Sykehusbygg HF

Vi bygger for pasientens helsetjeneste

Hva betyr industrialisering i teori og praksis?

Hvorfor engasjerer store byggherrer seg med dette?

Lars Abrahamsen

SYKEHUSBYGG

Om Sykehusbygg

- Startet i 2015
- Eies av de 4 regionale helseforetakene
- Oppdrag kun for helseforetak og regionale helseforetak
- Skal benyttes for alle prosjekt > 500 MNOK
- Hovedkontor i Trondheim og kontorer i Oslo, Stavanger, Kristiansand, Molde, Bodø
- Ca. 100 ansatte
  - Prosjektledere, klinisk personell/sykehusplanleggere, utstyrsplanleggere, ingeniører, arkitekter, økonomer, personell med spesialistkompetanse på spesialrom, fortidsminnevern, BIM

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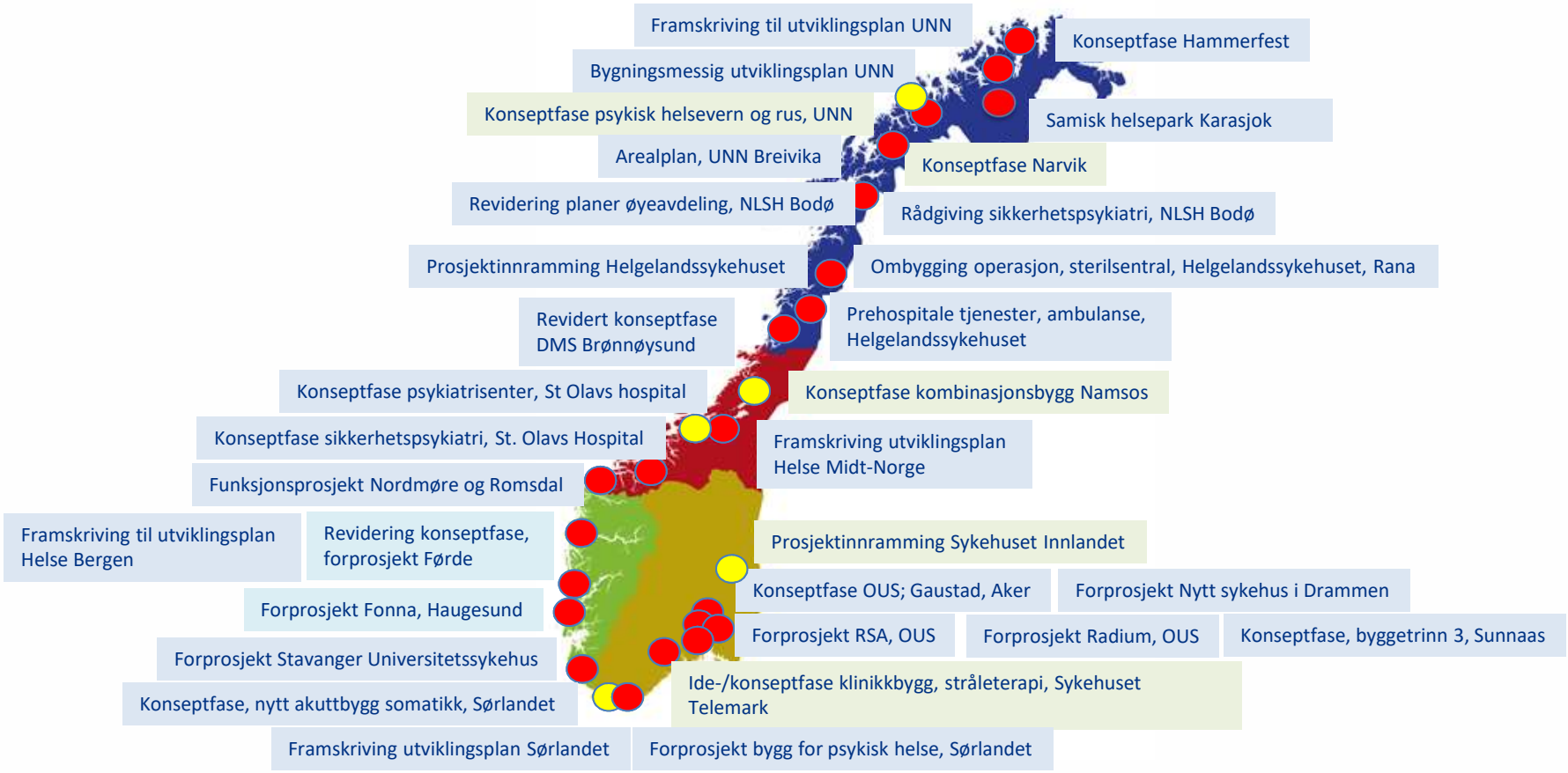
Prosjekter (utbygging, ombygging, analyser)



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SHARE OF TOTAL HOUSEBUILDING

1918 – labour & building materials shortages > experiments with OSM

1930s – supply of cheap labour & land, limited planning controls > mass suburbanisation

1945 – shortages of housing & factories not needed for war effort > move towards OSM. 150,000 constructed

1960s – rapid expansion of social housebuilding > OSM for high rise apartments

1970s – disillusionment, but also experiments to exploit economies of scope via flexible production techniques

1980s – growth of OSM for private housebuilding but plagued by quality problems

1990s – re-emphasis on OSM to deliver higher productivity and building performance

2000s – high-rise apartment building boom stimulates OSM

1918 1930 1945 1965 1975 1985 1995 2015

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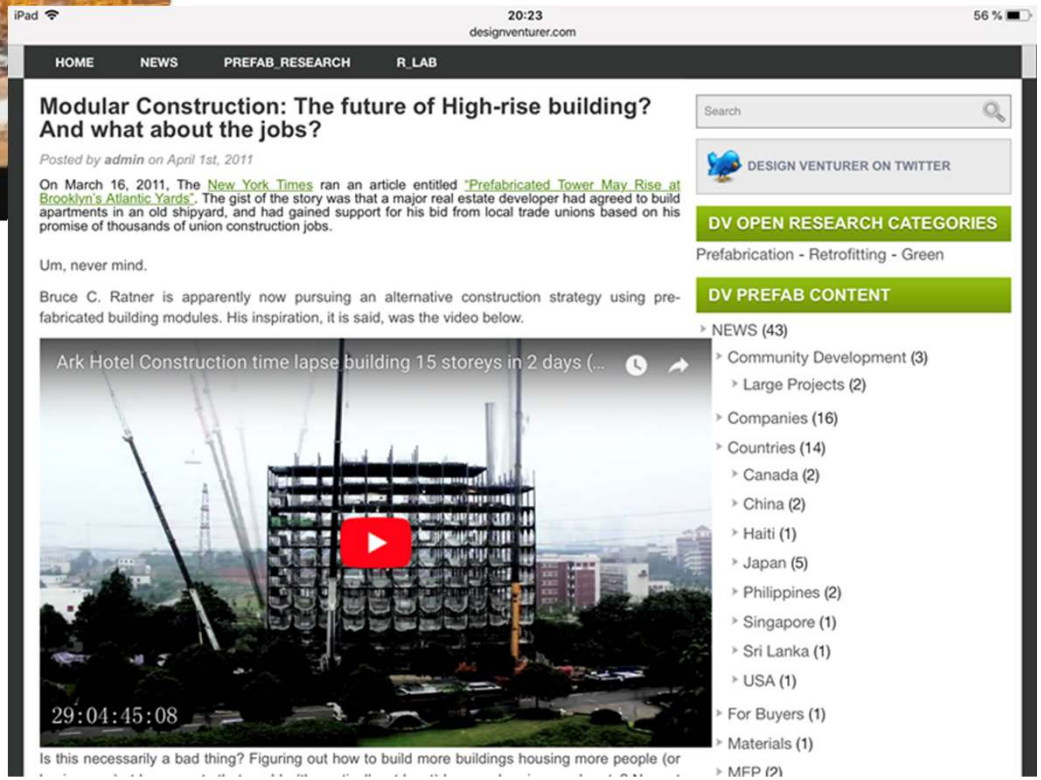
Ekstremt – Look to China!

30 etasjes hotell på 16 døgn



McKinsey&Company

MCKINSEY GLOBAL INSTITUTE

REINVENTING CONSTRUCTION: A ROUTE TO HIGHER PRODUCTIVITY

FEBRUARY 2017

IN COLLABORATION WITH
MCKINSEY'S CAPITAL PROJECTS & INFRASTRUCTURE PRACTICE

EXECUTIVE SUMMARY

MCKINSEY GLOBAL INSTITUTE
RESEARCH. INSIGHT. IMPACT.

The productivity opportunity in construction

Construction matters for the world economy

... but has a long record of poor productivity

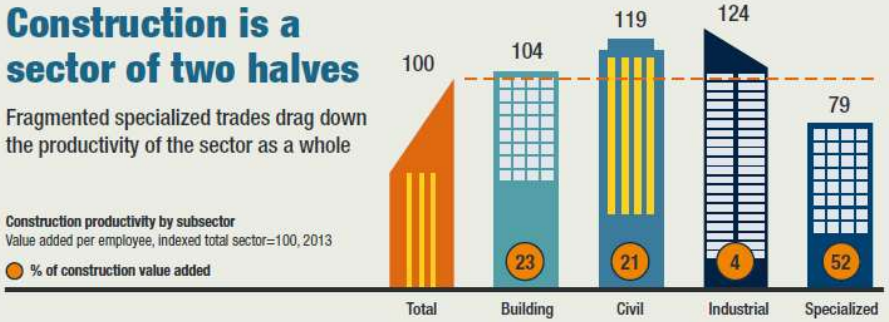
Construction-related spending accounts for **13%** of the world's GDP

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

$1.6 trillion of additional value added could be created through higher productivity, meeting half the world's infrastructure need

Construction is a sector of two halves

Fragmented specialized trades drag down the productivity of the sector as a whole



Action in seven areas can boost sector productivity by 50–60%

- Reshape regulation
- Rewire contracts
- Rethink design
- Improve procurement and supply chain
- Improve onsite execution
- Infuse technology and innovation
- Reskill workers

5–10x productivity boost

possible for some parts of the industry by moving to a manufacturing-style production system

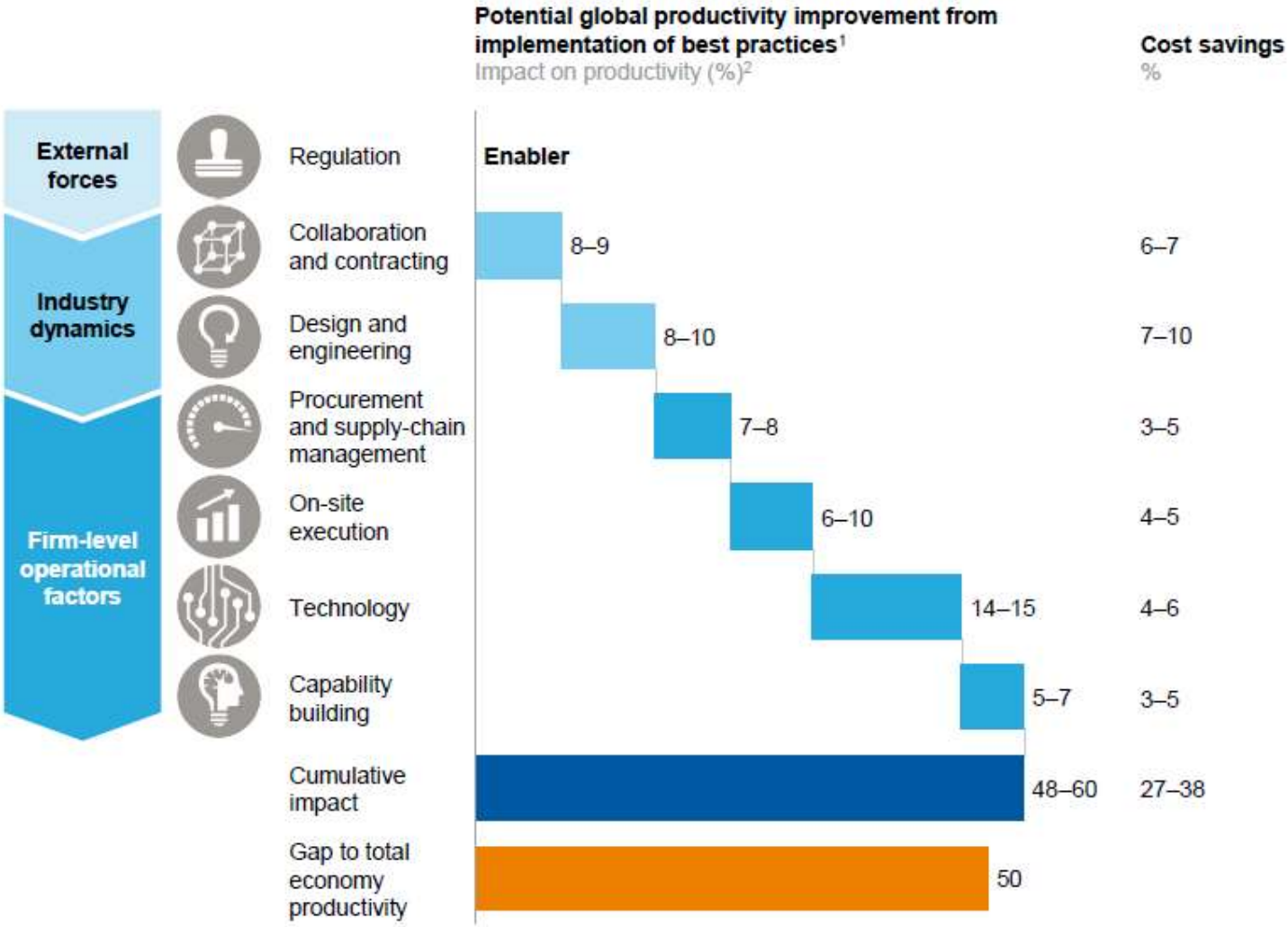
7 anbefalte tiltak for å håndtere 10 rotårsaker til byggebransjens dårlige produktivitet

- Omforme forskrifter og øke åpenhet
- Omstrukturer kontraktsregime
- Rekonstruere planleggings og prosjekteringsprosessen
- Forbedre innkjøp og ledelse i leverandørkjeden
- Forbedre gjennomføring på byggeplass
- Implementer ny teknologi, nye produkter og avansert automatisering
- Omskolere arbeidsstyrken

Exhibit E5

Construction can catch up with total economy productivity by taking action in seven areas

Cascading effect
Regulation changes facilitate shifts in industry dynamics that enable firm-level levers and impact



1 The impact numbers have been scaled down from a best case project number to reflect current levels of adoption and applicability across projects, based on respondents to the MGI Construction Productivity Survey who responded "agree" or "strongly agree" to the questions around implementation of the solutions.
2 Range reflects expected difference in impact between emerging and developed markets.

SOURCE: McKinsey Global Institute analysis

Store gevinster – McKinsey&Company

There is an opportunity for parts of the construction industry to move to a production system—and boost productivity up to tenfold

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Waste

Wasted Time in Construction is Out of Control.

The Construction Industry Institute (CII) published a report in 2004 comparing wasted time vs productive time in the manufacturing and the construction industry.

88% of time in manufacturing was found to be productive (value added) vs only 43 % of time spent in construction. This reports demonstrates that more than 50% of time spent on construction sites is waste (non value added).

Kilde: leanipd.com

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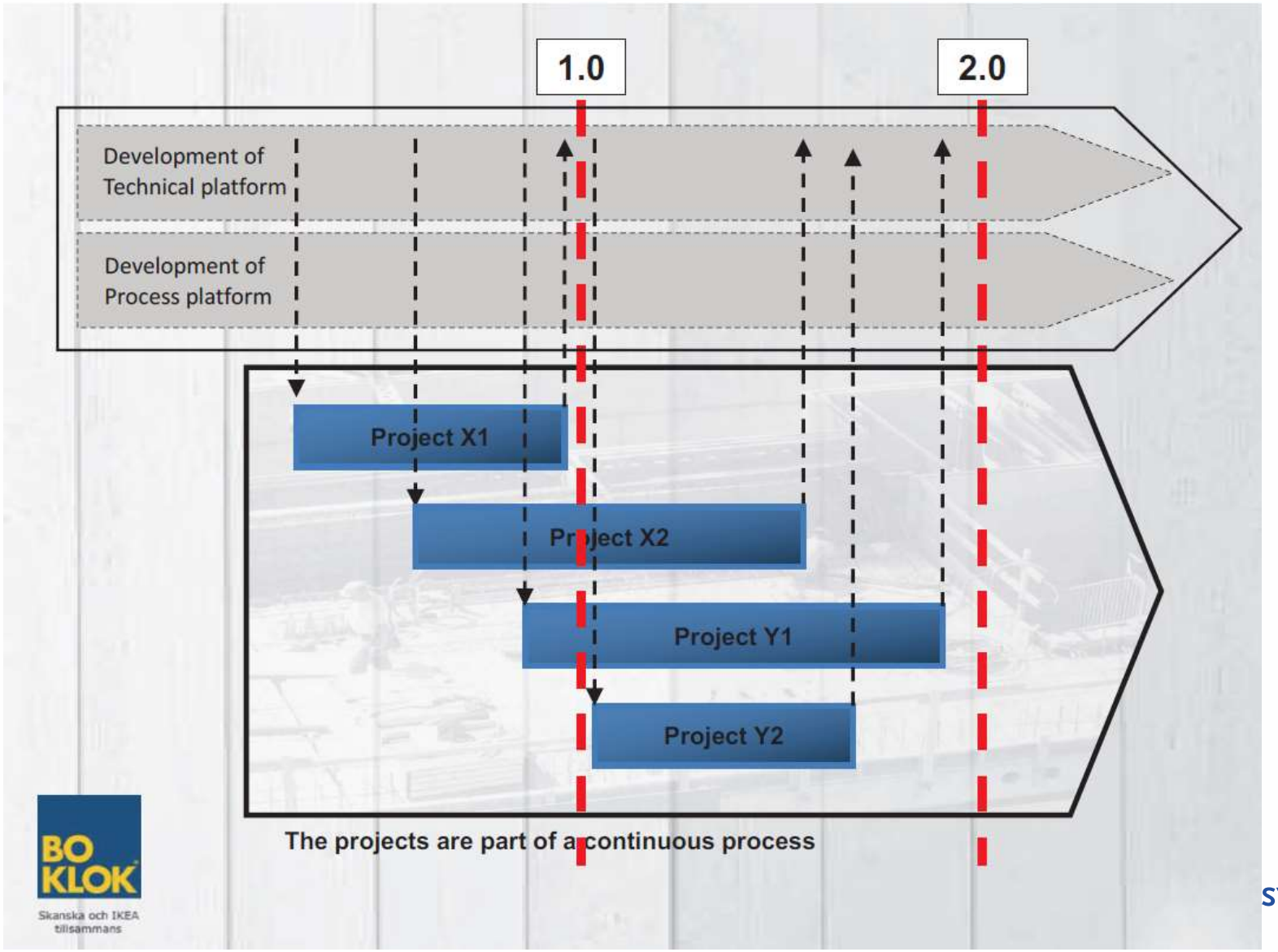
Behov for langsiktighet



Fra skreddersøm og onsite til standardisering og off-site

Sykehusbygg

Byggmetodikk / industriell byggproduksjon

Plassbygd
(Tradisjonell byggmetodikk)

«Flatpakket»
Separate moduler som settes sammen på byggeplass:

Store rommoduler

Ulike tilnærminger til industrialisering

OFF-SITE FABRICATION

- Benytter industripartnere for leveranser

NEAR-SITE FABRICATION

- Etablerer produksjon midlertidig i egnede nærliggende lokaler

ON-SITE FABRICATION

- Industrialiell byggeproduksjon

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Begreper industrialisering

Produktindustrialisering

- Flytter grensesnittet fra byggeplassproduksjon til industripartner

Prosessindustrialisering

- Utvikler vareflyt og produksjon mer industrielt

Enfaglige leveranser

Flerfaglig leveranser

Modulær industrialisering

- Innenfor etablerte bransjeinndelinger

Systemisk industrialisering

- På tvers av etablerte strukturer

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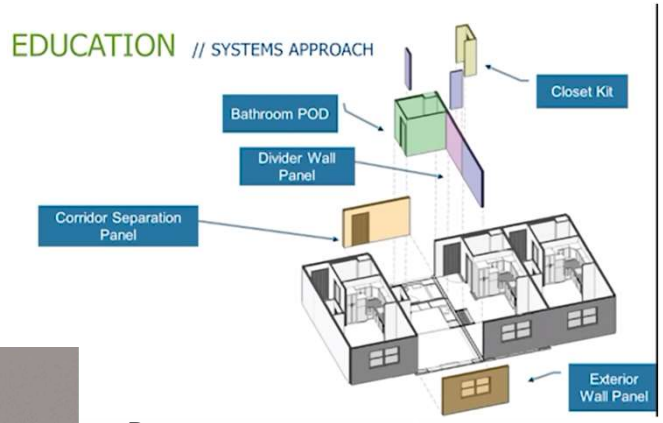
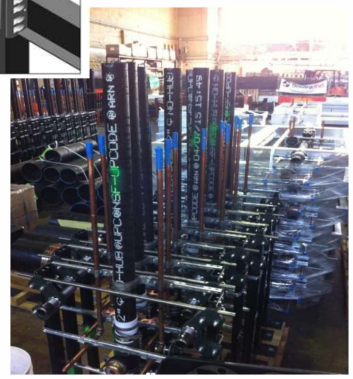
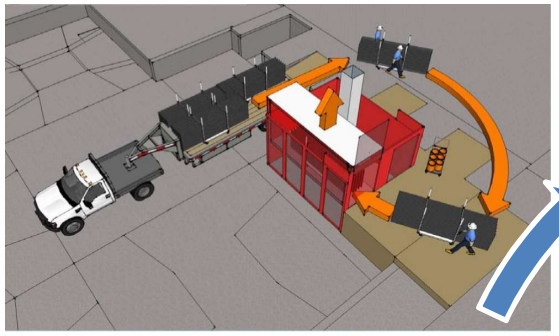
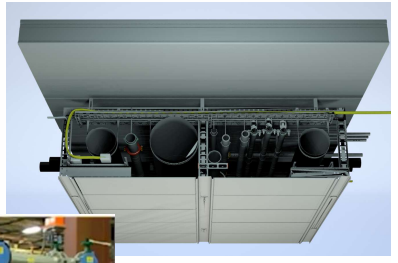






Prosess og logistikk

Komp enfag



Komp flerfag

Ulike tilnærminger til industrialisering

- OFF-SITE FABRICATION
  - Benytter industripartnere for leveranser
- NEAR-SITE FABRICATION
  - Etablerer produksjon midlertidig i egnede nærliggende lokaler
- ON-SITE FABRICATION
  - Industrialiell byggeproduksjon

Flate enfag

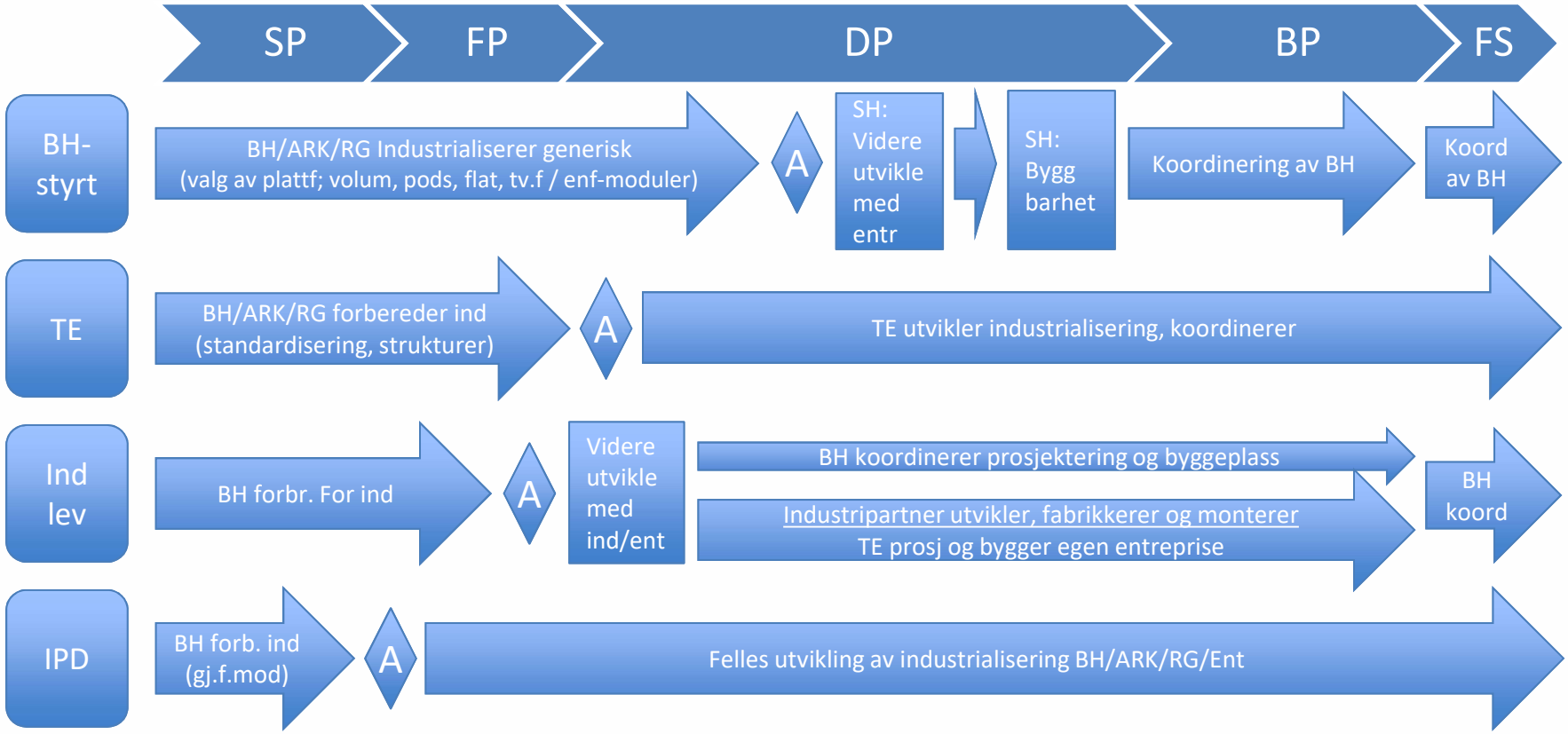
Volum flerfag

Rom flerfag

Flate flerfag

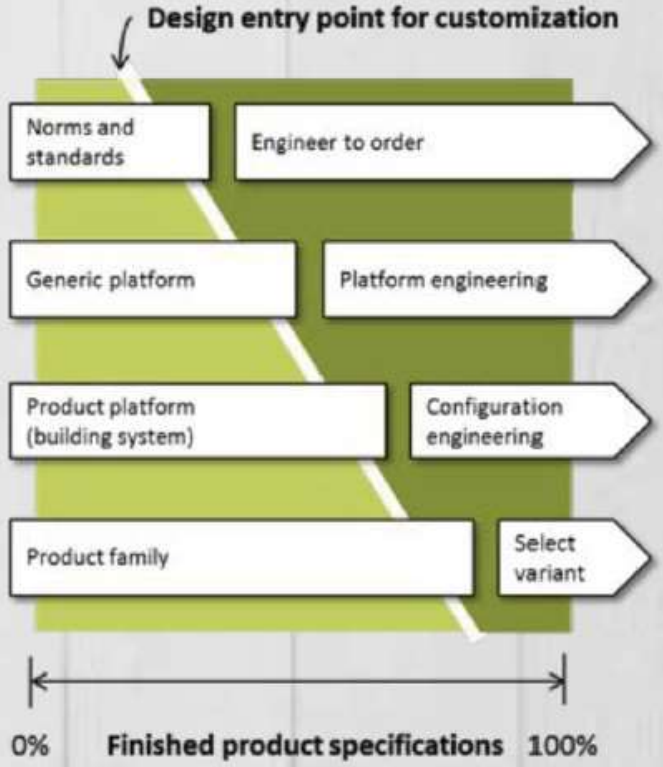
Industrialisering ved ulike entreprisemodeller

BH styrte delte E	• Industriløsning bestemmes av BH og RG • (SUS2023)
Total Entr	• Industriløsning bestemmes av TE • (SNR)
IPD	• Industriløsning bestemmes i fellesskap • (Tønsbergprosjektet)
Industrileverandør	• Industriløsning bestemmes av ind.part • (Nye Kirkenes)


SP
FP
DP
BP
FS
BH-styrt
BH/ARK/RG Industrialiserer generisk (valg av plattf; volum, pods, flat, tv.f / enf-moduler)
A
SH: Videre utvikle med entr
SH: Bygg barhet
Koordinering av BH
Koord av BH
TE
BH/ARK/RG forbereder ind (standardisering, strukturer)
A
TE utvikler industrialisering, koordinerer
Ind lev
BH forbr. For ind
A
Videre utvikle med ind/ent
BH koordinerer prosjektering og byggeplass
Industripartner utvikler, fabrikkerer og monterer
TE prosj og bygger egen entreprise
BH koord
IPD
BH forb. ind (gj.f.mod)
A
Felles utvikling av industrialisering BH/ARK/RG/Ent

DIFFERENT PLATFORM STRATEGIES

- Choice of platform strategy affects process structure and organization
- The business model changes with the platform strategy
- Difference in offer and company role



BO KLOK
Skanska och IKEA tillsammans

Litt om barrierer

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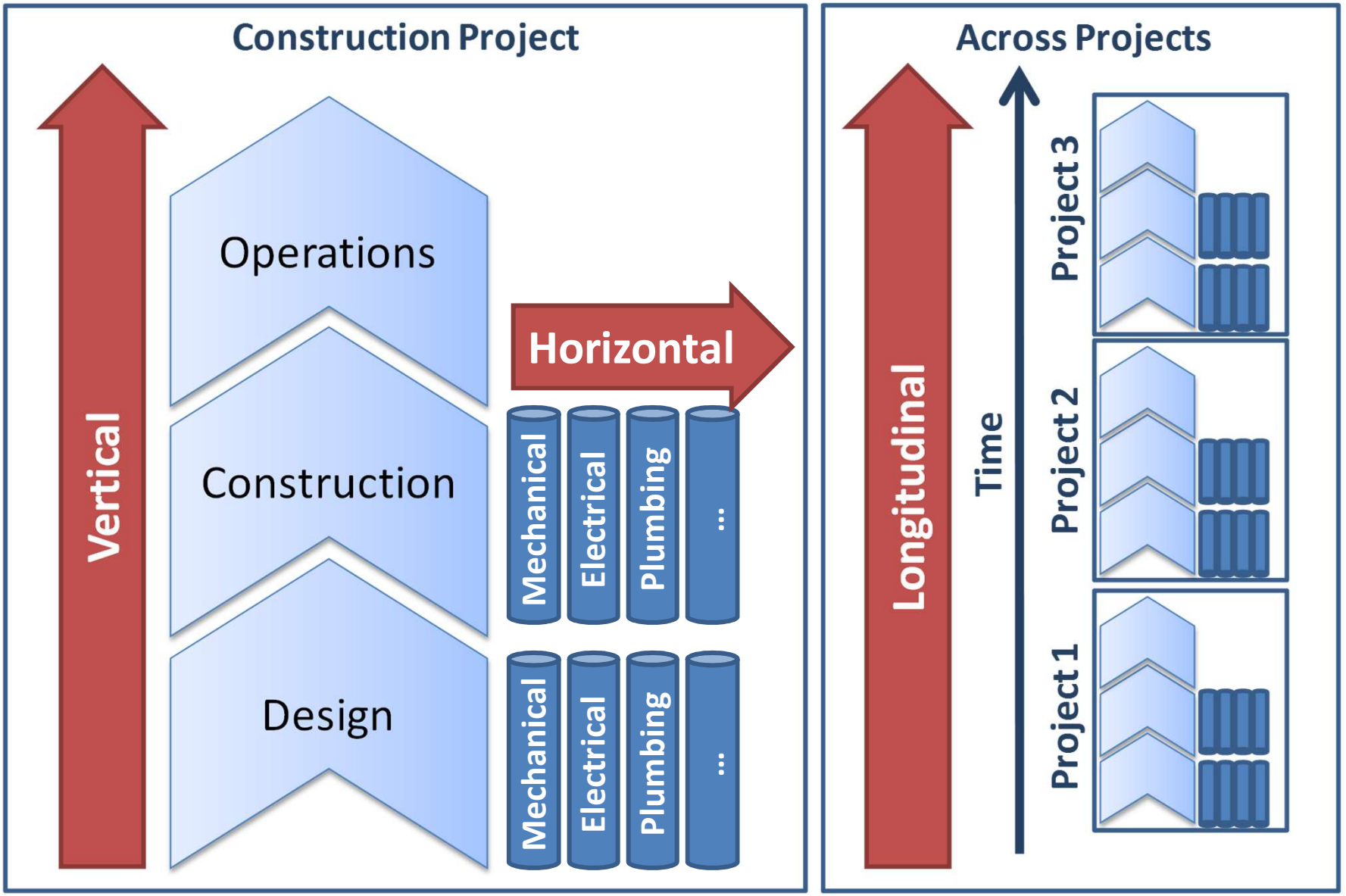
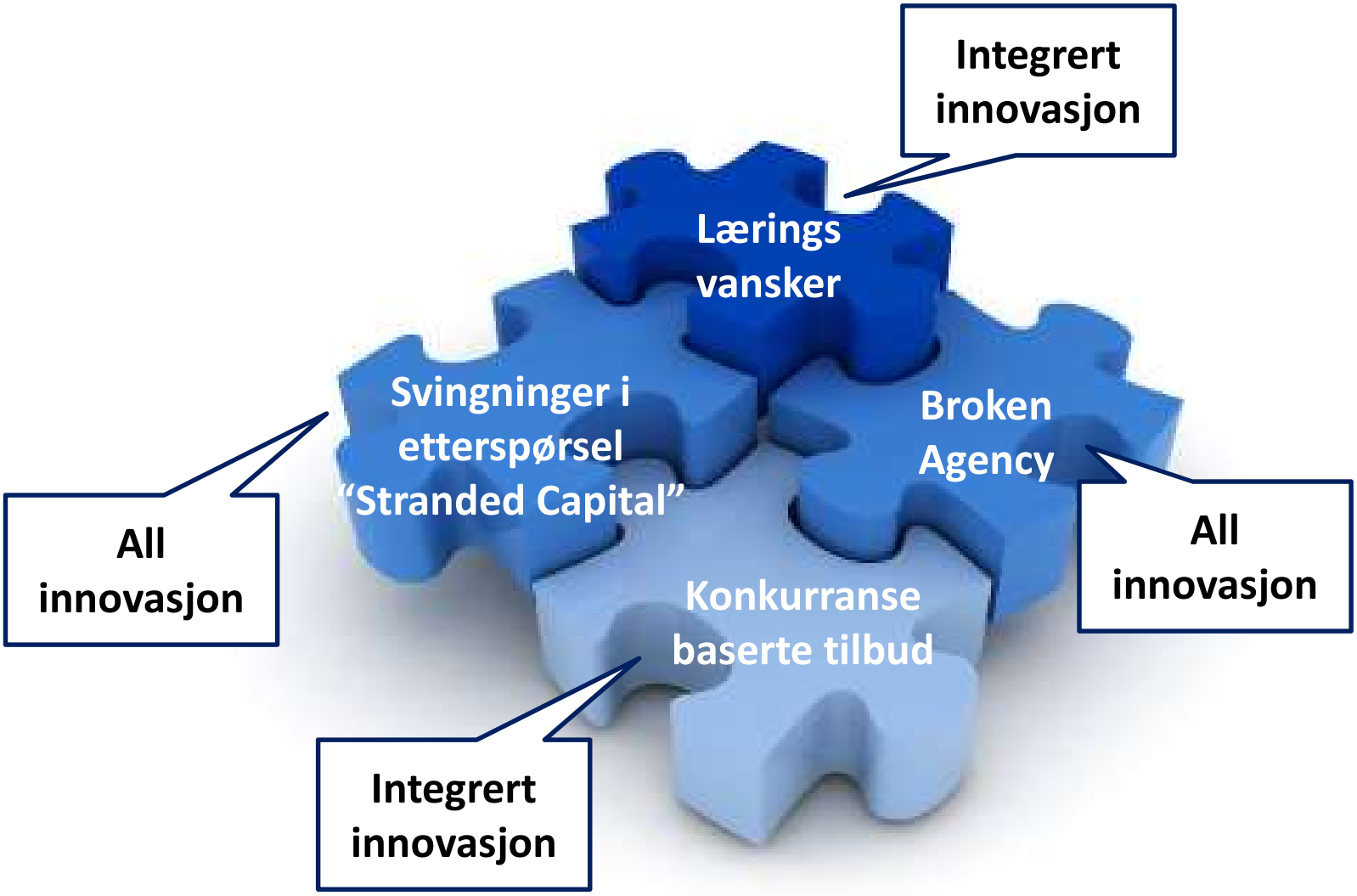
Fragmentering i en moden byggebransje



Strukturelle hindringer for diffusjon av innovasjon i byggebrasjen



Kilde: Sheffer & Levitt, 2010

Kontraheringsprosess og kontraktstype

Industrialisering og innovasjon

- Er fagforeningsinteresser med på å bremse? Det er god akkord på å gjøre det på gamlemåten når hindringer ryddes av veien i forkant.
- Det gir mer arbeid lokalt med mer tradisjonelle løsninger.
- Nye måter øker risikoen og krever mer samhandling. Aktørene må ha tid til det og ha en økonomisk gulrot for å gjøre det.
- Indualistrering krever relativt tidlig prosjektering i forhold til tradisjonell TE. Beslutningsvegring ødelegger fort mulighetene.

Bo Terje Kalsaas, uia

Et eksempel fra Denver, CO

A VALUE-BASED COST-BENEFIT ANALYSIS OF PREFABRICATION PROCESSES IN THE HEALTHCARE SECTOR: A CASE STUDY

Exempla Saint Joseph Heritage Project, Denver USA

$$B/C = \frac{[SiteBuilt\ Costs + Schedule\ Savings + Incident\ Costs\ Avoided]}{Prefabricated\ Costs}$$

Figure 2: Typical Prefabricated Bathroom Pod & Wall Panel

Figure 3: Typical Prefabricated Multi-Trade Rack & Patient Headwall

Kilde: Eric I. Antillón 1, Matthew R. Morris 2, William Gregor

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Sykehusprosjekt - 83000 m²

Table 3: Direct Cost Comparison Results

	Bathroom Pods	Wall Panels	MTRs	Headwalls	Total Prefab
Unit of Analysis:	Type 1 Bathroom Pod	15'H x 30'W Wall Panel	25'Lx8'Wx3'H MTR	Patient Room Headwall	All Prefab
Total Units:	440	346	166	376	1,328
Area (SF) / Unit:	51	284	200	72	N/A
Length (LF) / Unit:	N/A	19	25	N/A	N/A
Total Area (SF):	22,440	98,325	33,200	26,997	N/A
Total Length (LF):	N/A	6,458	4,150	N/A	N/A
Prefabrication Direct Cost	$ 9,498,000	$ 3,405,000	$ 3,006,000	$ 6,655,000	$ 22,560,000
Site-Built Direct Cost	$ 9,082,000	$ 3,535,000	$ 2,471,000	$ 6,187,000	$ 21,280,000
Total Direct Cost Delta	$ 416,000	$ (130,000)	$ 535,000	$ 468,000	$ 1,280,000
% Direct Cost Delta	4.6%	-3.7%	21.7%	7.6%	6.0%

Table 4: Schedule Impact Comparison Results

	Bathroom Pods	Wall Panels	MTRs	Headwalls	Total Prefab
Total Baseline Duration (Work Days)	649	649	649	649	649
Additional Work Days due to Site-built	52	41	20	0	72
Total Duration for Site-Built (Work Days)	701	690	669	649	721
% Schedule Delay Avoided	7.4%	5.9%	3.0%	0.0%	10.0%
Avoided GC's Cost (rates not shown)	$ 3,124,000	$ 2,384,000	$ 1,192,000	$ -	$ 4,275,000

Reelt oppnådd: 18%

Table 5: Labor Comparison Results

	Bathroom Pods	Wall Panels	MTRs	Headwalls	Total Prefab
Total Prefab Work-hours:					
Off-Site Prefab w-h	50,600	27,770	28,280	14,350	**121,000**
+ On-Site Prefab w-h	3,520	6,290	7,500	3,010	**20,320**
= Prefab w-h	54,120	34,060	35,780	17,360	**141,320**
Total Site-built Work-hours:					
Site-built w-h	81,820	39,210	31,070	18,700	**170,800**
Total Diverted Work-hours:					
Reduced On-Site Labor Hours	78,300	32,900	23,600	15,700	**150,500**
Diverted w-h	27,700	5,150	-4,710	1,340	**29,480**

Table 7: Benefit-to-Cost Ratio Analysis

B/C Analysis	Bathroom Pods	Wall Panels	MTRs	Headwalls	Total Prefab
Benefit					
Total Site-Built Cost Investment	$ 9,082,000	$ 3,535,000	$ 2,471,000	$ 6,187,000	**$ 21,280,000**
+ Total Schedule Cost Savings	$ 3,124,000	$ 2,384,000	$ 1,192,000	$ -	**$ 4,275,000**
+ Total Incident Cost Avoided	$ 50,395	$ 21,175	$ 15,189	$ 10,105	**$ 96,863**
= Total Benefit	$ 12,256,395	$ 5,940,175	$ 3,678,189	$ 6,197,105	**$ 25,651,863**
Cost					
Total Direct Prefab Cost	$ 9,498,000	$ 3,405,000	$ 3,006,000	$ 6,655,000	**$ 22,560,000**
Benefit/Cost Ratio	**1.29**	**1.74**	**1.22**	**0.93**	**1.14**

EXEMPLA **ST. JOSEPH** HERITAGE **PROJECT**

PREFAB ELEMENT	SCHEDULE REDUCTION	INDIRECT COST SAVINGS	DIRECT COST	REDUCTION IN REQUIRED LABOR	DIVERTED OFF-SITE LABOR	SAFETY INCIDENTS REDUCED	JOBSITE PRODUCTIVITY LOSS PREVENTION
Exterior Wall Panels	41 Days	$2.4 M	3.7% Savings	5,000 Hours	33,000 Hours	2	$0.5 M
Bathroom Pods	52 Days	$3.1 M	4.6% Premium	27,700 Hours	78,000 Hours	4	$1.4 M
Multi-Trade Racks	20 Days	$1.2 M	21.7% Premium	N/A	24,000 Hours	1	$0.4 M
Patient Room Headwalls	0 Days	$0	7.6% Premium	1,300 Hours	16,000 Hours	1	$0.3 M
TOTAL	**72** Days	**$4.3 M**	**6.0%** Premium	**29,500** Hours	**150,500** Hours	**7**	**$2.6 M**

https://www.usengineering.com/portfolio-item/exempla-saint-joseph-hospital-heritage-project-denver-co/

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LEAN // EVIDENCE

PROJECTS with **HIGH LEAN INTENSITY**

are **MORE LIKELY** to complete

AHEAD OF SCHEDULE & **UNDER BUDGET**

3X **2X**

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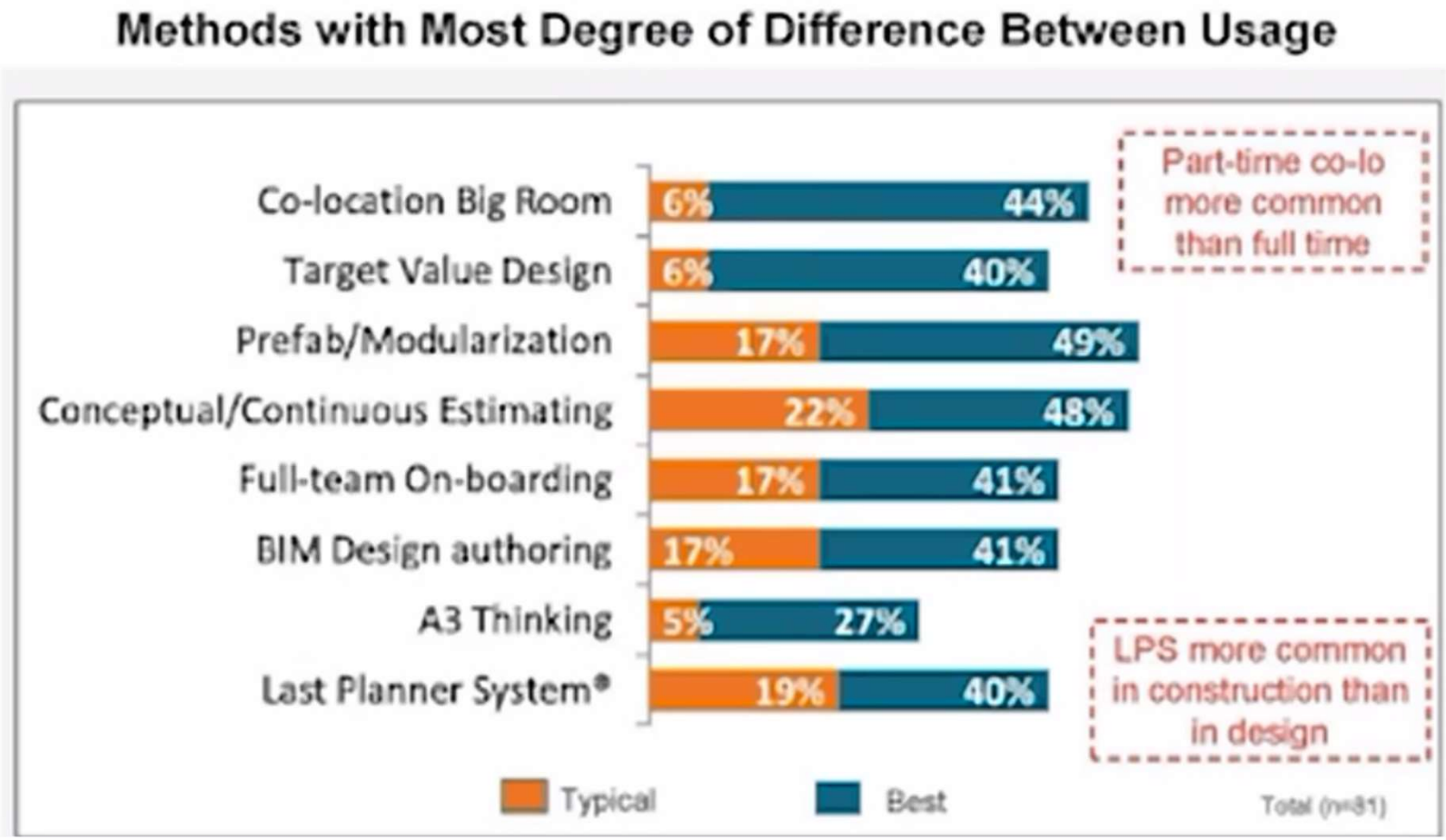
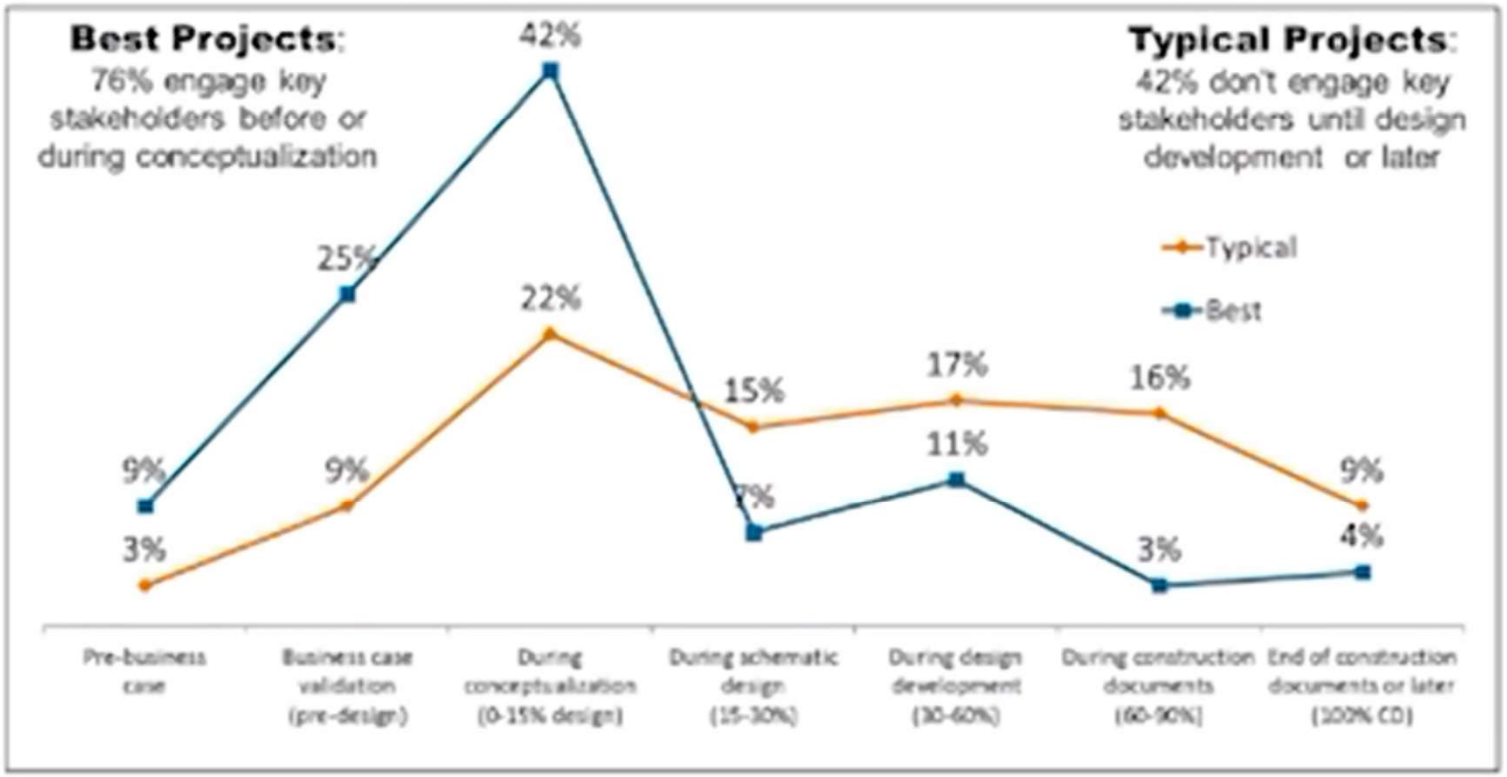
Learn as a Team



LEAN // EVIDENCE

Timing of Key Stakeholder Engagement



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