# Project Vision

Bruxelles, May-8th-2024

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Funded by the European Union

AUTO-TWIN GA n. 101092021

# Agenda

The Context

The Concept

The Methodology

The Work Plan

The Result

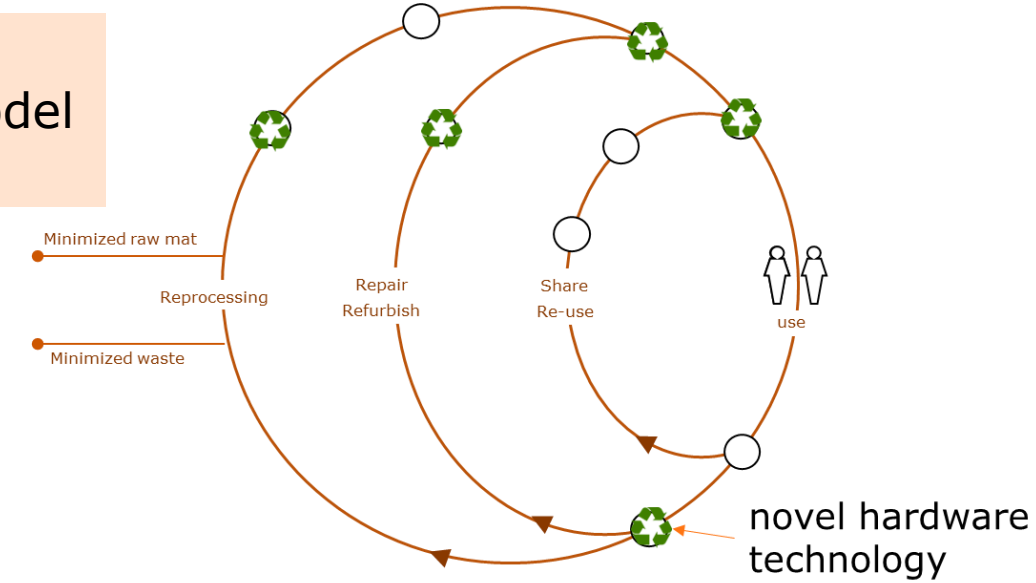
The Consortium

auto twin

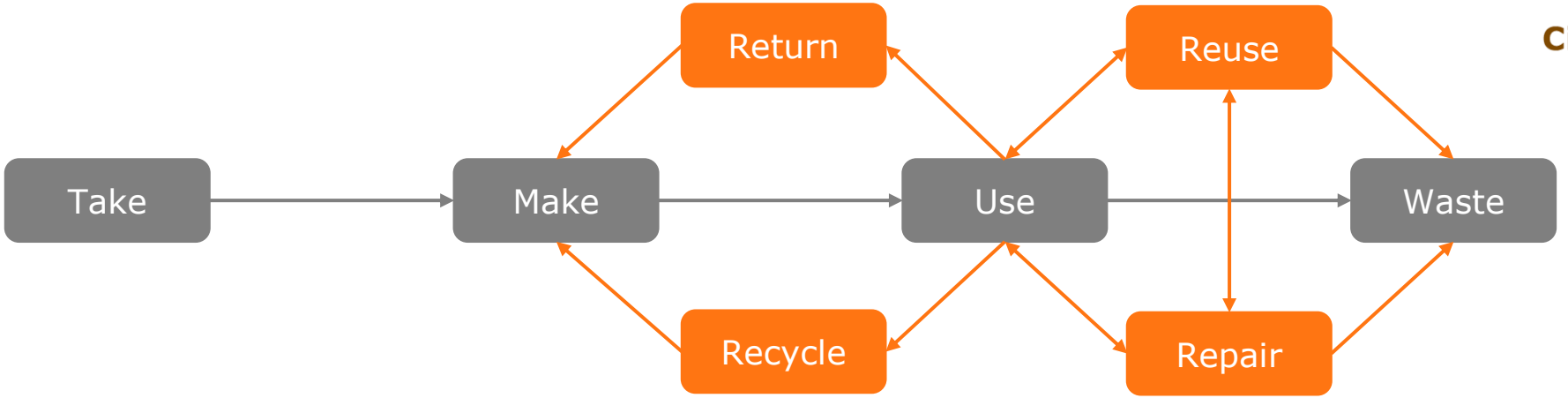
# The Context

# Context: from linear to circular

Evolution from the traditional **Take-Make-Use-Waste** model




**Circular value chain**



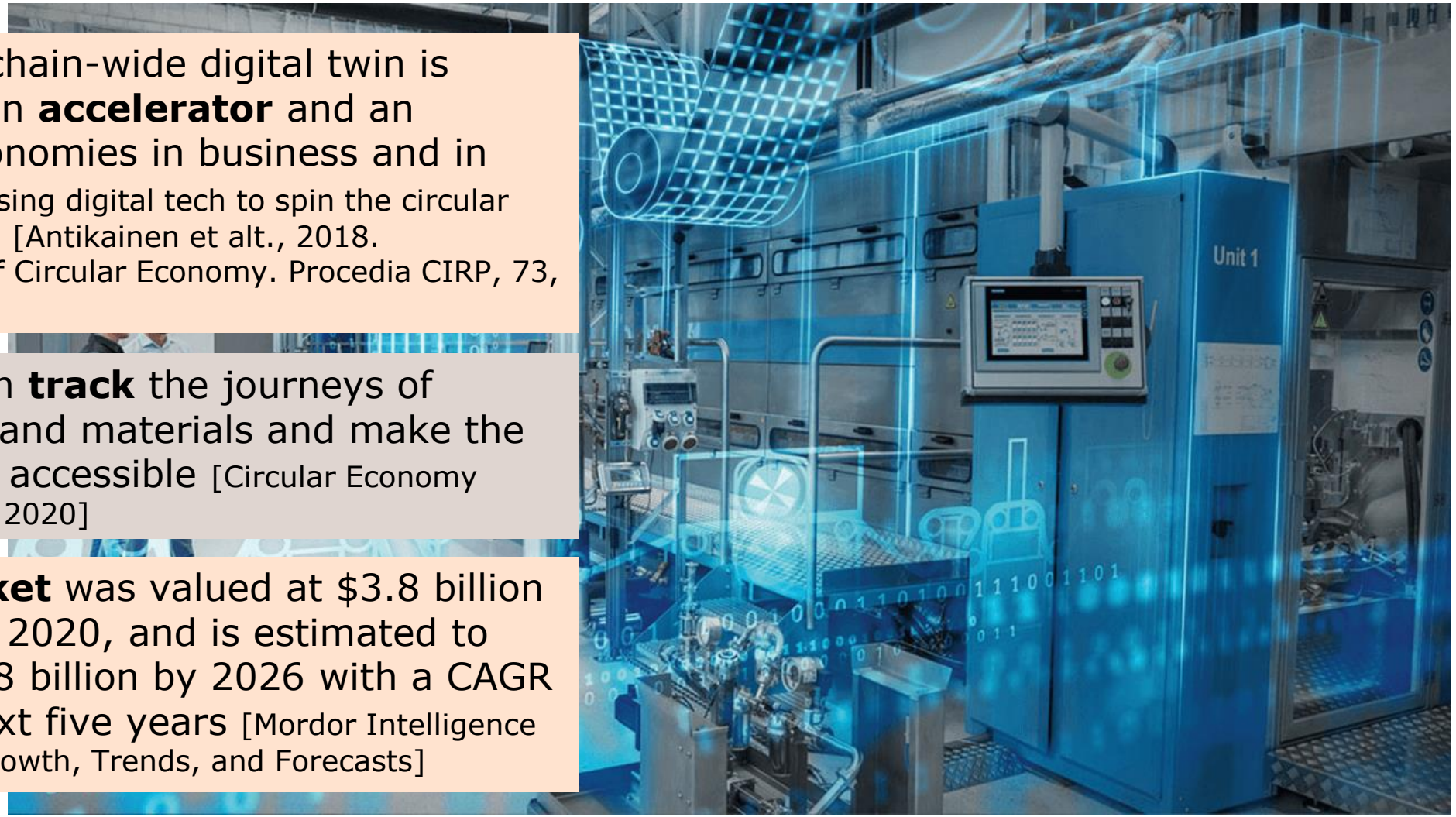

The World Bank. 2022. Squaring the circle: policies from Europe's Circular Economy Transition

# Context: digital twin as business accelerator

A fully-circular, value-chain-wide digital twin is largely recognized as an **accelerator** and an **enabler** of circular economies in business and in production [Lacy, 2015. Using digital tech to spin the circular economy. Accenture Outlook] [Antikainen et alt., 2018. Digitalisation as an Enabler of Circular Economy. Procedia CIRP, 73, 45-49]

Digital technologies can **track** the journeys of products, components and materials and make the resulting data securely accessible [Circular Economy Action Plan, European Union, 2020]

The **digital twin market** was valued at $3.8 billion in 2019, $7.5 billion in 2020, and is estimated to reach a value of $46.08 billion by 2026 with a CAGR of 34.48% over the next five years [Mordor Intelligence 2022, Digital Twin Market, Growth, Trends, and Forecasts]

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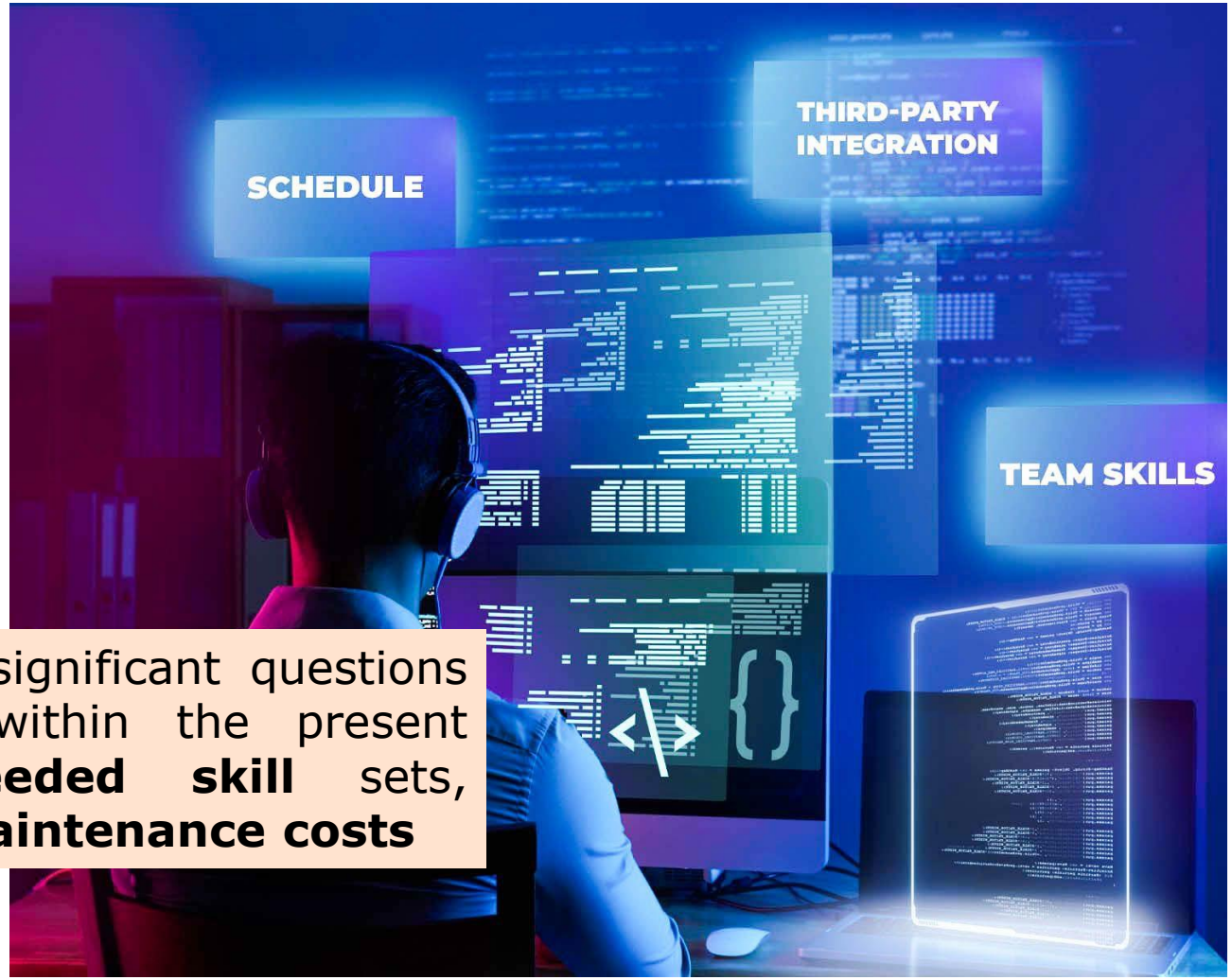
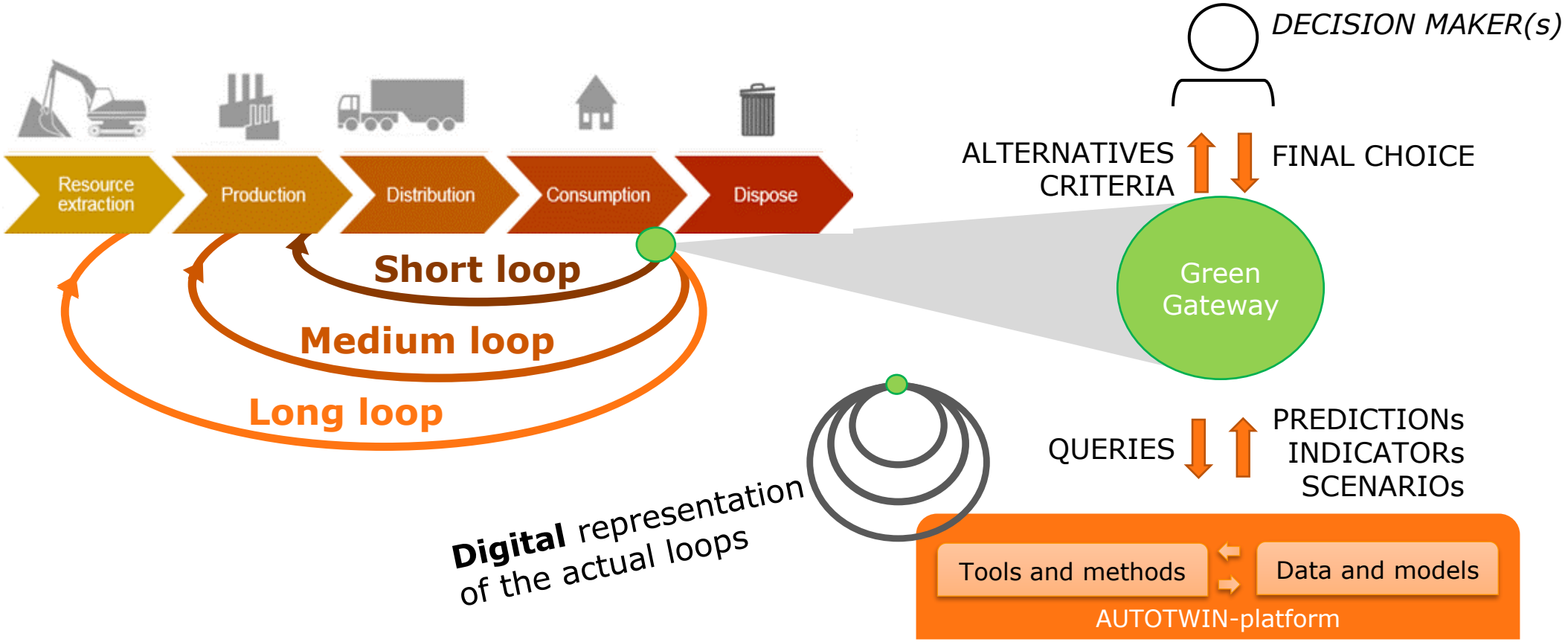
# Context: digital twin is not the simplest technology



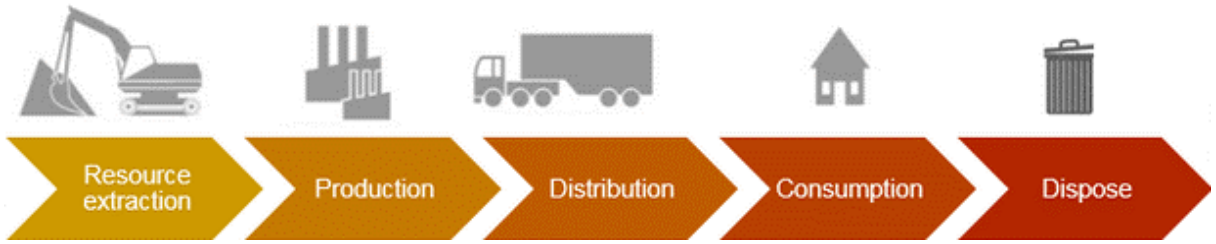

The pivotal role of DT raises significant questions related to its development within the present technological framework, **needed skill** sets, **implementation costs**, and **maintenance costs**

# The Concept

# The Green Gateway in AUTOTWIN



# Pilots: PET Endless Recycling




Feedstock

virgin PET

RECYCLE

PCPW

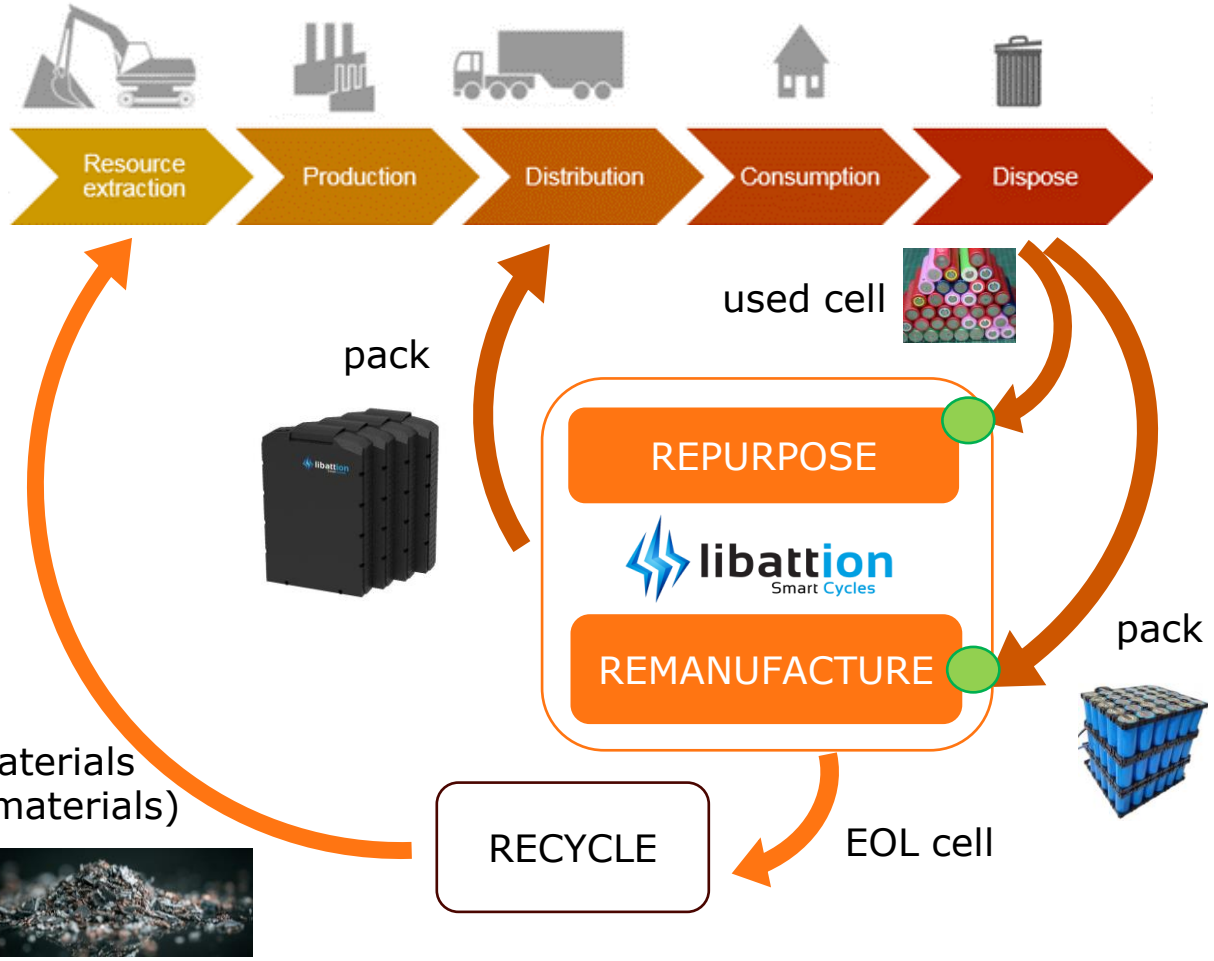
Advanced data-driven models are needed to capture the **process interactions** within the plant and to operate the plant at best

The semi-batch nature of the **chemical process** challenges current model discovering techniques as well as predictive capabilities of DT

Product impact assessment and **digital passport** are key to assure valuable upgrade of the recycled material flow

The hardware technology is the reactor enabling transformation of plastic into virgin PET

# Pilots: Battery Cloud Platform





Actual **state of charge** of batteries and related **residual life** is difficult to be predicted and affects significantly the performance of eBricks

Constantly **updated data** about eBricks usage are a key lever for the creation of a product DT supporting operative decisions (collection, repurpose, ...)

Product impact assessment and **digital passport** are key to assure valuable upgrade of the material flow

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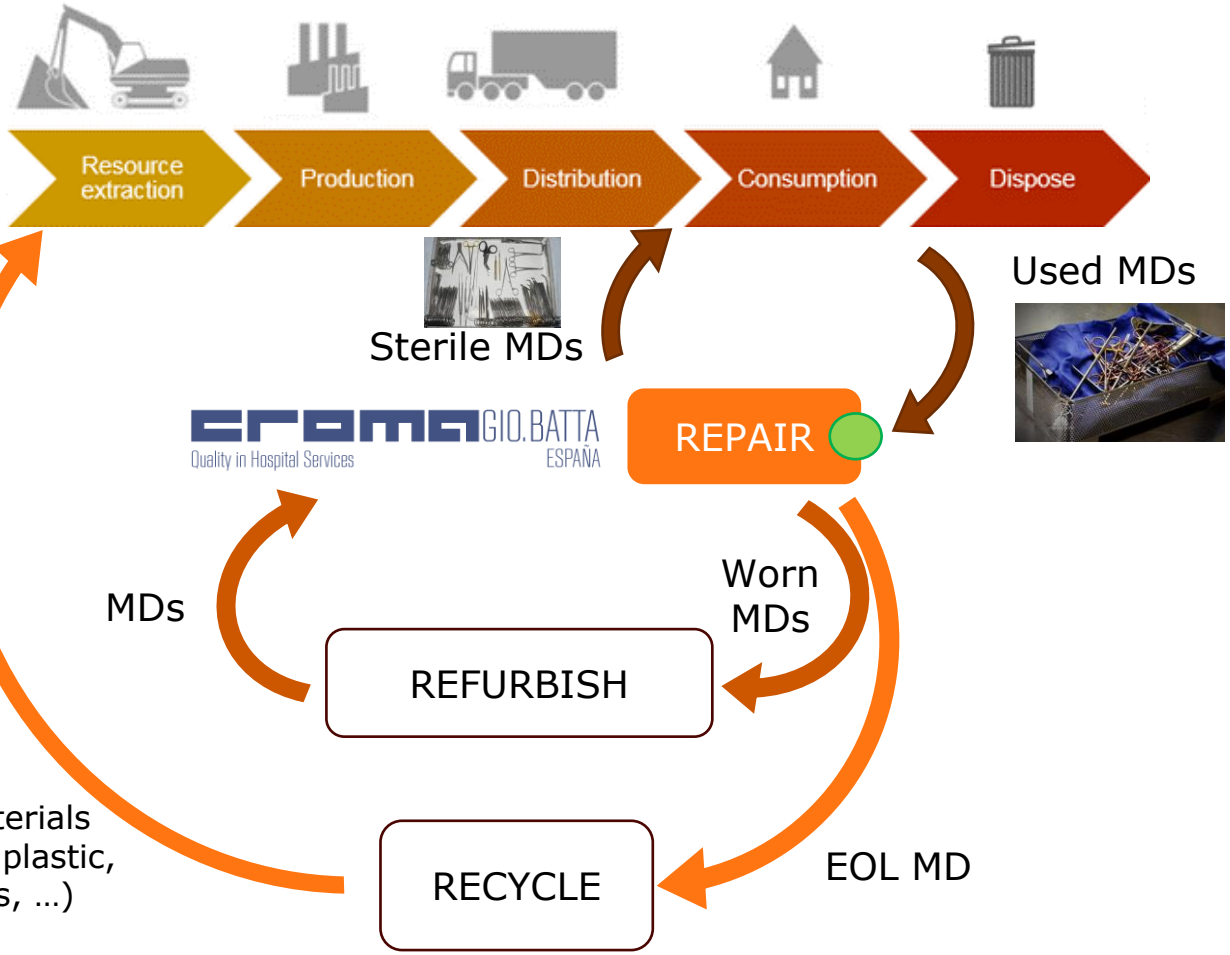
The hardware technology is the life-prediction tool enabling the decision of the next phase of the battery cycle

# Pilots: Sterilization Process




The sterilization center management requires accurate performance predictions to **improve resource and operator workload**

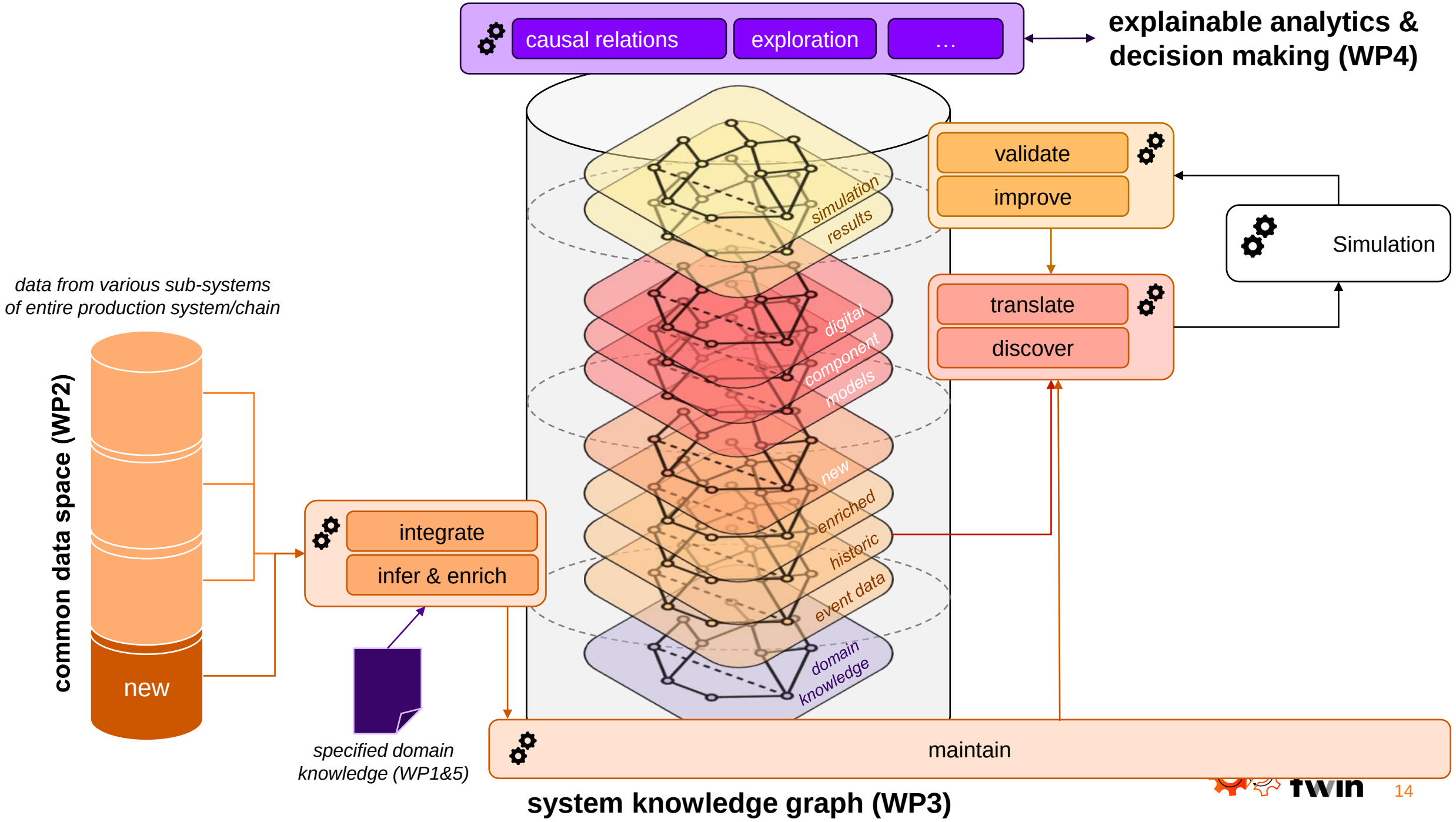
The large product mix, the highly **manual** nature of processes, and the numerous constraints, given also a large data variety, are arduous to model

The hospital and the center are **closely connected** so that operation management decisions might significantly impact on each other performance

The hardware technology is the sterilization enabling reconditioning of medical devices

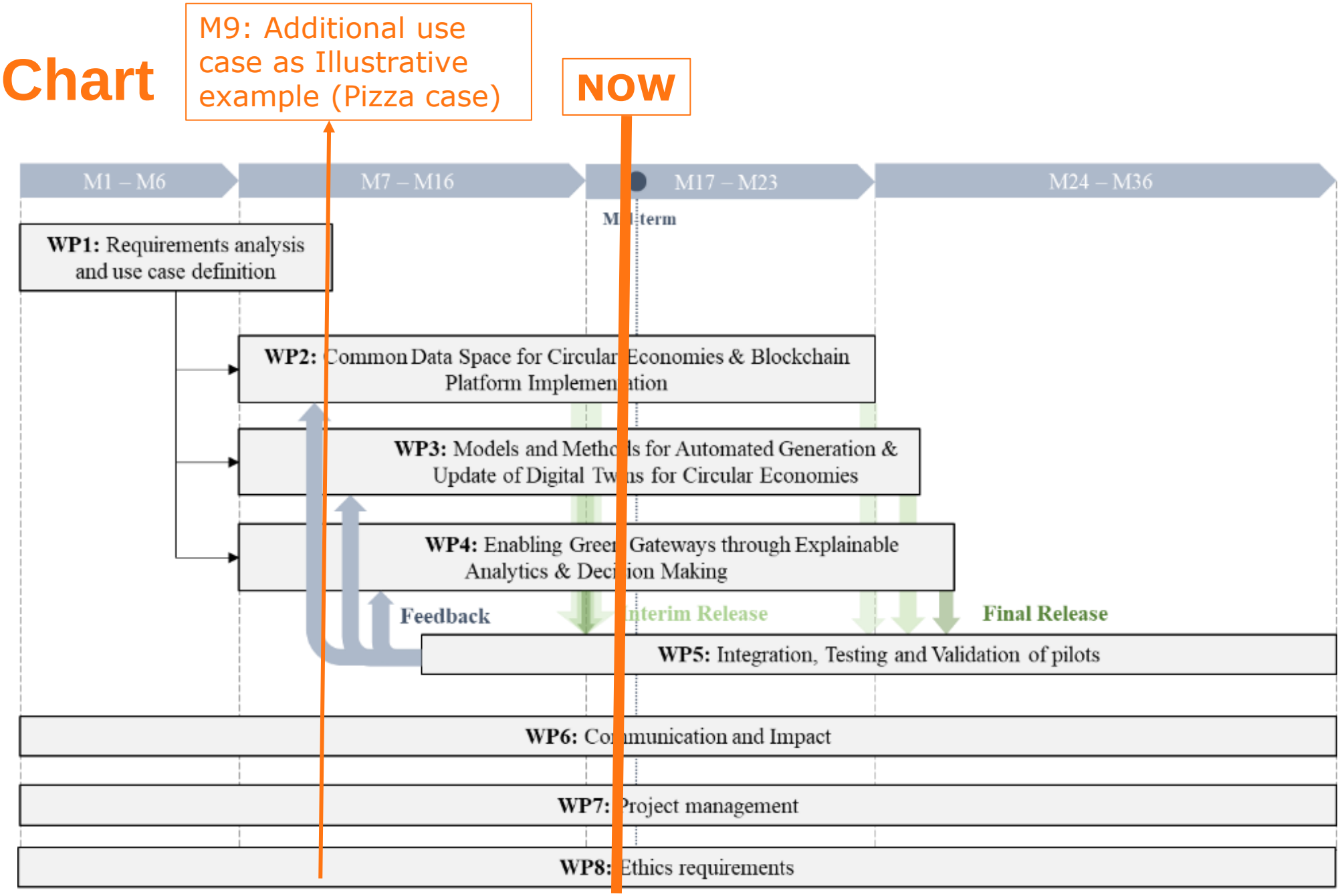
# The Methodology

# Auto-Twin Platform


causal relations
exploration
…
explainable analytics & decision making (WP4)
validate
improve
Simulation
translate
discover
simulation results
digital component models
new
enriched
historic
event data
domain knowledge
data from various sub-systems of entire production system/chain
common data space (WP2)
new
integrate
infer & enrich
specified domain knowledge (WP1&5)
maintain
system knowledge graph (WP3)

# The Work Plan

# Pert Chart


M9: Additional use case as Illustrative example (Pizza case)
NOW
M1 – M6
M7 – M16
M17 – M23
M24 – M36
WP1: Requirements analysis and use case definition
WP2: Common Data Space for Circular Economies & Blockchain Platform Implementation
WP3: Models and Methods for Automated Generation & Update of Digital Twins for Circular Economies
WP4: Enabling Green Gateways through Explainable Analytics & Decision Making
Feedback
Interim Release
Final Release
WP5: Integration, Testing and Validation of pilots
WP6: Communication and Impact
WP7: Project management
WP8: Ethics requirements

# The Result

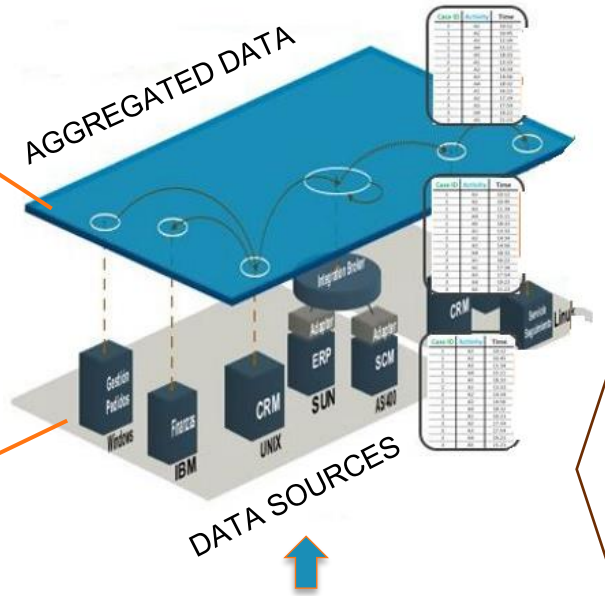
# Automated Generation & Validation

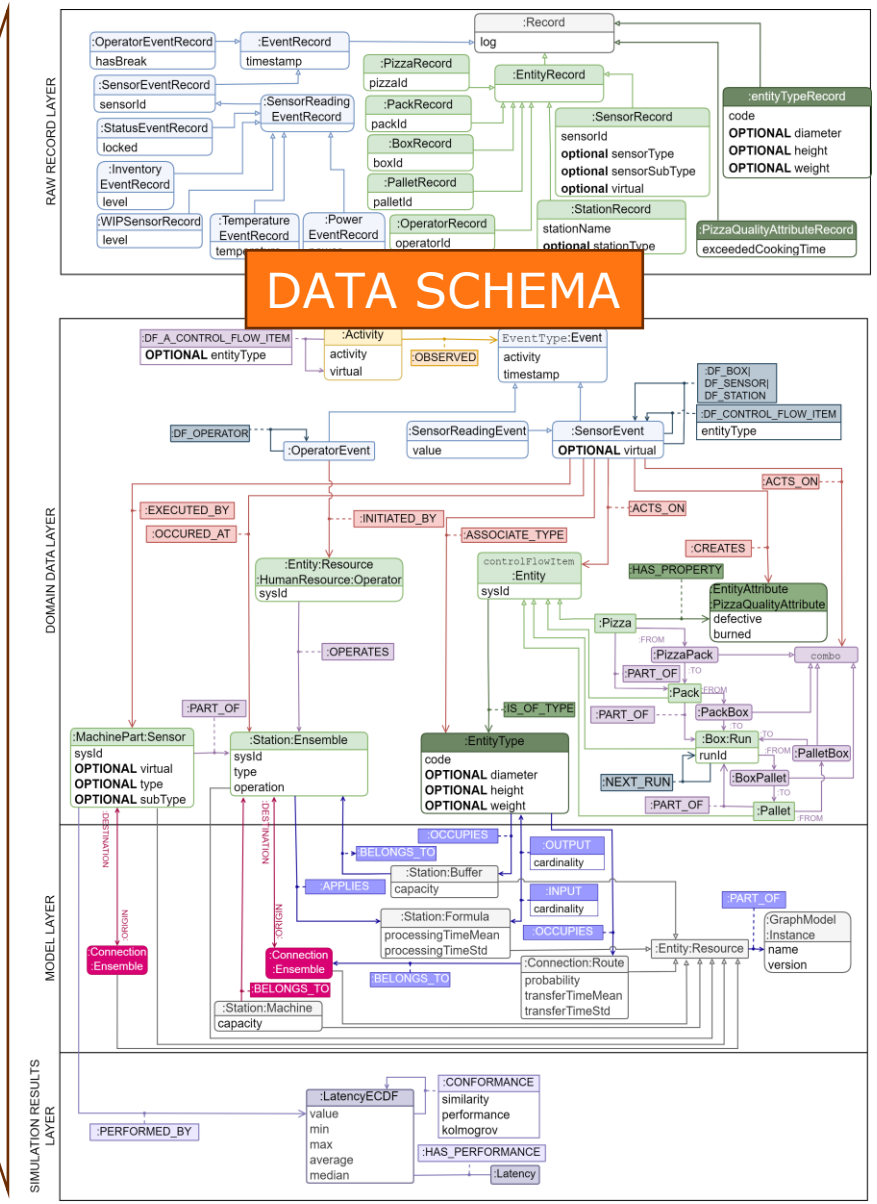
## system mining approach as enabler for Automated Model Generation

Data are manipulated for system mining purpose

Data are collected by sensors

Physical system is operating

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# Automated Generation & Validation

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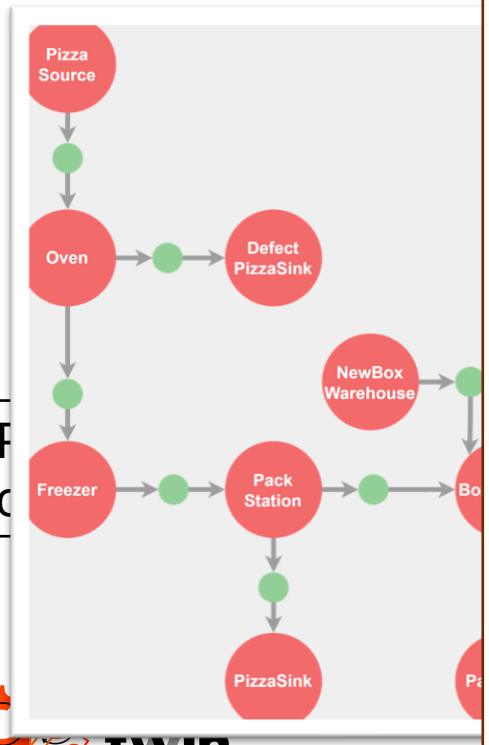


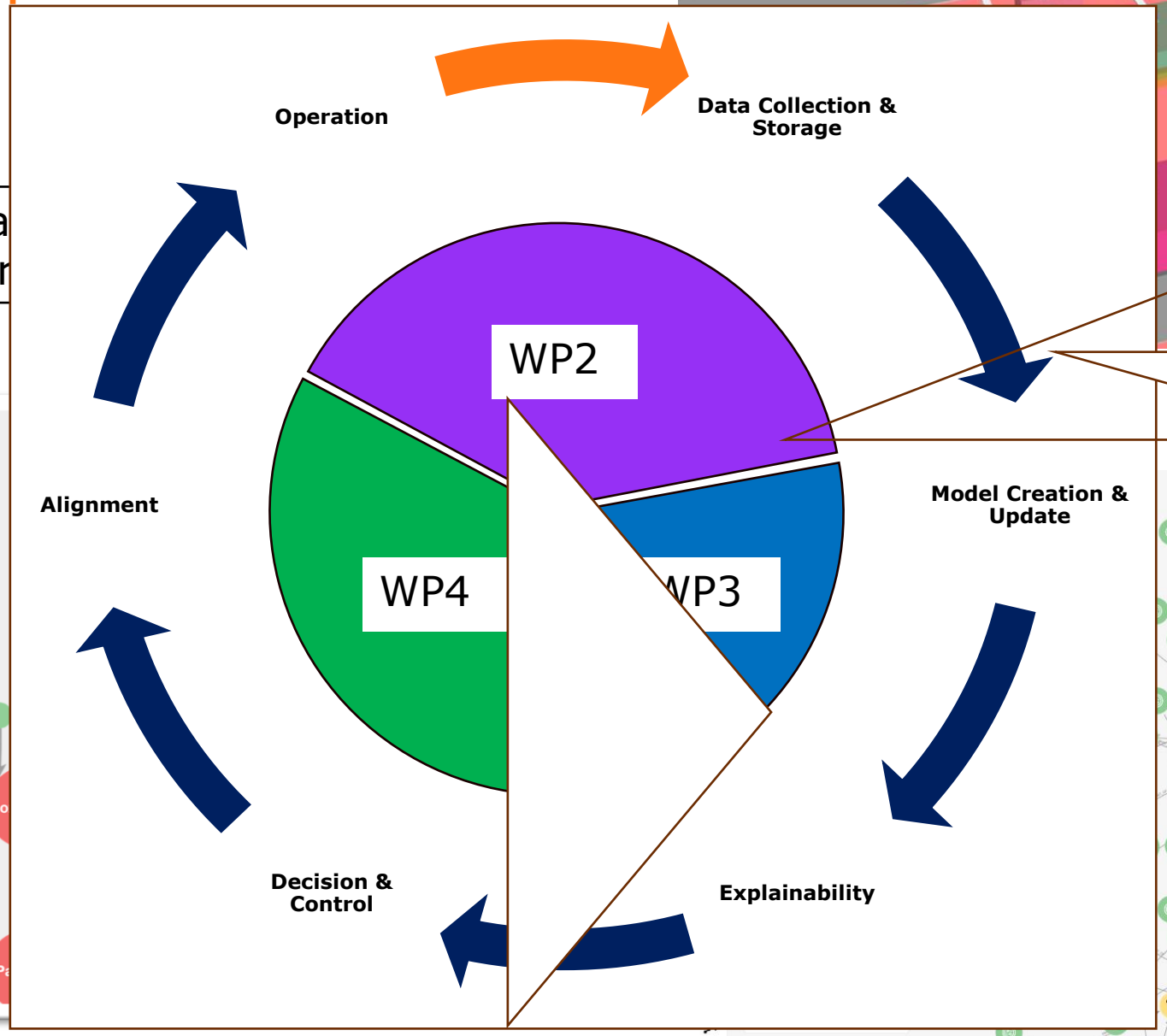


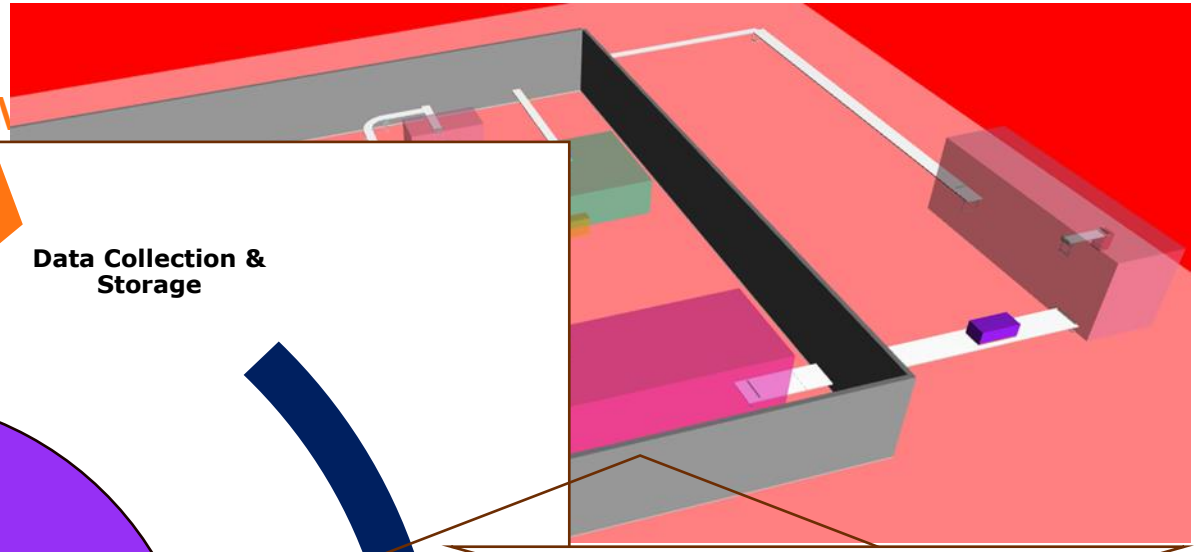

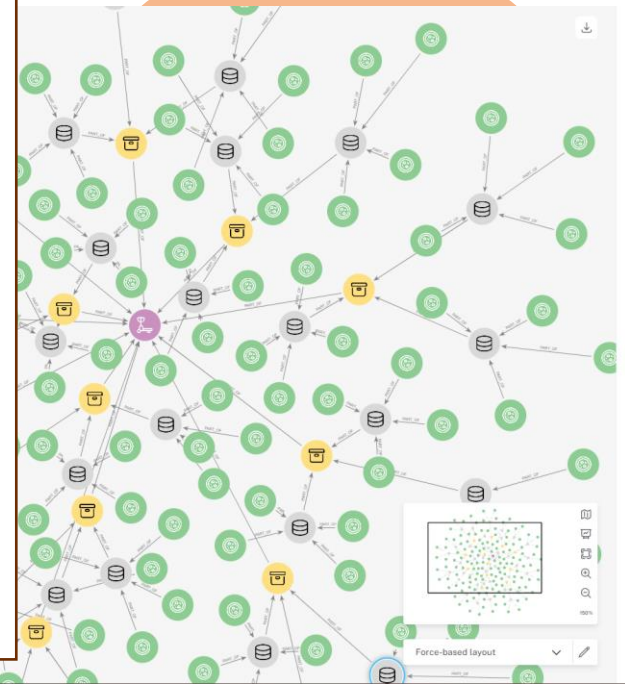

twin

# The Consortium

# Consortium

**Italy**

POLITECNICO MILANO 1863

Technology Transfer System

ERREQUADRO

**Greece**

core|IC

UBITECH ubiquitous solutions

**Spain**

innovalia ASSOCIATION

eurecat

**Turkey**

KOÇ ÜNİVERSİTESİ

**Lithuania**

SYXIS innovate together

**Netherlands**

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

**Switzerland**

grEn

libattion Smart Cycles

**Israel**

IBM

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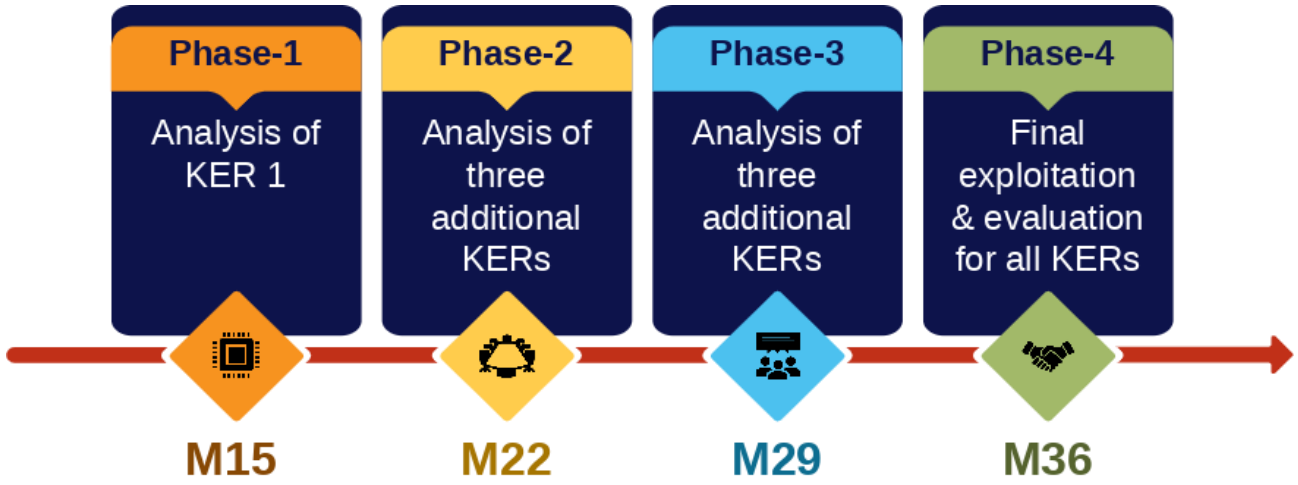
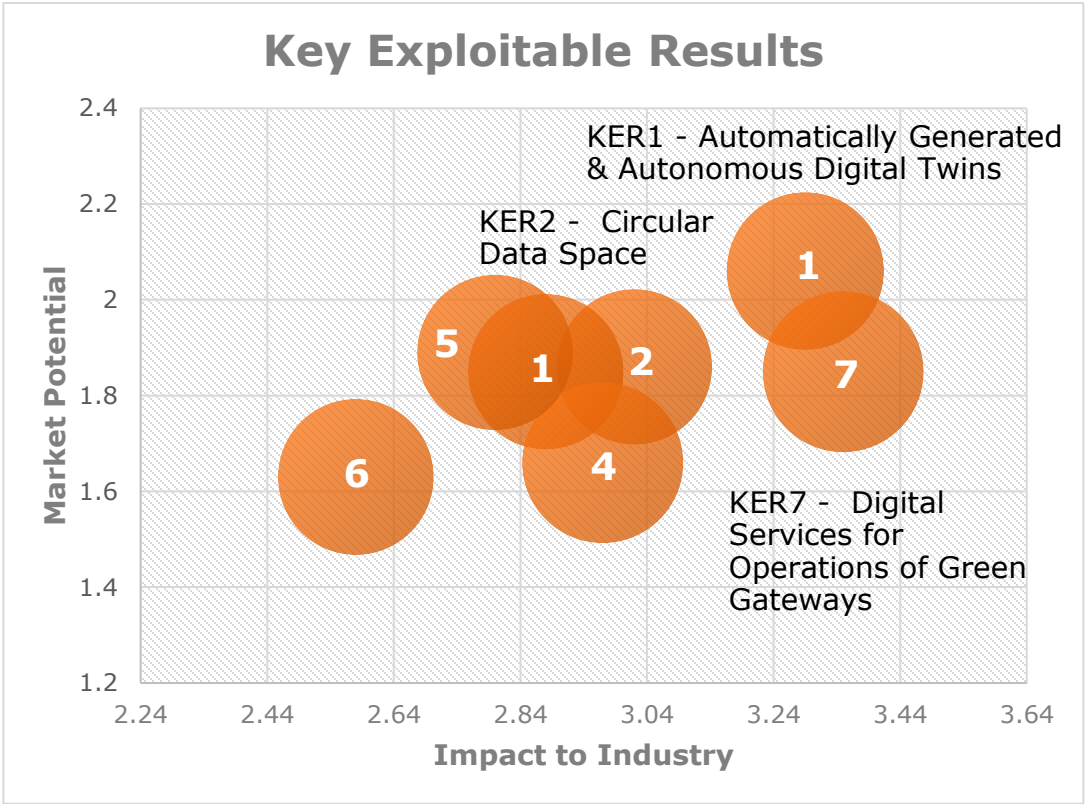
# Conclusion




| Key Exploitable Results |
|---|
| KER1 - Automatically Generated & Autonomous Digital Twins |
| KER2 - Circular Data Space |
| KER3 - Circular Digital Thread |
| KER4 - Digital Product Passport |
| KER5 - Situation Aware Data Enrichment & Explainability Techniques |
| KER6 - Reducing skills and knowledge gap and empowering humans through AI |
| KER7 - Digital Services for Operations of Green Gateways |




HORIZON RESULTS BOOSTER

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# Project essentials


| Feature | Value |
|---|---|
| Call | HORIZON-CL4-2022-TWIN-TRANSITION-01 |
| Type | HORIZON-RIA |
| Proposal number | 101092021 |
| Number of consortium members | 13 |
| Countries involved | 8 |
| Start date | Dec-01-2022 |
| Duration | 36 months |
| Total effort | 7,260 keuro -> 867 person months |
| Total eligible costs | 7,260 kEuro |
| Requested total EU funding | 6,000 kEuro |
| Deliverables | 22 |
| Milestones | 10 |
| Key Exploitable Results | 7 |
| Product value chains | EV Batteries, Medical devices, Plastic |

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Funded by the European Union

# Thank you

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SYXIS innovate together

Technology Transfer System

core IC

innovalia ASSOCIATION

croma GIO.BATTA Quality in Hospital Services ESPAÑA

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TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

IBM

UBITECH ubiquitous solutions

ERREQUADRO Research over Research

libattion Smart Cycles

grtn REDUCE, REUSE, RECYCLE