



WHEN TRUST MATTERS

Responsible use of AI in the petroleum industry

Human Factor in Control 2024

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Introduction



“We have trained operators so they will be able to manage the situation”
“It is not a safety critical system since we have a human-in-the-loop”



However,

the more capable and complex the AI enabled system is, the less people are able to ...

- understand it
- understand its limits
- compensate for its shortcomings

Endsley et.al.

What about AI?

- A lot of hype, but AI will become commonplace
- Typically used where it is difficult to develop rule-based systems
- AI adds complexity, both in development and operation
- Will have an impact on how we interact with industrial systems
- AI adds some new HF challenges, but the fundamentals are the same



2024 Drilling Rigs & Automation July/August

eDrilling kicks off ambitious R&D project leveraging agentic AI to develop a 'drilling agent'

Emerging field within AI targets systems that act independently without human intervention, could help realize fully autonomous drilling

[Drilling contractor magazine](#)

Autonomous Crane Control System

Since late 2017, Aker BP and Optilift has collaborated on developing technology for remotely monitored autonomous offshore crane operations. The development has been performed in stages, maturing the technology readiness level (TRL) where

[Optilift](#)

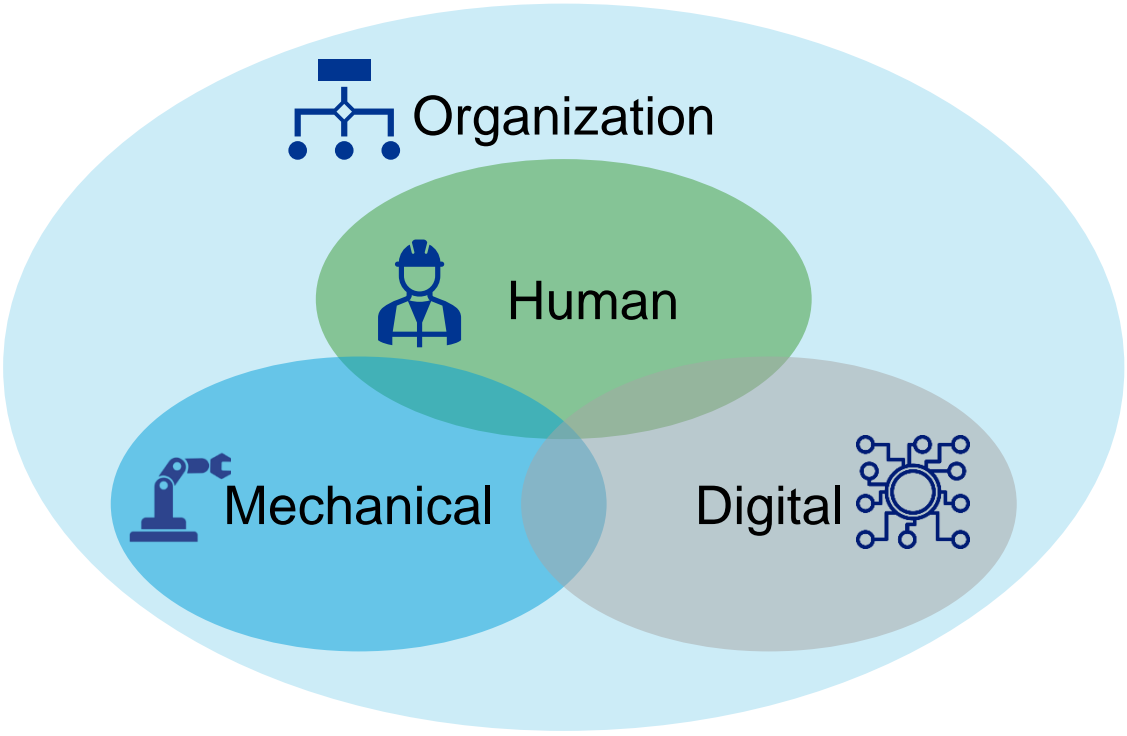
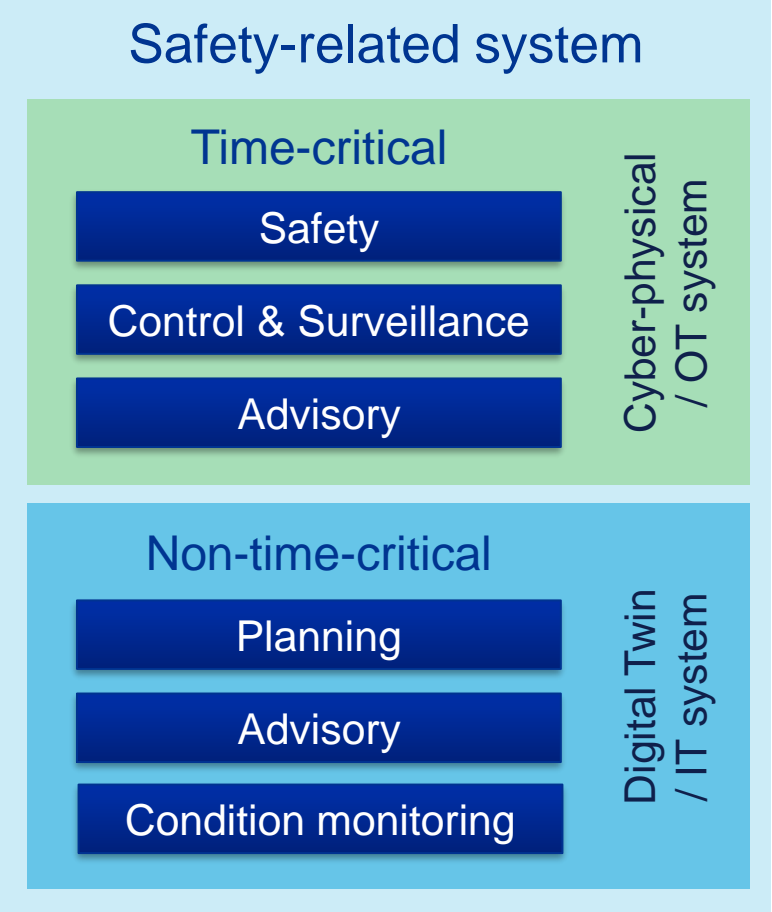


The rise of autonomous shipping

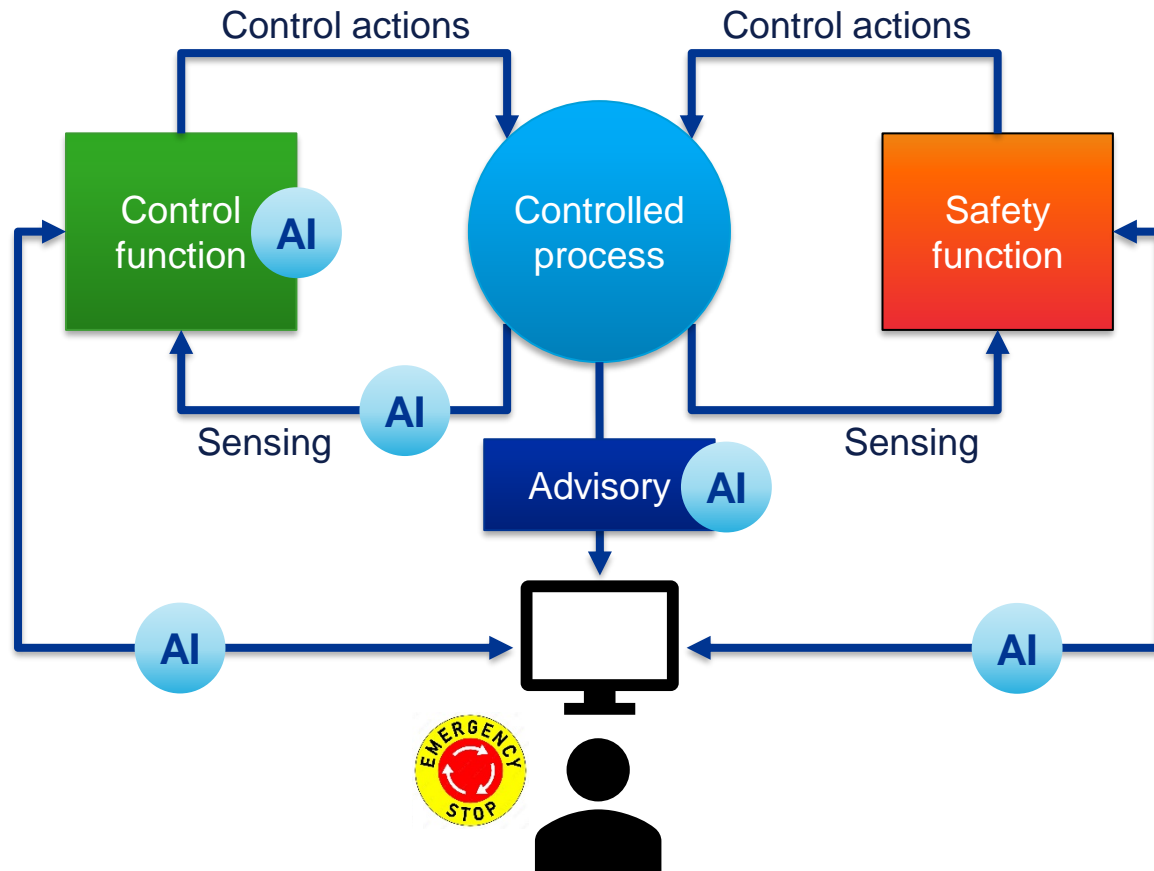
[DNV](#)



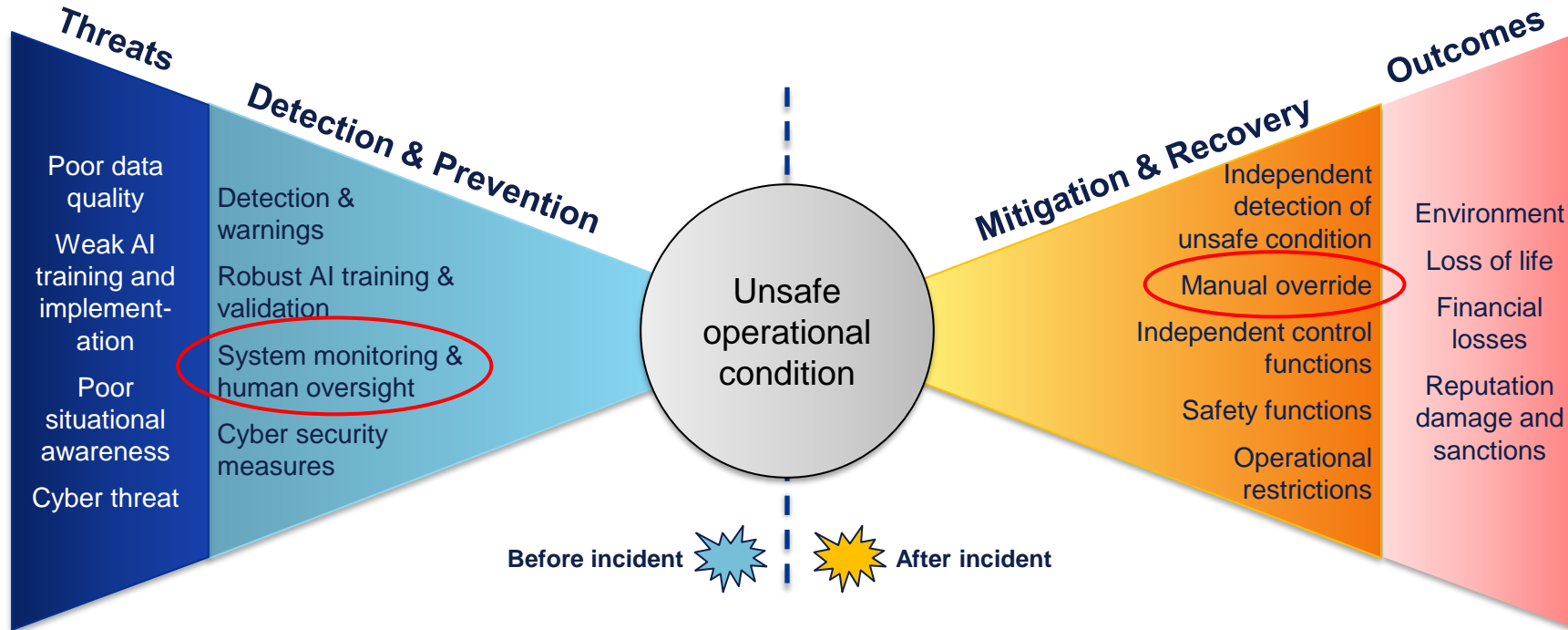
Safety-related systems



AI in time-critical safety related systems



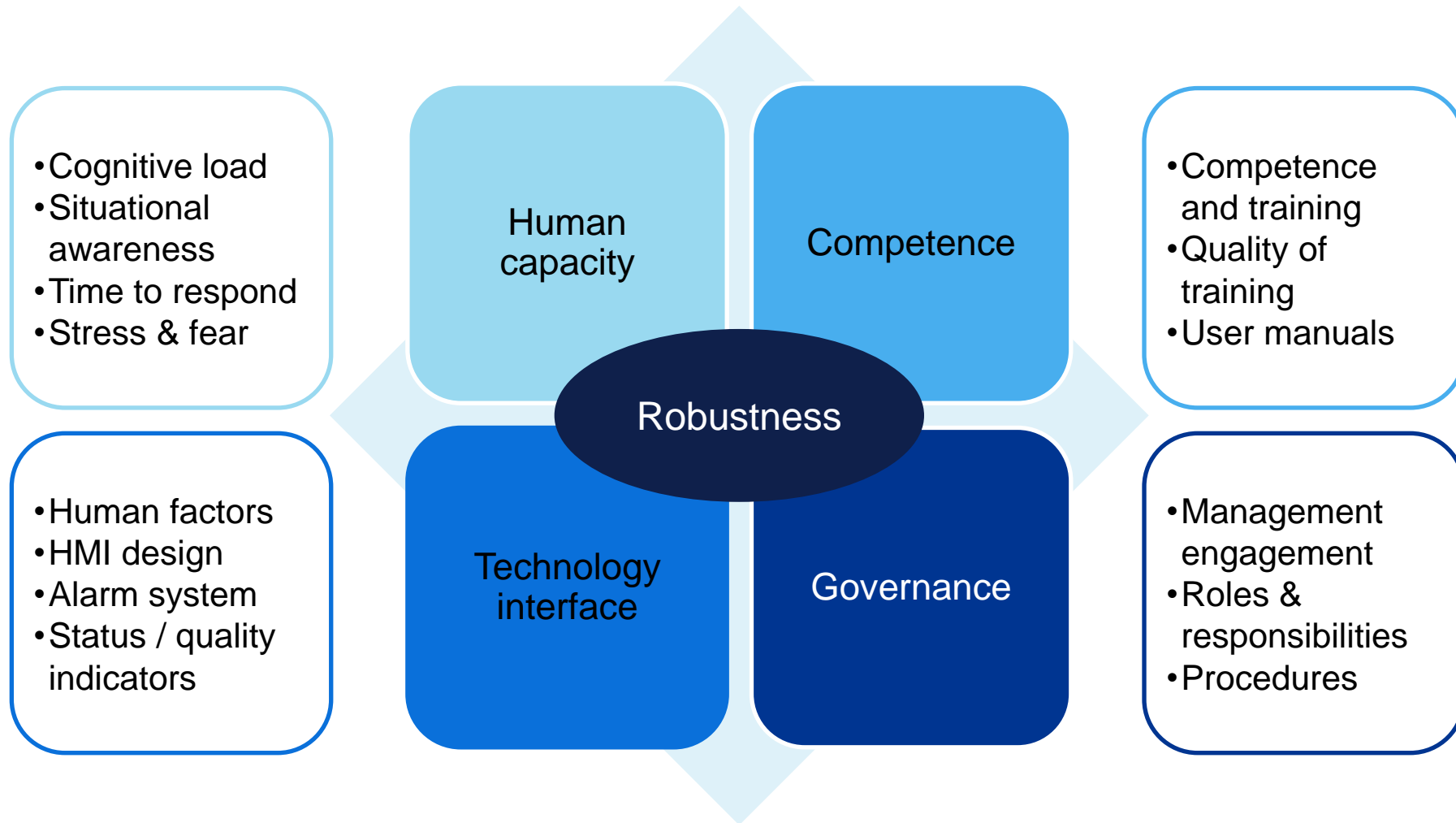
Barriers for safe use of AI



Source: DNV report
“Kunnskapsoversikt over forsvarlig bruk av KI i petroleumssektoren”

- AI can be a potential threat, or a barrier for avoiding or mitigating a threat, or a combination
- Havtil: Operators shall identify barriers that are critical for safety, ensuring that all potential risks, both technical and organizational, are understood and addressed
- EU AI act: High-risk AI systems shall be designed and developed in such a way that they can be effectively overseen by natural persons

Human-centered design

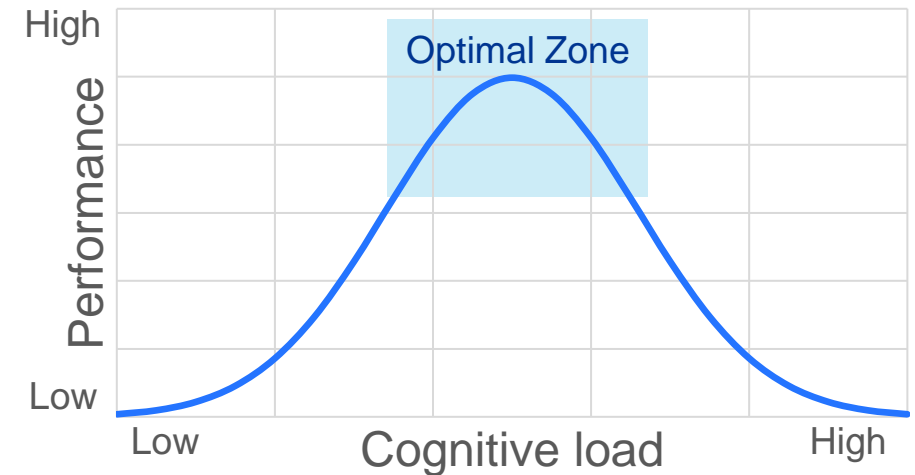


Human capacity



- Human supervision → risk mitigation
- More capable and reliable AI system → Less reliable human supervision
 - The cognitive load cannot be too low or too high
 - AI supervision of the human, supervising the AI
 - Risk: Operator becomes an automated button pusher
- Complex the system → less understanding
 - Less likely to detect system degradation → rely on system to warn
 - Operator dependent on the system for situational awareness
 - Lose situational awareness if the system degrades
- Explainable AI – describes the rationale for the recommended actions
 - Essential for building trust during operation
 - Not very useful in time-critical systems

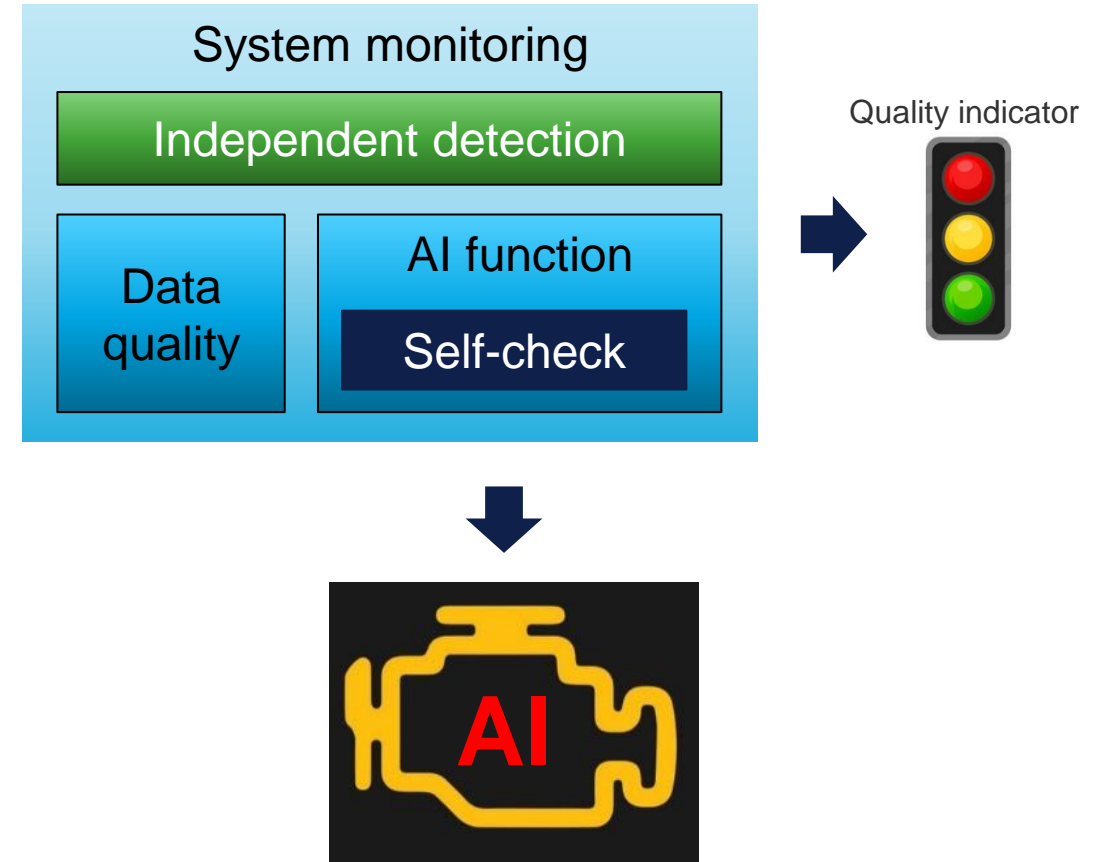
Surveillance capability



Technology interface



- Transparent AI – how the decision-making process functions
 - Useful for qualifying the system
 - Present the AI system's situational awareness
 - Creating mental models for the operator training
- How can the operator understand if the digital system is degraded?
 - With remote operations, can the operator independently verify the AI's situational awareness?
 - Need self-monitoring / diagnosing function to warn the operator
 - Critical system may require an independent monitoring solution
- Consider the time-criticality of the operation and the decision process
 - Traditional HF design guideline for HMI still relevant
 - Needs to be expanded with digital system status
- System must communicate uncertainty to be trustworthy
 - Manage data and model quality

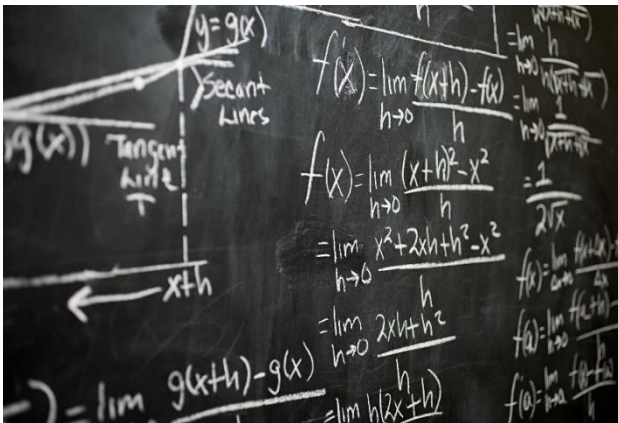


Building trustworthy AI

Bringing all knowledge into AI – not just data



Science-guided AI



- Combine physical-models with data-driven models (“hybrid-models”)
- Include physical constraints into AI
- Use synthetic data for safety-critical scenarios with little data

Uncertainty-aware AI



- AI that knows when it is uncertain
- Avoid confident mistakes
- Tells you when you cannot trust it

Causal AI

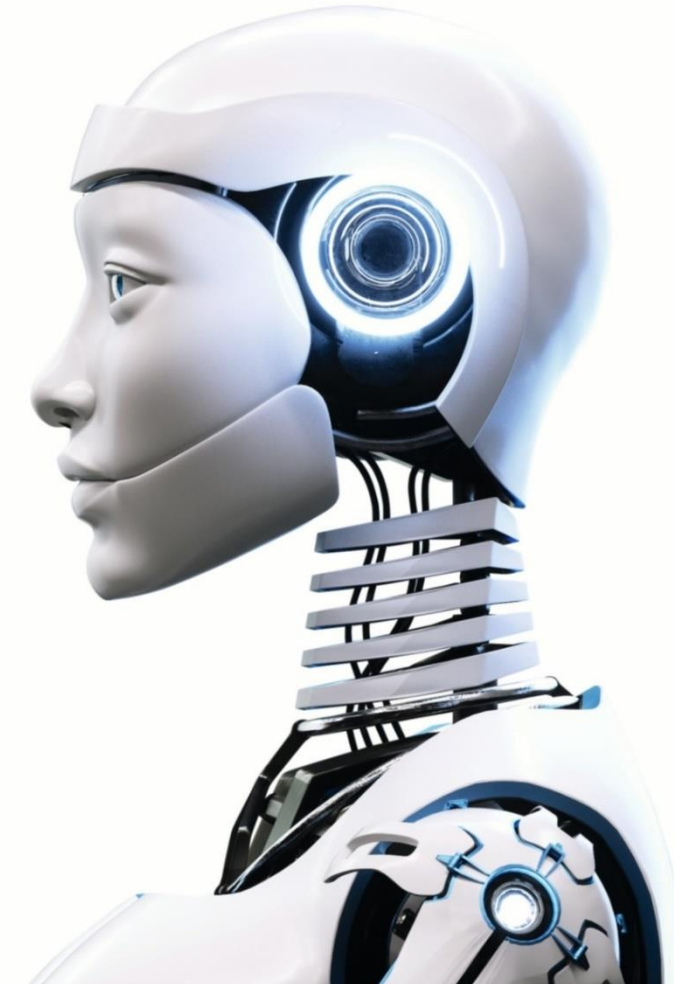


- Understands cause-and-effect
- Distinguishing correlations and causation
- Distinguishing observation from intervention

Summary



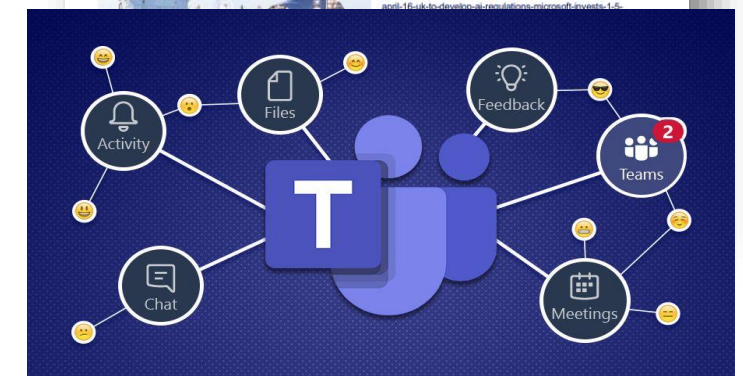
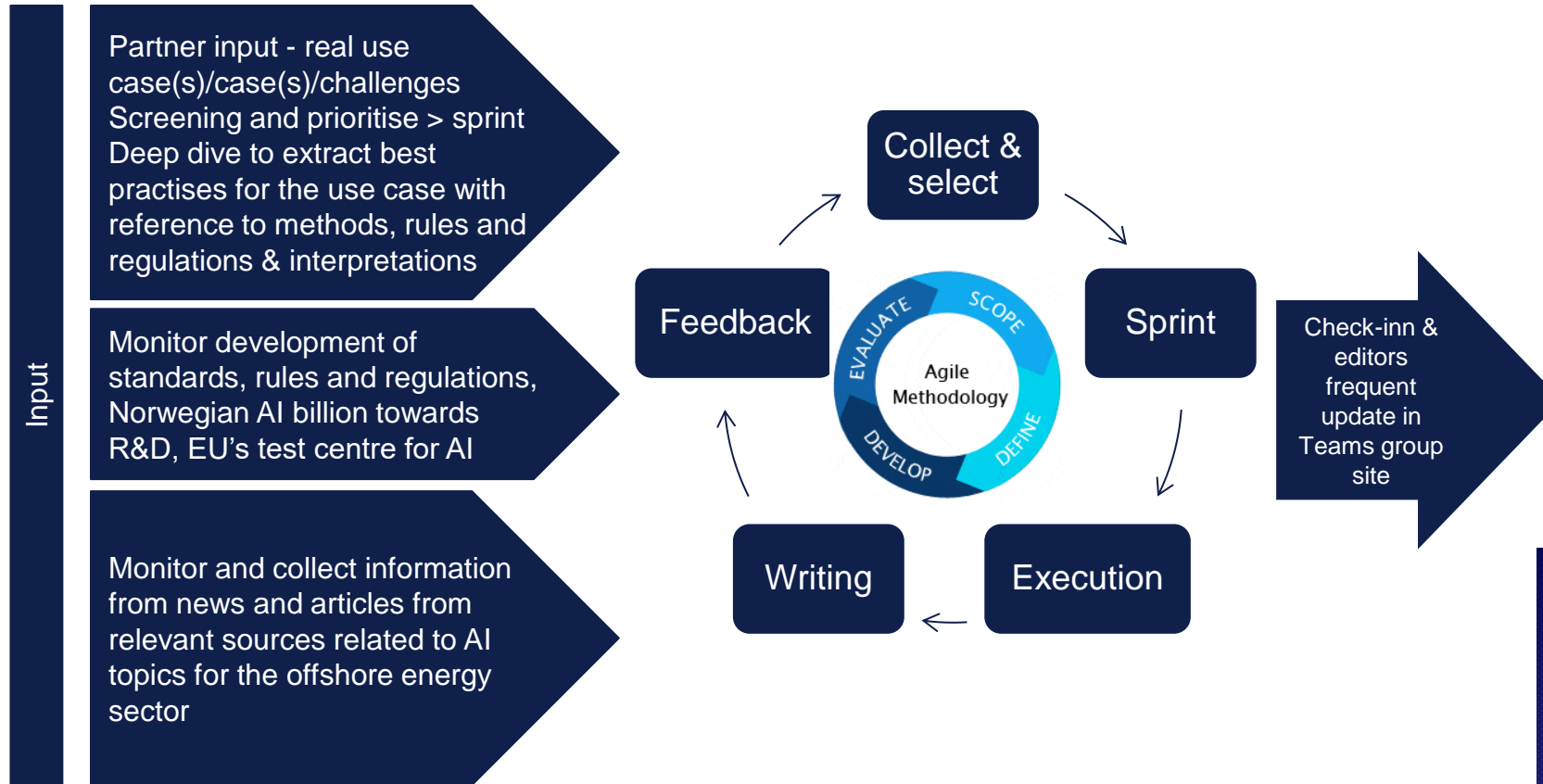
- Traditional HF techniques still very relevant but AI brings new challenges
- More capable and complex the system becomes
→ less ability to understand and supervise it
- Maintain situational awareness of operation / activity and the system
 - Self-diagnostic capabilities
 - Operators' situational awareness independent from AI system
 - Communicate uncertainties
- Transparency and explainability of the AI system is key for situational awareness, and to enable safe human supervision
 - Limited HF research on AI in time-critical systems



AIICE – A dynamic JIP



Artificial Intelligence Industrial Collaborating Environment



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Thank you for your attention

Questions?

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