



Stor usikkerhet i forsyningskjeder
setter krav til nye samarbeidsløsninger

Er digitale lagre og 3D print løsningen?

Hvem er jeg?

- Terje Sørby
- Gift, To voksne døtre
- Bor i Bergen
- Director i Deloitte siste 6 år
- Ansatt 10 år i Statoil og har i tillegg jobbet ca. 6 år som innleid konsulent
- Glad i å være aktiv på vann og fjell



Utfordringene synes overveldende





ANNONSERINGSBILD FOR ECONA

Kommer 3D-printing til å endre verdensøkonomien?

Gjester: Kias Magnus Boivie (seniorforsker, SINTEF), Brede Lierum (leder for 3D-printing, Equinor) og Hilde Hukkelberg (leder Innovasjon Norge, London).
Moderator: Nina Røbbe (administrerende direktør, Econa)

E24-podden: Nå tar 3D-printing av og inntar norsk sokkel

I Tronrud Engineerings lokaler i Hønefoss 3D-printes titandeler til Equinors nye oljefelt i Barentshavet. Interessen for teknologien tar av og vil fundamentalt endre flere bransjer, tror både Equinor og HP. Hør mer i ukens E24-podden!



SIEMENS

Produkter og løsninger Siemens i Norge

Siemens i Norge > Nyheter > Industri > 3D-printing revolusjonerer industrien

3D-printing revolusjonerer industrien

Med en 3D-printer kan man skrive ut reservedeler i stedet for å bestille. Det kan gi store gevinster.

Nå 3D-printer Forsvaret våpendeler for spesialstyrkene ute i felt

FFI-prosjekt.



Tre operatører fra Marinejegerkommandoen (MIJ) og tre kolleger fra nederlandske Korps Mariniers under Cold Response. (Bilde: Torkjorn Kjosvold/Forsvaret)

PER ERLIEN DALLØKKEN FORSVAR 19. APRIL 2016 - 06:00

Tema



Fordelene!



Eksempler!



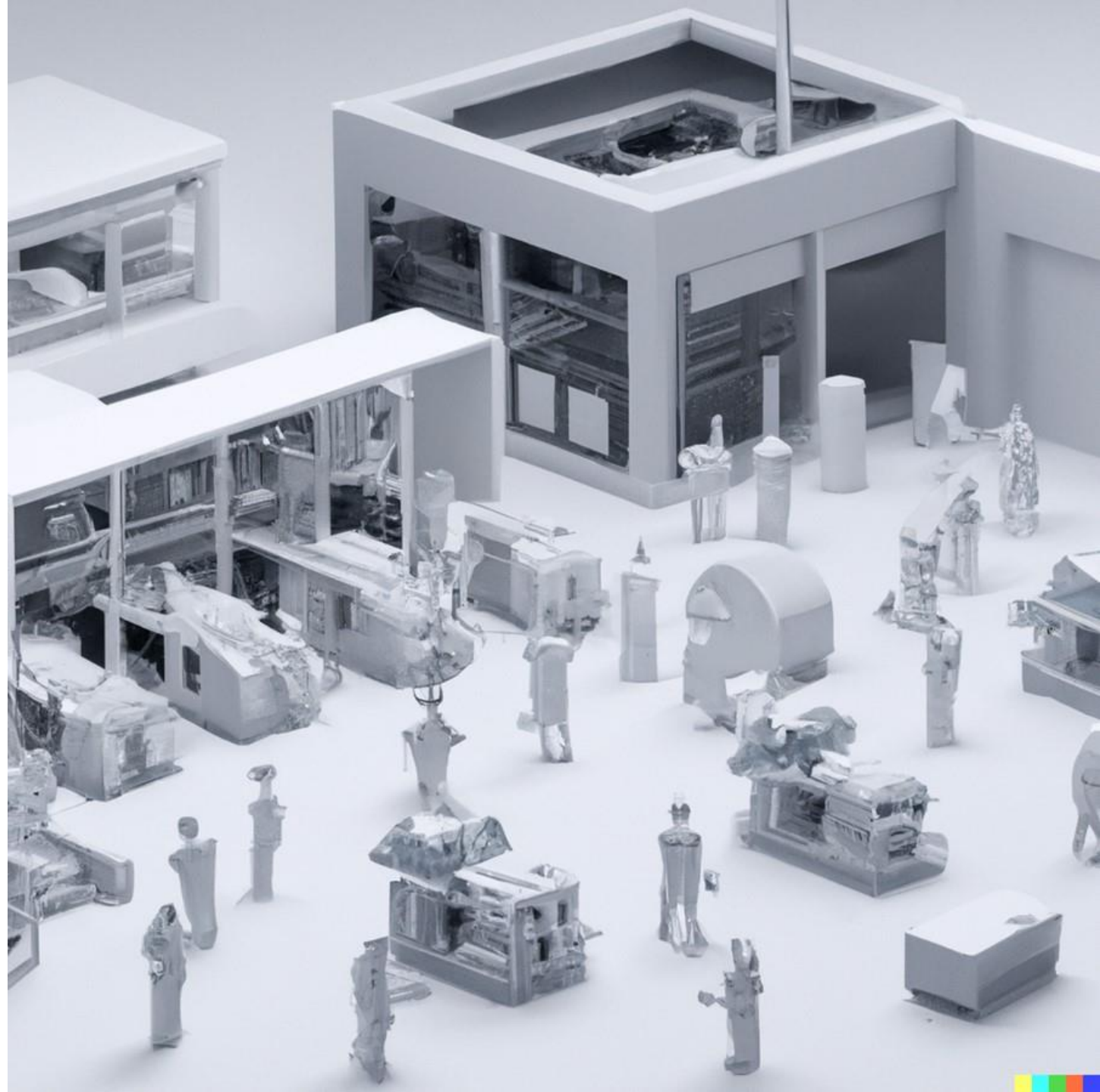
Hva må til?



Industriell
3D Print



3D print?
Men er ikke
det «falg»
det?





Fordelene!



Redusere ledetid



Reparasjon



On-site reparasjon



Utgåtte deler



Forbedre funksjon



Visualisering



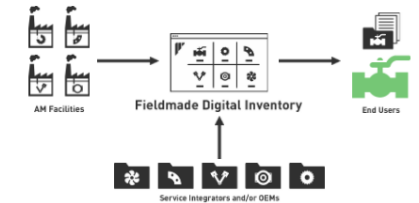
Redusere komponent kost



Alternative materialer



Midlertidig fiks



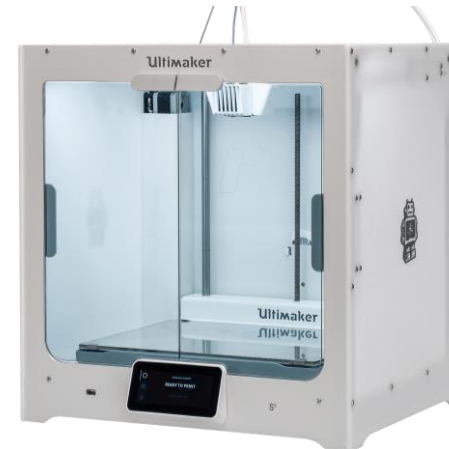
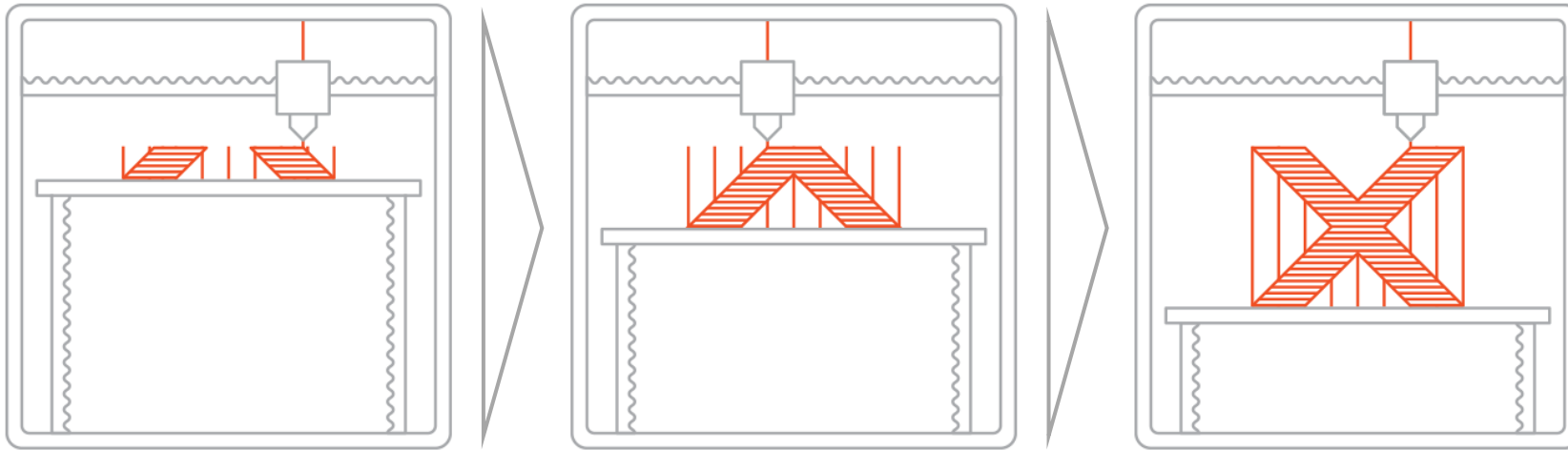
Digitalt lager

Eksempler hentet fra  equinor



Industriell
3D Print

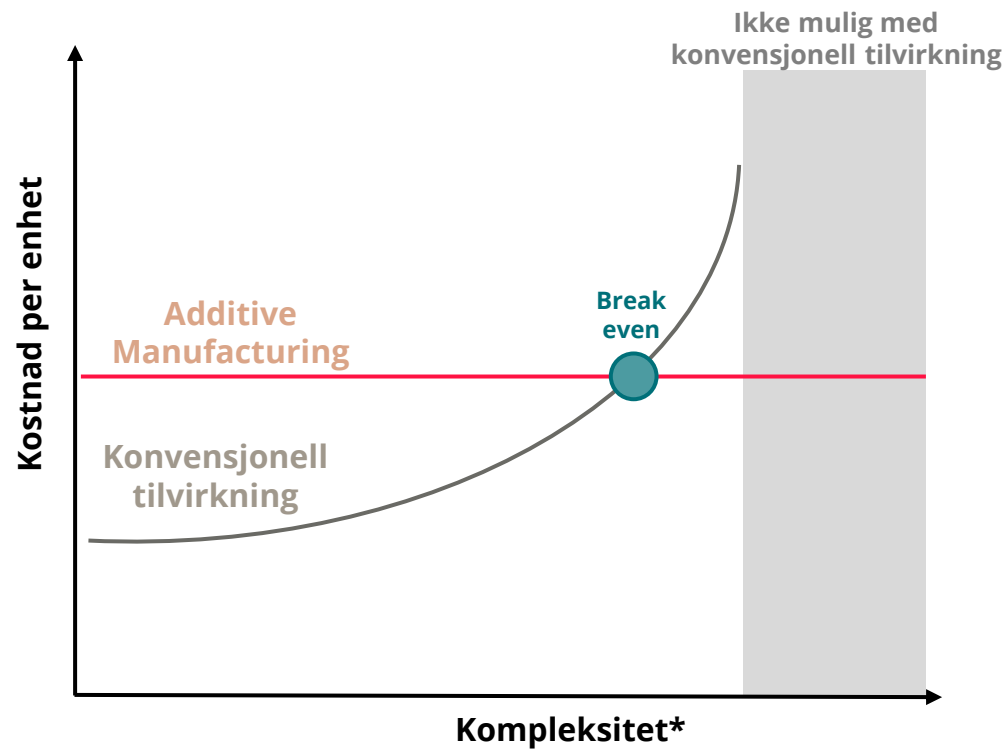
3D-Print prosessen bygger et tredimensjonalt objekt fra en computer støttet design (CAD) modell, vanligvis ved å suksessivt legge til materiale lag for lag





Sandvik

Kompleksitet og kostnad



*Kompleksitet kan fremkomme i geometri, kundekrav, styrke og vektbegrensninger

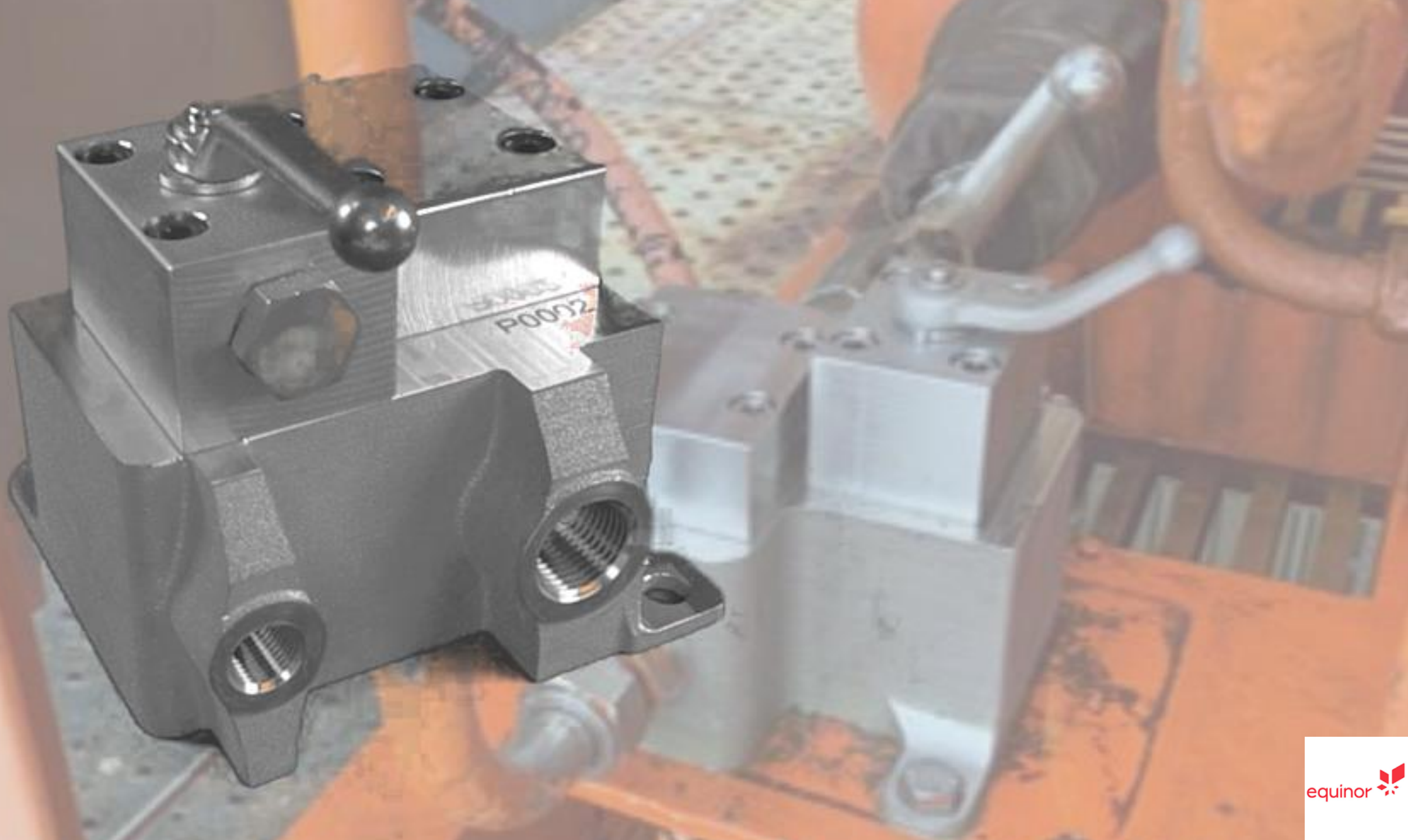
- Serieproduksjon av mange deler med enkel geometri kan gjøres mer effektivt med **konvensjonell tilvirkning**
- Deler med høy geometrisk kompleksitet, spesialtilpasning, kort ledetid, små serier eller strenge vektkrav sett i forhold til oppnådd styrke kan gjøres mer effektivt med **additive manufacturing (3D Printing)**

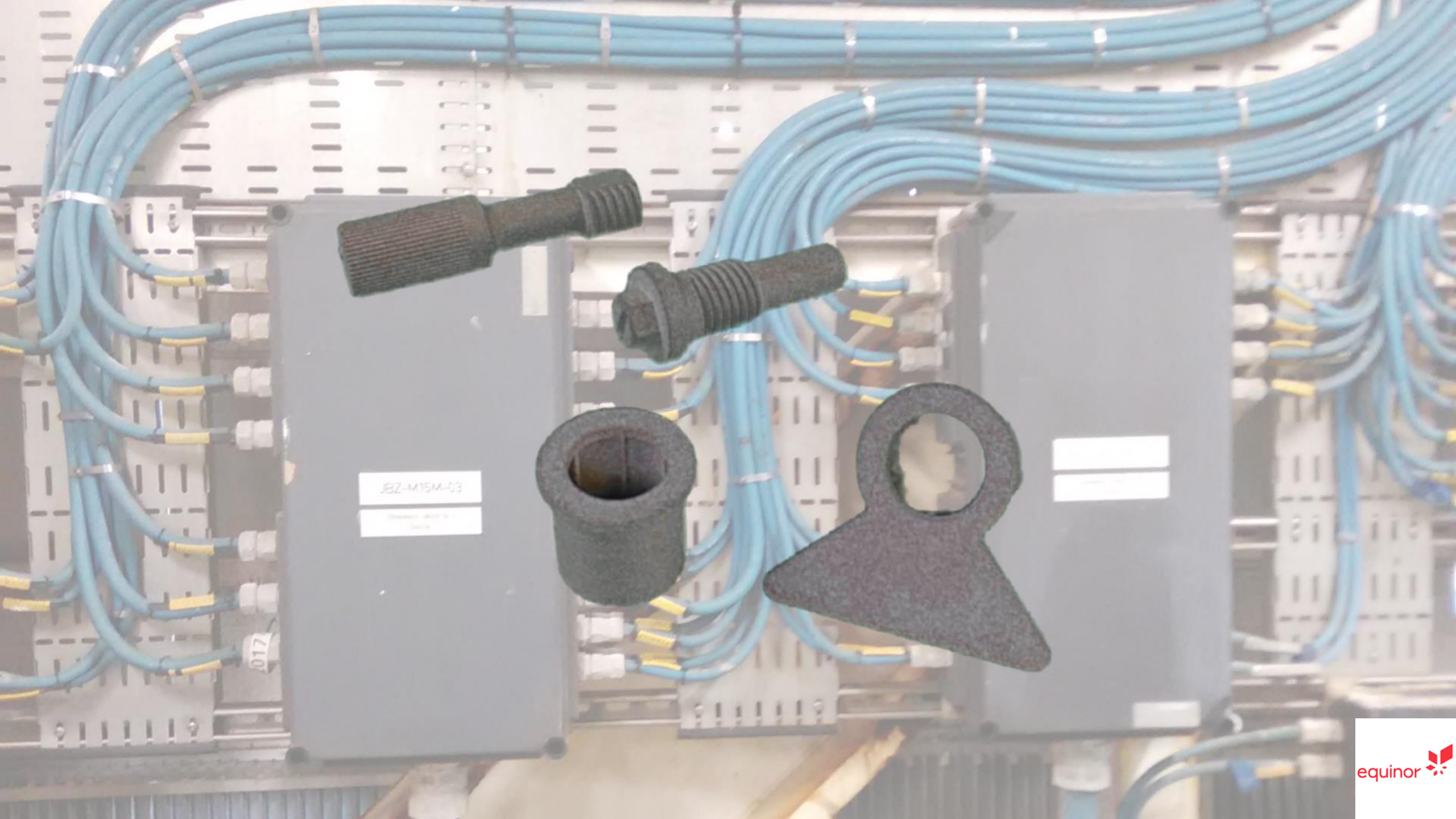


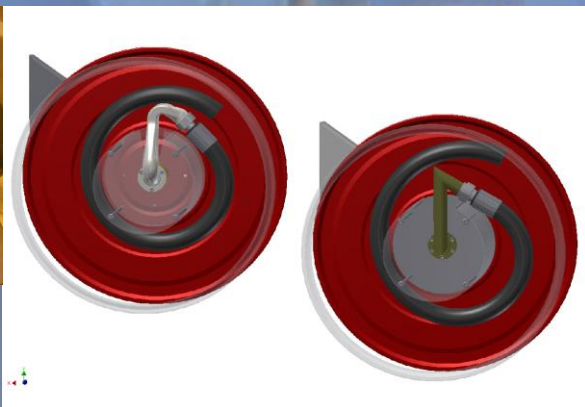
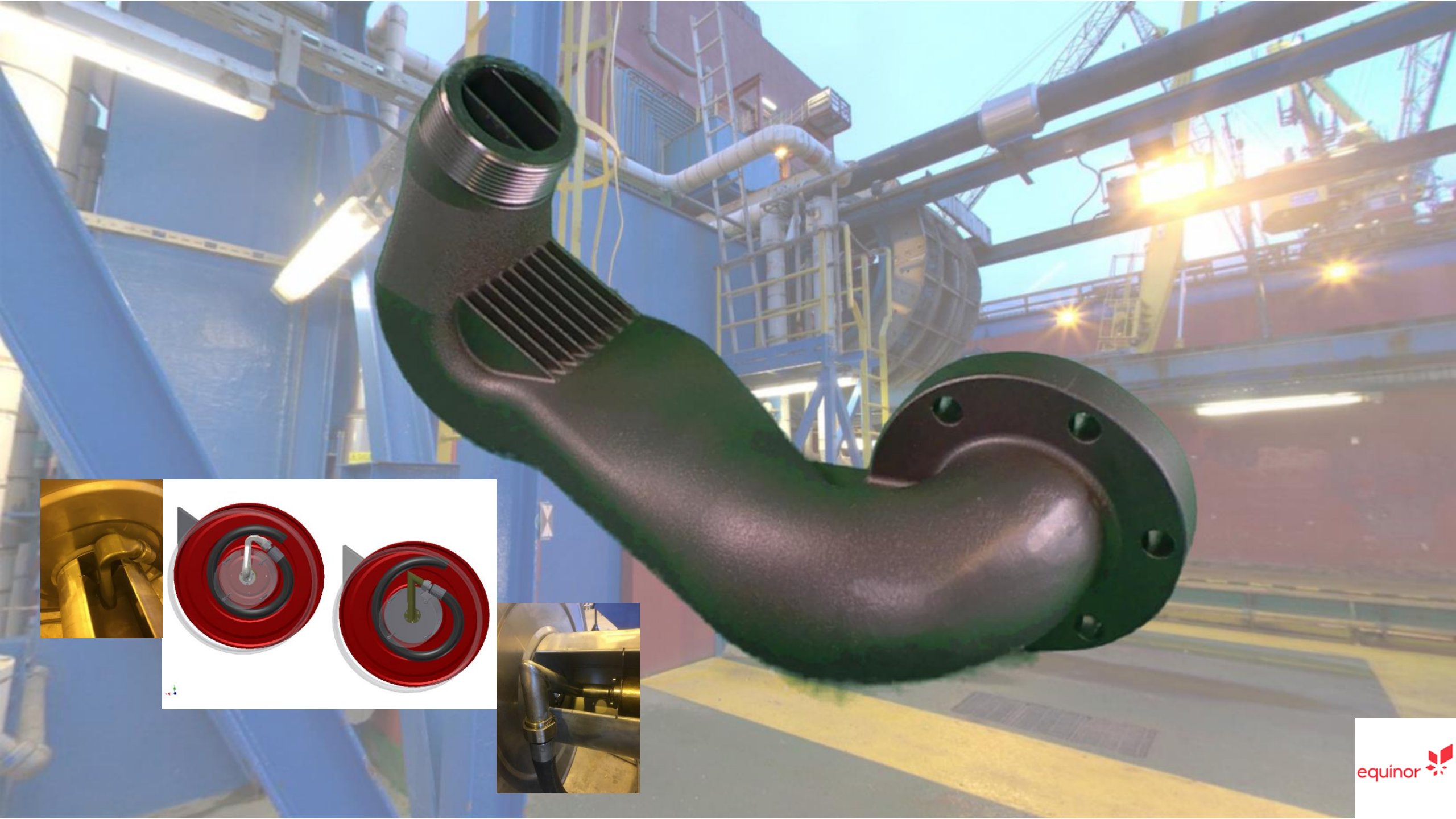
Eksempler!















3D print?
Men er ikke
det «falign»
det?



GE9X flymotor har over 274 3D printede deler ... og flere kommer til etterhvert...

GE9X engine

1

T25 SENSOR

1

HEAT
EXCHANGER



16

PARTICLE
SEPARATORS

228

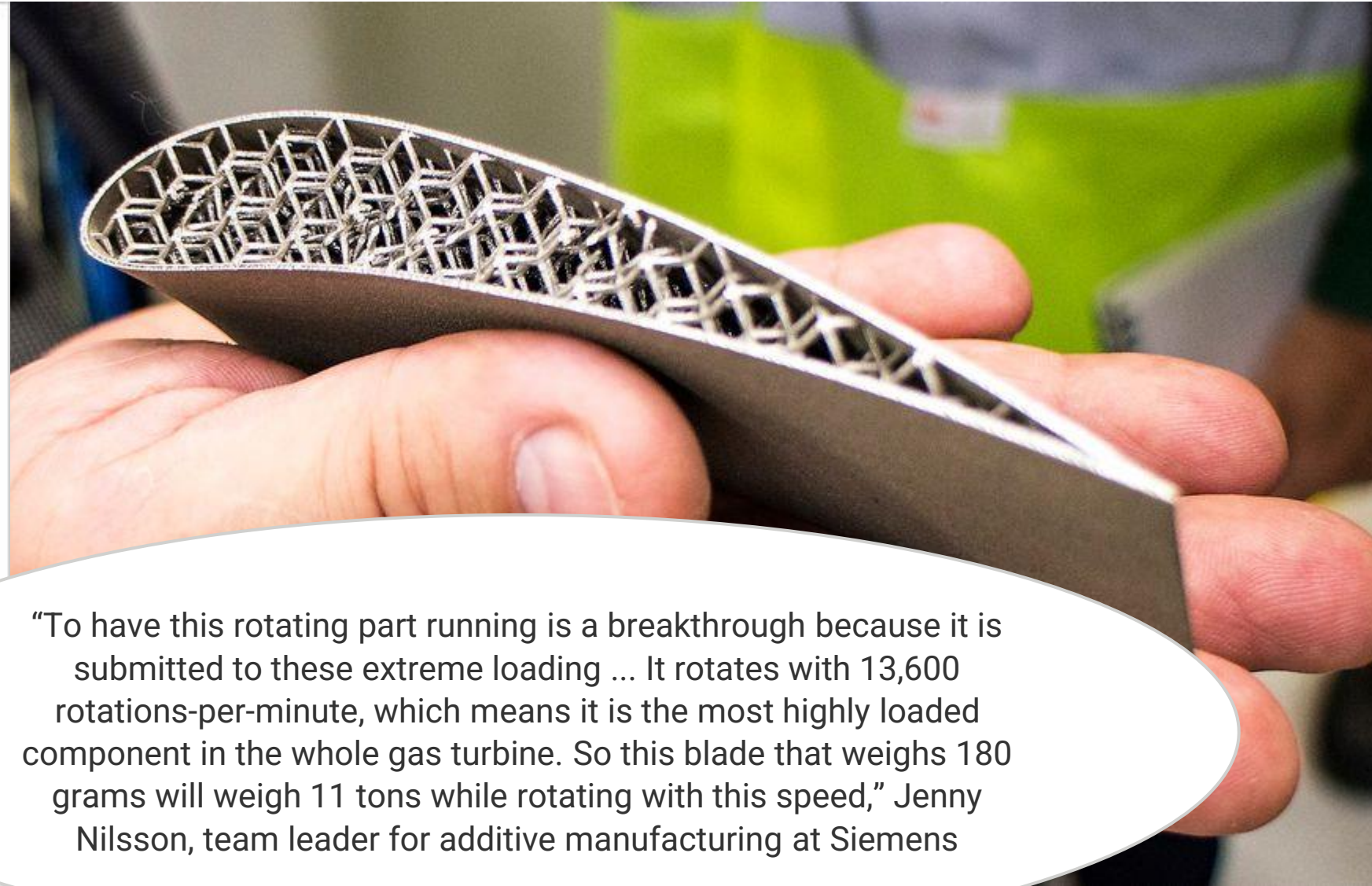
STAGE 5 & 6
LPT BLADES

28

FUEL NOZZLES
& COMBUSTOR MIXERS



Siemens 3D Prints Power Turbine Blades



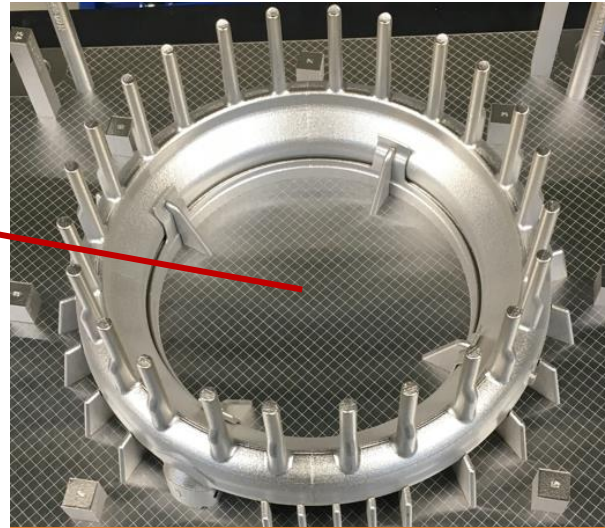
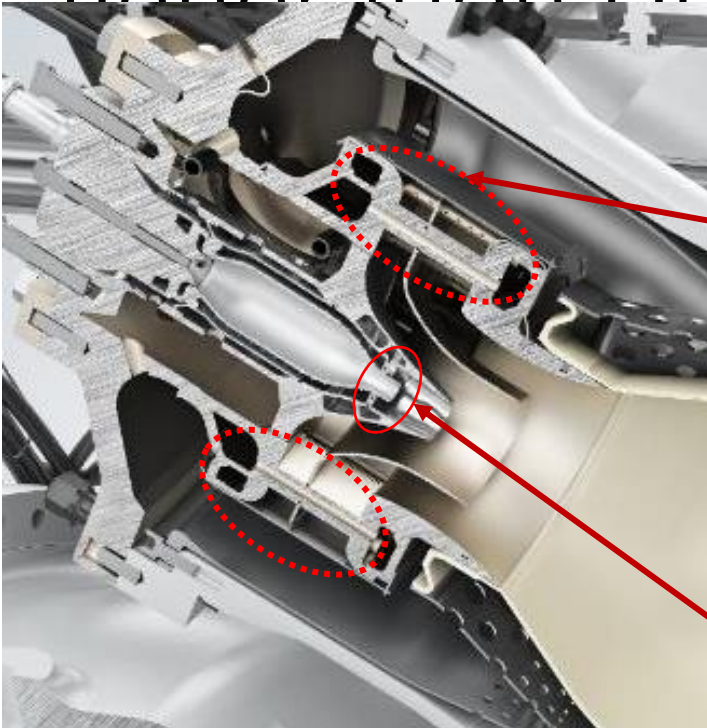
“To have this rotating part running is a breakthrough because it is submitted to these extreme loading ... It rotates with 13,600 rotations-per-minute, which means it is the most highly loaded component in the whole gas turbine. So this blade that weighs 180 grams will weigh 11 tons while rotating with this speed,” Jenny Nilsson, team leader for additive manufacturing at Siemens

Johan Castberg



Siemens 750 SGT

AM components utilized in SGT-750 4th generation DLE



Main stage "Gas Insert"



Pilot stage Swirler

The latest design of the SGT-750 4th generation DLE Burner utilizes the AM production method in two main components:

- Gas injection in the two main stages via the so called "Gas Insert"
- Pilot stage Swirler for gas injection and central swirl generation

The pilot stage swirler has been part of the burner design since the SGT-750 market introduction, while the "Gas Insert" has been gradually introduced during the past year and is now defined as the new standard.

By incorporating AM technology to solve the design challenge surrounding the internal "Main stage" gas feed, a modular bolted design has been enabled

- Improve serviceability, separate pieces can be exchanged. With the original brazed burner design the whole component must be exchanged in case of any damaged parts.
- A more future-proof design, aerodynamic features of the burner can be adapted to future needs

Fieldmade NOMAD03 3D Print container at Equinor Johan Castberg site in 2022/23



NOMAD®03

- Deployed and operational in less than 1h
- Fully self-sustained
- Transportable by air, sea and land
- Controlled climate section
- ISO/CSC certified expandable container
- Office space for up to 4 operators
- Features metal PBF (SLM)
- Monitored through a *digital twin*
- Access to **Fieldmade Digital Inventory**



Standarder for 3D Print i metall og polymer

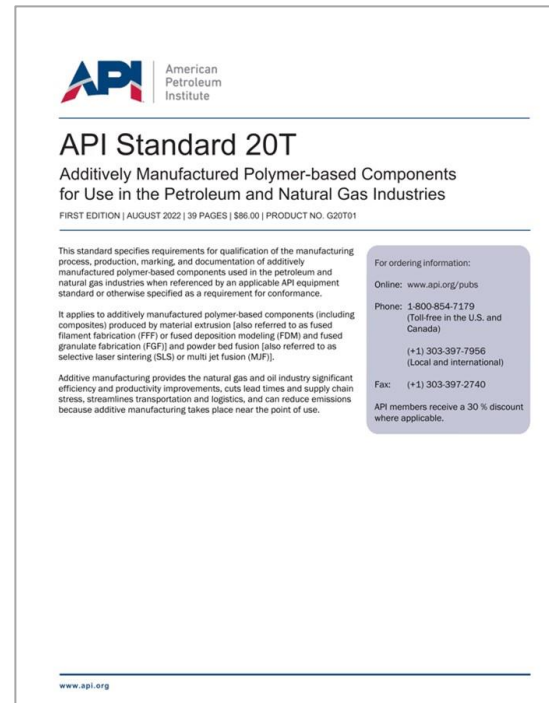
DNV-ST-B203 Additive manufacturing of metallic parts



This standard (ST) specifies requirements and guidance for:

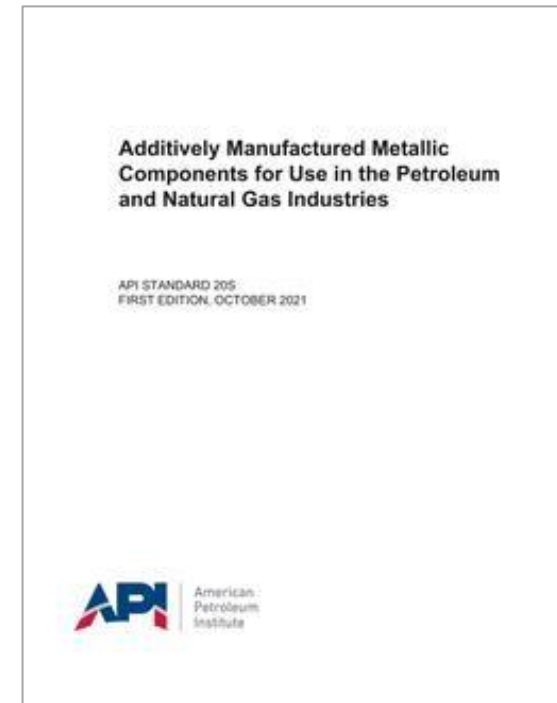
- the qualification of parts made by additive manufacturing (AM) for the oil and gas and related industries
- the purchasing of AM parts
- quality management for manufacturers of AM parts
- the manufacturing of AM parts.

API 20T



Additively Manufactured Polymer-based Components for Use in the Petroleum and Natural Gas Industries

API 20S



Additively Manufactured Metallic Components for Use in the Petroleum and Natural Gas Industries



Hva må til?

Forretningsmodeller endrer seg

Raskt!

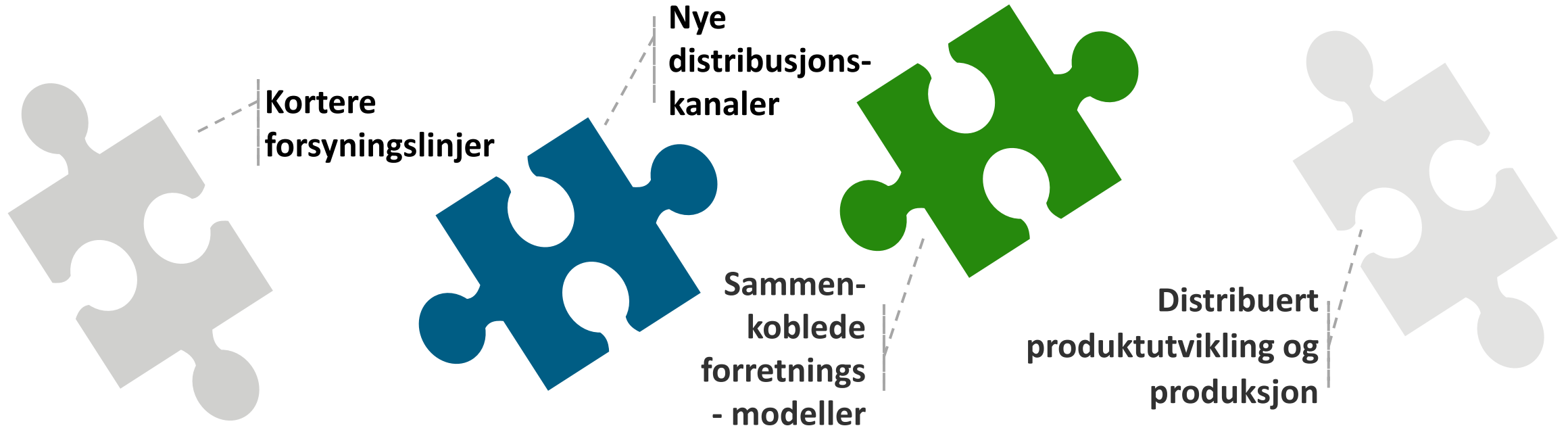
26%

8%



Hva er det som endrer seg?

Etablerte aktører står overfor fortrenkning av nye aktører som bruker ny teknologi

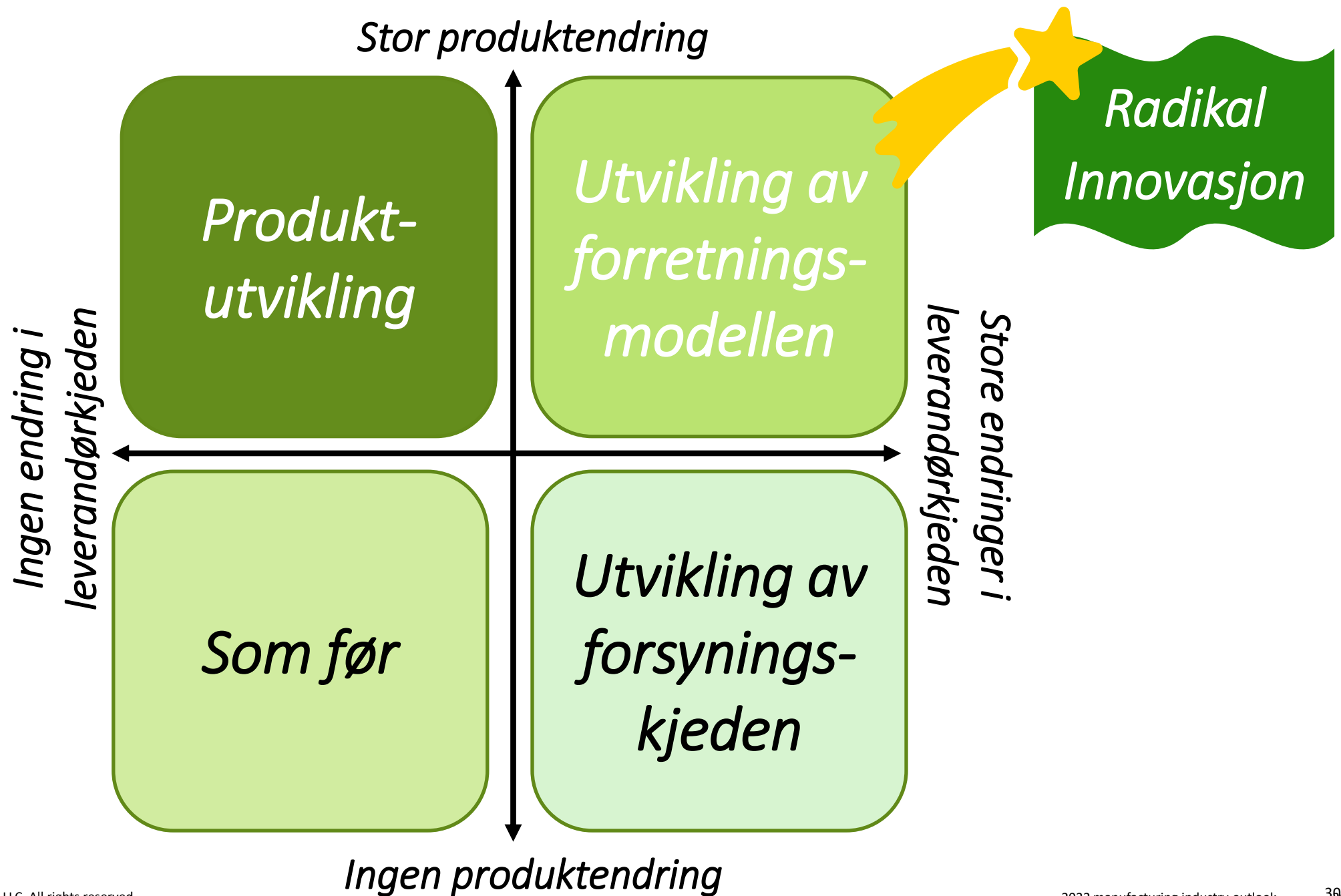


Eksempler



Google AdWords

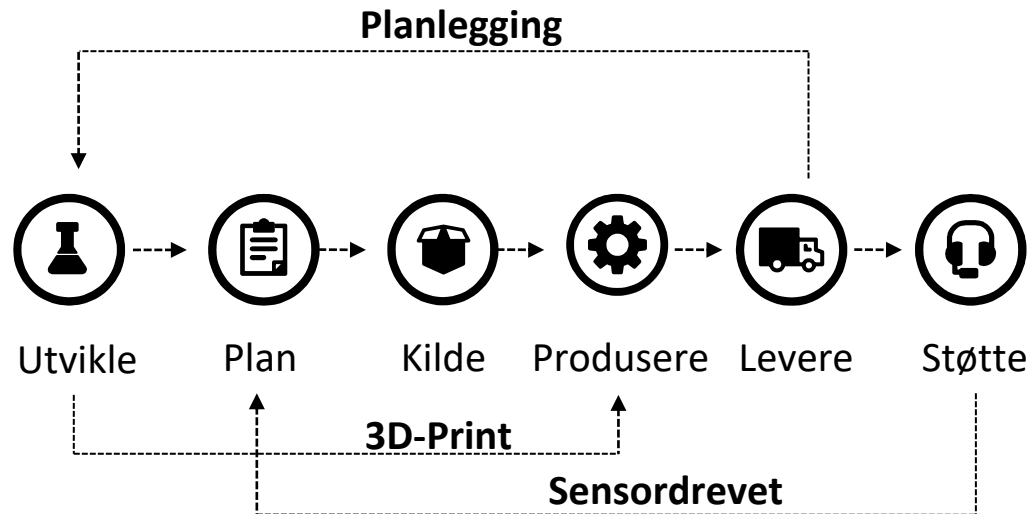




Forsyningskjeden utvikler seg til et **digitalt forsyningsnettverk**

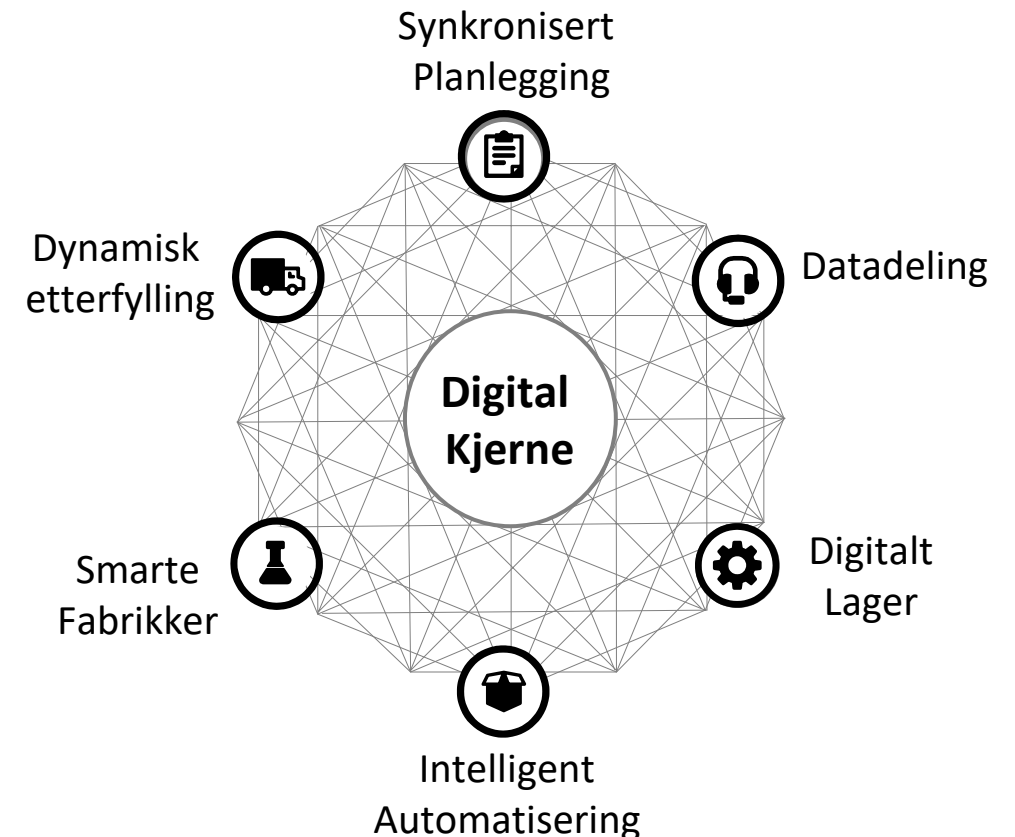
Tradisjonelle forsyningskjeder

Styrking og optimalisering av beste praksis, verktøy og metoder

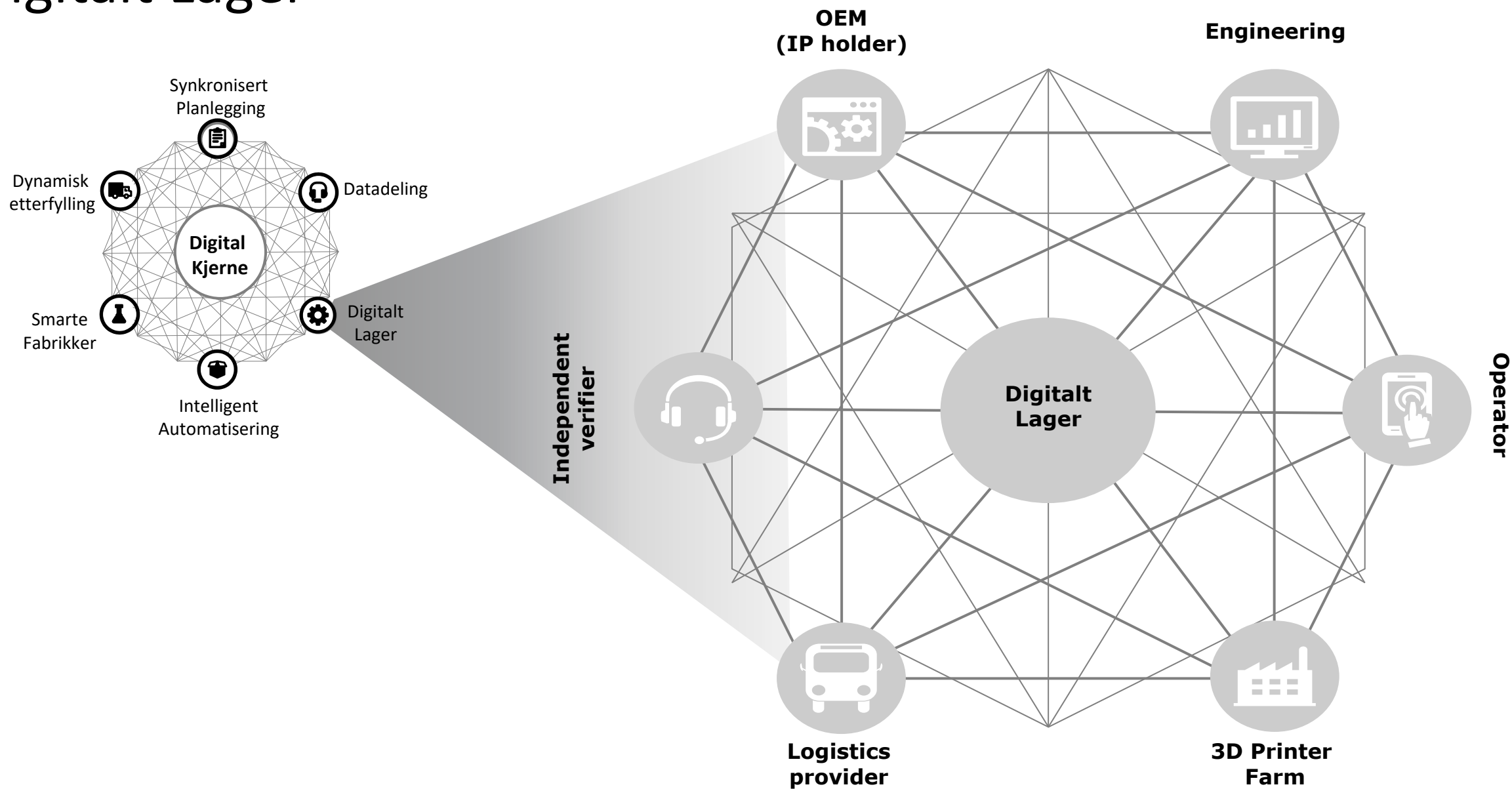


Digitalt Forsyningsnettverk

Etablerer en "digital tråd" gjennom fysiske og digitale kanaler, og kobler sammen informasjon, varer og tjenester



Digitalt Lager



Teamcenter PLM Data Viewer



Application Description

- View and edit Teamcenter PLM data from Mendix application
- Enriched and consolidated data view from Teamcenter, SAP and Opcenter
- Enhanced 3D Visualization data view with PMI from Mendix
- Responsive web application built using Mendix
- User-friendly application accessible through a mobile device for PLM data



Major Functionalities

- Mendix - Teamcenter Connector – Enable read and edit access of Teamcenter Part, Document and BOM data from Mendix
- Mendix 3D Viewer For Teamcenter – View 3D JT Model with PMI data from Teamcenter



Future Functionalities

- Extract engineering parameters to perform metrics, advance search and data filtering, 3D visualization, quality reporting and supply chain product collaboration
- Consolidated one stop view of product data with a focus on Teamcenter, SAP and Opcenter integration thru single Mendix Application interface



Valuable insights from data in a single application



Improved Workforce Efficiency



Easy access to product data, design data and documentation



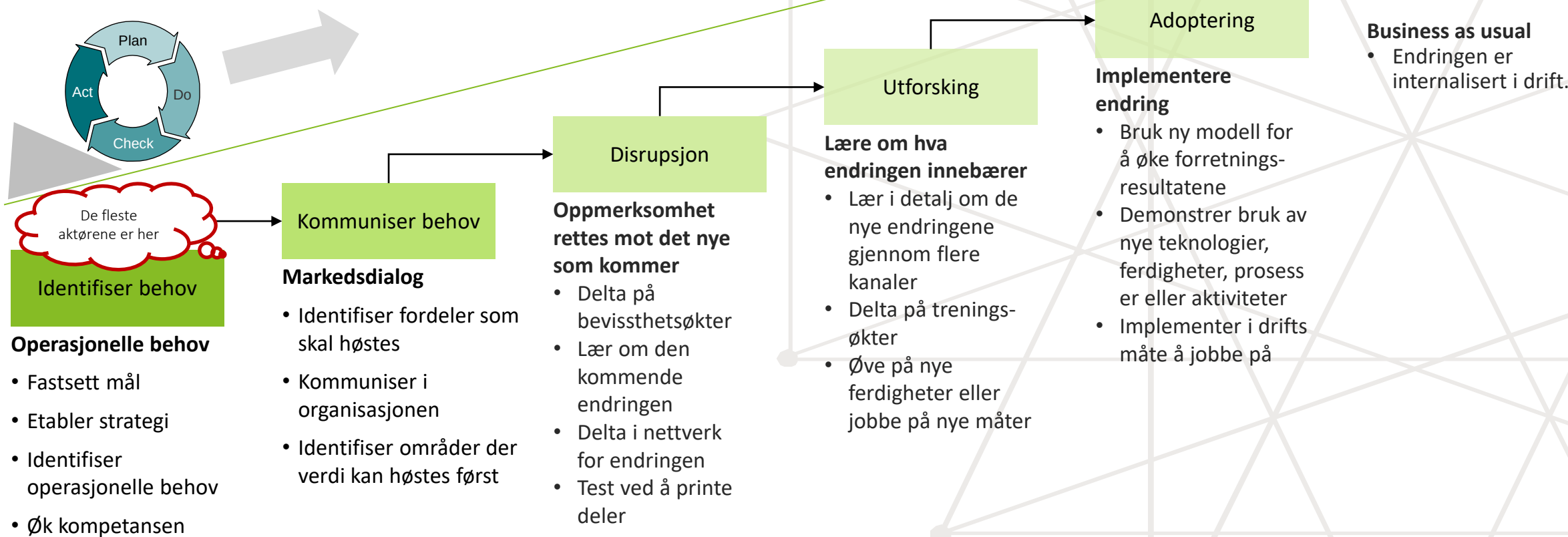
Consolidated data view



3D Visualization data view

Verdinettverket må endres i en stegvis prosess

Seks steg for aktører på veien til ny leveransemodell



Deloitte sine profesjonelle tjenester innen additiv tilvirkning

Vi besitter en dyp forståelse av utfordringene ved å drive innovasjon og transformasjon i store organisasjoner

Globalt nettverk av profesjonelle tjenester for bruk av additiv tilvirkning

Som en del av det globale nettverket for profesjonelle tjenester i Deloitte samarbeider Deloitte Norge med kolleger i en rekke globalt integrerte tjenester for å levere multinasjonale løsninger.

Vi har solid og anerkjente publikasjoner innen additiv tilvirkning

Vi skaper tankevekkende, ledende publikasjoner innen additiv tilvirkning, og bygger innsikt som hjelper organisasjoner med å skape ny verdi og inntekter i digitale forretningsmodeller.

Vi kombinerer innsikten med vår erfaring med å drive endring i store organisasjoner

Deloitte's sentre for fremragende forskning bidrar til å transformere vår egen organisasjon og som grunnlag for å skape økosystemer for våre klienter. Dette muliggjør raskere læring og akselerasjon av innovasjon innen additiv tilvirkning.

320 000

Globalt antall ansatte

1500

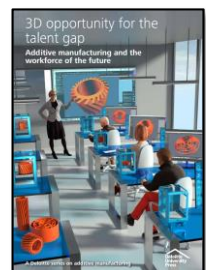
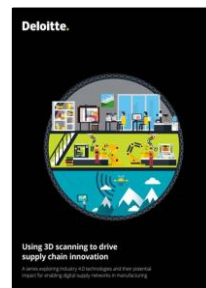
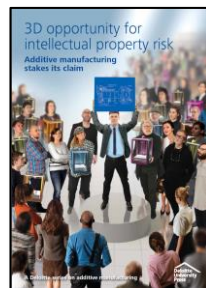
Ansatte i Deloitte Norge



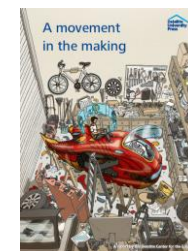
150
Land



10 Kontorer i
Norge



Fremtidens
produksjon



En bevegelse i
utvikling



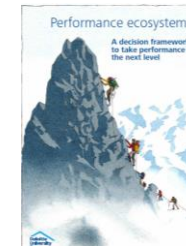
Fremtidens
Mobilitet



Landskapet i
endring



Kraften til
plattformer



Ytelsen til
økosystemer



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