NHO MAT OG DRIKKE
KOMPETANSEKONFERANSEN 2016
HVA VIL INDUSTRI 4.0 BETY FOR
NORSK MATPRODUKSJON?
OSLO 17.11.16

ODD MYKLEBUST,
SINTEF RAUFOSS MANUFACTURING
An Industrial change in Norway....
Globalization
Industrial revolutions and Industrie 4.0

Industrial revolutions are a mirror of demands, developments and crisis in society. The 4th industrial revolution is based on digitalization and connectivity.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1750</td>
<td>Development of steam machine</td>
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<tr>
<td>1870</td>
<td>Introduction of steam-based, mechanical production machines</td>
</tr>
<tr>
<td>1970</td>
<td>Increasing automation of production</td>
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Source: Plattform Industrie 4.0, Druckhelden, Leoni
The Future in Digitalization

• Advanced manufacturing, disruptive technologies
• Digitalization (extended automation possibilities)
  • BIG DATA
  • INTERNET OF THINGS
  • CPS Cyber Physical Systems
• Flexibility, (even more) custom orientation
• Knowledge oriented workers/operators
• Product – services

• Sustainability, going green, live-cycle perspectives

• Industrie 4.0 is an *Manufacturing* approach; however ICT and Digitalization are the enablers.*
Europa – many national approaches for manufacturing strategies.

<table>
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<tr>
<th>Program</th>
<th>Goal</th>
<th>Focus</th>
<th>Priorities</th>
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<tbody>
<tr>
<td>Europe</td>
<td>Manufacturing is a key enabler for Europe's grand societal challenges</td>
<td>Factory of the future</td>
<td>Advanced manufacturing processes, Adaptive and smart manufacturing systems, Digital, virtual and resource-efficient factories, Collaborative and mobile enterprises, Human-centred manufacturing, Customer-focused manufacturing</td>
</tr>
<tr>
<td>Germany</td>
<td>Securing the future of German manufacturing industry</td>
<td>Cyber physical systems</td>
<td>Standardisation and reference architecture, Managing complex systems, A comprehensive broadband infrastructure for industry, Safety and security, Work organisation and design, Training and continuing professional development, Regulatory framework, Resource efficiency</td>
</tr>
<tr>
<td>Dutch</td>
<td>A portent of a new era of manufacturing in Netherlands</td>
<td>Network centric production</td>
<td>High quality, network-centric communication between players, human and system, in the entire value network, Digitisation of information and communication among all value chain partners and in the production process on all levels, Granular, flexible, and intelligent manufacturing technologies, adjustable on the fly to meet highly specific end-user demands</td>
</tr>
<tr>
<td>Sweden</td>
<td>Strengthening innovation for production in Sweden</td>
<td>Sustainable production</td>
<td>Environmentally sustainable production, Flexible manufacturing processes, Virtual production development and simulation, Human-centred production system, Product- and production-based services, Integrated product and production development</td>
</tr>
</tbody>
</table>
INDUSTRI FUTURUM
– Fremtiden produsert i Norge
To analyse over Norges status inne Digitalisering

Norway has a relatively low manufacturing share but indicates a high readiness to implement and leverage Industrie 4.0

Positioning European countries for Industrie 4.0

Roland Berger
Industrie 4.0
Readiness Index

Figure 4.2: Level of digitalisation and automation in manufacturing companies in the Nordic countries, Germany, UK and EU

Source: Eurostat. Note: Survey data are due to the use of samples and modest reply rates connected with some uncertainties, and the results should therefore be interpreted with some caution.
Industry 4.0 concerns all kinds of Manufacturing: From Discrete Manufacturing to Process Industries
Den norske utfordringen

• Liten og sårbar leverandørindustri (utenom olje og gass)
• Lavere investeringstakt og utnyttelse av roboter sammenlignet med våre konkurrenter
  • Norge har 40 roter pr. 10.000 industriansatt sammenlignet med Sverige og Danmark som har 150 per 10.000 industriansatt (IFR, 2013)
  • *Men hva betyr egentlig det?*
• Økende restrukturering innen oljesektoren
  • Fall i oljeprisen, Når én riggjobb forsvinner tar den med seg flere andre stillinger hos leverandørene.
• Mange EU land har betydelig nasjonalt fokus og stort trykk på Manufacturing som strategisk satsingsområde

Noen Norske konkurransefortrinn

• Sterk og globalt ledende industri innen utvalgte områder (*f.eks. automotive, aerospace, Havbruk, maritim, prosess, forsvar*)
• Avansert leverandørindustri til O&G
• Den norske modellen
• Høyt kunnskaps- og kompetansenivå
• Høy teknologiaksept i samfunnet
Sammenligner vi Norge med utenlandsk industri bransjevis, ser det ikke ut som om vi ligger etter i Teknologi, automatisering, digitalisering enn Tyskland eller andre land som vi sammenligner oss med.
To norske eksempler

Zero Defect Manufacturing, GKN Aerospace Kongsberg
- Censoring and cognitive signal analysis
- Real-time corrections and adaptive control (self optimizing)
- AI Techniques (Neural Networks and Fuzzy logic) for machine system self adaption
- Data communication, integration and storage
- Demonstration, requirement, development, implementation
- Methodology for ZDM development and implementation

Neuman Aluminium (Raufoss Technology), flytter virksomhet fra Kina til Norge
- Raufoss Technology lager produktene på omtrent en fjerdepart av tiden, og vi bruker en fjerdepart så mange operatører.
- I fabrikkhallen på Raufoss produserer ultra-effektive roboter aluminiumsdeler til bilmerker som Mercedes, Land Rover og Volvo. Nytt produksjonsutstyr blir nå installert slik at produksjon av hjulopheng kan dobles.
Challenge:

• Adaptive sewing process: Integrated, digital, and automated joining of fabric for the furniture industry

Solution

• Development of novel adaptive automated joining sewing process in an industrial context. Based on the knowledge of welding and other joining processes.

The outcome:

• An innovation in technology that can enable a high cost country to compete with low cost competitors.
Collaboration Robots ("Cobots"), for complex lines

Company example Airbus

controlled by augmented reality
Horizontal and vertical value chain
What is a CPPS?

Cyber-Physical Production System

Source: Fraunhofer IPT, ABB
Konsekvenser av Industrie 4.0 innen kvalites
Zero Defect Manufacturing with further focus on predictive maintenance
Difference shapes, sizes and structures
Men man kan måle på alt som kan påvirke prosessen

- Proteininnhold
- Fettinnhold
- Trykk temperatur
- Prosesstyring
  - Gjæring
  - Koking
  - Baking
  - Salting
  - Tøriking
- Alkoholinnhold
- Sukker
- Kjemisk sammensetning
- Sporstoffer
- Etc........
Industrie 4.0 and Food Industry

- Food and drink manufacturers could benefit from the implementation of Industry 4.0 even more than most industries.
- The constant pressure on costs in the food industry means it has a long history of innovating, so is likely to embrace Industry 4.0 quickly and enthusiastically.
- The need for traceability right through the production chain has already ensured that machines are interconnected and archiving data. Industry 4.0 will enhance this.
- Greater flexibility will enable bespoke production for each customer and rapid adaption to changing product specifications.
- Energy usage can be monitored and optimised to new levels.
Fremtidig digitlisering

• "Industrie 4.0 must be understood as a project of, and for, the society as a whole and it requires a close alliance between the private sector, academia, research, politics and trade unions." Henning Banthien, Secretary General, Platform "Industrie 4.0", Germany.

• ---Future labor force must be positively connected to the changes and advantages resulting from "Industrie 4.0"

• Dette er det tyske synet hvordan ser vi på dette i Norge?
Industrie 4.0 metodikk på produkt/anlegg og produksjon av utstyr, inkludert underleverandører

Industrie 4.0 metodikk i foredling, automatisering, autonome anlegg

*Bør kunne bli et Stort Norsk Ocean Technology satsning*

The Ocean Industries of tomorrow (Havbruksområdet)
Industrie 4.0 metodikk på produkt/anlegg og produksjon av utstyr, inkludert underleverandører

Industrie 4.0 metodikk i produksjon, digitalisering, autonome anlegg

*Bør kunne bli et Stort Norsk Vareproduksjons og/eller mat program*
Teknologi for et bedre samfunn