



Integreret Digitalisering

BIM Aarhus – 11. September 2018

Niels Trelidal, NCC Building



Niels Trelidal

Områdechef, VDC Forretningsudvikling

Erhvervserfaring:

- Rambøll, 2008-2017
- NCC Building, 2017->

Uddannelse:

- Bygningsingeniør, DTU 2008
- Erhvervs PhD, DTU og Stanford 2017

Kompetancer

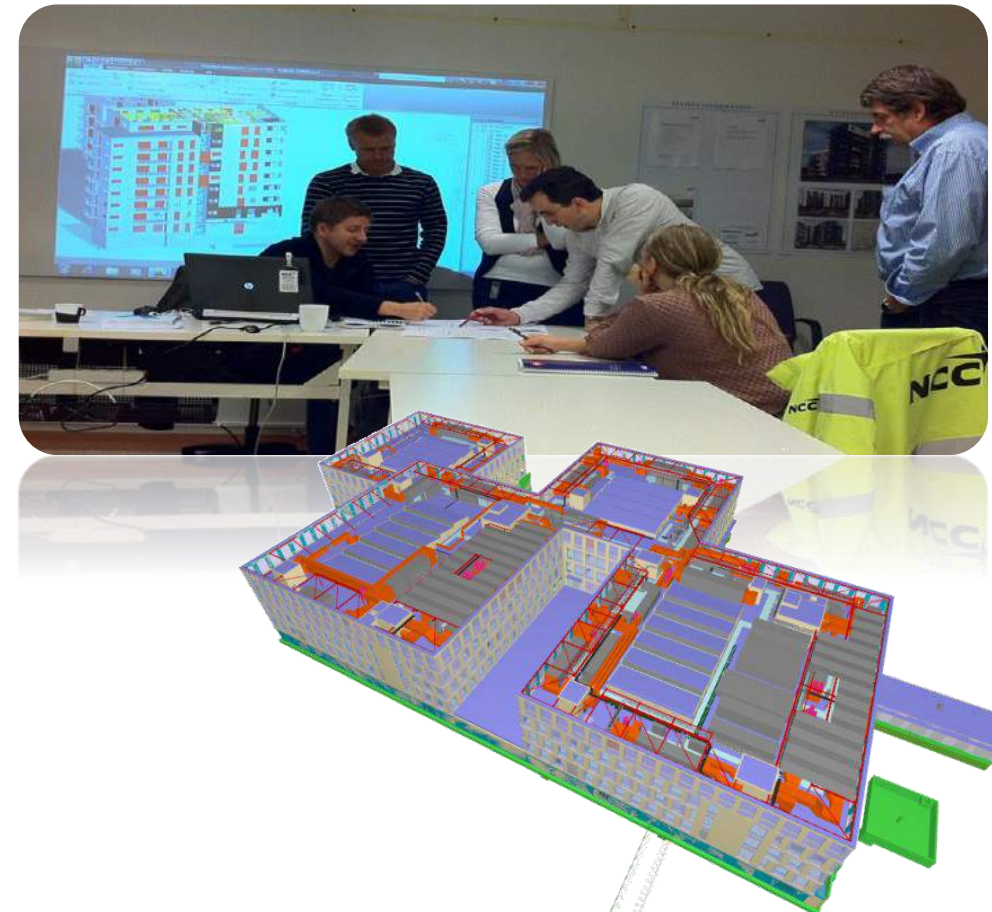
- Bygningsinstallationer
- Energi og bæredygtighed
- Fag- og projektledelse
- IKT-ledelse
- Digitalisering og standardisering
- Forandringsledelse



nietre@ncc.dk

Agenda

1. Udfordringer
2. Samarbejde og agile arbejdsmetoder
3. Standarder og forbedrer informationsflowet
4. NCC's Integreret VDC og nye arbejdsmetoder



Digitalization as Driver for Standardized Specification and Design of Buildings

- In Search of an Efficient Building Design Management Methodology



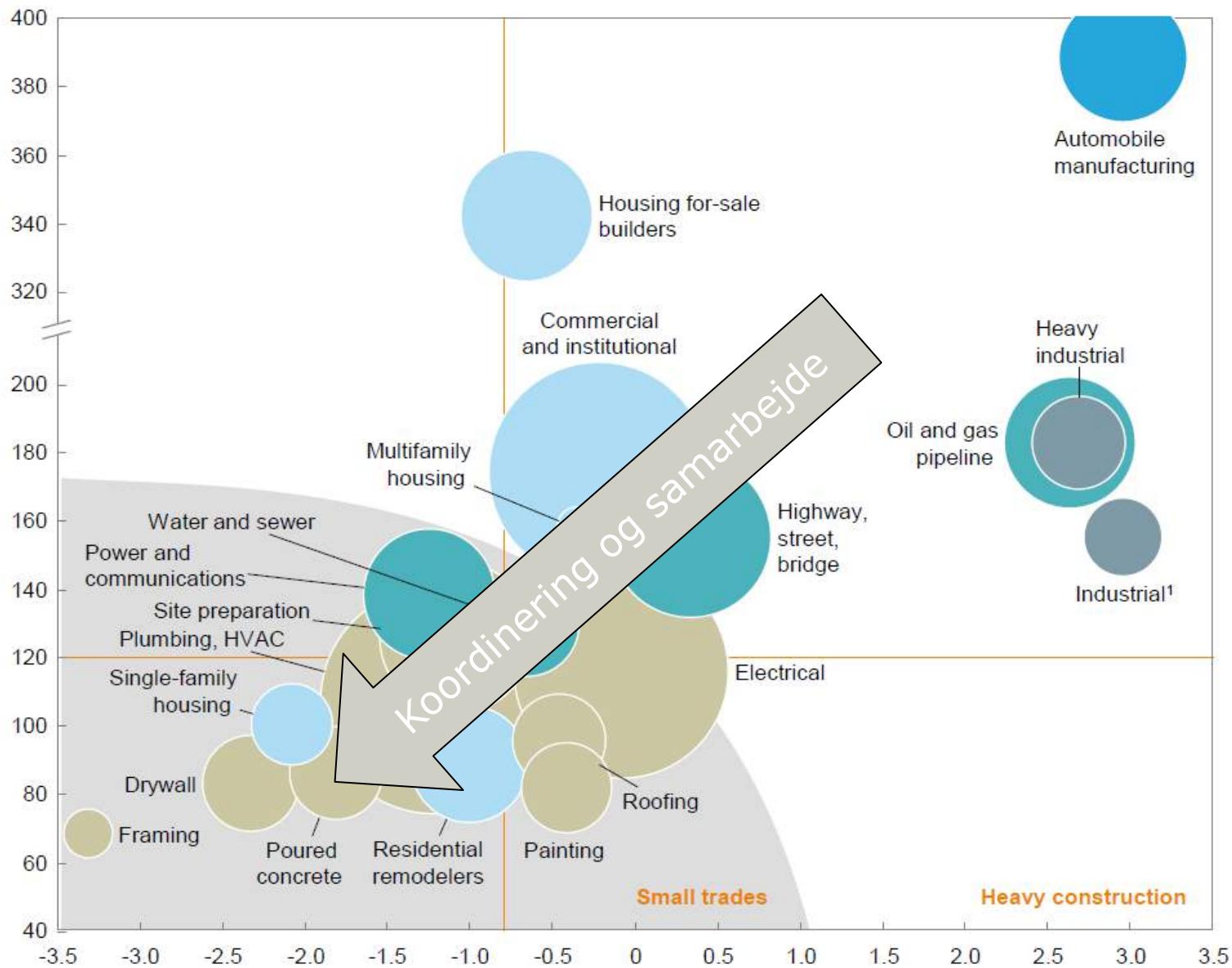
Niels Trelal

PhD Thesis

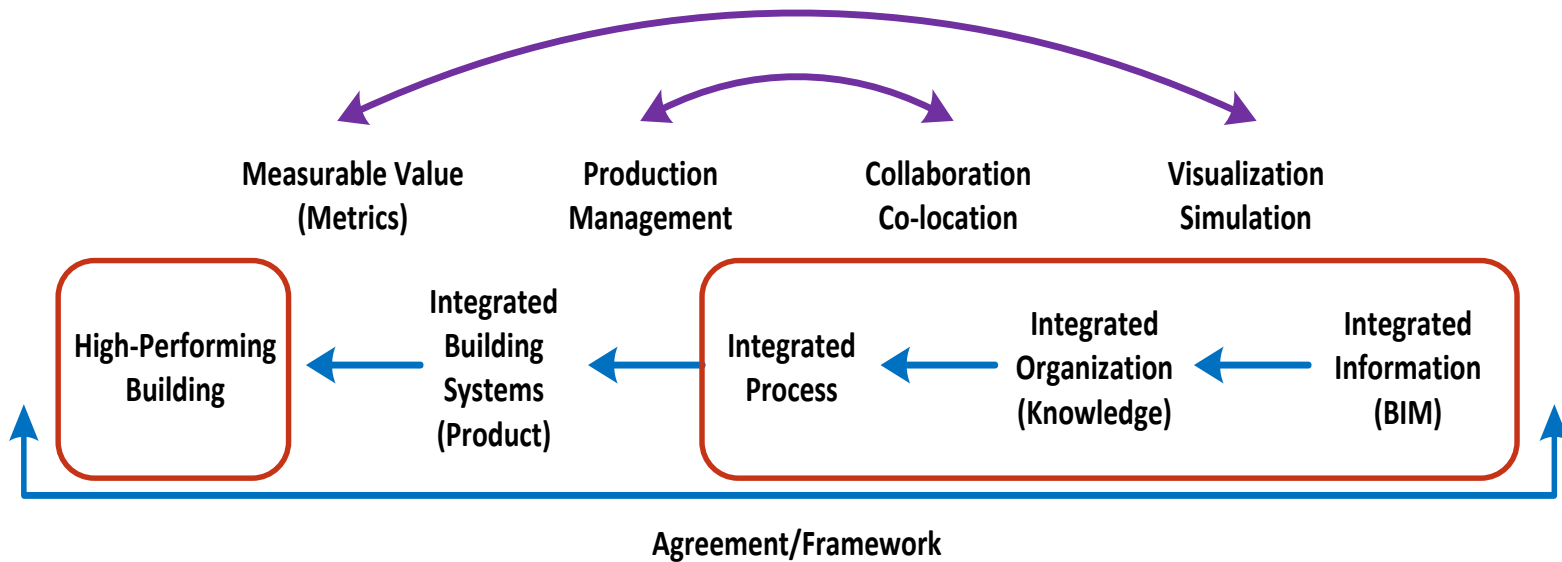
Department of Civil Engineering
2017

CURRENT STATE

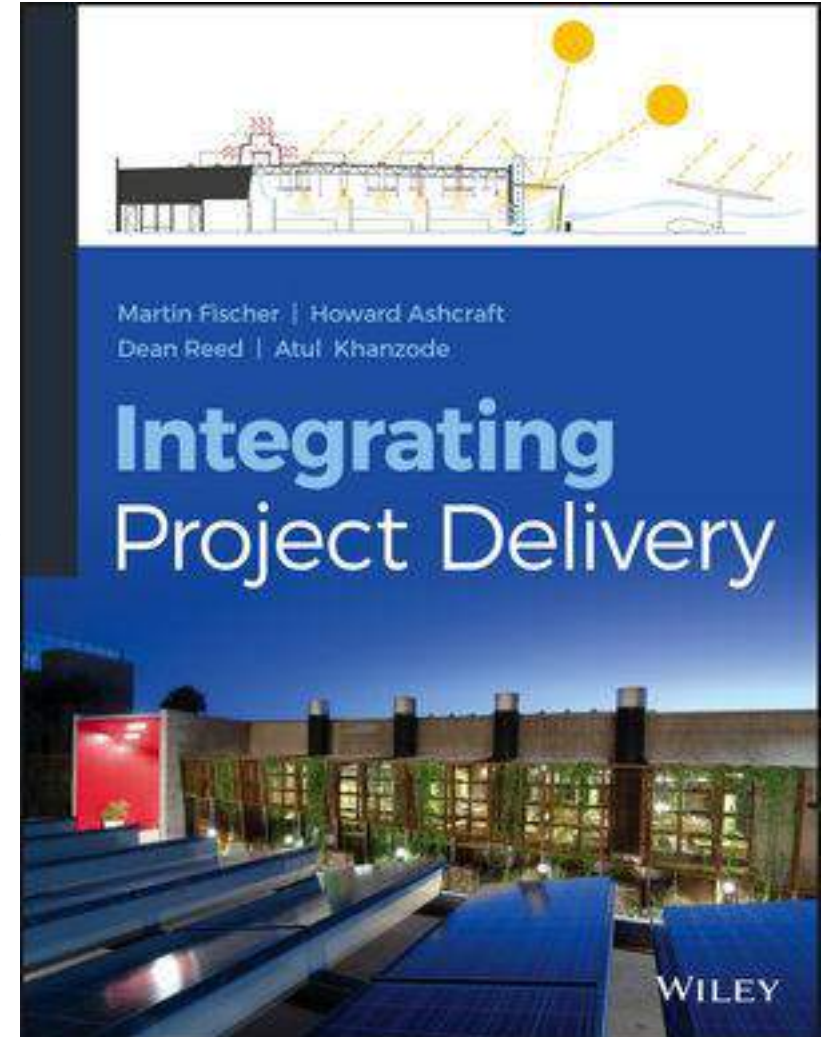
Productivity, 2012
\$ thousand per person employed, 2015 \$



BEHOV FOR BEDRE SAMSPIL



“...we have not seen a project that has put all of the framework into practice...”
(Fischer et al. 2017)



UDFORDRINGER I PROJEKTERINGEN

Undersøgelse blandt 65 projekteringsleder i Rambøll

Konklusion:

- Al for høj usikkerhed i processen
- Mangel på de rigtige kompetancer, når der er brug for dem

Limited availability of required employees when needed

Lack of coordination between disciplines

Too many design changes

The schedule is too tight

Unclear client requirements

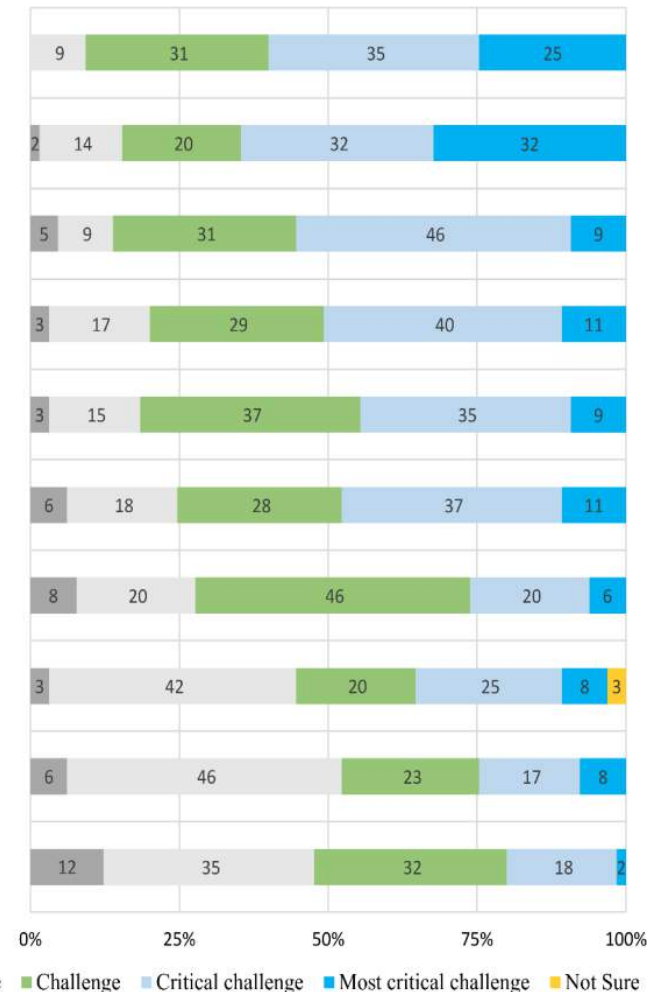
The fee is too low

Not getting required information to my design team in time

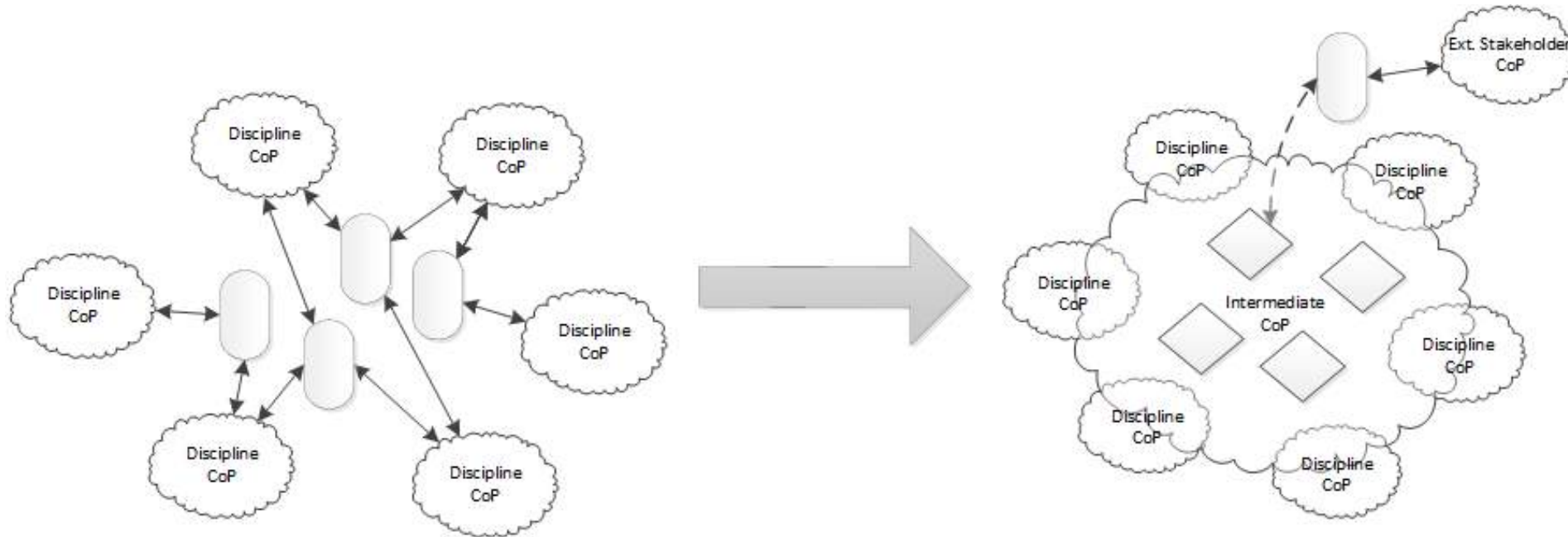
Due dates for deliveries by different disciplines differs too much

Poor qualifications of my design team

Design team being too spread out in different offices



USIKKERHED OG OPBYGNING AF FÆLLESSKABER



Network of Practice (NoP)

- Motiverer kun til koordinering

Community of Practice (CoP)

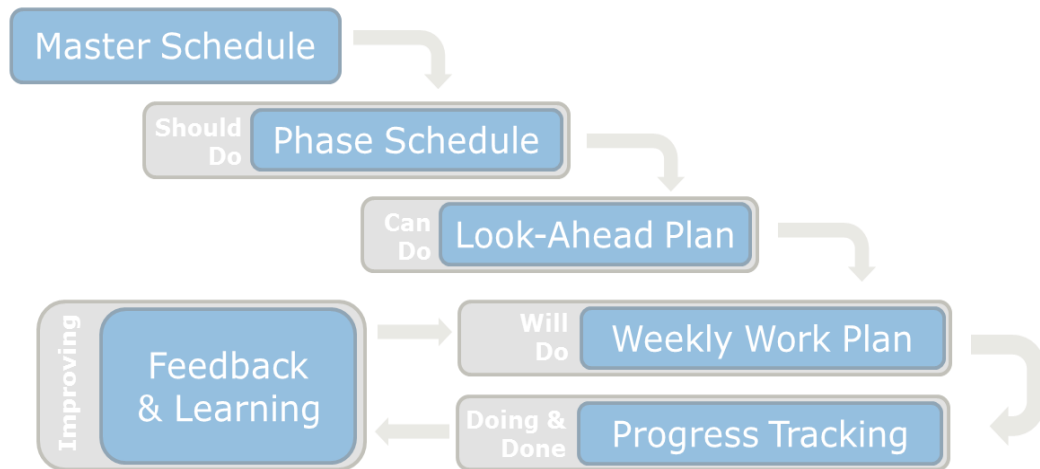
- Kan skabe samarbejde
- Kan reducere usikkerhed i projektet
- Digitalisering skal støtte fællesskabet

AGILE PROJEKTTLEDELSE

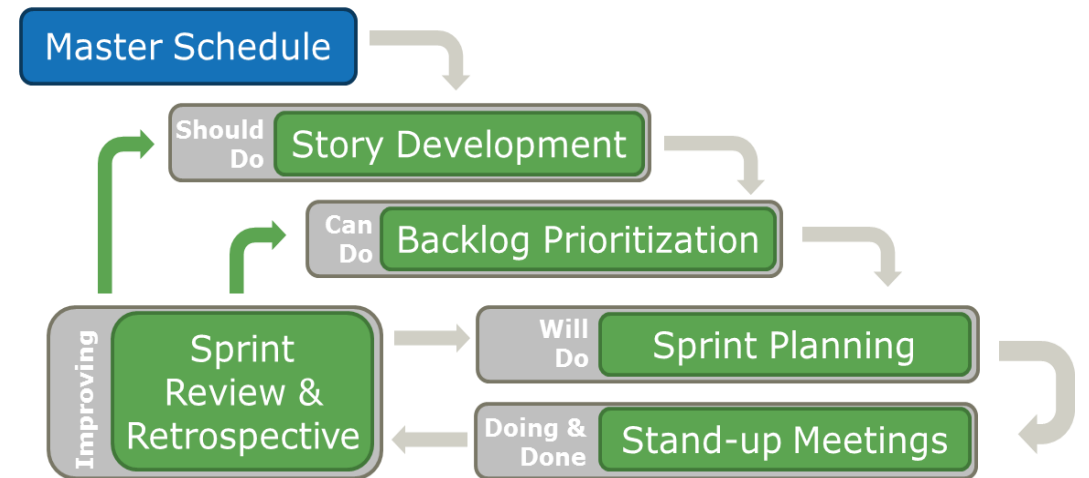


AGILE PROJEKTLEDELSE FREM FOR REN LEAN-TÆNKNING

LAST PLANNER SYSTEM™



SCRUM-BASED APM METHODOLOGY



AGILE PROJEKTLEDELSE

3 case studies:

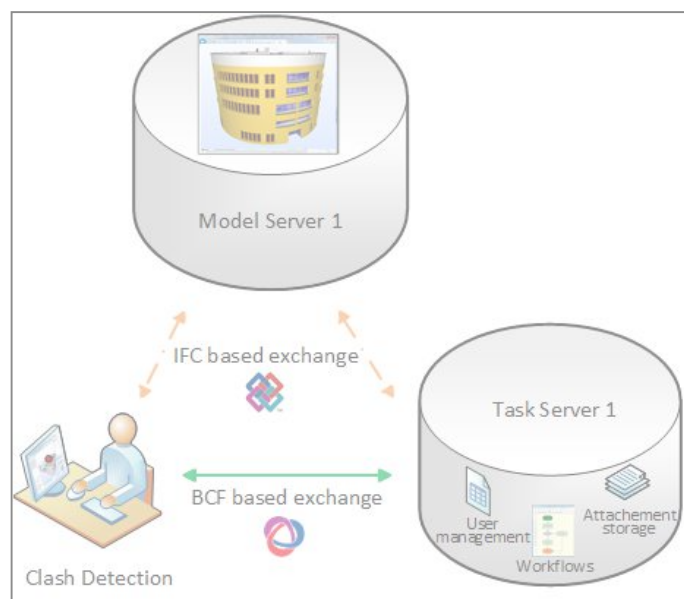
- A. Pharma €3.7M production rebuild, 10 team members
- B. Pharma €4.0M production extension, 10 team members
- C. Pharma €7.1M production extension, 25 team members



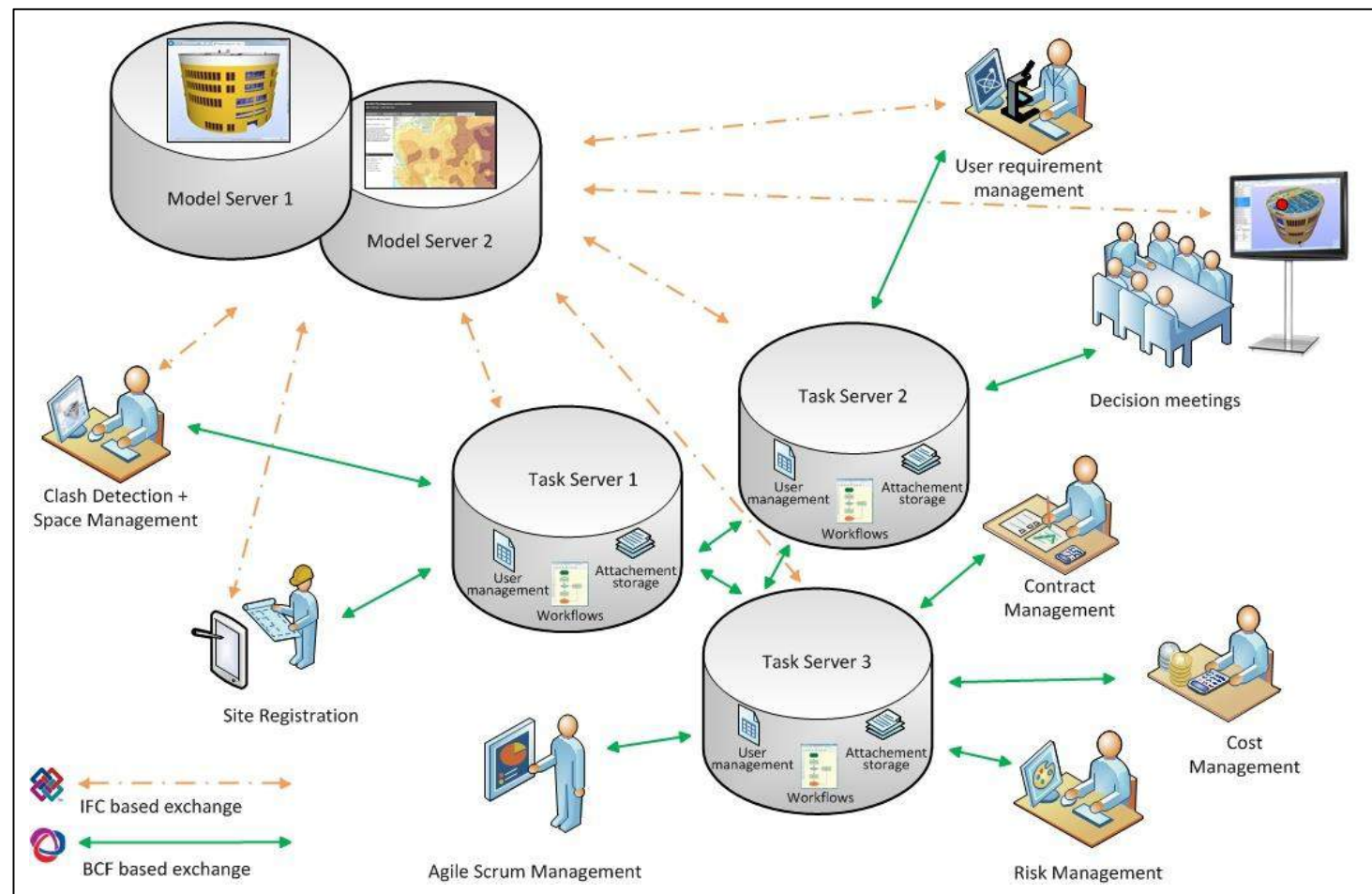
✓ Bedre samarbejde, mindre uforudsigelighed, mere selvkørende teams

✗ Det virker ikke hver gang (kræver noget af PL), beslutningsprocessen skal styres stramt, det kræver dygtige folk

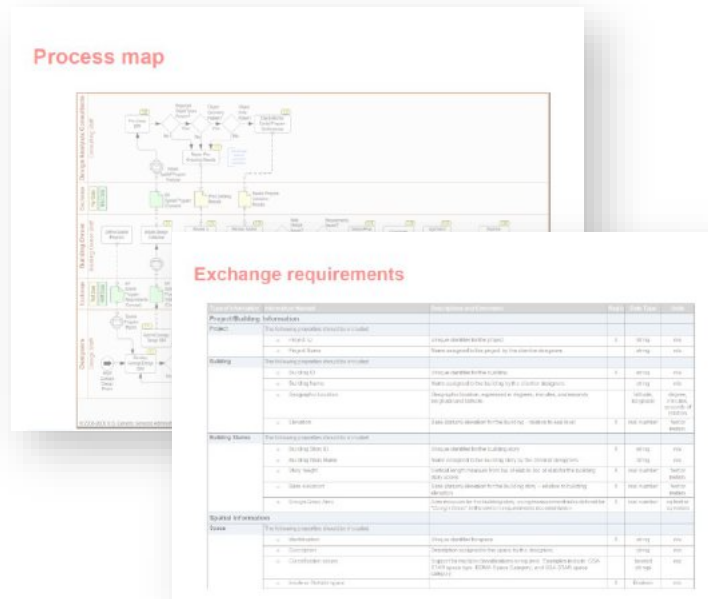
LØSNINGSFORSLAG: INFORMATION SYSTEM BASERET PÅ BCF FORMATET



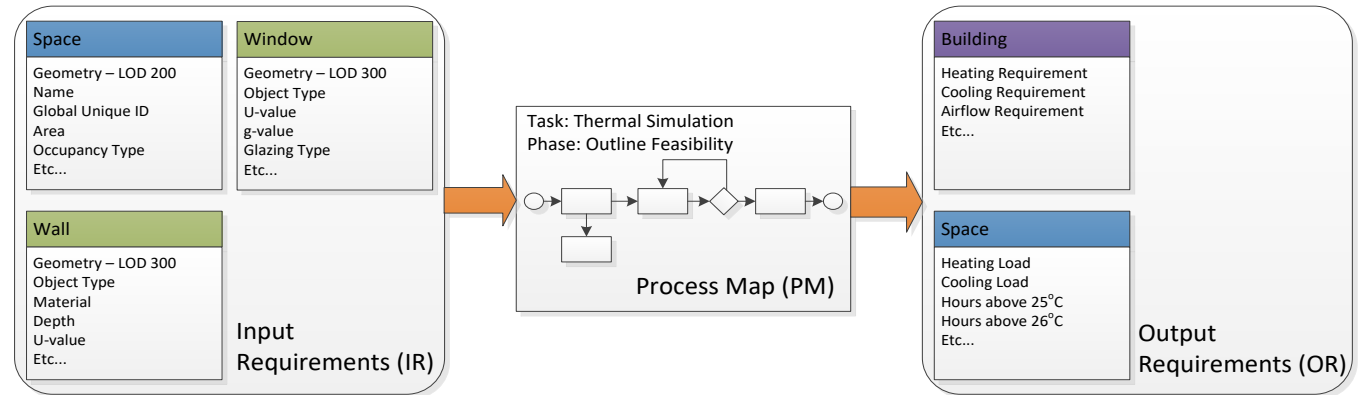
Nuværende scope for BCF



IDM PAKKER

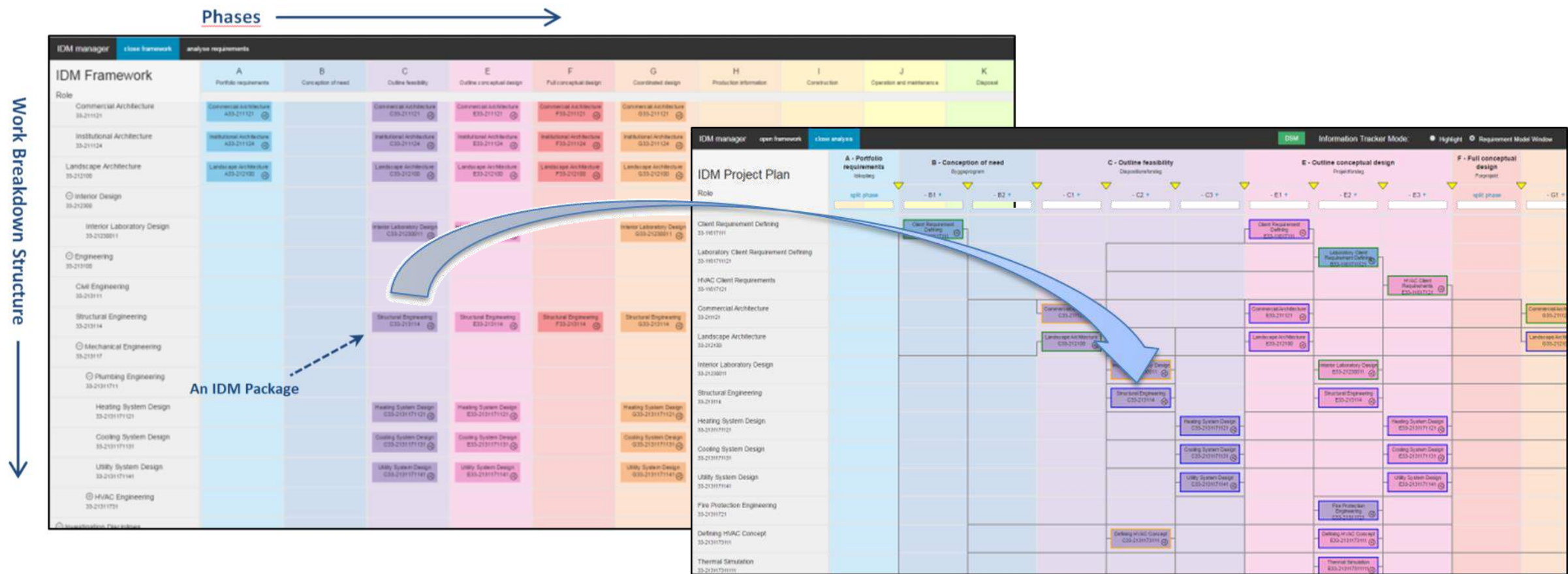


Nuværende IDM Løsning



IDM Pakker

IDM MANAGER



69 % genbrug af
pakker fra
laboratorie- til
børnehaveprojekt



$$I_{Gr} = \bigcup_{i=1}^{nG} \{x \in OR_i | x \notin \bigcup_{i=i+1}^{nG} OR_i\} \quad [2]$$

$$IR_G = \bigcup_{i=n_F+1}^{n_G} IR_i \quad [3]$$

$$EM_G = I_{Gr} \cap IR_G \quad [4]$$

$$A_G = \{x \in IR_G \setminus EM_G | x \in \bigcup_{i=n_G+1}^{n_H} OR_i\} \quad [5]$$

$$M_G = \{x \in IR_G | x \notin \bigcup_{i=1}^{n_H} OR_i\} \quad [6]$$

SAMMENFATNING

Hvis digitalisering skal give værdi, skal den:

1. **Understøtte fællesskabet** og ikke skubbe os fra hinanden
2. **Skabet forståelse** for andres behov

Digitalisering kan ikke skabe samarbejde, men kun forberede det, hvis det findes



NCCs Integreret VDC



VDC in Design

Clash Detection



ProjectStudio



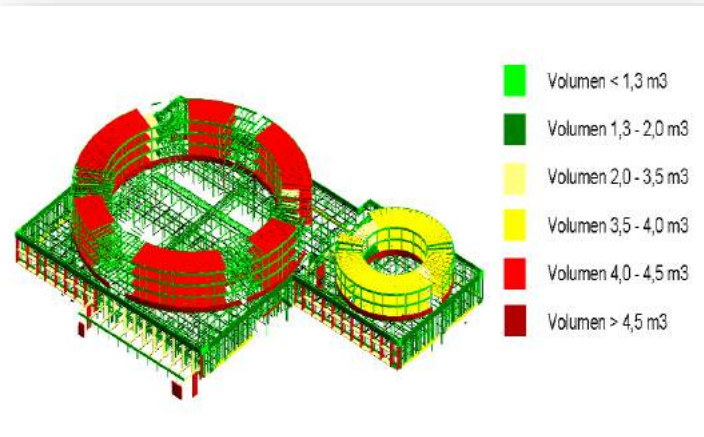
Laser scanning/point cloud



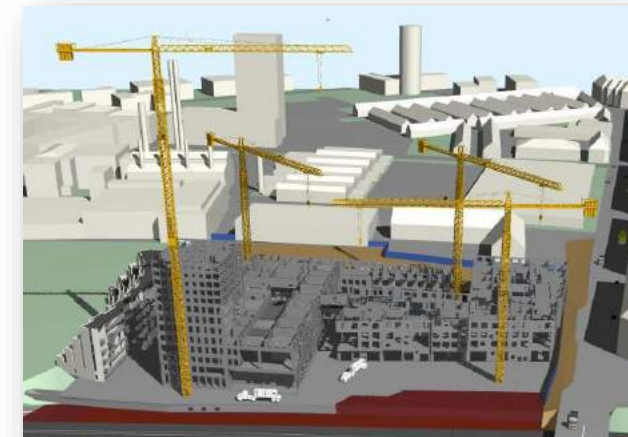
VR and AR visualization



Planning and Analyzing



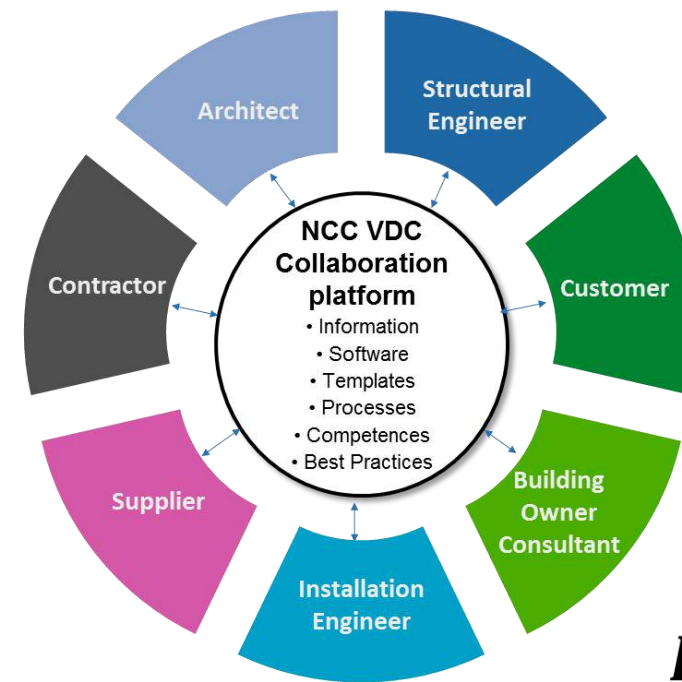
3D/4D Simulations



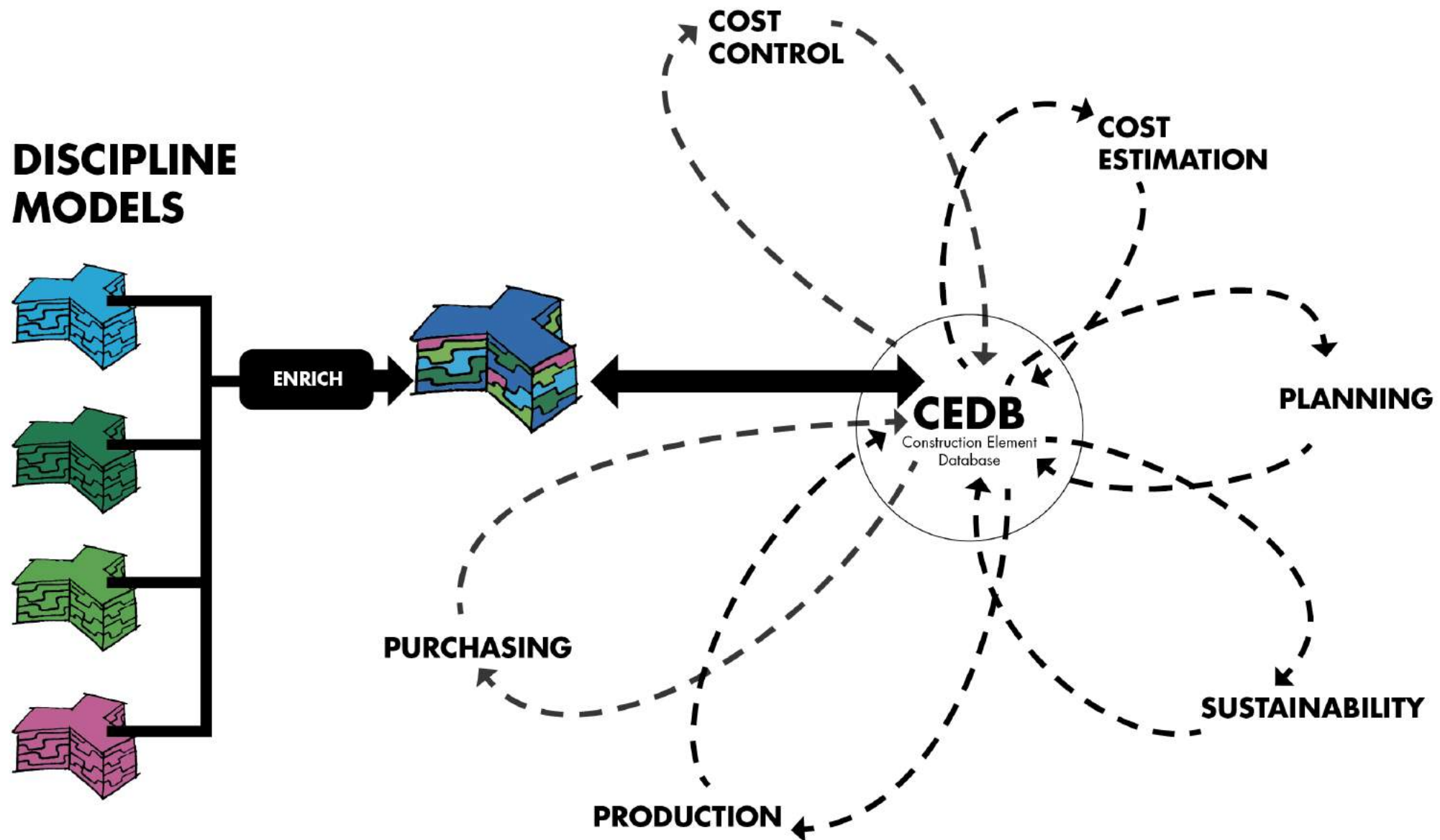
NCC's VDC Samarbejdsplatform

– Proces og løsning

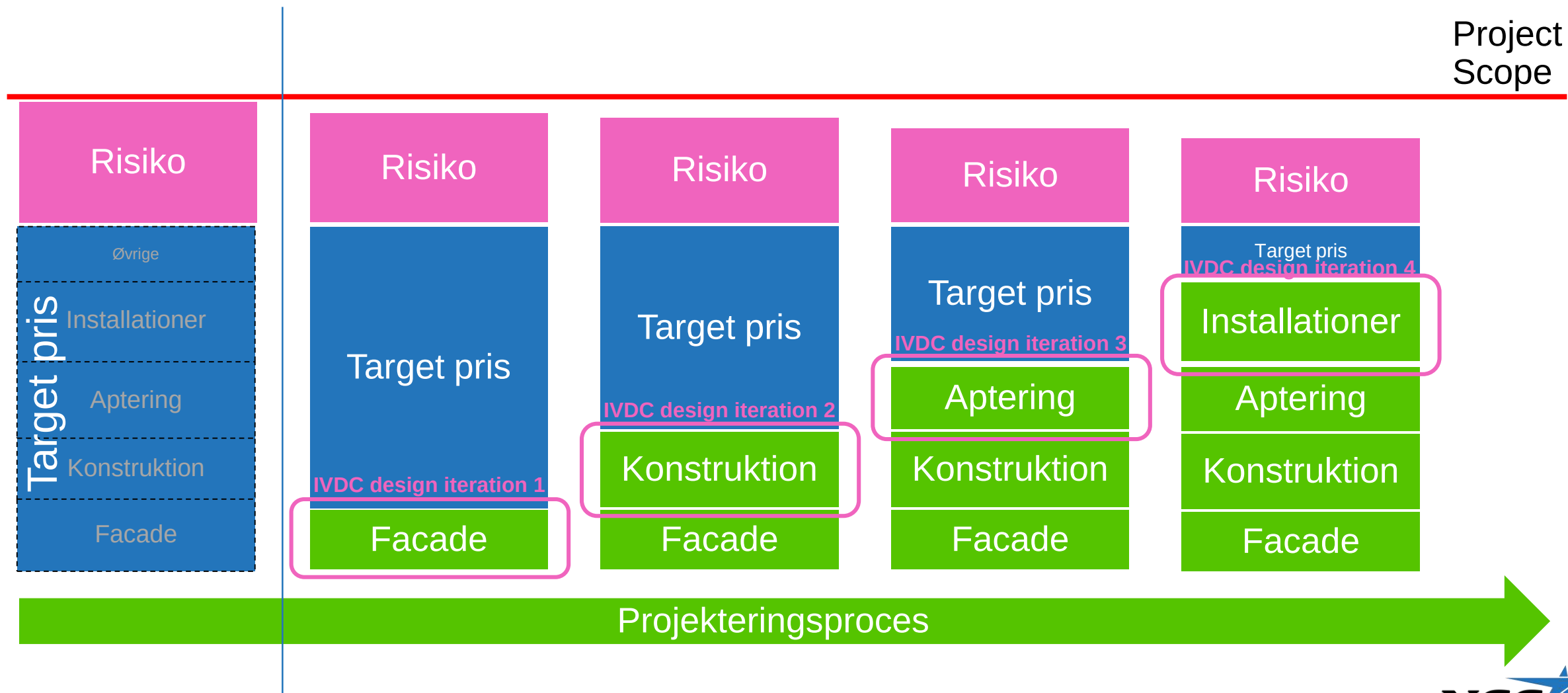
- NCC og vores leverandører som **kompetente medrådgiver**
- **Tidlig involvering** af alle aktører
- Samarbejde **centreret omkring BIM modeller**
- **VDC som afgørende beslutningsgrundlag**
- NCC tager ansvar for **koordinering** og sikre **en optimal design process**



NCCs Integreret VDC



Stepvis priskalkulation



NCC kravstillelse

2	Building element	Concrete column					
3	Description	Applies to site-cast and prefabricated concrete columns					
4	Revision date						
5	CCS informationsniveau	Inf. 1	Inf. 2	Information level 3	Information level 4	Information level 5	Information level 6
6	LOD (BIMFORUM)			LOD ~200	LOD ~300	LOD ~350	LOD ~400
7	Geometry						
8				Columns are modelled as generic objects in max. outer contour broken down into overall types. Expected main geometry, orientation and Location.	Columns are modelled in specified main dimension, orientation and Location. Larger holes for main lead-throughs with specified size and Location.	Columns are modelled in final dimension, element length, orientation and location and in producible lengths. Final brackets, corrugated pipes and holes for lead-throughs.	Columns are modelled in final dimension, production length, orientation and Location. Final brackets, holes for lead-throughs, joints, reinforcement incl. supports, mounting points, bevels and insert plates.
	Mandatory NCC pilot attributes (Model defined attributes)			Classification (CALC) Type name/ ID (CALC) (PL) Cross section (CALC) Profile (CALC) Assembly Control Number (ACN) Class (Tekla) Top Elevation Bottom Elevation Area (Gross) (CALC) Area (Net) Length (Thickness) (CALC) Width (Thickness) (CALC) Height (CALC) Volume (CALC) (LCA)	Classification (CALC) Type name/ ID (CALC) (PL) Cross section (CALC) Profile (CALC) Construction type (PL) Assembly Control Number (ACN) Class (Tekla) Top Elevation Bottom Elevation Area (Gross) (CALC) Area (Net) Length (Thickness) (CALC) Width (Thickness) (CALC) Height (CALC) Volume (CALC)	Classification (CALC) Type name/ ID (CALC) (PL) Cross section (CALC) Profile (CALC) Construction type (PL) Floor (CALC) (PL) Concrete strength (LCA) Material (Concrete)(LCA) Material isolation (LCA) Assembly Control Number (ACN) Class (Tekla) Top Elevation Bottom Elevation Area (Gross) (CALC) Area (Net) Length (Thickness) (CALC) Width (Thickness) (CALC) Height (CALC) Volume (CALC)	Classification (CALC) Type name/ ID (CALC) (PL) Cross section (CALC) Profile (CALC) Construction type (PL) Floor (CALC) (PL) Concrete strength (LCA) Material (Concrete)(LCA) Material isolation (LCA) Assembly Control Number (ACN) Class (Tekla) Top Elevation Bottom Elevation Area (Gross) (CALC) Area (Net) Length (Thickness) (CALC) Width (Thickness) (CALC) Height (CALC) Volume (CALC)

Standardizing and enriching models - NCCifc

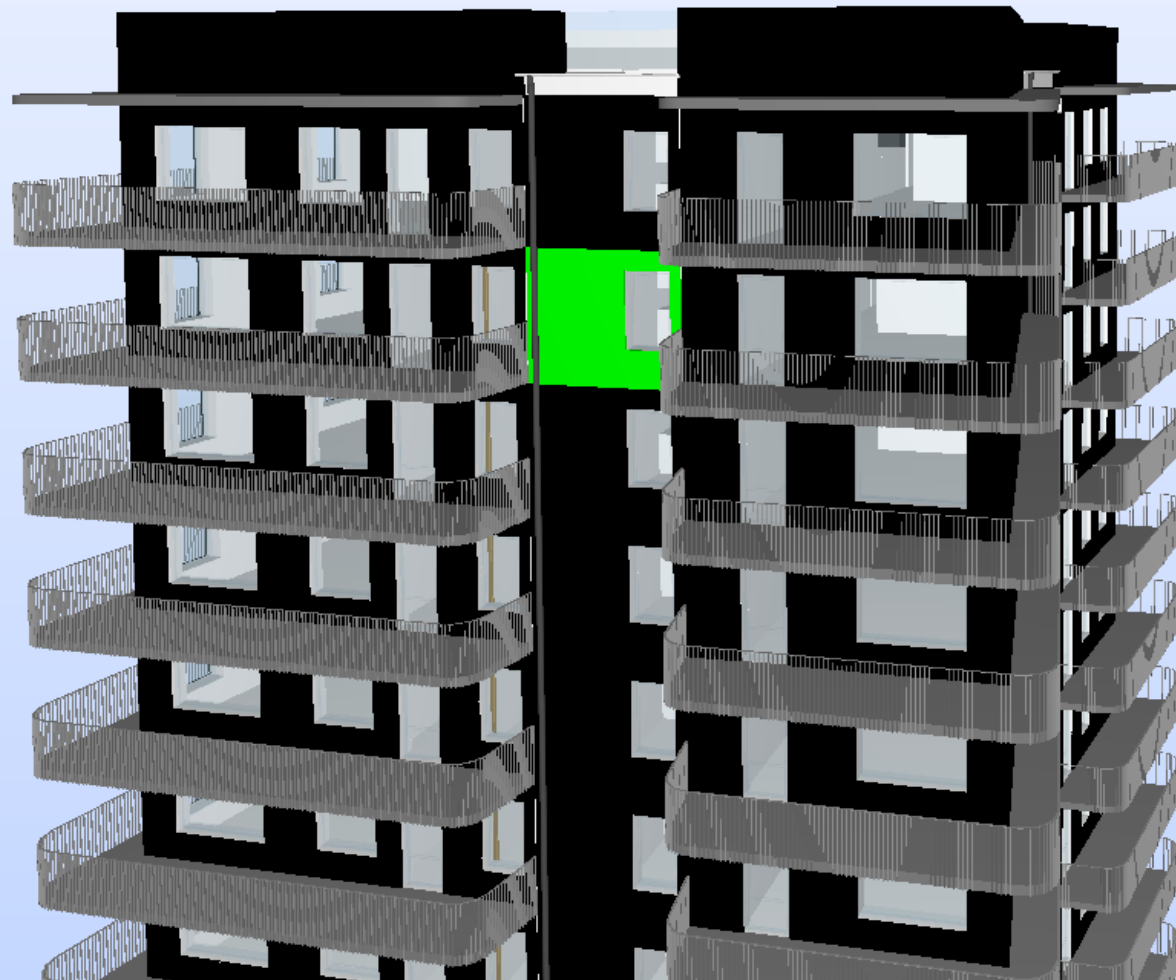
Classification

Info

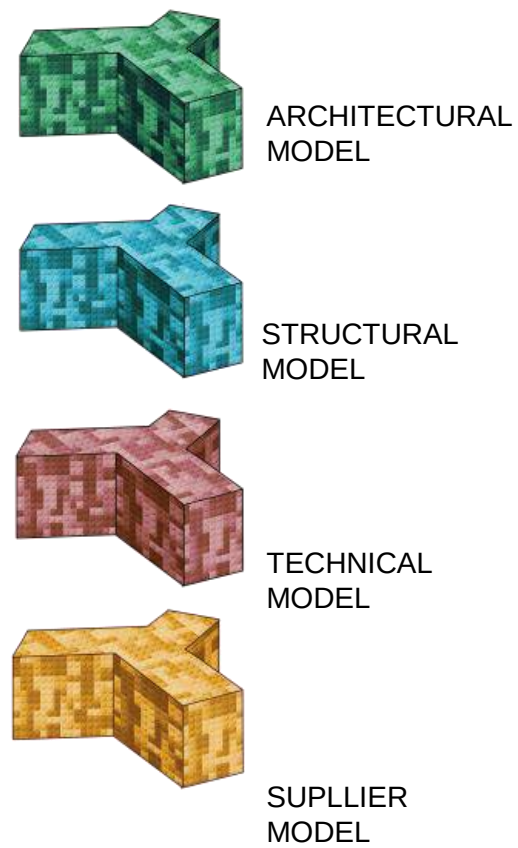
Wall. 19.95

Info Identification Location Quantities Material Profile Relations Classification Hyperlinks NCC

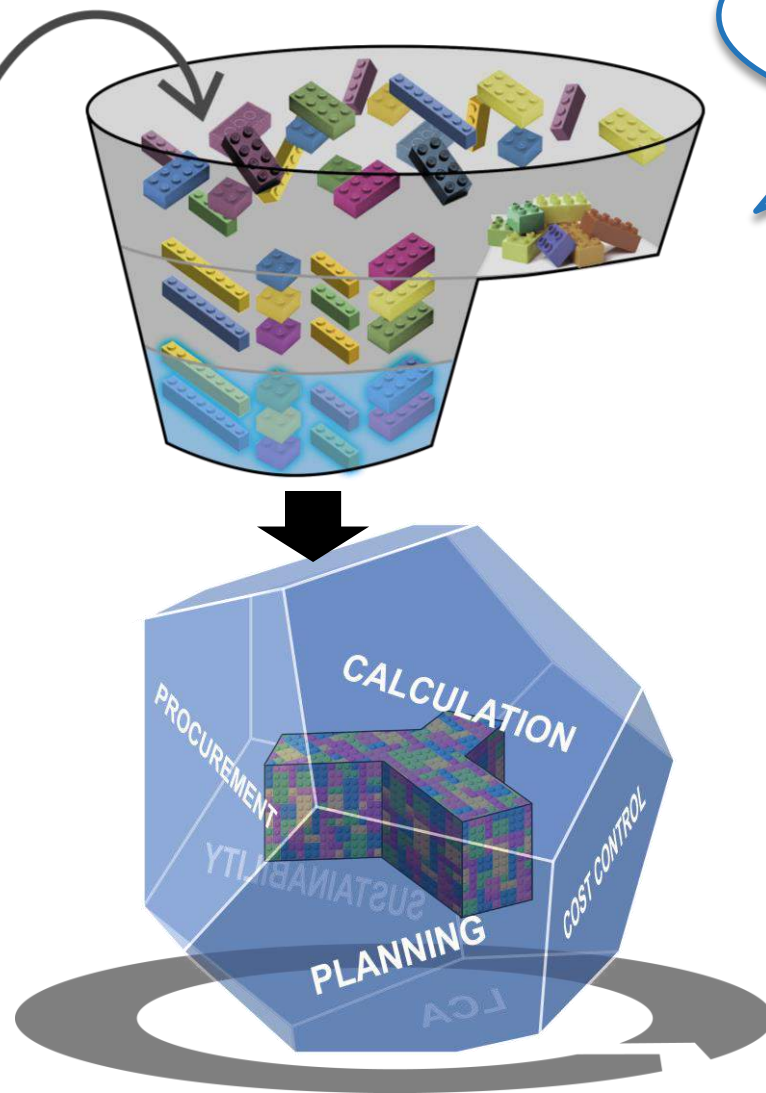
Property	Value
INFO_BSAB	43.CB
INFO_Category	Walls
INFO_Core Material	Skivmaterial, svart
INFO_Description	Skivmaterial
INFO_Family	Basic Wall
INFO_GUID	01uMYApID7PuG4JrMIZmOi
INFO_Model Discipline	Architectural Model
INFO_Model Name	A-40-V-00.ifc
INFO_Name	Skivmaterial
INFO_Object Class	Wall
INFO_RenovationStatus	Nytt
INFO_Structure	Skivmaterial, svart
INFO_Talo2000	43.CB
INFO_Time Stamp	2016-10-31T08:44:51
LOC_Floor	Plan 27
QTY_Area Side Largest Gross	8.18 m2
QTY_Area Side Largest Net	8.18 m2
QTY_Height	2.87 m
QTY_Length	3.43 m
QTY_Thickness	50 mm



Vores mål med Integreret VDC...



NCC BUILDING



*Opdateret viden om
tid og økonomi tager
få dage*

↓ Udvælg

↓ Grupper

↓ Berig

↓ Udtræk data

← Gem og genbrug data

Grupperede objekter i databasen

Kv. Bostadshuset

Groupings

Activities

3D Visualisation

Models

Import/Export

Showing Architectural ▼

Groups

Activities

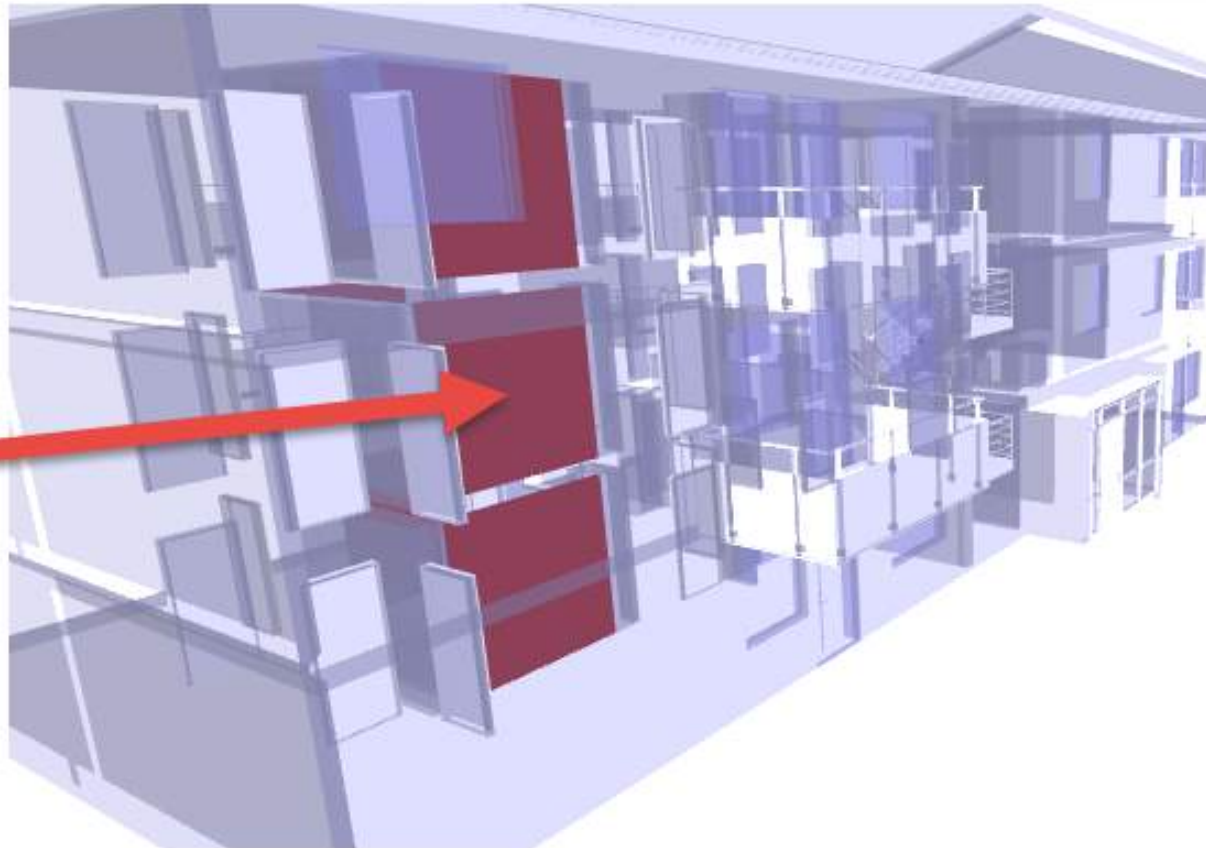
63_IV531_Architectural

IV531 -
63_IV531_Architectural

IV534 -
63_IV534_Architectural

☐ Show only selected

☐ Show spaces



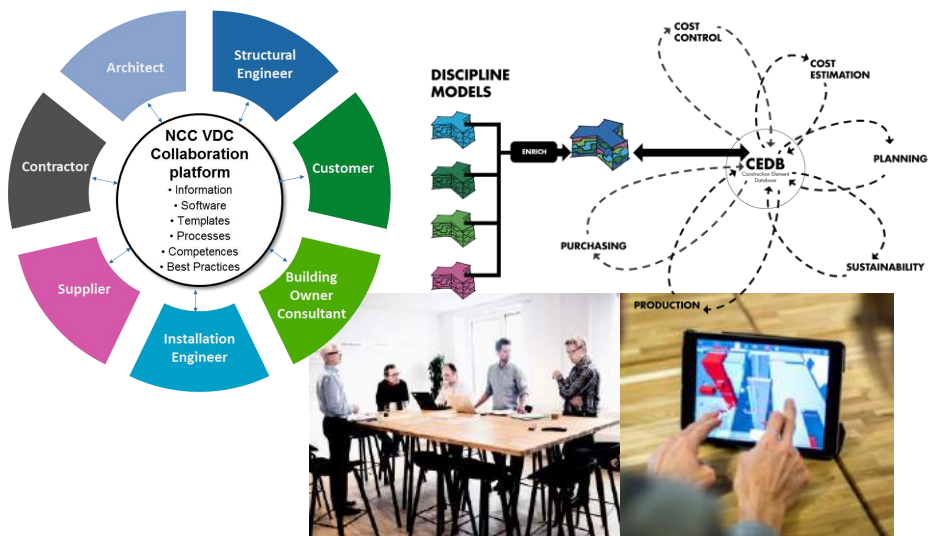
BUILD 4.0

- 1) *Kollaborative og integrerede designprocesser*
- 2) *Digitale værktøjer og automatisering*
- 3) *Digitale prototyper og simuleringer*
- 4) *IoT – Internet of things*

Kilde: <http://bygg40.se/>

Vi er klar med Build 4.0!

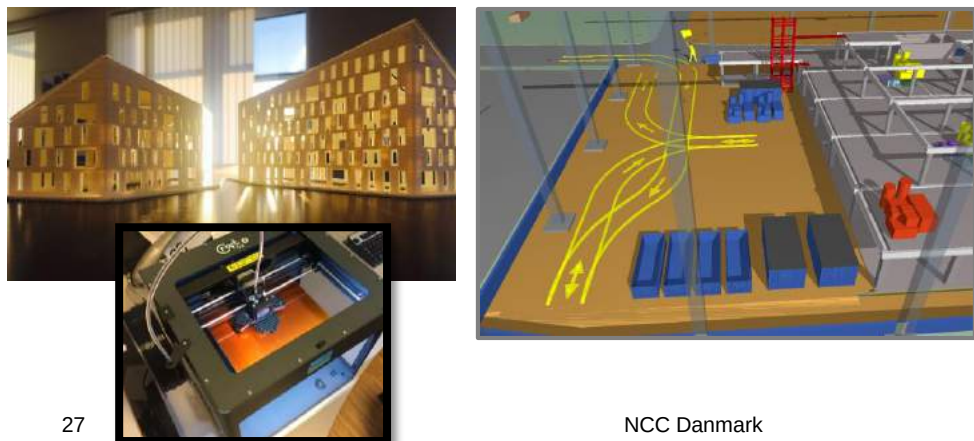
Kollaborative og integrerede designprocesser



Digitale værktøjer og automatisering



Digitale prototyper og simuleringer



IoT – Internet of things

