

Digital Twins in Data Spaces

Dr. Birgit Boss

Bosch Connected Industry, 10th February 2023

CIIT TechTalk

17th February 2023



Digital Twins in Data Spaces

Dr. Birgit Boss, Bosch Connected Industry

- ▶ Board member of the Industrial Digital Twin Association (IDTA) & Chair of the Working Group “Open Technology”
- ▶ Chair of the joint working group “Asset Administration Shell” between IDTA and the Working Group “Reference Architecture, Standards and Norms” of the Plattform Industrie 4.0
- ▶ Chair of the Working Group “Semantic Layer including Digital Twins” of Catena-X
- ▶ PMC member of the Eclipse Digital Twin Top Level Project



Connect on:

www.linkedin.com/in/birgit-boss/

Digital Twins in Data Spaces

CLIMATE CHANGE

WE WERE THE FIRST



CO₂ neutral

NO CARBON FOOTPRINT



**At all our locations
WORLDWIDE
since February 2020**



**“COMPANIES SHOULDN'T HAVE
TO CHOOSE BETWEEN BEING
PROFITABLE AND DOING WHAT'S
BEST FOR THE PLANET.**

**IF THE RIGHT PATH IS CHOSEN,
BOTH AIMS GO HAND IN HAND.”**

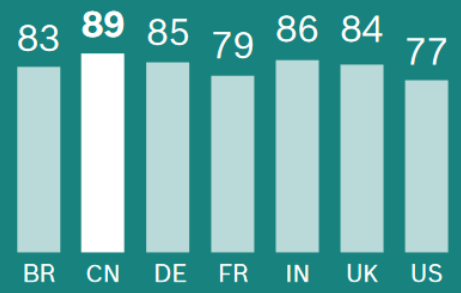
**Dr. Stefan Hartung, Chairman of the
board of management of Robert
Bosch GmbH**

COMBATING CLIMATE CHANGE

To what extent do you personally agree with the statement 'Future technological progress will play the key role in combating climate change.'?

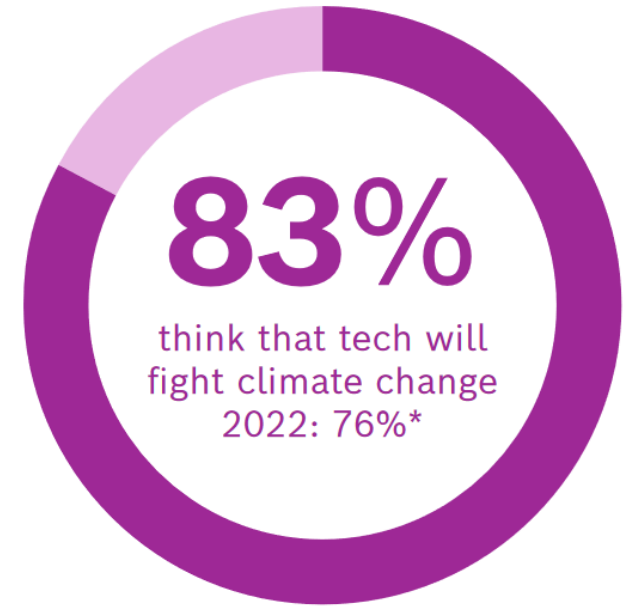
REGIONAL

In every country surveyed, a majority of respondents believe that technology is the key to fighting climate change. This view is most widespread in China (89%), and least common in the US (77%) – though even there, most people would agree with it.



BRA N = 2035, China N = 2023, DE N = 1016, FR N = 1031, UK N = 1015, USA N = 2035, India N = 2024. Answers in %.

Tech Compass
2023



GLOBAL INDEX

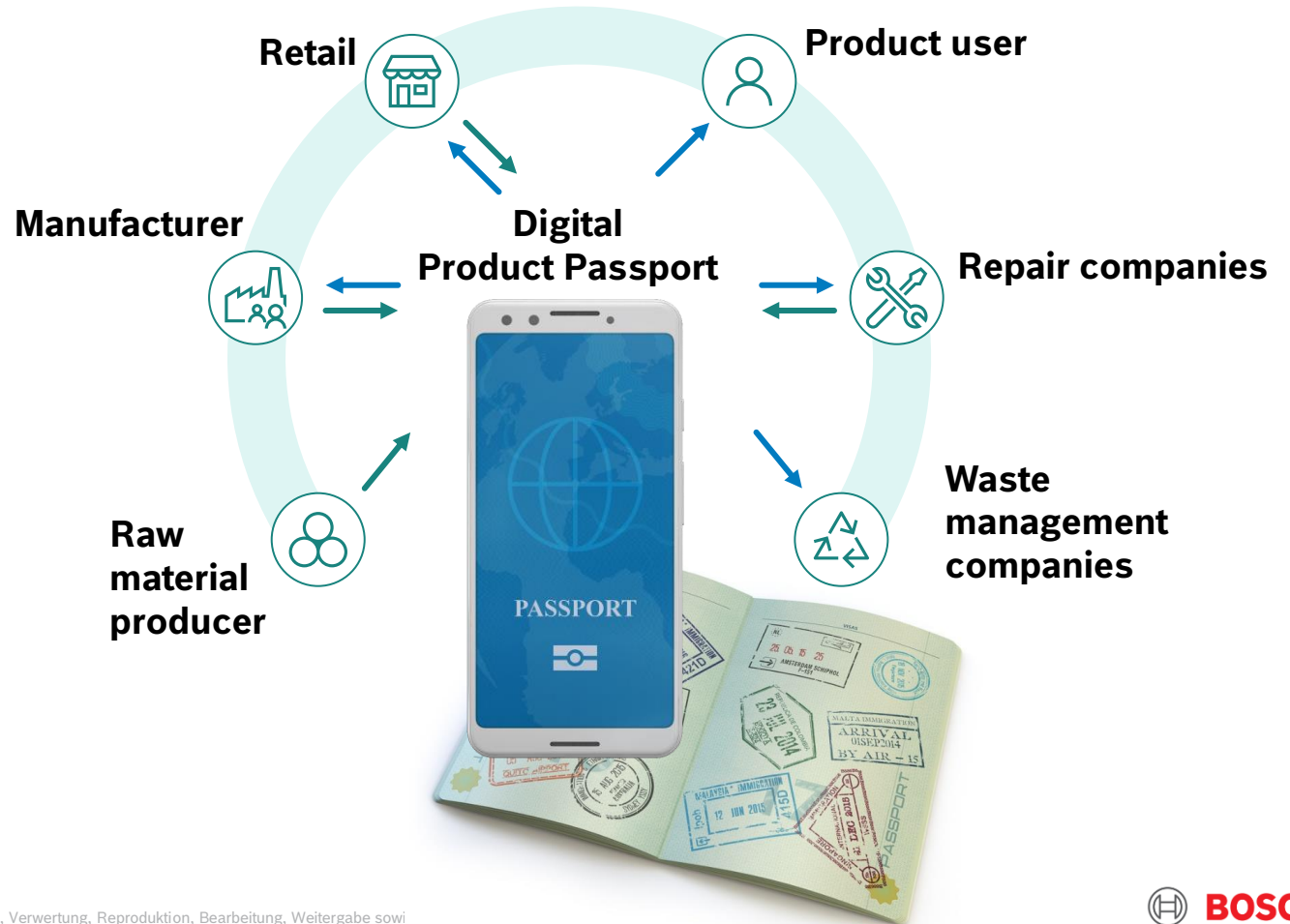
83% of respondents worldwide believe that future technological progress will be the key to combating climate change – 7 percentage points more than last year.

*For ease of reading and interpretation, the global index for 2023 based on 7 countries is compared with the index of 2022 based on 5 countries. Calculating a global index for 2023 based on the 5 previous countries provided equivalent results.
Answers were scaled from 1 to 4. Top-2-Box Results. 2023 All Countries N = 11179, 2023 Previous Countries N = 8113, 2022 N = 8076. Answers in %.*

Digital Twins in Data Spaces

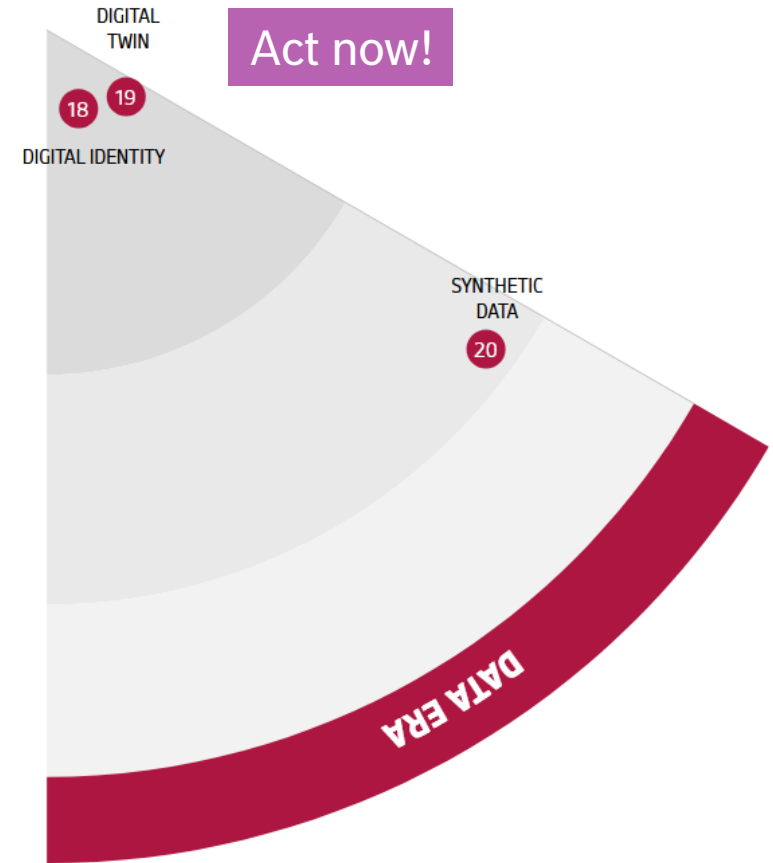
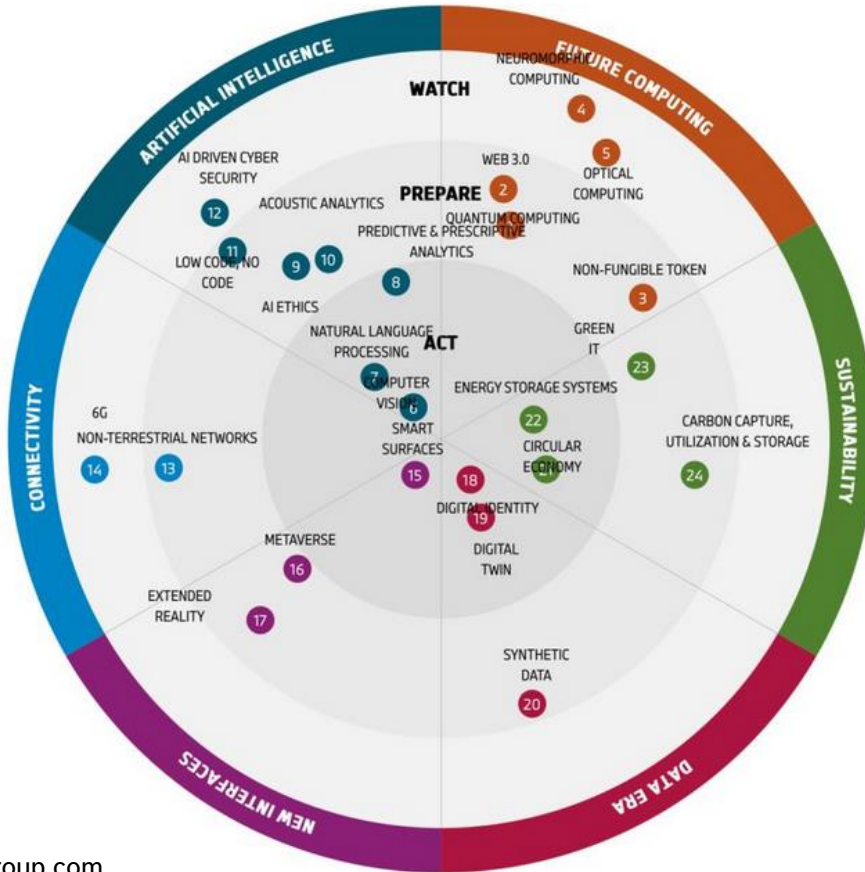
The Digital Product Passport as Digital Twin

The Digital Product Passport can be represented by aspects of a **digital twin**. Each stamp represents data provided or needed by different stakeholders and apps in the lifecycle of the product.



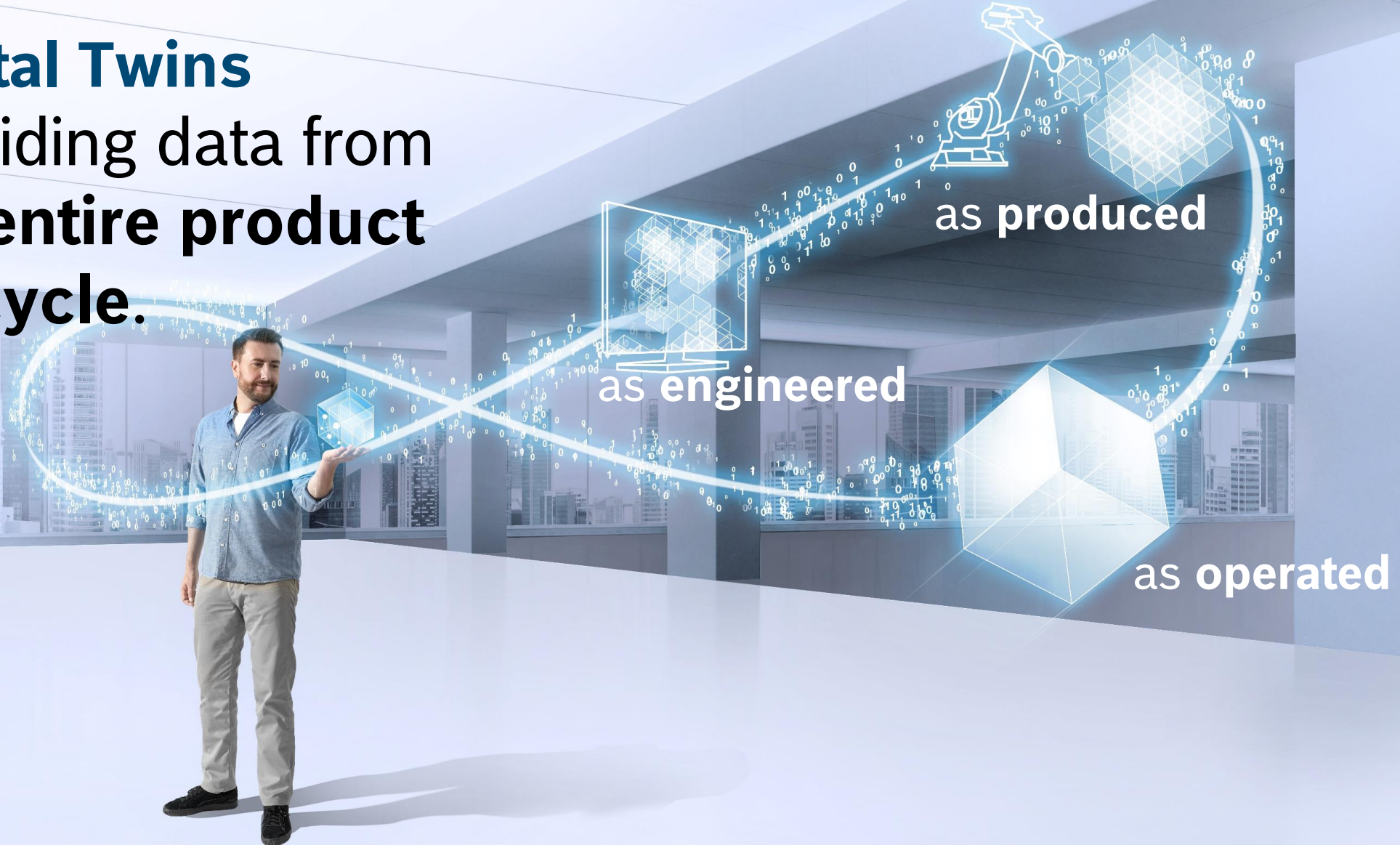
Digital Twins in Data Spaces

BMW Group Technology Trend Radar



Source: bmwgroup.com

Digital Twins
providing data from
the **entire product**
lifecycle.

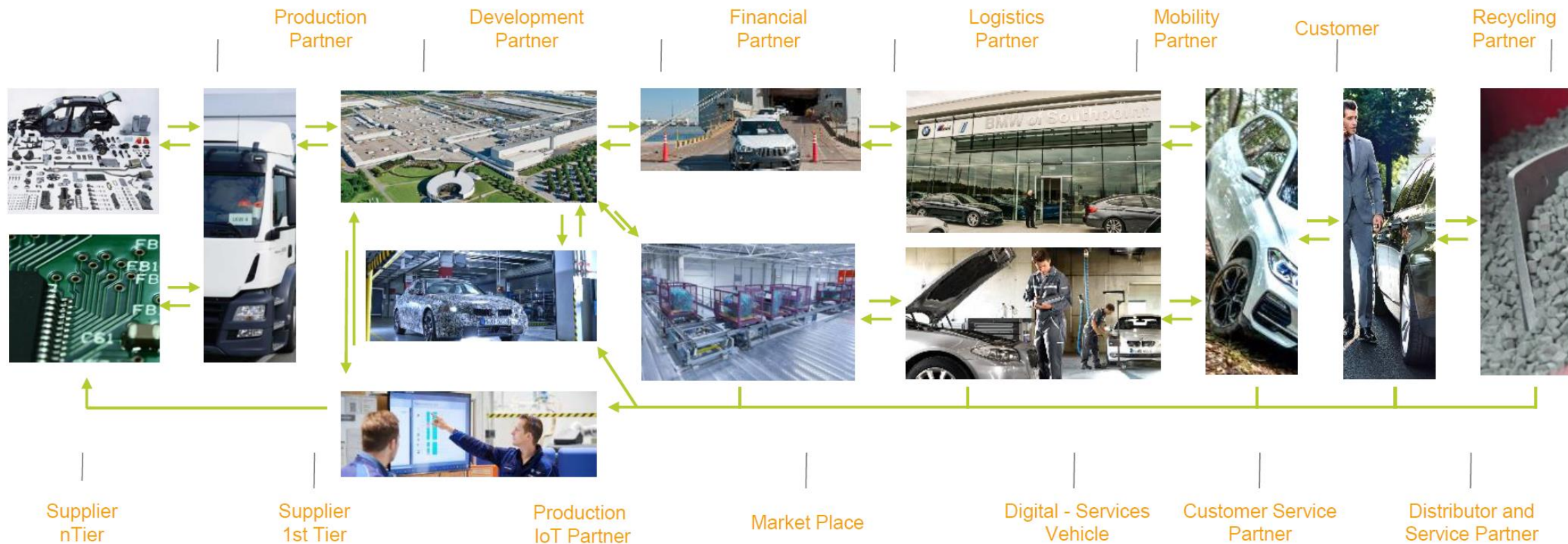


“Companies face a paradox. They are increasingly expected to take responsibility for their social, environmental and economic impacts, yet they cannot directly control many of them [...]”



Digital Twins in Data Spaces

Dataspace Catena-X: “Data Driven Value Chain”



Industry Platform

Providing the most user-friendly environment for **building, operating and collaboratively using end-to-end data chains** along the entire (automotive) value chain.

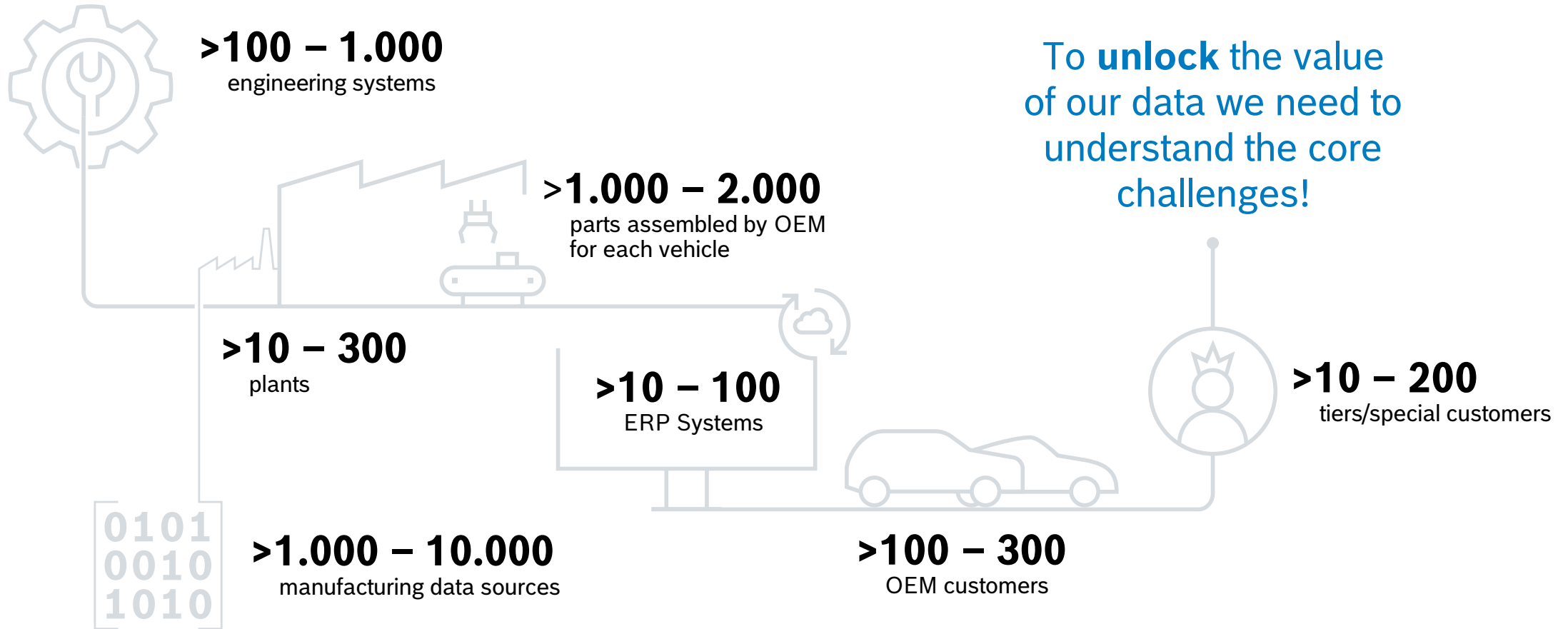


Catena-X
Automotive Network



Digital Twins in Data Spaces

In numbers for Original Equipment Suppliers (OES)

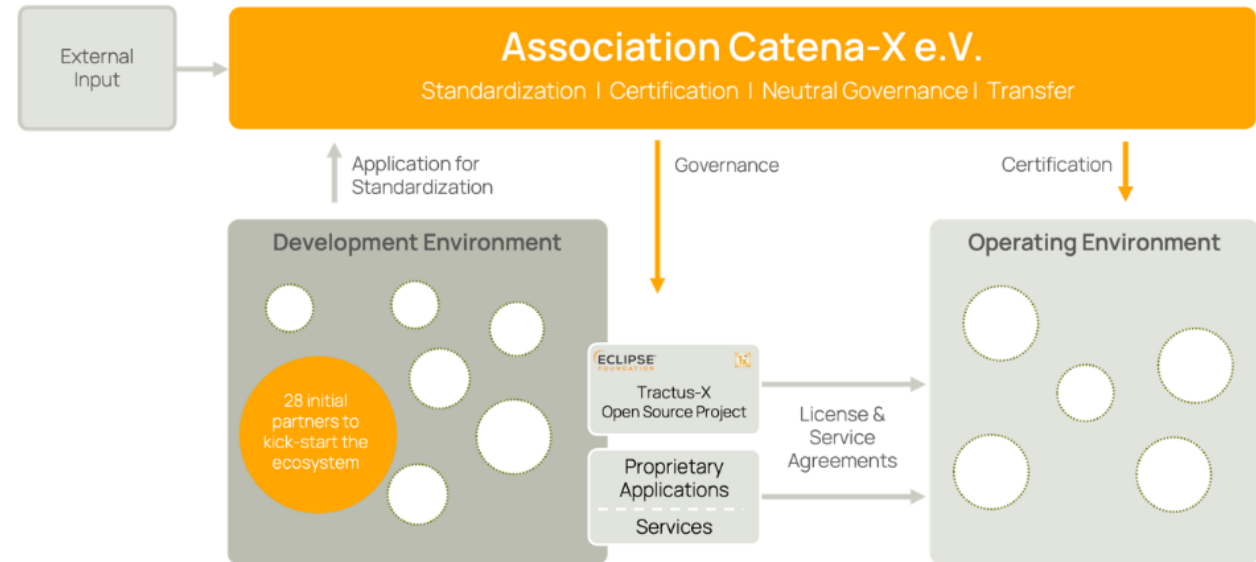


Digital Twins in Data Spaces

Operating Data Spaces



First Request for tender in Jan. 2023



Digital Twins in Data Spaces

Coming together

- event of the Industrial Digital Twin Association (IDTA)
- 28 funded projects KoPa35c

Source: atpinfo.de



Digital Twins in Data Spaces

Resilient and sustainable supply chains with the digital twin



German Digital Summit 2022

zvei electrifying ideas

Product Carbon Footprint Showcase

Disclaimer: displayed PCF values are for demo purposes only

Submodels:


- Nameplate
- ProductCarbonFootprint**
- TechnicalData
- eClass
- Downloads

FootprintInformationModule1	
Methodology	ISO 14040 & 14044
CO2eq in kg	4.499
LifeCyclePhase	Cradle-to-gate
ReferenceQuantity	piece
UnitOfQuantity	1
GoodsTransferLocation	

FootprintInformationModule2	
-----------------------------	--


FootprintInformationModule3	
-----------------------------	--

68

 cyber® simco® drive 2


→

0.057

 ATP-ST 4


→

4.499

 US-EMLP (15X5)


→

568

 Combination - SACE Emax 2


→

398

 SACE Emax 2

→

170

 SACE Emax 2 Fixed Part

→

<https://www.elektro-automatisierung-digital.de/branchennews/digital-gipfel-2022-zvei-stellt-bundeskanzler-scholz-pcfcontrol-cabinet-vor>

<https://zvei-pcf.germanywestcentral.cloudapp.azure.com/backend/pcf>

Digital Twins in Data Spaces

Dataspace: Manufacturing-X



Digital Twins in Data Spaces

Open and Collaborative Communities



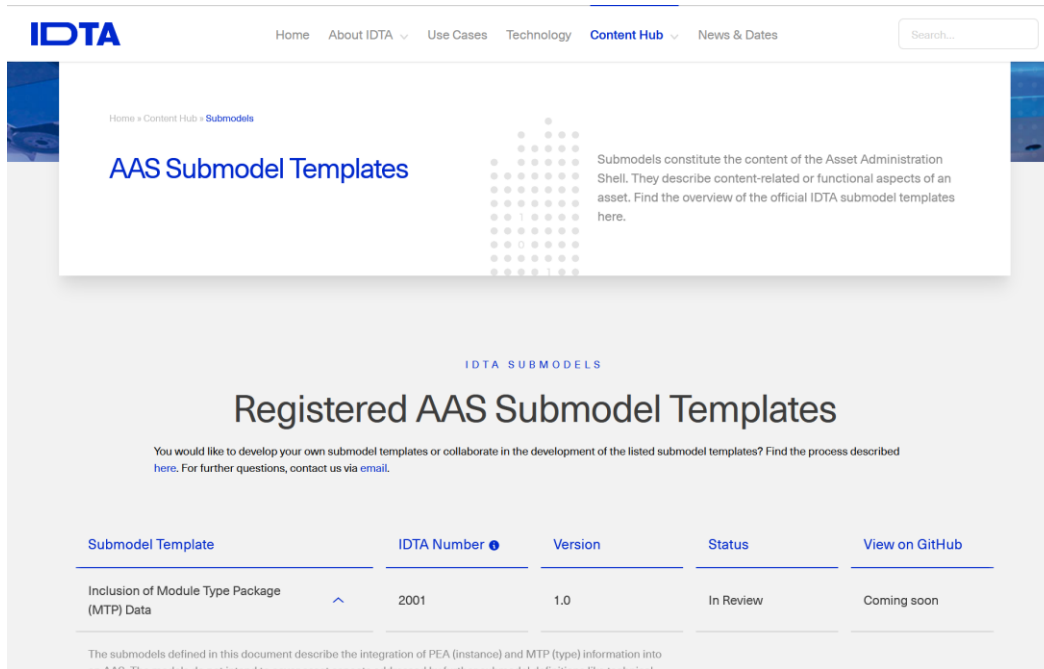
Project Hierarchy:

- » Eclipse Digital Twin
 - » Eclipse AAS Model for Java
 - » Eclipse AAS Web Client
 - » Eclipse AASX Package Explo...
 - » Eclipse BaSyx™
 - » Eclipse Semantic Modeling F...

Digital Twins in Data Spaces

Open Standards for Data Exchange

**Both, data provider and data consumer
need to understand the data**






The screenshot shows the IDTA Content Hub page for Submodels. The header includes the IDTA logo and navigation links: Home, About IDTA, Use Cases, Technology, Content Hub (selected), and News & Dates. A search bar is also present. The main content area is titled 'AAS Submodel Templates' and includes a description: 'Submodels constitute the content of the Asset Administration Shell. They describe content-related or functional aspects of an asset. Find the overview of the official IDTA submodel templates here.' Below this, there is a section titled 'Registered AAS Submodel Templates' with a link to find the process described here. A table lists the registered submodel templates.

Submodel Template	IDTA Number	Version	Status	View on GitHub
Inclusion of Module Type Package (MTP) Data	2001	1.0	In Review	Coming soon

The submodels defined in this document describe the integration of PEA (instance) and MTP (type) information into an AAS. The models do not intend to cover asset aspects addressed by further submodel definitions like technical

<https://industrialdigitaltwin.org/en/content-hub/submodels>

The Catena-X Standard Library

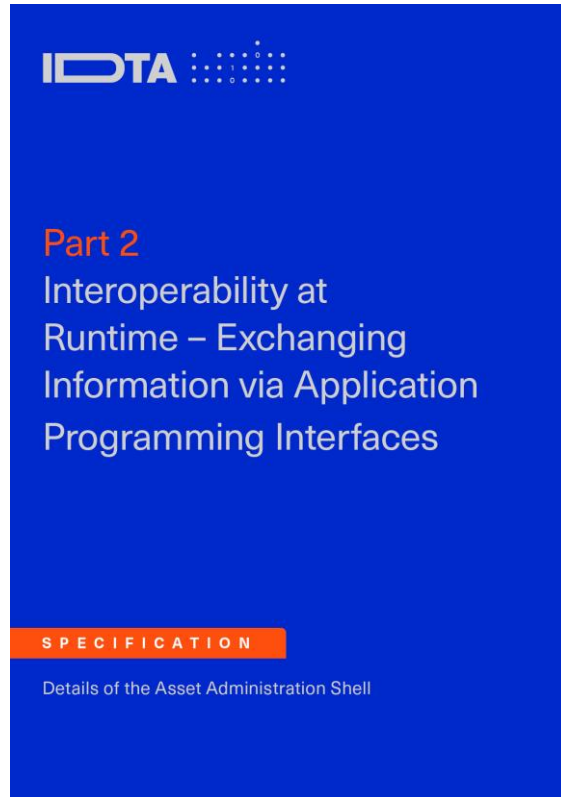
Sustainability	2.1	SUS-002 Product Carbon Footprint (PCF) Aspect Model	Published	 Datei herunterladen
Sustainability	2.1	SUS-003 Product Carbon Footprint (PCF) Request API	Published	 Datei herunterladen
Sustainability	2.1	SUS-004 Product Carbon Footprint (PCF) Rulebook	Published	 Datei herunterladen

<https://catena-x.net/de/standard-library>

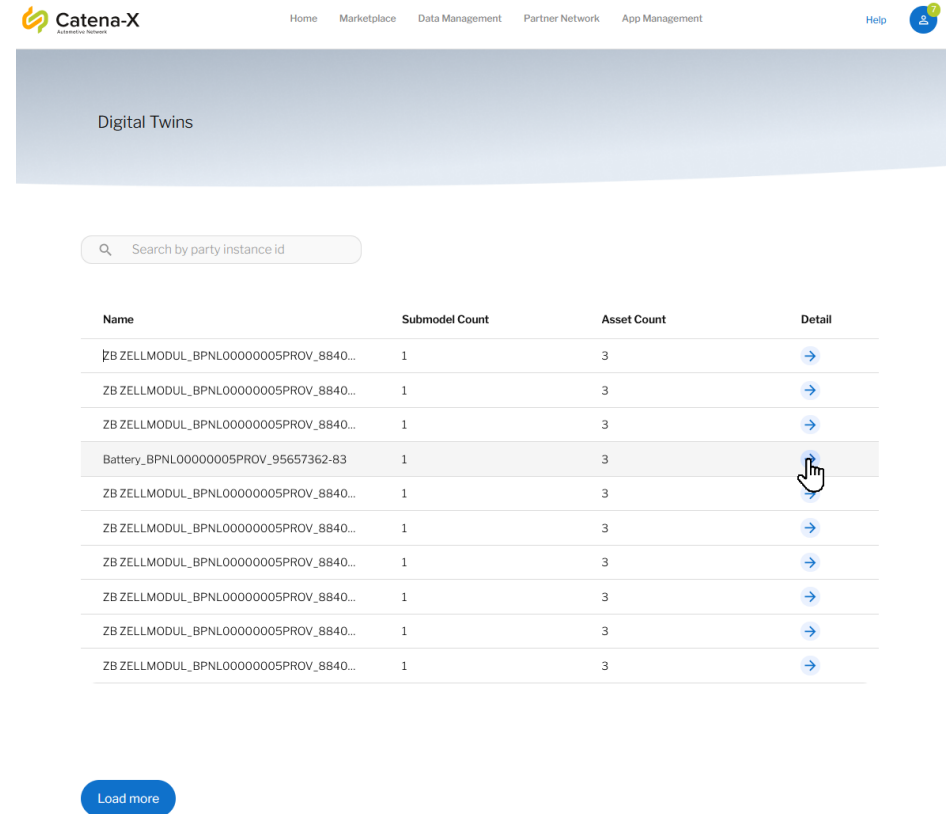
Digital Twins in Data Spaces

Open API Standards

data consumer need to find the data provided



Digital Twin
Discovery
and Registry



The screenshot shows the Catena-X Digital Twins interface. At the top, there is a navigation bar with links: Home, Marketplace, Data Management, Partner Network, App Management, and a Help icon. Below the navigation bar is a header section with the text 'Digital Twins'. Underneath is a search bar with the placeholder text 'Search by party instance id'. Below the search bar is a table with the following columns: Name, Submodel Count, Asset Count, and Detail. The table contains 10 rows of data. The fourth row, 'Battery_BPNI00000005PROV_95657362-83', is highlighted in grey. A mouse cursor is pointing at the 'Detail' link in this row. At the bottom of the table is a 'Load more' button.

Name	Submodel Count	Asset Count	Detail
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
Battery_BPNI00000005PROV_95657362-83	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→
ZB ZELLMODUL_BPNI00000005PROV_8840...	1	3	→

Digital Twins in Data Spaces

„Semantic work on data will be the future”

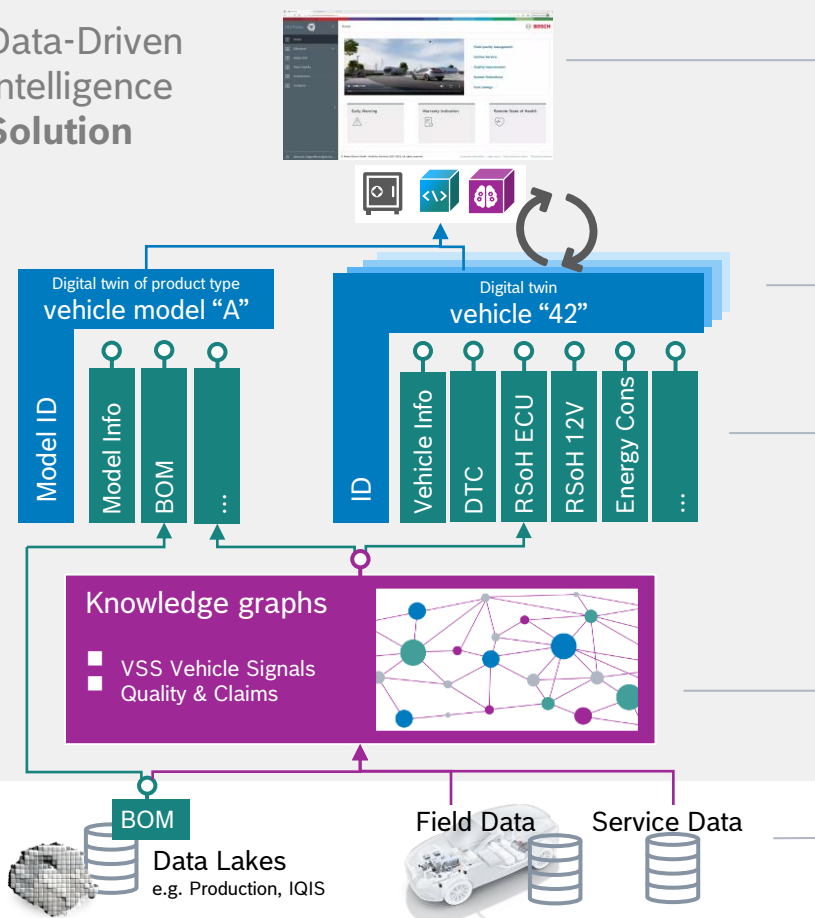


Digital Twins

Bosch Semantic Stack



Data-Driven Intelligence Solution



Know the relevant

- **product** and
- **valuable questions**

answered with **domain knowledge & meaningful data**

Introduce **semantic digital twins** for
product types and **products**

Describe the required **domain-specific data** in small & encapsulated **semantic models**:

i.e., create required **aspects** for your digital twins

- With APIs compliant to the semantic model
- providing meaningful & domain specific data

Combine, relate and structure data and knowledge upfront using **knowledge graphs**

Adapt the required data sources **once** fitting to the semantic models

Digital Twins

How to get your data-driven project going



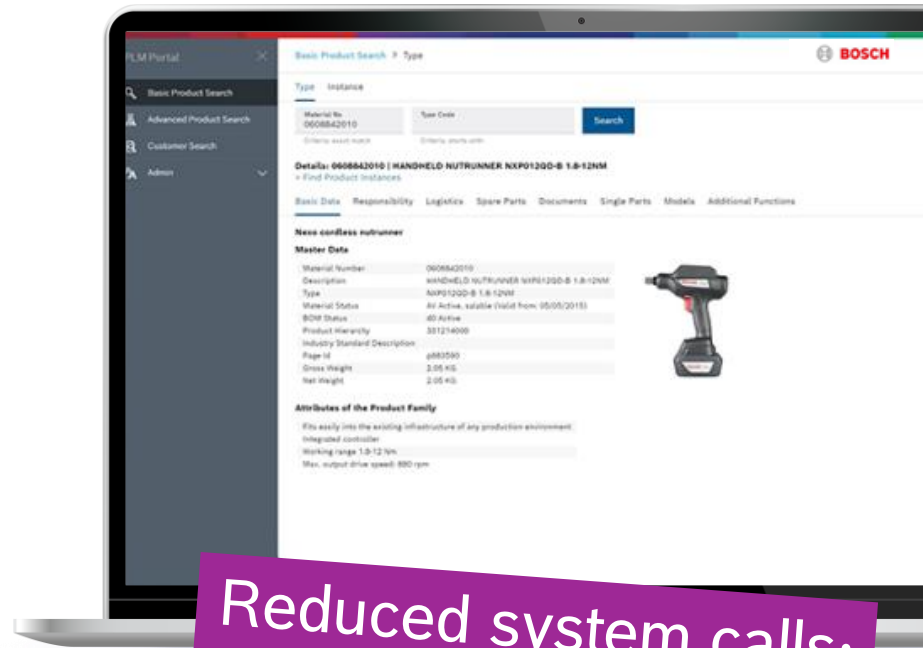
White paper: your data-driven projects in 4 steps | Bosch Semantic Stack

1 Scope	2 Prepare	3 Execute	4 Scale
 Initial talks Use case workshop Feasibility check / implementation check	 Project team selection Software & support organization	 Implement & launch	 Scaling plans Planning of further projects
 Business owner Key users Product/process experts Data experts	 Project leader Product/process experts Data experts	 Project leader Project team with product/process experts and data experts Key users	 Project leader Project team with product/ process experts and data experts Key users
 1 Month	 1-3 Months	 3-9 Months	 3-6 Months
 Use case profile Value definition & strategic fit Business & system context Ready-to-decide	 Project roadmap Initial architecture Effort estimation Ready-to-execute	 Productive solution (defined scope) Result presentation Ready-to-use	 Scale productive solution Blueprint for additional use cases Ready-to-reuse

PLM Portal @ Bosch Rexroth: Lifecycle management powered by Bosch Semantic Stack

All product knowledge in a central place

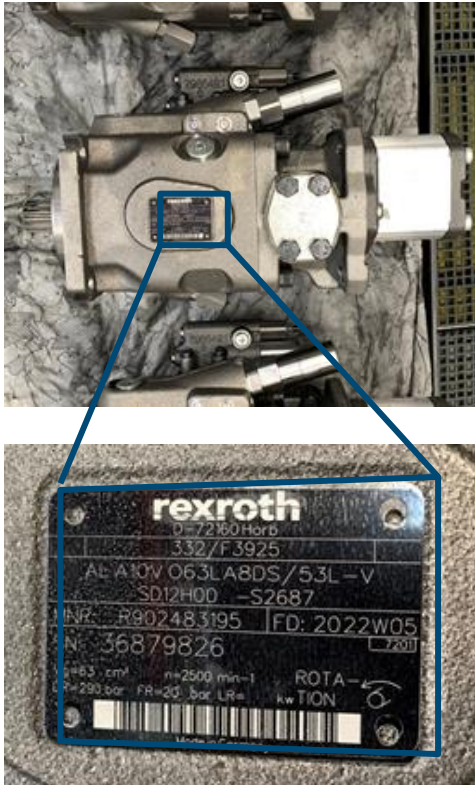
Bosch Rexroth's Product Lifecycle Management (PLM) portal is the home for **more than 170 million digital twins**, making it a central knowledge pool for the service team. Every inquiry can be answered immediately and without tedious manual searching – for maximum customer satisfaction.



Reduced system calls:
From 32 to 1 system

Digital Twins

Example: PLM Portal @Bosch Rexroth



Material Number (MNR) → Type Twin
Material Number (MNR) + Serial Number (SN) → Instance Twin

PLM Portal

- Einfache Produktsuche
- Erweiterte Produktsuche
- Kundensuche
- Admin

Hilfe

Logout

Erweiterte Produktsuche > Typ

Typ Instanz

Details: R902483195 | AL A10V O63LA8DS/53L-VSD12H00 -S2687


> Zeige Produktinstanzen

Grunddaten Verantwortlich Logistik Ersatzteile Dokumente Einzelteile Modelle

Axialkolben-Verstellpumpe

Stammdaten

Materialnummer	R902483195
Status	AV
Typkurzbezeichnung	AL A10V O63LA8DS/53L-VSD12H00 -S2687
Normbezeichnung	
Bruttogewicht	33 KG
Nettogewicht	33 KG
Page Id	p662666
Materialkurztext	AL A10V O63LA8DS/53L-VSD12H00 -S2687



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PLM Portal 1.10.0-1 (P)

Fußzeile ausblenden

One portal
for the digital
twins of the
Bosch
Rexroth
products

Data-Driven Intelligence solutions with Bosch Mobility Solutions

3 ready to use solutions for the automotive quality experts

We build 3 use case specific solutions with our colleague's from Bosch Mobility Solutions that **leverage the data and the Bosch domain knowledge** into **actionable insights**. E.g., **Warranty Indication**: You don't need a physical inspection, you get **remotely indicate warranty claims**

Around 65% of decisions can be made digitally*

* Results from pilot application, accuracy above 90%



Simple data integration



Data-based decision making



Optimal scaling effects

DigitalCV @Bosch Powertrain Solutions

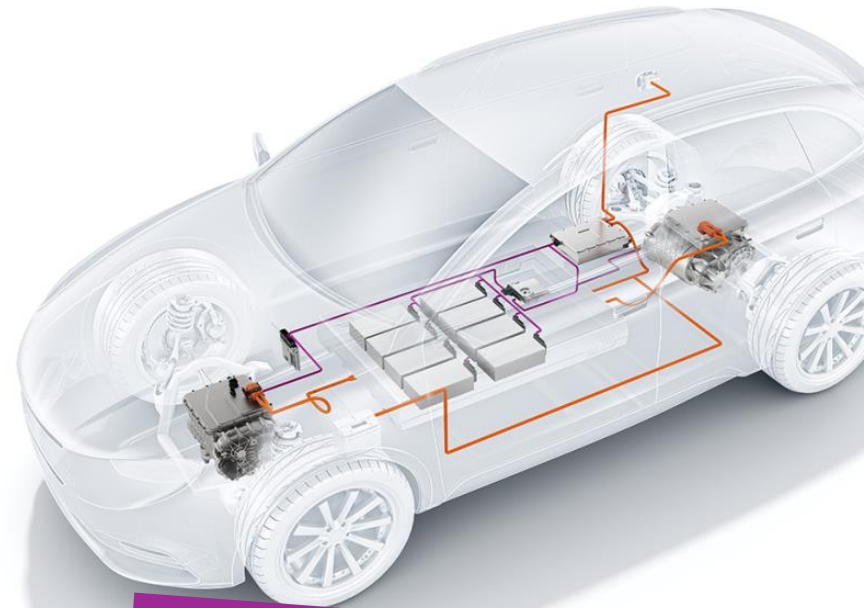
The entire automotive product life cycle

Bosch Powertrain Solutions offers highly complex drive units for electrical vehicles. With the DigitalCV – **a digital résumé for each produced unit and its components** – the manufacturer can always view the information from the complete life cycle as well as all cross-connections at a glance and can answer even difficult questions quickly.

 Continuous life-cycle transparency

 Cost and time savings

 Improved decision-making



20% reduction of failure costs by early failure identification

Digital Twins in Data Spaces

Closing

**„Digital twins are the key
of our work in the
connected world.
Semantic work on data
will be the future.”
Stefan Hartung**



Stefan Hartung, Chairman of the Board of Management, Robert Bosch GmbH at BCW 2022



Data-Driven Intelligence
powered by Bosch Semantic Stack