# Digital Plant of the future

Joep Verwegen

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## About

Making manufacturing plants run better is my drive and has always been a theme in my career, in project management, consultancy as well as in line management. I take people along and combine that with interest in content knowledge. I have been responsible for the primary end-to-end operations processes in fast changing business environments, from double digit growth to significant decline. Also, as a Program Director I lead and have led several improvement programs, both in corporate environments as well as on business unit level.

Specialties:
Business Process Excellence, IT-OT, Manufacturing, Supply Chain Management, Procurement, People Management, Change Management, QESH, asset utilization, cost reduction (unit cost, FOOP), asset management, maintenance, scale-up, continuous improvement, working capital improvement
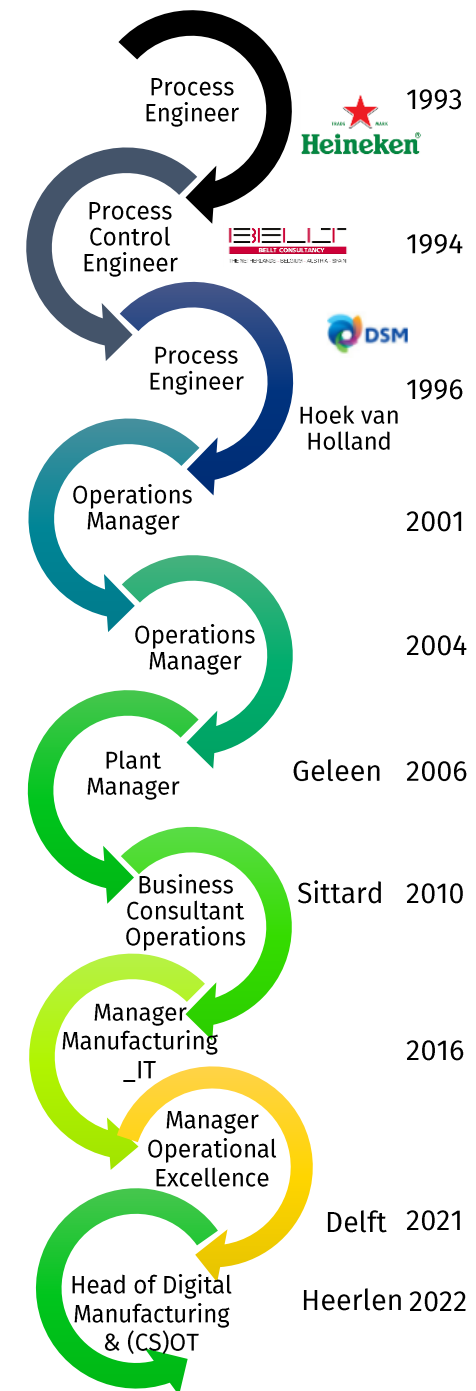
Experience:
Industries: chemicals, food, pharma
Working in an international, multi-cultural environment
Leading teams up to 100fte
Tools and techniques: PMP, HAZOP, RCA, GxP, FMEA, Lean, PERT, HPO, Agile

| Role | Location | Year |
|------|----------|------|
| Process Engineer (Heineken) | | 1993 |
| Process Control Engineer (BELLT) | | 1994 |
| Process Engineer (DSM) | Hoek van Holland | 1996 |
| Operations Manager | | 2001 |
| Operations Manager | | 2004 |
| Plant Manager | Geleen | 2006 |
| Business Consultant Operations | Sittard | 2010 |
| Manager Manufacturing _IT | | 2016 |
| Manager Operational Excellence | Delft | 2021 |
| Head of Digital Manufacturing & (CS)OT | Heerlen | 2022 |

# Innovators in nutrition, health and beauty



Perfumery
& Beauty

Taste, Texture
& Health

Health, Nutrition
& Care

Animal Nutrition
& Health

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# Three dynamic markets, two iconic names, one foundational purpose

**dsm-firmenich: we bring progress to life**
We're a trusted partner to global companies operating in high-growth and resilient markets. We're innovators in nutrition, health, and beauty

## ~30,000
passionate, talented, and diverse people in our global team

## 150+ years
of combined scientific discovery and innovation heritage

## €12+ bn
combined revenue

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# A global group with European roots



**88**
Manufacturing sites

**78**
Application labs

**40**
Creation centers

**70**
Premix sites

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**What are we trying to achieve?**

**Create support ecosystem through the 'Digital Plant of the Future' journey to enable scaling and accelerating initiatives that solve specific Challenges and unlock Untapped Opportunities**
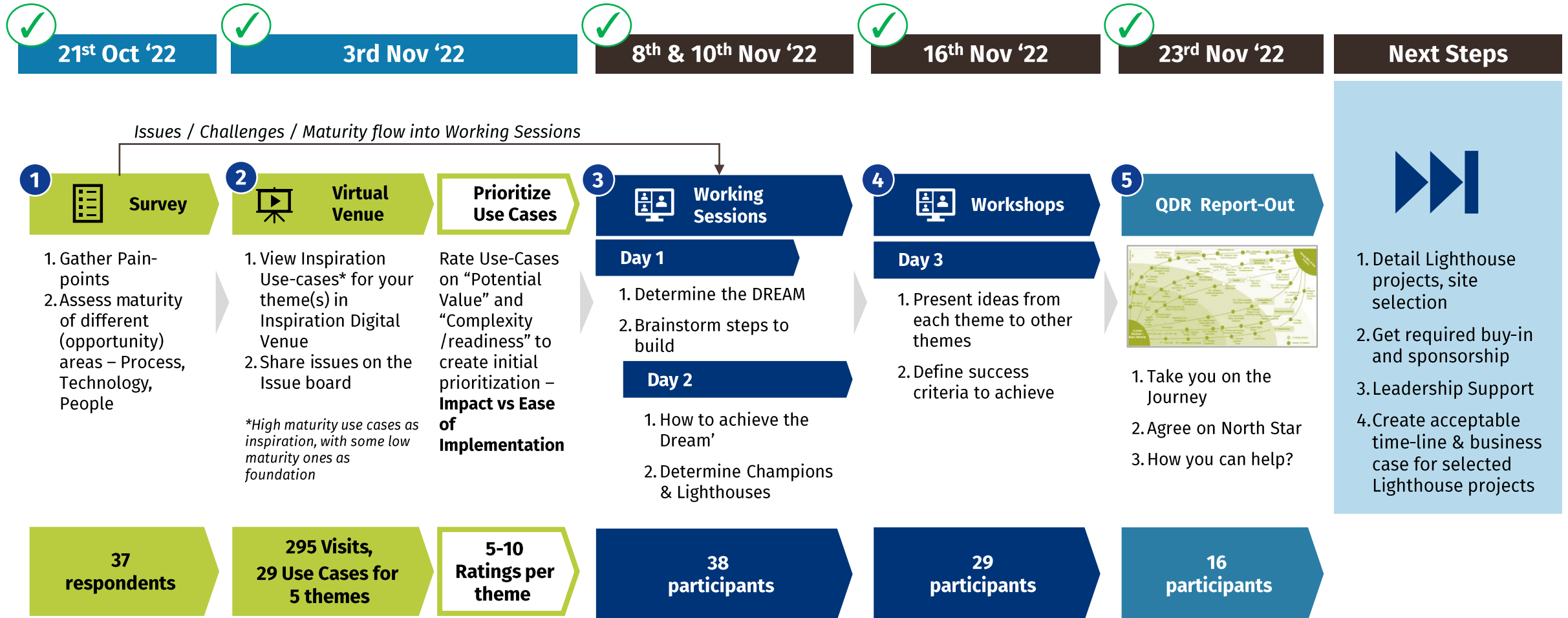
# Why now…

o **Stay Competitive** – innovation that helps to compete in market and accelerate topline & bottom–line growth

o **Race for 'Talent of the Future'** – Gen Z's & millennial generation's interest and capabilities to join the industry

o **Retaining Knowledge** – Capturing ageing workforce's experience and utilizing it

*"Incremental change gives incremental benefits. Especially in today's business scenario, we need revolutionary change, not just incremental change"*

*- Larry Page*

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# Process to derive the 'DSM Digital Plant of the Future'

## Process undertaken to derive 'Digital Plant of the Future'

| ✓ | ✓ | ✓ | ✓ | ✓ | |
|---|---|---|---|---|---|
| **21st Oct '22** | **3rd Nov '22** | **8th & 10th Nov '22** | **16th Nov '22** | **23rd Nov '22** | **Next Steps** |

*Issues / Challenges / Maturity flow into Working Sessions*

**① Survey**

1. Gather Pain-points
2. Assess maturity of different (opportunity) areas – Process, Technology, People

**② Virtual Venue**

1. View Inspiration Use-cases* for your theme(s) in Inspiration Digital Venue
2. Share issues on the Issue board

*High maturity use cases as inspiration, with some low maturity ones as foundation*

**Prioritize Use Cases**

Rate Use-Cases on "Potential Value" and "Complexity /readiness" to create initial prioritization – **Impact vs Ease of Implementation**

**③ Working Sessions**

**Day 1**
1. Determine the DREAM
2. Brainstorm steps to build

**Day 2**
1. How to achieve the Dream'
2. Determine Champions & Lighthouses

**④ Workshops**

**Day 3**
1. Present ideas from each theme to other themes
2. Define success criteria to achieve

**⑤ QDR Report-Out**

1. Take you on the Journey
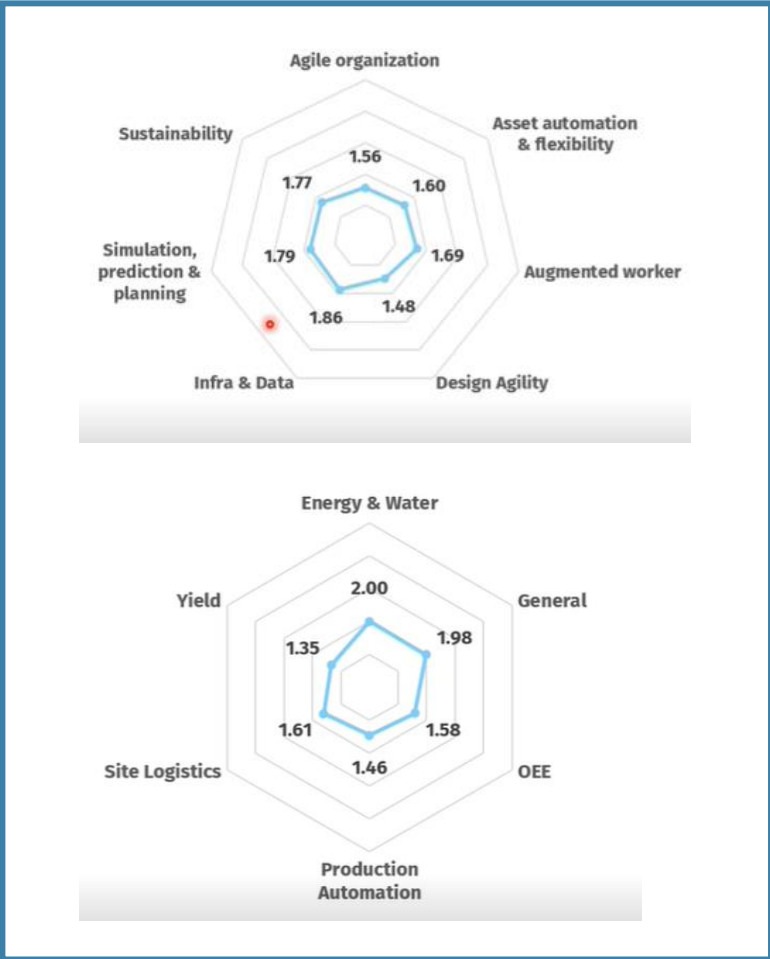2. Agree on North Star
3. How you can help?

**Next Steps**

1. Detail Lighthouse projects, site selection
2. Get required buy-in and sponsorship
3. Leadership Support
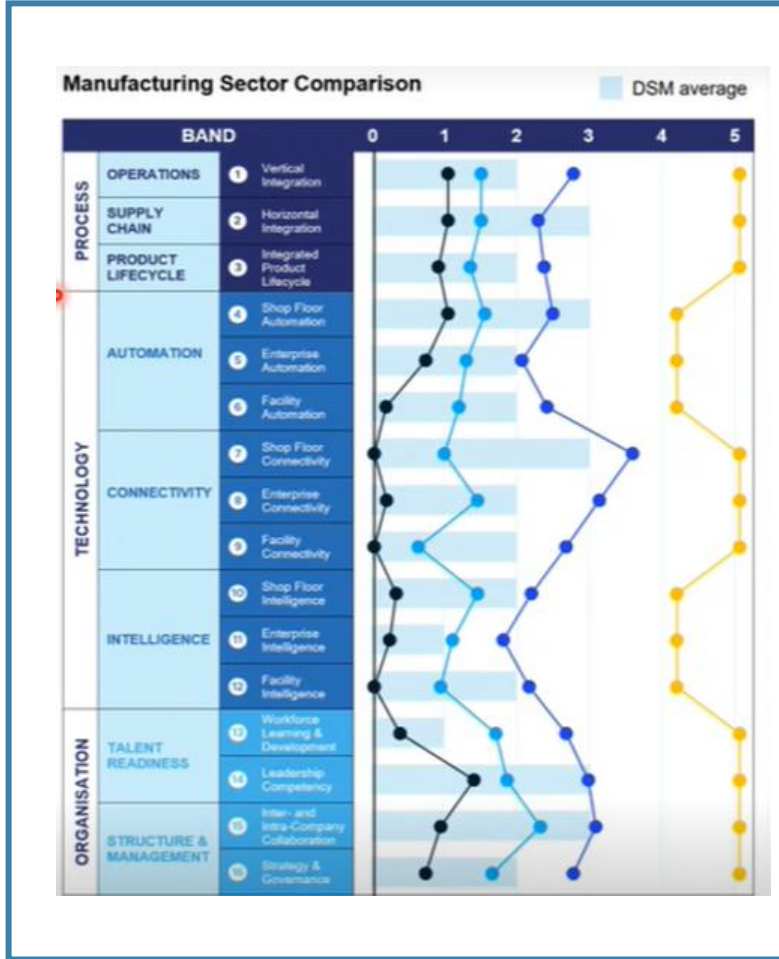4. Create acceptable time-line & business case for selected Lighthouse projects

| **37 respondents** | **295 Visits, 29 Use Cases for 5 themes** | **5-10 Ratings per theme** | **38 participants** | **29 participants** | **16 participants** |
|---|---|---|---|---|---|

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# Reasons for Action

## 1 We believe we are not where we should be :



**Internal Appetite to go faster now**
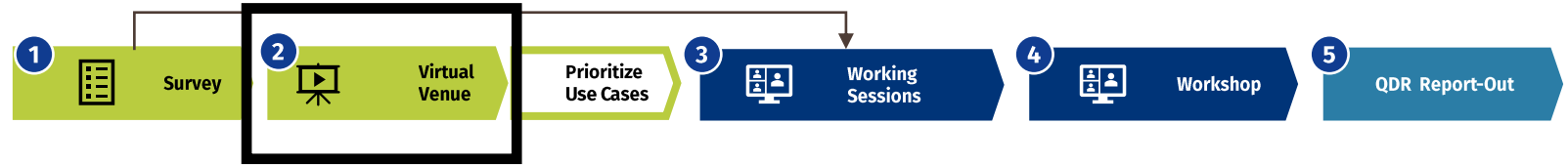
## 2 SIRI report shows we can aim much higher



Manufacturing Sector Comparison — DSM average

**Invest now to stay in the Race**

## 3 Talent War and Aging Population

- >70 open positions in DSM EU and >40 in DSM US

- **Over past year : 338 in age 20-35 came in and 224 left** Start and exit count employees



| | |
|---|---|
| <26 | −71,3%. |
| 26-35 | − 33,7% |
| 36-45 | −27,0% |
| 46-55 | +30,6 % |
| 55< | +86,3% |

- Retirement will hit 16% of our workforce in 5 y
- External trend confirms "less young people joining the workforce and leaving quickly"

Employment level in EU and US per age group



US: 25-54
EU: 25-54
EU: 55-64
US: 55+
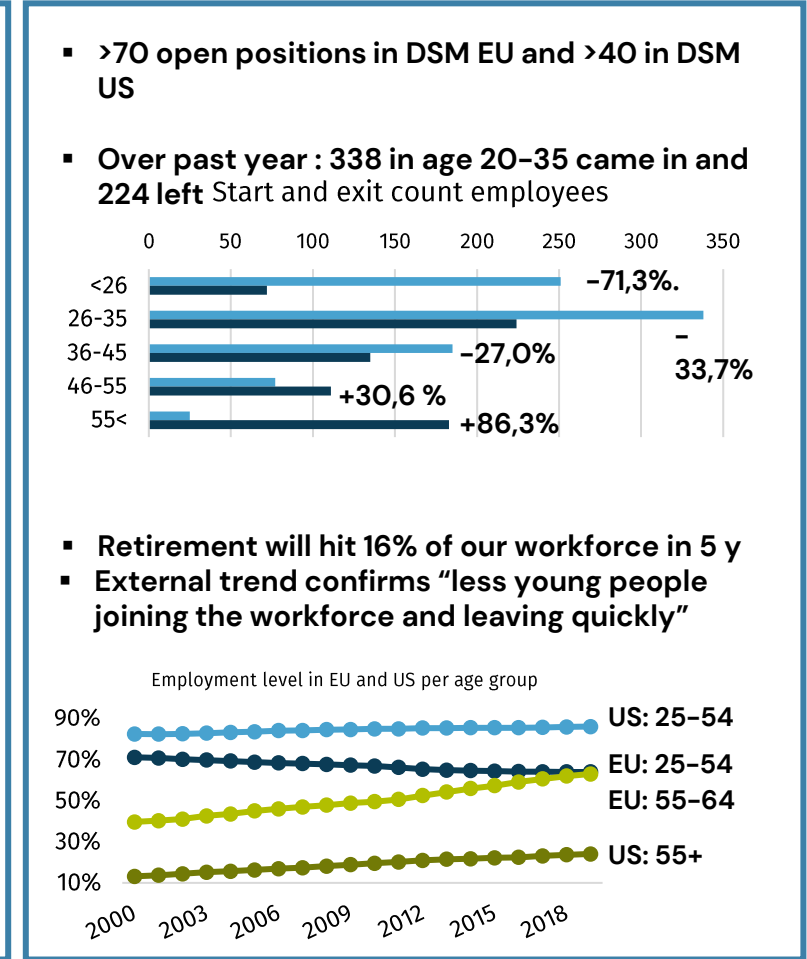
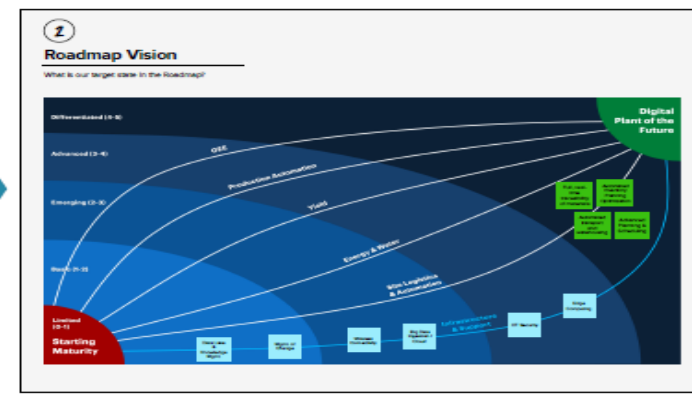**Let's remain to be employer of choice**
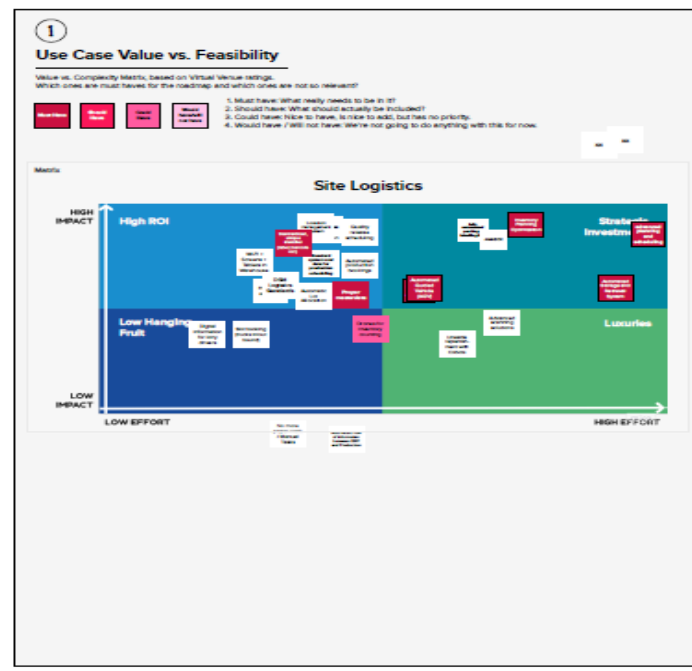
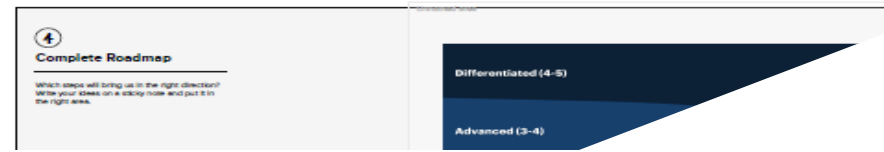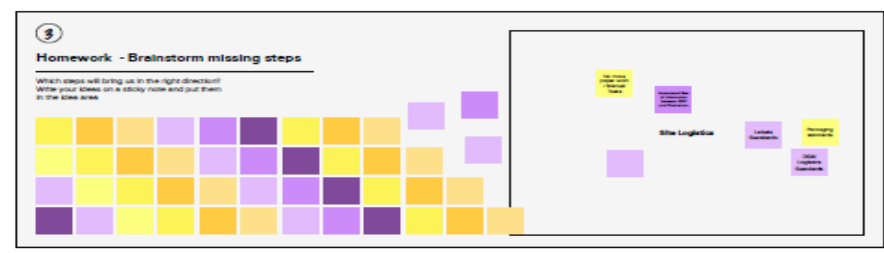dsm-firmenich

# Digital Venue

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# Working Sessions (1&2)

Three participant teams working on the digital manufacturing maturity journeys for five different themes during two working sessions.

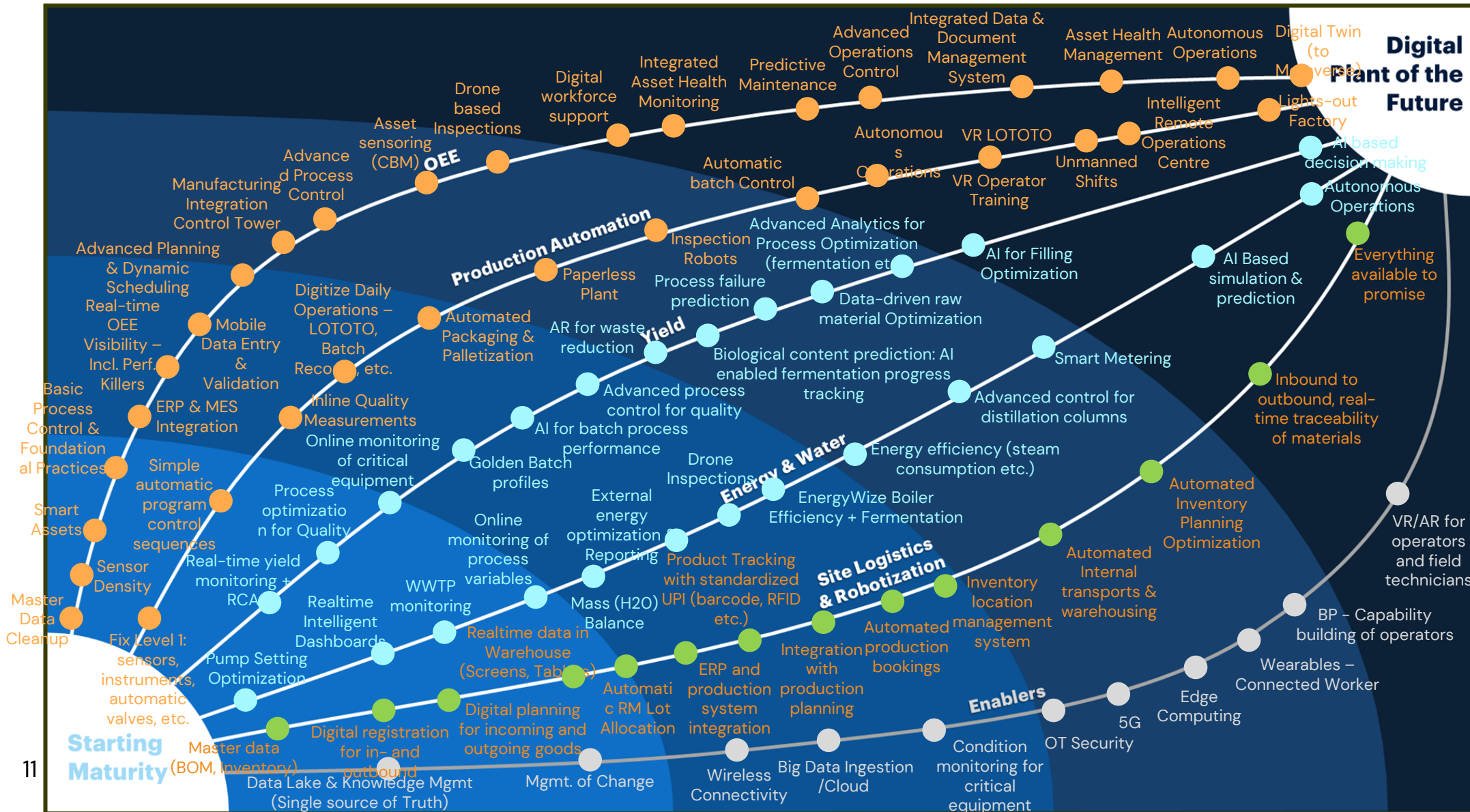*All Mural Boards can be found as Appendices in the Report-Out folder*

# Digital Maturity Journey combined

## Many of the initiatives listed may be under Pilot but included here due to need of Connecting & Scaling
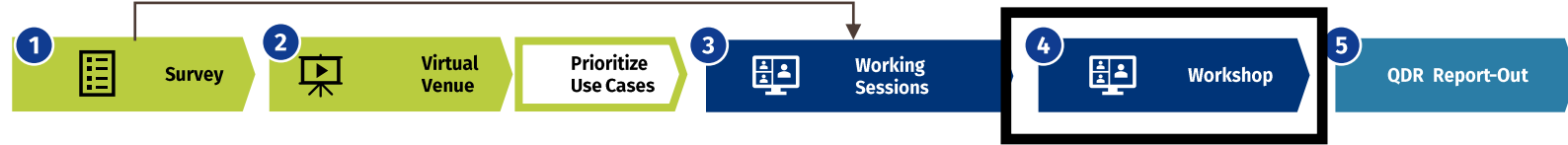


Legend:
- Differentiated (4–5)
- Advanced (3–4)
- Emerging (2–3)
- Basic (1–2)
- Limited (0–1)

Digital Plant of the Future

Key initiatives shown across maturity swim-lanes:

**OEE / Production Automation:** Drone based Inspections, Asset sensing (CBM), Digital workforce support, Integrated Asset Health Monitoring, Predictive Maintenance, Advanced Operations Control, Integrated Data & Document Management System, Asset Health Management, Autonomous Operations, Digital Twin (to Metaverse), Lights-out Factory, Advanced Process Control, Manufacturing Integration Control Tower, Advanced Planning & Dynamic Scheduling, Real-time OEE Visibility – Incl. Perf. Killers, Mobile Data Entry & Validation, Digitize Daily Operations – LOTOTO, Batch Records, etc., ERP & MES Integration, Automatic batch Control, Autonomous Operations, VR LOTOTO, VR Operator Training, Unmanned Shifts, Intelligent Remote Operations Centre, AI based decision making, Autonomous Operations, Everything available to promise, Inspection Robots, Paperless Plant, Advanced Analytics for Process Optimization (fermentation et..), AI for Filling Optimization, AI Based simulation & prediction, Inbound to outbound, real-time traceability of materials

**Yield:** Basic Process Control & Foundational Practices, Smart Assets, Simple automatic program control sequences, Inline Quality Measurements, Online monitoring of critical equipment, AI for batch process performance, Advanced process control for quality, Process failure prediction, Data-driven raw material Optimization, Biological content prediction: AI enabled fermentation progress tracking, Advanced control for distillation columns, Smart Metering, AR for waste reduction, Golden Batch profiles

**Energy & Water:** Sensor Density, Real-time yield monitoring + RCA, Process optimization for Quality, Online monitoring of process variables, External energy optimization Reporting, Drone Inspections, EnergyWize Boiler Efficiency + Fermentation, Energy efficiency (steam consumption etc.), WWTP monitoring, Mass (H2O) Balance

**Site Logistics & Robotization:** Master Data Cleanup, Fix Level 1: sensors, instruments, automatic valves, etc., Pump Setting Optimization, Realtime Intelligent Dashboards, Realtime data in Warehouse (Screens, Tablets), Automatic RM Lot Allocation, Product Tracking with standardized UPI (barcode, RFID etc.), ERP and production system integration, Integration with production planning, Automated production bookings, Inventory location management system, Automated Internal transports & warehousing, Automated Inventory Planning Optimization

**Enablers:** Master data (BOM, Inventory), Digital registration for in- and outbound, Digital planning for incoming and outgoing goods, Data Lake & Knowledge Mgmt (Single source of Truth), Mgmt. of Change, Wireless Connectivity, Big Data Ingestion /Cloud, Condition monitoring for critical equipment, OT Security, 5G, Edge Computing, Wearables – Connected Worker, BP – Capability building of operators, VR/AR for operators and field technicians

Starting Maturity

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1 Survey
2 Virtual Venue
Prioritize Use Cases
3 Working Sessions
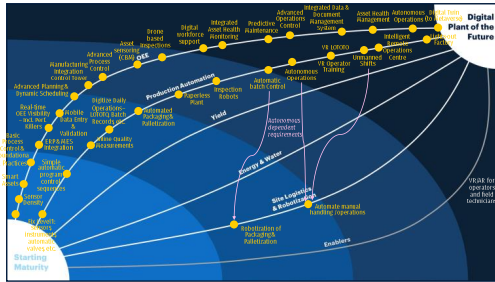4 Workshop
5 QDR Report-Out

# Workshop (3)

Three teams with one champion per theme coming together to combine the five journeys and enablers into one Digital Manufacturing Maturity Journey, draft the Digital plant of the Future vision statement and introduce Lighthouses.
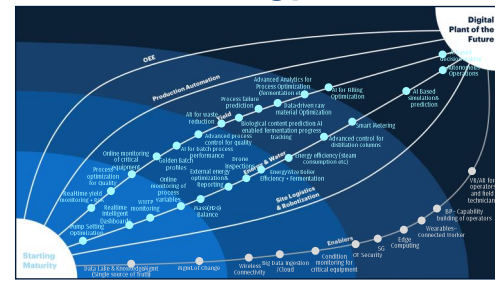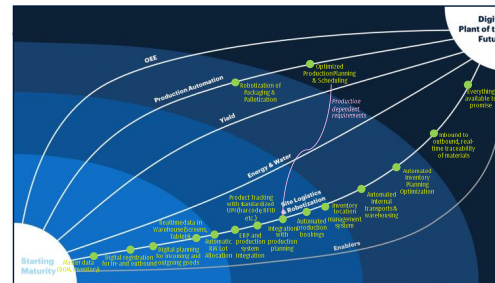
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# Maturity Journey to Lighthouse Map

### OEE and Prod. Automation



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### Yield and Energy & Water



\+

### Site Logistics &



## What is our understanding of a Lighthouse Project?

A lighthouse project is **a small–scale but big–picture project**. It's like a **beacon** for future digital transformation, **done in a time–box** to finalize **design for scaling** (replicable) and **build capabilities**. With this tried–and–tested approach, ideas are turned into **real value** and **new, stretched digital capabilities** – and serve as a test case to understand feasibility, risks and opportunities before scaling.

### Draft Digital Maturity



## Lighthouse Project Themes



**Autonomous Plant**   **Intelligent Assets**   **Robotization**
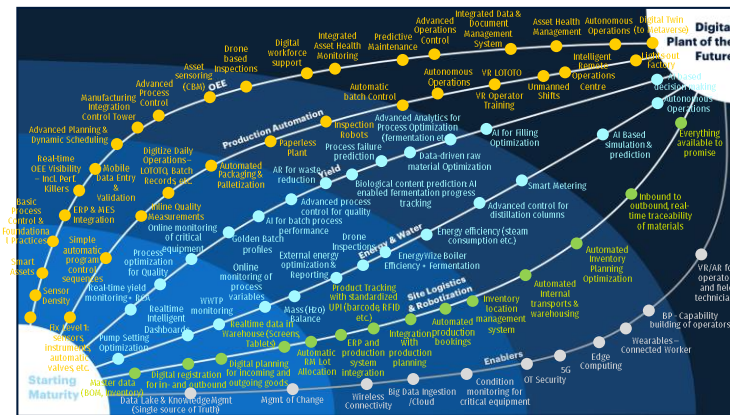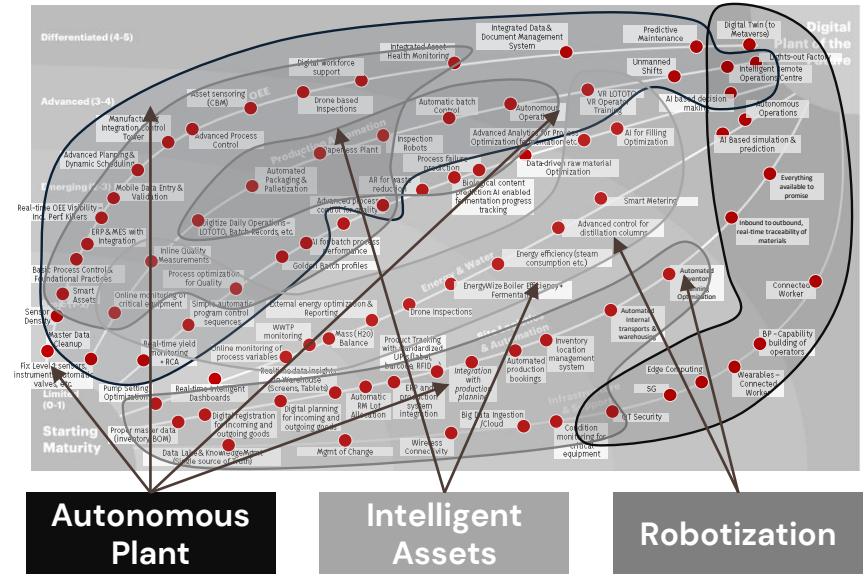
- Currently, Lighthouse themes have been identified and initial mapping done with initiatives in the digital maturity journey

- **Next step is to detail each Lighthouse theme further** into a Charter and map all relevant initiatives in the maturity journey to each lighthouse

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# Vision Statement
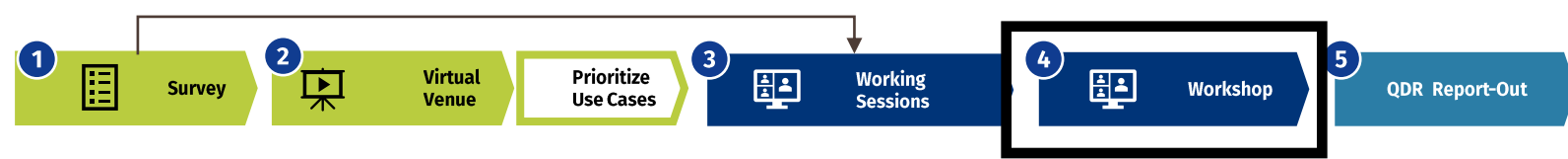
To the benefit of our customers and our people, the digital plant of the future is:
- **autonomous;**
- **intelligent and;**
- **fully integrated.**

**Autonomous** means: Highly efficient, No Touch and Minimal Waste manufacturing, with minimal human labour requirement. Most groundwork required for regular operations, simple and repetitive tasks are automated/robotized.

**Intelligent** means: Smart integrated systems, processes and asset that can determine when a manufacturing process, plant, machine, component, or part is likely to fail, and what next best action should be taken. Utilize data from across the environments for accurate predictions.

**Fully integrated** means: All systems integrated from sensors to reporting and visualization. Data flows un-interrupted. Also, capabilities, processes and operating model are aligned with system improvements.

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# Lighthouse Project Themes

Derived from the Vision, this is what we propose to do for being "Purpose-led, Performance-driven"

## Autonomous Plant – *Highly efficient, minimized control room operator interventions*

Focusses on the optimization & conservation of all resources through incorporation of technological advancements in connectivity and computing power – as well as access to IT & OT data – in order to progressively improve performance based on data analytics, and models without significant human intervention.

This stiches initiatives for Automation integration like Sensors, Instrumentation, Real-time OEE visibility, Advanced Planning & Dynamic Scheduling, Paperless plant, Automated Batch Control, Integrated Data & Document Management System, with layer of analytics & contextualization.

## Robotization & Integrated Plant – *Material status in real-time, light field work*

Focusses on shifting manual physical work to robots for carrying out a particular function. This essentially means we aim at introducing automation of systems or processes by use of robotic devices. Use people for most innovative and creating work. Combined with vertical integration all the way from sensors to MES and ERP, it creates real-time visibility and integration of the enterprise.
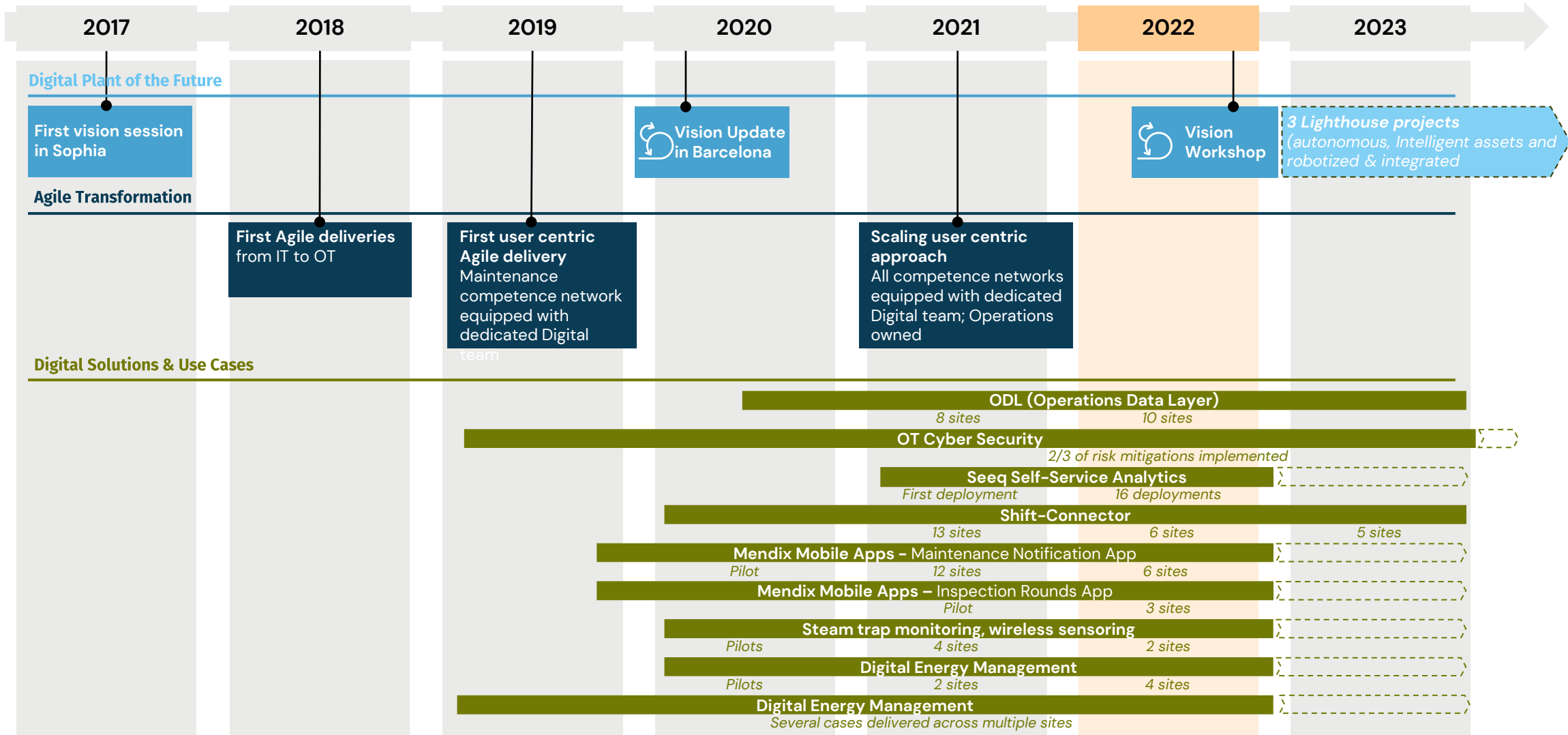
## Intelligent Assets – *Smart Integrated Asset Management*

Focusses on increasing return on assets (ROA) through reduction of unplanned downtime, operational costs, enhancing productivity, improving safety & compliance, along with extending life of assets that decreased regular CAPEX outflow. This happens through Integrated Health Monitoring & Management, informed and accurate decision making, along with prediction capabilities.

## Digital Twin *(reserved for a later date)*

This will create a virtual representation designed to accurately reflect the physical plant – as the indistinguishable digital counterpart of it for practical purposes, such as simulation, integration, testing, monitoring, and prediction.
It will integrate and envision the whole maturity journey on a single platform, super-imposing on all themes and light-house projects.

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# The past, the now and the future

| 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|------|------|------|------|------|------|------|

**Digital Plant of the Future**

First vision session in Sophia

Vision Update in Barcelona

Vision Workshop

*3 Lighthouse projects (autonomous, Intelligent assets and robotized & integrated)*

**Agile Transformation**

**First Agile deliveries** from IT to OT

**First user centric Agile delivery**
Maintenance competence network equipped with dedicated Digital team

**Scaling user centric approach**
All competence networks equipped with dedicated Digital team; Operations owned

**Digital Solutions & Use Cases**

**ODL (Operations Data Layer)**
*8 sites          10 sites*

**OT Cyber Security**
*2/3 of risk mitigations implemented*

**Seeq Self-Service Analytics**
*First deployment          16 deployments*

**Shift-Connector**
*13 sites          6 sites          5 sites*

**Mendix Mobile Apps – Maintenance Notification App**
*Pilot          12 sites          6 sites*

**Mendix Mobile Apps – Inspection Rounds App**
*Pilot          3 sites*

**Steam trap monitoring, wireless sensoring**
*Pilots          4 sites          2 sites*

**Digital Energy Management**
*Pilots          2 sites          4 sites*

**Digital Energy Management**
*Several cases delivered across multiple sites*

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