SIRIUS Center for Scalable Data Access in the Oil and Gas Domain

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Digitalization as transition strategy formulation

Structural tensions in the oil and gas industry

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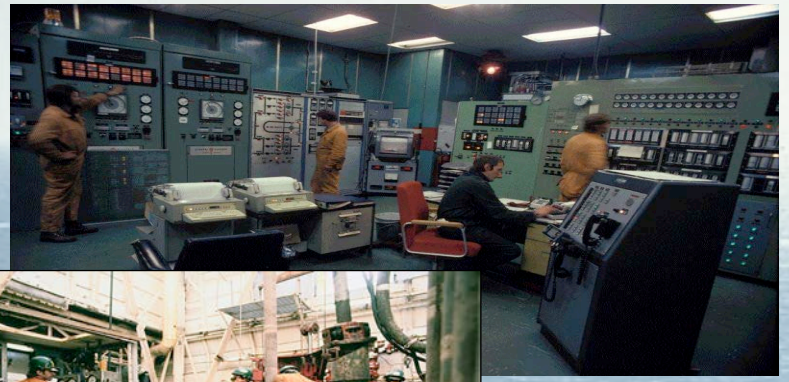
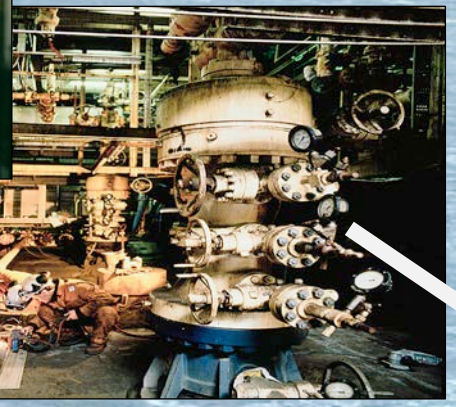
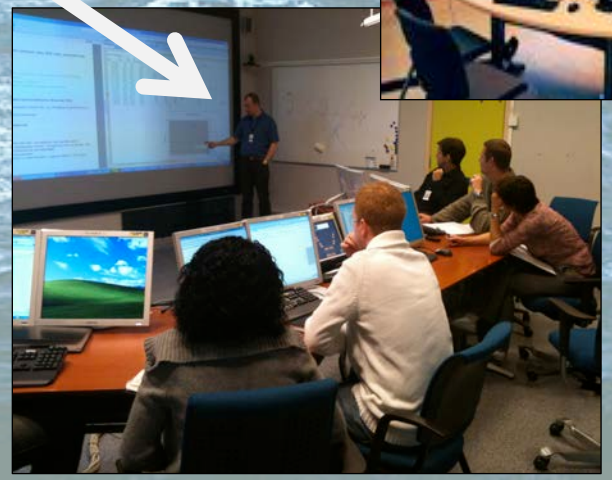
November 12, 2019







Digitalization and transition strategies

Background: Sustained engagement with digitalization of offshore oil and gas industry

- Historically: Development, implementation, and adoption of IIoT visualizations and simulations
- Recently: Digitalization of design and construction

Key observations: Digitalization actualizes and bring structural tensions to the foreground

- One-sided focus on technological possibilities
- Limited if any conceptions of transition strategies

BUT: Digital twins show something new

What do we mean by digitalization?

Digitizing vs. digitalization

- Digitizing – rendering the analog digital
- Digitalization – application of digitizing techniques

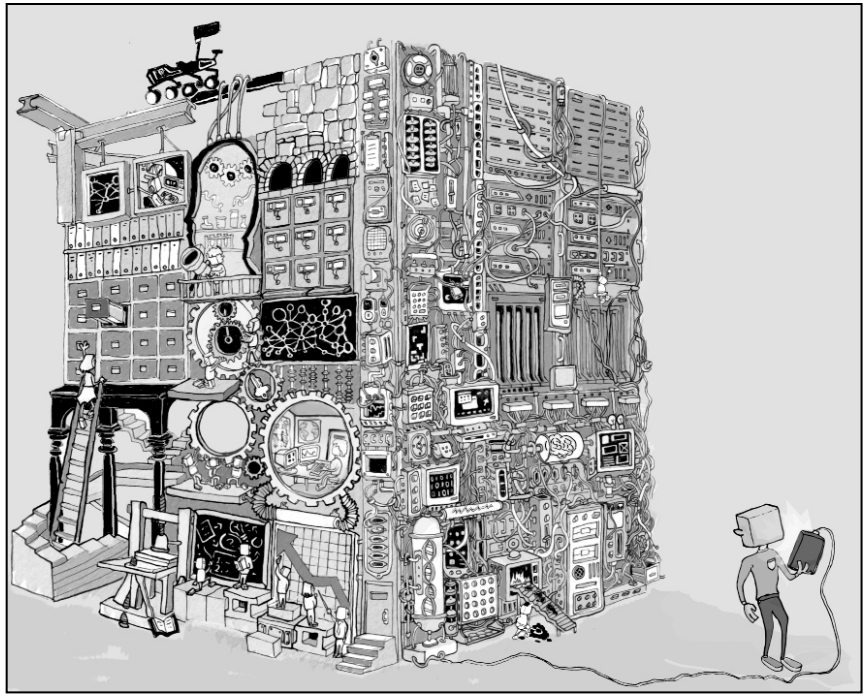
From computerization to digitalization

- Computerization – support or automation of more or less clearly delineated tasks or activities
- From stand-alone applications to portfolios or systems of systems

Beyond the rhetoric of disruption

- Unleashing generativity, or digitizing the cow paths?

Towards more network-oriented organizing



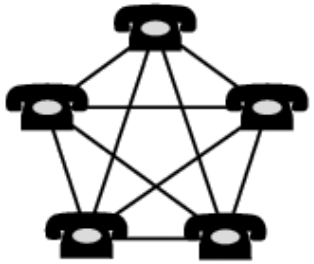
*Digitalization: the sociotechnical process of applying digitizing techniques to broader social and institutional contexts that render digital technologies infrastructural**

*Tilson et al. (2010). "Digital infrastructures: The missing IS research agenda", Information Systems Research,

Digitalization in an infrastructure perspective

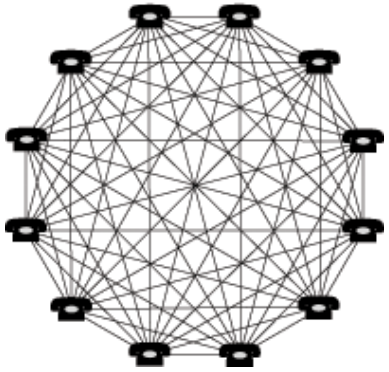
Information infrastructure theory

- Loosely couple conglomerate of theoretical constructs
- Theorize emergence, growth, and change of large-scale networks of digital technologies
- Socio-technical – social and technical arrangements mutually constitutive



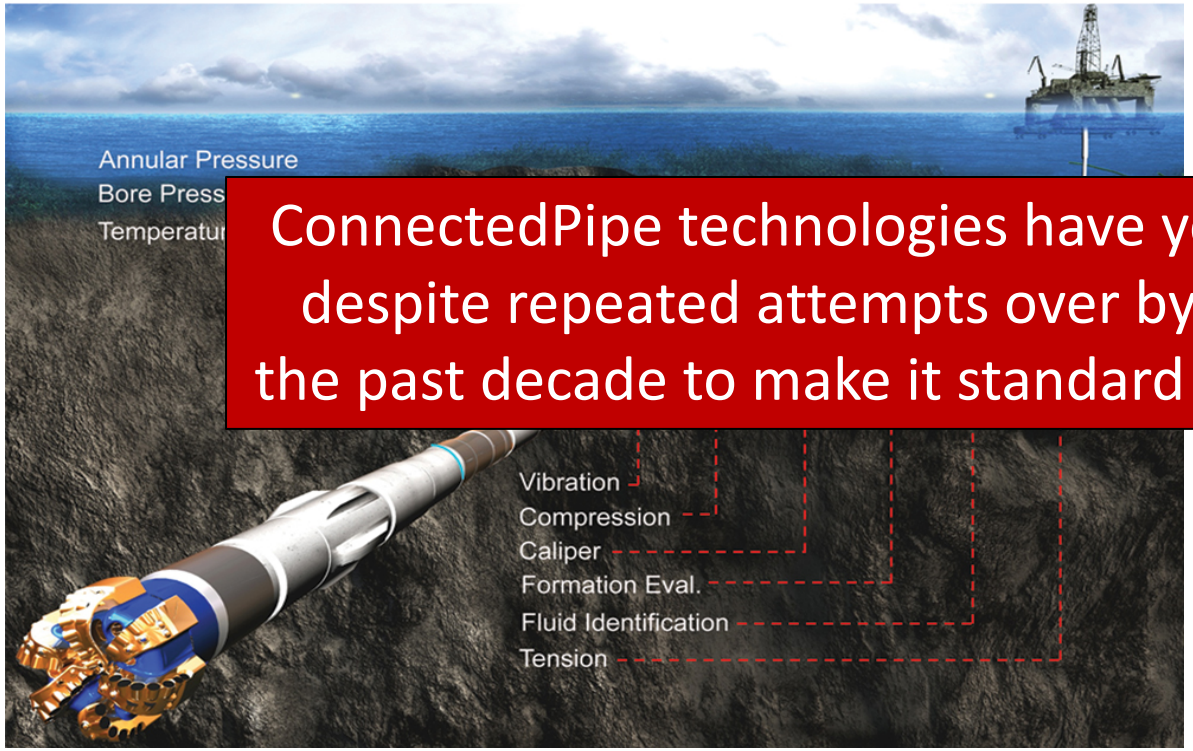
Evolutionary change

- No starting from scratch
- Change negotiated against existing economic, organizational, and technical arrangements – installed base
- Follows tipping-point logic



=> Emphasis on transition strategies over disruption

Illustration #1: ConnectedPipe



ConnectedPipe technologies have yet to scale beyond isolated trials despite repeated attempts over by several leading operators over the past decade to make it standard part of the drilling infrastructure

Improved downhole communications

- Increased capacity: from 6-8 bps with mud pulse to 56 000 bps!
- Distributed sensors

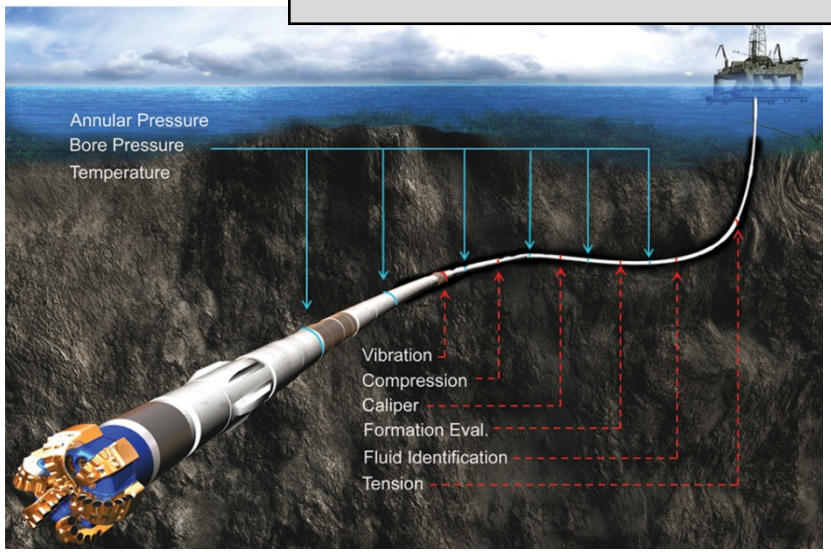
Data platform for drilling

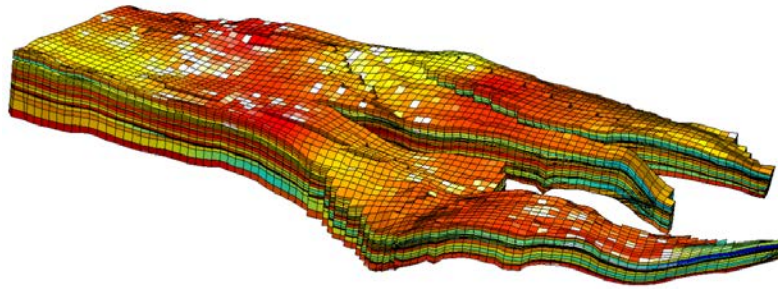
- Multi-sided market connecting sensors and data-driven applications
- Facilitate emergence of network of specialist companies offering data-based services to drilling

"You have to be stupid not to understand the significance of this technology for the longevity of the whole industry." (industry consultant)

Internal explanations

"There are need to have technologies, and then there are nice to have technologies. ConnectedPipe is a nice to have technology." (Lead geologist, Operator X)





"There is a two meters thick wall between drillers and geologists in Operator Y." (Drilling contractor)

ConnectedPipe and structural tensions

Industry structure: Well drilling project-based

- Equipment and expertise distributed throughout ecosystem of service companies
- Circulation of equipment and expertise between operations
- Drilling operations integrate expertise and equipment

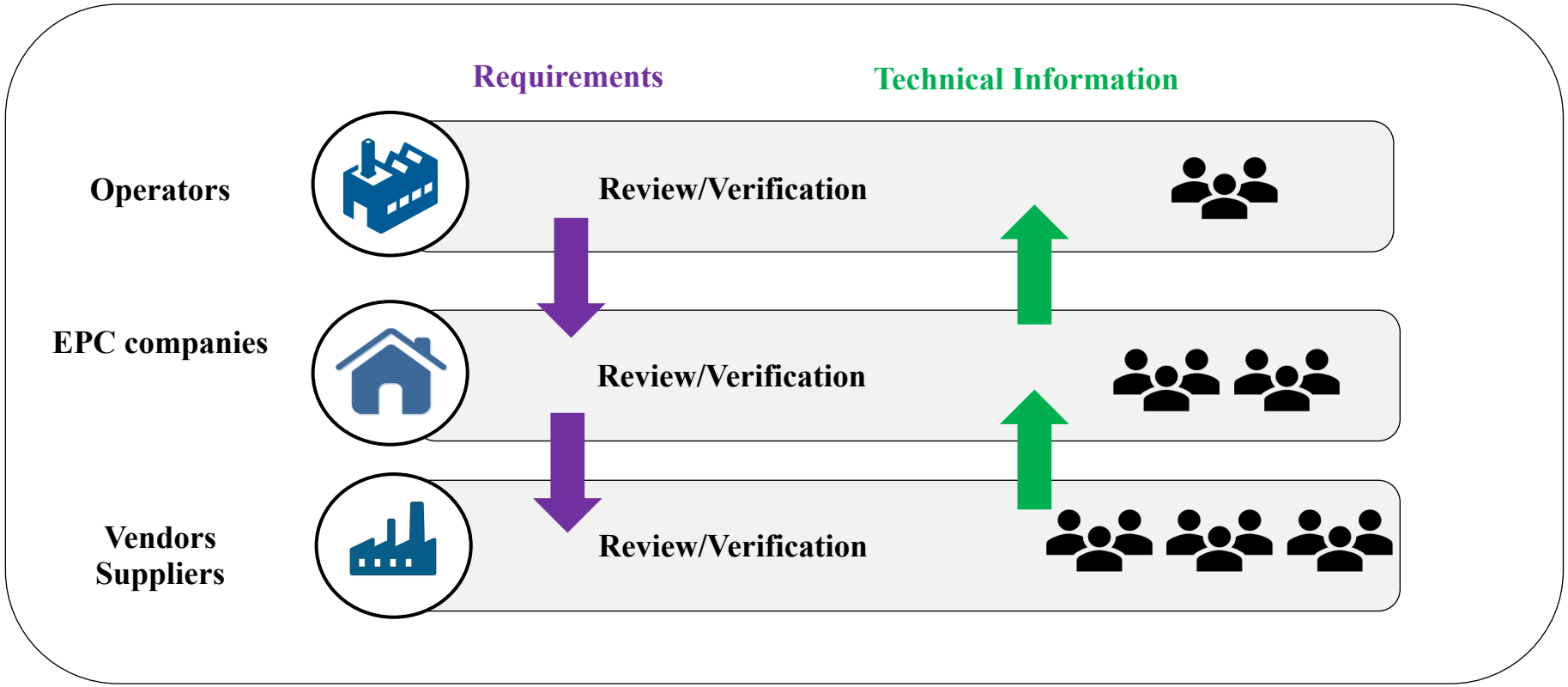
Tension #1: Mobilization

- "We threatened to exclude Downhole Company from future bids." (operator representative)
- Bid-for tender
- Need for upselling (e.g. wire-logging)

Tension #2: Retention

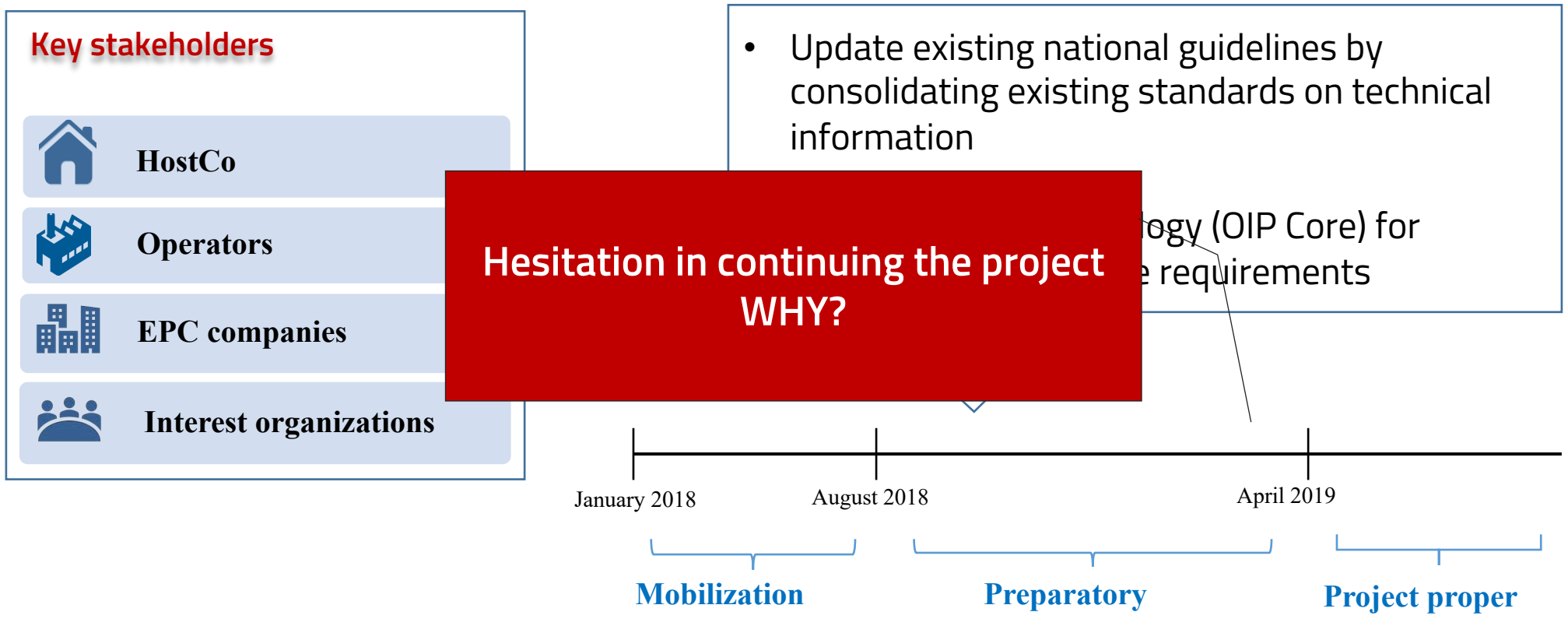
- "Rig companies want full crew mobility and thereby full equipment standardization" (Industry consultant)
- How to retain rarely used equipment and expertise?

Illustration #2: Digital delivery of EPC projects



How does digital innovation unfold within the confines of existing industrial, organizational, and technological structures?

The case: Open Industry Platform (OIP)*



* Study conducted together with Mina Haghshenas

Structural tensions in OIP

	Digital infrastructure innovation	**Innovation in digital infrastructure**
Description **Dimension**	*Innovating infrastructure for digital EPC project delivery through OIP*	*OIP as an innovative part of existing technical and organizational arrangements for digital EPC project delivery*
Focus	Technology-driven	Oriented towards extending installed base
Trajectory	Start afresh with new technology	Build on existing digitalization initiatives
Outcome	OIP as digital platform outside of installed base	OIP integrated as system for digital exchange of technical information within installed base

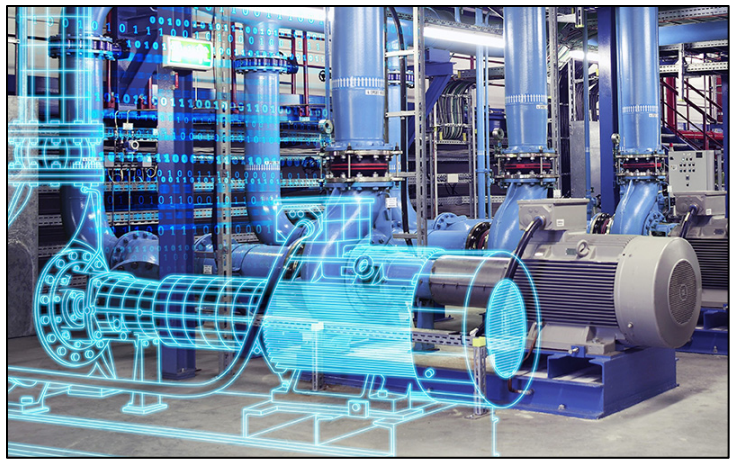
Illustration #3: Digital Twins

Digital twin: Virtual asset replica

- Extends assets' IIoT capabilities
- Real-time data asset monitoring
- Simulation (e.g. predictive maintenance)

Digital twins as servitization strategy by suppliers

- From delivering equipment to selling equipment as a service
- Lockin of maintenance



Digitalization as transition strategy formulation

- Gradual, localized transitions through strategically bounded, parallel initiatives throughout service ecosystem (i.e. no central coordinating authority)
- Transition strategies balances two concerns
  - Fortifying – secure existing core activities, strengthen peripheral activities
  - Ecosystem reconfiguration – opening up for third-party access

Transition strategy – A plan outlining 1) **how big** changes can or have to be made in evolving the infrastructure, 2) **where** to make changes, and 3) **when** and in **what sequence** to deploy the changes.