Autonome marine operasjoner og systemer - muliggjørende teknologier som skaper industrielle muligheter for Norge
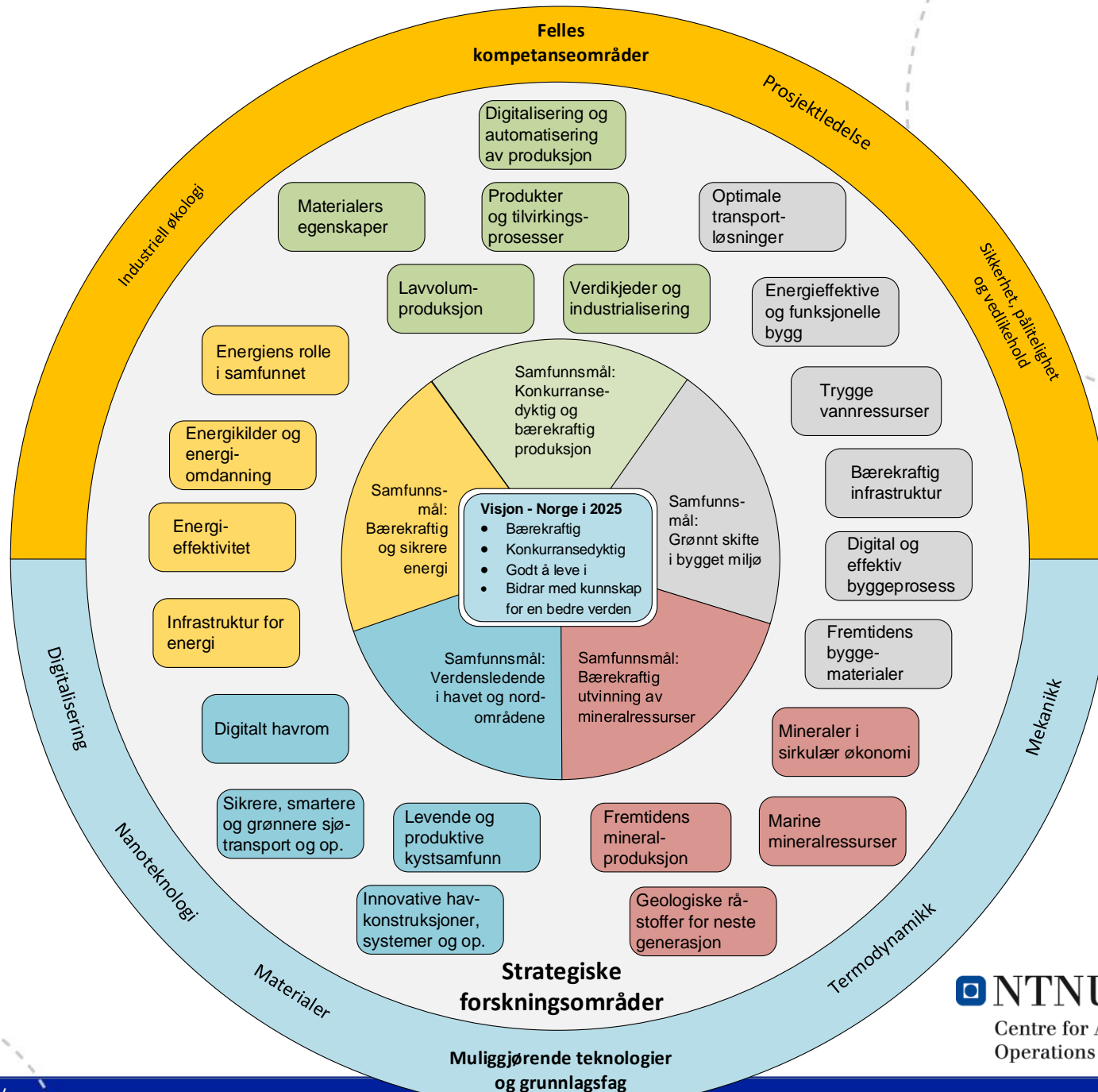
Professor Asgeir J. Sørensen

Senter for autonome marine systemer og operasjoner (NTNU AMOS)
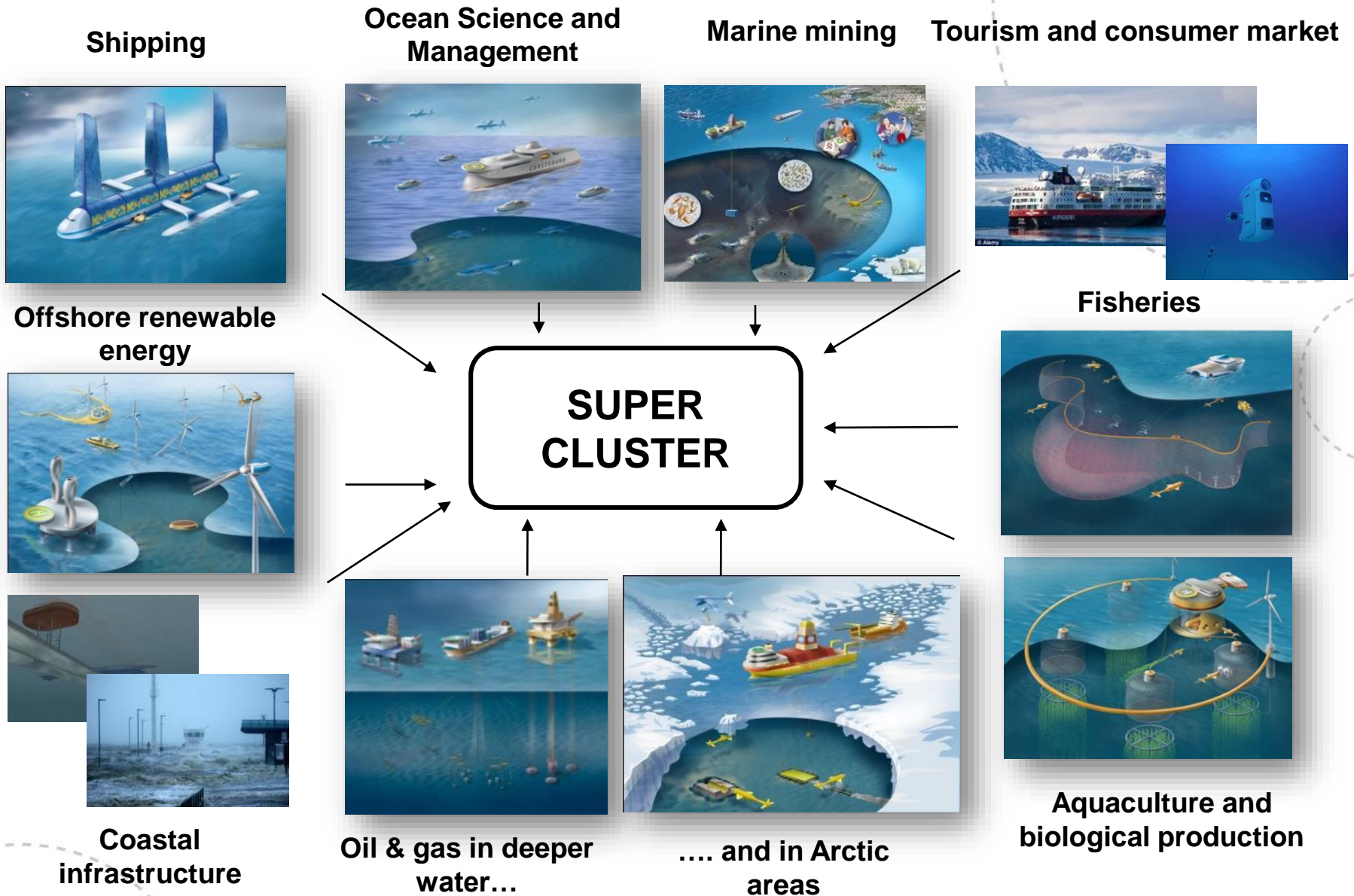
Norges Teknisk-Naturvitenskaplige Universitet, Trondheim

Innovasjon IMT

Norwegian Centre of Excellence

2018-05-31

AMOS

Research Strategy: NTNU Faculty of Engineering

Ocean Space Industries- The blue economy

Shipping

Ocean Science and Management

Marine mining

Tourism and consumer market

Offshore renewable energy

Fisheries

SUPER CLUSTER

Coastal infrastructure

Oil & gas in deeper water…

…. and in Arctic areas

Aquaculture and biological production

Ocean Space Industries- The blue economy

Shipping

- Greener (CO2/NOx tax?)
- Smarter (Autonomy)
- Logistic chains
- Energy storage

Ocean Science and Management

- Governance
- Instrumentation
- Big data
- Marine robotics
- Cleaning (plastic+)

Marine mining

- Minerals
- Marine operations
- New concepts

Tourism and consumer market

- Travel and accommodation
- Marine robotics
- New ships
- ..

Offshore renewable energy

- Offshore wind
- Marine operations
- Smart grid
- Energy storage

SUPER CLUSTER

Fisheries

- New species
- Lower trophic biomass (krill, ++
- New ships
- Better preservation and logitsics

- Instrumentation
- Climate adaption
- Novel concepts

- …

- Marine operations
- Robotics and autonomy
- Open innovation
- More standard industrial solutions
- Remote areas, deep water
-
- ..

- New species
- More exposed
- Closed flexible cages
- Better preservation and logistics
- …

Coastal infrastructure

Oil & gas in deeper water…

…. and in Arctic areas

Aquaculture and biological production

How do we meet the global challenges?

Energy

Sea food

Transportation

Mineral shortage

Climate

Environment

Coastal Infrastructure


NTNU Vision
"Knowledge for a better world"

NTNU AMOS
Centre for Autonomous Marine Operations and Systems

New business by fundamental knowledge fields and enabling technologies

- **Mathematics, physics (mechanics, ++), chemistry, biology, computer science**
- **Information and communication technology**
- **Nano technology**
- **Bio technology**
- **Material technology**
- **Big data cybernetics and data analytics**
- **Autonomous systems**
- **Integration of disciplines and technologies**
- **Multi-scale and distributed systems for sensing and actuation: Micro to macro (M2M)**
- **…..**

Research and innovations based on disruptive game changing technology beyond imagination…..

Innovasjon er også en del av samfunnsoppdraget til NTNU
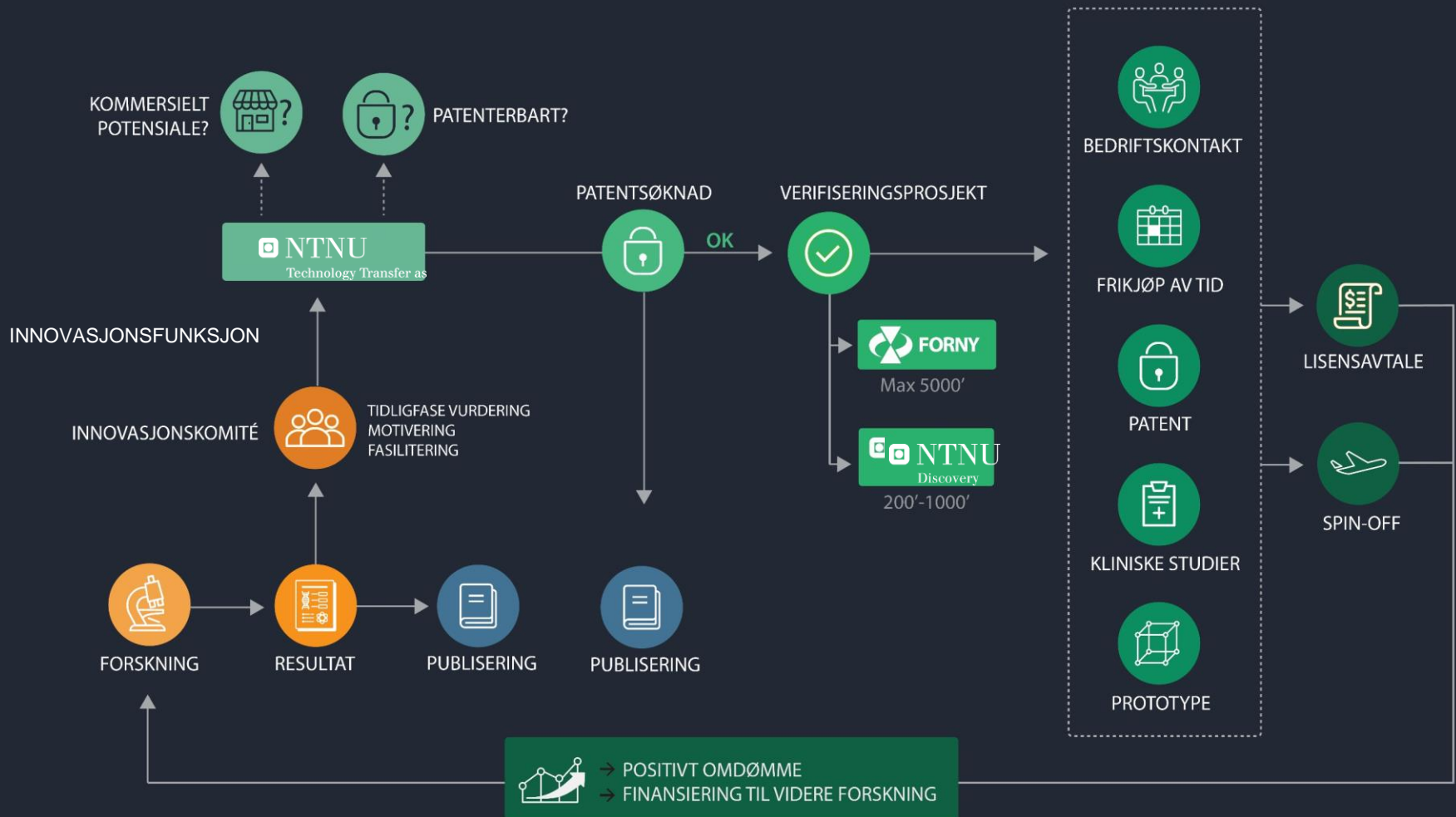
Equinor expectations:
"Shaping the future of energy - Innovate and accelerate"

equinor

- Simplify and standardise to stay competitive at all times
- Radical and innovative solutions to transform the industry
- Technologies to provide energy for a low carbon future
- Safe marine operations, anywhere, at any sea state and at 1/10th of the cost
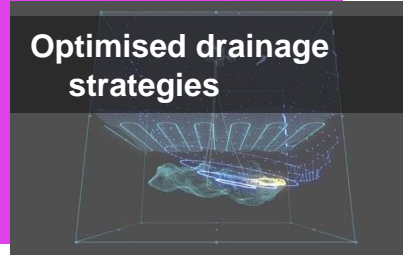
Next level digitalisation

Offshore wind

Safe marine operations

Radical innovations

Optimised drainage strategies

Unmanned production platforms

NTNU AMOS
Centre for Autonomous Marine Operations and Systems
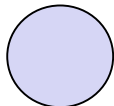
Autonomous ships and ports…

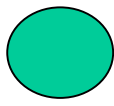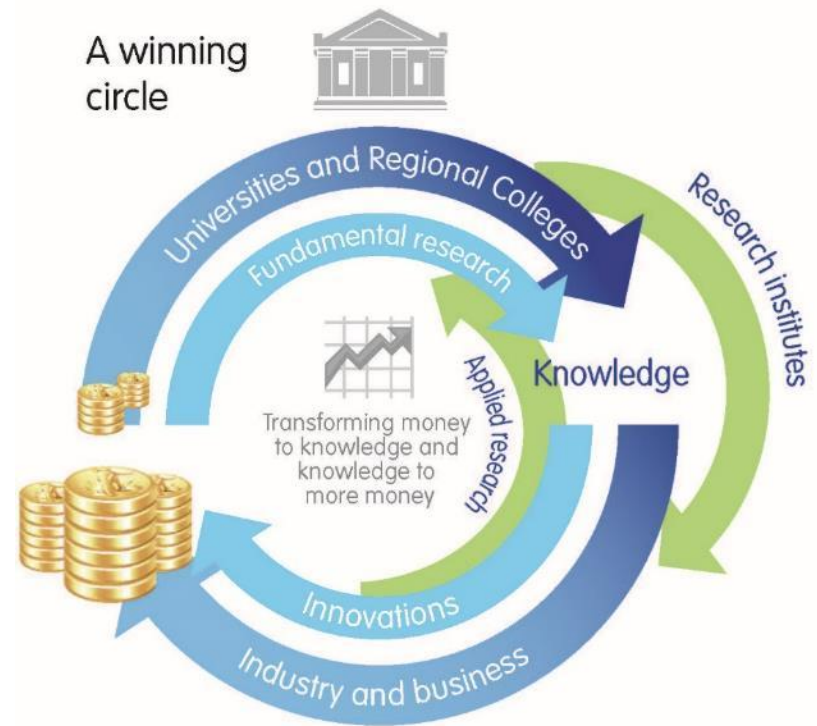# NTNU AMOS creates innovations for…

90%
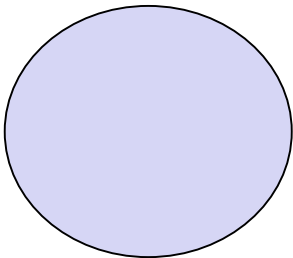
Industry partners and collaborators

2%

Universities and research institutes

4%
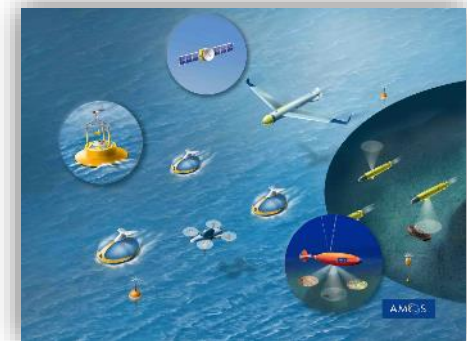
Governmental agencies

4%

New industry – company spinoffs

A winning circle

Universities and Regional Colleges

Fundamental research

Research institutes

Knowledge

Applied research

Transforming money to knowledge and knowledge to more money

Innovations

Industry and business

New method, product or process that are **valuable** and **taken in use**

NTNU AMOS
Centre for Autonomous Marine Operations and Systems

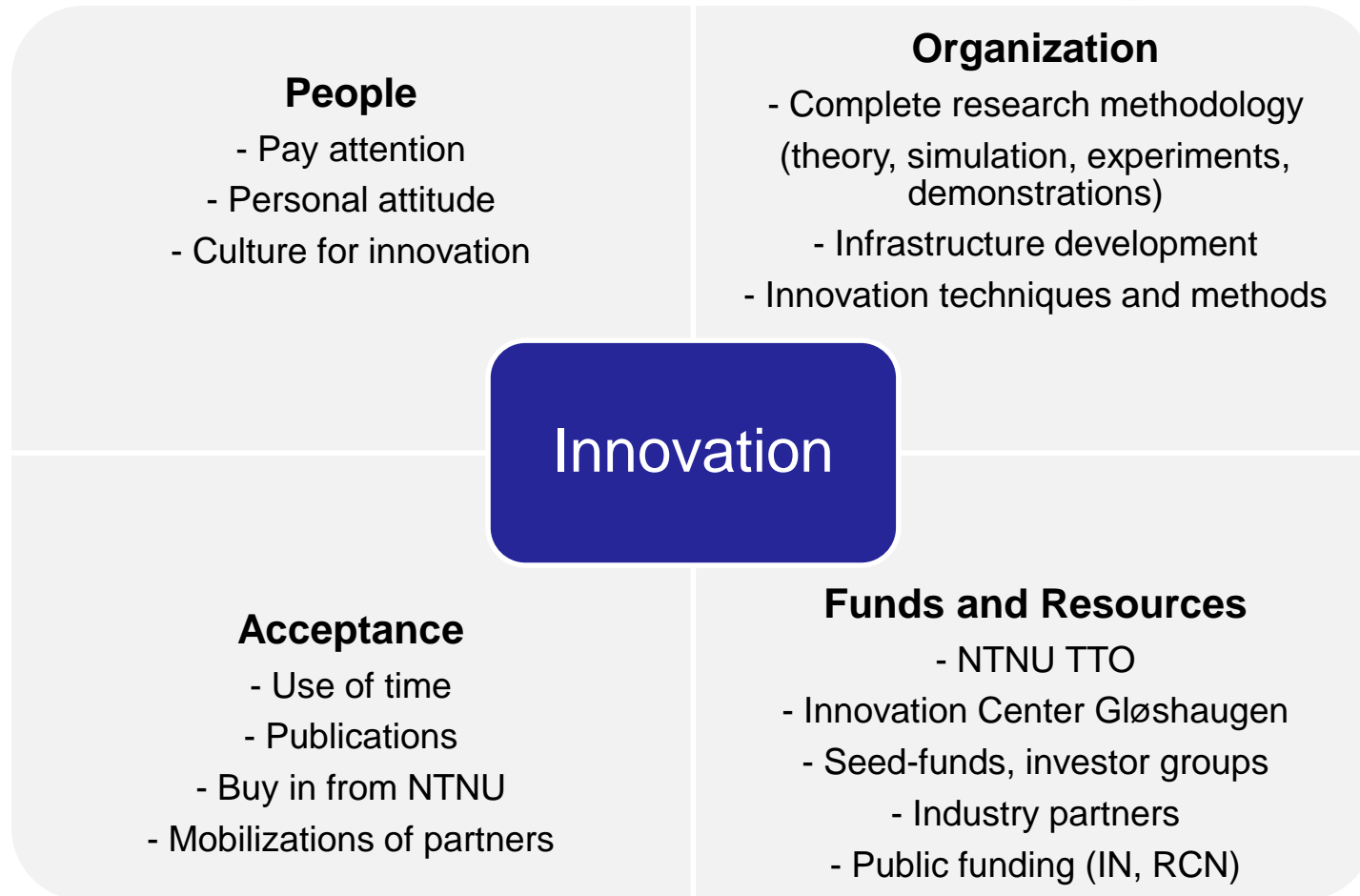# The Norwegian "*Silicon Valley*" is the blue economy…

- Setting agenda for research, education and innovations on important national areas
- Provide top qualified BSc, MSc and PhD candidates for industry and academia
- Publications in internationally leading journals and conferences
- Enabling cooperation between national and international collaborators
- NTNU will accelerate research-based innovations with partners including development of emerging industry

➡ 10x increase in spinoffs

NTNU AMOS
Centre for Autonomous Marine Operations and Systems
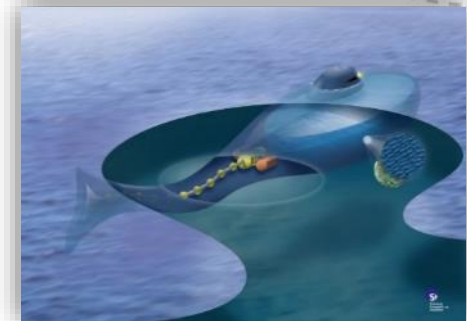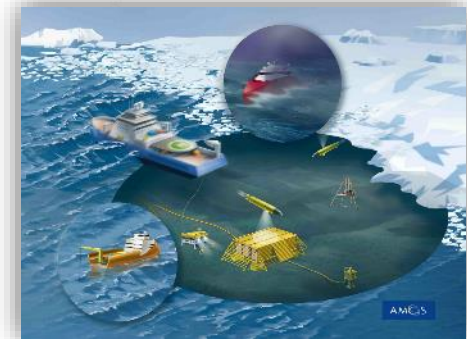
AMOS approach for innovation

People

- Pay attention

- Personal attitude

- Culture for innovation

Organization

- Complete research methodology

(theory, simulation, experiments, demonstrations)

- Infrastructure development

- Innovation techniques and methods

Innovation

Acceptance

- Use of time

- Publications

- Buy in from NTNU

- Mobilizations of partners

Funds and Resources

- NTNU TTO

- Innovation Center Gløshaugen

- Seed-funds, investor groups

- Industry partners

- Public funding (IN, RCN)

AMOS will contribute to improved international competitiveness of Norwegian industries

NTNU AMOS
Centre for Autonomous Marine
Operations and Systems

OCEAN SCHOOL OF INNOVATION

NTNU
Technology Transfer as

STEP 4 Industrialization
- Establish AMOS Fund
- Company spin-offs
- Innovation Centre Gløshaugen

STEP 3 Business Dev.
- Business development
- Meet investors, IN, NRC, etc.
- International cooperation

STEP 2 Creativity
- Clustering
- Company presentations
- Tailored made courses
- Screening of spin-off candidates

STEP 1 Culture
- Introduction, culture building, speed dating
- Seminars & Courses
- Pitching
- Business recognition

AMOS   SMART MARITIME   SAMCoT   MOVE   EXPOSED   NTNU OCEANS

NTNU Research Centre of Excellence Spin-offs (CeSOS, NTNU AMOS)

A complete drone inspection solution for enclosed environments

Scoutdroneinspection.com

CONCEPT

Origin:
NTNU AMOS and
Department of
Enigneering
Cybernetics

Contact:

Susanne Jäschke
susanne.jaschke@ntnu.no

Technology:
Advanced indoor navigation. Drone-based Automated Mapping and Inspection System

Application areas:
Industrial inspection of ballast and oil tanks

Market:
Classification of industrial infrastructure and ships in the maritime and oil & gas industry

Uniqueness:
Autonomous inspection, high-quality data capture and automatic report generation through:
- Indoor collision avoidance,
- Advanced navigation and mapping,
- Software, sensors and AI

Status:
• NTNU spin-off company established 2017
• Industry verification and testing in progress
• Actively seeking investors

NTNU AMOS
Centre for Autonomous Marine Operations and Systems