

# DAGENS PROGRAM

**Bjørn Polenz:** *Velkommen*

**Jacob Lundgaard:** *Danmarks klynge for byggeri og anlæg*

**Finn Kirkegaard Christensen:** *Introduktion til robotter i byggeriet*



A photograph of two construction workers on a site. One is wearing an orange hard hat and a high-visibility vest, the other a white hard hat and a high-visibility jacket. They are standing on a wooden structure, possibly a bridge or a large building under construction, with a city and water in the background. A semi-transparent blue box is overlaid on the image, containing text.

# WE BUILD DENMARK

## Danmarks klynge for byggeri og anlæg

Jacob Lundgaard  
Innovationschef/digitalisering

2-6-2022



## Byggeri og anlæg i tal



250 mia. kr. i omsætning



7% af DK's økonomi



181.121 beskæftigede



6% af den danske eksport



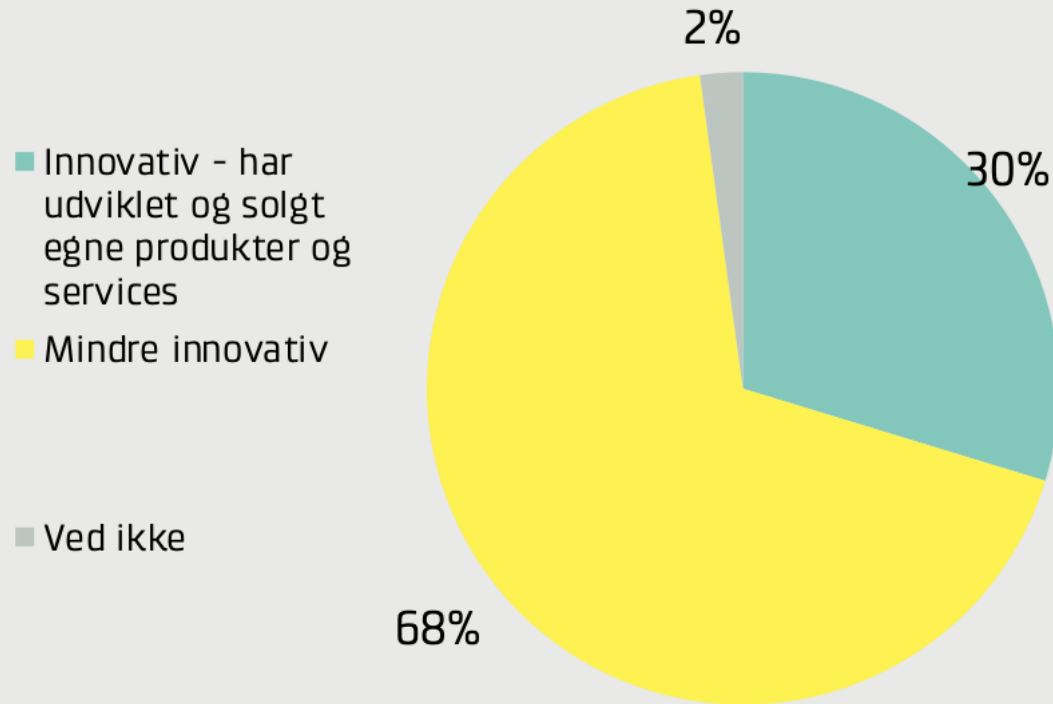
Genererer 4,5 mio. ton affald om året , og står for 30% af DK's CO2-udledning



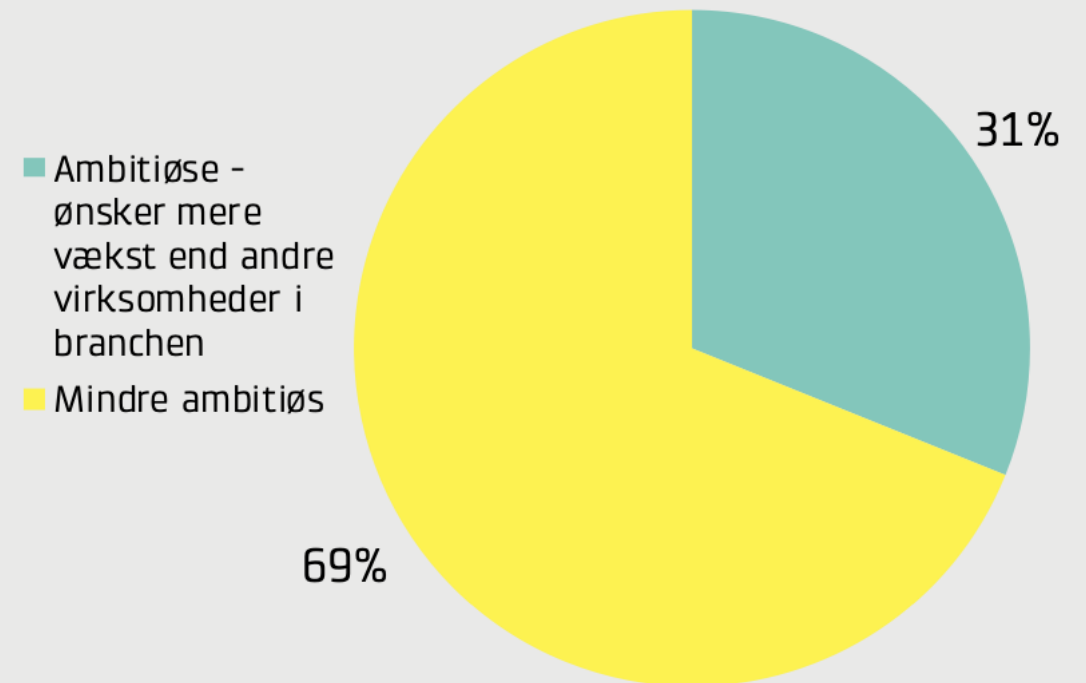
92% af virksomheder < 10 ansatte

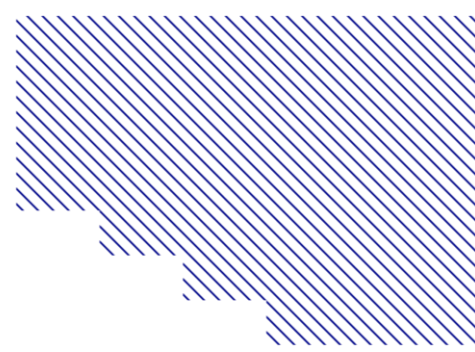
0,3% af virksomheder > 100 ansatte  
(23% af omsætningen)

**Innovation.** 30 procent af bygge- og anlægsvirksomheder har udviklet nye produkter og services de sidste 2 år



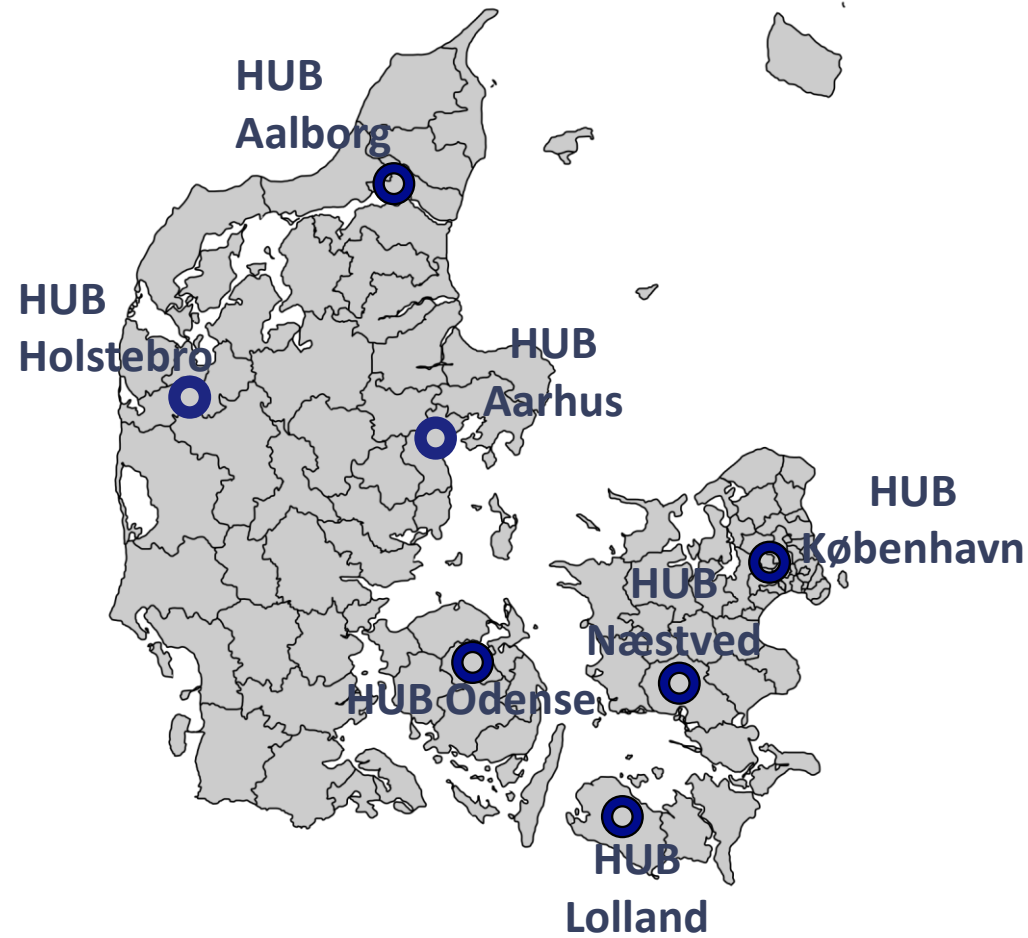
**Ambition.** 31 procent af bygge- og anlægsvirksomhederne ønsker mere vækst end andre i samme branche i de kommende 2-4 år





# Geografien

Hele Danmarks klynge for byggeri og anlæg



## Hvem står bag



Byggeri



DANSKE  
ARKITEKT  
VIRKSOMHEDER



Foreningen af  
Rådgivende Ingeniører  
FRI



BYGHERRE  
FORENINGEN



BAT-kartellet



## Partnerskabsaftale med 16 videnpartnere



AALBORG UNIVERSITET



AARHUS UNIVERSITET



TEKNOLOGISK  
INSTITUT



DBI  
BRAND OG SIKRING



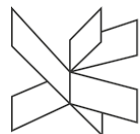
Det Kongelige Danske Kunstakademiske Skoler  
for Arkitektur, Design og Konservering



ARKITEKTSKOLEN AARHUS



ALEXANDRA  
INSTITUTTET



VIA University  
College



Erhvervsakademi og  
Professionshøjskole

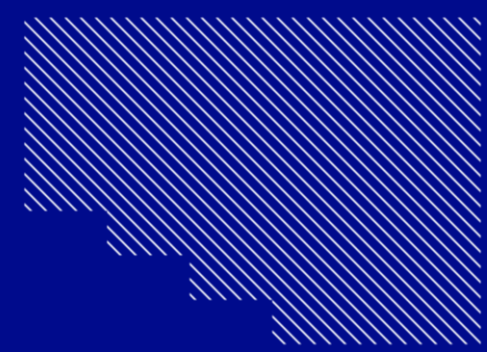


kea  
KØBENHAVNS ERHVERVSAKADEMI

Zealand

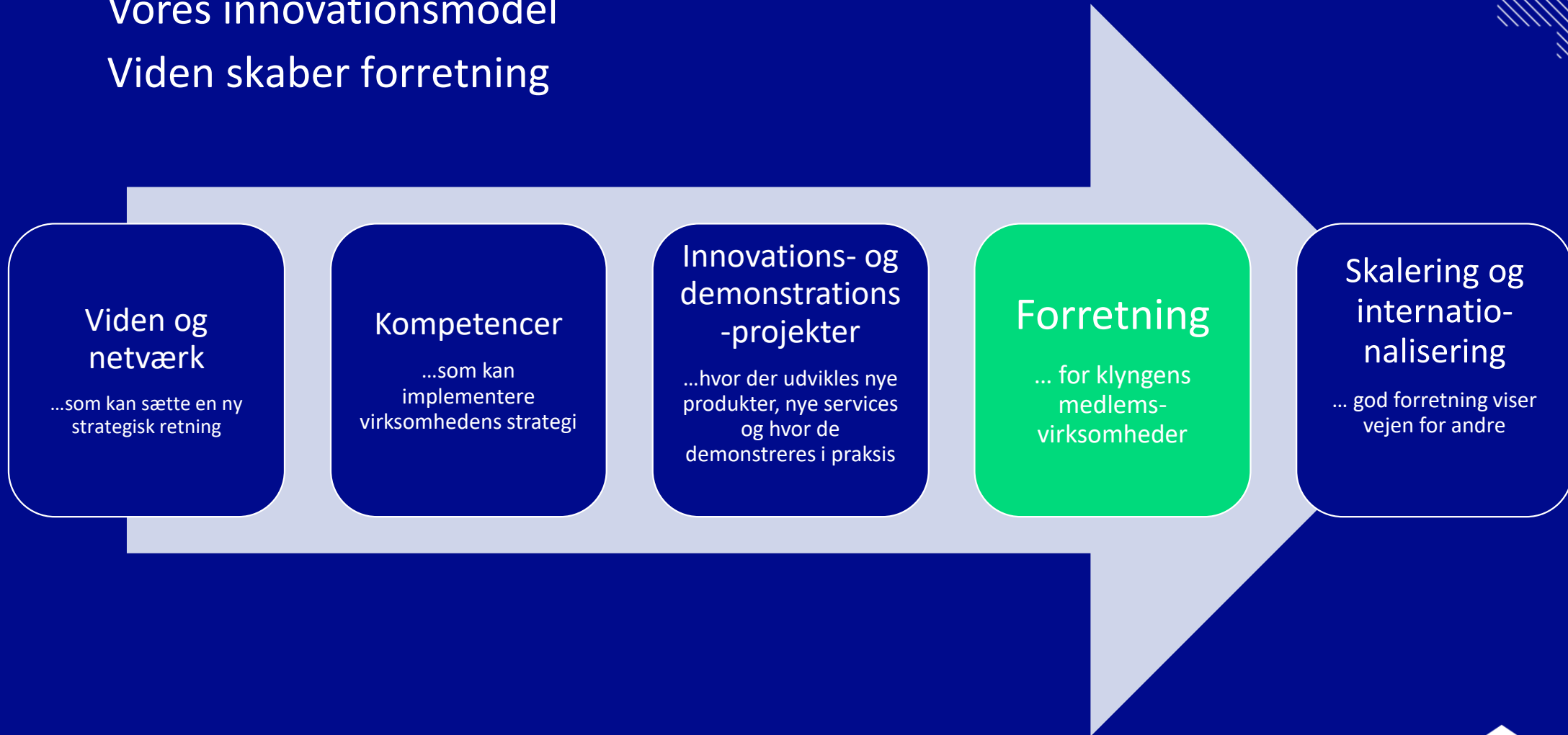


WE  
BUILD  
DENMARK



# Vores innovationsmodel

## Viden skaber forretning



Klyngens aktiviteter

## Fokusområder

Flere innovationsparate virksomheder

Materialer i det bæredygtige byggeri

Cirkulær Økonomi i byggeriet

Emissionsfrie/bæredygtige byggepladser

Digitalisering og data i byggeriet

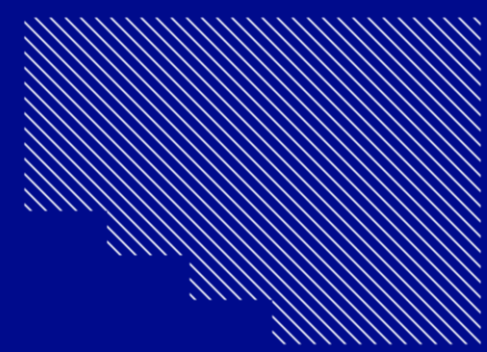
Bæredygtig drift af bygninger

Smart City teknologier og DOLL

## BÆREDYGTIGHED DIGITALISERING KOMPETENCER



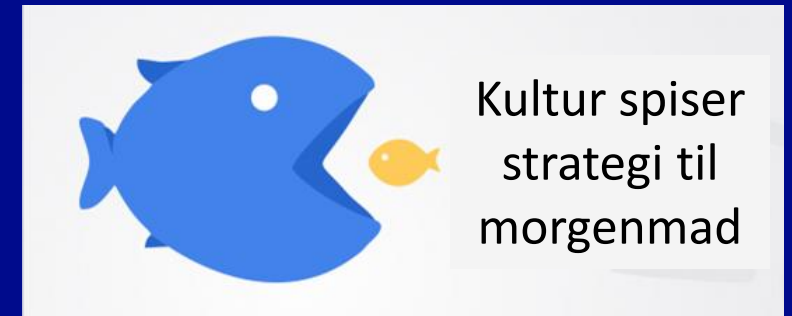


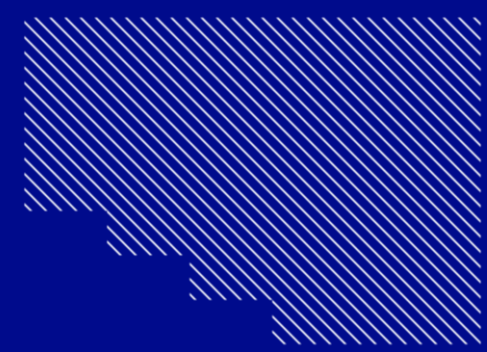


## Digitalisering og data i byggeriet

Hjælpe innovative virksomheder med behovsdrevet teknologiudvikling

Understøtte bæredygtighed, produktivitet og konkurrencedygtighed på tværs af en kompleks værdikæde med vidt forskellige forudsætninger og behov – og langt flest ikke-innovationsparate virksomheder





## Øget digital modenhed: udførende virksomheder

Vidensforløb rettet mod udførende på byggepladsen

Lokal indsats med Erhvervshuse og –Erhvervscentre i Midtjylland, på Fyn og på Sjælland

Kobling til SMV Digital finansiering

Samarbejde med professionshøjskolerne og rådgivere

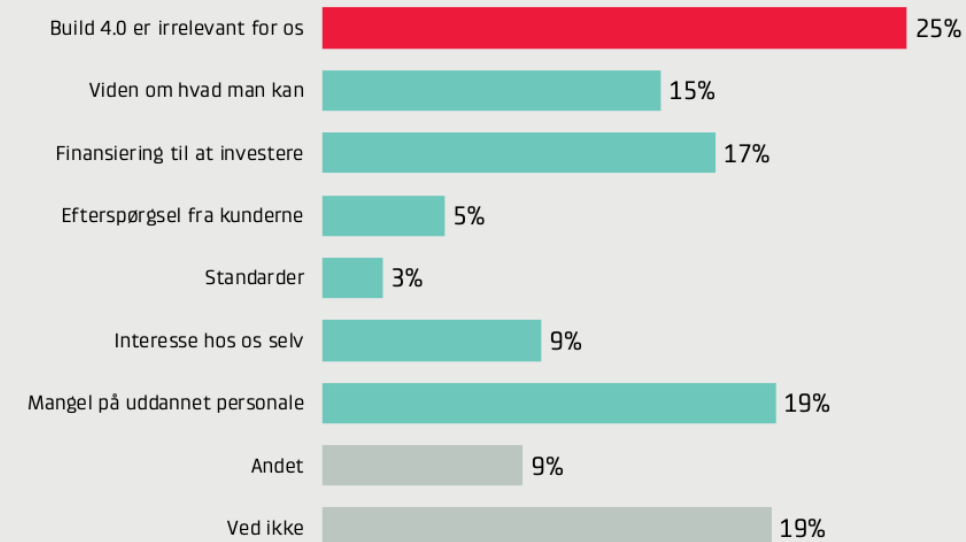
Bæredygtighed og kvalitetsstyring som drivers

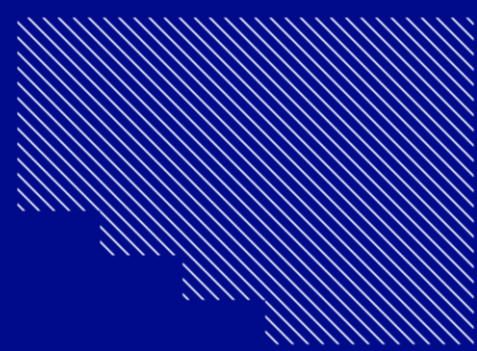
Spotte de virksomheder som er klar til næste skridt

*Netværk for forandringsledelse og innovation*

*”Arkitekter og rådgivere er klar til at tage avancerede digitale teknologier som sensorer, 3D print og droner i brug i byggeriet, men på byggepladserne er håndværksvirksomhederne i mindre grad rustet og orienteret mod de nye teknologier”*

Forhindringer for at bruge nye digitale teknologier i bygge- og anlægsbranchen





## Digital innovation: præfab

Øget anvendelse af avancerede teknologier i præfab

Robotter/droner, procesautomation, 3D print, IoT og AI

Potentiale for øget produktivitet, mindre nedslidende arbejde, CO2- og materialereduktion

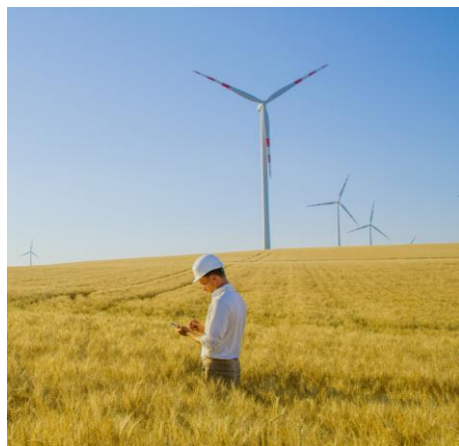
Samarbejde med ODENSE ROBOTICS og MADE - klyngerne for robotteknologi og avanceret produktion

Samarbejde med Teknologisk Institut og Syddansk Universitet

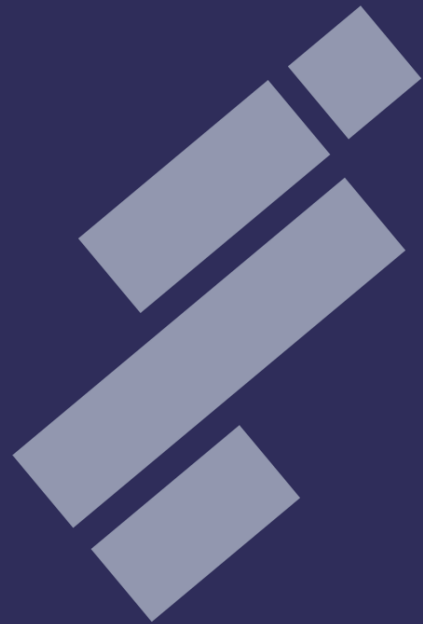
- Netværksgruppe
- Samarbejdsprojekter
- Internationalt klyngesamarbejde

Næste skridt: ud på byggepladserne





# INTRODUKTION TIL ROBOTTER I BYGGERIET



# RAW

ROBOT AT WORK

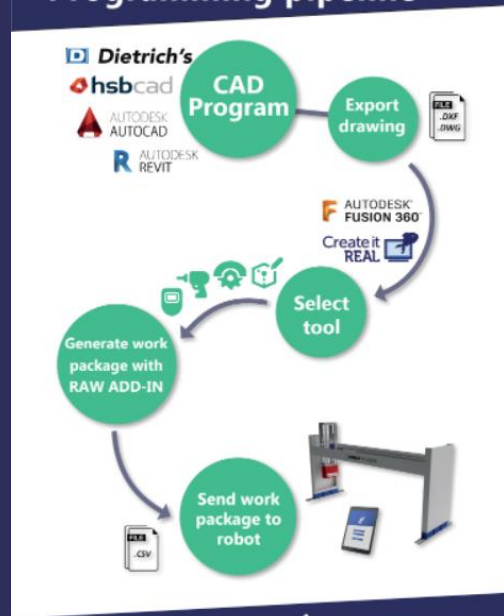
# RAW Bridge

Multitool-robot til prefab

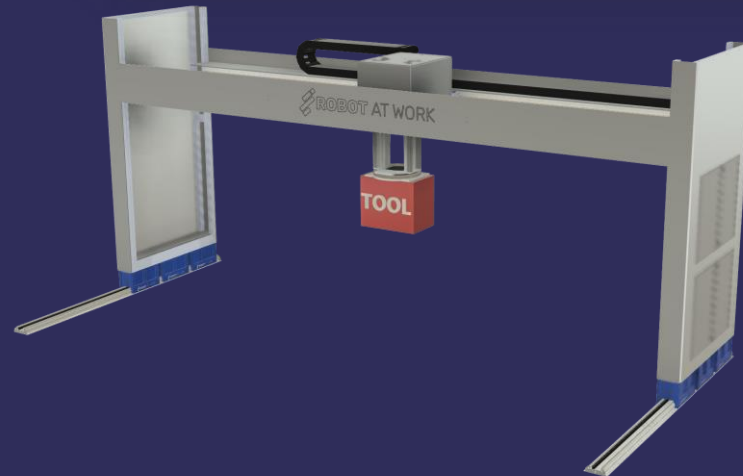
<https://player.vimeo.com/video/715557444?h=aeb6c53603>

## RAW configuration

### Programming pipeline



**ROBOT AT WORK**



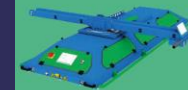
3D-PRINT  
EKSTRUDER



KLAMME-  
PISTOL



ARMERINGS-  
KLIPPER



ISOBLOW



SUGE-  
VÆRKTØJ  
BONDY



LIM-  
PISTOL



DYK-  
SAV



SKRUE-  
MASKINE









SØM-  
PISTOL









SLIBE-  
MASKINE



# Problem

-  Byggeri og hussalg er øget i volumen de seneste år
-  Folk vil bo selv, og det giver et øget boligmasse-behov
-  Byggeprocessen on-site har ikke ændret sig i de sidste 100 år
-  Unge mennesker vil ikke arbejde i byggeriet
-  En global udfordring
-  Kendetegn ved byggeri:
  - ≠ Store overflader
  - ≠ Hårdt miljø
  - ≠ Tunge løft
  - ≠ Lav digitaliseringsgrad
  - ≠ Begrænset kvalitetskontrol
  - ≠ Begrænset dokumentation

# Løsning

-  Vi skal hæve boligmassen med have flere små boliger/lejligheder
-  Vi skal optimere byggeprocessen og bygge mere bæredygtigt
-  Det gøres ved at flytte byggeriet fra on-site og ind i fabrikker
-  På fabrikkerne kan vi tænke processer, produktion og taktider
-  Det giver plads til nye løsninger og nye værktøjer
-  Så vi ser muligheder i træ og beton branchen (prefab)

# RAW Bridge



## Supporting the prefabs of tomorrow

RAW Bridge is an intelligent, collaborative, and robust robot ideal for the prefabrication industry. It operates on large surfaces in X, Y, Z movements and can be equipped with different tools to cope with the specific task at hand.

RAW Bridge is adaptable to all production tables and can easily be installed in existing production lines without major changes.

### Production automation

Automating production and reducing the need for skilled labor

### Easy to operate

Plug&Play optimization  
Integration to Autodesk

### Does all the dirty work

Minimizing the dirty and repetitive work  
Securing better working environment

### Consistent quality

Optimizing your quality and reducing faulty productions

Grinding	<b>Multitool function</b>		
Insulation	Cutting	3D-printing	Custom tools - your own unique tool
Polishing		Milling	Stapling
		Duraspin	Nail shooting



## High Load Nail Gun with RAW Adapter



### Technical specifications

Version: SHLCN90 high load coil nail gun\*

Net weight: 10 kg

Mode: Automatic

Operating air pressure: 5-7 bar

Magazine capacity: 3000 units

Air consumption (at 60 staples/min.): 1260 l/m

### Consistent and precise

SHLCN90 high load nail gun is designed for large volume, consistent and precise fastening, and has the capacity for repeated nailing, and increasing the productivity. The coil nail gun fires nails from 2.5 to 3.1 mm with the length of 50-90 mm.

\*Must be purchased directly from a Senco dealer

ROBOT AT WORK



## Smart Series Duraspin with RAW adapter



### Technical Specifications

Version: DS7525 18 V smart series duraspin\*

Net weight: 2,11 kg

Shots per charge: 1400

Mode: automatic

Magazine capacity: 50 pieces

Recharge time: 45 min.

Battery type: Li-Ion

Battery voltage: 18 V

Rotations per minute: 2500

### The Professionals Choice

Battery powered with the capability to drive up to 75mm screws makes this Auto-Feed screwdriver the professionals choice for driving a wide variety of screws into many different applications.

\*Must be purchased directly from a Senco dealer

ROBOT AT WORK



## High Load Stapler with RAW adapter



### Technical specifications

Version: SHLS80-N25\*

Net weight: 11 kg

Mode: Automatic

Operating air pressure: 6.8-3 bar

Magazine capacity: 3080 units

Air consumption (at 60 staples/min.): 2000

### Consistent and precise

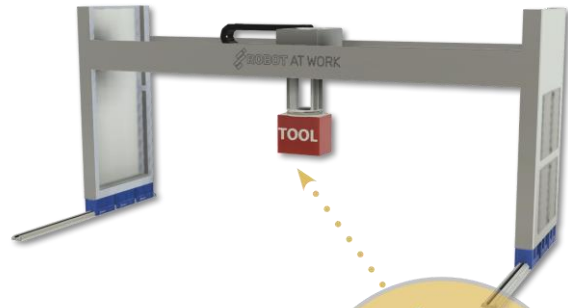
SHLS80-N25 High Load stapler is designed for great volume, consistent and precise fastening, and has the capacity for repetitive stapling. SHLS80-N25 is designed for permanent installation in automated production lines, and can fire N-pins on 25 mm to 63 mm.

\*Must be purchased directly from a Senco dealer

ROBOT AT WORK



## DEWALT Diving Saw with RAW adapter



### Technical specifications

Version: DEWALT DW5520KT\*  
 Saw depth: 55 mm  
 Recorded power: 1300 Watt  
 Blade diameter: 165 mm  
 Cutting depth (45/90 degrees): 44/59 mm  
 Rotations per minute: 1750 - 4200  
 Net weight: 5,1 kg  
 EAN: 39227015

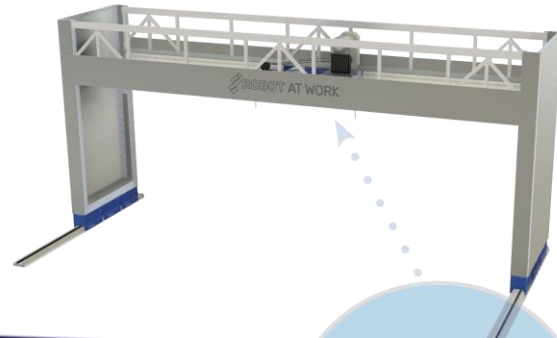
### Precise and tough

Anti-kickback function prevents the saw from moving backwards along the rail and moving out of the workpiece during sawing. The many variables of speed allows for correct speed depending on different types of materials. And the full-wave electronics maintain a constant speed under heavy load.

\*Must be purchased directly from a Dewalt dealer



## Isoblow Elements 4.0 with RAW adapter



### Technical specifications

Version: Isoblow elements 4.0\*\*  
 Net weight: 250 - 400 kg\*  
 Dimensions: 300 x 100 cm  
 Number of nozzles: 4  
 Electrical connection: 230 V/ 16 A  
 Compressed air: filtered, 6-8 bar

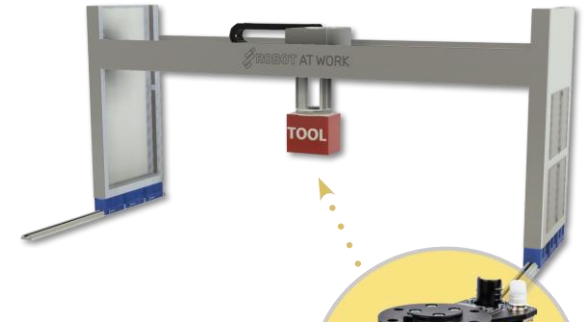
### Fast, efficient and easy to operate

With Isoblow Elements' supply air technology, fast and efficient insulation is guaranteed. Some of the advantages includes: Automation of the insulation process, optimal blow control, flexible for all types of insulation and easy to operate.

\*Must be purchased directly from a ISOCELL dealer  
 \*\*Requires RAW Bridge reinforcement add on



## Mirka AIROS sander with RAW adapter



### Technical specifications

Version: Mirka AIROS 650CV\*\*  
 Power input: 350 W  
 Orbit: 5 mm  
 Size of pad: 150 mm  
 Net weight: 1,4 kg  
 EAN: 6416868744590

### Automating high workload sanding

The Mirka Airoads is an automatic, integrated, random orbital sander for any industry with the need to automate surface finishing tasks. It is engineered to carry out intensive, high workload sanding, where precision and minimal maintenance is critical.

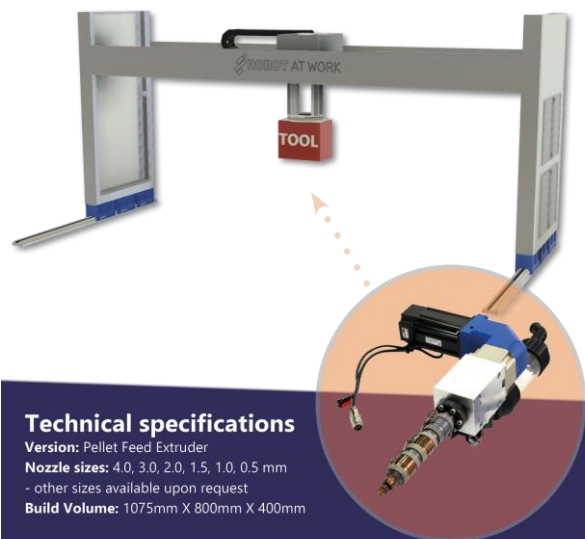
\*Must be purchased directly from a Mirka dealer

\*\*comes without vacuum cleaner and hose.

RAW Adapter includes pressure sensitive regulator.



## Pellet Feed Extruder with RAW Adapter



### Technical specifications

**Version:** Pellet Feed Extruder  
**Nozzle sizes:** 4.0, 3.0, 2.0, 1.5, 1.0, 0.5 mm  
 - other sizes available upon request  
**Build Volume:** 1075mm X 800mm X 400mm

### Fast and cost effective

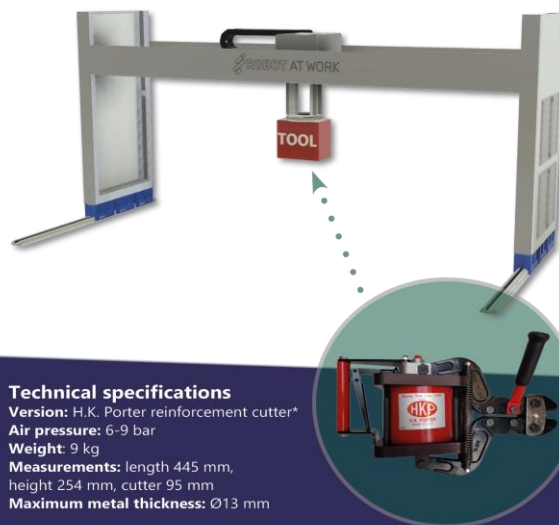
The 3D-print Pellet Feed Extruder provides immense possibilities with custom materials and high extrusion rates. With higher pressures and higher temperatures, print options are limitless making the extruder one of the most cost effective options.



\*Must be purchased directly at the Cosine dealer



## Reinforcement Cutter with RAW Adapter



### Technical specifications

**Version:** H.K. Porter reinforcement cutter\*  
**Air pressure:** 6-9 bar  
**Weight:** 9 kg  
**Measurements:** length 445 mm,  
 height 254 mm, cutter 95 mm  
**Maximum metal thickness:** Ø13 mm

### Powerful and robust

H.K. Porter is a powerful air reinforcement cutter, mounted with center cutting head. The high air pressure allows the cutter to cut both soft, medium and hard metal, however max Ø13 mm.

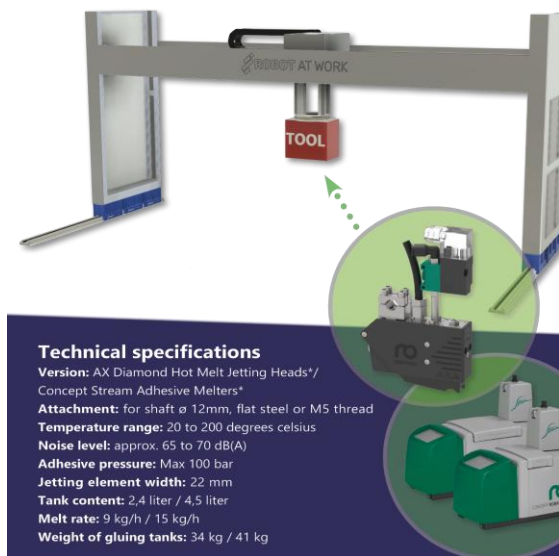
\*NEVER use the reinforcement cutter on energized circuits, wire, or cable



\*Must be purchased directly from a H.K. Porter dealer



## AX Diamond & Concept Stream with RAW Adapter



### Technical specifications

**Version:** AX Diamond Hot Melt Jetting Heads\*/  
 Concept Stream Adhesive Melters\*  
**Attachment:** for shaft Ø 12mm, flat steel or M5 thread  
**Temperature range:** 20 to 200 degrees celsius  
**Noise level:** approx. 65 to 70 dB(A)  
**Adhesive pressure:** Max 100 bar  
**Jetting element width:** 22 mm  
**Tank content:** 2,4 liter / 4,5 liter  
**Melt rate:** 9 kg/h / 15 kg/h  
**Weight of gluing tanks:** 34 kg / 41 kg

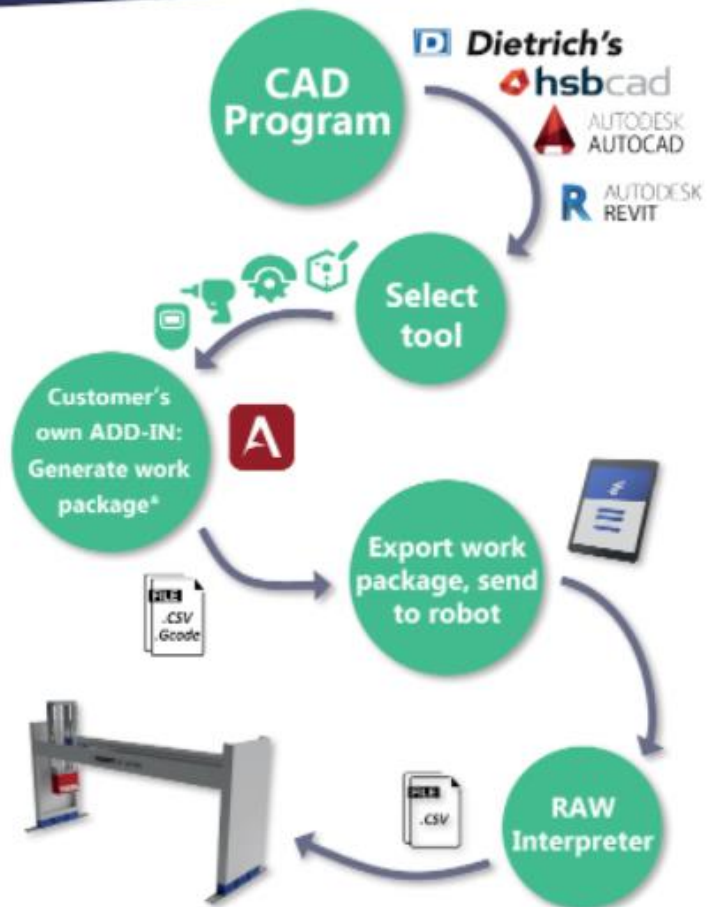
### Robust and efficient

This gluing tool is resistant and robust making it the perfect fit for dirty and harsh environments. Thanks to the CoolTouch insulation both tool and tank are safe to use. The tool has an integrated filter that prevents nozzle blockage making it reliable and efficient. The gluing tank has a fast heat-up time and is energy-efficient saving over 20 % thanks to the GreenLine technology.



\*Must be purchased directly from a Robatech dealer

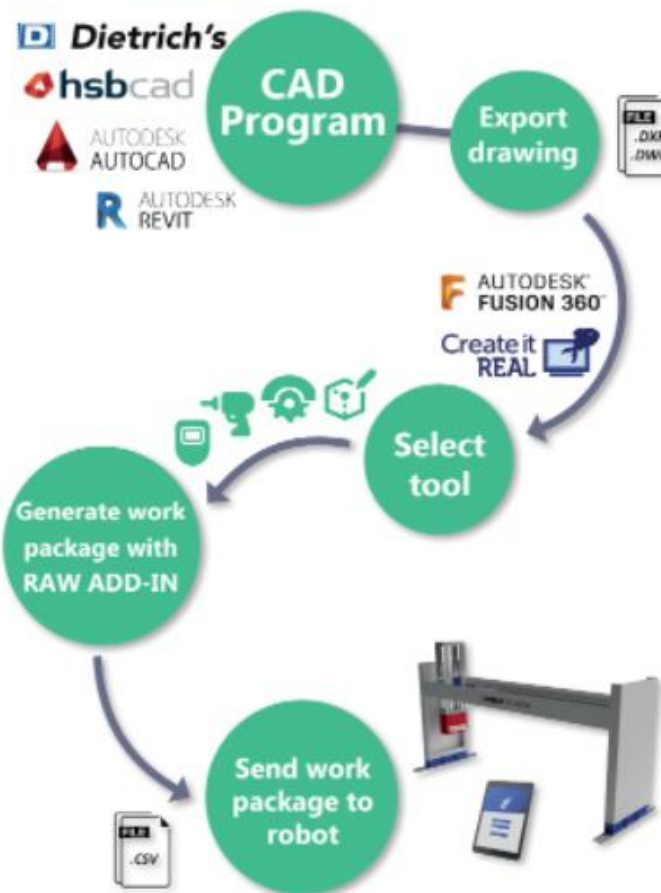
## Programming pipeline (custom)



\*Output must follow RAW format

 **ROBOT AT WORK**

## Programming pipeline



 **ROBOT AT WORK**

# **ROBOT AT WORK**

RAW Bridge – skalerbar størrelse



RAW tools - multitool



RAW Bridge - leverandører



**Hydro**

DELTA ELEKTRONIK A/S

**KOLLMORGEN**



**Bihl  
+ Wiedemann**

**TecNordic**  
INDUSTRIAL SOLUTIONS

RAW tool-leverandører



ROBOT NORDIC

RAW service – in process:

Hardware  
Reservedele, reparationer onsite, tool  
adaptere – serviceleverandør

Software – 100 % RAW  
RAW support, Cloud, YouTube-vejledning

Tool – ikke RAW  
Henvisning til Senco, Dewalt, Isocell  
Megatron, m.fl.