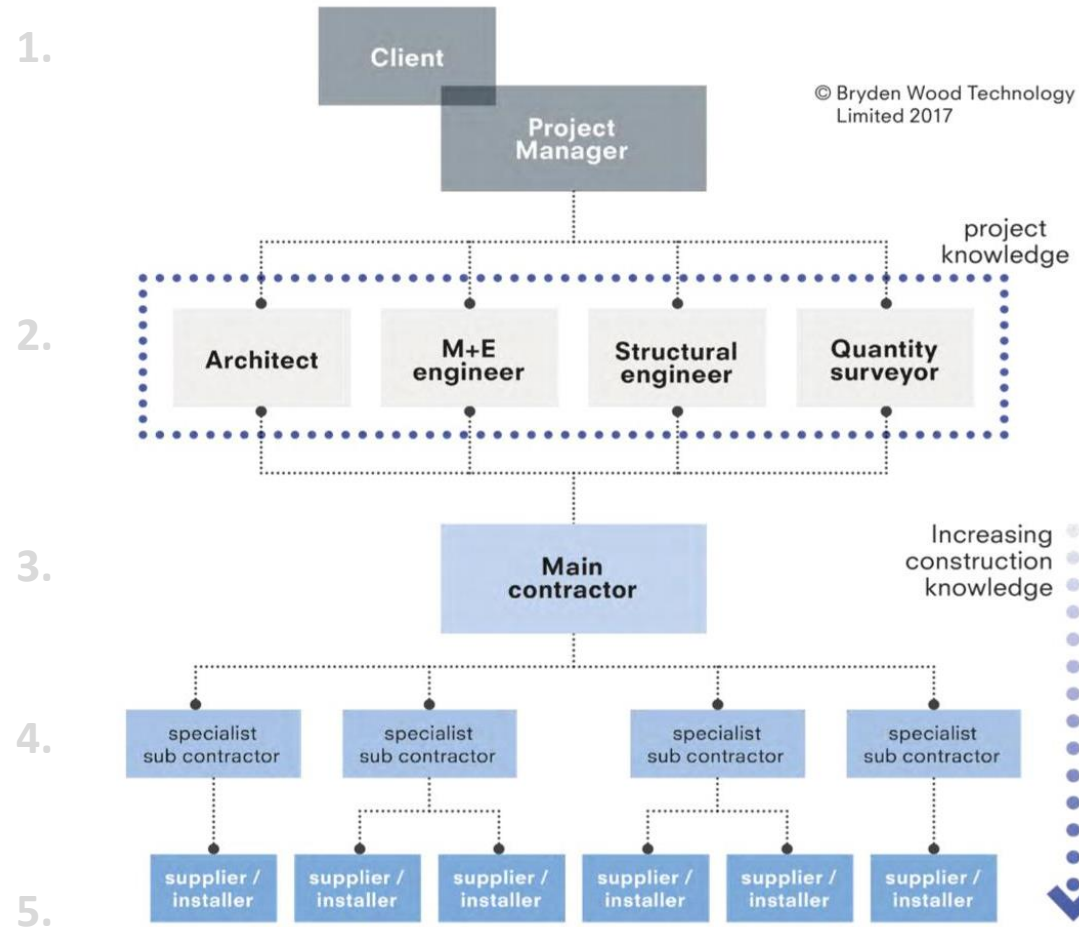
Graphs by buildingSMART International

# DIGITAALSE KESKKONNA 3 DIMENSIOONI

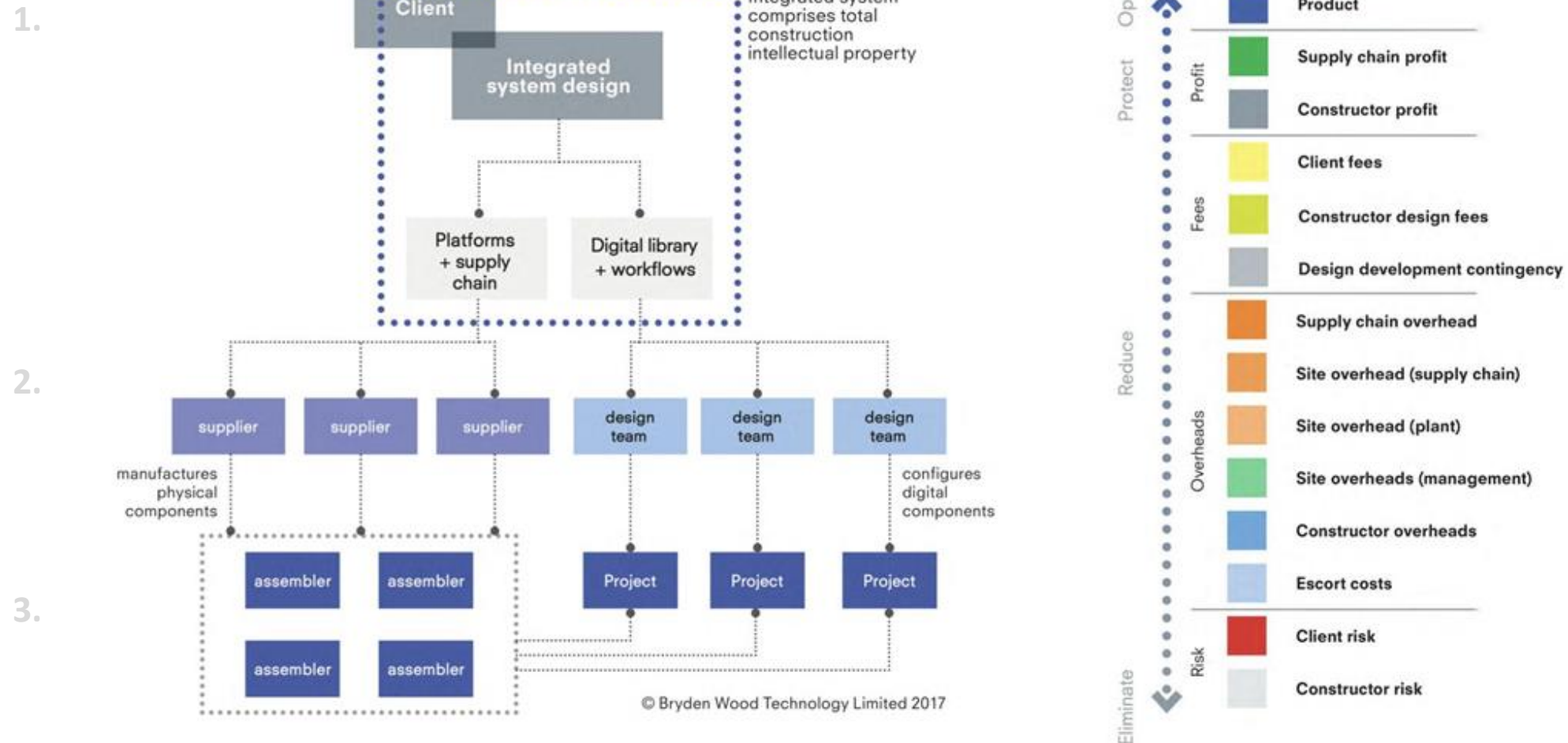


Graphs by buildingSMART International

# PROJEKTIPÕHINE TARNEAHEL (TÄNA)



# PROJEKTIPÕHINE TARNEAHEL (HOMME)

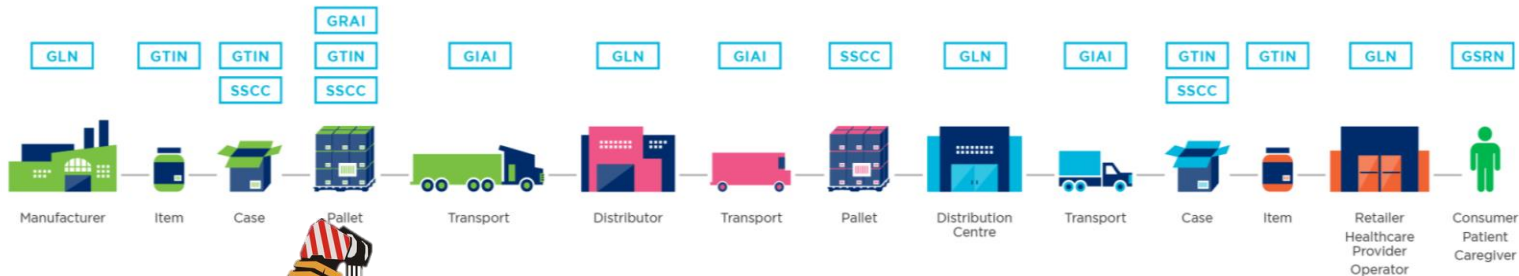




# „EHITUS-LEGO“

## Identify: GS1 Standards for Identification

GLN Global Location Number GTIN Global Trade Item Number SSCC Serial Shipping Container Code GRAI Global Returnable Asset Identifier GIAI Global Individual Asset Identifier GSRN Global Service Relation Number



## Capture: GS1 Standards for Barcodes & EPC/RFID

### GS1 Barcodes

EAN/UPC



9 501101 021037

ITF-14



1100 000001001 9

GS1 DataBar



GS1 DataMatrix



GS1 QR Code



GS1 Composite Barcode



EPC HF Gen 2



### GS1 EPC/RFID

EPC UHF Gen 2



## Share: GS1 Standards for Data Exchange

Master Data Synchronisation Network (GDSN) Transactional Data eCom (EDI) Event Data EPC Information Services (EPCIS)

### Interoperability

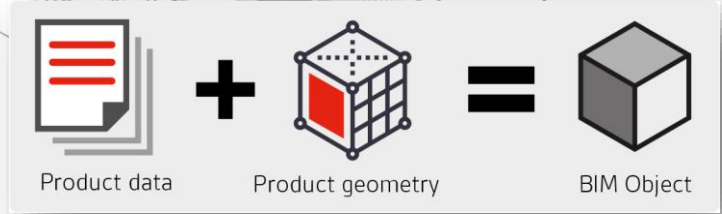
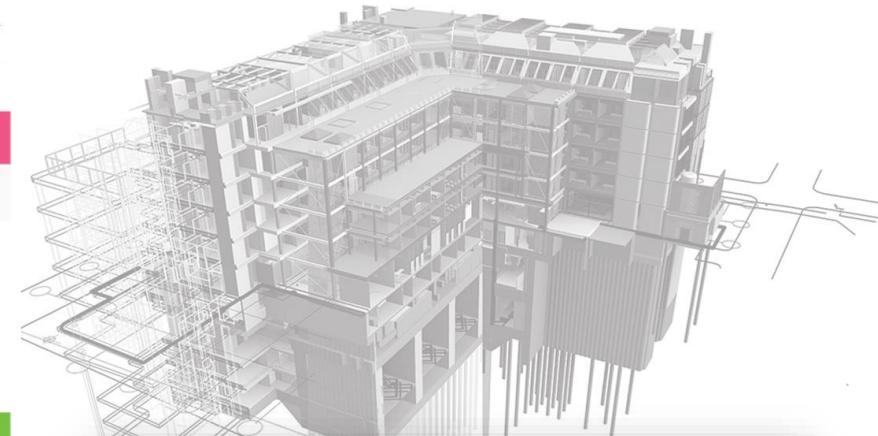
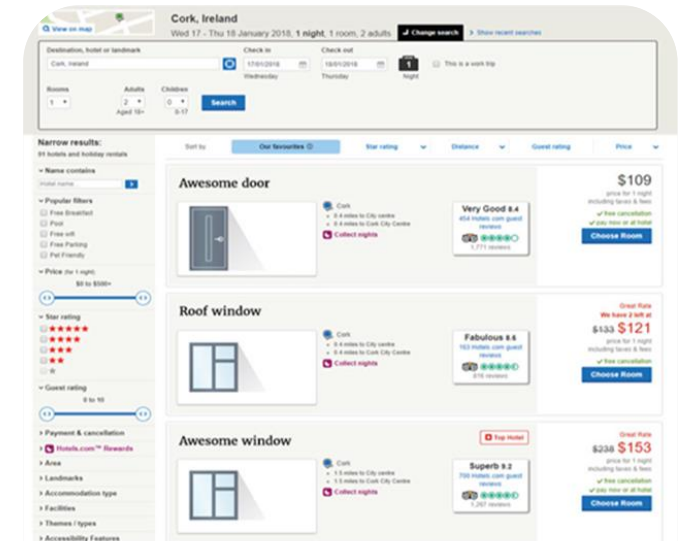
Item/Shipment Tracking

Traceability

Product Recall/Withdrawal

Pedigree

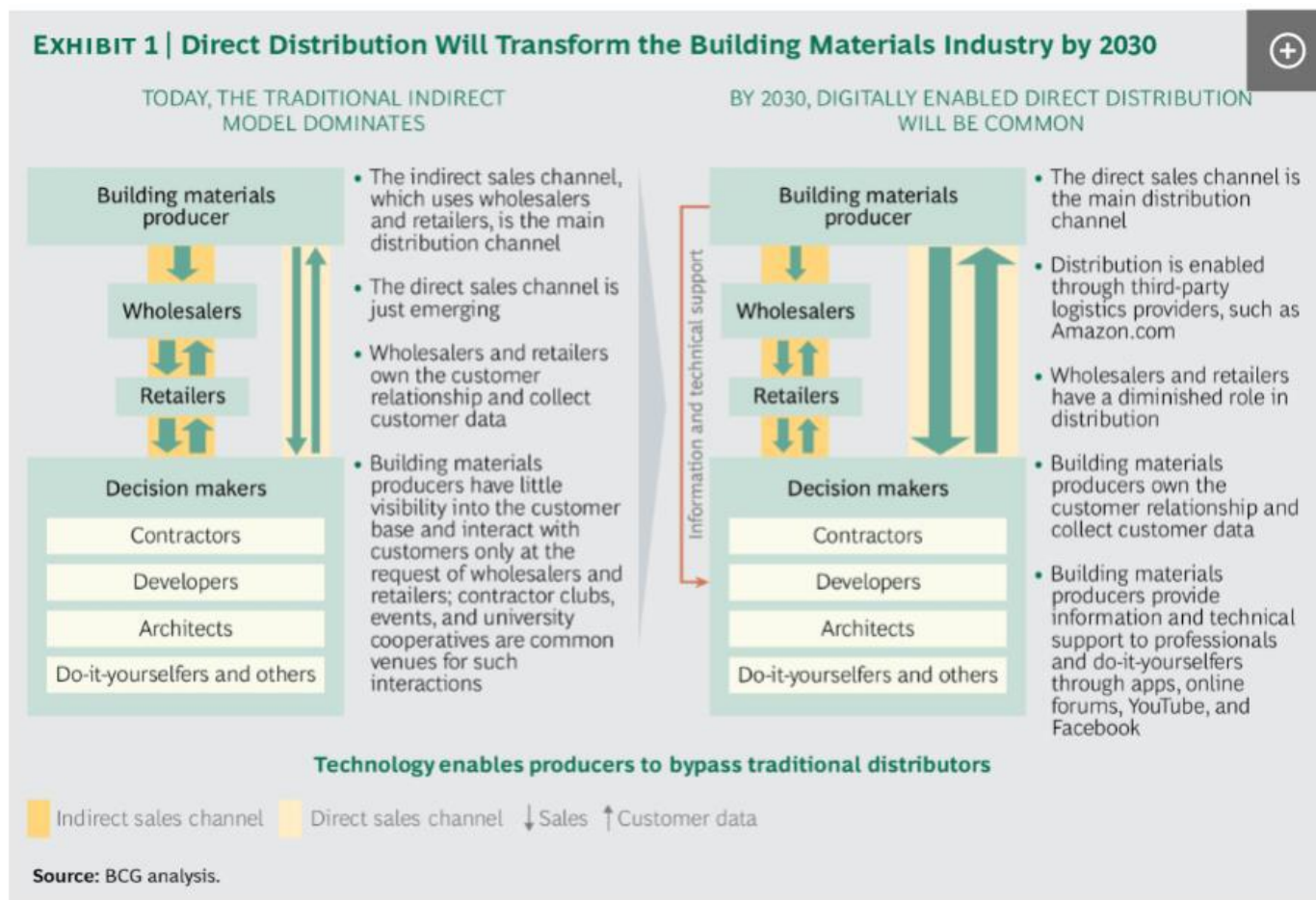
Purchase Order/Despatch Advice/Invoice



# EHITUSMATERJALIDE TURUSTAMISE TARNEAHEL

Täna

Homme

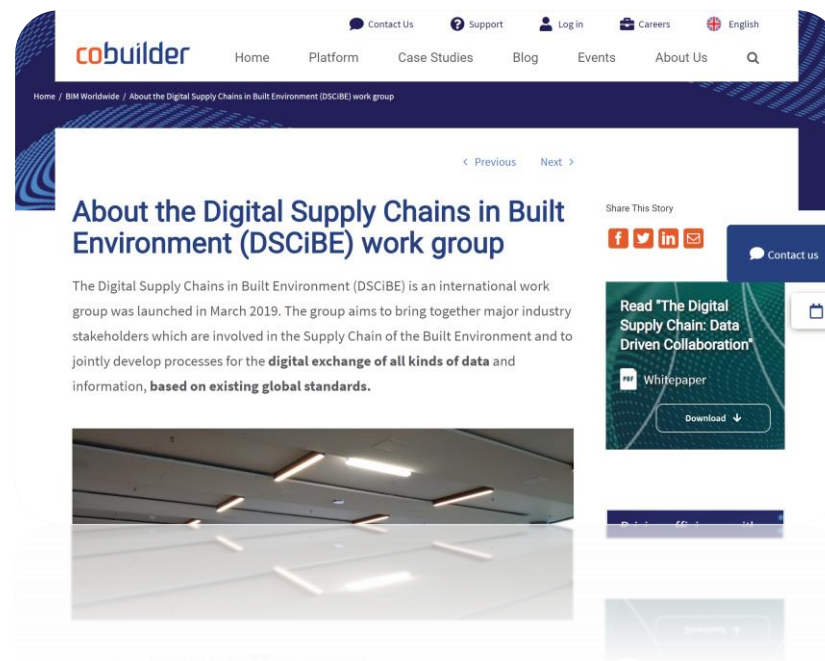


# DIGITALISEERITUD TARNEAHEL - erinevad initsiatiivgrupid

## DigiPLACE - Digital Platform for Construction in Europe



## DSCiBE - Digital Supply Chain in Built Environment





**Digital design:** Assist with document control and integration as design progresses from sketches to construction documents

## Preconstruction



**Estimating:** Automate and improve the accuracy of bid estimates



**Construction relationship management:** Provide dashboard for business-development pipeline



**Market intelligence:** Gather and analyze Information gathering from past projects and competitor performance



**Marketplace:** Create a platform for stakeholders to prequalify, evaluate, and select partners

## Construction



**Design management**



**Scheduling**



**Materials management**



**Field productivity**



**Equipment management**



**Quality control**



**Contract management**



**Performance dashboard**



**Document management**



**Safety**

Enterprise-resource-planning systems (ERP-systems)

## Operations and management



**Work-order management**



**Remote monitoring of building systems**



**Predictive analytics for system management**



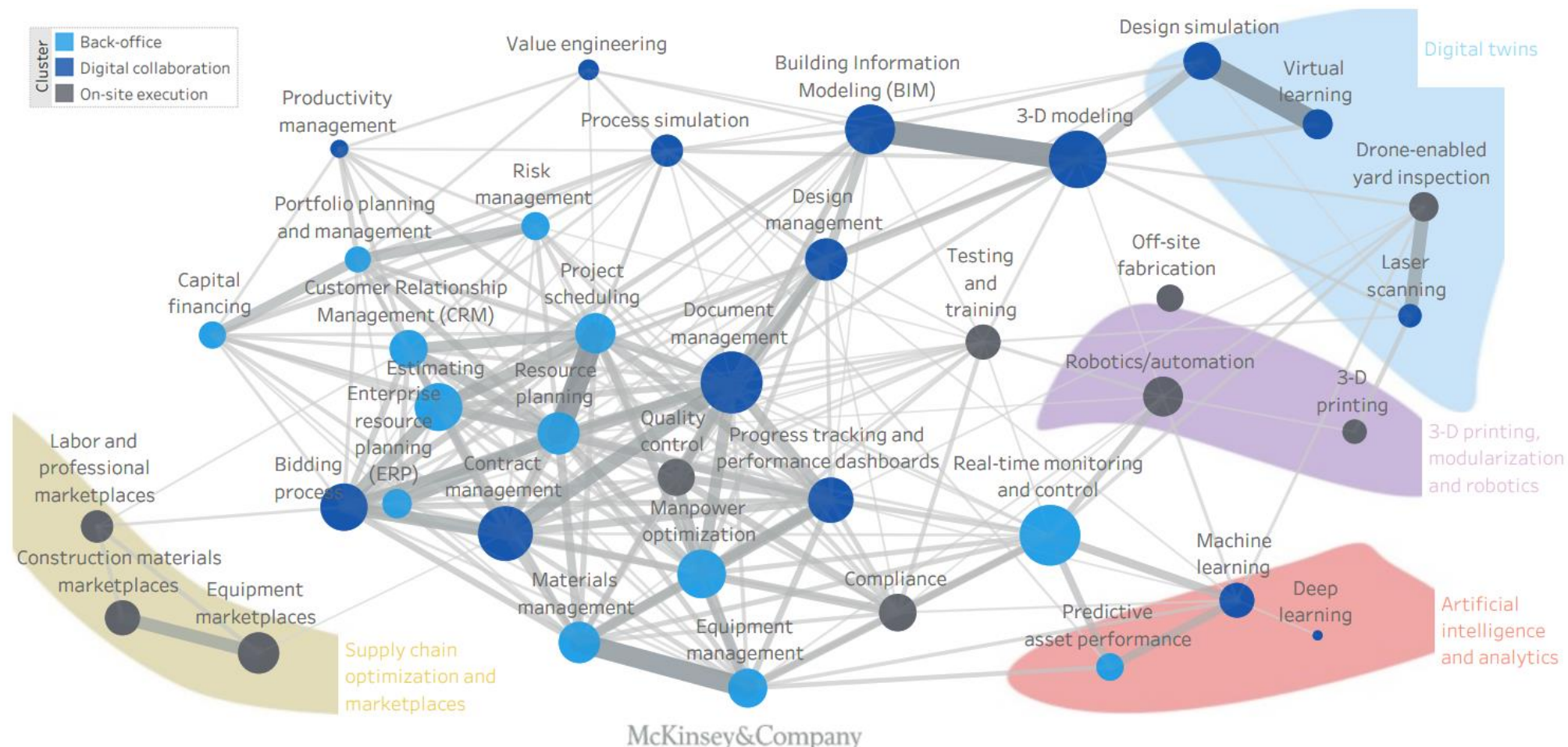
**Mid to small project management**



**Asset management with an ongoing record of facility performance and maintenance backlog**

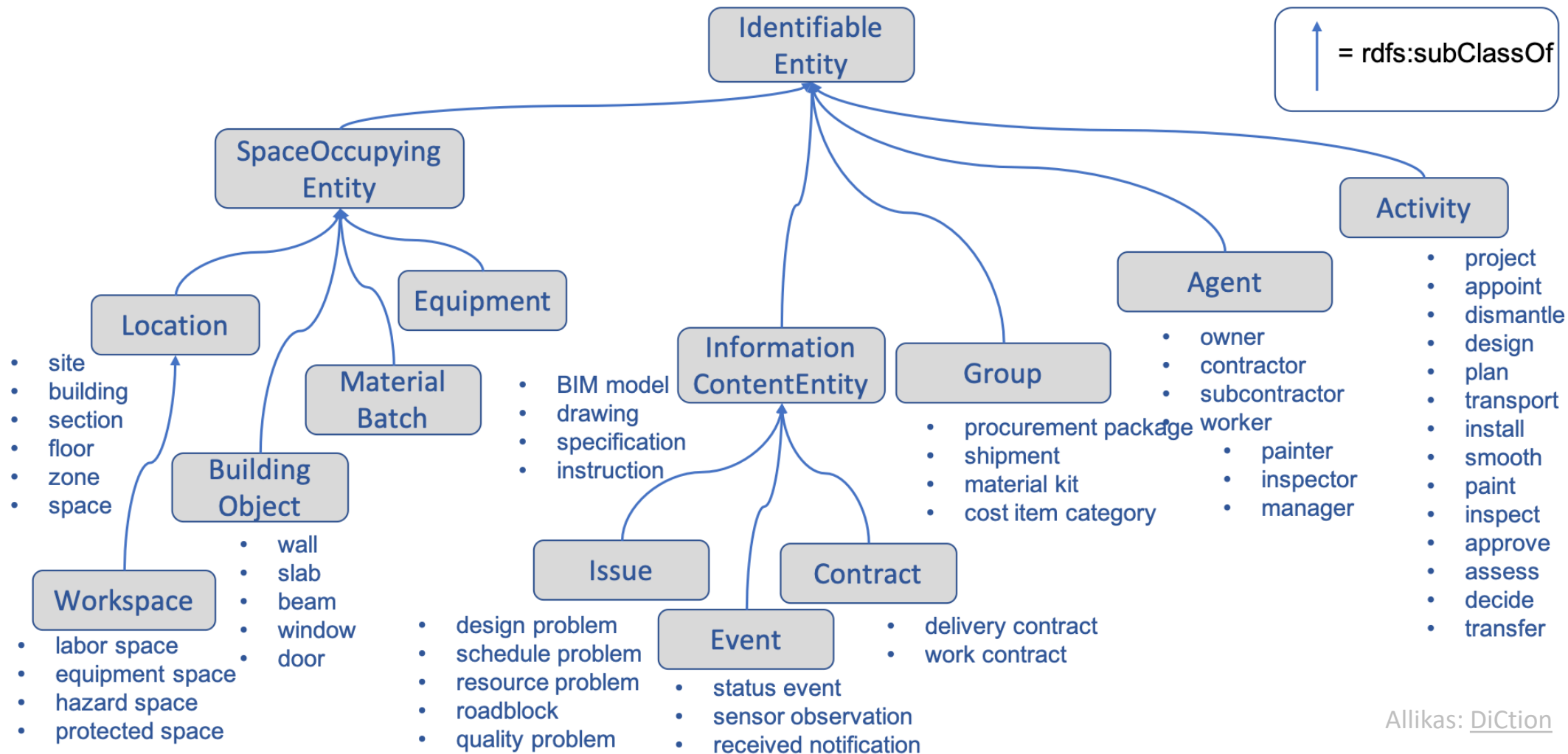


# TEHNOLOOGIAD – ERINEVAD VÕIMALDAJAD



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

# DIGITAL CONSTRUCTION ONTOLOGIES



Allikas: [DiCtion](#)



# STANDARDISEERIMISEST

„digi-koostöö“ võimaldaja



# MILLINE SEE EESTI JA ISO SEOS NÜÜD OLIGI?

**EVS/TK 50** – Eesti Standardkeskuse temaatikal „*Ehitusinformatsiooni modelleerimine (BIM)*“ tehniline komitee osaleb vastava Euroopa komitee kõrval standardite koostamisel ja tegeleb valminute tõlkimisega eesti keelde.

- Mõtestav eesmärk:
  - **BIM ja selle kasutusvõimalused ehitise elukaare jooksul.**
- Seejuures on siis:
  - **CEN/TC 442 „Building Information Modelling (BIM)“** - Euroopa tehnilise komitee
  - **ISO/TC 59 “Buildings and civil engineering work”** - rahvusvaheline tehniline komiteepeegelkomiteeks.



=



+

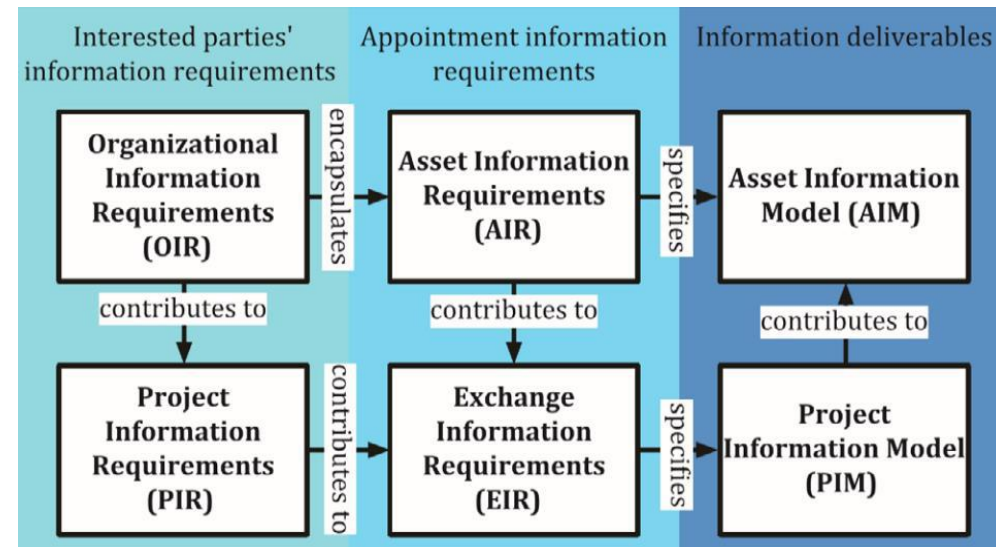


# high-level infohalduse STANDARTIMISEST

Erinevate tasemega **infovajaduste** ja  
nendest tekkivate **info nõuete juhtimine**:

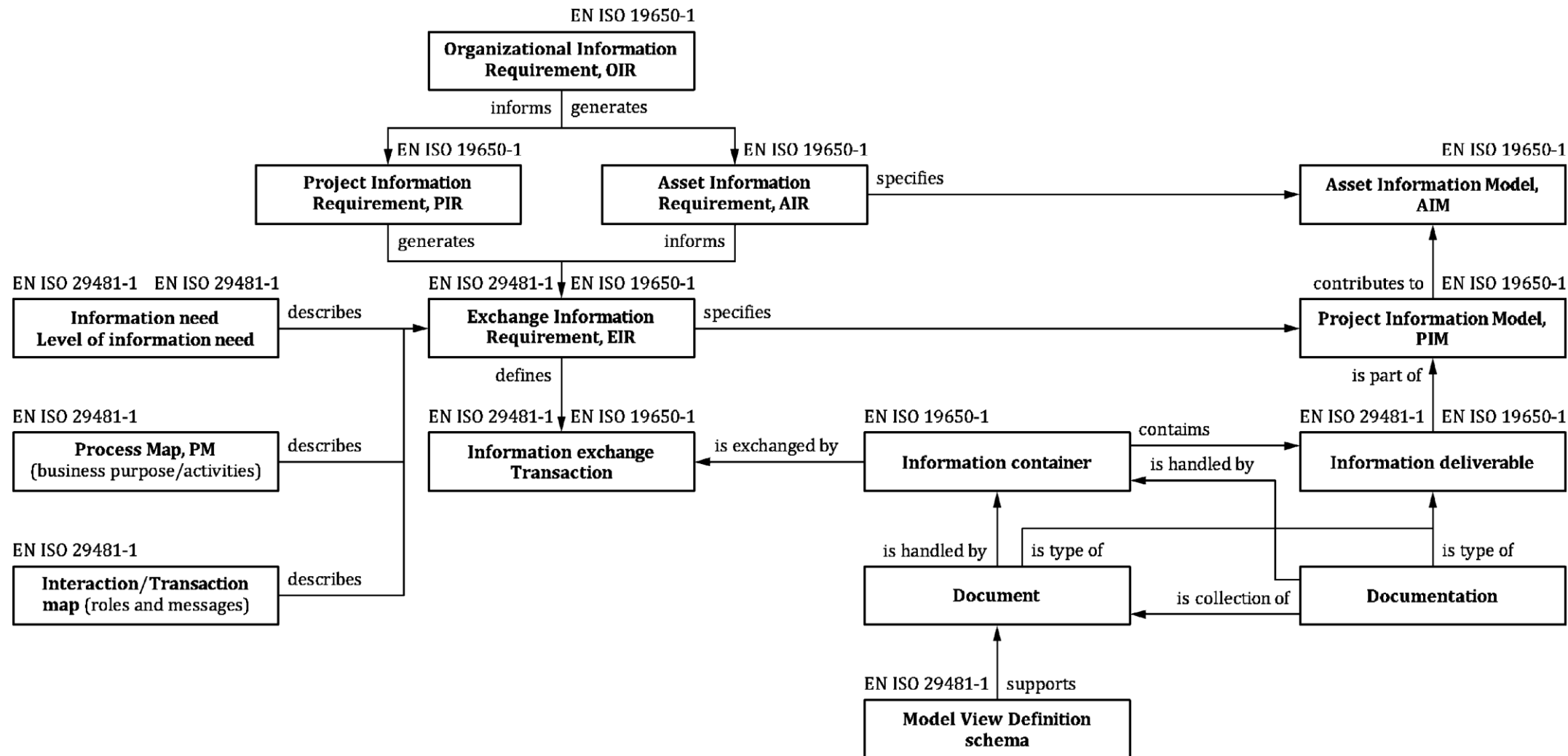


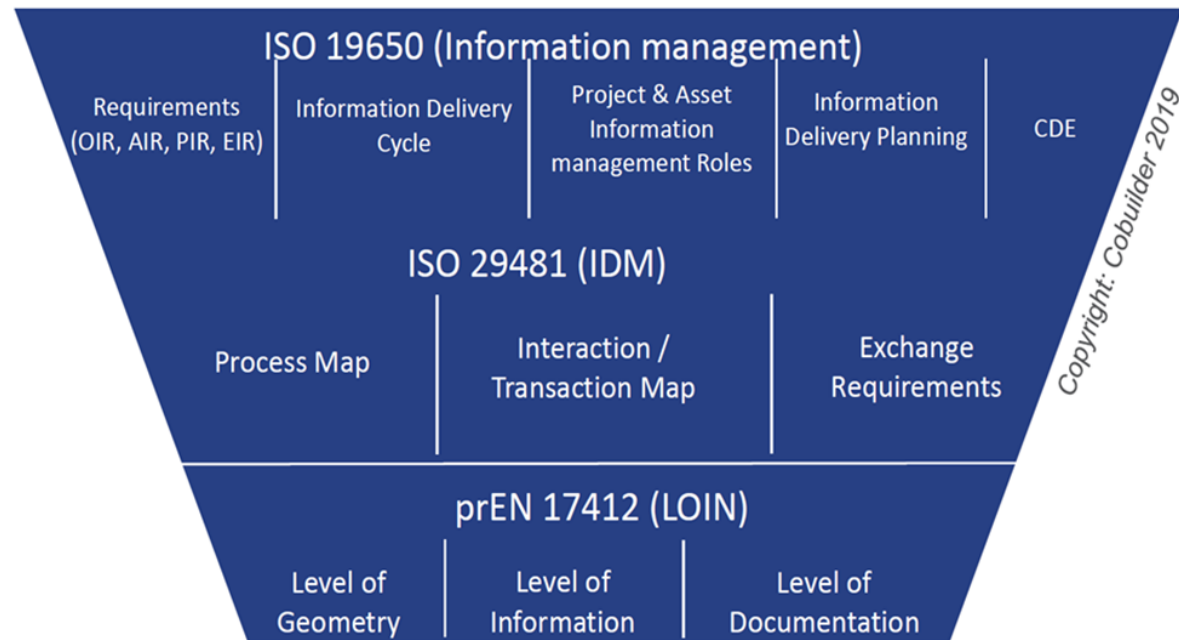
Joonis: ISO 19650-1:2018



Üldine ülevaade standardiseeritud  
kujul vara haldamise kohase info  
juhtimisest elukaarel.

# INFOVAHETUSE PÕHISTANDARDID

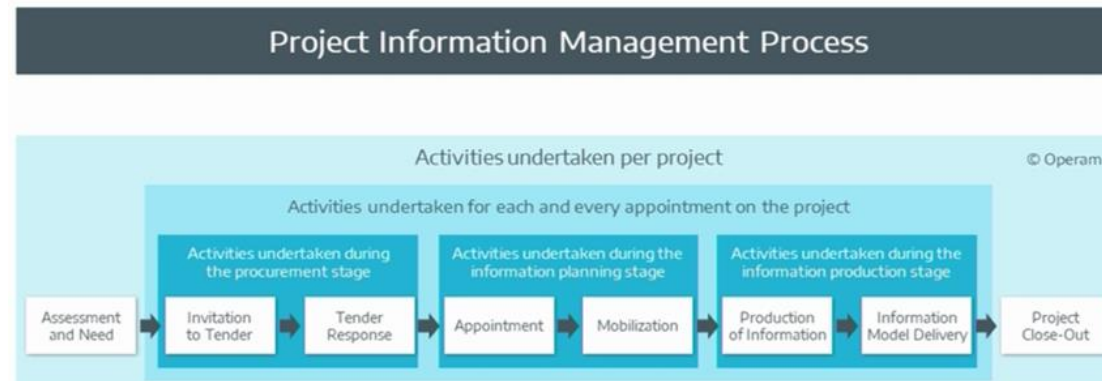




## ISO 19650 – 1

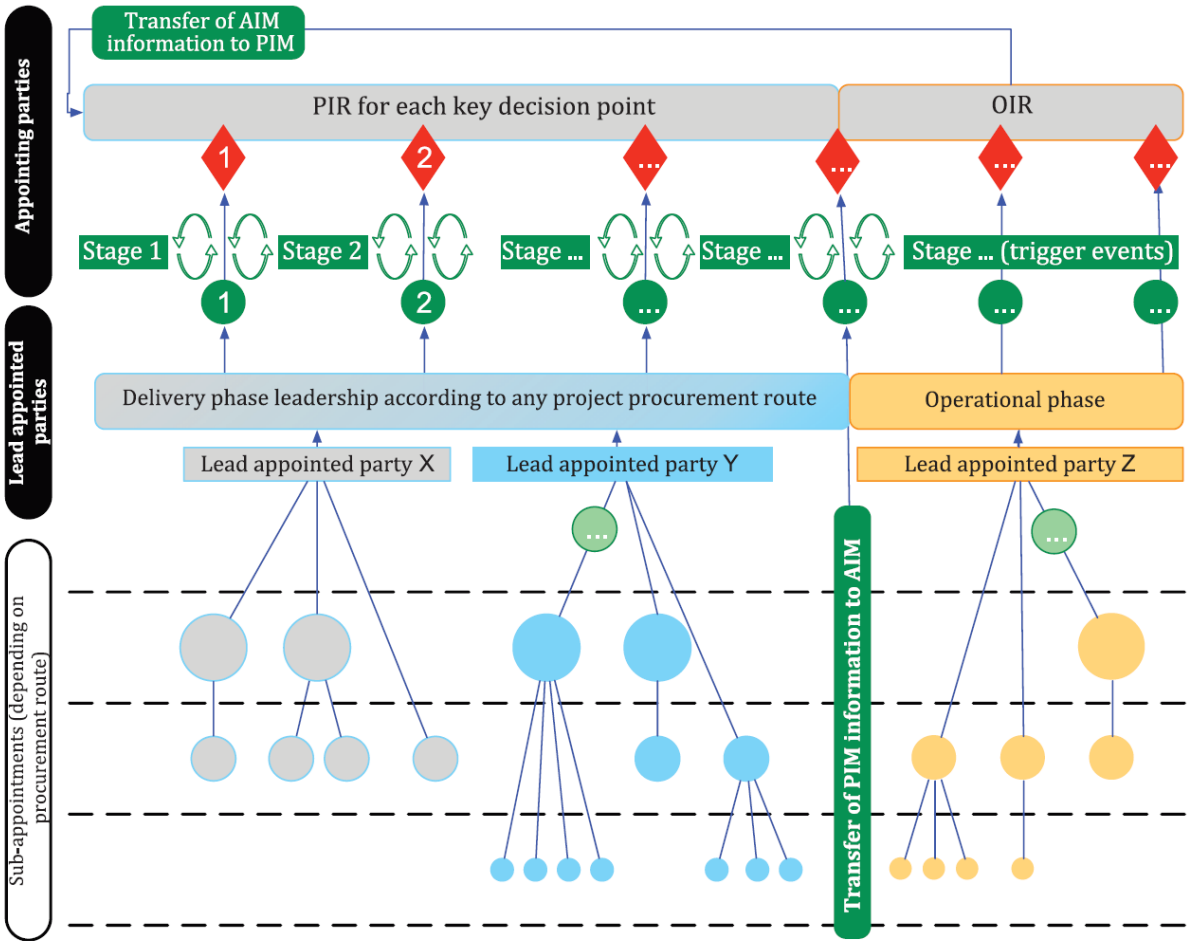


## ISO 19650 – 2



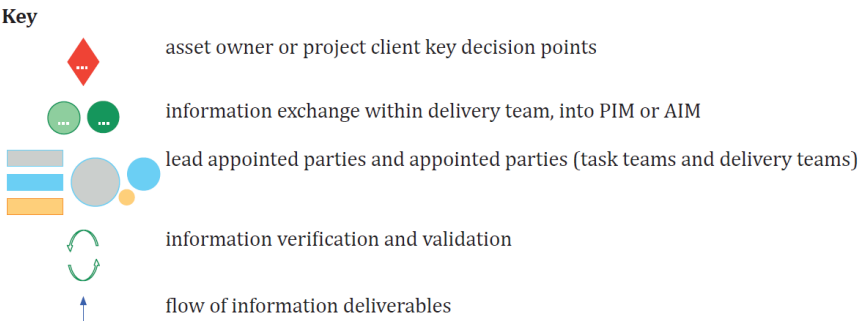


# PROJEKTIPÕHINE INFOKORRALDUS ELUKAAREL



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

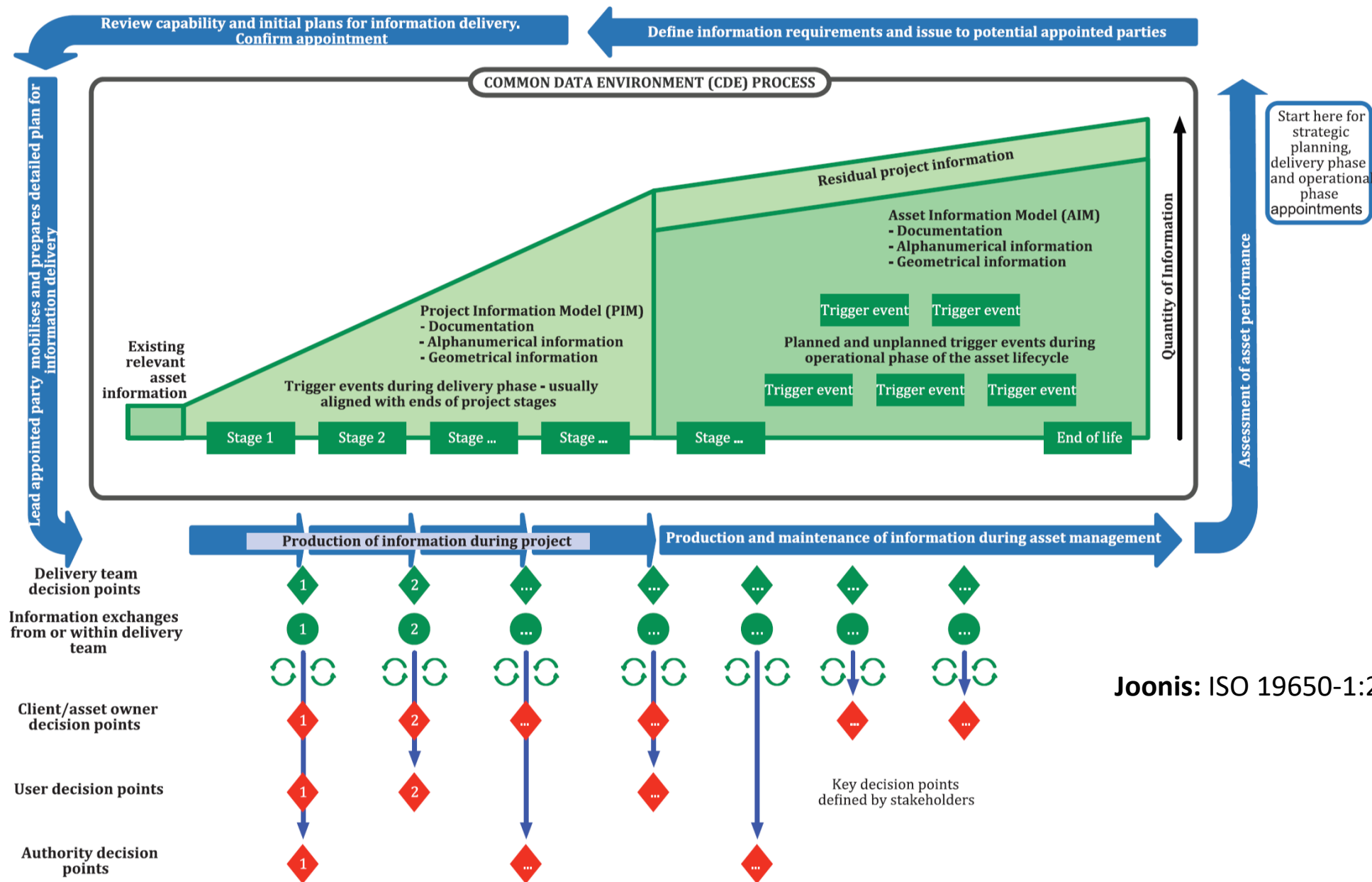
protip: BIM DICTIONARY



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

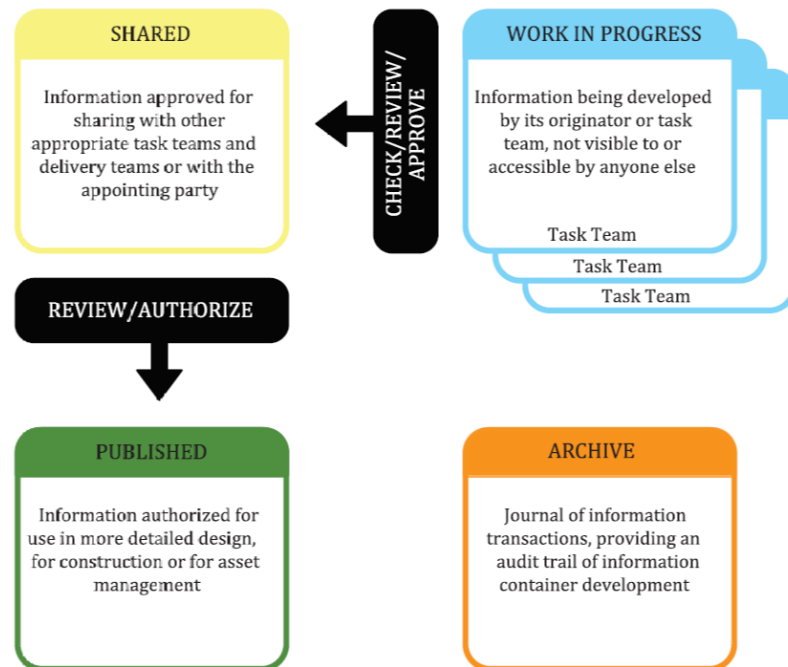


Joonis: ISO 19650-1:2018

# ANDMETE VALMIDUSE STAATUSED

Koostöö ühtses infokeskkonnas?

Üks näide olulisest põhimõttest



Joonis: ISO 19650-1:2018

Table 3 – Status codes in the CDE

| Status                         | Description                                                                                                                                                                                                                                                |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Work in Progress (WIP)</b>  |                                                                                                                                                                                                                                                            |
| S0                             | Initial status or WIP<br>Master document Index of file identifiers uploaded into the extranet.                                                                                                                                                             |
| <b>Shared</b>                  |                                                                                                                                                                                                                                                            |
| S1                             | Issued for co-ordination<br>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                                                                                                                                                                                                                                              |
| <b>Published documentation</b> |                                                                                                                                                                                                                                                            |
| A                              | Issued for construction                                                                                                                                                                                                                                    |
| B                              | Partially signed-off:<br>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.

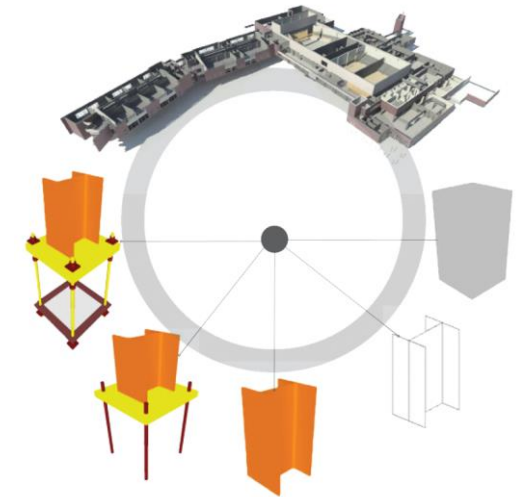
**Joonis: PAS 1192 järgselt andmete staatuse tunnused. Nüüd on need lisatud regionaalse lisana ISO külge.**



# DATA-TEMPLATES

## GS1 standards & structured DATA TEMPLATES

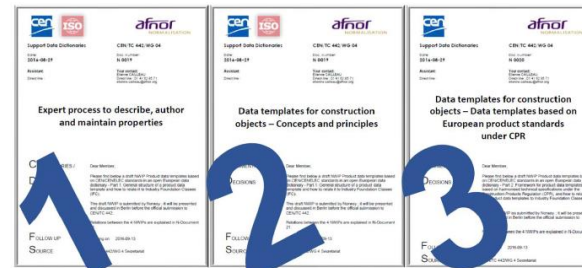
Infosisu ajas:  
LOIN (LOI/LOD)



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 (kgCO<sub>2</sub> eq/piece)
16. Warranty period (number of months)

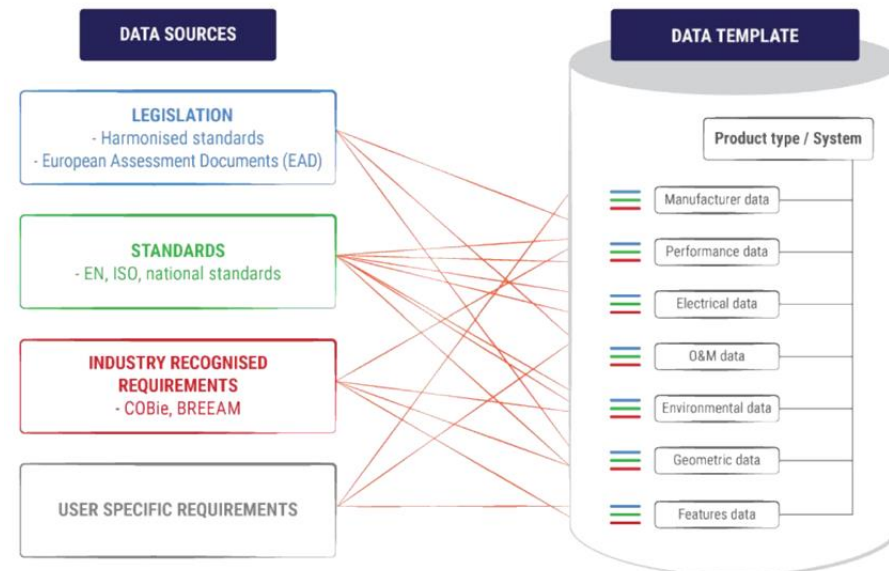
GS1



Data Template

Seejuures viidatakse  
konkreetsete  
andmete puhul  
vastavatele allikatele

Allikas: CoBuilder



Standardiseeritud  
kujul kirjeldatava  
objekti spetsiilsed  
andmekogud



## Building codes



**Support Data Dictionaries** CEN/TC 442/WG 04  
 Date: 2014-08-29  
 Doc. Number: N 0019  
 Assistant: Eirine CALLAGH  
 Direct line: 01 41 92 88 71  
 eirine.callagh@afnor.org

**Data templates for construction objects – Concepts and principles**

**COMMENTS /** Dear Member,  
**DECISIONS** Please find below a draft NWIP Product data templates based on CEN/ISO standards in an open European data dictionary - Part 1: General structure of a product data template and how to relate it to Industry Foundation Classes (IFC).  
 This draft NWIP is submitted by Norway - it will be presented and discussed in Berlin before the official submission to CEN/TC 442.  
 Relations between the 4 NWIPs are explained in N Document 21.  
**FOLLOW UP** Meeting on: 2016-09-13

**EN ISO 23387**

**Support Data Dictionaries** CEN/TC 442/WG 04  
 Date: 2014-08-29  
 Doc. Number: N 0019  
 Assistant: Eirine CALLAGH  
 Direct line: 01 41 92 88 71  
 eirine.callagh@afnor.org

**Expert process to describe, author and maintain properties**

**COMMENTS /** Dear Member,  
**DECISIONS** Please find below a draft NWIP Product data templates based on CEN/ISO standards in an open European data dictionary - Part 1: General structure of a product data template and how to relate it to Industry Foundation Classes (IFC).  
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 Relations between the 4 NWIPs are explained in N Document 21.  
**FOLLOW UP** Meeting on: 2016-09-13

**EN ISO 23386**

**Support Data Dictionaries** CEN/TC 442/WG 04  
 Date: 2014-08-29  
 Doc. Number: N 0020  
 Assistant: Eirine CALLAGH  
 Direct line: 01 41 92 88 71  
 eirine.callagh@afnor.org

**Data templates for construction objects – Data templates based on European product standards under CPR**

**COMMENTS /** Dear Member,  
**DECISIONS** Please find below a draft NWIP Product data templates based on CEN/ISO standards in an open European data dictionary - Part 2: Framework for product data templates based on harmonised technical specifications under the Construction Products Regulation (CPR), and how to relate the product data templates to Industry Foundation Classes (IFC).  
 This draft NWIP is submitted by Norway - it will be presented and discussed in Berlin before the official submission to CEN/TC 442.  
 Relations between the 4 NWIPs are explained in N Document 21.  
**FOLLOW UP** Meeting on: 2016-09-13

**WI 442008**

**Support Data Dictionaries** CEN/TC 442/WG 04  
 Date: 2014-08-29  
 Doc. Number: N 0019  
 Assistant: Eirine CALLAGH  
 Direct line: 01 41 92 88 71  
 eirine.callagh@afnor.org

**IFC exchange structure for product data templates**

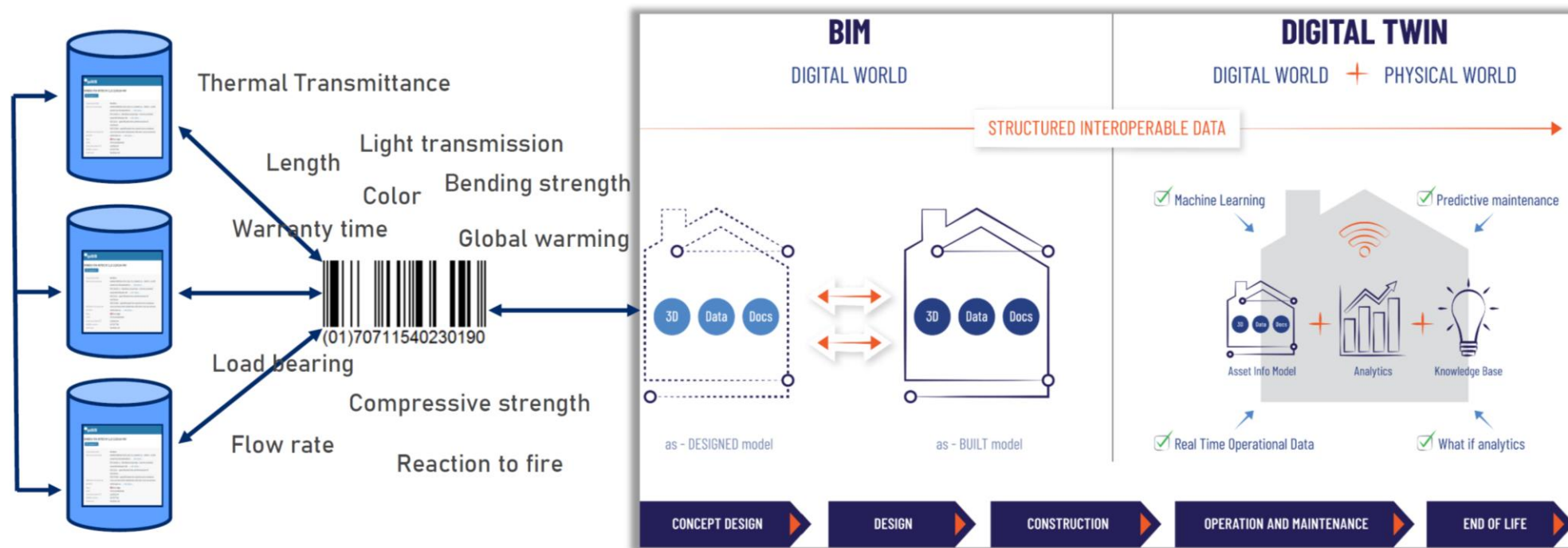
**COMMENTS /** Dear Member,  
**DECISIONS** Please find below a draft NWIP Product data templates based on CEN/ISO standards in an open European data dictionary - Part 1: General structure of a product data template and how to relate it to Industry Foundation Classes (IFC).  
 This draft NWIP is submitted by Norway - it will be presented and discussed in Berlin before the official submission to CEN/TC 442.  
 Relations between the 4 NWIPs are explained in N Document 21.  
**FOLLOW UP** Meeting on: 2016-09-13

**WI 442018**



# DIGITAALNE JA FÜÜSILINE MAAILM

## GS1 standards & structured DATA TEMPLATES



The as-designed model is based on input from the design teams which ultimately forms the basis for the as-built model that contains all the characteristics of a building. #CEN #ISO #ASTM etc. standards opens a closed market

BIM enables Cobuilder to provide data to create Digital Twins which is a virtual representation of physical as-built asset by linking standardized data to 3D. This opens a new digital market on planned development, where assets are sold

Allikas: CoBuidar



# WAIT, WHY, WHAT?:D

## ...standardite baasilt:

- **Sektoriülesed koostöö-reeglid ja -protsessid**
  - BIM juhendmaterjalid
    - riiklikud/ettevõtete juhendmaterjalid/nõuded
      - Projektipõhised rakenduskavad
- **IT-süsteemide ülesehitamise võimalikkus:**
  - Veebipõhised (koostöö-)platvormid aga ka *desktop* tarkvarad;
    - » failid; andmebaasid, API, CDE, etc...;
    - » sisseehitatavad automatiseeritavad protsessid;



# KOKKUVÕTE

Oluline on **standardiseeritud** ja **masinkäsitletavate** andmedete juhitav liikumine terves tarneahelas, selleks:

- **Standardid:**

ISO 19650 / 23386 / 23387 / prEN 17412 ...

- Omakorda neil põhinevad rahvusvahelised (sidus-) andmebaasid ja toetavad platvormid;

- **Identifitseerivad lahendused:** GUID, GS1;

- **Materjalitootjate vastutuse tõus** ja sh nende otseintegratsioon sektori tarneahelasse.

# TÄNUD TÄHELEPANU EEST!

hendrik.park@usesoft.ee

+372 58 163 712

