



Equinor AM vision and strategy

Transforming the way we work

Brede Lærum 12.09.2019



*"If I would have asked people what they wanted,
they would have answered '-Faster horses.'"*

Henry Ford, attributed

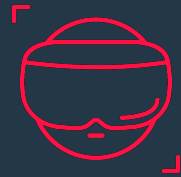
The digital energy company

Changing the way we provide energy

Always safe

High value

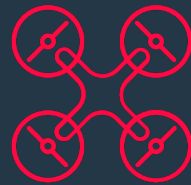
Low carbon



Make data available anytime, anywhere



Predicting and preventing safety and security incidents

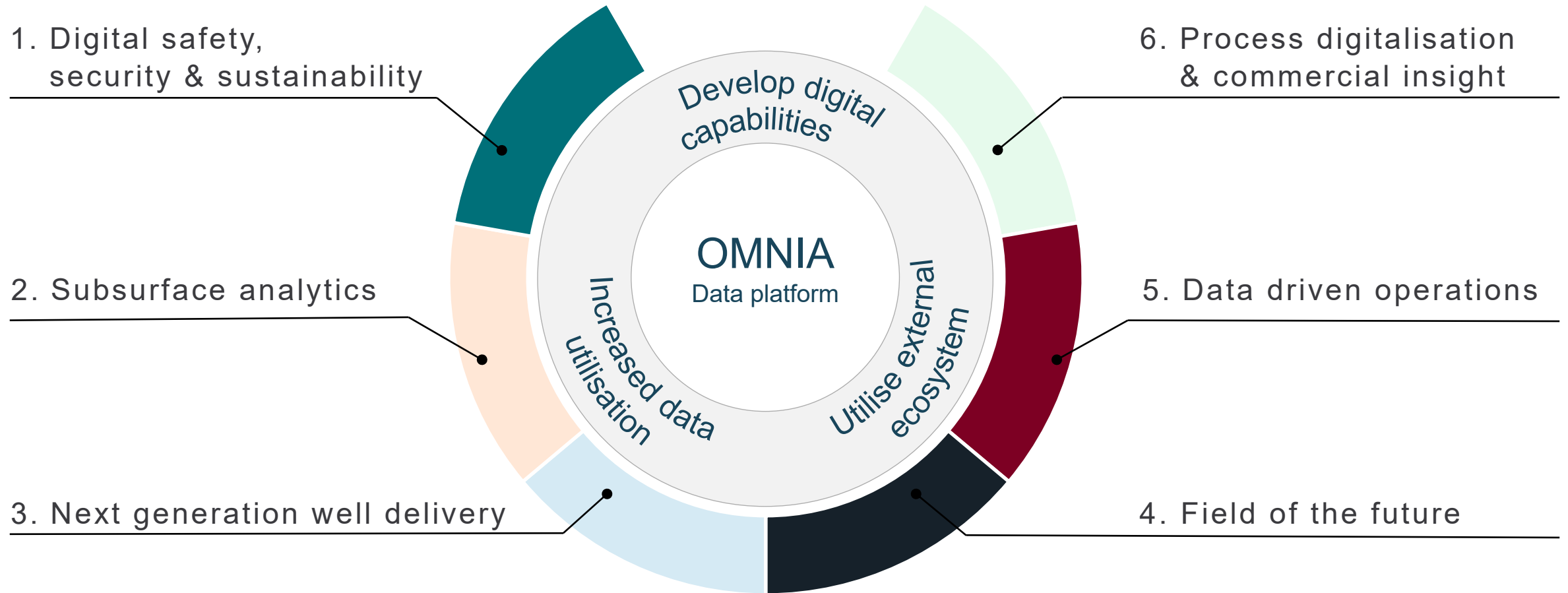


The robots will make our work easier



Connecting minds and technology to become industry leader

A company wide digital roadmap



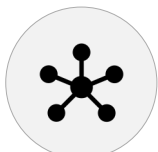
Sense

Sensors | Connectivity



Think

Data science & analytics



Integrate

Data | Cloud



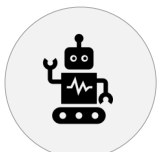
Visualise

VR | AR



Automate

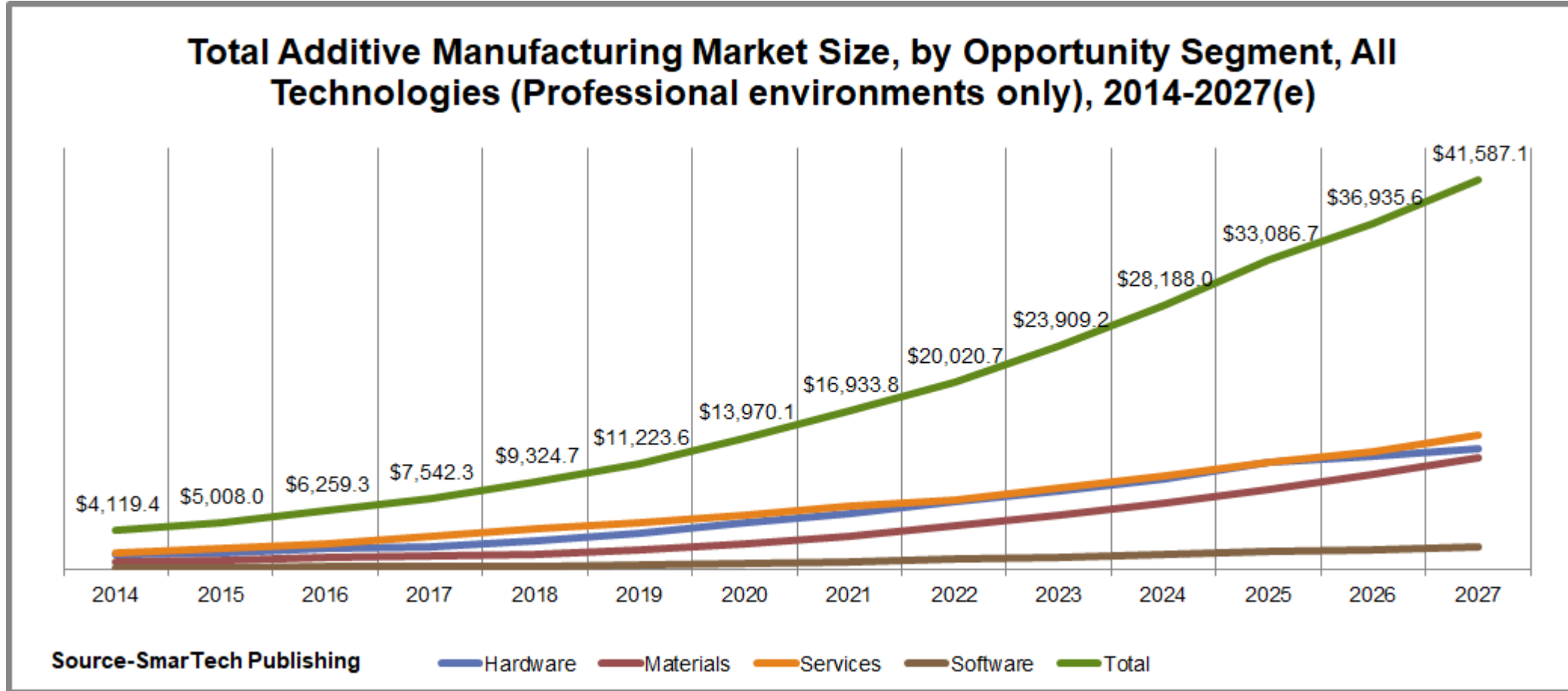
RPA | Blockchain



Act

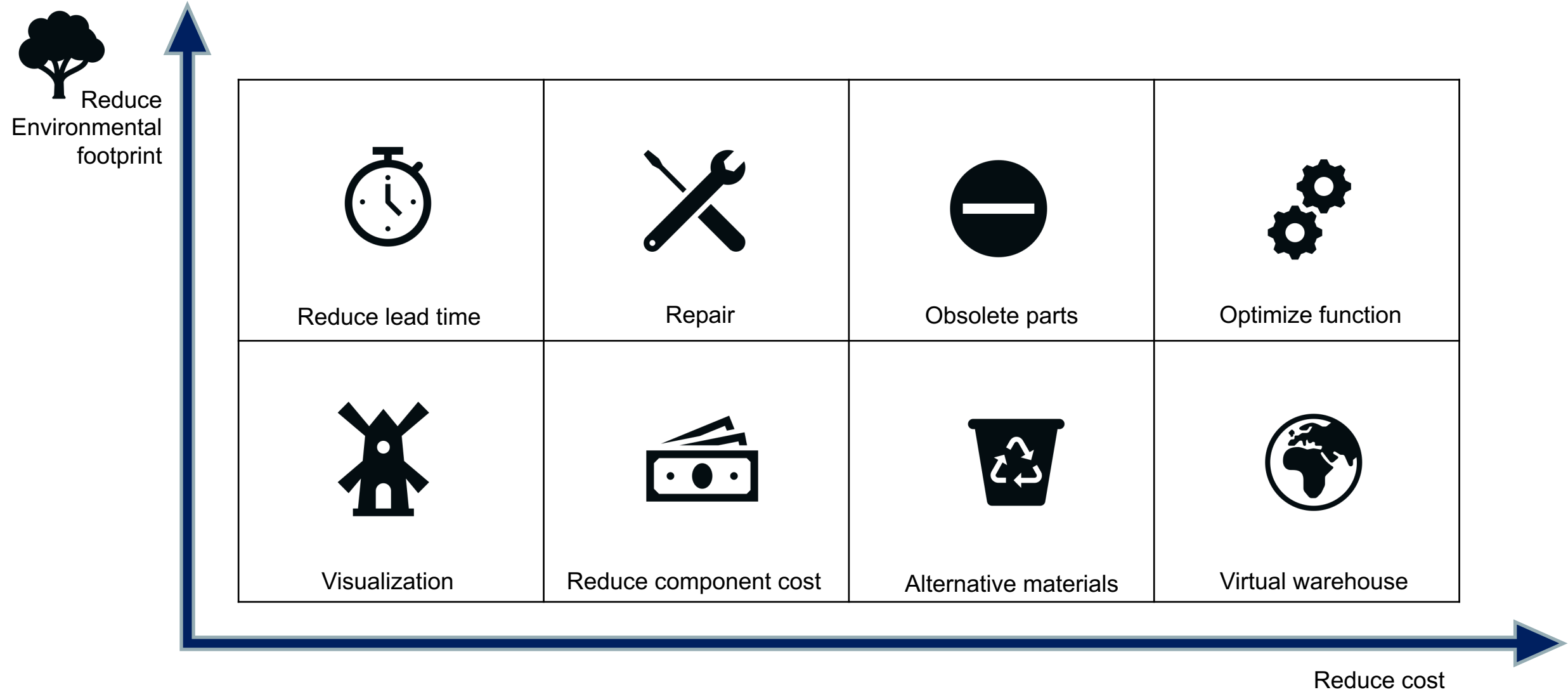
Robotics | 3D printing

AM Market size (SmarTech)



*Figures in MUS\$

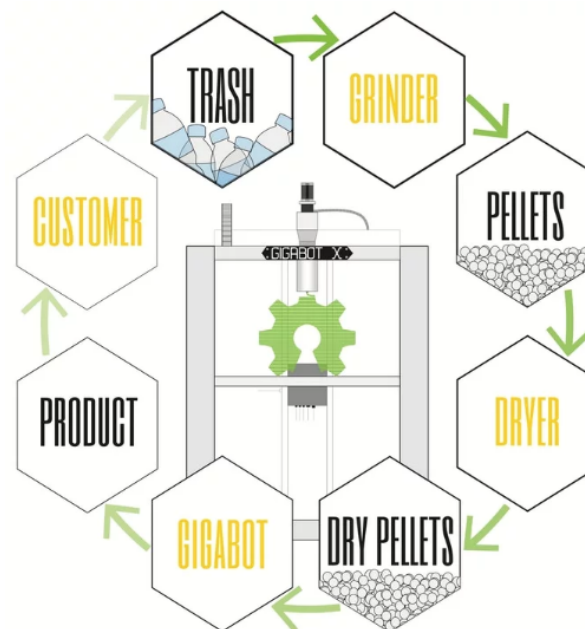
Potential of 3D print in Equinor



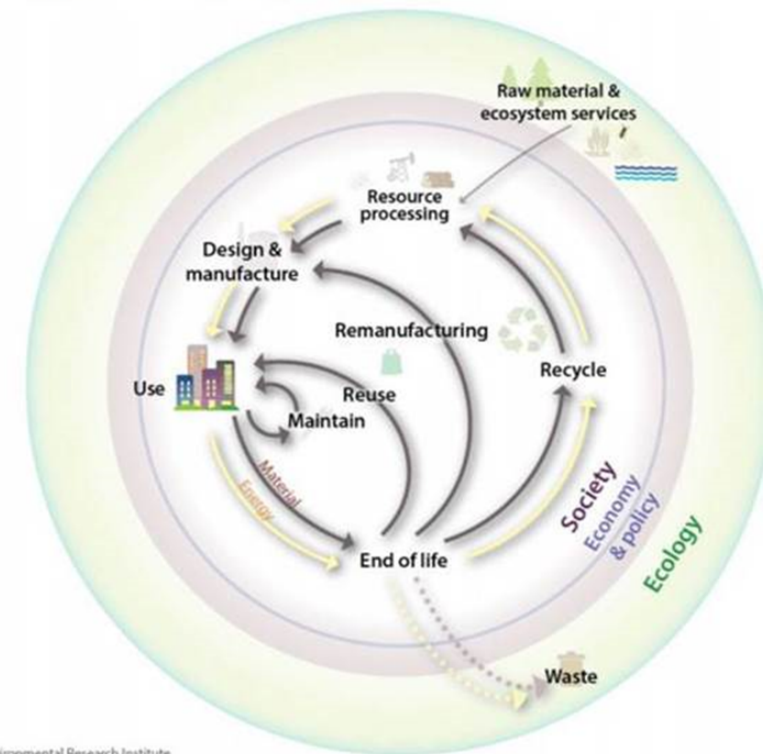
AM Environmental footprint and circular economy



Source: Wikipedia



Source: All3DP

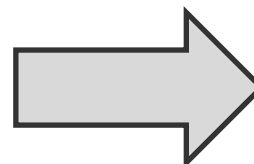


 ivl
© IVL Swedish Environmental Research Institute

Reduced transport - Reduced waste - Reduced raw materials - Reduced CO2 emissions

Transforming the Norwegian Continental Shelf

Just-in-case



Just-in-time

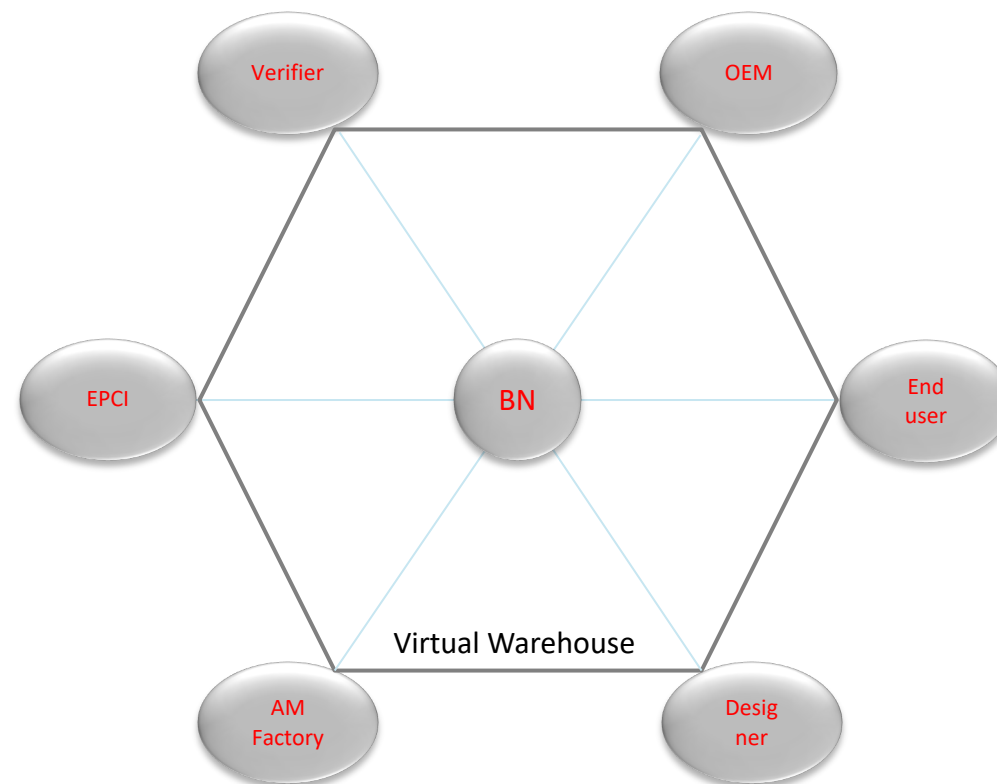


New business models

Existing linear model

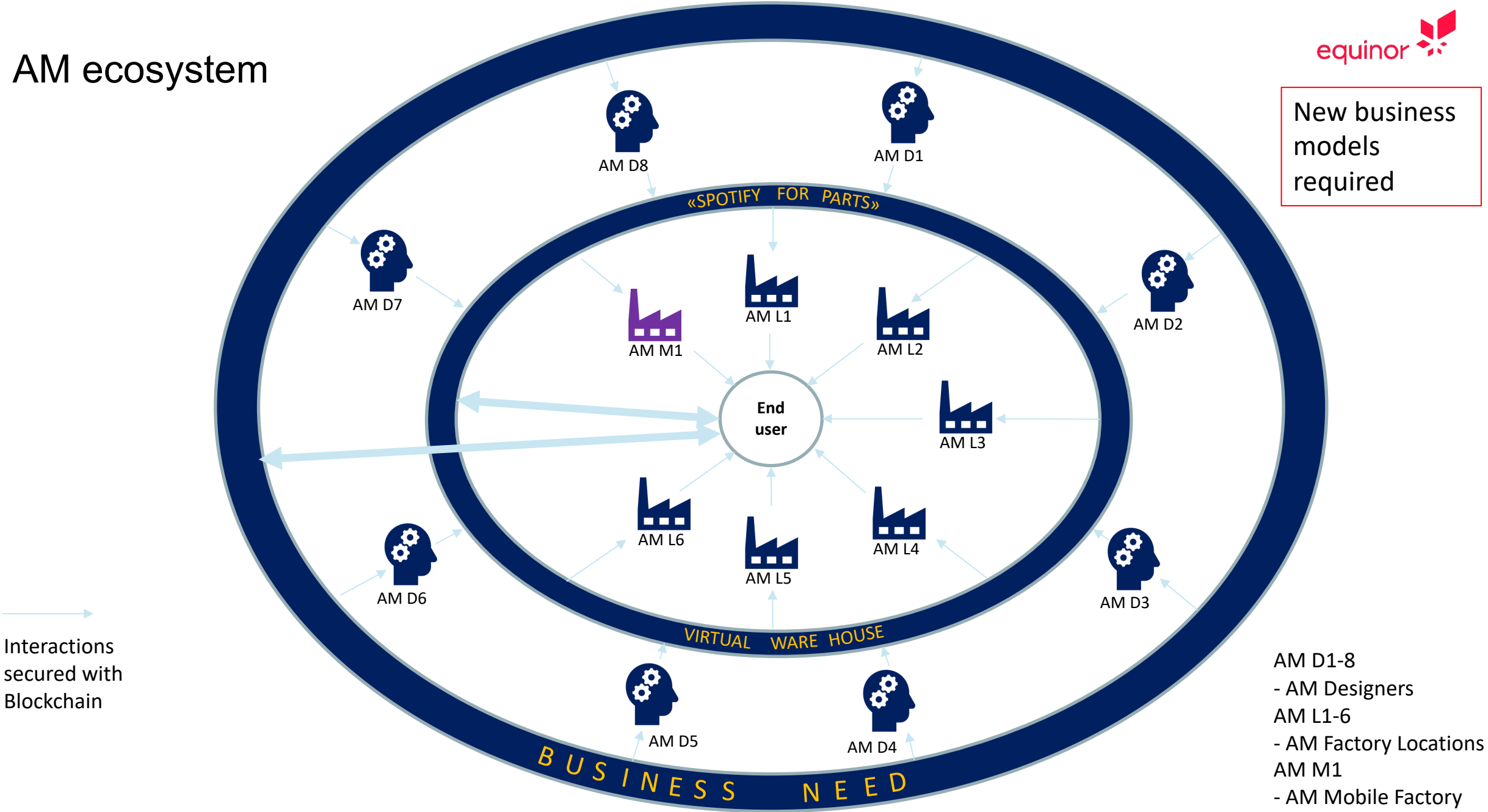


New ecosystem



AM ecosystem

New business models required



Vision for AM in Equinor



2019

- Demonstrate businesscases
- Establish organisation, work processes and best practices
- Build competence
- Engage suppliers

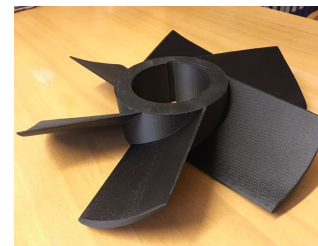
2020

- Virtual warehouse in operation
- Digital valuechain in operation
- AM fully integrated in OMM
- On-site print use cases



2021

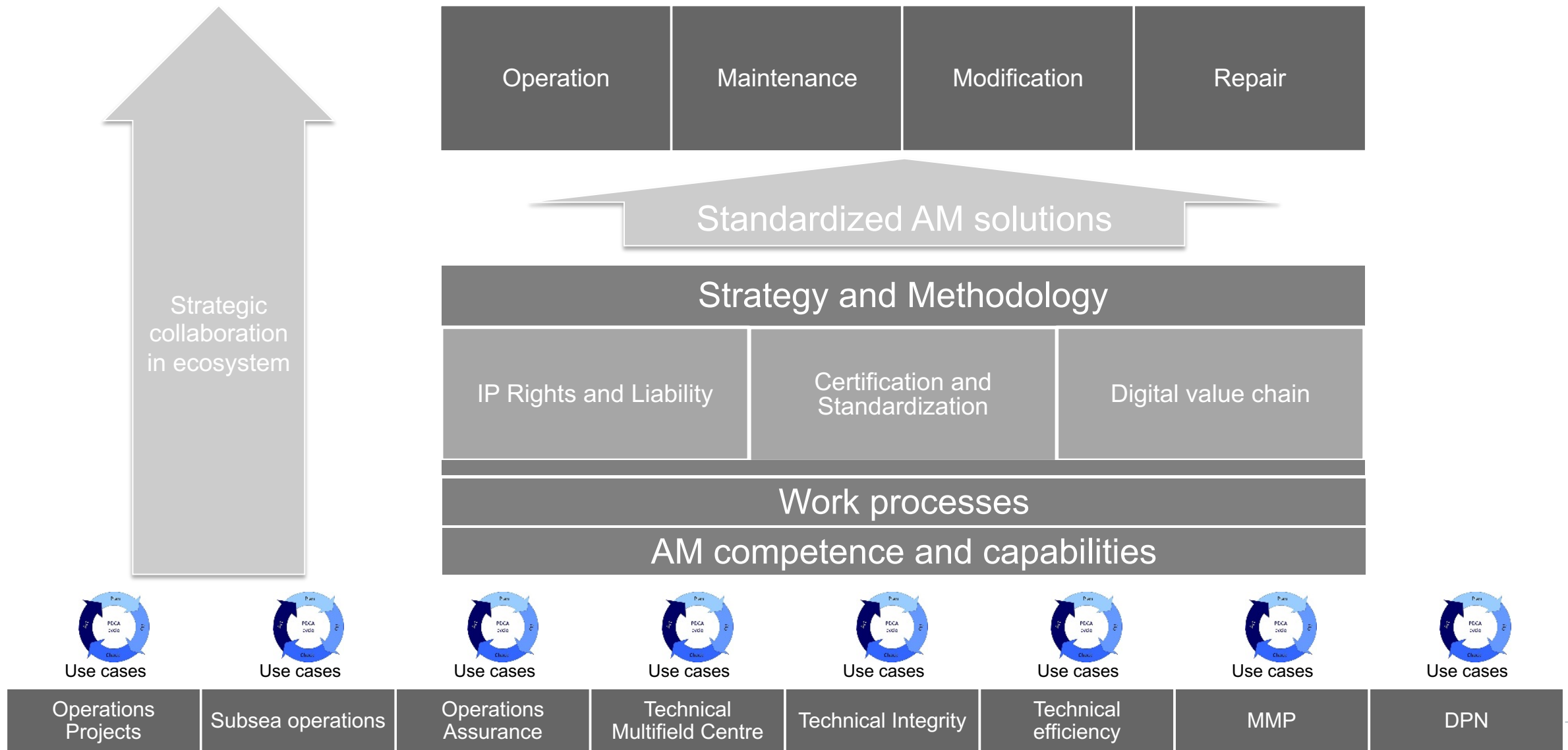
- Distributed 3D print capacity available – Supplier driven
- Physical warehouse reduced
- Modifications reduced
- Maintenance cost reduced
- Increased production due to improved component function
- Fully utilized in value chain



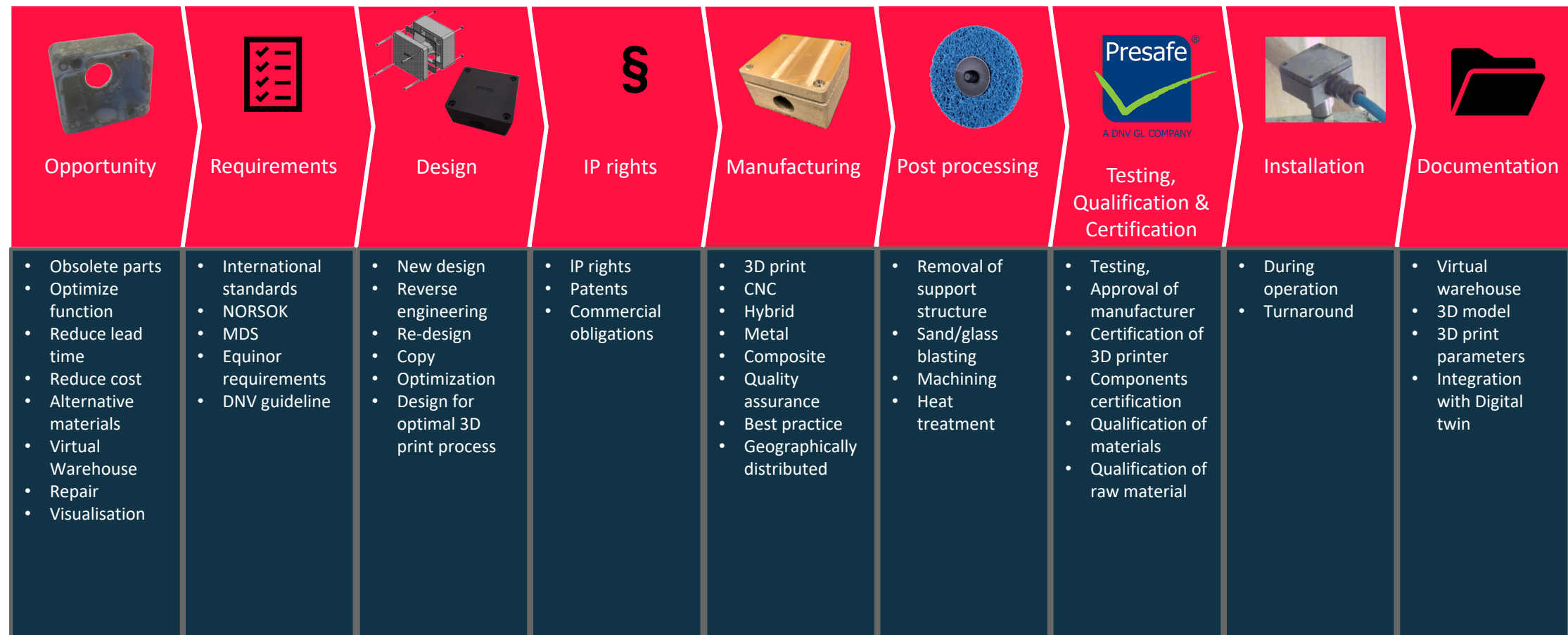
2028

- Virtual warehouse and digital value chain fully integrated
- Physical warehouse reduced to full potential
- Spare parts available just-in time
- Distributed 3D print capacity available, supplier driven
- Significant cost reduction
- Performance improvement
- HSE improvement
- Environmental footprint reduction

Equinor 3D printing Roadmap



3D print process



Examples

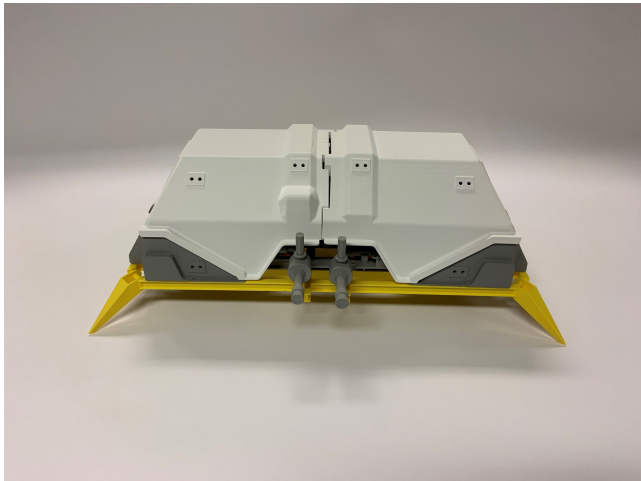
Visualization



Reservoir Gina Krog



Modification of exhaustpipes Snorre



Subsea template Snøhvit



Krafla platform

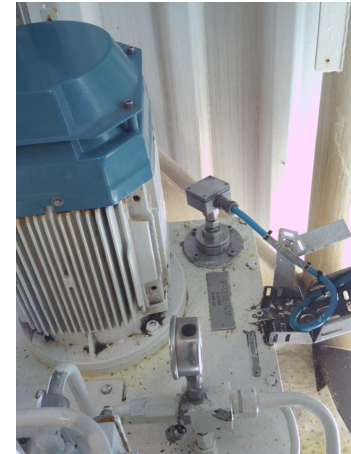
Obsolete parts



Nozzleholder for lifeboat engine



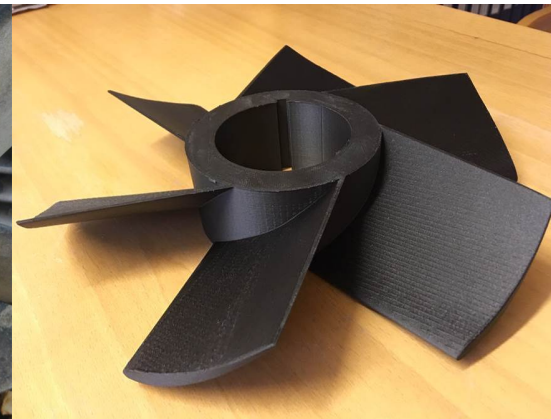
Cover for lightfixture Gullfaks



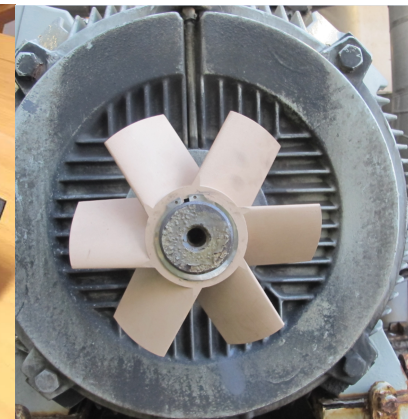
Junction box Melkøya



Worn-out cooling fanTjeldbergodden



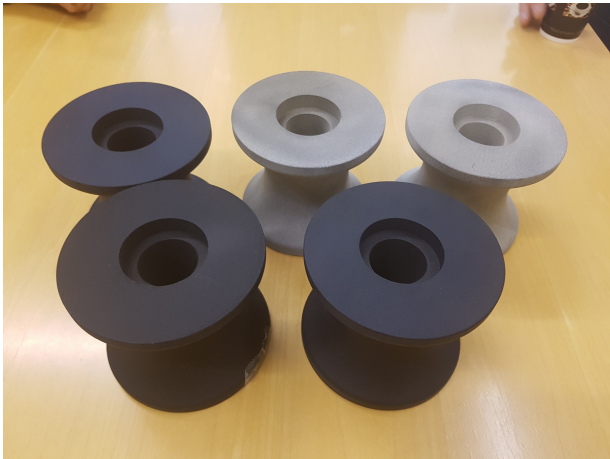
New 3D printed fan



Installed

Reduce cost

Repair



Nylon Sheave rollers



Impeller seawater pump Tjeldbergodden



Valve plug Tjeldbergodden



AlSi7Mg Impeller Kårstø



Thermal pocket Tjeldbergodden

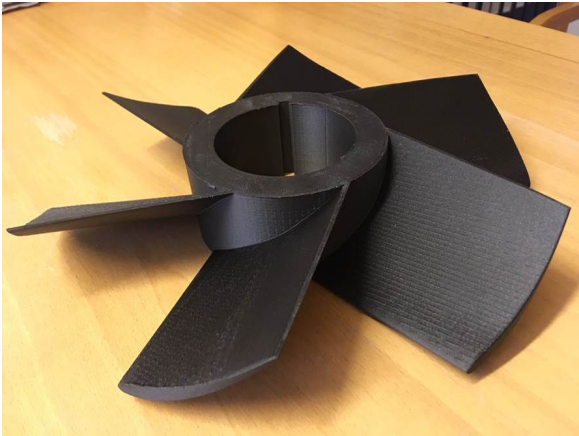
Alternative materials



Impeller Nylon 12



Impeller Nylon 12



Cooling fan, carbon enforced ASA



Handwheel, ASA

Optimise function



Source: Siemens (Gas turbine burners)



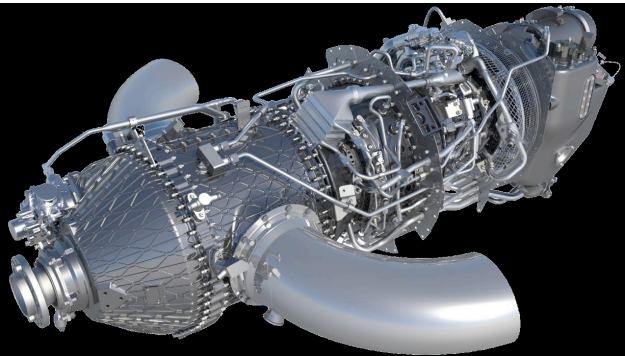
Titanium gooseneck Johan Castberg



In place



Old model



855 → 12
PARTS

Source: GE, Turboprop

5%
WEIGHT
REDUCTION

20%
LOWER MISSION
FUEL BURN



20 → 1
PARTS

30%
COST EFFICIENCY
IMPROVEMENT

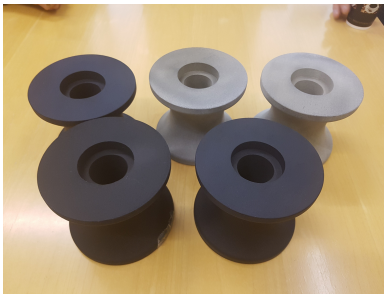
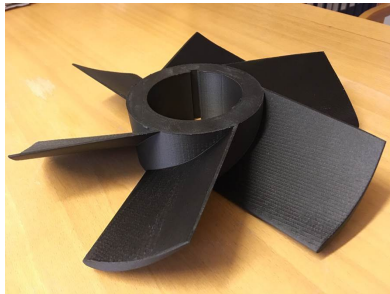
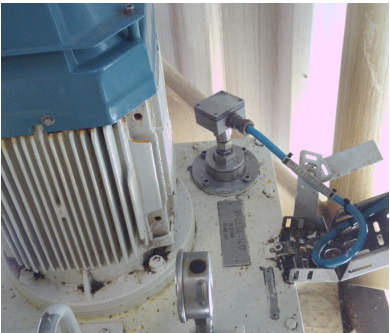
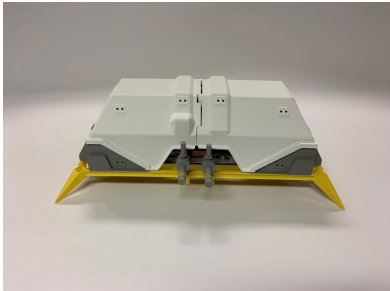
5x MORE
DURABLE

25%
WEIGHT
REDUCTION

95%
INVENTORY
REDUCTION

Source: GE, LEAP fuel nozzle

Virtual warehouse





Equinor AM vision and strategy

Brede Lærum, Manager digitalisation

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