

TRANSFORMING CONSTRUCTION NETWORK PLUS

THE TRANSFORMING CONSTRUCTION NETWORK PLUS (N+)

Stimulating participation, facilitating collaboration, and encouraging exploration

The N+ unites construction's academic and industrial communities to create a new research and knowledge base, dedicated to addressing the systemic problems holding back the sector.



Imperial College
London



More information about the N+ can be find:

www.bit.ly/transforming-construction-network-plus

THE TRANSFORMING CONSTRUCTION NETWORK PLUS

- The N+ is funded by **UK Research and Innovation** through the **Industrial Strategy Challenge Fund**
- It is supported by UK Research & Innovation (UKRI) funding

The aim of the N+ is to provoke, enable and amplify innovation, through four main objectives:

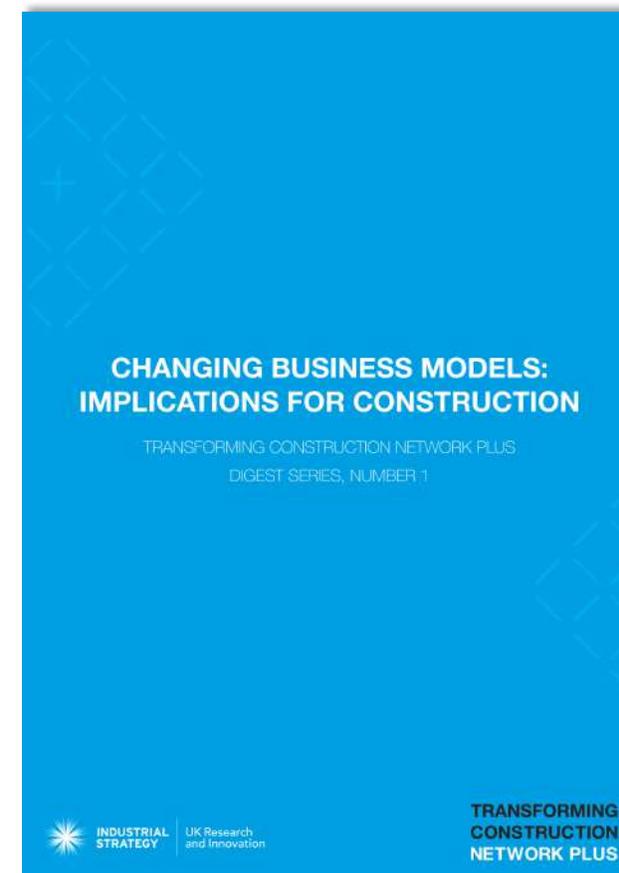
- Knowledge
- Community building
- Business models
- Investment and legacy

THE TRANSFORMING CONSTRUCTION NETWORK PLUS N+ RESEARCH PROGRAMME DIGEST

Changing Business Models: Implications for Construction

The digest summarises influential ideas about business models from industry and academia.

bit.ly/researchprogramme-transformingconstructionnetworkplus



WEBINAR: THE BUSINESS OF INDUSTRIAL TRANSFORMATION



Dr. Samuel C. MacAulay

Senior Lecturer at UTS Business School at the University of Technology Sydney and a Visiting Researcher at The Bartlett, UCL.



Dr Lena E. Bygballe

Associate Professor and Head of Centre for the Construction Industry in the Department of Strategy and Entrepreneurship at BI Norwegian Business School.



Prof Andrew Davies

RM Phillips Freeman Chair and Professor of Innovation Management at the University of Sussex Business School. Honorary Professor at the Bartlett Faculty of the Built Environment, UCL. Co-Investigator of the Transforming Construction Network Plus

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**TRANSFORMING
CONSTRUCTION
NETWORK PLUS**

New ways of creating and
capturing value

Dr. Samuel C. MacAulay
University of Technology Sydney
samuel.macaulay@uts.edu.au

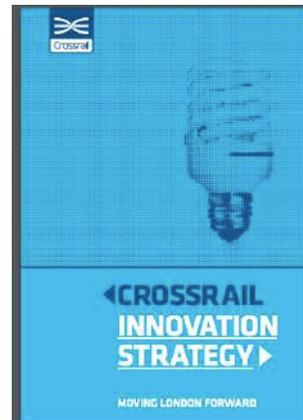
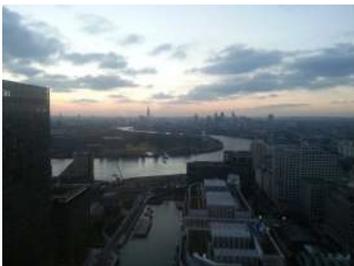
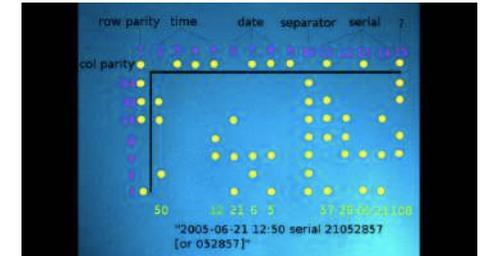
What I do

- Teach strategy & innovation



What I do

- Teach strategy/innovation
- Research



What I do

- Teach strategy/innovation
- Research
- Advisory & Thought Leadership



Today

1. Innovation being driven by Industry 4.0
2. Three new ways of creating value
3. New challenges to capturing value
4. Tools for inhibiting imitation and gaining competitive advantage

Key changes being driven by 4.0 innovation

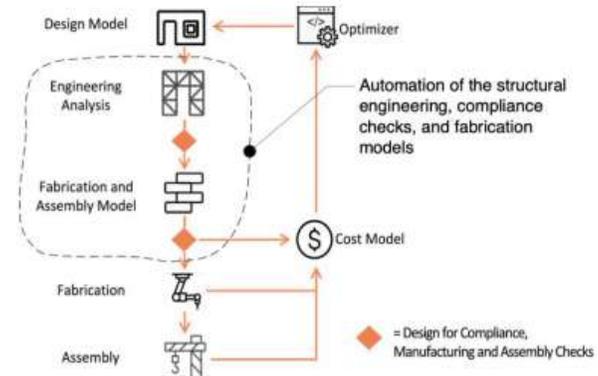
Now: fast, low cost, high fidelity, simulation, analysis and prediction

Next: mass customization and autonomous construction?

Radical innovation



e.g. Real-time safety monitoring by AI



e.g. Design automation
(Barg, Flager and Fisher, 2019)

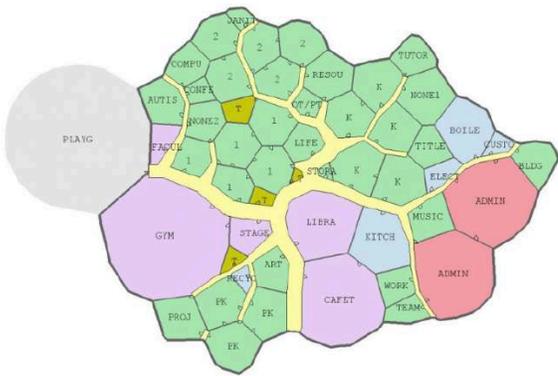
Figure 4. Katerra Process Diagram

Single function

Transform the value chain

e.g. AI-driven generative design

e.g. Digital twins



Incremental innovation

Three new ways of creating value

2. Stakeholders can digitally construct a high-fidelity, shared representation of value through **playful** engagement

Value proposition	Value Created for client
Functionality	Step-change in quantity or quality of output.
Speed	Reduced time-to-market.
Flexibility	Adapt to uncertainty in demand, supply, technology, or policy.
Reliability	Budget certainty, reduced contingency cost.
Lowest cost (CapEx/OpEx)	Higher margins.
Legitimacy	“Nobody ever got fired for buying IBM”



3. Construct high-fidelity, predictive models that allow diverse communities to converge on justifications required for radical innovation:
“in case of fire please use elevator”



Dodgson, Gann, and Salter (2007)



Implications for value creation

The value of capabilities involving human calculation and memory will fall.

The value of capabilities involving human judgment and negotiated interpretation will rise.

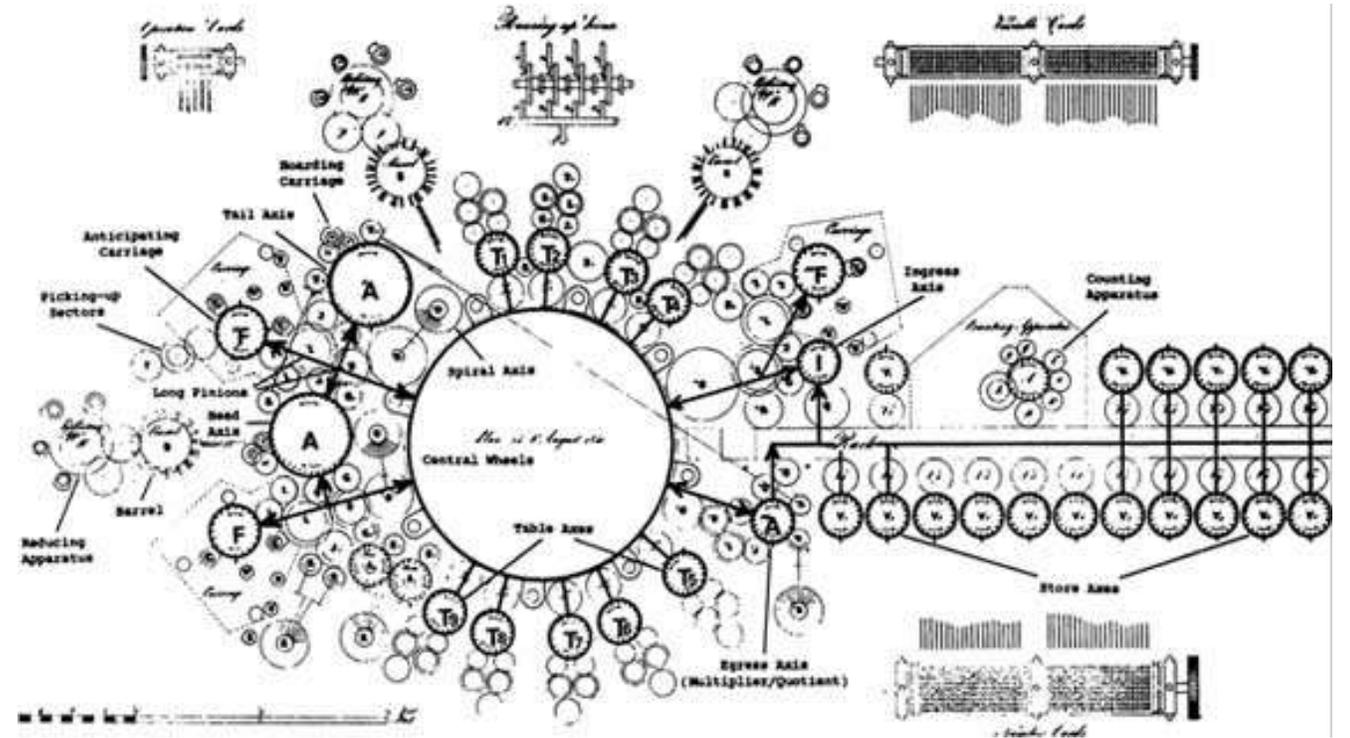
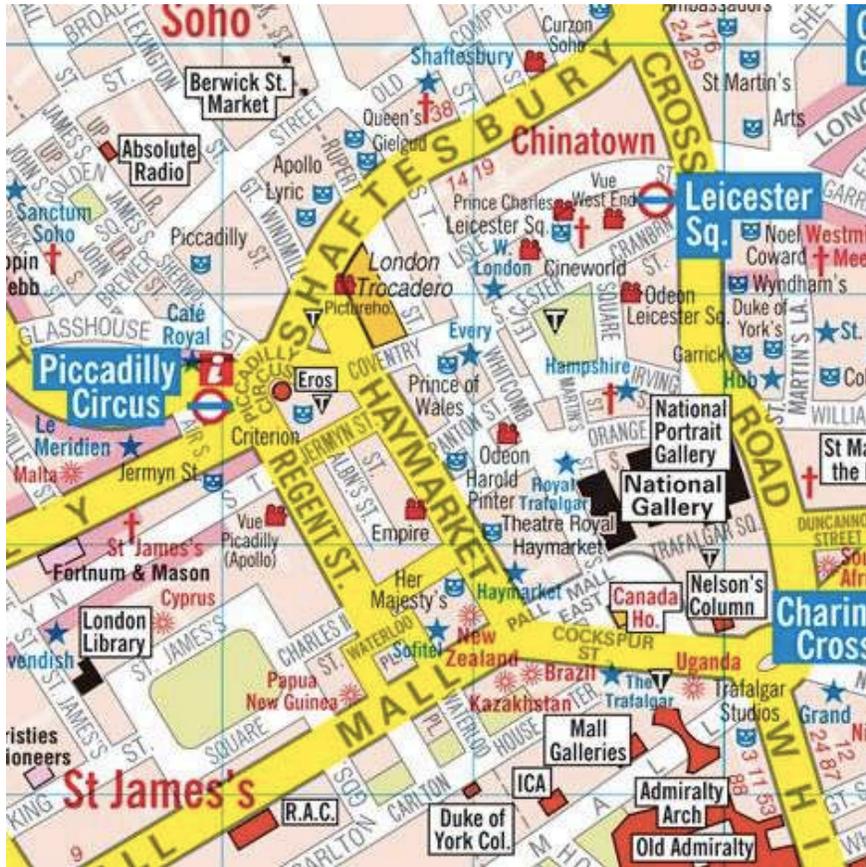
The basis of value creation will change. But competitive advantage also depends on capturing value by inhibiting imitators. Not clear how this will play out.

Physical vs. digital assets



It's difficult to walk out the gate of a mine site and take the economic value of a physical asset with you. You'll notice it's missing. When the asset is digital, the same cannot be said and a copy can extinguish your competitive advantage.

New articulation and codification technologies always creates value capture challenges



And imitating is getting easier

- **Codification and replication machines**

- Technologies to rapidly articulate and codify knowledge have seen revolutionary change. e.g. digitisation of manuals, 3D printing, laser scanning etc

- **Weakening appropriability regimes**

- “We estimate that the annual cost to the U.S. economy continues to exceed \$225 billion in counterfeit goods, pirated software, and theft of trade secrets and could be as high as **\$600 billion**” (US IP Commission Report (2017))



Common mechanisms for preventing imitation

- **Economic**

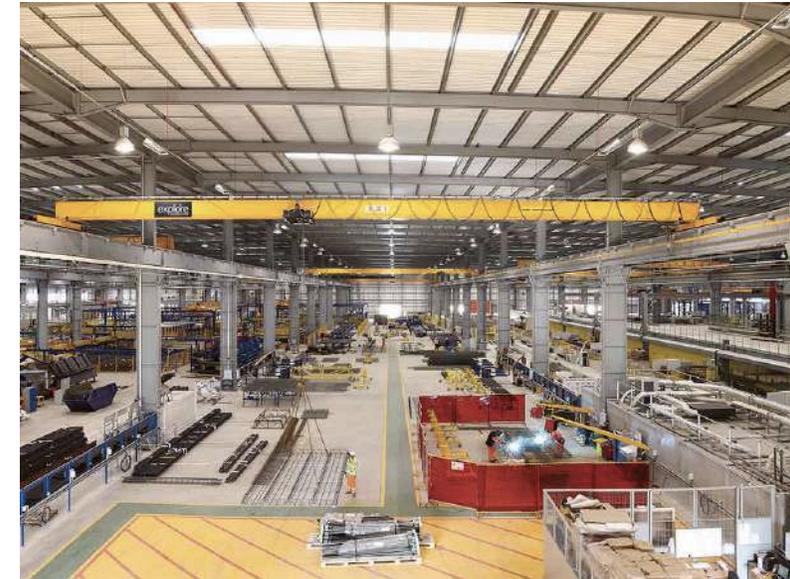
- Complementary assets e.g. LoR's factory

- **Legal**

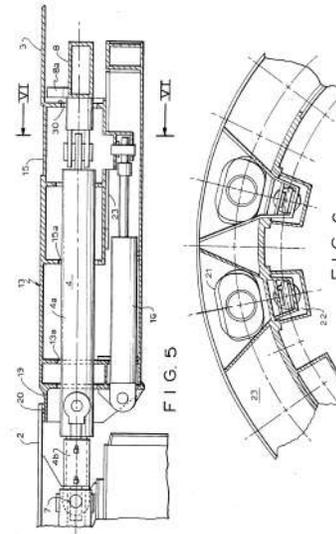
- Patent, Trademark, Trade secret, Copyright etc
- Employee conduct rules

- **Social**

- Norms: e.g. Chefs, Clowns etc



U.S. Patent Dec. 9, 1986 Sheet 5 of 5 4,627,765



Imperative of the new era: Design mechanisms

DESIGN

Great leap forward for pre-fab boats

A Western Australian pre-fab aluminium boat company has come up with software that "eats" itself as the boat panels are being cut.

COMPUTER Design Marine, a Perth company that is generating world-wide interest with its pre-fabricated aluminium boat packages, has devised a unique solution to the problem of protecting its boat designs while allowing boat panels to be cut by high-precision plasma torches overseas.

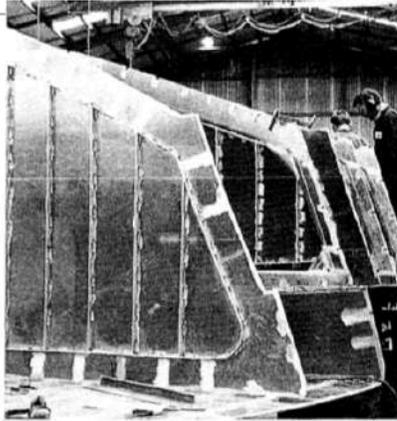
In conjunction with Curtin University, the company has developed a security software package which allows it to send discs or e-mail designs anywhere in the world safe in the knowledge that the design cannot be copied.

The software eliminates or "eats" itself as soon as the numerically controlled plasma cutter has cut out a panel and checked that the panel has been accurately cut.

"If a customer buys a disc from us, they can only produce one boat," said Computer Design Marine (CDM) Managing Director, Phil Curran.

"The software may have applications to designs of a whole range of other products, such as clothing or footwear."

Mr Curran, an internationally recognised naval



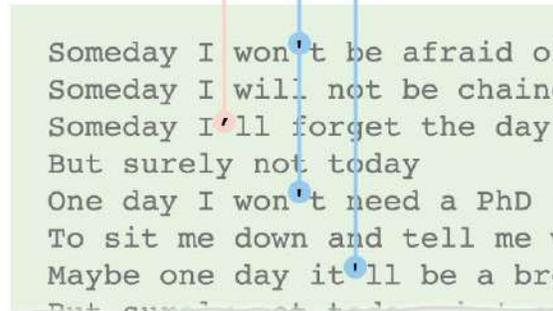
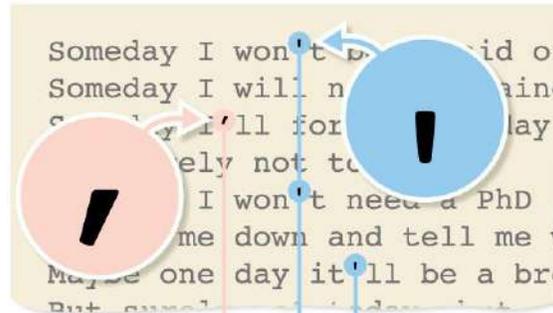
The Vessel Construction Package enables Australian-designed boats to be built overseas, minimising transport costs and avoiding government restrictions and tariffs imposed on importing completed vessels.

"We think the software may have applications to designs of a whole range of other products, such as clothing or footwear – anyone who needs to have shapes cut remotely by a cutting machine."

The Vessel Construction Packages (VCPs) supplied by CDM are extremely detailed and have unique features which enable boats to be assembled by low-skilled operators.

The packages come with instructions and all the necessary computer-cut aluminium segments to build the vessel quickly and easily.

"Local people with education to lower Primary standard can put them together – in fact anyone who can build a chair or weave a basket can build one of



Industry 4.0 is changing the way value is created and captured. What are you changing?

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WEBINAR: THE BUSINESS OF INDUSTRIAL TRANSFORMATION



Dr Lena E. Bygballe

Associate Professor and Head of Centre for the Construction Industry in the Department of Strategy and Entrepreneurship at BI Norwegian Business School.

Transforming Organisational Practices in Construction

Lena E. Bygballe, Phd

Centre for the Construction Industry

BI Norwegian Business School

www.bi.no/bygg

Agenda for the talk

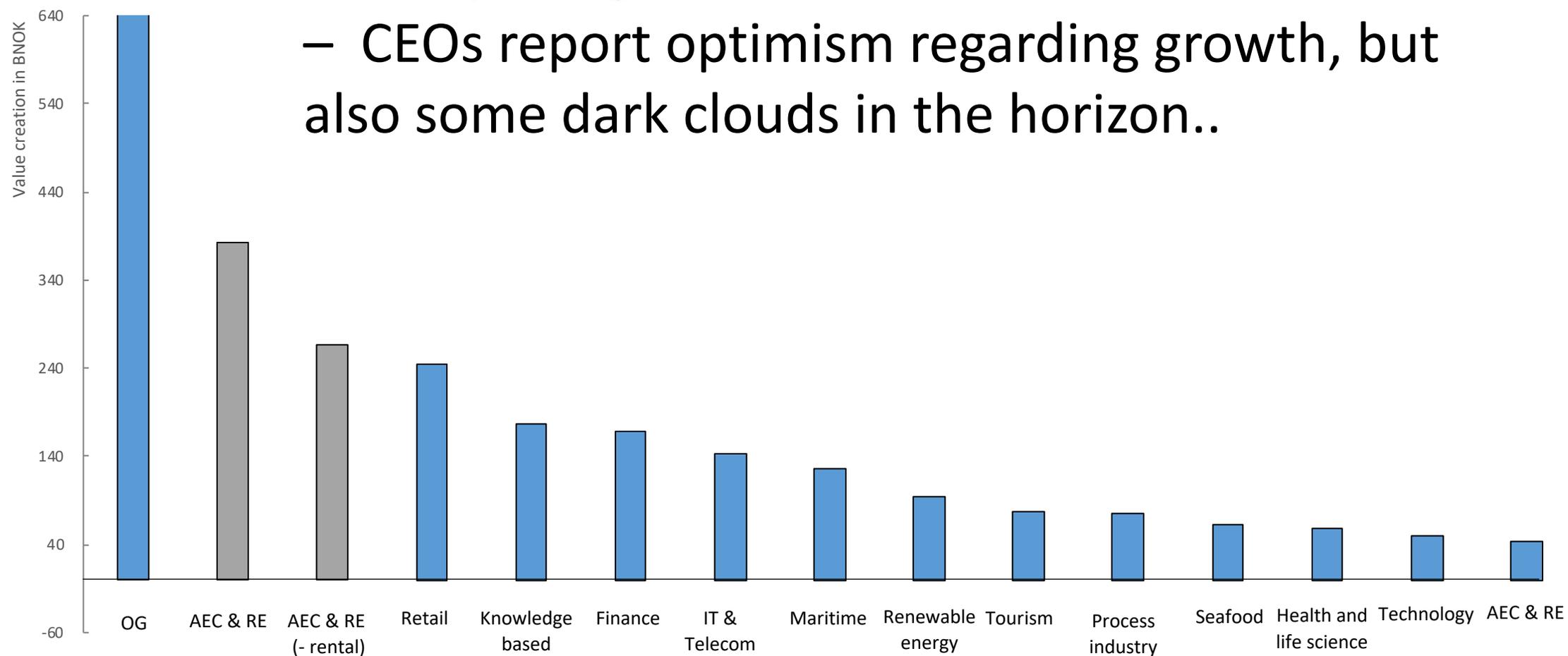
- ❑ Short introduction of myself and the Centre for the Construction Industry at BI Norwegian Business School
- ❑ What's the situation in the Norwegian AEC sector?
- ❑ So, what is the problem, and how can we approach it?

Introduction

- ❑ Since 2008, Associate professor in the Department of Strategy and Entrepreneurship and leader of BI's Centre for the Construction Industry
- ❑ The Centre is one of BI's main research centres:
 - Established in 2005 based on an industry initiative
 - Research on value creation, strategic and organisational change and innovation, related to climate change, lean construction, digital technologies, etc.
 - Administers the national Lean Construction Norway network
 - 15 associated academics on various levels

The situation in the Norwegian AEC sector

The AEC and Real Estate industry is one of Norway's largest in terms of value creation (GDP) – CEOs report optimism regarding growth, but also some dark clouds in the horizon..

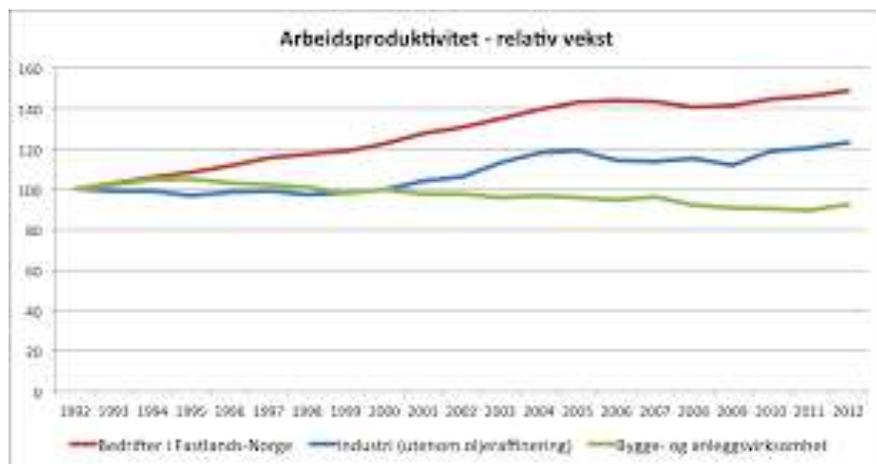




Low margins (4 percent) in the labour intensive parts of the industry



High (and costly) conflict level, particularly in public infrastructure projects



Lower productivity than rest of the industry



Poor reputation influences the attractment of talents – which is a key concern

bygg 21



Klyngemedlemmer:



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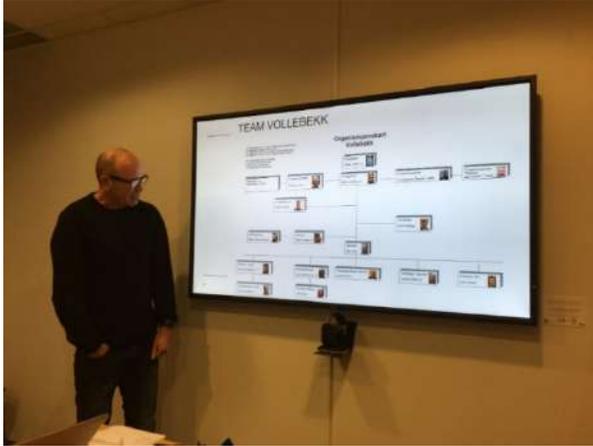
Two key collaborative initiatives:
Bygg21 and
Construction City Cluster



So, what is the problem and
how can we approach it?

«Our challenge is not the lack of good ideas and ambitions, but in scaling these to accelerate the change we have to go through»

Research program on implementing lean construction



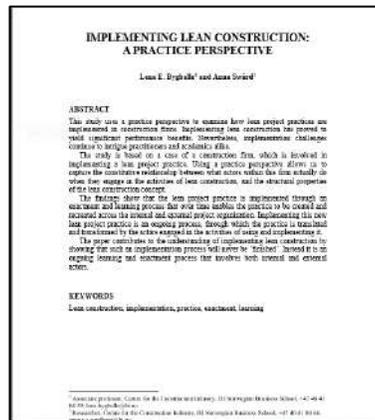
The role of middle managers as mediators and issue sellers



The role of projects and construction sites as important learning arenas



The role of HQ in prioritising, supporting and aligning with overall strategy



The role of research in creating the chain of evidence

Lean Construction NO
Nettverk for prosjektbasert produksjon

The role of networks in communicating knowledge

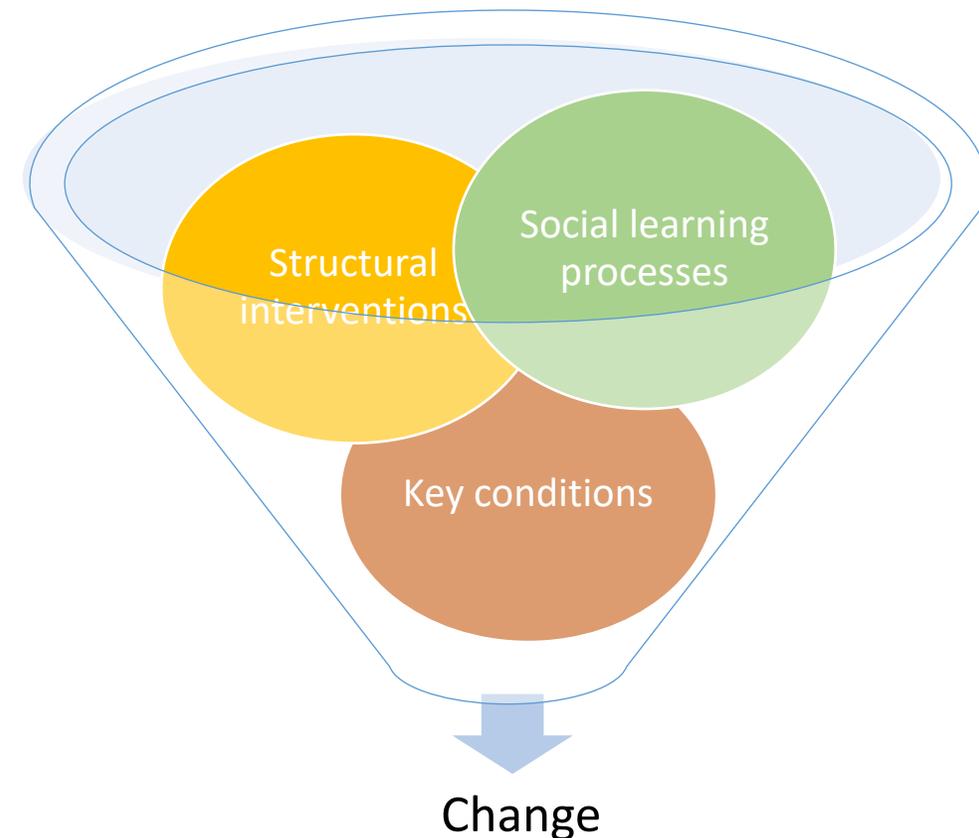
□ What are good strategies and practices for change?

- Create awareness of joint problem and need for change through signalling and legitimising
- Facilitate common understanding through social learning processes
- Allow for experimenting through prioritising and supporting
- Ensure a chain of evidence through evaluating and reporting
- Enable institutionalising change through embedding into practice

- ❑ Change is enabled through a combination of structural interventions and social learning processes

- ❑ Change is conditioned by several issues:
 - Legitimation, involvement, climate for change, competence, resources, chain of evidence and embeddedness

Summarising lessons learned about transforming organisational practices in construction



Thanks for the attention!

THE TRANSFORMING CONSTRUCTION NETWORK PLUS

For general enquiries about the N+, please contact the network team:

enquiries.tcnetworkplus@ucl.ac.uk



Imperial College
London



Join our mailing list to hear about the latest N+ news, upcoming events, and funding opportunities:

www.bit.ly/transforming-construction-network-plus