



**Digital for Nuclear:
Accelerating transformation**

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NEA, May 2021

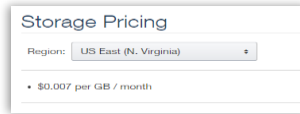
Digital transformation is rethinking the value chain by leveraging the digital toolbox

Sensing



Accelerometer
\$0.60

Storing



1 GB
< \$0.01 / month

Processing & connecting



160 MIPS, Wifi & BLE
\$1.00

AI datascience



Defects recognition
Documents analysis

Cloud & software components



1000 recognitions = 1 \$
One click roll out

How can we create value with digital ?

Opportunities Exploration

Exploring potential performance improvement opportunities to identify where improvements are possible:

- top-down (redesigning key processes, for example: designing, building, installing key components) : big but complex/slow
- bottom-up (starting from operator/plant level issues, for example: paperless inspection reports) : easier/faster but smaller



Digital Lean

Reengineering processes to save time or resources, leveraging lean and operation excellence methods in new ways made possible by digital tools

Fast application delivery

Quickly developing months secure applications solving internal or customer problems, integrated in mission critical environments

Data Science

Extracting value from data & identifying actionable performance levers in this data (industrial / projects / support, etc.)

What is different in this industry ?

Feature	What is new ?	Nuclear Challenge
Data access	Data lakes making data access & correlation easier Extended enterprise made easy with standard ERPs	Limited connectivity & strong barriers to data exchange → The industry was historically the first to leverage computer simulation, but is lagging for supply chain digitalization
Computation power & standard software components access	Cloud solutions Standard components for many standard uses (text or image recognition, fraud detection, etc.)	Sovereign concerns limiting use of public solutions Standard solutions only cover some use cases (e.g.: document search), others are very specifics
Collaborative development	Cross country & industry collaborative methods & tools to develop new solutions	Confidentiality & security limits (some of them rational – see cyber attacks via open-source collaborations)
Organizational complexity	Agile methods & decentralizing decision at the shop floor level (Toyota methods)	Security limits decentralization Complex norms limit operators' ability to change

As a conclusion : some potential solutions

- Digital transformation is never simple, and even less in the nuclear industry
- Some actions could help accelerating the digital transformation in nuclear such as:

Roadblock	Potential solution	NON-EXHAUSTIVE - FOR DISCUSSION
Lower collaboration culture due to strong sovereignty / competition constraints	Collaboration initiative on topics that do not raise such issues such as standards for data exchange, asset representation models, common safety frameworks, internal change management methods, etc. → Possible next step : industry workout to identify common topics members are ready to share	
Top-down compliance regulation	Dialog initiative between regulators & industry on specific topics: <ul style="list-style-type: none"> - digital regulatory training - digital solution making both regulation & compliance simples → Possible next step : dedicated working group	

Lots of cost reduction opportunities!

Let's keep in touch:



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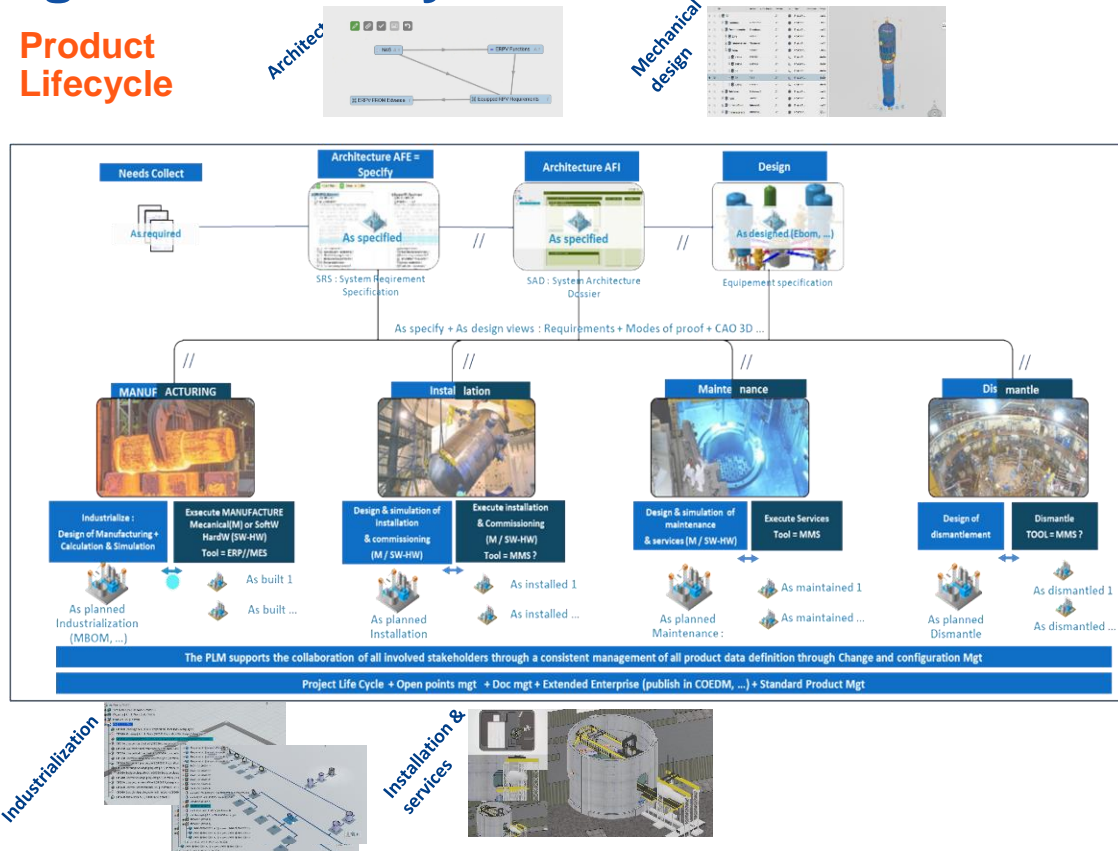
Backups

Safety example 1 : Managing the full lifecycle

Key benefits

- **Saves time by using standard tools** from design of architecture (functions, systems, interfaces, needs, requirements, modes of proof for every requirement), **design of mechanical or Safety I&C**, **design of manufacturing** (industrialization), **design of installation**, commissioning and service to execution of manufacturing, construction & services
- **Facilitates concurrent engineering** to give the ability to develop all facets of the product in parallel but in coherence with all actors : architect, designer, method, operators of manufacturing, of construction or of services.
- **Facilitates requirement traceability & conformity check** for customers & authorities. This Conformity proofs coming from design calculation, from execution tests for every instance manufactured, installed ...
- **Facilitates changes control** & configurations of every products data
- **Support standard product management (ie, increased security & reduces costs)** giving the ability to projects to reuse standard product bricks (bricks of architecture, brick of design, bricks of manufacturing element of a steam generator)
- **Facilitates connection with extended enterprise** (supplier and customers), allows moving from a document contract to data contracts
- **Facilitates Know how & intellectual property protection**

Product Lifecycle



Safety example 2: Training

Context




Operators need to be trained to sort fuel pellet to ensure pellets quality and eliminate defective pellets. It takes time for them to learn how to do this, and it was typically done using “one the job” training, which exposed operators to radiation doses, and needed lots of human supervision

Solution

A simulator generates 3D photo-realistic pellets pictures and reproduce a typical operator’s work environments, as well as all the possible defects cases – even the rarest ones.



Benefits

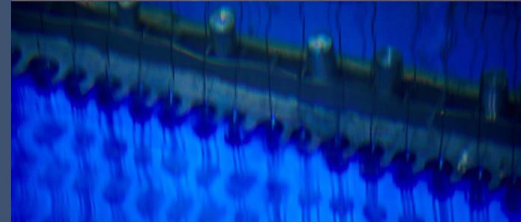
-  Trainees security and plant security (no more trainees)
-  Time saving & simpler training
-  More exhaustive & efficient training

May 27th, 2021

Bruce Power Digital Transformation

NEA Digital Transformation Workshop

Presented by: Jennifer Edey, VP Site Services Bruce Power



About Bruce Power

- Largest operating nuclear facility in the world with a capacity of 6,430 MW
- Equivalent to the annual energy use of more than 5 million homes
- key source of life-saving isotopes
 - **LSA Cobalt-60** – sterilization of medical equipment,
 - **HSA Cobalt-60** – radiation-based treatment of cancer; non-invasive Gamma Knife treatment
 - Coming soon – delivery system for Lu-177 for treatment of Prostate Cancer



Bruce A – 4 CANDU Reactors



Bruce A

- 1969 – construction
- 1977 / 1979 – start up
- 1995 / 1998 – units taken off-line
- 2003 / 2004 – Unit 3 & 4 restart
- 2012 – Units 1 & 2 restart

Bruce B – 4 CANDU Reactors

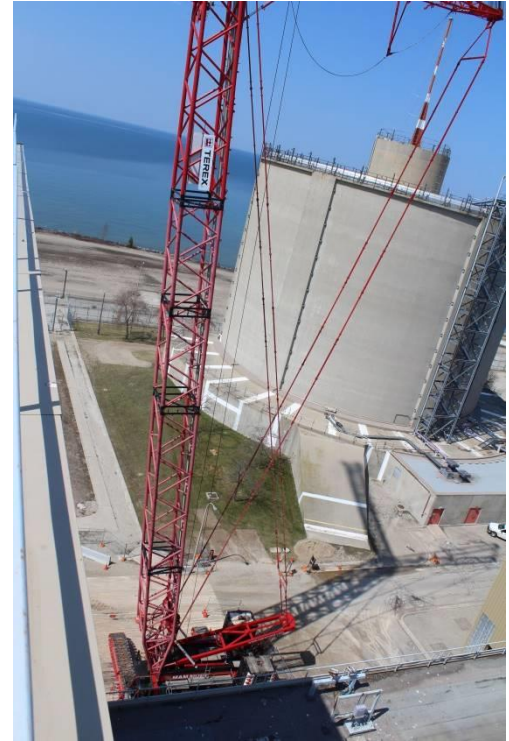


Bruce B

- 1976 – construction
- 1984 / 1987 – start up

Bruce Power's Life-Extension Program

- Long term contract with Provincial Government until 2064
- In 2020 we commenced construction on 12 year \$13 billion Life-Extension program
 - one of Canada's largest infrastructure projects
 - Refurbishment of 6 units
- Our Life-Extension Program will help ensure this important source of emissions-free, low-cost electricity will meet the Province's electricity needs for decades to come



Digital Transformation Journey

- Data as an Enterprise Asset
- Data Governance
- Digital Twin Strategy
 - Digital Engineering
 - Smart Procedures, Mobile Worker, Smart Apps
 - Continuous Online Monitoring

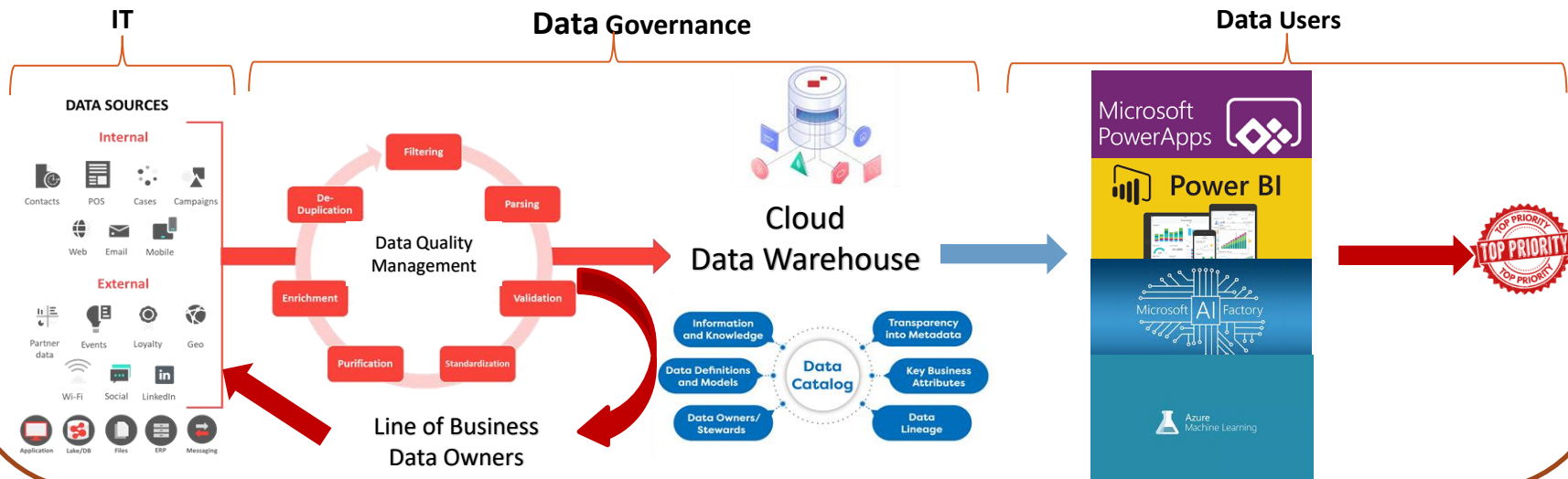
Data As An Enterprise Asset

- Nuclear generators are rich in Data and Information
 - Collect and store records for life of asset
 - Multitudes of databases
 - reliability of data questionable over time
 - Hours of time wasted in searching
- Imperfect and untimely business decisions which could impact safety, cost and performance excellence



With Strong Data Governance, Data in warehouse is:

- **Secure:** access rights are managed
- **Accessible and shared:** added to Data Catalog, offering an overview of all data available
- **Governed:** Accountability for the data is assigned, users have a single point of contact for usage questions
- **Defined:** it is clearly described
- **Trustworthy:** quality of the data is measured and maintained to a certain standard



Digital Twin

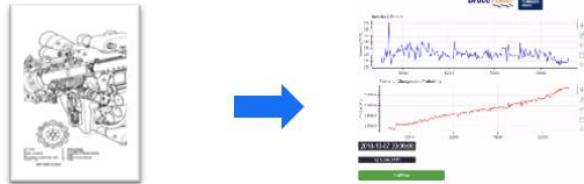
1. DIGITAL ENGINEERING (BIM) – BASELINE DIGITAL PLANT



2. SMART PROCEDURES – DIGITIZED PROCESSES, MOBILE WORKER



3. CONTINUOUS ONLINE MONITORING – WHAT IS THE PLANT TELLING US



These large transformative digital efforts combined have high cost and duration but have massive payback in the long run:

- headcount reduction
- Design, Construction and Operational cost reduction
- soft cost savings through increased Equipment Reliability productivity and safety



Multi-D Platform
POCATOM • ACЭ

**Changing nuclear organizations and
supply chains with the digital
transformation**

ASE EXPERIENCE

Olga Tolstunova

CDO, Vice President

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ASE – Rosatom Engineering Division



Multi-D Platform

POCATOM • AC3

Key business areas



Design of high-power NPPs



Construction of high-power NPPs on terms of EPC, EPC(M)



Management of complex engineering facilities



Global leader in nuclear power engineering, holding **about 30%** of the global NPP construction market.

Operates in Europe, Middle East, North Africa and the Pacific region – foreign projects account for **about 80%** of the portfolio.

1951
foundation date

~ 24.000
employees

14 countries
with our NPPs



Digital Transformation
is always about changes.

Where there is a **change**, there is
always **resistance**.



3 PREREQUISITES FOR CHANGE



- 1 CHANGE OR... GOODBYE**
- 2 BECAUSE BIG BOSS SAID SO**
- 3 I SEE BENEFITS IN IT**



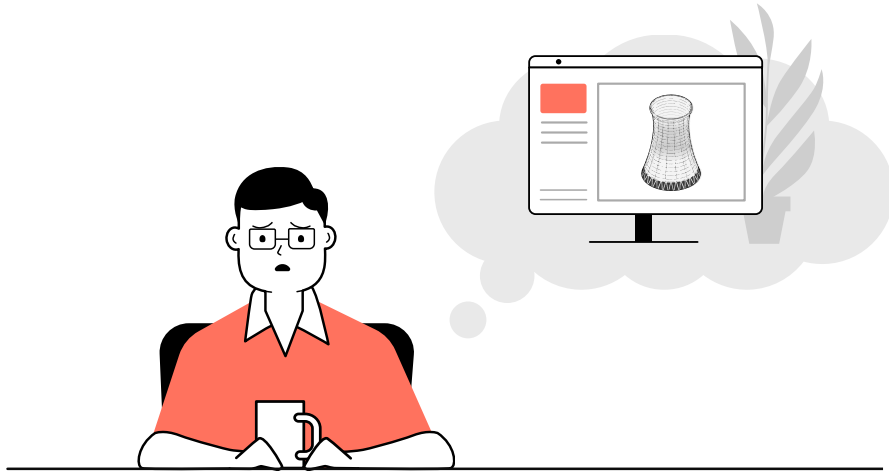
1

CASE STUDY: CHANGE OR...GOODBYE

Virtual Workplaces for Designers (VDI) our respond to 2020

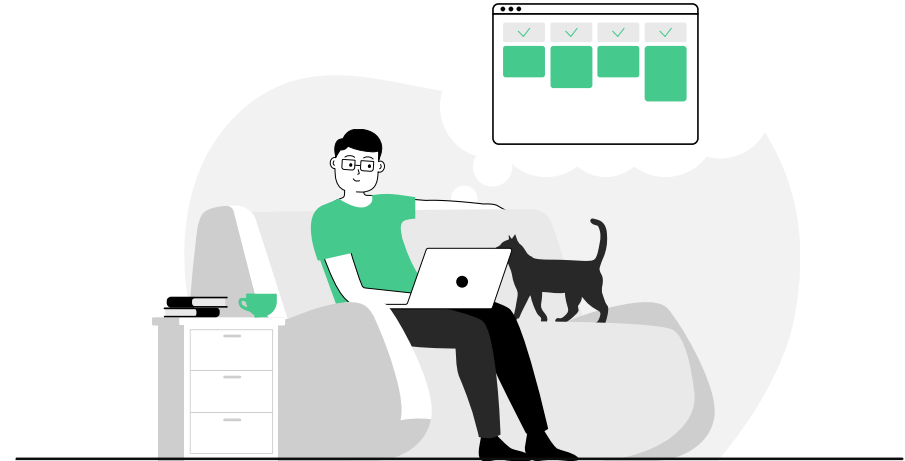


Multi-D Platform
POCATOM • AC3



**~ 5000
employees**

**1.5 months for
deployment**



Additional pluses:



Fast and flexible provisioning of computing power for engineering



Employee mobility - access from "any" device, 24/7, including from abroad



SAINT PETERSBURG



NIZHNY NOVGOROD



Data security and safety



Lower cost of ownership



MOSCOW



12 BRANCHES WORLDWIDE

2

CASE STUDY: BECAUSE BIG BOSS SAID SO

Geotags for workers



Problem:

To monitor workers at the construction site, safety and work progress

Solution:

Hard hats with geotags for monitoring workers at the construction site

Our thoughts:

Each worker wear hard hats, perfectly safe and controlled

Reality

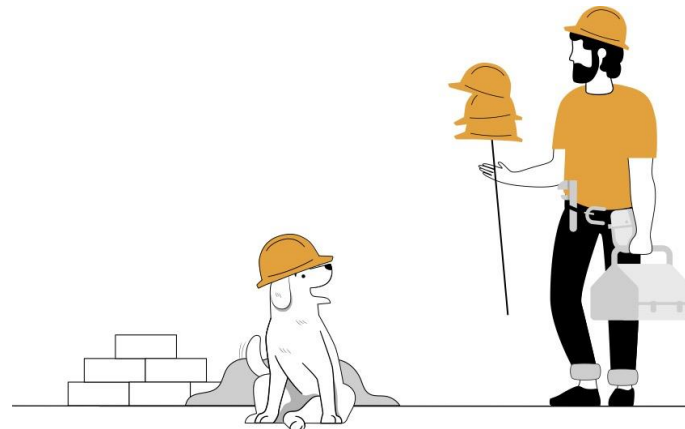
Hard hats were

Stacked and put on one person

+ Hard hats moved with sticks

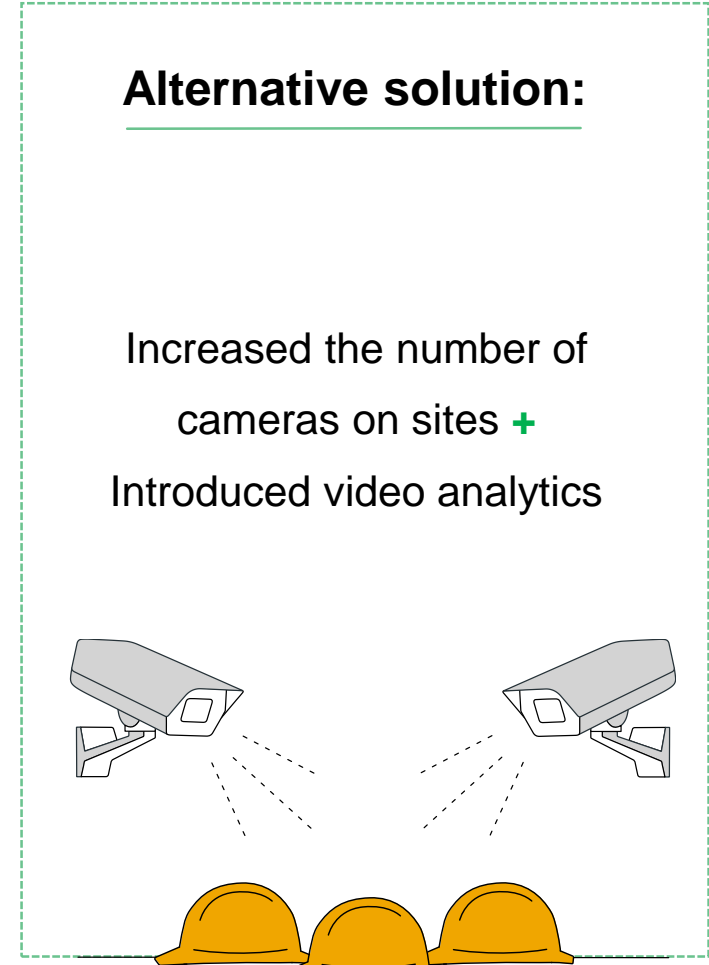
Hard hats were put on dogs

=



Alternative solution:

Increased the number of cameras on sites + Introduced video analytics



CASE STUDY: I SEE BENEFITS IN IT

Schedules control app in construction management



Challenges of project manager:

- * Planning and control of work execution is carried out in separate systems, by different project participants
- * Over 1 000 000 works influencing each other
- * Manual comparison of all schedules from all the participants



Project manager with Multi-D Unified Time Schedule app gets

- Unified project schedule based on data from detailed schedules of individual functions
- Ability to analyze collisions in work schedules (both causes and consequences) and make timely management decisions on corrective actions

Labor savings from using UTS are **5,148 man-days per year** with weekly updates and **24,453 man-days per year** with daily updates, which is **91.7%** respectively

MAIN AIMS & CHALLENGES OF DT



Multi-D Platform
POCATOM • AC3



Cost reduction



Increase profit from the major product



Change the business model and create a new product



ASE. Think digital, be digital

Thank you!

Olga Tolstunova


CDO, Vice President

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CHANGING NUCLEAR ORGANIZATIONS AND SUPPLY CHAINS WITH THE DIGITAL TRANSFORMATION

مؤسسة الإمارات للطاقة النووية
Emirates Nuclear Energy Corporation 

شركة براكة الأولى ش.م.خ
Barakah One Company PJSC  شركة نواة للطاقة
Nawah Energy Company 

DIGITAL TRANSFORMATION

DEFINITION AND FOCUS

The process of exploiting the latest digital technologies and practices to improve organizational processes, to improve interactions between people, organizations and things, or to create a robust new digital business model.

STRATEGIC PRIORITIES

1

Digital to enhance operational excellence

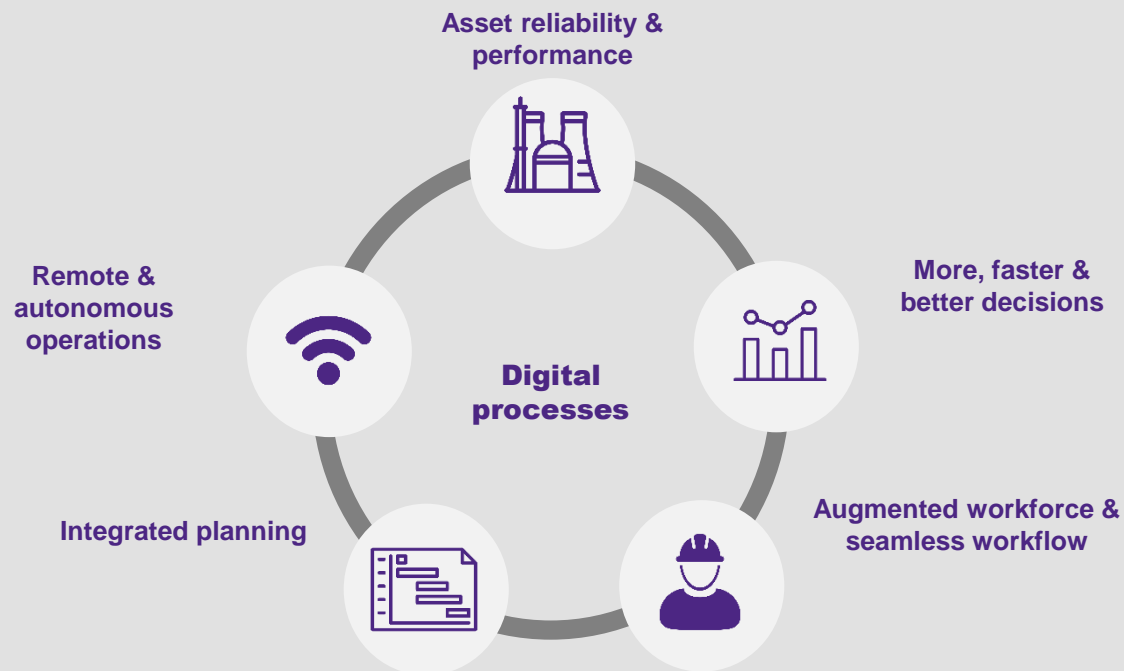
2

Digital to augment new ways of working and empower workforce

3

Digital to reinforce safety and security enterprise wide

OUR CORE DIGITAL TRANSFORMATION FOCUS



DIGITAL TRANSFORMATION

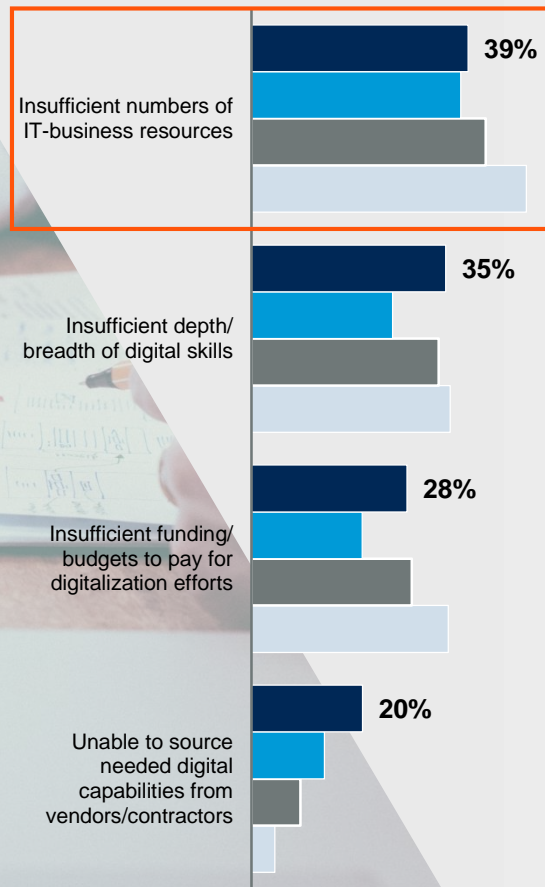
MAIN BARRIERS IN GCC

Fostering an innovation culture

Clear destination and governance

Business and technology fusion teams

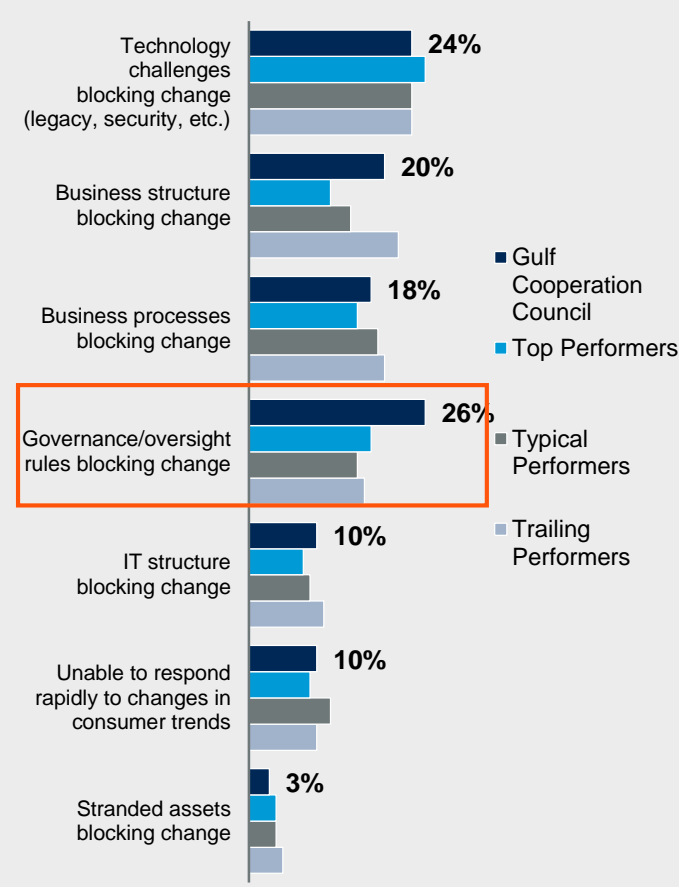
Resource Barriers



Culture Barriers



Other Barriers



DIGITAL ORGANIZATION

CRITICAL SUCCESS FACTORS



Digital Organization

Five initiatives to prepare the Enterprise to Digital Business Acceleration

1 Develop Clear Digital Destination

2 Build High Digital Dexterity

3 Elevate Digital Competency

4 Establish Digital Executive Responsibility

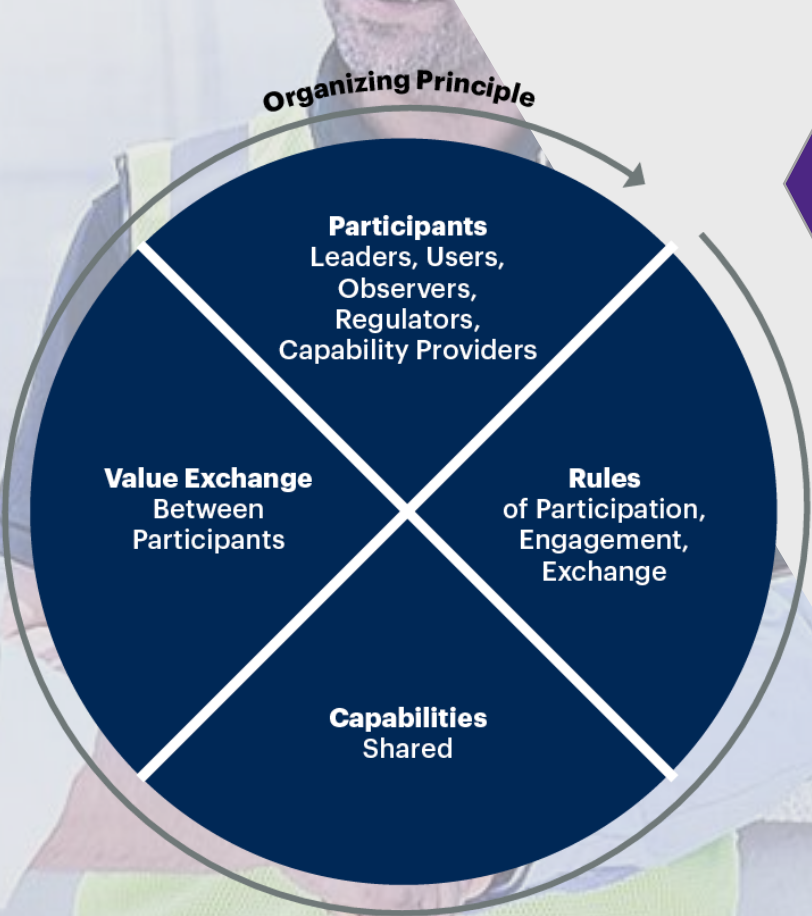
5 Establish New Enterprise I&T Model



**Digital Business
Acceleration**

DIGITAL SUPPLY CHAIN

MAIN CHALLENGES AND SUCCESS FACTORS

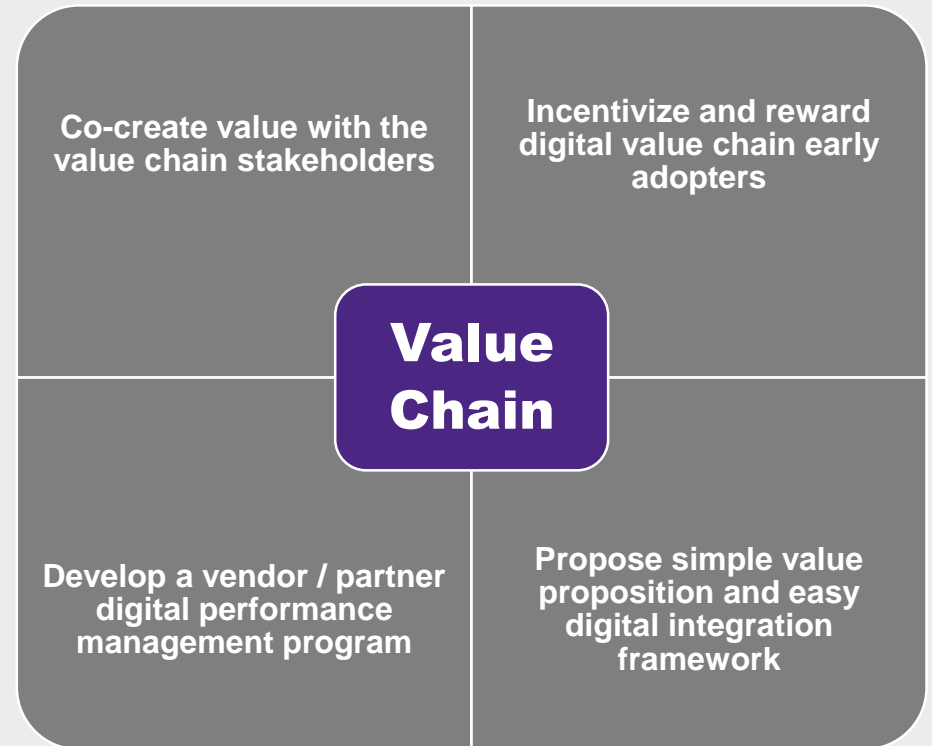


1

Creating the digital ecosystem

2

Develop a digital supply chain value proposition



DIGITAL SUPPLY CHAIN

GETTING READY TO THE NEXT DECADE WITH DIGITAL



Digital acceleration

Greater resiliency

Innovation through disruption



Questions and Discussion

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شركة نواة للطاقة
Nawah Energy Company



DIGITAL ORGANIZATION

SAFETY AND REGULATORY ELEMENT

