A case study of the adoption of the Automotive Process Framework (APF) at MAHLE

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WE SHAPE
FUTURE
MOBILITY

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- MAHLE is a leading international development partner and supplier to the automotive industry with customers in the passenger car and commercial vehicle sectors.

- The technology group, which was founded in 1920, is working on the climate-neutral mobility of tomorrow with a focus on the strategic fields of electromobility and thermal management as well as other technology fields to reduce CO_2 emissions, for example fuel cells or highly efficient combustion engines that can also run on e-fuels or hydrogen.

- Currently the share of MAHLE sales earned independently from the internal combustion engine for passenger cars amounts to more than 60 percent and is to increase to 75 per cent by 2030.

- **Half of all the vehicles in the world now contain MAHLE components.**

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We shape future PLM as a company culture, not only as an IT system

There is **no alternative to a uniform PLM basis** – today and in the future. MAHLE must quickly create this by transforming the fragmented PLM landscape into "One PLM" and empowering PLM colleagues to quickly and easily develop MAHLE global solutions together.

This is achieved through **standardization and harmonization** of all **PLM processes** and data and their provision on a global engineering work platform by mid of 2024. This new "One PLM" is also the foundation for future digitalization and automation.
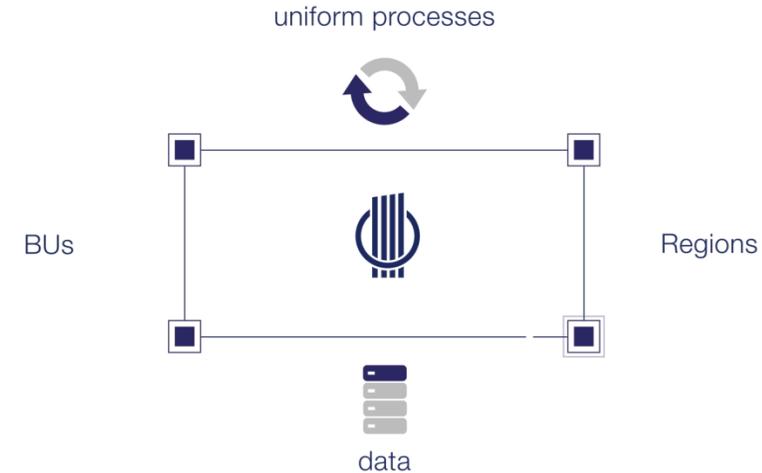
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This is done by harmonizing and standardizing PLM **processes, methods,** and tools

HARMONIZATION

We harmonize **processes, methods, work methods** and IT cross-BU and globally – except there is a product-specific verified need. One question from the customer – one answer from MAHLE.
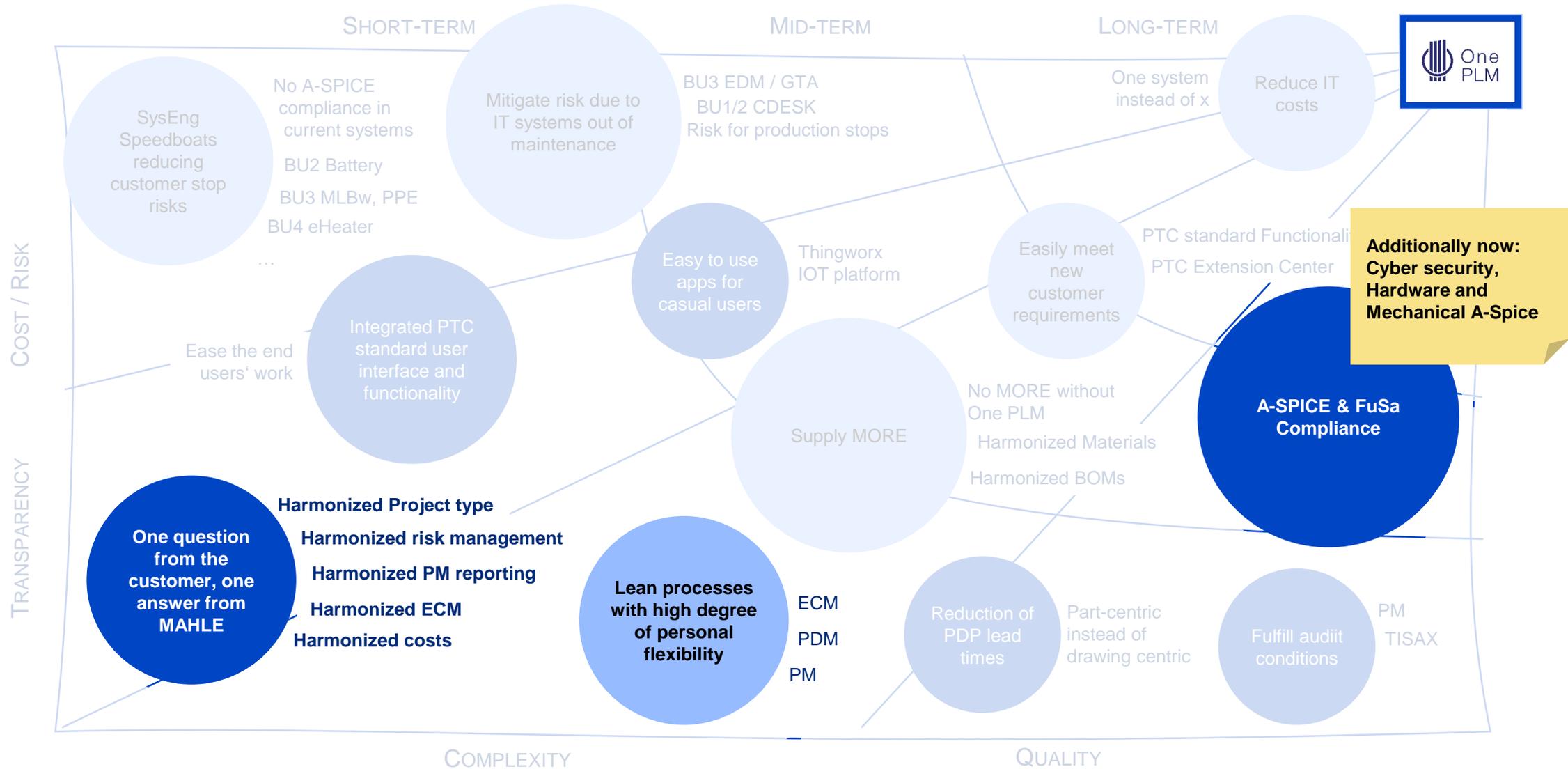
harmonization

↑

standardization

uniform processes

BUs

Regions

data

STANDARDIZATION

Due to constantly decreasing release cycles in the software industry, we use software providers' standard functionality. **Standard first!**

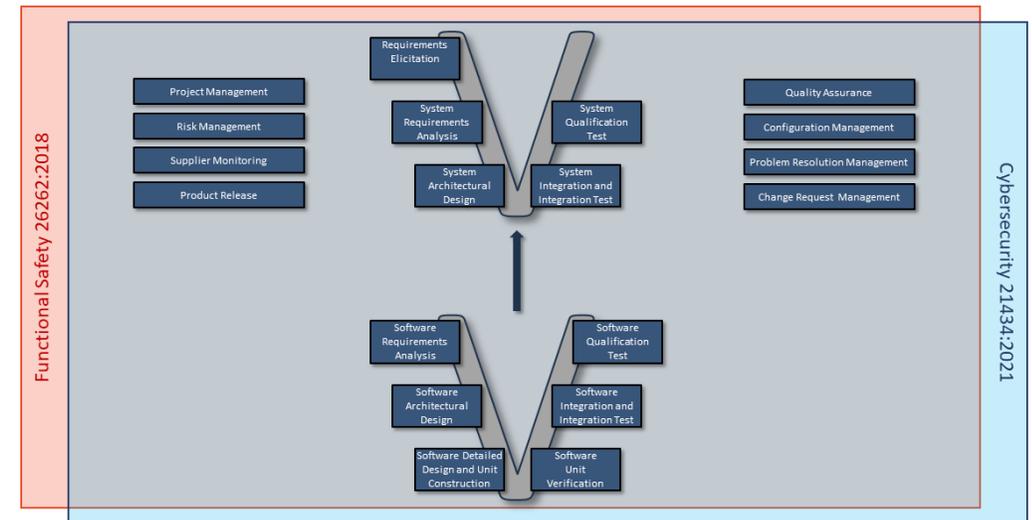**MAHLE**

Key Benefits One PLM

SHORT-TERM

MID-TERM

LONG-TERM

One PLM

COST / RISK

TRANSPARENCY

SysEng Speedboats reducing customer stop risks

No A-SPICE compliance in current systems

BU2 Battery

BU3 MLBw, PPE

BU4 eHeater

...

Mitigate risk due to IT systems out of maintenance

BU3 EDM / GTA
BU1/2 CDESK
Risk for production stops

One system instead of x

Reduce IT costs

Additionally now: Cyber security, Hardware and Mechanical A-Spice

Easy to use apps for casual users

Thingworx IOT platform

Easily meet new customer requirements

PTC standard Functionali

PTC Extension Center

Ease the end users' work

Integrated PTC standard user interface and functionality

Supply MORE

No MORE without One PLM

Harmonized Materials

Harmonized BOMs

A-SPICE & FuSa Compliance

One question from the customer, one answer from MAHLE

Harmonized Project type

Harmonized risk management

Harmonized PM reporting

Harmonized ECM

Harmonized costs

Lean processes with high degree of personal flexibility

ECM

PDM

PM

Reduction of PDP lead times

Part-centric instead of drawing centric

Fulfill audiit conditions

PM

TISAX

COMPLEXITY

QUALITY

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We started with the APF V4.1.3

- The APF V4.1.3 only supported the project scopes of the following standards:

  - Automotive SPICE 3.1 focusing on the VDA scope plus MAN.5, SPL.2, PIM.3 and SYS.1
  - ISO/SAE 21434:2022 Road vehicles - Cybersecurity engineering
  - ISO 26262:2018 Road vehicles - Functional safety

- We needed to extend the APF to cover our full Product Development Process (PDP), and ultimately other development lifecycles:
  - New domains/disciplines and practices
  - A full PDP lifecycle

- We also needed support for ASPICE Hardware Engineering 2.0 and Mechanical Engineering 1.8 …

Both Stages and the APF were new products to us …

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Method Park: Understanding and aligning to MAHLE One PLM

- It took a while for us to fully understand the company-wide One PLM capability improvement program

- There are many interfaces that needed to be identified and ultimately supported:
  - PLM tooling using PTC Windchill
  - Wider company processes captured using other tools
  - Alignment of the different teams in One PLM
  - Stages tailored project process imported into Contact Software as draft project plans
  - This is still work in progress!

- It was excellent that our Method Park Consultancy Team was also engaged to help to support 'speedboat'/pilot projects and help with ASPICE+ capability development

Ultimately strong leadership within the One PLM End-to-End (E2E) Team helped us understand all the necessary dependencies and help us all to start to focus on the process modeling!

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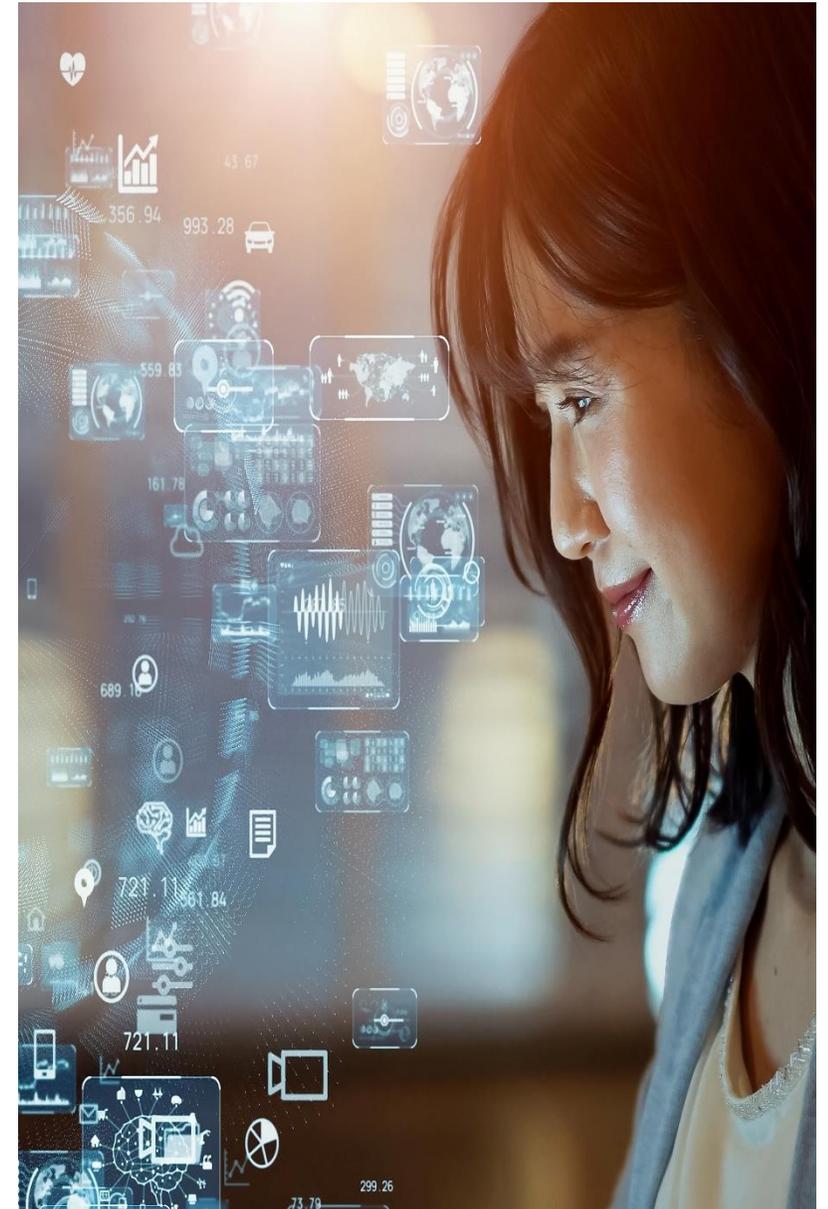
Reasons why we selected Stages with the APF

- Creating a process from scratch is very time-consuming, expensive and hard

- The APF provided a neutral framework to align and integrate our 4 business units' processes for greater standardization

- Good project coverage and compliance mapping to key ASPICE and ISO standards

- The potential to have company wide standard processes, but tailor it to the needs of specific projects

- Need for greater System Engineering focus as our products get more complex often including mechanical, hardware and software components.

We wanted our company-wide processes to fundamentally support, "One question from the customer, one answer from MAHLE"

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Modifying and extending the scope of the APF

Automotive Process Framework developed using stages

- Several MAHLE specific domains/disciplines were added:
  - Project Sales
  - Project Controlling
  - Project Manufacturing Engineering
  - Project Logistics
  - Project Purchasing

- Additionally, a few MAHLE specific practices were added:
  - System Risk Evaluation
  - Validation Test
  - 2 variant sets of Software Development practices

- MAHLE modeled their complete PDP lifecycle with 2 levels of milestones identifying all the work products with quality-levels required for both levels

We collaboratively developed support for ASPICE Hardware Engineering 2.0 and Mechanical Engineering 1.8 …

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Collaboration to develop the APF's support for Hardware and Mechanical Engineering

- Method Park proposed that we collaborate on the development of the new processes:

  - **Method Park** would perform all the modeling in their APF development environment

  - **MAHLE** would provide SME input to modeling and review the first version

  - **Method Park** would develop earlier than planned the ASPICE Hardware 2.0 and Mechanical Engineering 1.8 Reference Models

  - **Method Park** would retain the IPR to sell the new processes to other customers

  - No **MAHLE** specific IPR or best practice would be included into the processes

MAHLE received a significant discount on purchasing the new content and Method Park delivered it much earlier than initially planned!

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MAHLE's PDP Lifecycle

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# Tailorable project specific navigation diagrams

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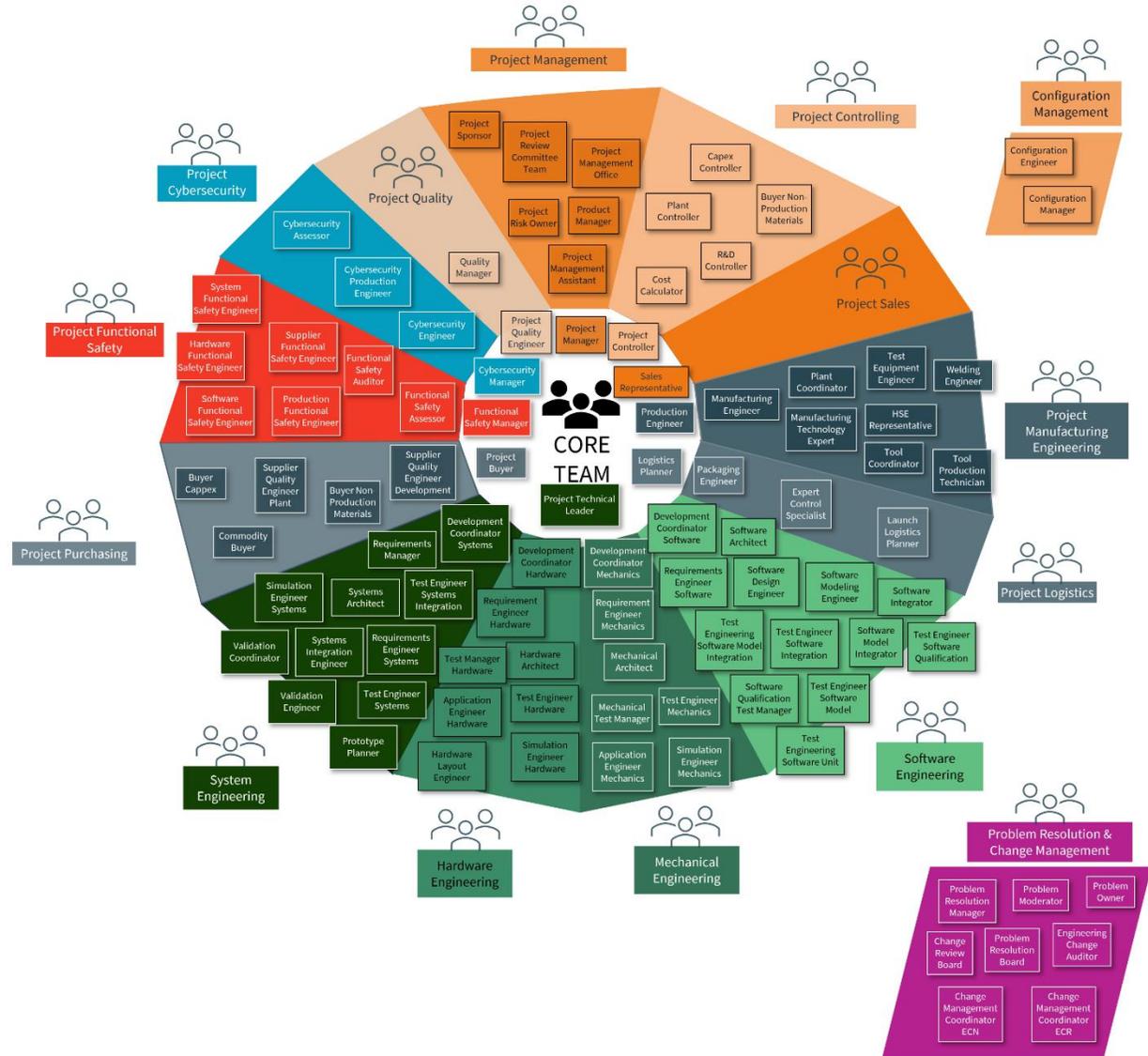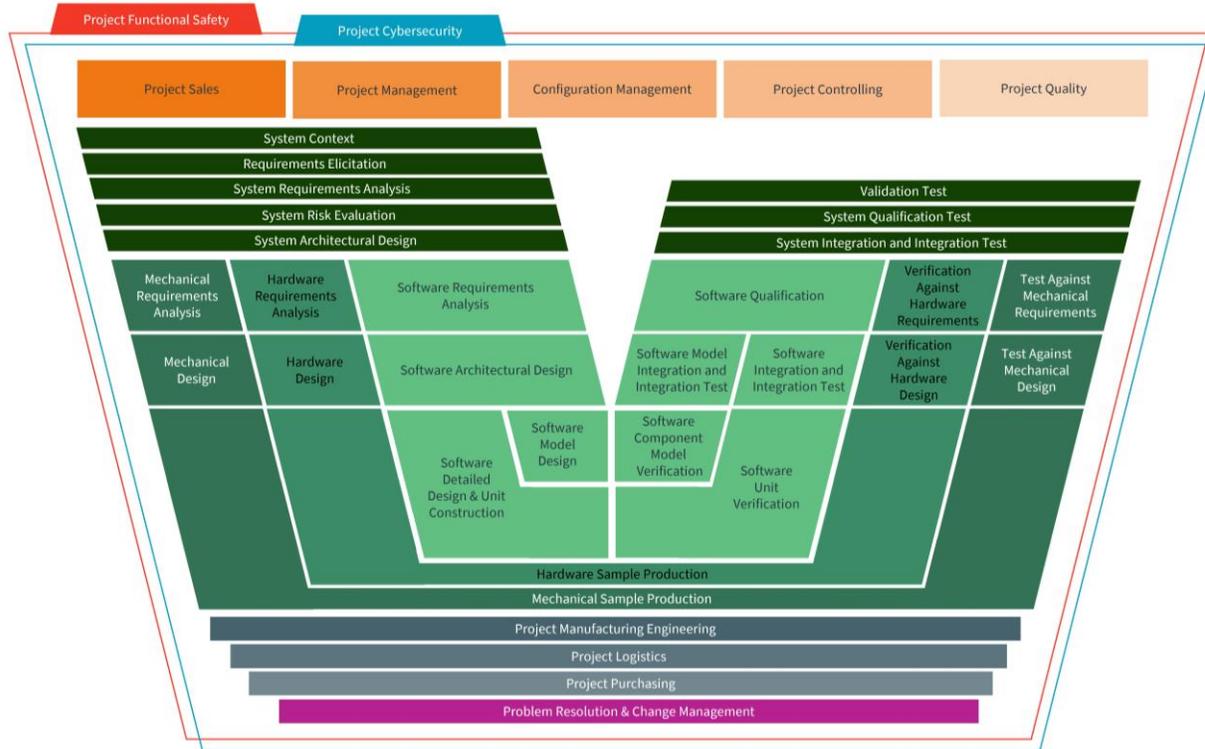
Challenges
and things we would do differently

- A couple of the domain modelling teams started re-modeling existing processes from scratch!?!
  - It is always more effective to modify and extend than start from scratch
  - Significant rework to re-integrate and re-compliance map the re-modelled processes
  - Ultimately the process developed looked a lot like the starting APF processes

- Keeping support from very busy Subject Matter Experts (SME) is always challenging
  - Getting strong business support with assigned resources is always critical

- It was a constant struggle to keep the modeling teams focused on developing a good but not perfect first version of MAHLE's automotive processes
  - Maybe a little more analysis upfront of the specific changes needed could have helped

- The extension processes for Functional Safety and Cybersecurity took a long time to get the balance between the specific and integrated processes
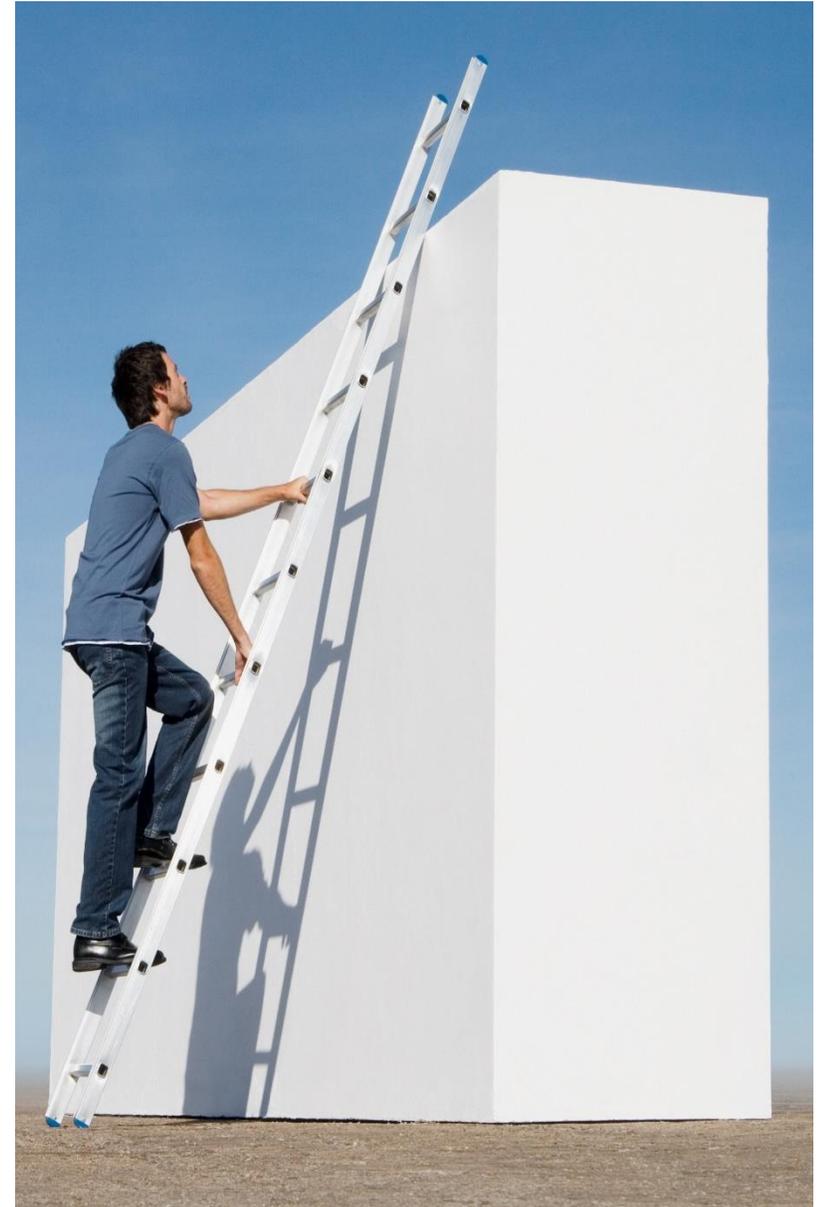
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Summary, conclusions and next steps

- We have released the first MAHLE-wide standard Product Development Process (PDP)

  - "One question from the customer, one answer from MAHLE"
  - Good support and buy-in across the business units to develop a common process
  - Achieving the first version is a huge success in itself!

- Excellent collaboration between MAHLE and Method Park for our joint success

- Key next steps:

  - To refine and pilot the first version of the PDP process
  - Introduce further governance, management and change management of the process improvement
  - Further work to extend the basic APF tailoring to be MAHLE specific
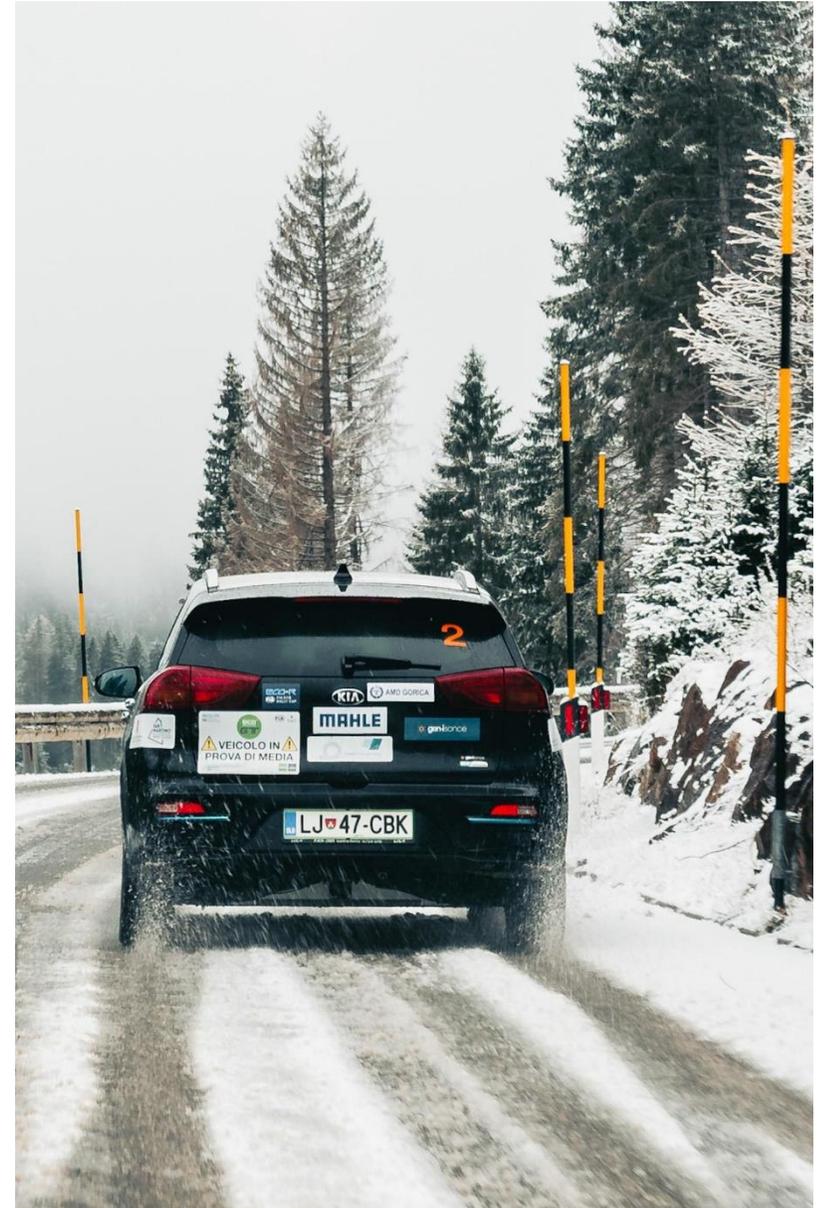
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Any questions or comments? ...
Remember you will get only one answer from us!