Industrialized Construction

The development and evolution in Sweden and globally

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LESSING INNOVATION
Industrialized Construction

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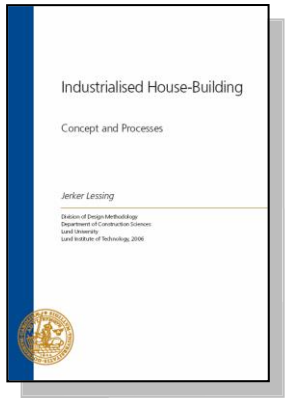
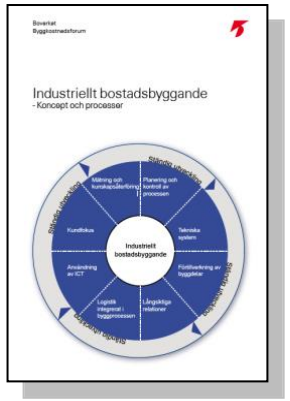
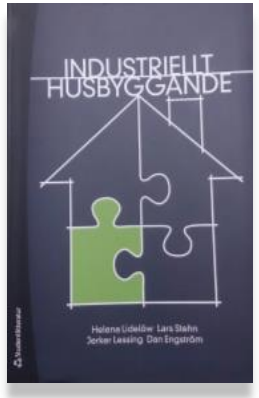
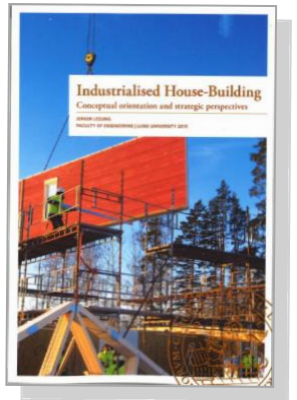
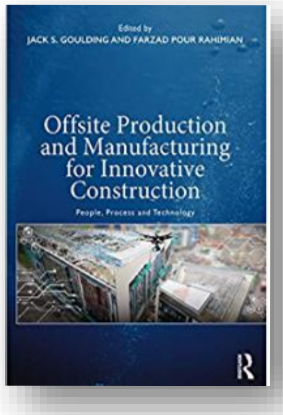
- PhD from Lund University, Industrialized Construction
- Specialized in IC development for 20+ years

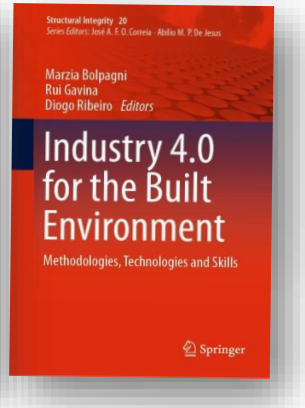












LESSING INNOVATION

Industrialized Construction

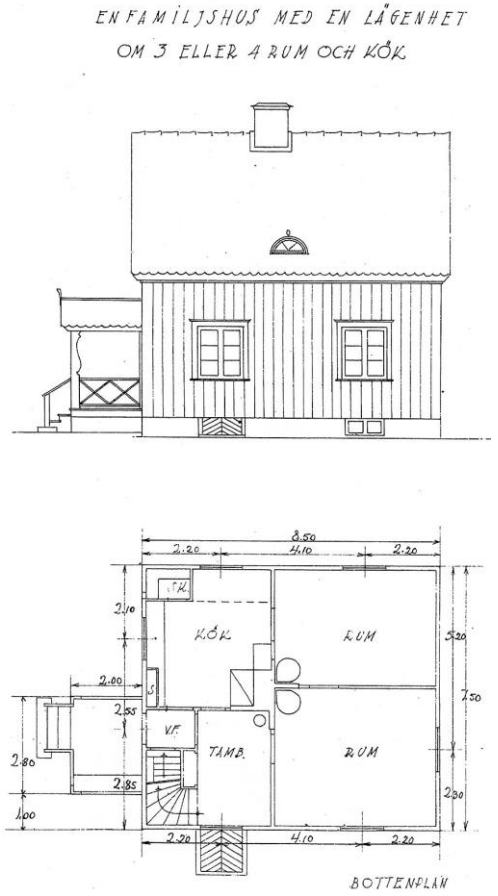
Today´s presentation

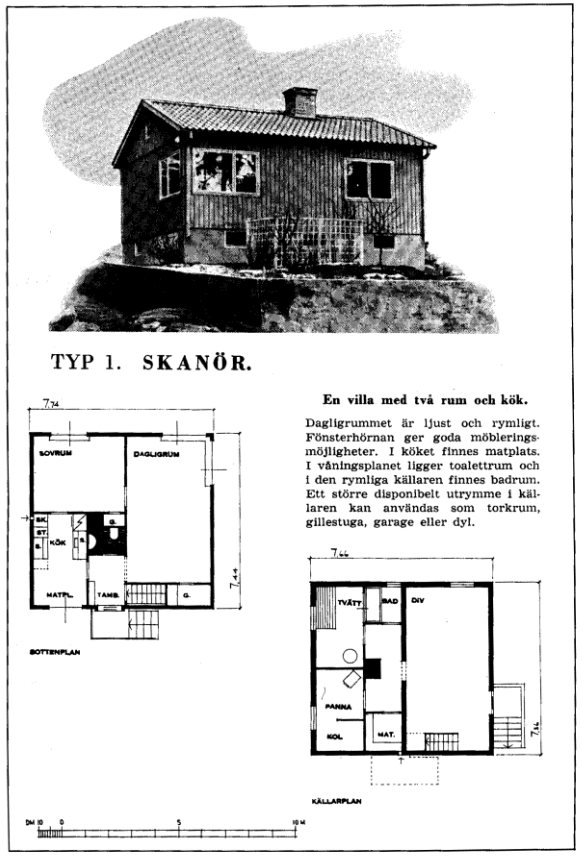
- Looking back
- Looking around

Looking back

It started 100 years ago

- In 1922 ”The National Building Bureau” published a series of standard drawings for detached houses
- These became popular and when used, a 50% shorter lead time on site was achieved!
- Some companies decided to produce prefabricated wall panels
- Some of the companies from this time are still active





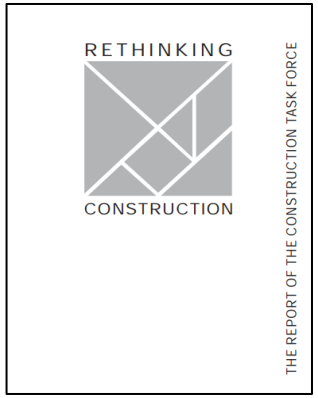
Example from 1942. Boro-hus offered a pre-defined, prefabricated detached house

More industrialization 1950-1970

- 1964 the government launched the ”Million Homes Programme”
- Strong development of building systems, methods, machines and factory production
- Large-scaled projects were supported by government
- The goal was achieved, but **the result was not a success**
- Weak customer focus, too large-scaled housing areas, too much focus on (mass) production
- The methods and the result gained a bad reputation

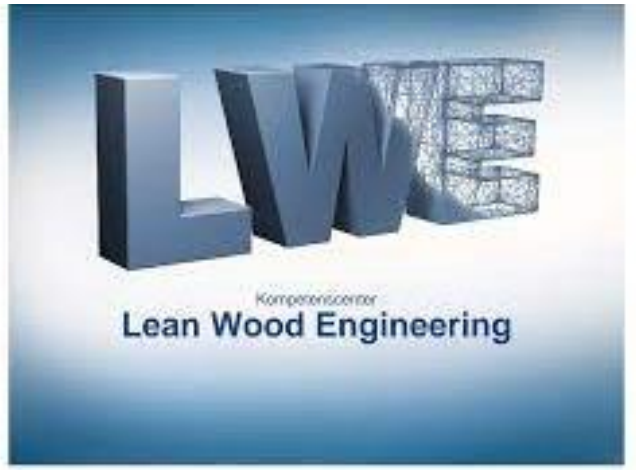
IC development early 2000s

- Industry and academia responded to alarming reports about the industry's challenges
- Several construction companies launched industrialization programmes – several failed!
- Also small and medium sized companies played an important role in the development – more succesful!
- A series of industry/academia research projects played an important role



Research early 2000s

- Lean Wood Engineering : a 6 year R&D programme funded by the government
- Industry and academia worked closely together to develop and evaluate processes, building solutions and business models
- Important knowledge supported the companies' developmnent
- These programs fostered experts in Industrialized Construction



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Industrialised house-building – development and conceptual orientation of the field

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Abstract

Purpose – This article aims to describe the development of industrialised house-building (IHB) to increase the understanding of the field.

Design/methodology/approach – The study is based on an extensive literature study and a case study with three companies, studied between 2005 and 2013 which enabled an in-depth knowledge about the companies' development within IHB. Interviews, observations and document studies are the main sources of information in the case studies.

Findings – IHB is a complex field, consisting of several constructs that need to be integrated and continuously developed. Development of structured technical building systems has been central to the development of IHB along with developed production methods and processes. The interest in organisational fit or adaptation to industrialisation and strategy concerning business, production and products is increasing. This implies that IHB needs to be managed strategically and not on a building project level.

Practical implications – The article gives an orientation on how leading companies have structured and organised their work within industrialisation, giving valuable advice to practitioners with interest in the field.

Originality/value – This article describes the development of IHB based on studies of literature and three Swedish IHB companies' development. This provides an aggregated view of the field's emergence and unique information about the studied companies' development.

Keywords Production system, Strategy, Industrialisation, Building system, Industrialised house-building, Offsite production

Paper type Research paper

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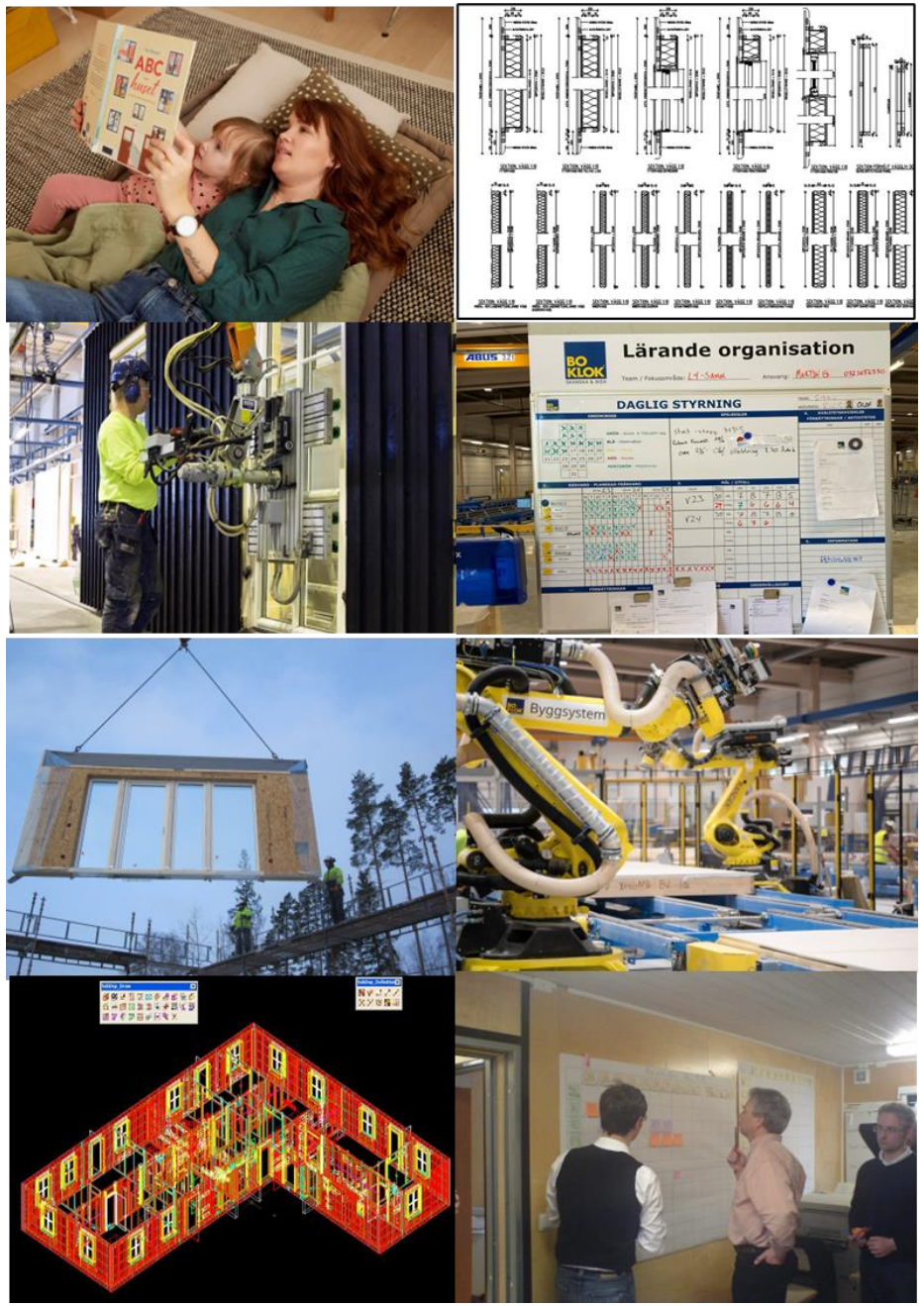
Introduction

The interest for industrialisation of house-building has grown in academia since the mid-1990s, connected to an increasing interest in the house-building industry with many companies applying alternative methods for customisation, production, design and supply chain management (Lessing, 2006). The industry development has been supported by academic research; one Swedish example is the Lean Wood Engineering programme, an industry-academia research programme focused on industrialised

What did we learn?

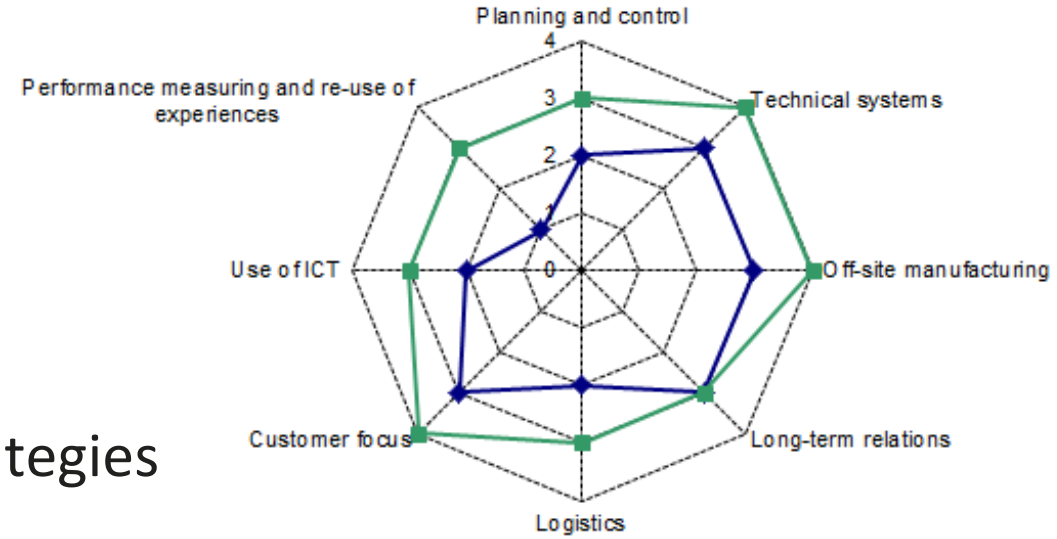
- Industrialization is not only about production
- A holistic, integrated approach is required
- Changed business models are needed
- It takes time to get it right
- A customer centric approach is crucial
- Several concepts, methods and systems are available – Strategic choices are crucial!
- Dare to specialize and stick to your strategy!

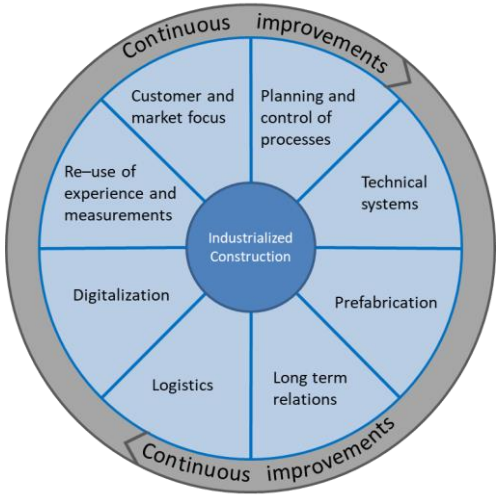


Framework, Models, Strategies

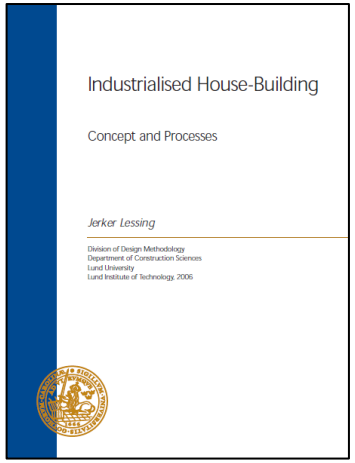
- Theoretical Framework
- Descriptive models
- Product and Production Strategies
- Business Models

-Important results from the research!





Lessing, 2006


Industrialised House-Building

Concept and Processes

Jerker Lessing

Division of Design Methodology
Department of Construction Sciences
Lund University
Lund Institute of Technology, 2006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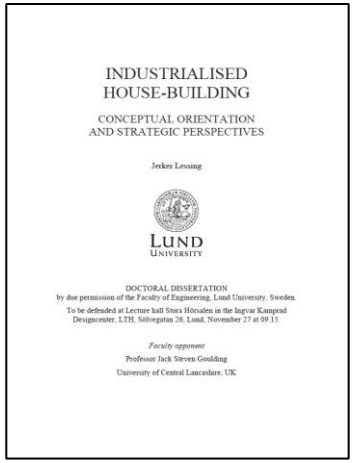

INDUSTRIALISED HOUSE-BUILDING

CONCEPTUAL ORIENTATION AND STRATEGIC PERSPECTIVES

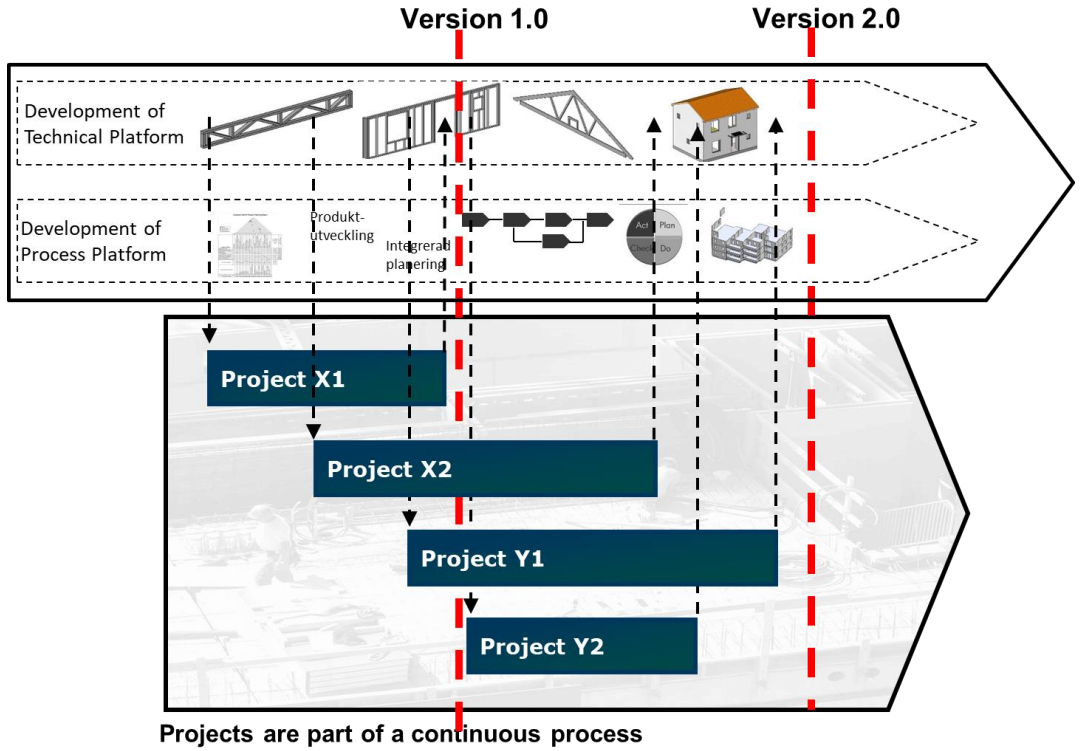
Jerker Lessing

LUND UNIVERSITY

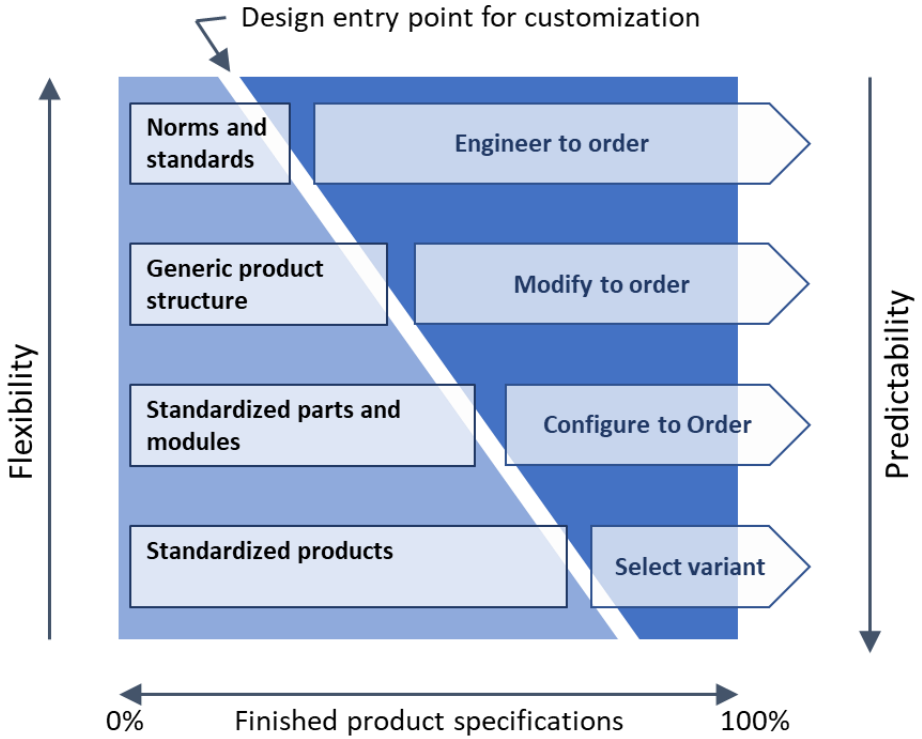
DOCTORAL DISSERTATION
by due permission of the Faculty of Engineering, Lund University, Sweden.
To be defended at Lecture hall Stora Hörsalen in the Ingvar Kamprad Designcenter, LTH, Sölvegatan 26, Lund, November 27 at 09.15.

Faculty opponent
Professor Jack Steven Goulding
University of Central Lancashire, UK

Platform strategies for IC



Lessing, 2006



Based on Hvam, 2008

Looking around

Industrialized construction in Sweden 2025

- 20% market share in multi storey housing
- 90% market share single family housing
- Growing market share for other buildings
- Some 15 producers of building systems for multi-storey buildings
- 4 CLT producers, many prefab concrete factories

- 15-20 single family house companies dominate (but there are many more)
- Investments in new production facilities being realized
- Presence at leading universities
- Strong political back-up

Three tracks in the industry development

Complete Concept Offers for apartment buildings

- Offered by vertically integrated companies
- Complete housing concepts
- Volumetric building systems dominate

Project Oriented Concepts

- Projects built with open building systems
- Wide variety of project types
- Big market opportunities

Single family homes (product offerings)

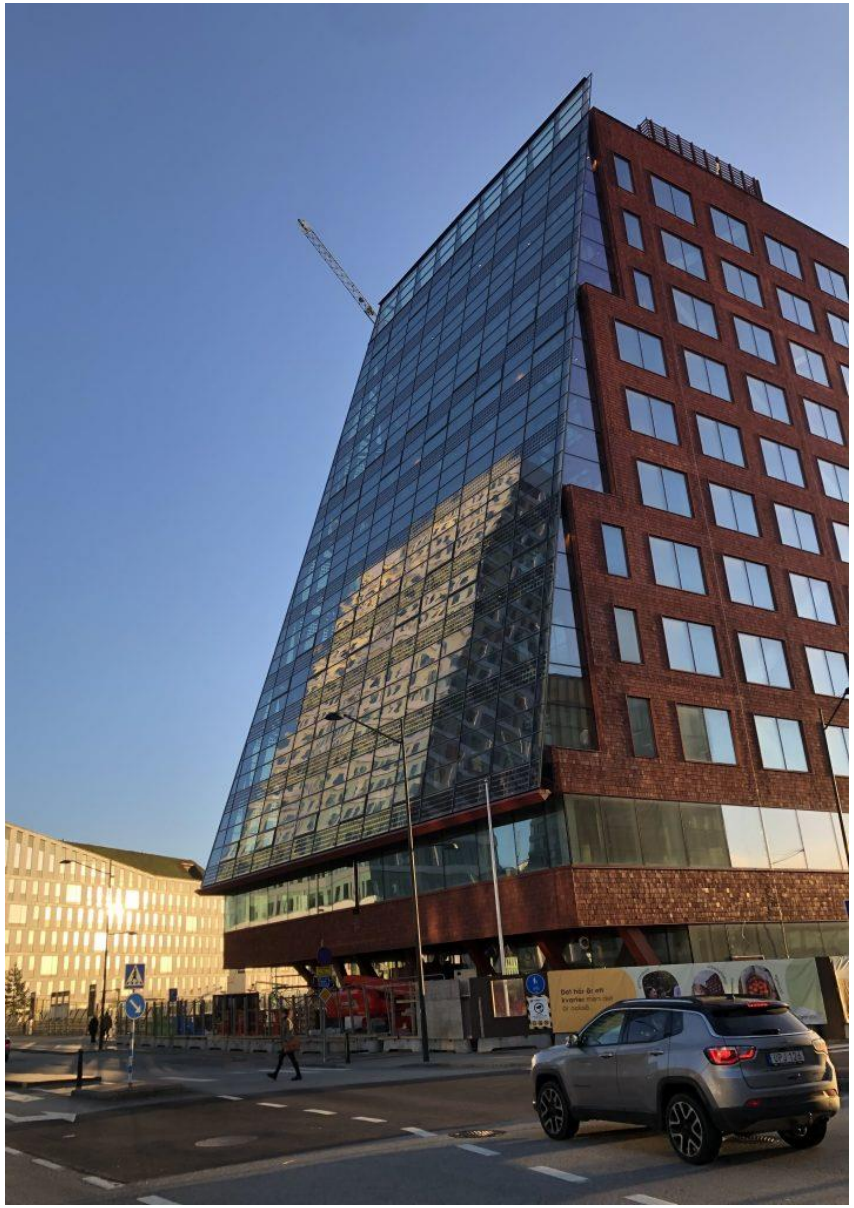
- Long history and high market share
- A variety of offerings – from standardized to unique
- Panelized systems dominate but also volumetric is used

Project from BoKlok

Projects from Derome

Project from Lindbäcks Bygg

Kv Strandparken, 8 storeys, apartments, Stockholm
Picture from Wihngårds arkitekter



Project Fyrtornet, Malmö. 14 storeys Office building
Picture: Skönhetsrådet Malmö

Project Sara Culture Centre, 20 storeys including volumetric, CLT based hotel

White Architects, Derome, Martinssons Byggsystem

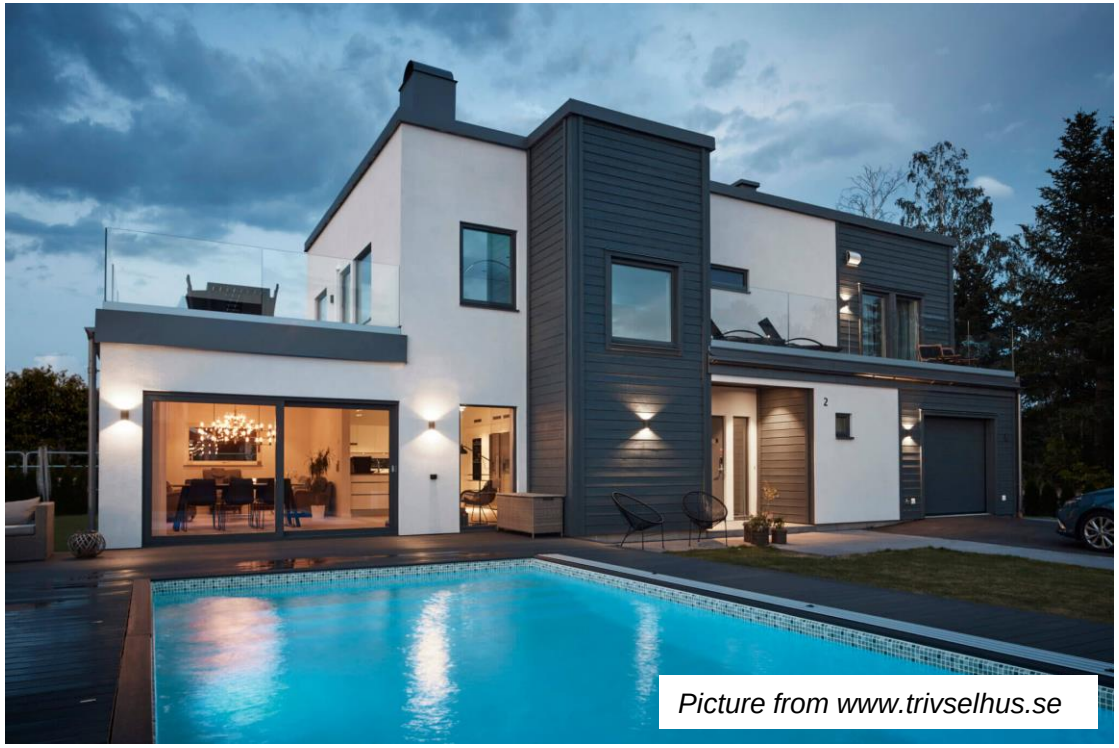
Project Sara Culture Centre, 20 storeys including volumetric, CLT based hotel

White Architects, Derome, Martinssons Byggsystem

Picture from www.fiskarhedenvillan.se

Picture from www.lbhus.se

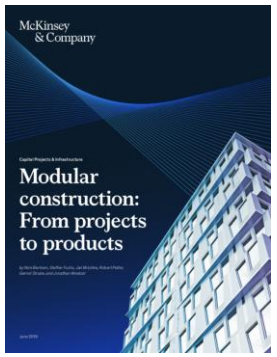
Picture from www.a-hus.se

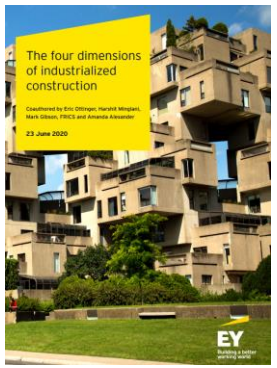


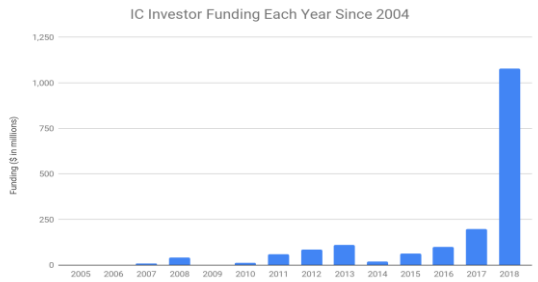
Picture from www.trivselhus.se

Industrialized Construction is a global movement

- Industrialized Construction develops globally
- Great development last 5-10 years (Scandinavia, Japan,UK, Germany, USA, China, Singapore, Australia)
- A common insight: Need for alternatives to traditional construction
- And not least: Radical improvements in sustainability is needed
- Some initiatives did not work out, some became succesful
- Huge build-up of knowledge



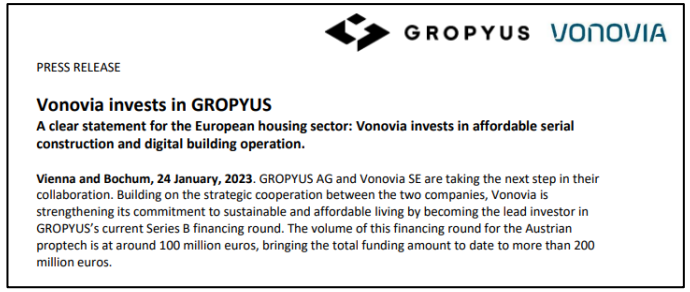




Veev
GOLDBECK
VOLUMETRIC BUILDING COMPANIES
GROPYUS
Autovol VOLUMETRIC MODULAR
ASSEMBLY OSM
plant PREFAB plantprefab.com
Derome
LINDBÄCKS
OBOS
SÖDRA
ptblink
Factory_OS™
SEKISUI HOUSE
Haas besser bauen.
TOYOTA HOME
BECC be capable, be creative
Z Modular® ALIGN TO BUILD BETTER
MODSCAPE.
HUF HAUS
Intelligent City

Germany

- Both established and start-up companies
- Germany and Sweden has many similarities, fx a strong manufacturing industry
- **Goldbeck** – Large IC-company, vertical integration. Offices, parking garage, apartments, industry. Kit of parts-strategy.
- **Haas Fertigbau** – Wood-based housing company. Element strategy.
- **Gropyus** – Timber based VC-backed start-up. Element strategy. High level of automation.
- **Renggli** – Expanding company - timber based volumetric elements
- **Huf Haus** – High-end concept houses with prefabricated elements



Japan

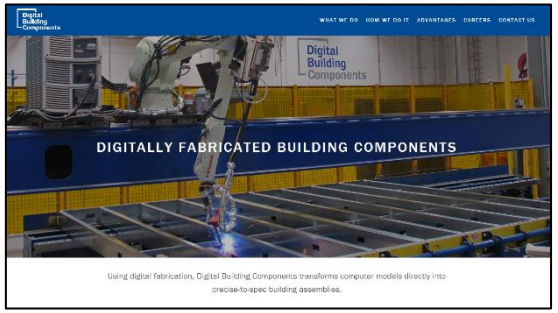
- Several very experienced IC companies
- Toyota Home, Sekisui Heim, Sekisui House, Daiwa House produce btw 5 000 to 45 000 houses per year
- Vertically integrated companies controlling the value chain
- Many IC firms derive from other industries such as the automotive- and process industry
- All companies have their own Product- and Production strategy
- Strong customer focus!

Volumetric element production at Toyota Home

Kit-of-parts at Sekisui House

USA

- Strong development the last 10 years
- Research & Development at several universities and institutes
- Venture capital backing (not always suitable)
- Several industry failures (Katerra, Skender etc)
- But also succesful initiatives!
- **Clark Pacific** – well established manufacturer with ophisticated building system
- **Volumetric Building Companies** – Module manufacturer expanding in the US and Europe
- **Veev –** VC backed, panelized concept for single family homes. Went out and came back!
- **PlantPrefab** – VC backed with new state of the art factory, flexible hybrid building system
- **Digital Building Components** – Spin-off from DPR. Manufacturing of building parts
- **Aro Homes –** Product oriented high-end homes



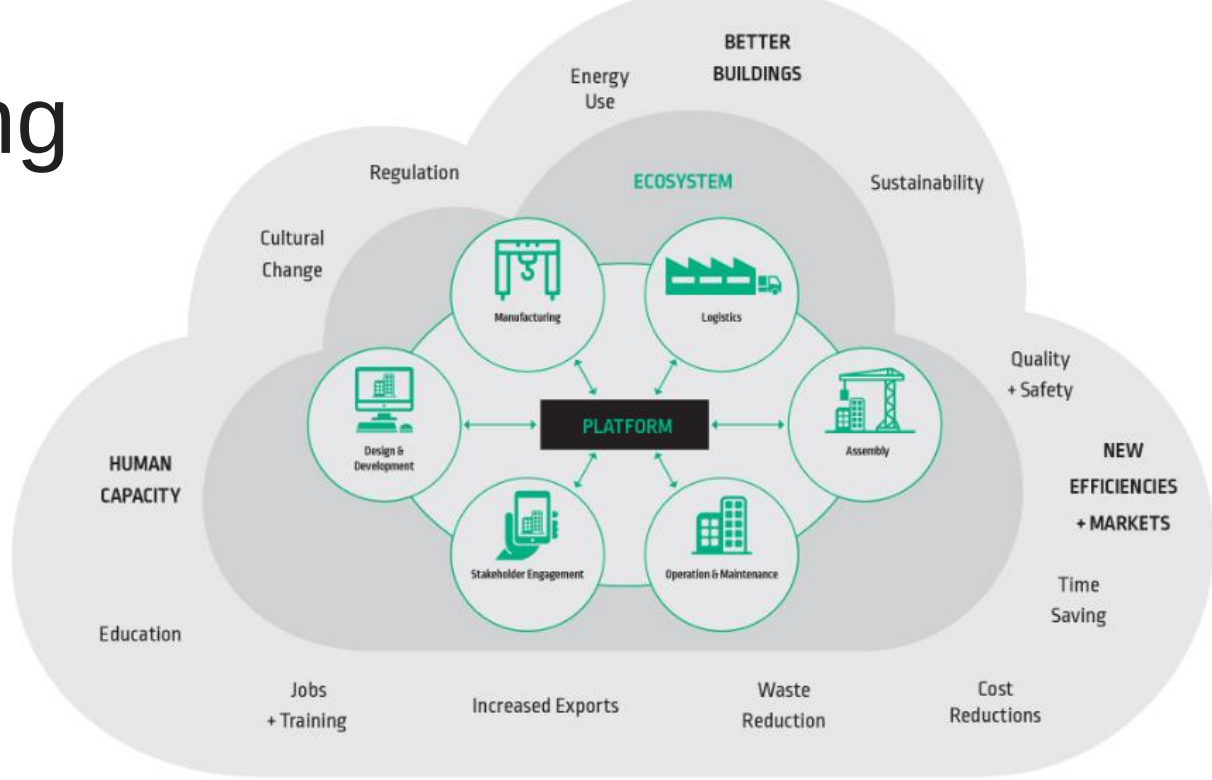
Digital Building Components
Spin-off from DPR Construction
Supplier of building elements to construction projects

INDUSTRIALIZED CONSTRUCTION FORUM

Center For Integrated Facility Engineering
Stanford University

Innovation Program: Building 4.0 CRC, Australia

- 7 year program
- Industrialization and digitalization in construction
- Academia (3 universities), Industry and Authorities in close collaboration
- 45 PhD students (so far)
- Large number of development projects
- Inspired by the Swedish IC development and research



A platform to transform the building industry

Our three integrated research programs will help to ensure that we deliver on:

- new industry-wide culture, practices and standard protocols that will enable the transformation of the entire sector;
- new building processes and techniques through leveraging the latest technologies, data science and AI; and
- improvements to building "hardware" and processes, and their interaction with our digital and sectoral programs, to ultimately improve all aspects of the key building phases (development, design, production, assembly, operation, maintenance and end-of-life).

Thank you!

Industrialized Construction