
DATA SPACE 4.0
Manufacturing Data Space
Blueprint
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DFA
TRANSFORMING MANUFACTURING TOGETHER
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What is a Blueprint?

Data Spaces Blueprint v1.0

Last updated 11 March, 2024

This is the start page for all Blueprint v1.0 information. The Blueprint is a consistent and comprehensive set of guidelines to support the development cycle of **data spaces**. It includes the **conceptual model of a data space**, **data space building blocks**, and recommended standards and specifications.

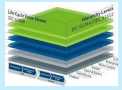
GUIDELINES TO SUPPORT THE **DEVELOPMENT** CYCLE OF DATA SPACES

Toward a Blueprint for Mnfg DS (MDS) supporting Dynamic Asset Management (AM), Predictive Maintenance (PdM) & Agile Supply Chains (SC)

DATA SPACE 4.0

DSSC BB Taxonomy

RAMI4.0



Available Data Platforms and Key technologies

Existing OSS Implementations

BP Design phase

Reference Use Cases

Methods & Tools for designing and deploying MDS

Certification Strategies

BACKGROUNDS

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What the DS4.0 Blueprint offer

1 RAMI4.0 Convergence

To ease the understanding of the Data Spaces Building Blocks to any system architect already experienced in designing and implementing manufacturing platforms based on RAMI 4.0

2 MDS Checklist

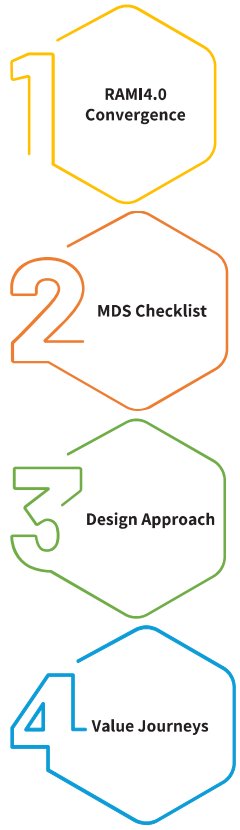
Evolving the DSSC Starter Kit checklist, adding new questions or detailing the existing ones to make them more effective for our stakeholders in the manufacturing domain

3 Design Approach

Common best practices optimized for the ecosystem's specific needs, supporting an evolutionary (centralized, decentralized, federated, …) development

4 Value Journeys

Digital Transformation journey following the cumulative value generated from data transactions and use cases within a data space as data space participants collaboratively use it



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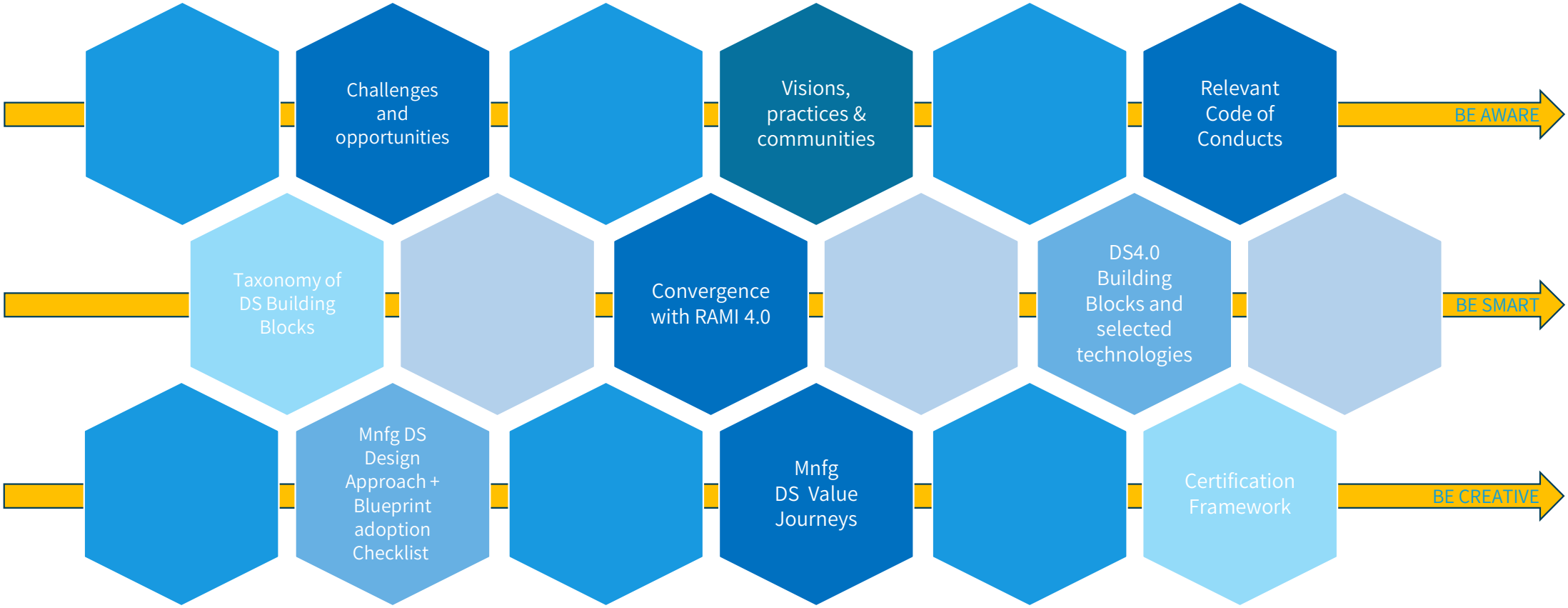
Our pathway toward a MDS Blueprint



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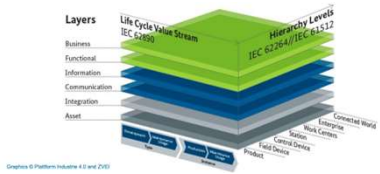
Manufacturing Data Space & RAMI 4.0

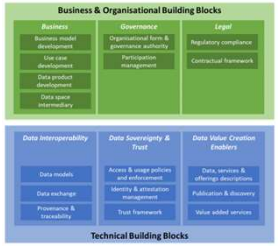
WHY

Showing the impact of DSSC BB Taxonomy to a manufacturing expert using a very well known standards such as RAMI4.0



WHAT

Mapping DSSC BB Taxonomy with RAMI 4.0 to create a convergence toward Industry 4.0



HOW

Adding domain-specific requirements and components (e.g. based on OPC UA, AAS, …)

1 RAMI4.0 Convergence

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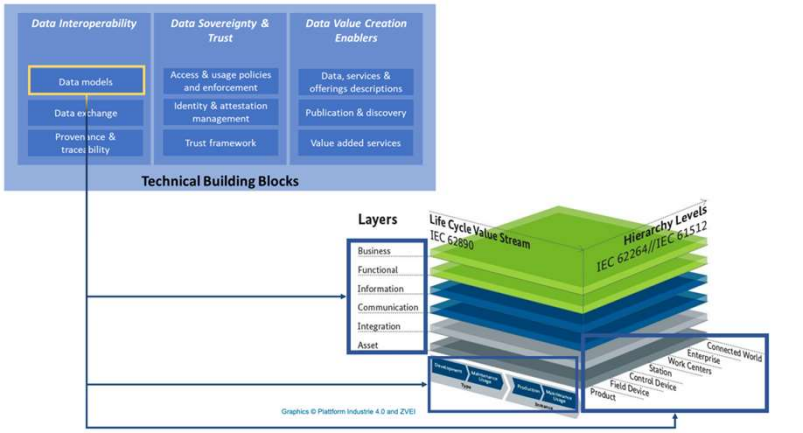
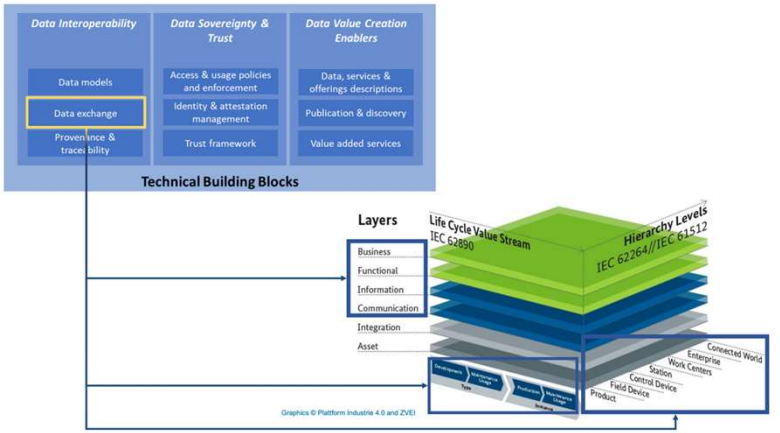
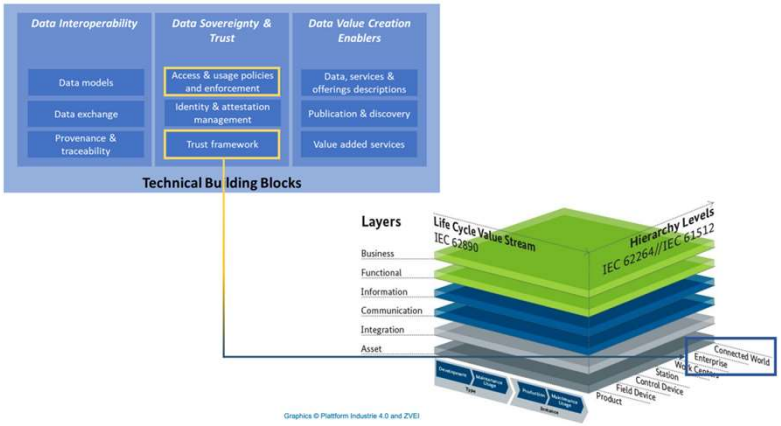
Manufacturing Data Space & RAMI 4.0



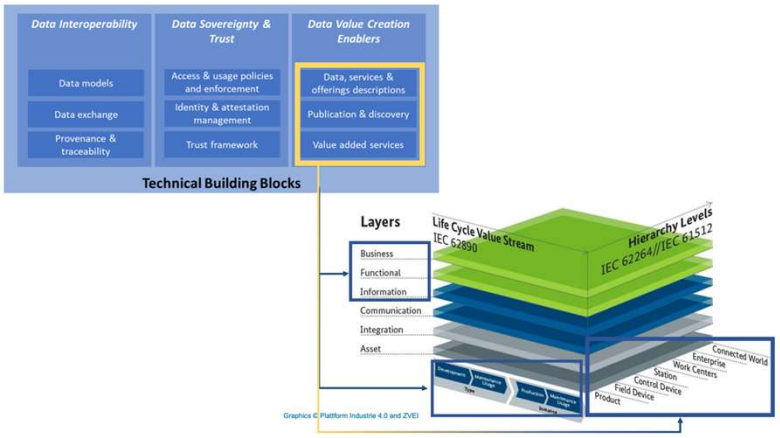
Data models



Data exchange



Access & usage policies and enforcement and Trust framework



Data Services & offering descriptions, Publication & discovery, Value added services

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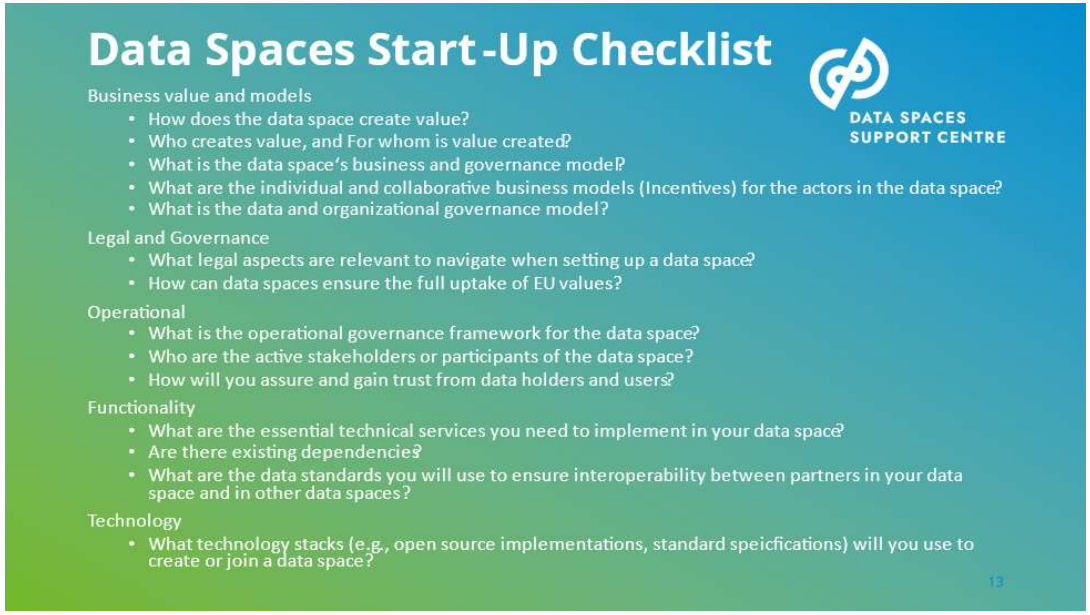
Manufacturing Data Space Checklist

Based on DSSC Checklist



…but extended to Mnfg purposes:

- Needs for exchanging data among vendors, machine builders, manufactures and other operators
- Identified standard agreements on data sharing/exchange for users
- Integration mechanisms to support your business at tactical/operational/strategic level
- Integration mechanisms of Artificial Intelligence applications, Digital Twin (and other simulation/modelling elements) or any other industrial smart data models (DTDL, AAS, …)

Manufacturing Data Space Checklist

Business

- Value creation
- Stakeholders and participants
- Business and governance model
- Incentives for actors in the data space? Any specific for SMEs?
- DS4.0 Industry Agreements
- Enterprise/organizational processes
- Data exchange among vendors, machine builders, manufactures and other operators
- Value of the data shared
- Data Space certification

Legal

- Legal aspects to navigate
- Legal requirements and challenges
- Legal dimensions of data governance
- Full uptake of EU values?
- Standard agreements on data sharing/exchange

Operational

- Operational governance framework
- Day-to-day for sustaining
- Barriers on data availability and reusability
- Data management approach
- Intermediation services
- Data space operator (certified?)
- Control actions

Functional

- Core functionalities
- Essential building blocks
- Physical entities and systems
- Integration mechanisms
- Digital Twin
- Artificial Intelligence benefits

Technical

- Standards
- Requirement specifications
- Open source implementations
- Data Traceability
- Meta-data
- Trusted identity providers
- Rules and policy languages
- Data artifacts (data offering)
- Data publication schema
- Infrastructural components
- Use certified components

Life Cycle

- Product/process design benefits
- Connect assets
- Manufacturing/supply chain processes impacted
- Maintenance processes benefits

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Manufacturing Data Space Design Approach

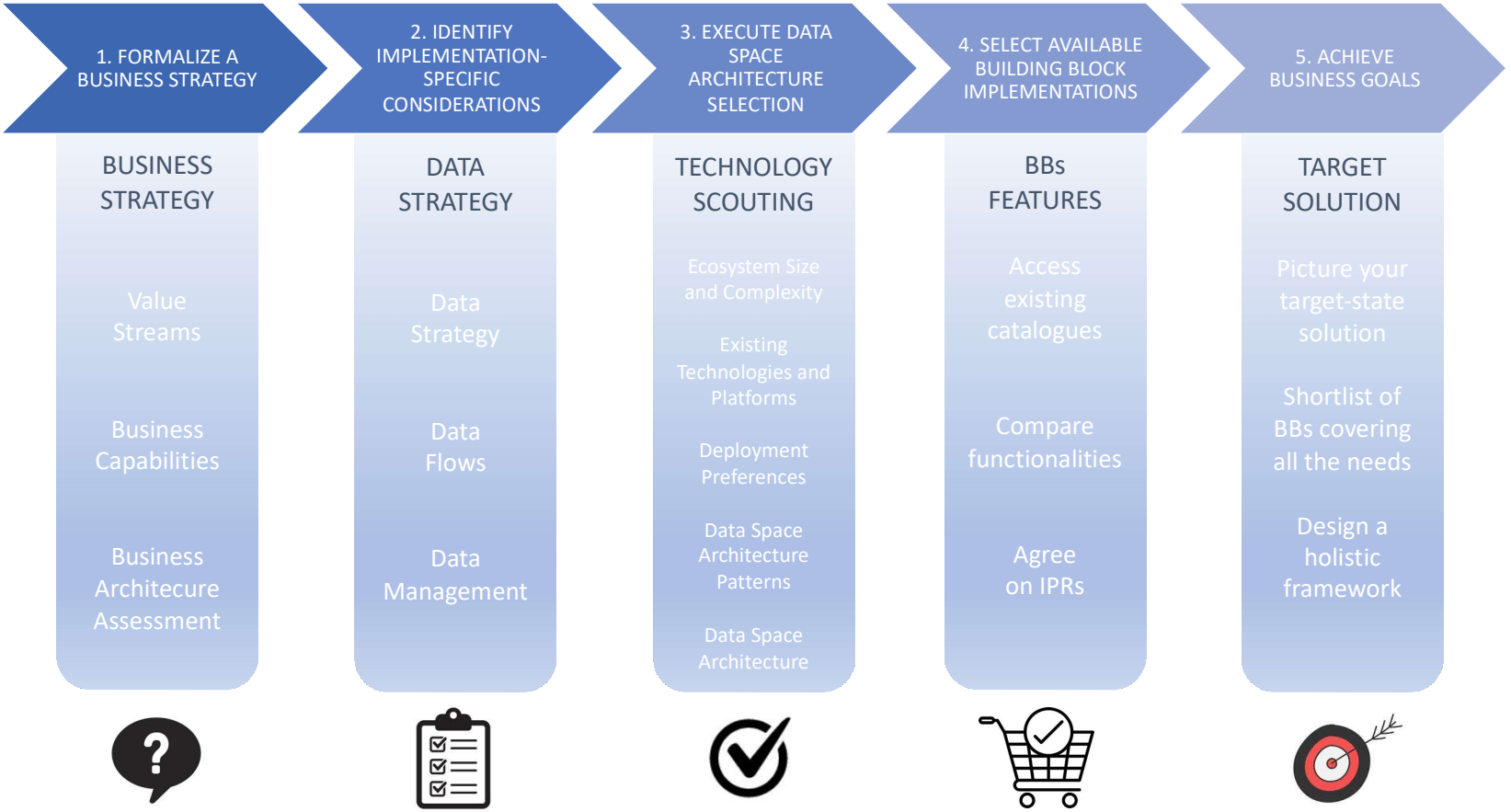
APPROACH

- Use a pragmatic approach
- Understand your goals and priorities
- Picture your target-state architecture
- Identify the current technology coverage and maturity level
- Select the software based on feature/functional enablement

PAINS

- Unique set of requirements
- Building Block implementations are difficult to compare
- Several Data space initiatives interested in getting as large a footprint as possible
- Some implementations are just not compatible
- Certification programmes and standards are still under development

Manufacturing Data Space Design Approach



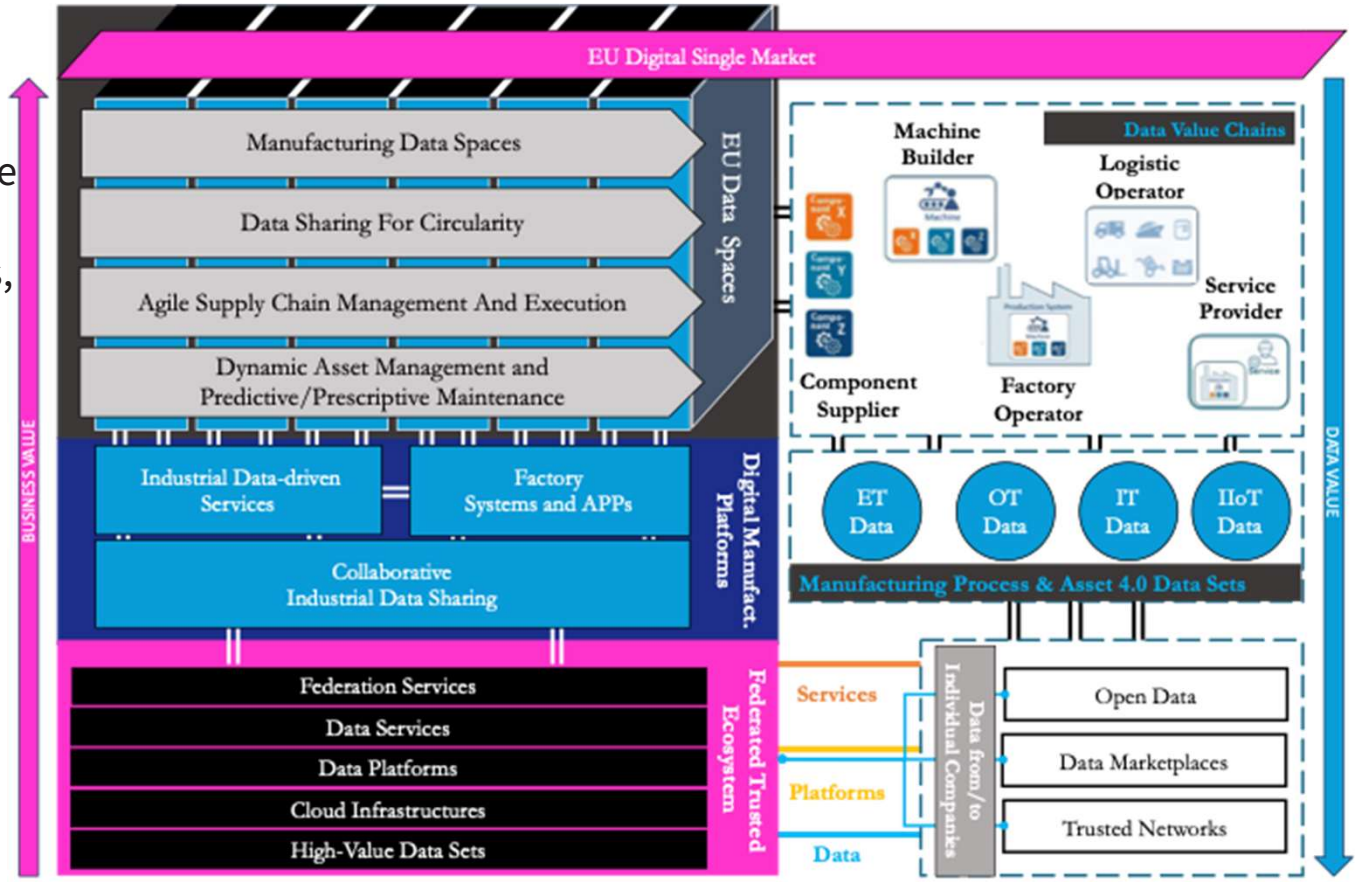
Every **Data Value Chain** (DVC) ecosystem needs to define and adopt specific technologies and infrastructure to deploy and operate a data space

Manufacturing Data Space Value Journeys

The **Data Value Journey** & the **Business Value Journey:**

From the identification of all the actors, their Manufacturing Process and Asset 4.0 Data Sets, and the adopted techs to share data…

…to Federated Trusted Ecosystem able to host Data Platforms and relevant Data Services and Federation Services, and to support the federation of sovereign Data Platforms in Data Spaces.



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Manufacturing Data Space Value Journeys

Data Value Journey

Start with the identification of all the actors of the Data Value Chains of interest (e.g. manufacturing companies, OEM providers, suppliers, operators, …). These actors (and especially the manufacturing companies) have already access to several Manufacturing Process and Asset 4.0 Data Sets, coming from their systems operating at Engineering Technology (ET), Operational Technology (OT), Information Technology (IT), and Industrial IoT (IIoT) level.

Business Value Journey

Most of these datasets are underexploited if left in silos, within a Company or even within a single department. Only when Individual Companies start adopting trusted technologies to share data (via Trusted Networks, Data Marketplaces or Open Data portals) in their Data Value Chains, their Business Value Journey will be realized.

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Circular TwAIn

DATA SPACE 4.0

Circular TwAIn

A pratical example

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The Circular TwAIn BATTERY Pilot

De- and Re-manufacturing of Li-Ion battery packs in e- mobility

Remanufacture and the re-use of the disassembled cells with proper residual characteristics into second-life stationary applications

The mission of this pilot is implemented in five use cases

1. Computer-vision driven collaborative robotics for the disassembly of LIB packs
2. Machine learning aided automated disassembly of LIB modules
3. AI tool for the characterization of the LIBs state-of-health combining historical and testing data
4. AI tool for optimised mechanical recycling of degraded LIBs
5. Market oriented holistic decision-support-system for the LIBs de- and re-manufacturing

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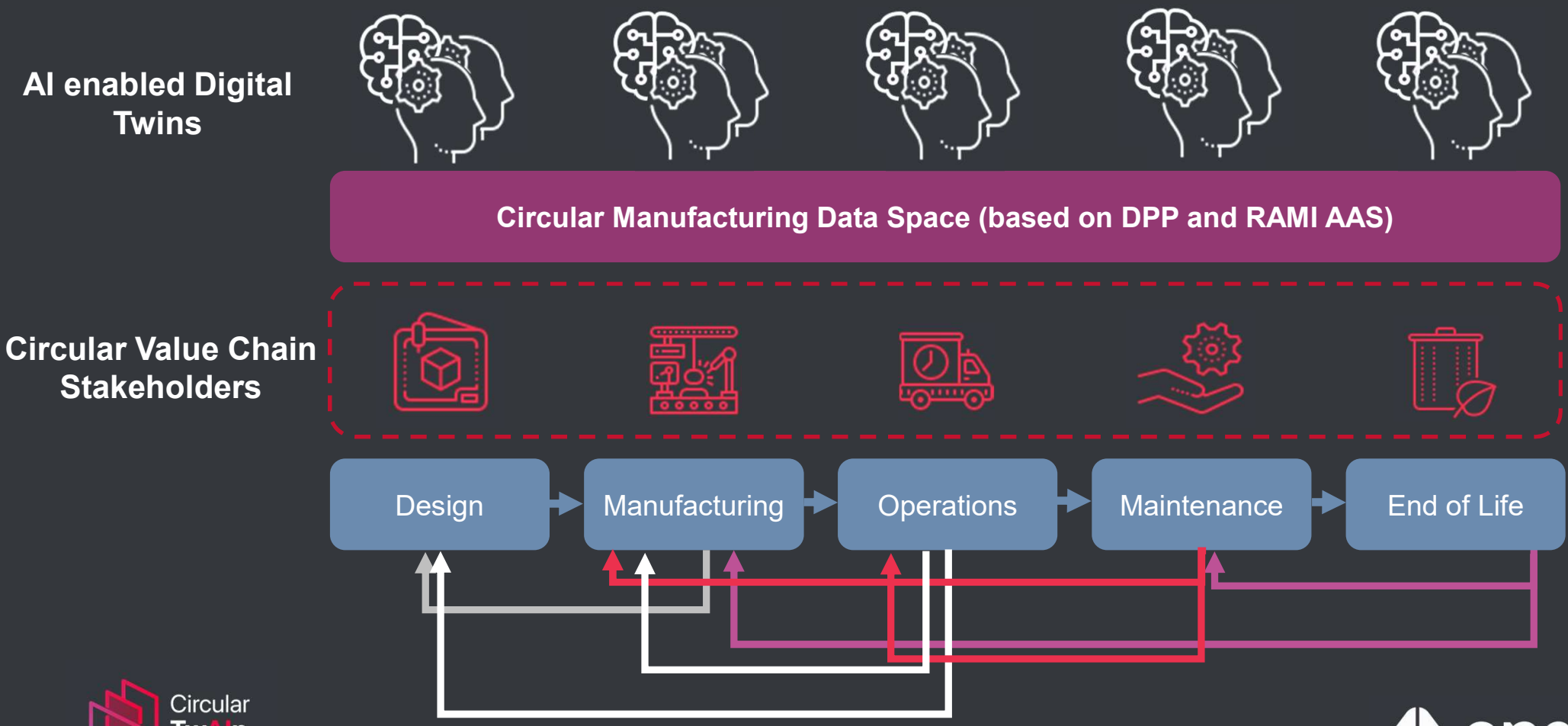
Circular TwAIn – Adding Circularity to Data Spaces



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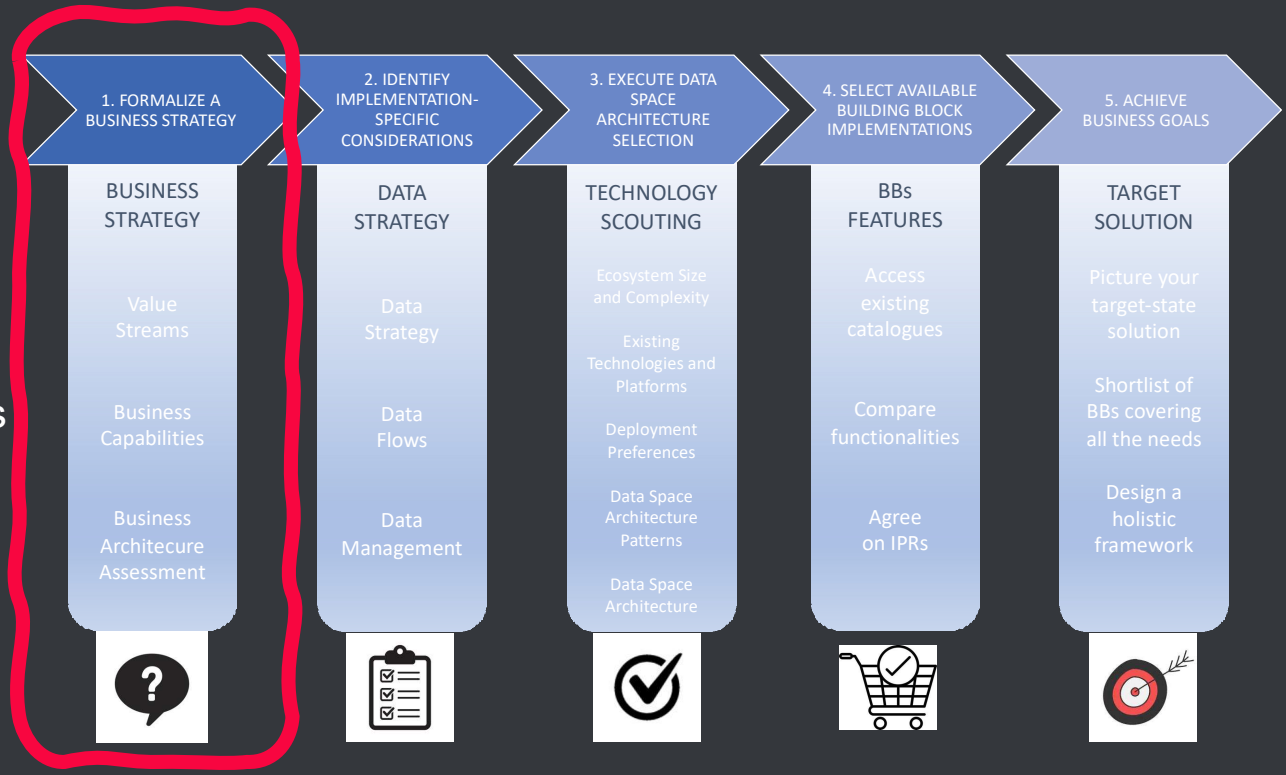
1. Business Strategy

- Identify the Value Streams
- Value Network vs UCs
- Identify the Commercial Relationships



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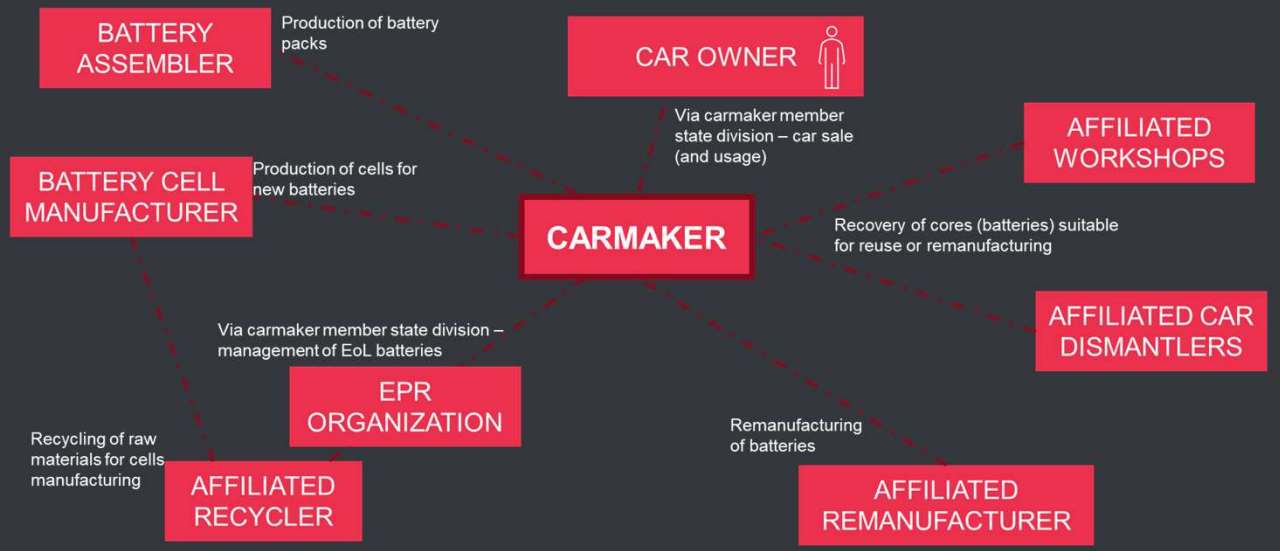
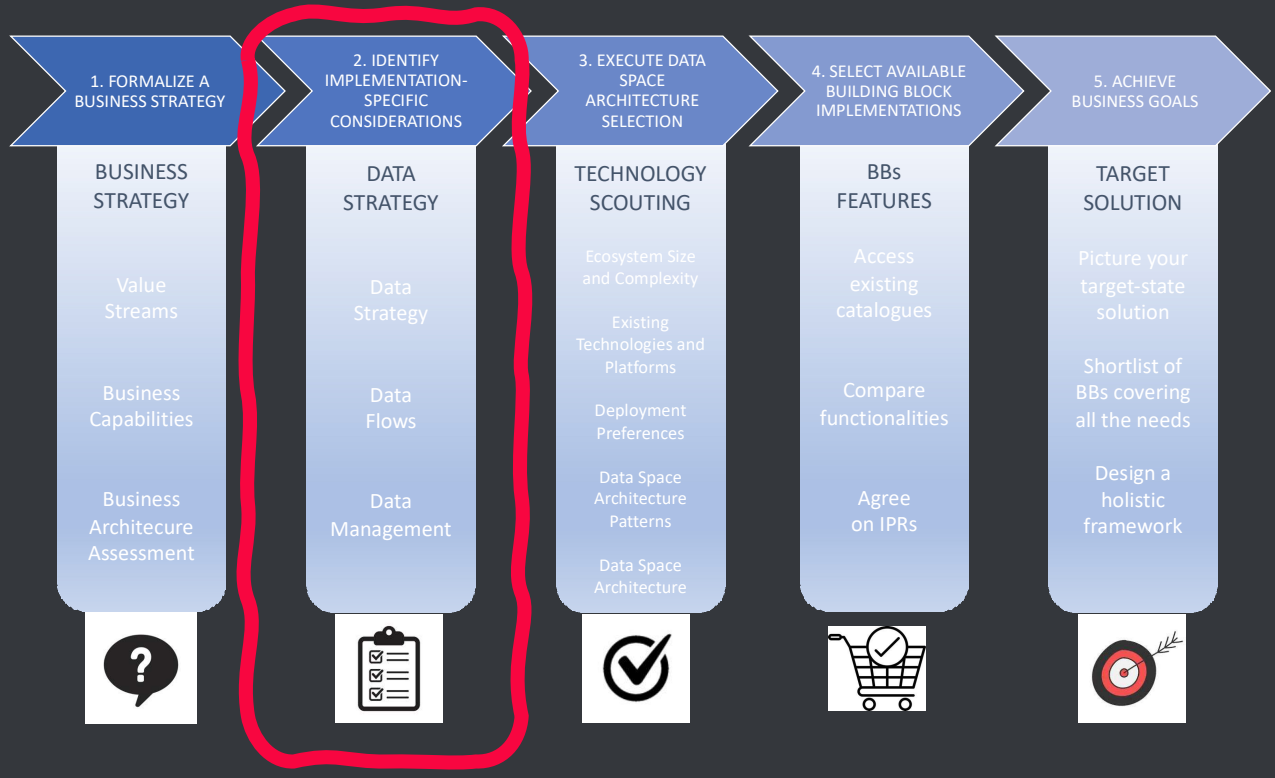


2. Data Strategy

- Identify the Data Sources and define stakeholder roles
- Analyse data flows within the DS



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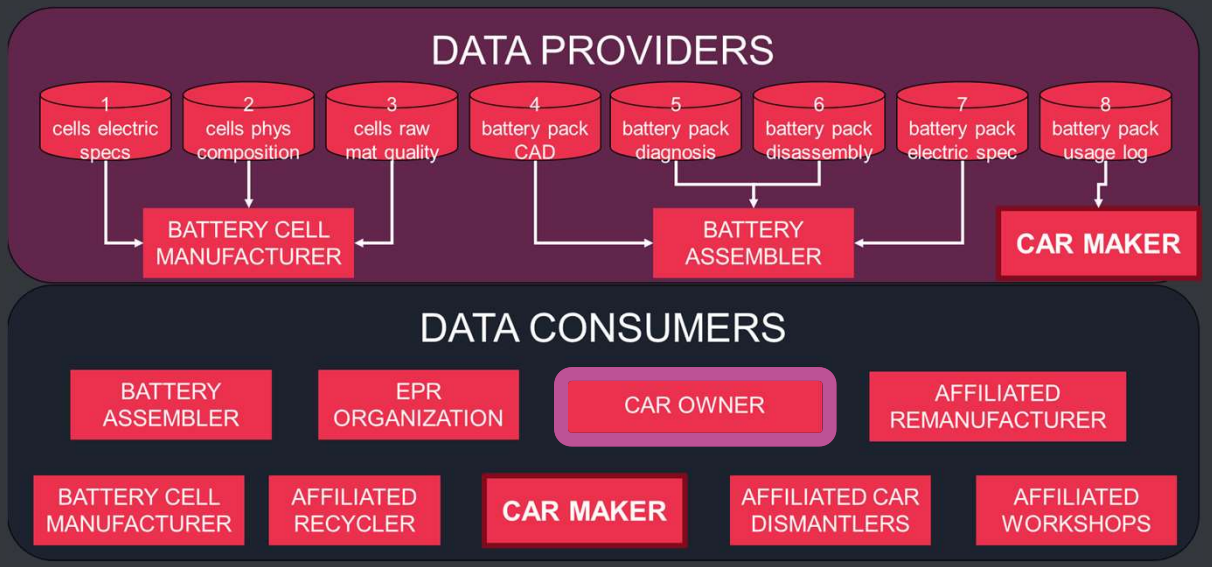
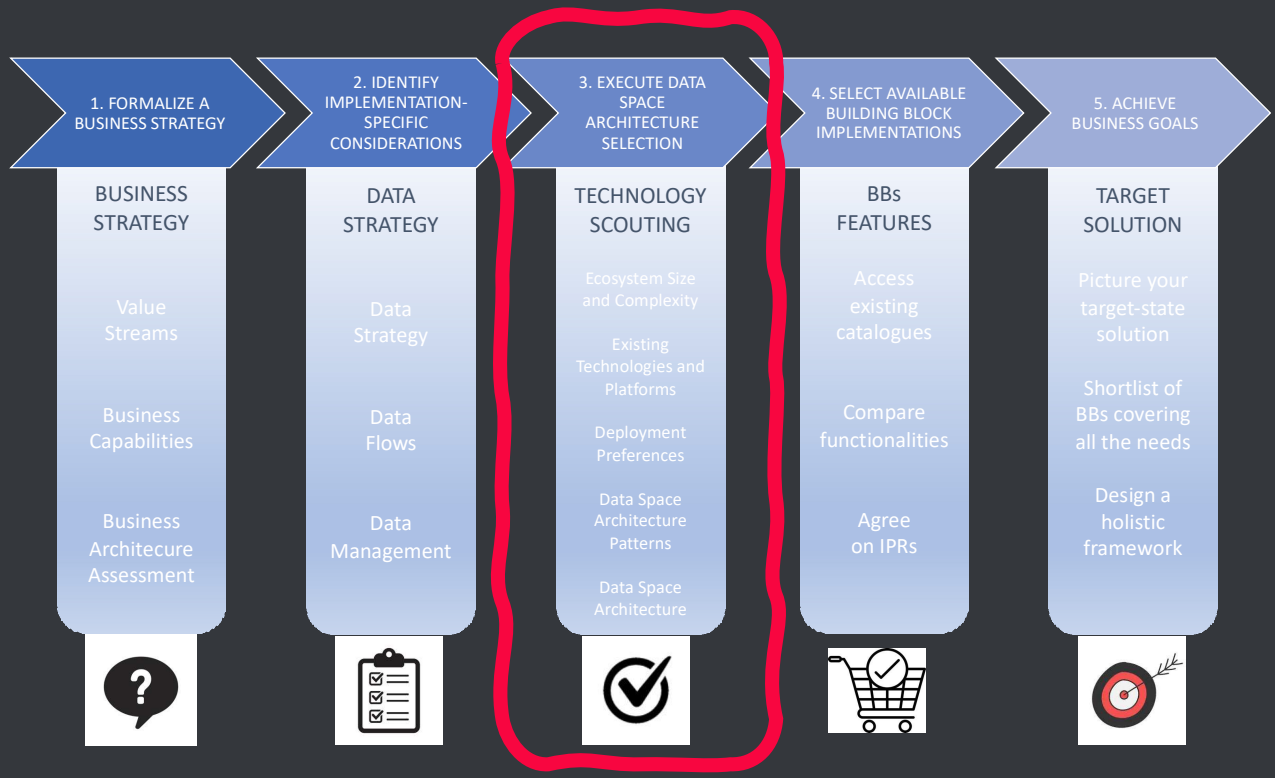


3. Technology Scouting

- MVDS: Develop actors specific data flow exchanges



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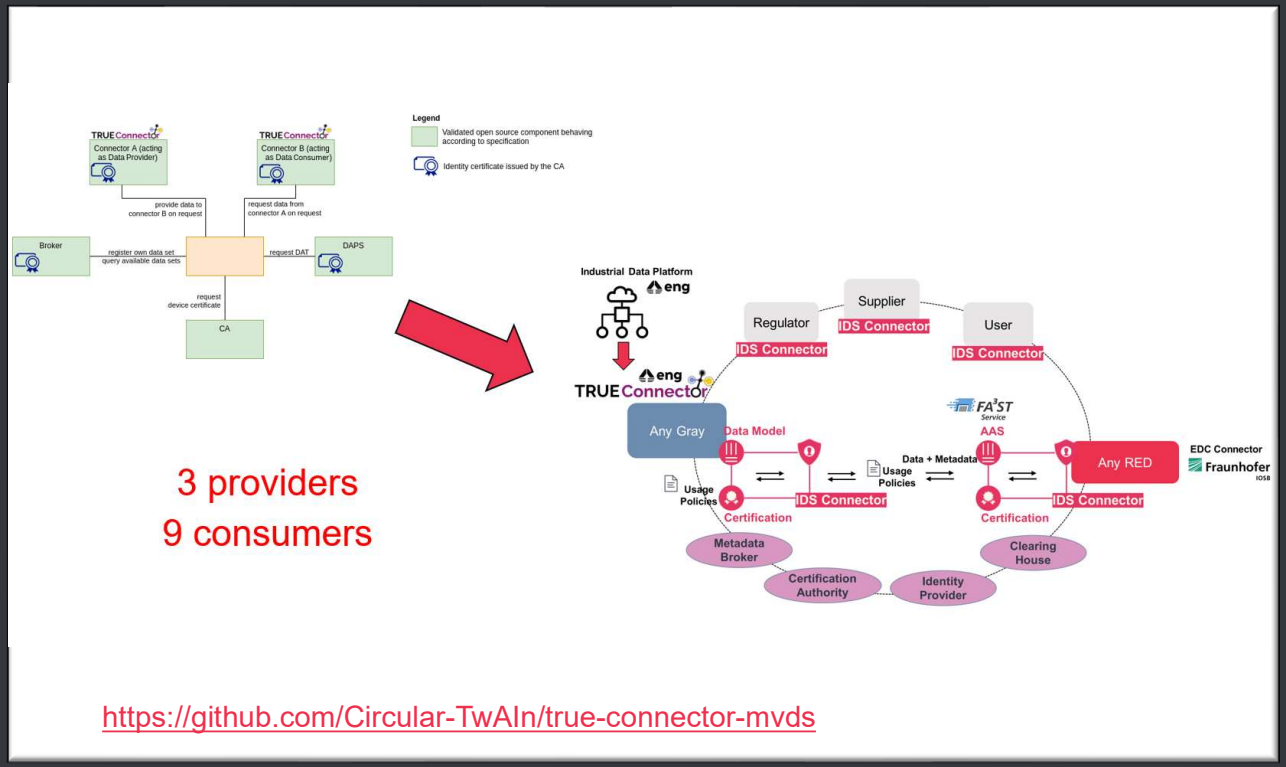
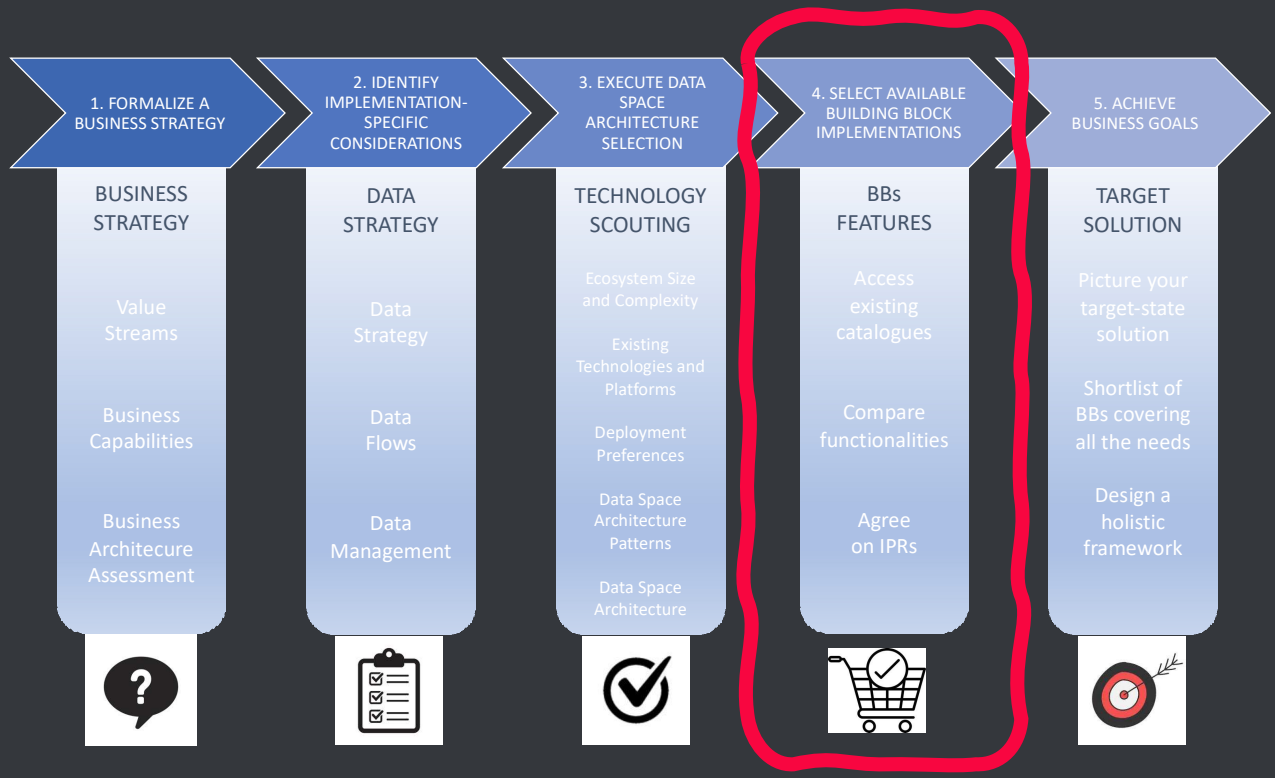


https://github.com/Circular-TwAIn/true-connector-mvds

4. BBs Features

- TC Catalogue Browser
- Modelling DBP 7 Categories



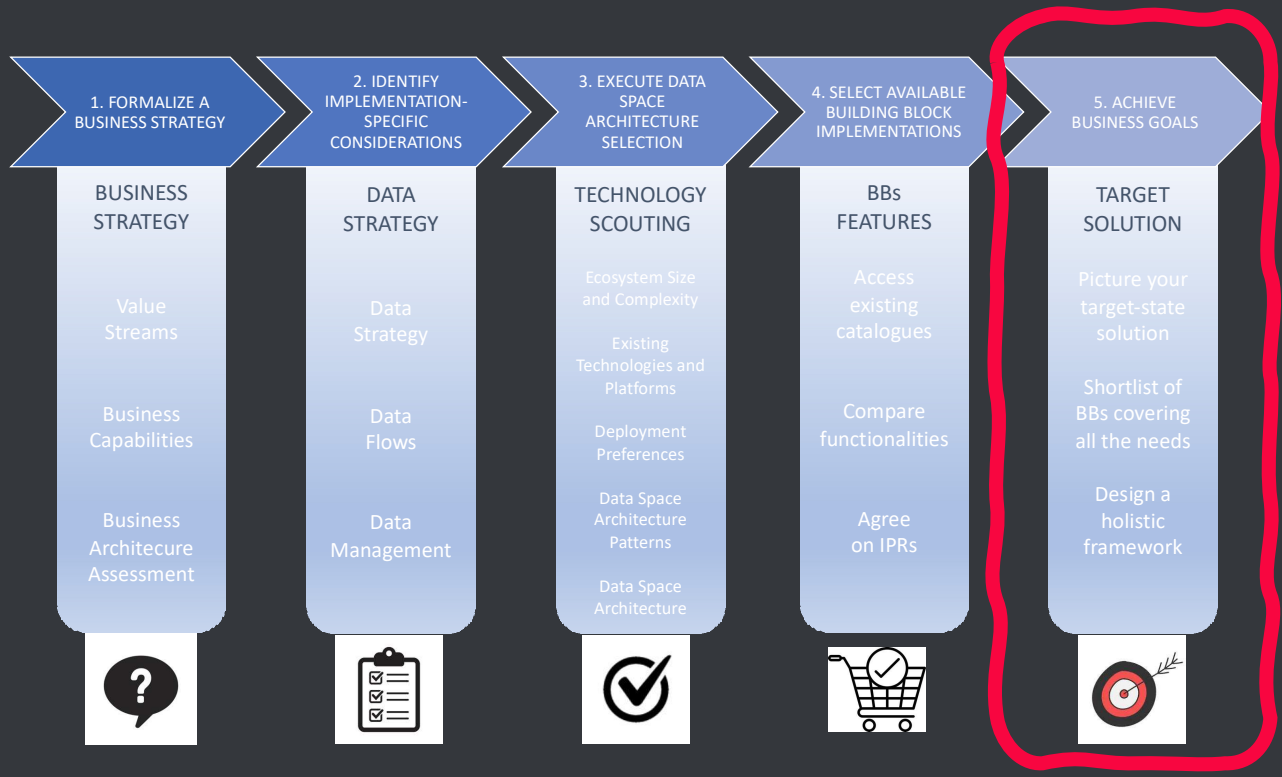
4. BBs Features

- TC Catalogue Browser
- Modelling DBP 7 Categories

Categories	Sub-categories
1: General battery and manufacturer Information	Identification
	General characteristics
2: Compliance, labels & certifications	Conformity
	Symbols
3: Battery materials and composition	Materials
	Substances
4: Carbon footprint	Carbon footprint
5: Supply chain due diligence	Due Diligence Report
	Additional voluntary
6: Circularity and resource efficiency	Design for circularity
	Safety requirements
	Recycled content
	Renewable content
	End-of-Life information
7: Performance and durability	Capacity, energy, SoH & voltage
	Power capability
	Round trip energy efficiency & self-discharge
	Internal resistance
	Battery lifetime
	Temperature conditions
	Negative events

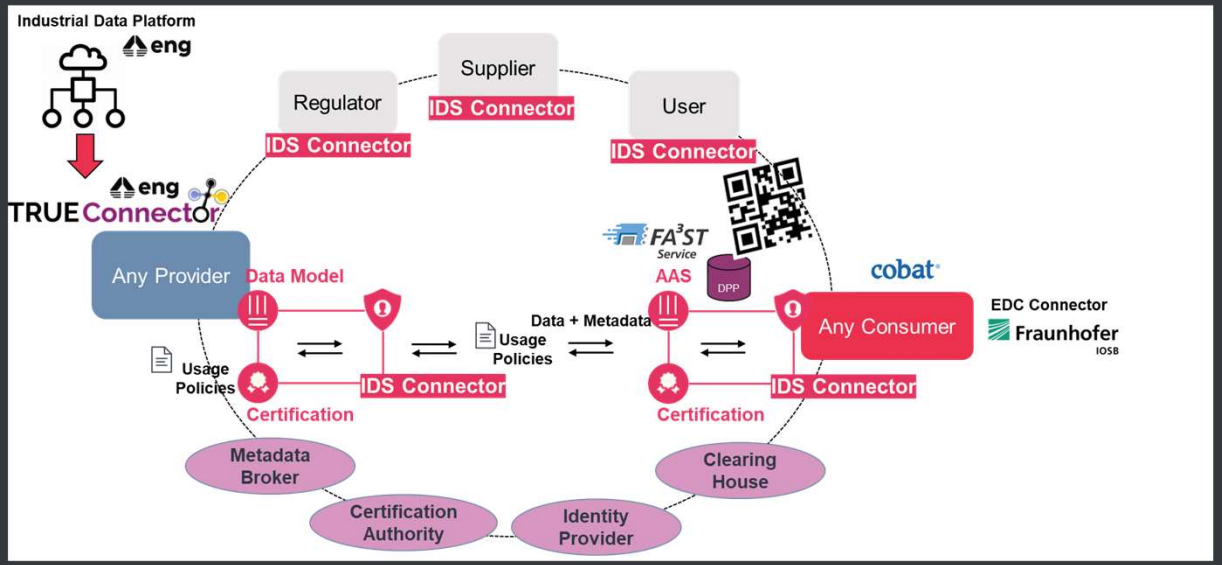
5. Target Solution

- Circular Data Space for Battery Pilot



5. Target Solution

- Circular Data Space for Battery Pilot

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