

UPGRADING THE CIRCULAR ECONOMY IN AUTOMOTIVE ENGINEERING



**Sebastien
GAUTIER**

SIMULIA Sales &
Marketing VP

Dassault Systèmes



**Bastien
HILLEN**

CATIA Head of
Strategy & Alliances

Dassault Systèmes



**Prof. Dr.
Günther
SCHUH**

CEO

e.Volution GmbH

Working with Industry Leaders on New Challenges

1 year faster on Car Program lead time
 Continuous product improvement



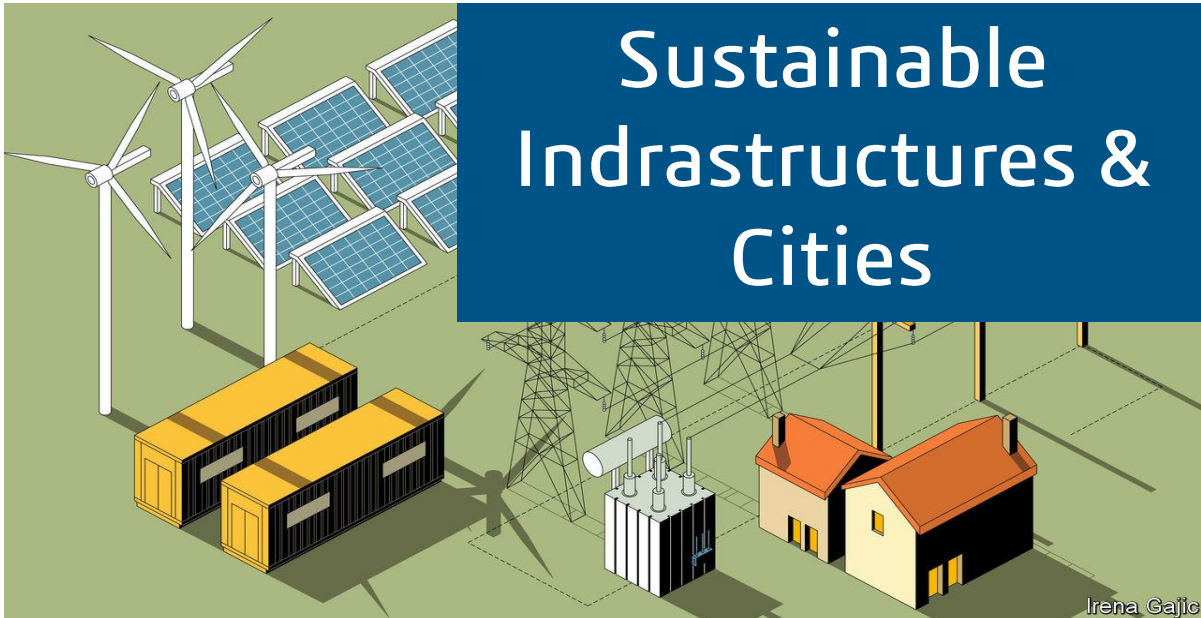
Defense Program affordability vs System Complexity
 Global Collaboration based on Sovereign Cloud



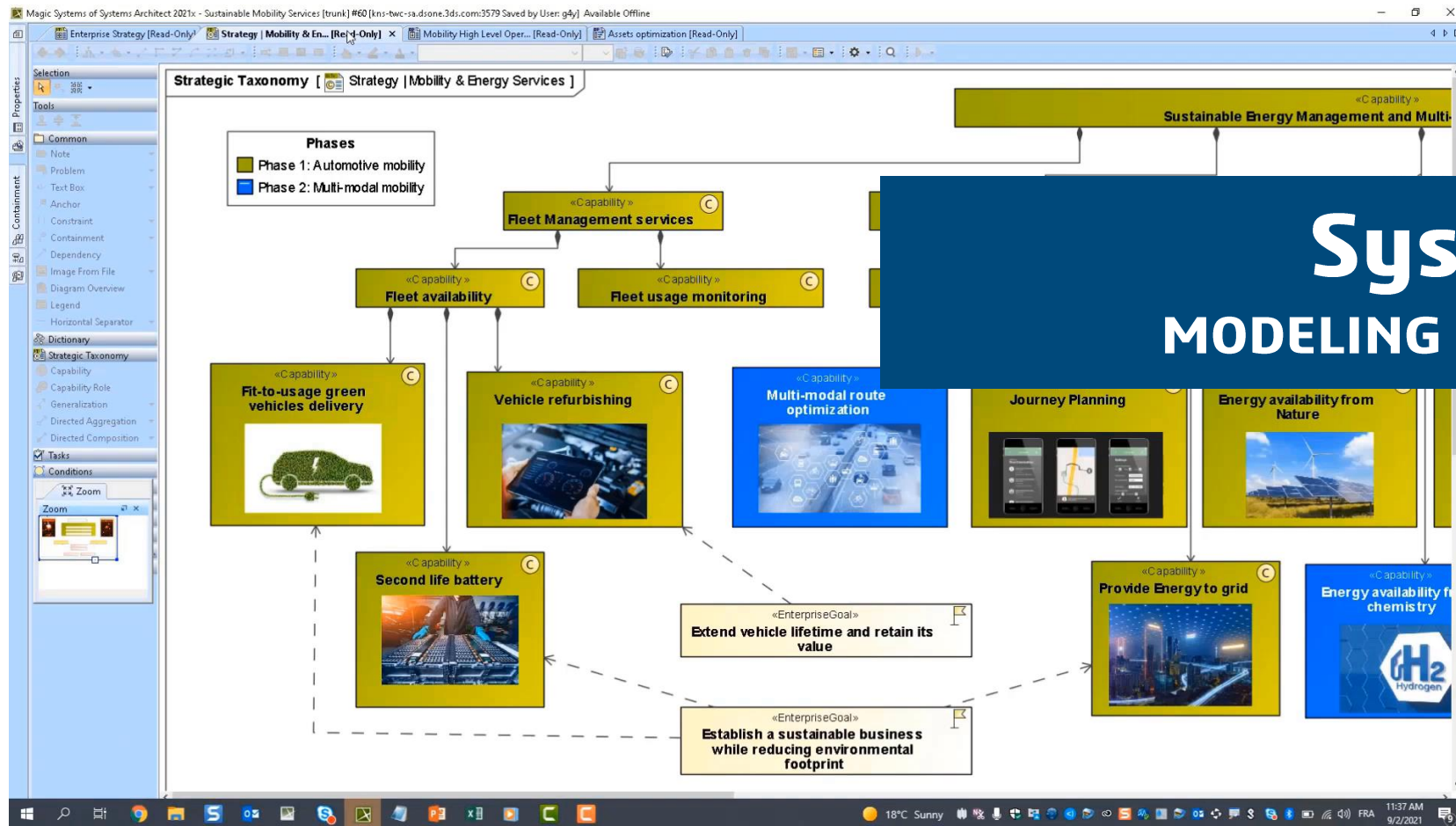
Reduce cost of recalls
 Lead time to Certification



New Infrastructure Virtual Twin (Giga Factories, SMR, Train systems)
 x10 productivity gain thru Modular Infrastructure & Construction



Model & Simulate the Virtual Twin combining Systems & 3D



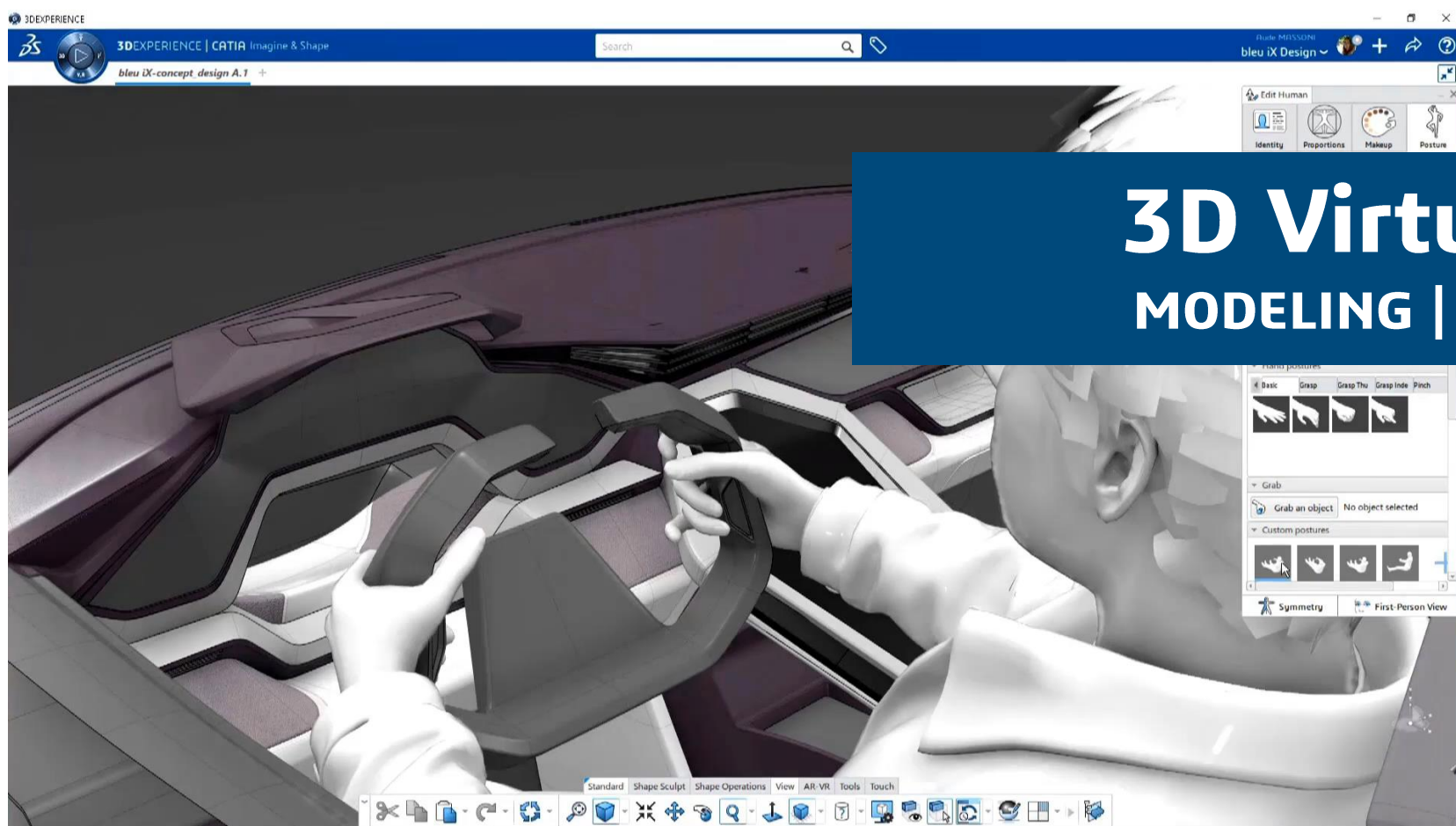
**Systems
MODELING | SIMULATION**

Functional
Requirement
Architecture
Logical Behavior

Enterprise
System of System
System

Net
Diagrams
Electrical
P&ID

CO2
Human Activities
Weight



**3D Virtual Twin
MODELING | SIMULATION**

Algoritmics Solid
Geometry
Surface Lattice

Composite
Materials
Layered Product

Mechanism
Knowledge / Know How
Tolerance & Dimension

Rebars
BIM
Terrain
Civil

... with Virtual Twin Experiences MODSIM + Data Science + Collaboration

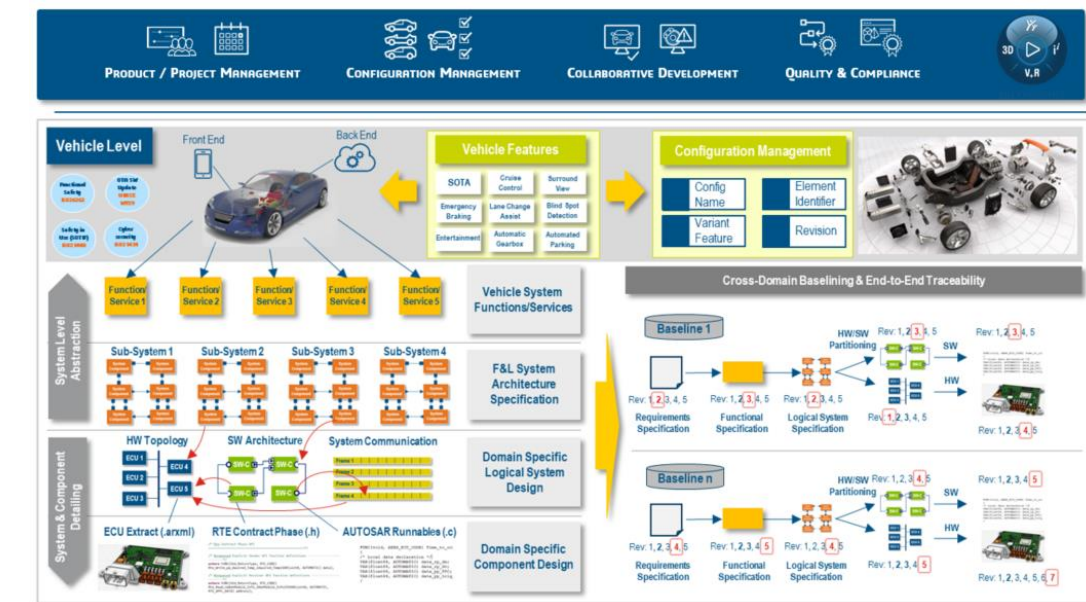
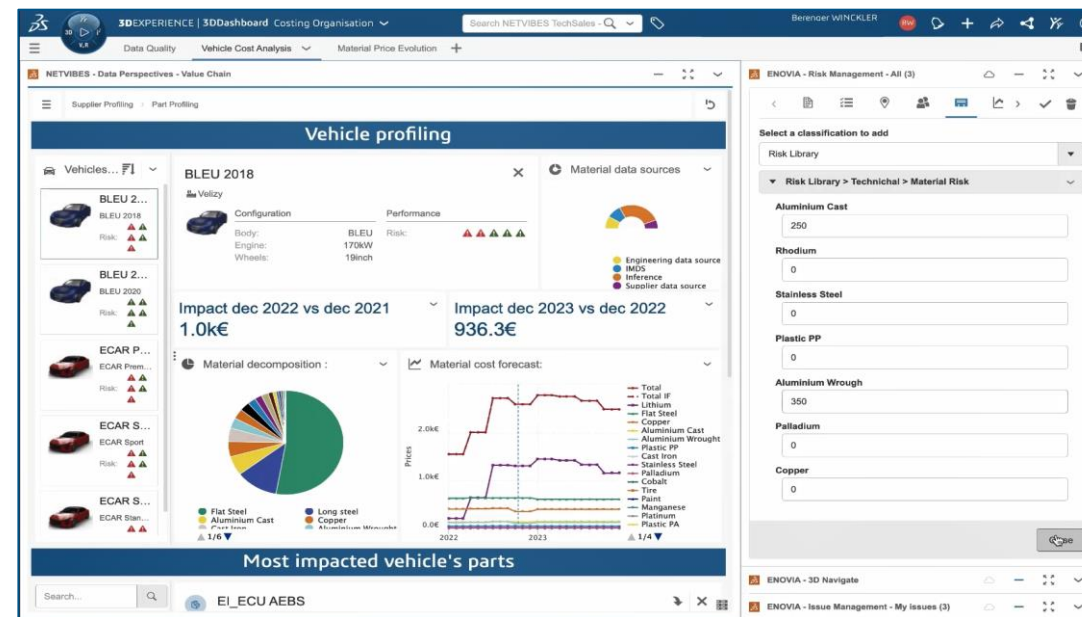


MOD | SIM

DATA SCIENCE
Real World Evidence
BIG DATA & AI

COLLABORATION
Product/Project Management
Configuration Management

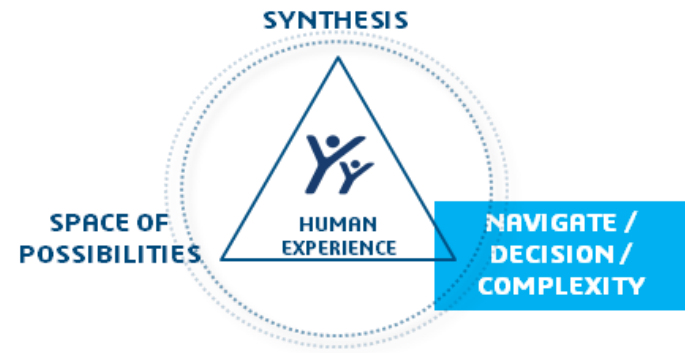
Systems



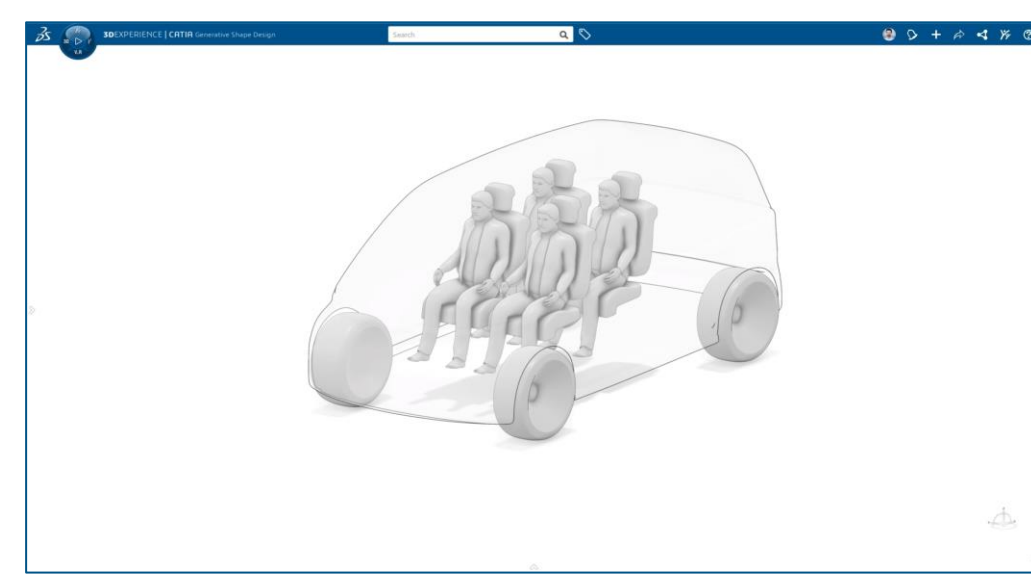
3D



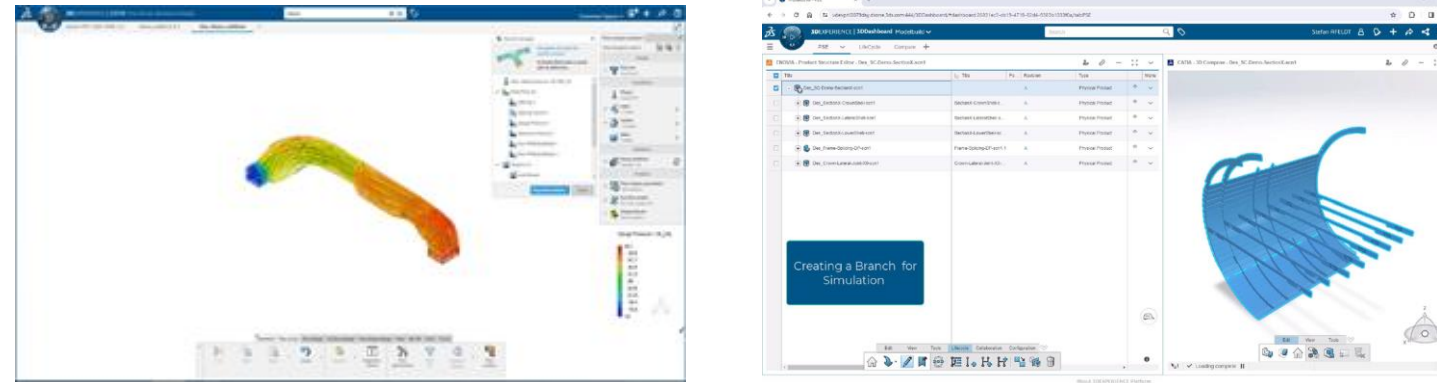
GENERATIVE EXPERIENCES POWERED BY AI



Generative Experiences
With Artificial Intelligence

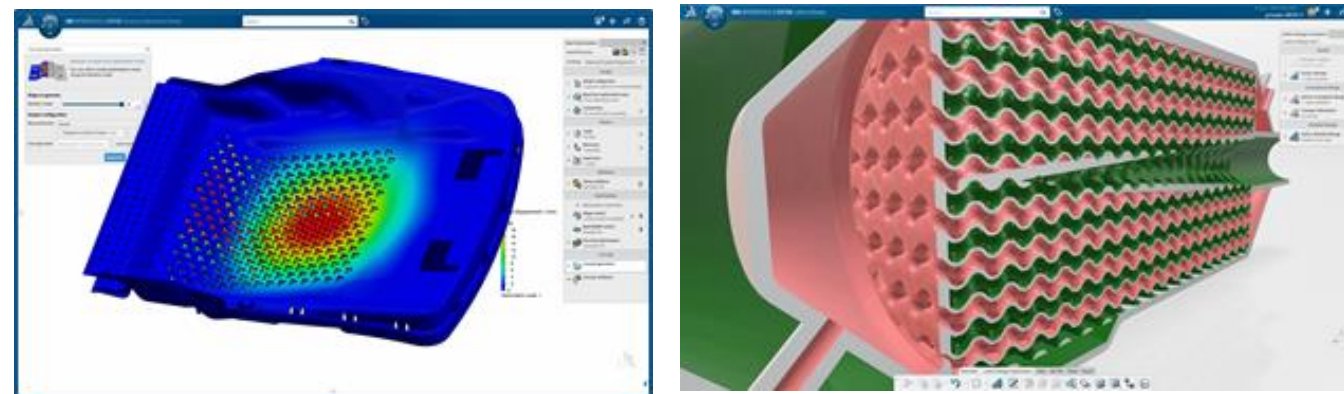


MODSIM



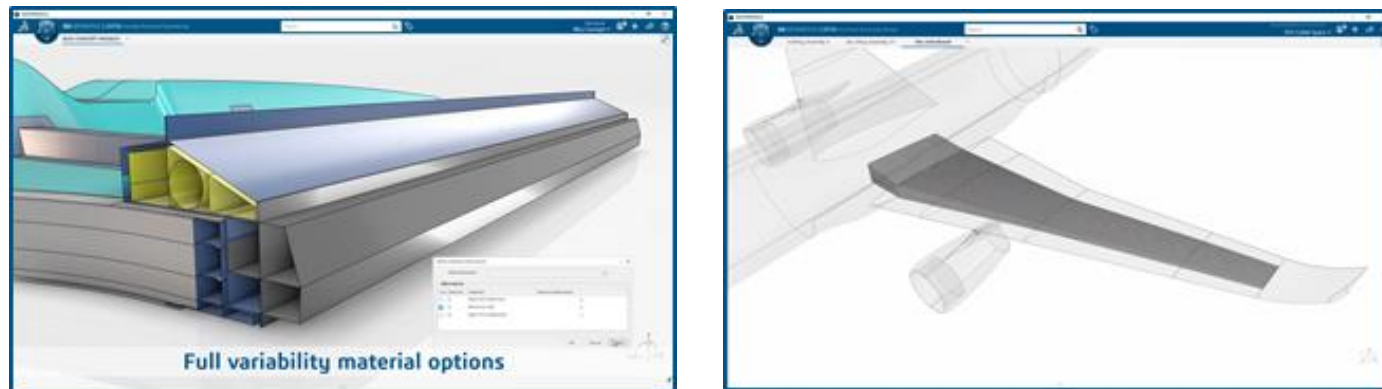
Faster design & validation
with 3DEXPERIENCE
MODSIM

Algorithmic Design



Reach a new level of shape complexity
and reusable designs with Design by
Algorithms

Knowledge-Based Engineering



Dramatically increase
the design space exploration

V4

V5

CATIA V6 /



3DEXPERIENCE

3DEXPERIENCE®
platform



AI Driven GENERATIVE
EXPERIENCES

AI – LEVERAGE KNOWLEDGE KNOW-HOW



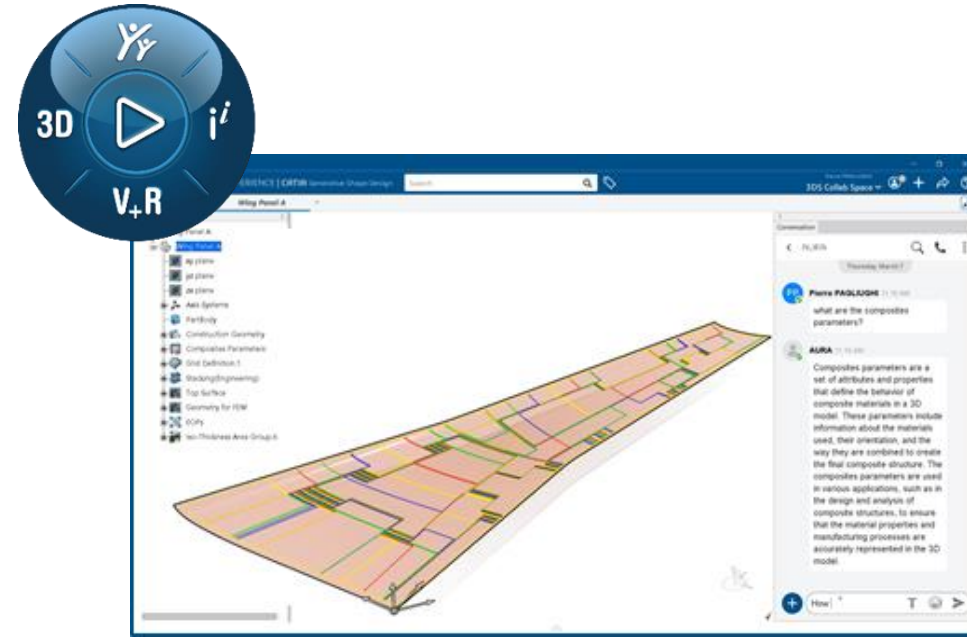
Academic Knowledge & Know How



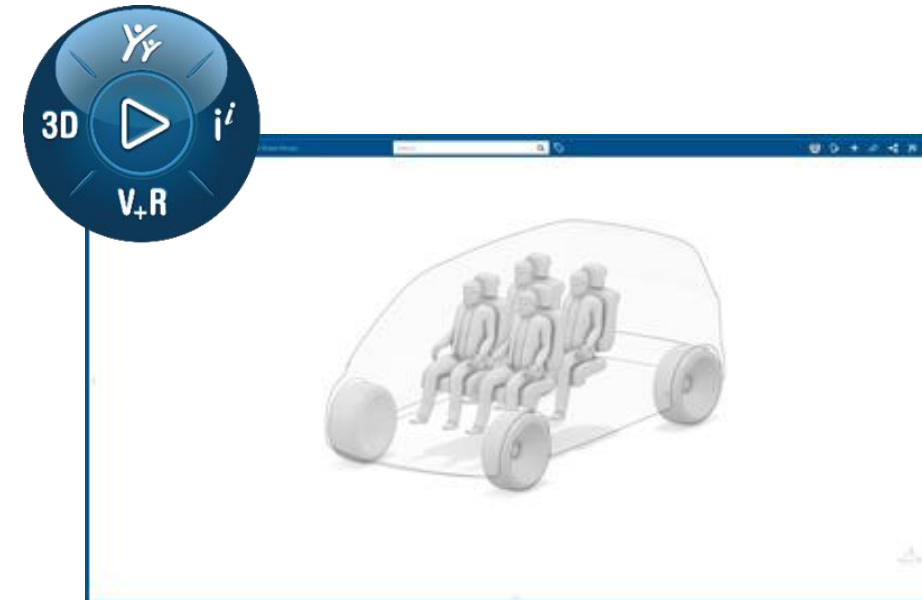
Standards & Regulations



Customer Industrial Corpus

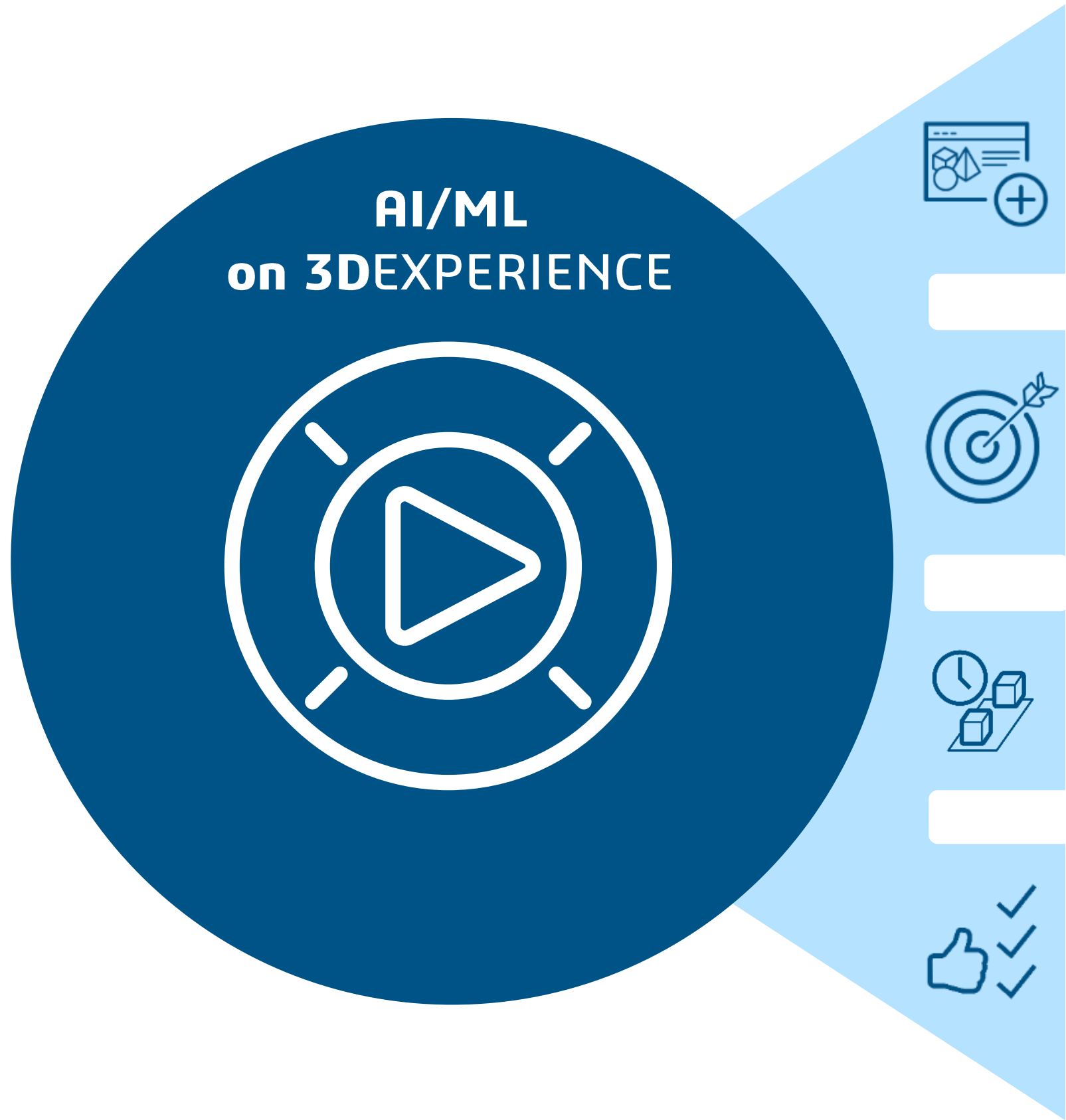


Assist anyone with AI augmented conversational experience



Drive your design with natural language interactions

AI-GUIDED PERFORMANCE DESIGN - BUSINESS VALUES



FULL ASSOCIATIVITY WITH MODSIM

Digital continuity throughout the product development process
Automatic traceability across multidisciplinary data



ASSESS MORE DESIGNS EARLIER

Move from linear design process to analysis in the loop
Democratization of simulation across the enterprise



INCREASE PRODUCT INNOVATION

Expand design space
Make physics-driven decision to optimize the design

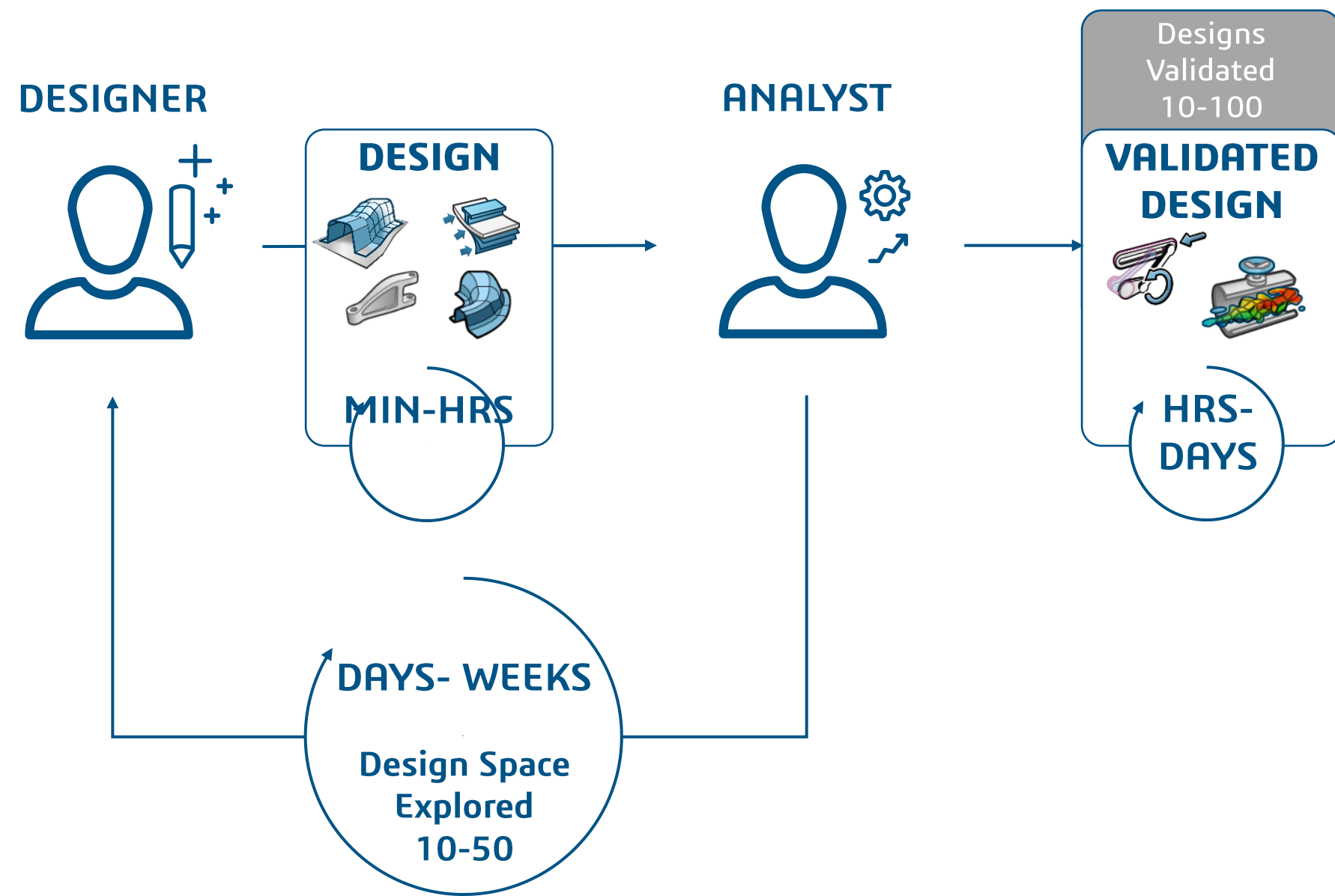


ACCELERATE DESIGN DECISIONS WITH MACHINE LEARNING

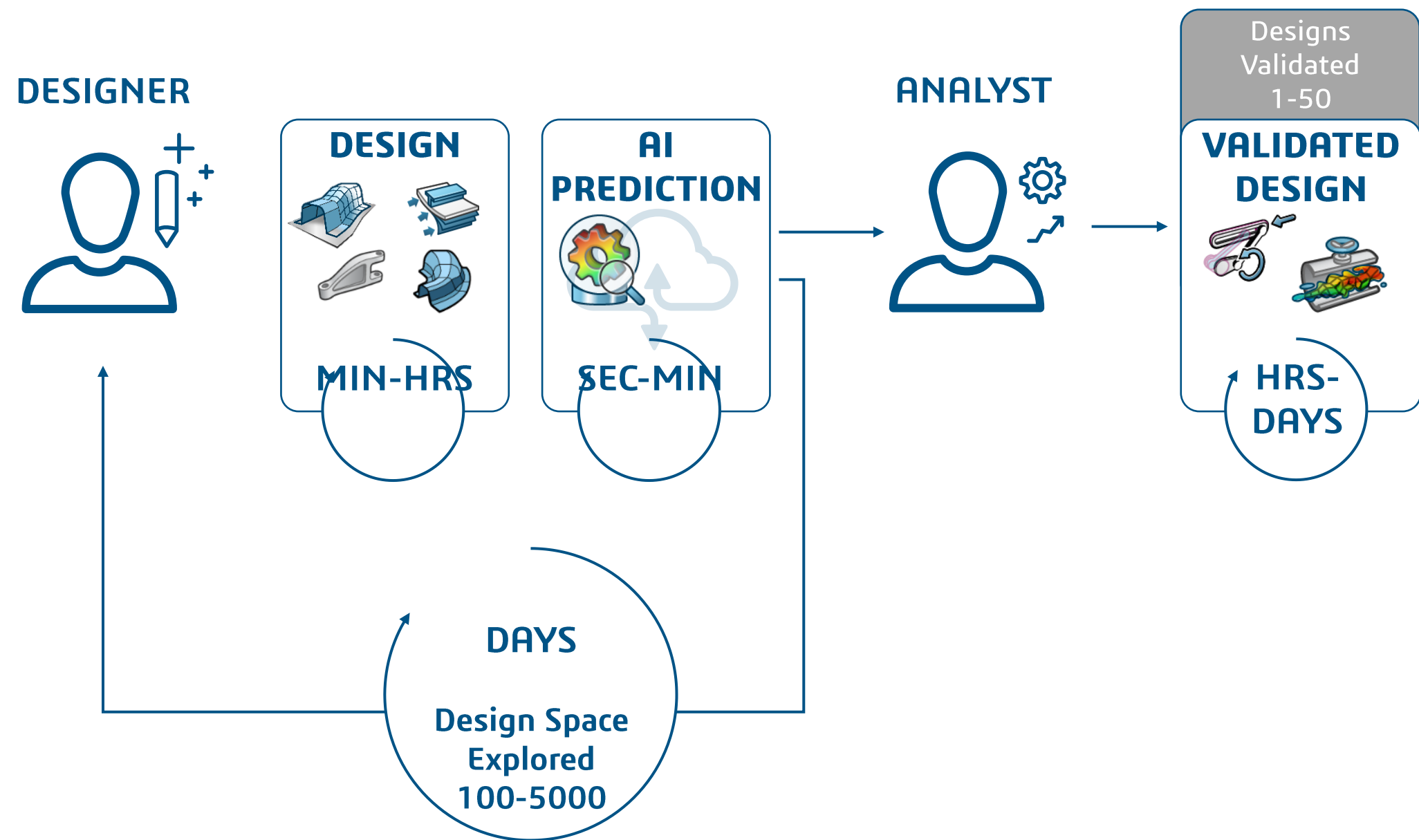
Quickly perform assessment cross variants and versions to study the impact of the changes right through the evolution of the product and process

AI-GUIDED PERFORMANCE DESIGN – AS IS | TO BE PROCESS

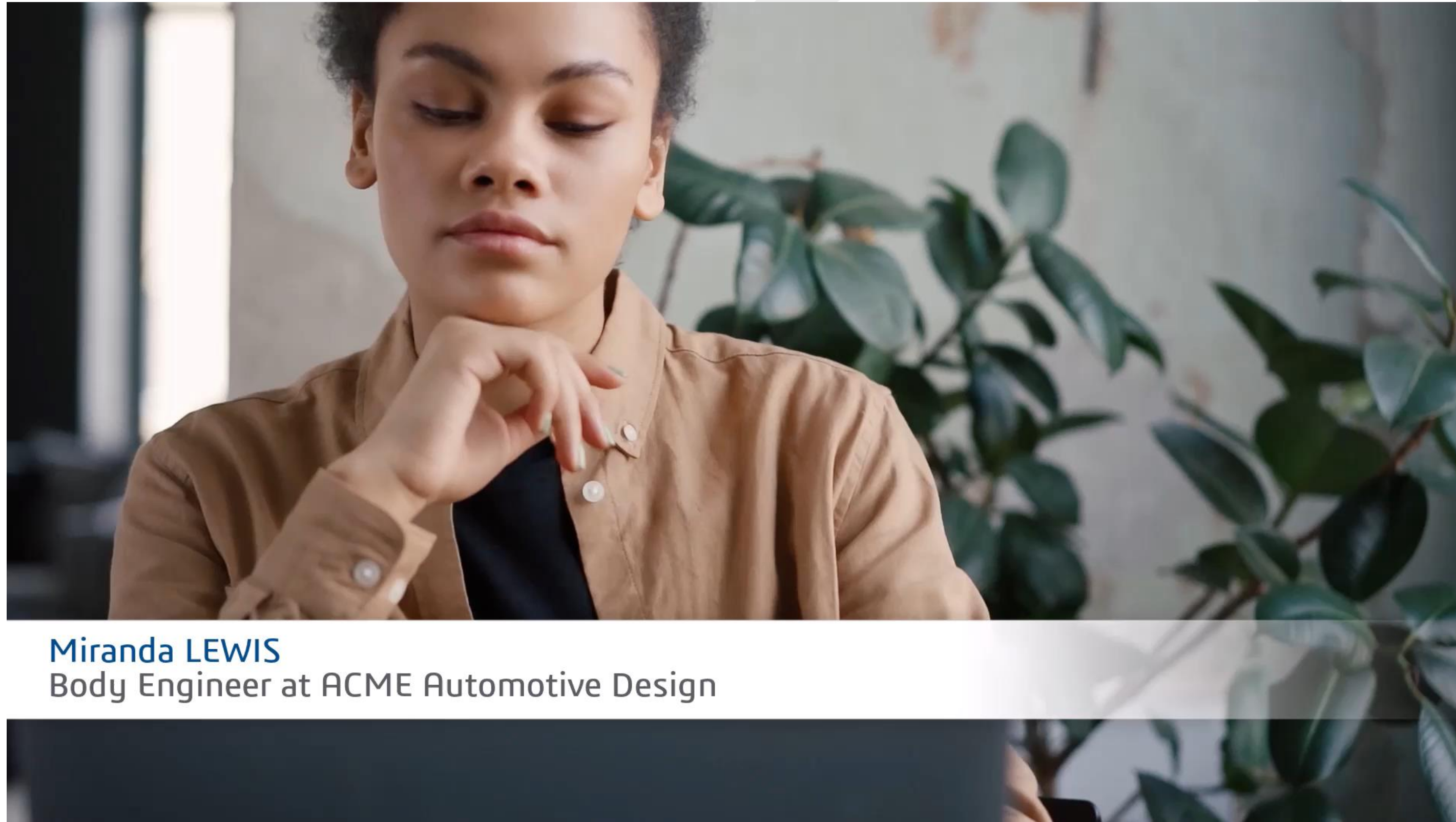
AS IS



TO BE



AI-GUIDED PERFORMANCE DESIGN



Miranda LEWIS
Body Engineer at ACME Automotive Design

PREDICTION

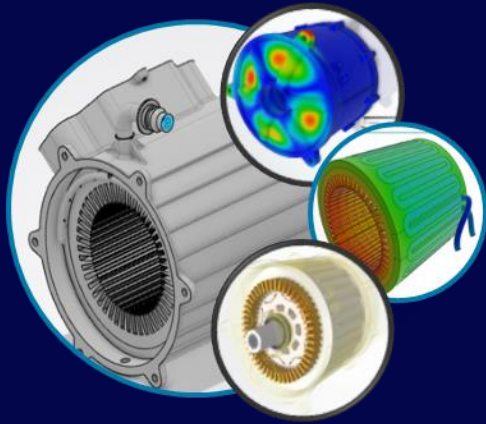


Predictive Guidance

Create a Performance Guidance Study to predict results in near real-time

SIMULIA PHYSICS SIMULATION ADVISOR
Available from 2025x GA in CA

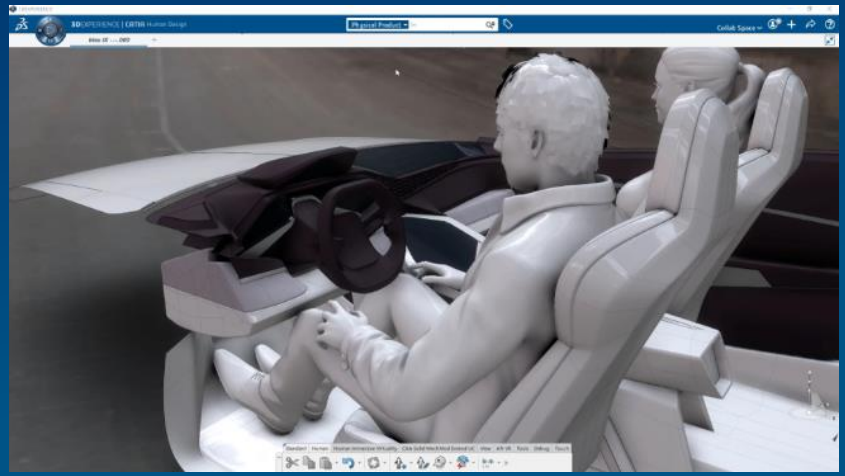
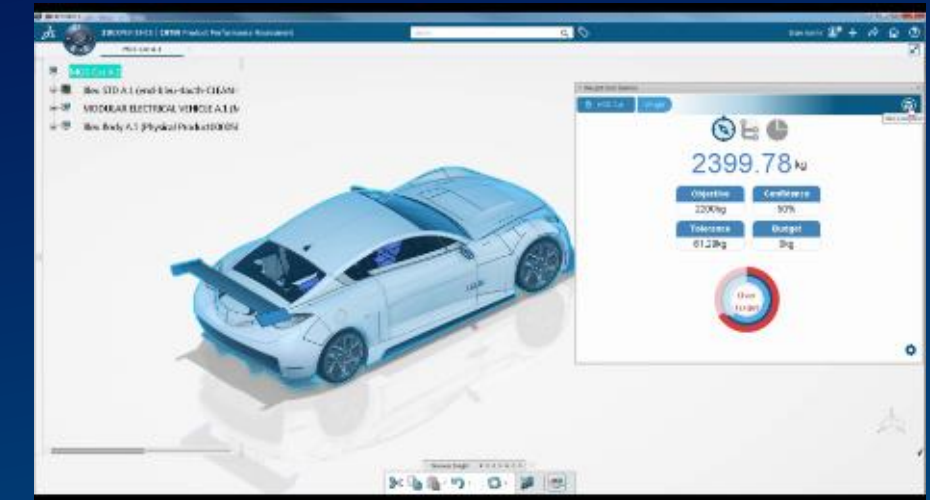
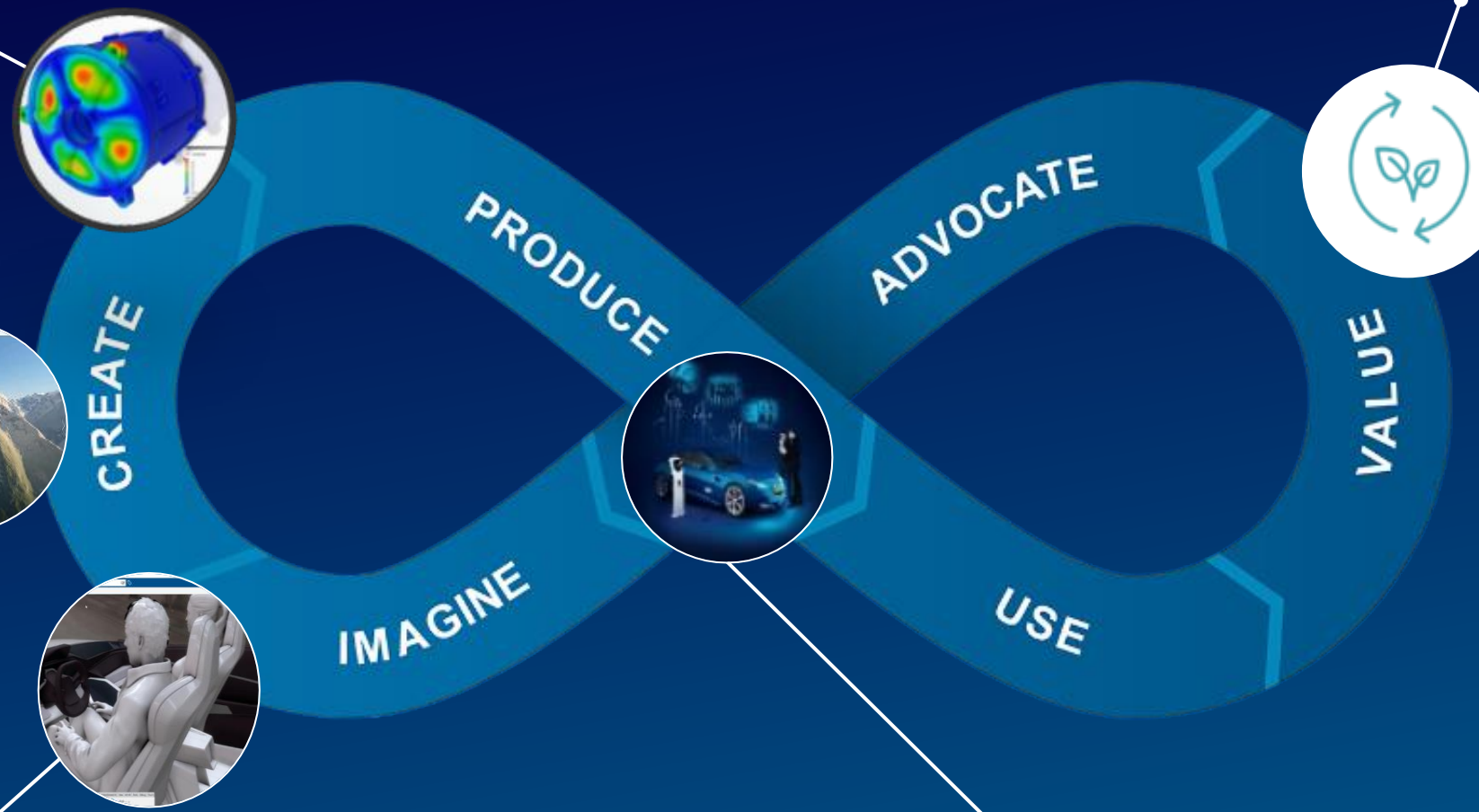
Future of Engineering on 3DEXPERIENCE Platform



AI Driven Generative Design
From Interactive Design (CAD/CAE)
To MODSIM
(Multi Material, Multi Scale, Multi Physics)

DATA Driven Engineering
From Lifecycle Analysis (LCA)
to SUSTAINABILITY-driven INNOVATION
thanks to Real World Evidence and democratized MODSIM

SOFTWARE Defined VEHICLE
From Requirement management
to CYBER SYSTEM



HUMAN Centric DESIGN
From Product design
to Integrated Design & Styling

3DEXPERIENCE
(on Prem/Cloud)

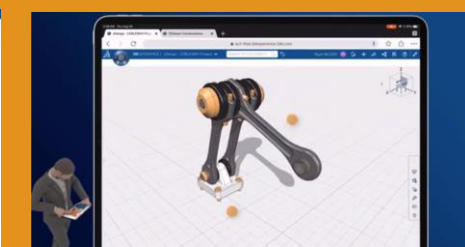
End to End **MODEL-BASED**
Collaboration and Innovation on
3DEXPERIENCE



Immersive,
Fast,



Model based,
Collaborative,




Inclusive,
Cloud, Mobile.



**Prof. Dr.
Günther
SCHUH**

CEO

e.Volution GmbH

A decorative graphic on the left side of the slide, featuring a network of interconnected nodes in various colors (red, yellow, orange, black, white) against a blue background with a glowing globe.

UPGRADING THE CIRCULAR ECONOMY IN AUTOMOTIVE ENGINEERING



Upgrading the circular economy in automotive engineering

Prof. Dr.-Ing. Dipl.-Wirt. Ing. Günther Schuh, 3DEXPERIENCE Conference

Munich 16.10.2024

EVOLUT-ON

The ecological potential of e-mobility was falsely identified - the potential lies in the modularity made possible by the drive system e.VOLUTION



Carriage Architecture



Combustion Architecture

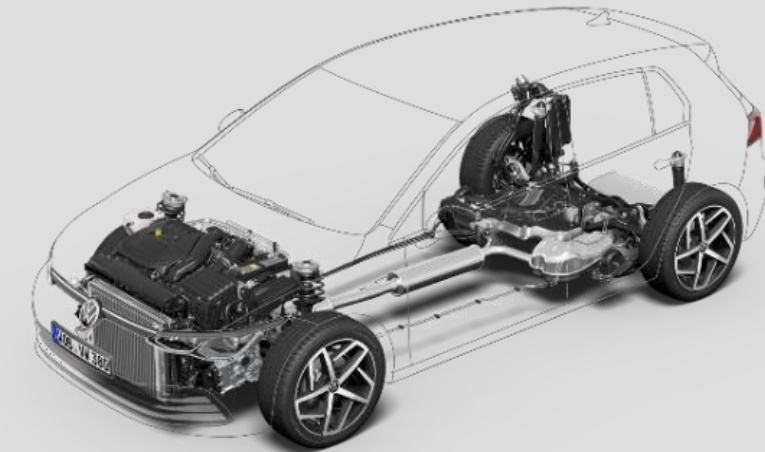


Automotive Architecture



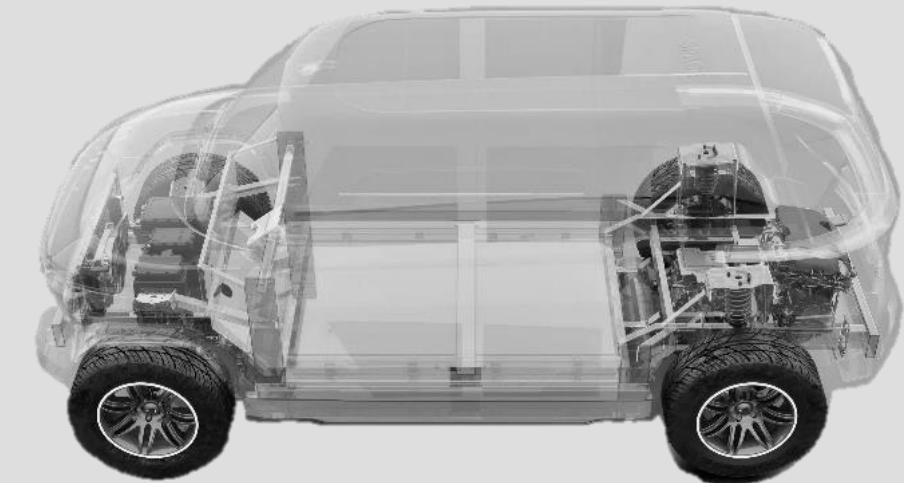
Electric Architecture

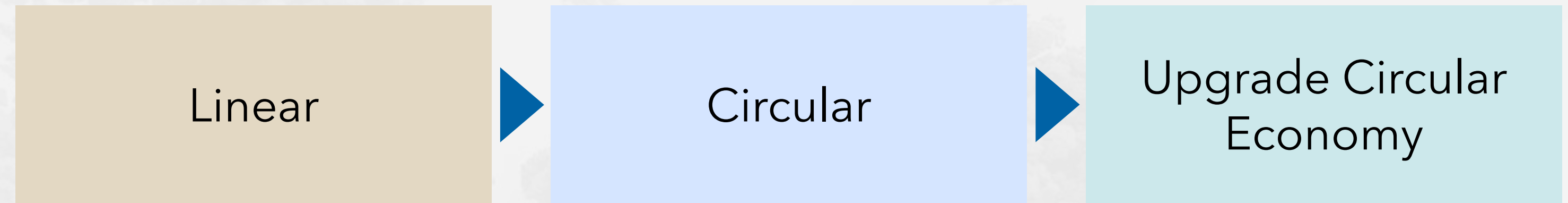
Rediscovery of the chassis as a module



+20-30 %
Value creation
of the OEM

-50 %
Material and
environmental impact





PRODUCTION APPROACH

» **Mass production**

» **Adapted** production

» **TCO-production** with modular upgrades

VALUE MANAGEMENT & MATERIAL USAGE

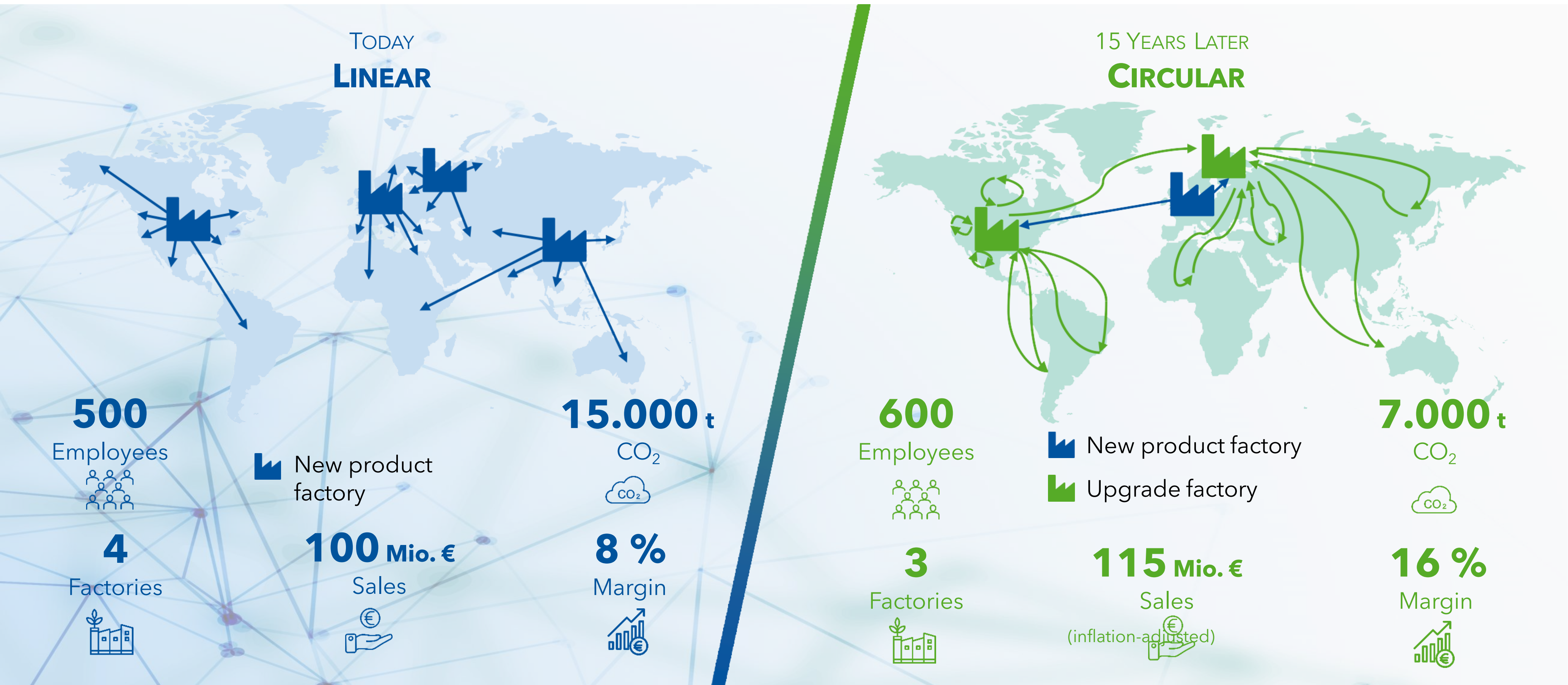
» High depreciation, focus on **economies of scale**

» Recycling and **Recovery of material value**

» Low depreciation, long-term **value retention** through upgrades

Only the circular economy combines sustainability and long-term success by upgrading products through modular upgrades and extending their lifespan.

The Upgrade Circular Economy halves the ecological footprint in the global production network, increases value creation and doubles the margin

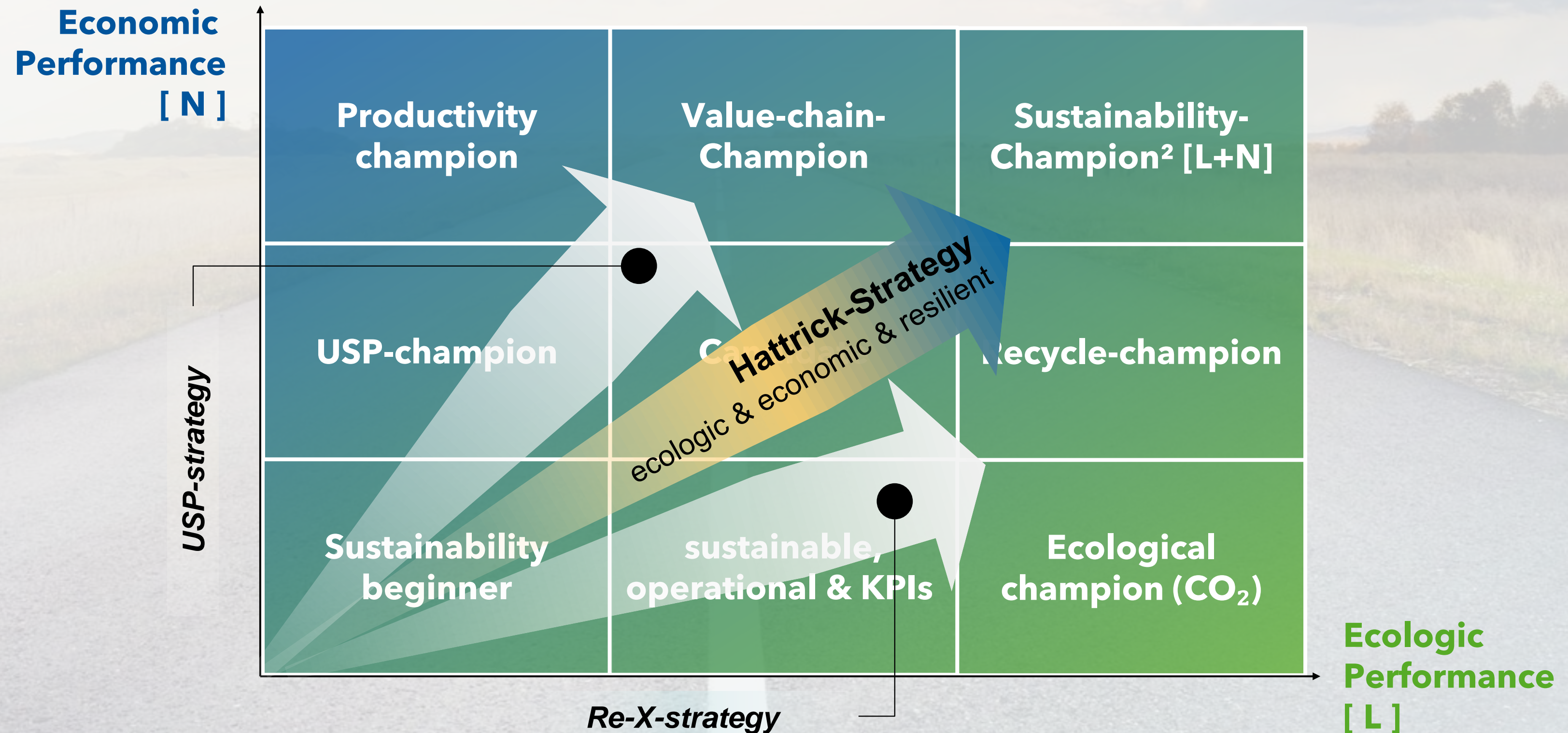


Source and visualisation: WZL RWTH Aachen

The choice of sustainable innovation strategy has a significant impact on ecological and economic performance



The choice of sustainable innovation strategy has a significant impact on ecological and economic performance



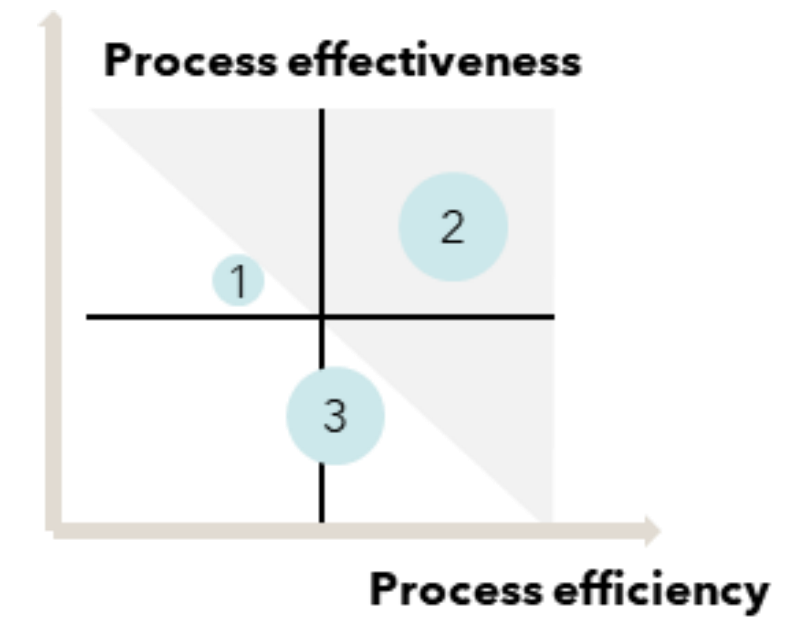
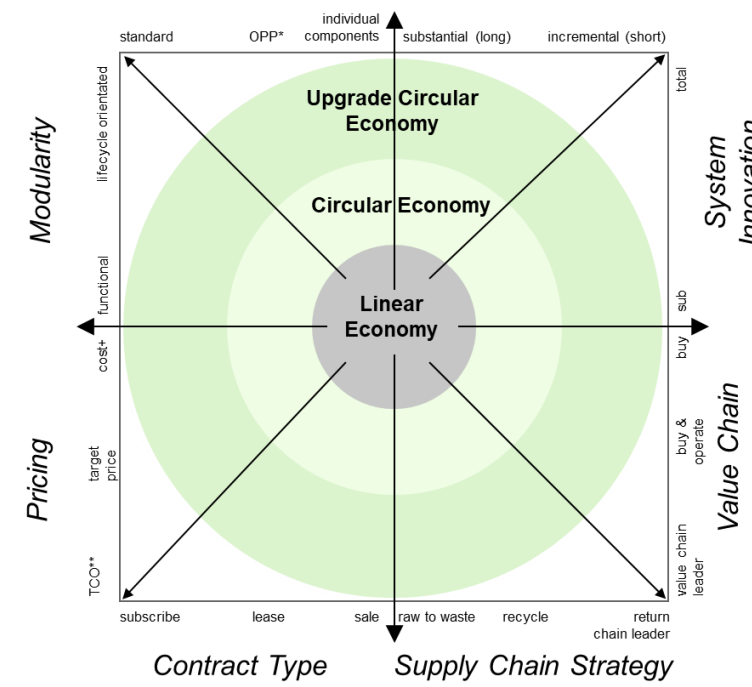
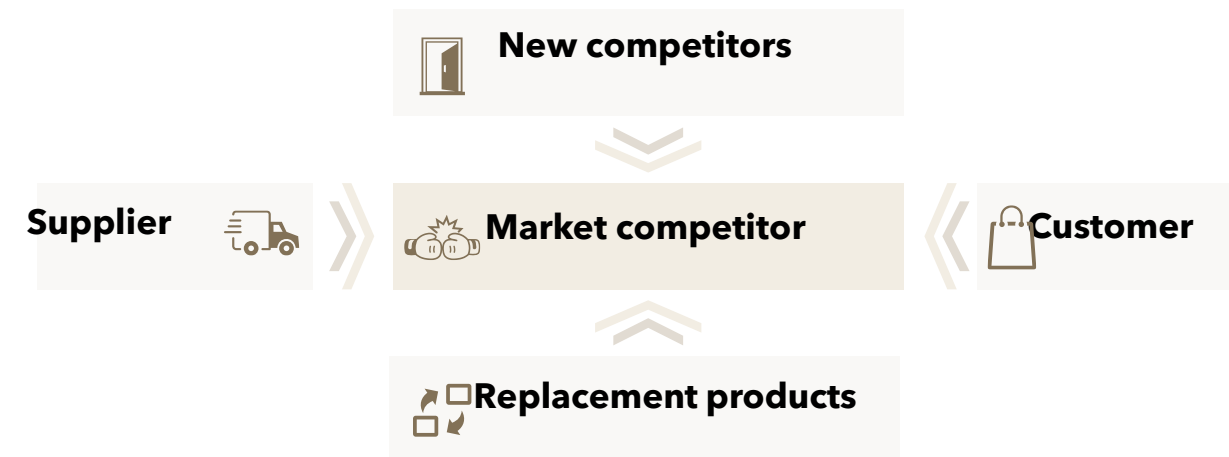
Setting the strategic course for sustainable success - USP, Hattrick and Re-X strategy

USP-Strategy

Hattrick-Strategy

Re-X-Strategy

STRATEGY



CHALLENGES

„Are our **SSPs strong enough** to continue implementing the USP strategy?“

„Are necessary **changes** to management profiles **feasible**?“

„Can **competitiveness** be **maintained** if suitable Re-X measures are installed?“

In order to be successful in the long term, a strategic design must first be made - a strategy audit helps to find the right strategy.

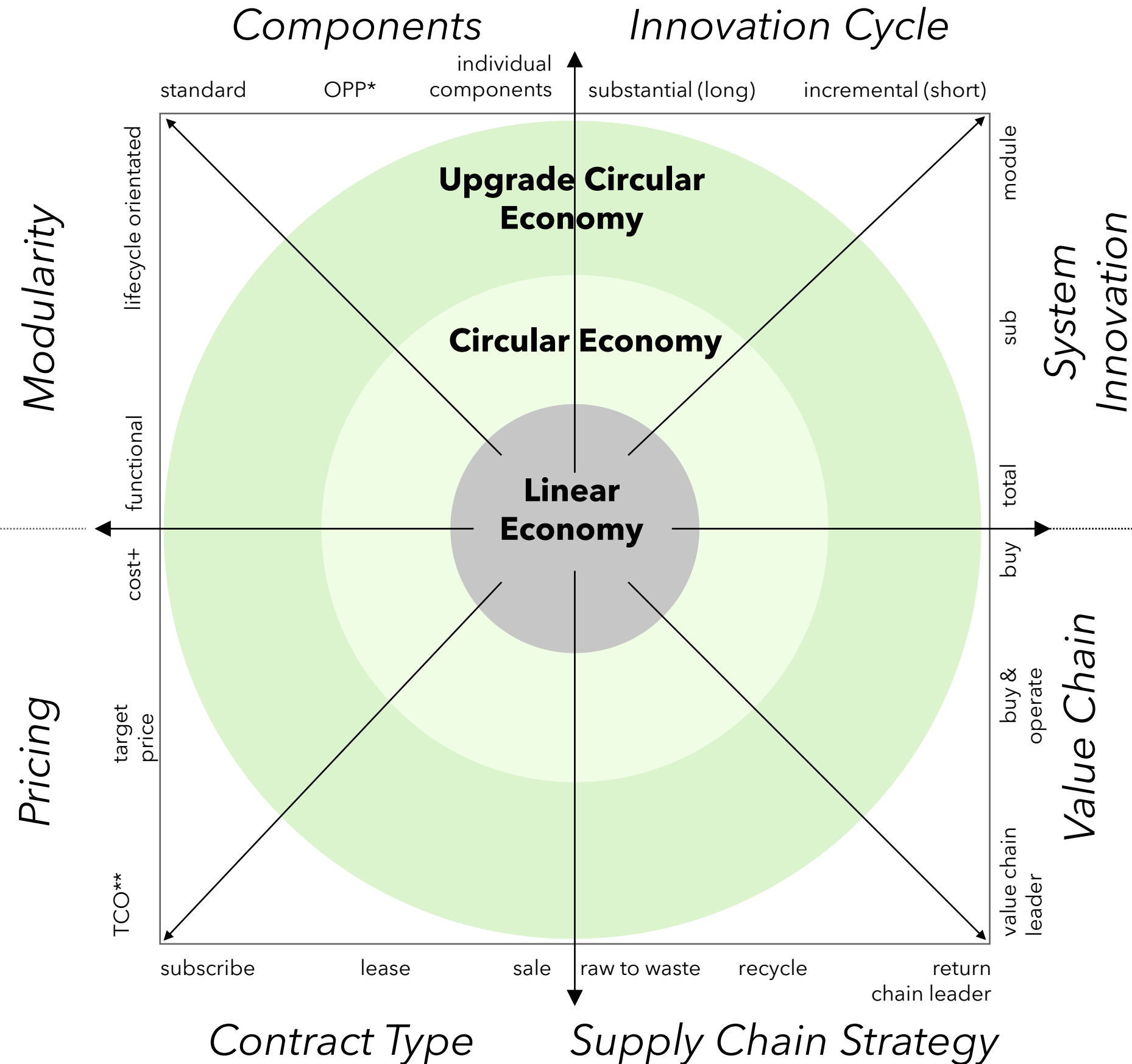
The framework for the Circular Economy upgrade shows how the transformation to a value-enhancing circular economy can succeed

PRODUCT-ARCHITECTUR

INNOVATION-STRATEGY

MARKET ORIENTATION

VALUE CREATION



* Order Penetration Point
 ** Total Cost of Ownership

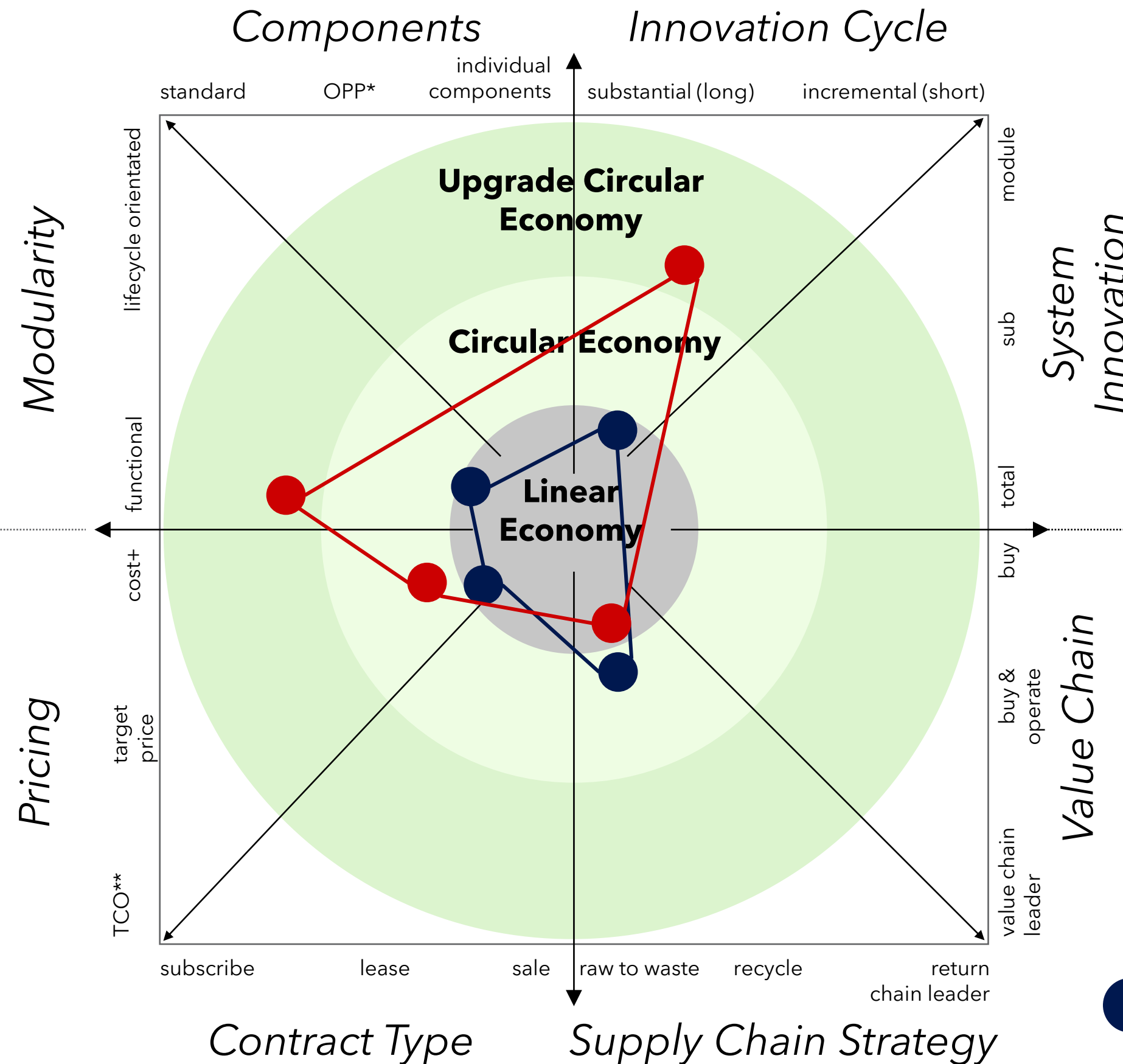
The framework for the Circular Economy upgrade shows how the transformation to a value-enhancing circular economy can succeed

PRODUCT-ARCHITECTUR

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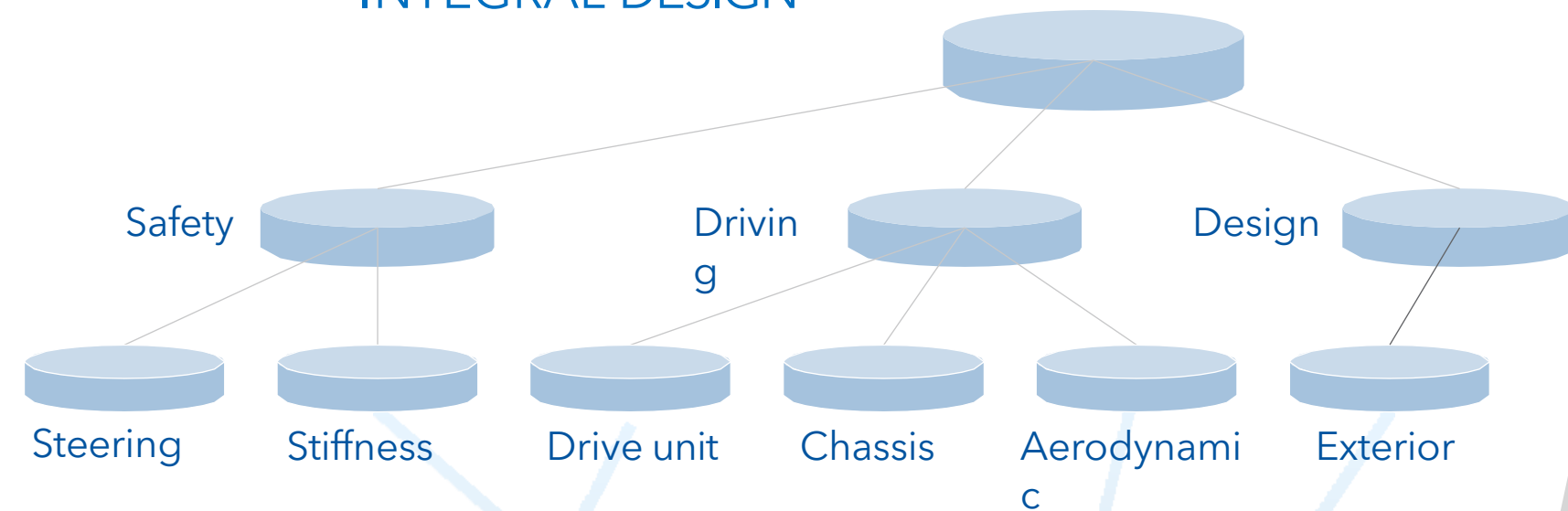


● Traditional OEM ● E-OEM

* Order Penetration Point
 ** Total Cost of Ownership

The new product modularity synchronizes component functions and technical life cycle by separating functions

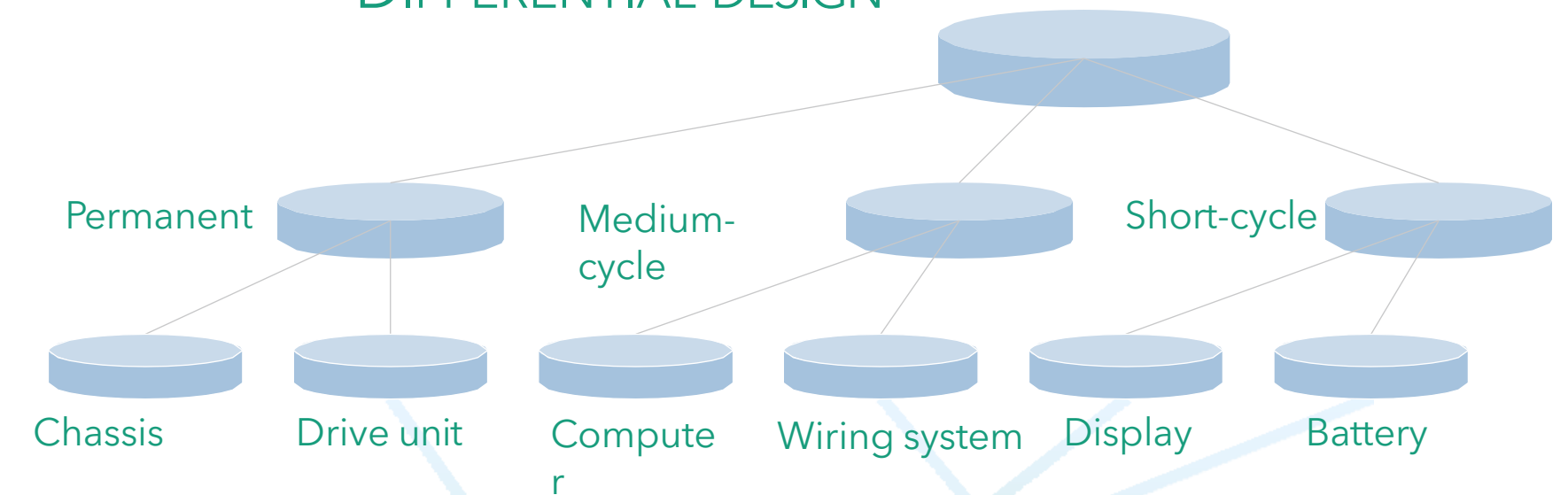
PRODUCT STRUCTURE TODAY INTEGRAL DESIGN



Motor + chassis are not part of the modular structure

Body-in-white are not manufactured modularly

PRODUCT STRUCTURE TOMORROW DIFFERENTIAL DESIGN



Motor + chassis as part of the overall modular product architecture

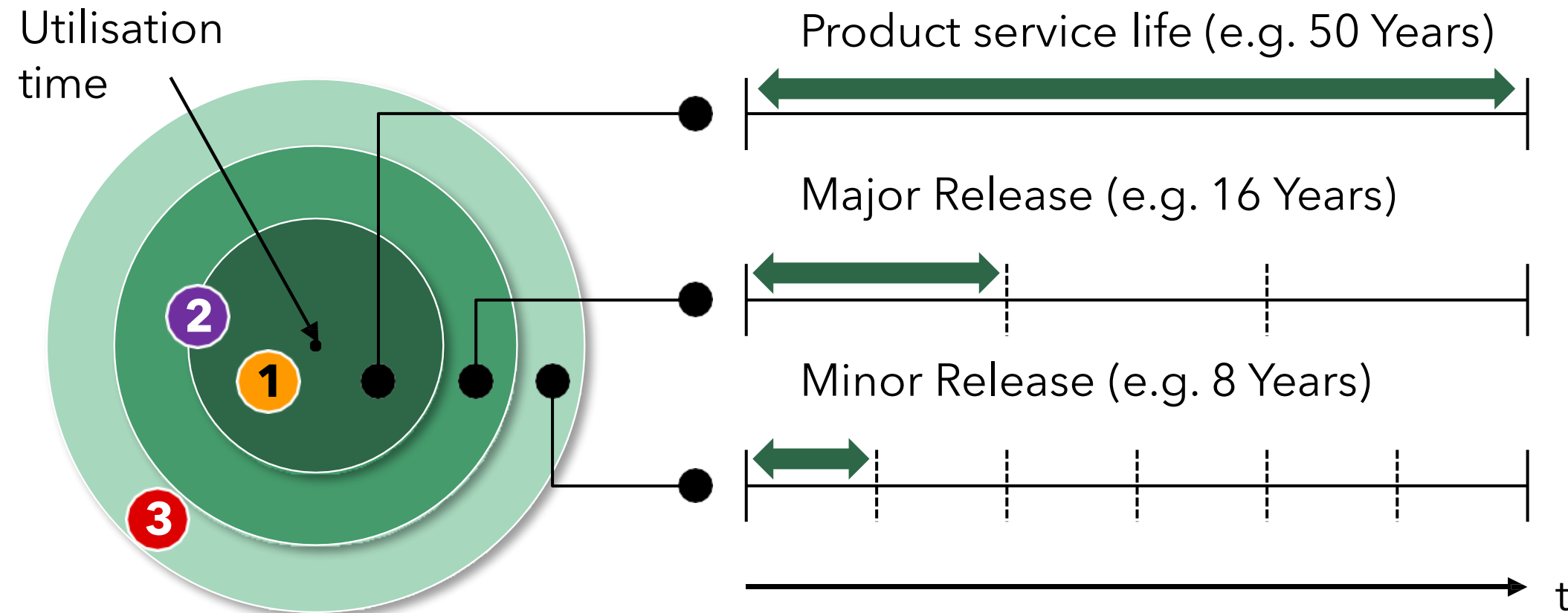


Source: GKN Automotive, Mahle Group, ElringKlinger AG, e.Volution GmbH

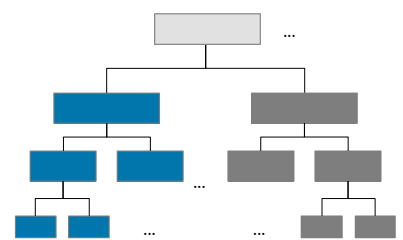
Source and visualisation: WZL RWTH Aachen

One pillar to the value-enhancing extension of the utilisation time is a new logic in product architecture by integrating Upgrade Circular Economy

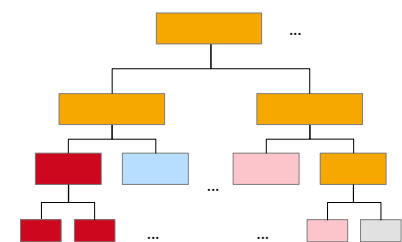
Consideration of the **Obsolescence**



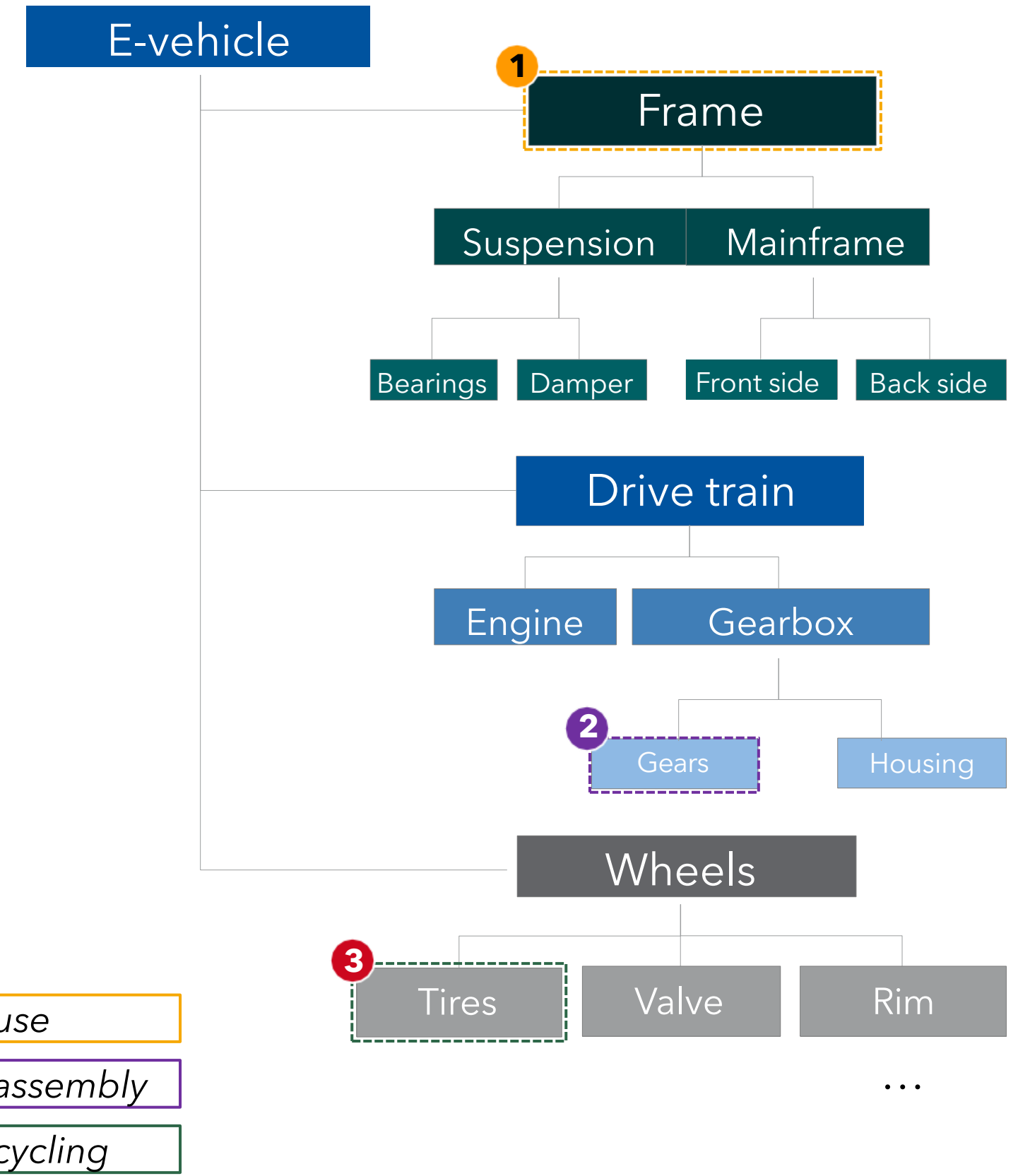
+ *Function-oriented View*



+ *Material-oriented View*



+ *Interface-oriented View*



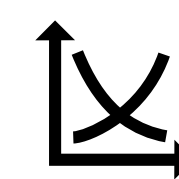
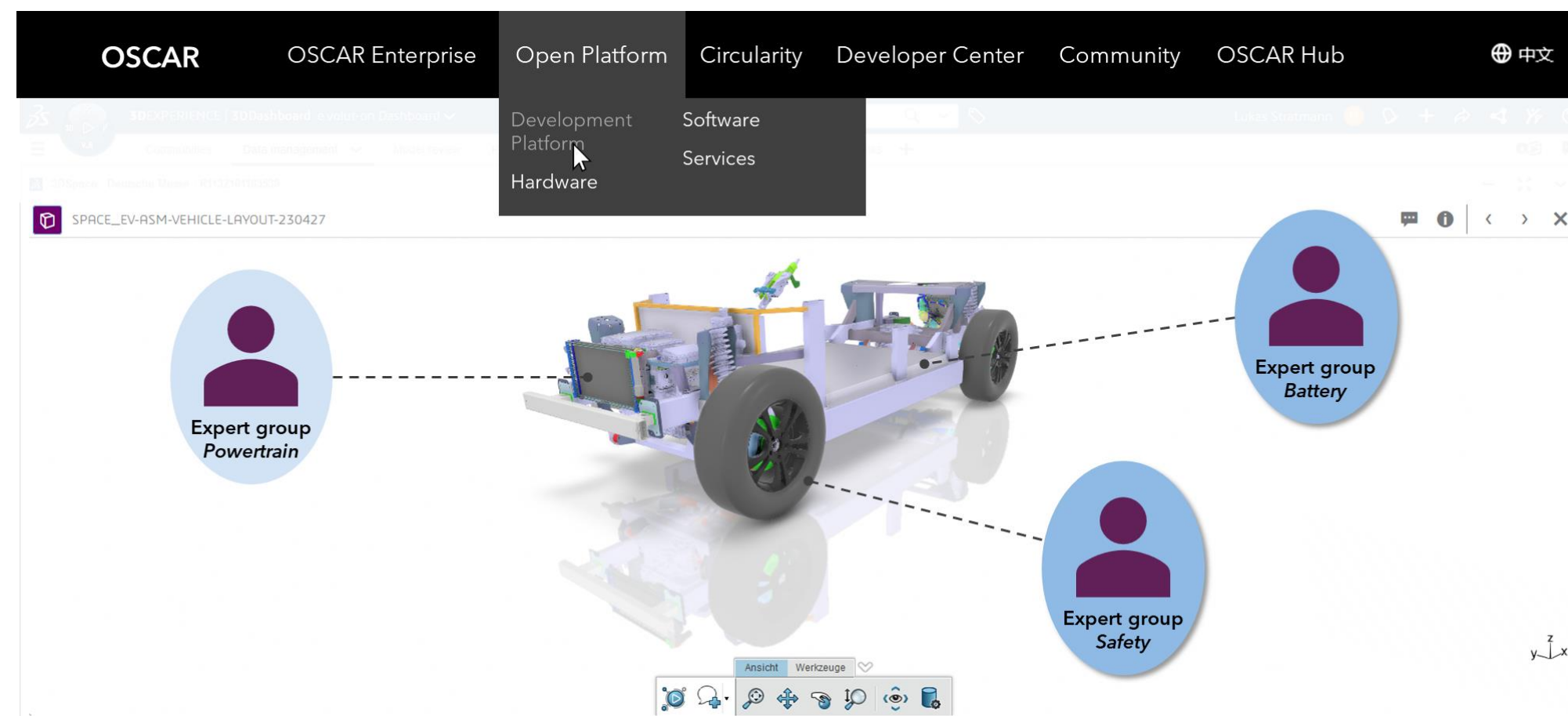
Transformation to Upgrade Circular Economy requires collaborative engineering, standards and efficiency on a global scale.

OSCAR

Open Source Car
Architecture Research

OSCAR will be a **collaborative design and engineering platform**. It integrates system providers, software providers, Tier-X - suppliers, and specialized service providers to produce shared value.

OSCAR will develop and operate a Circular-oriented Architecture (CoA), a test environment, a Digital Product File framework and the related standards.



Enable **Upgrade-Circular Business Models** using a modular differential design,



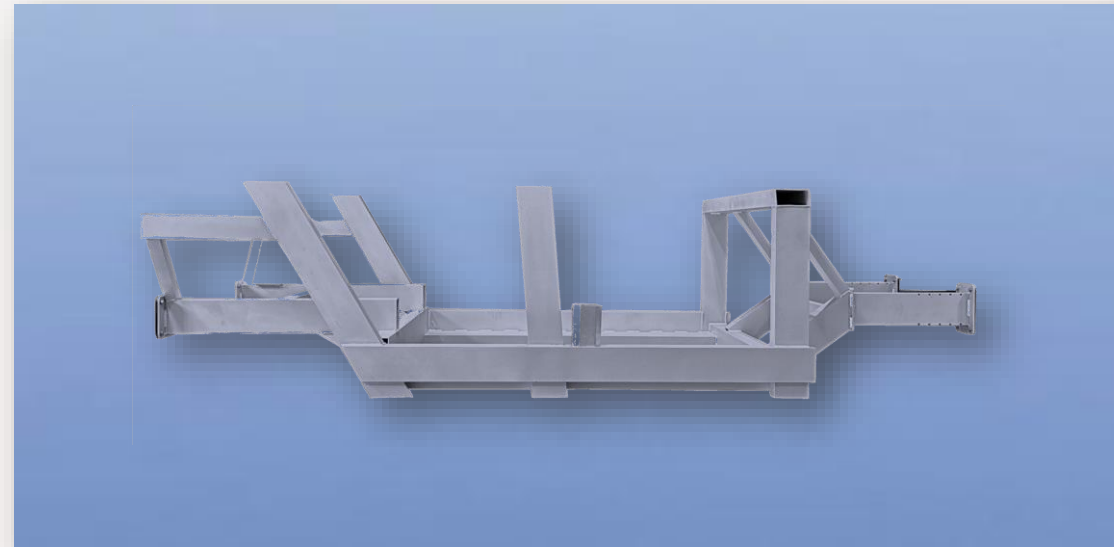
Develop **digital product files** to enable upgrades, circular loops and circular supply chains,



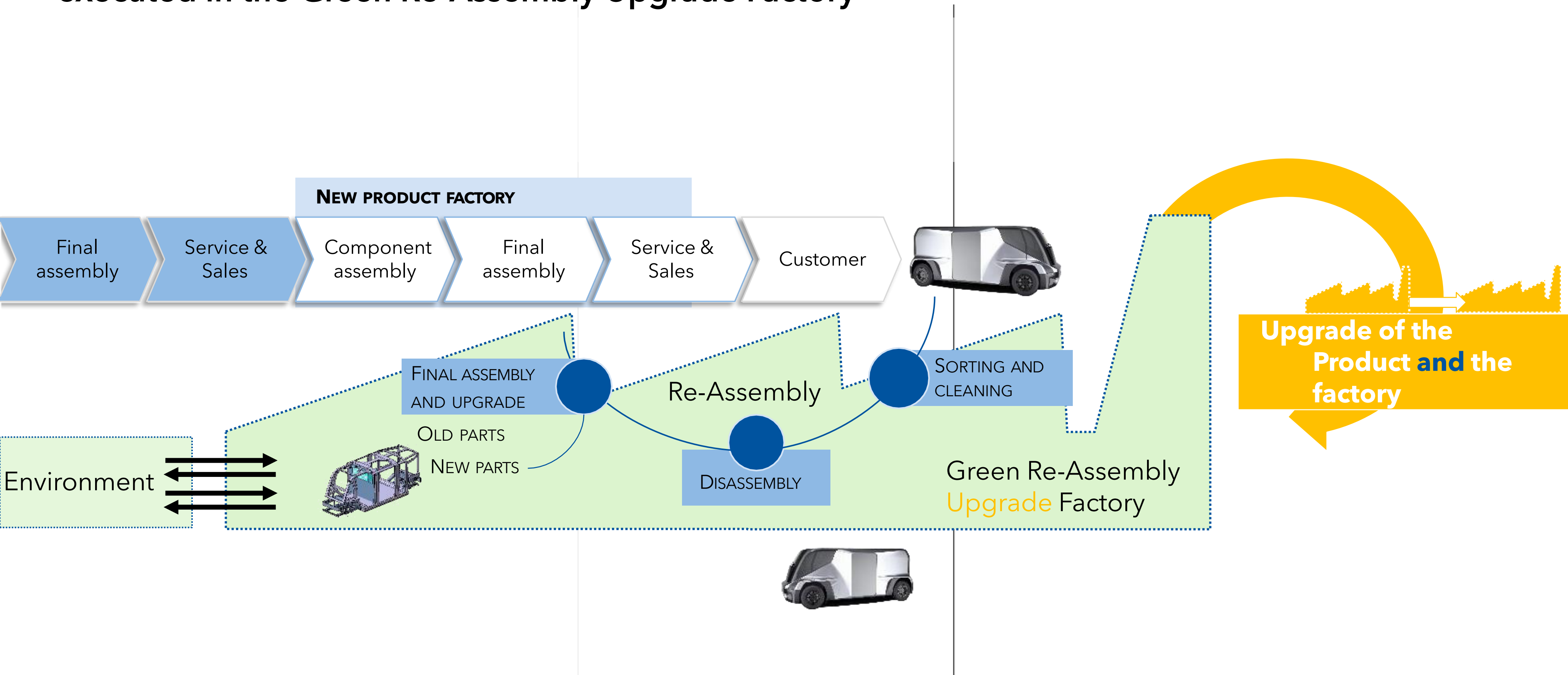
Achieve **cost reduction** in test- and homologation processes.

Enabling the Upgrade Circular Economy through an incremental innovation strategy for upgrades and updates

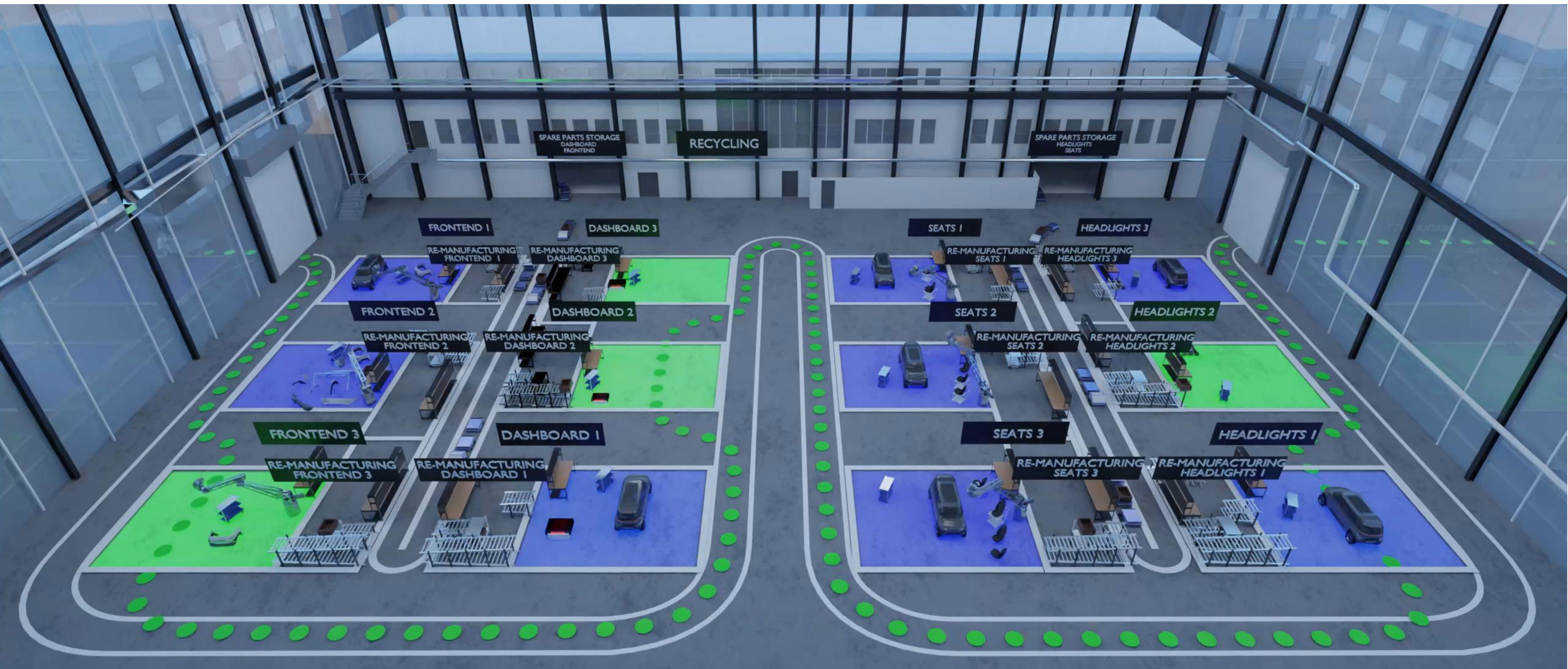
e.VOLUT-ON



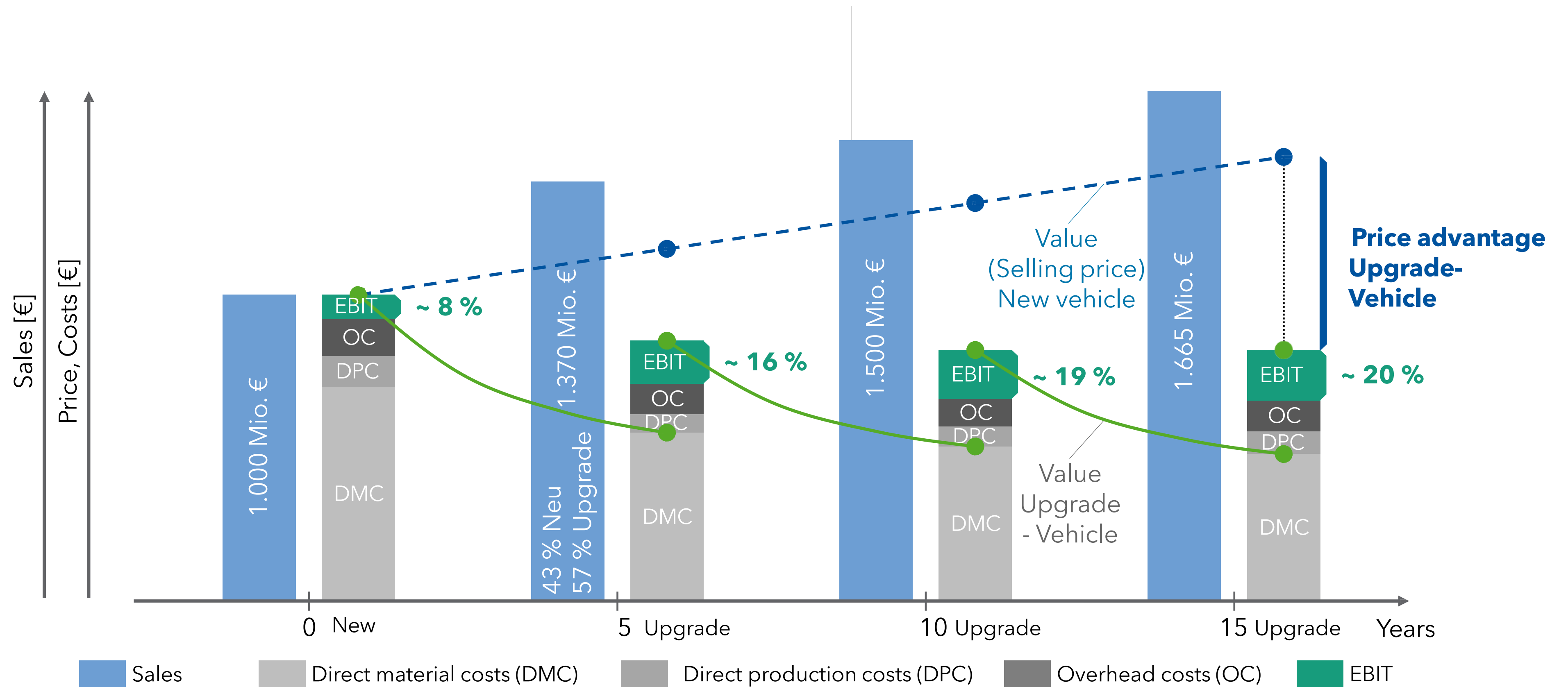
Sustainable production is no longer linear, but circular and is executed in the Green Re-Assembly Upgrade Factory



Upgrade Circular Economy takes place in the Green Re-Assembly Upgrade Factory, where value is added through upgrades



The hattrick of the value-enhancing circular economy - half the environmental impact, cheaper use, higher margin





Thank you for your attention!

Prof. Dr.-Ing. Dipl.-Wirt. Ing. Günther Schuh

CEO e.Volution GmbH

Director of the Machine Tool Laboratory WZL at RWTH Aachen University

Director of the Fraunhofer Institute for Production Technology IPT

Director of the Research Institute for Rationalization (FIR) at RWTH Aachen University

THANK YOU FOR YOUR INTEREST!

