

Future challenges

Risks & opportunities



Principles of Systems Engineering



Complexity Management



Stakeholder Management



Controlling & Baselineing

Questions of Value Stream Analysis

What are the core value elements?

Who is creating these elements?

What effort is behind the creation?

Definition: The **value stream analysis** creates **transparency** about the current **distribution of effort** regarding **Work Products** and **involved roles** within a R&D organization.

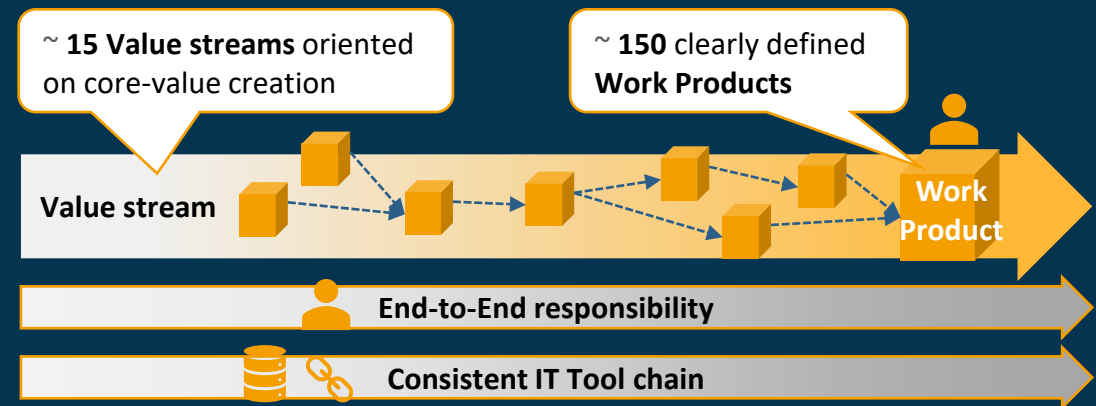
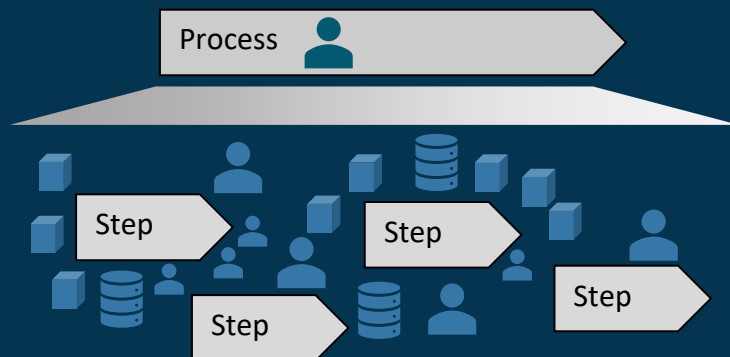
Core value creation

Typical situation ...

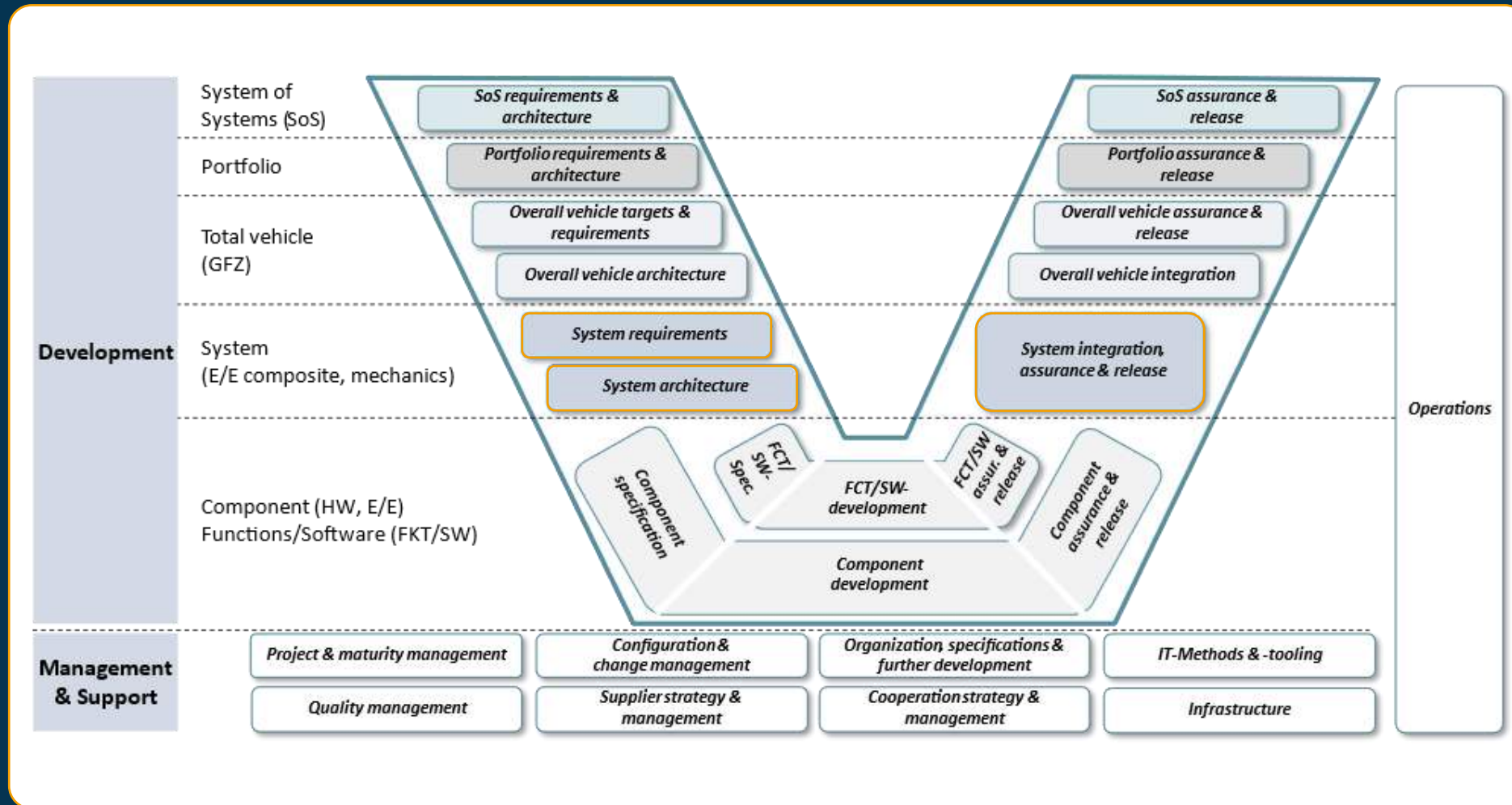
1. **Multi-Dimensional Transparency:** Effort & cost transparency in R&D for different, overlapping views (e.g., Org units, Cost centers, Projects, Inhouse / external, Years).
2. **Value-Misunderstanding:** Department-specific (“silo”) understanding of valuable and non-valuable tasks and work products.
3. **Task-Focus:** HOW (tasks & detailed processes) more dominant compared to WHAT (deliverables, results, work products, maturity).

... and what a R&D VSA delivers

1. **Transparency on Core Value Creation:** Effort & cost transparency on work product level, combinable with existing views, based on estimation per work product and department, aggregation bottom up to R&D level.
2. **Common Value-Understanding:** Org-wide common view on valuable and non-valuable work products.
3. **Work Product Focus:** Dominant perspective on WHAT (work products) and related methods, tools as basis for day-to-day work of engineers / dev teams.



The V-Model – Basis for the Value Stream Analysis



System level:

E/E compound or mechanical systems through which a customer function is realized or a customer-value property/functions is influenced.

Sample of Work Products – System integration, test and release :

- System test planning / strategy
- Testable overall system (test environment)
- Test report system (incl. test results)
- Test report security
- Integration Stage configuration (SW & HW)
- System Acceptance Report
- System release

Scope & Methodology

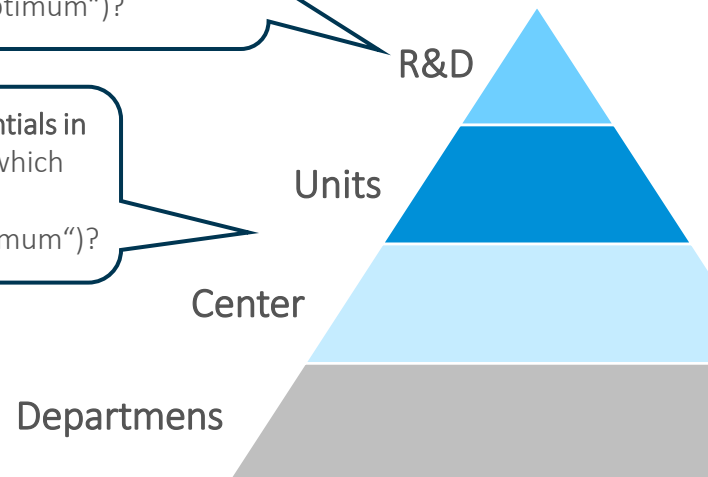
Analysis Scope



Baseline for centrally coordinated, **global optimization** as well as **local optimization** in units and centers

What are potentials across our entire R&D organization, which can only be addressed overarching („global optimum“)?

What are specific potentials in single Units / Centers, which need to be addressed decentrally („local optimum“)?

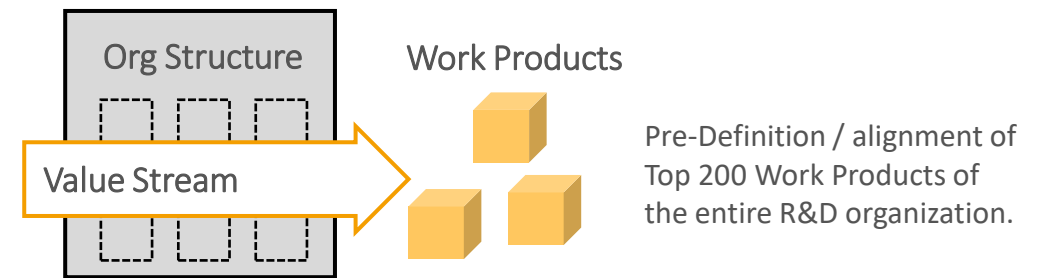


Methodology



Focus on **Work Products*** (deliverables/ outputs) of the development stream, as a common structure.

Analysis Structure



Interviews per Department

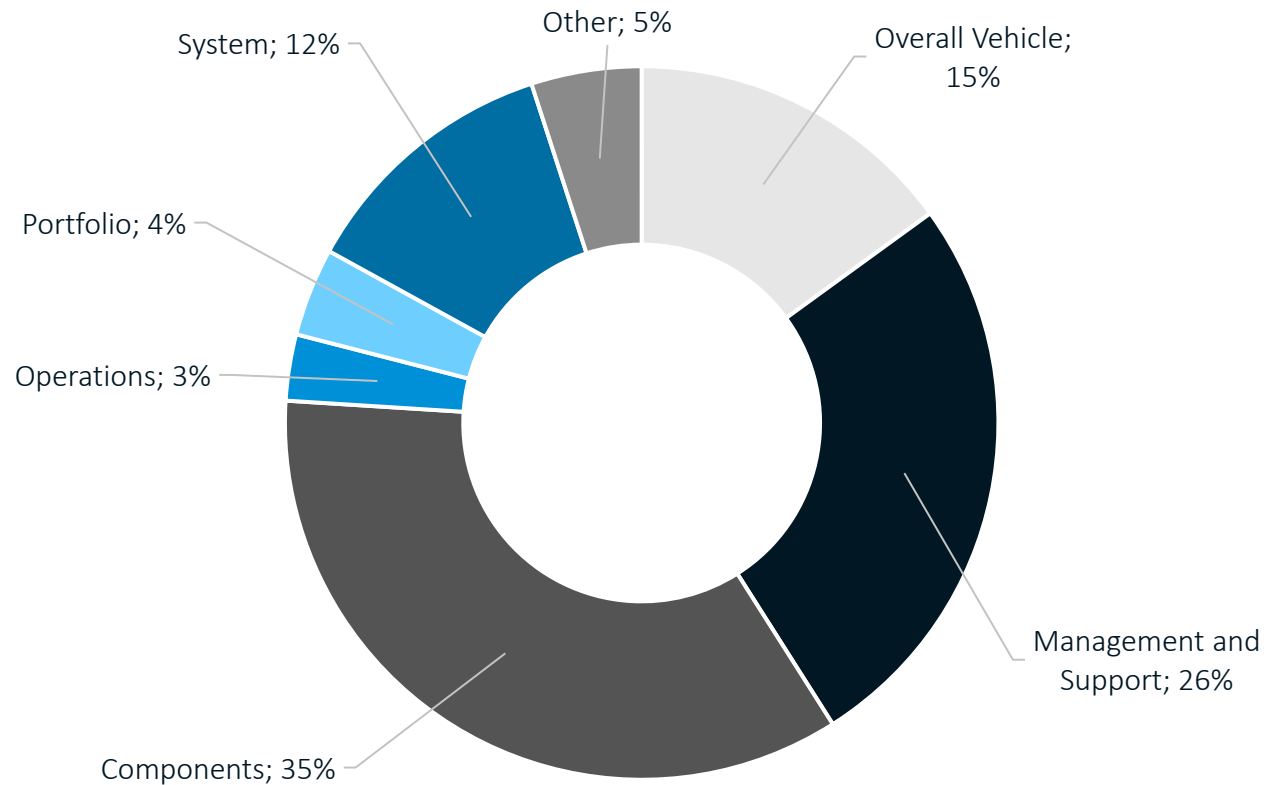
4 questions in 3h; results bottom up aggregated afterwards with FTE data:



1. **Relevant Work Products** for day-to-day work of dpt. X.
2. **Acting key roles** to deliver each relevant Work Products.
3. **Internal effort** per Work Product, estimated relatively.
4. **External effort** per Work Product, estimated relatively.

*generated result of an engineering / R&D process or activity, e.g. geometrical architecture, status report, component specification, vehicle release, test report, budget plan, project target agreement

Distribution and total effort per value stream level



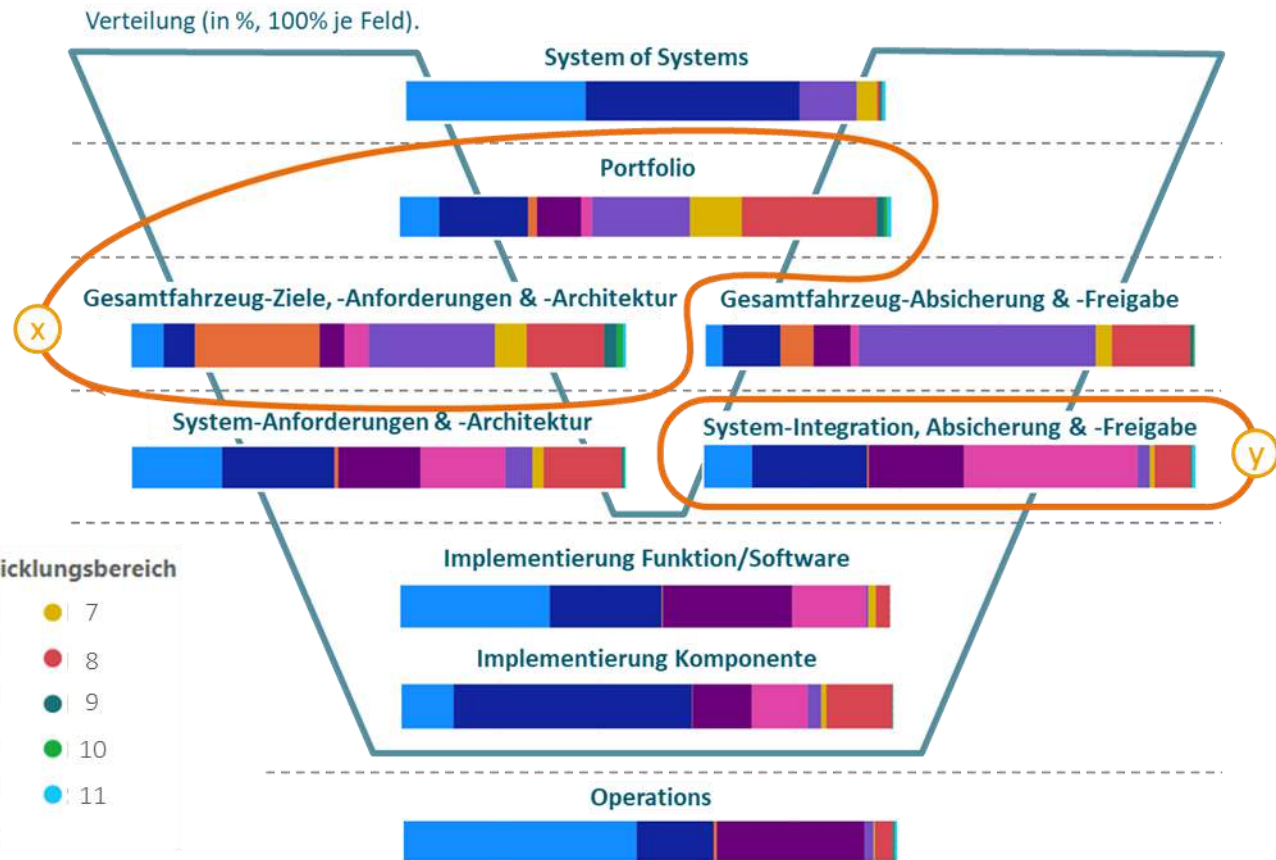
Significant anomalies

- **"Management & Support"**: High share of expenses (approx. 26 %), ratio of control to core value added not optimal
- **"System"**: Weight "System" (approx. 12 %) compared to overall vehicle (approx. 15 %) the same.
- **"Operations", "SoS"**: Relatively little effort in "Operations" (approx. 3 %)

Causes

- **"System"**: Development, safeguarding, integration either on overall vehicle or component/ function level, continuity over system level not shown; system level not clearly defined and anchored as connecting element between overall vehicle and implementation.
- **"Operations", "SoS"**: Not yet in focus, more important in future regarding end-to-end customer experience and networking of the vehicle in the ecosystem.

Effort within the V-Model



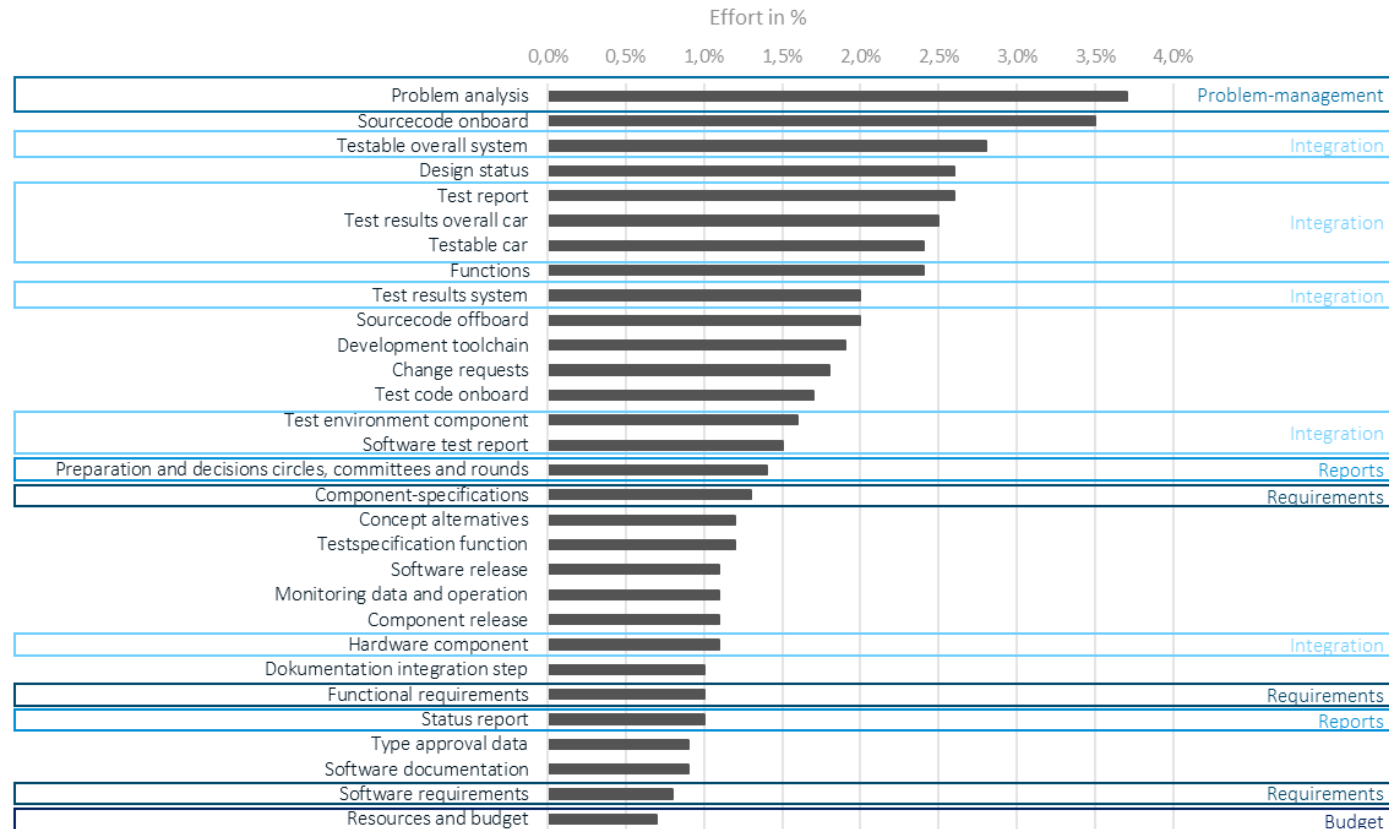
Significant anomalies

- **Portfolio & overall vehicle goals, requirements, architecture:** Relatively small contribution from connected ecosystem (light blue), software, electronics (violet), driving experience (magenta), in total approx. 15%.
- **System integration, test, release:** High share of drive (dark blue), driving experience (magenta), total approx. 60%

Causes

- ⊗ **Portfolio & overall vehicle goals, requirements, architecture:** Strongly hardware-oriented, less E/E & SW-oriented, i.e. "architecture is oriented more to the skeleton than to the nervous system". The whole development organization is component oriented (physical hardware components).
- ⊙ **System integration, test, release:** no clear strategy and understanding discernible regarding system integration, test, release, anchoring decentrally within the division.

Top 30 Work Products by effort



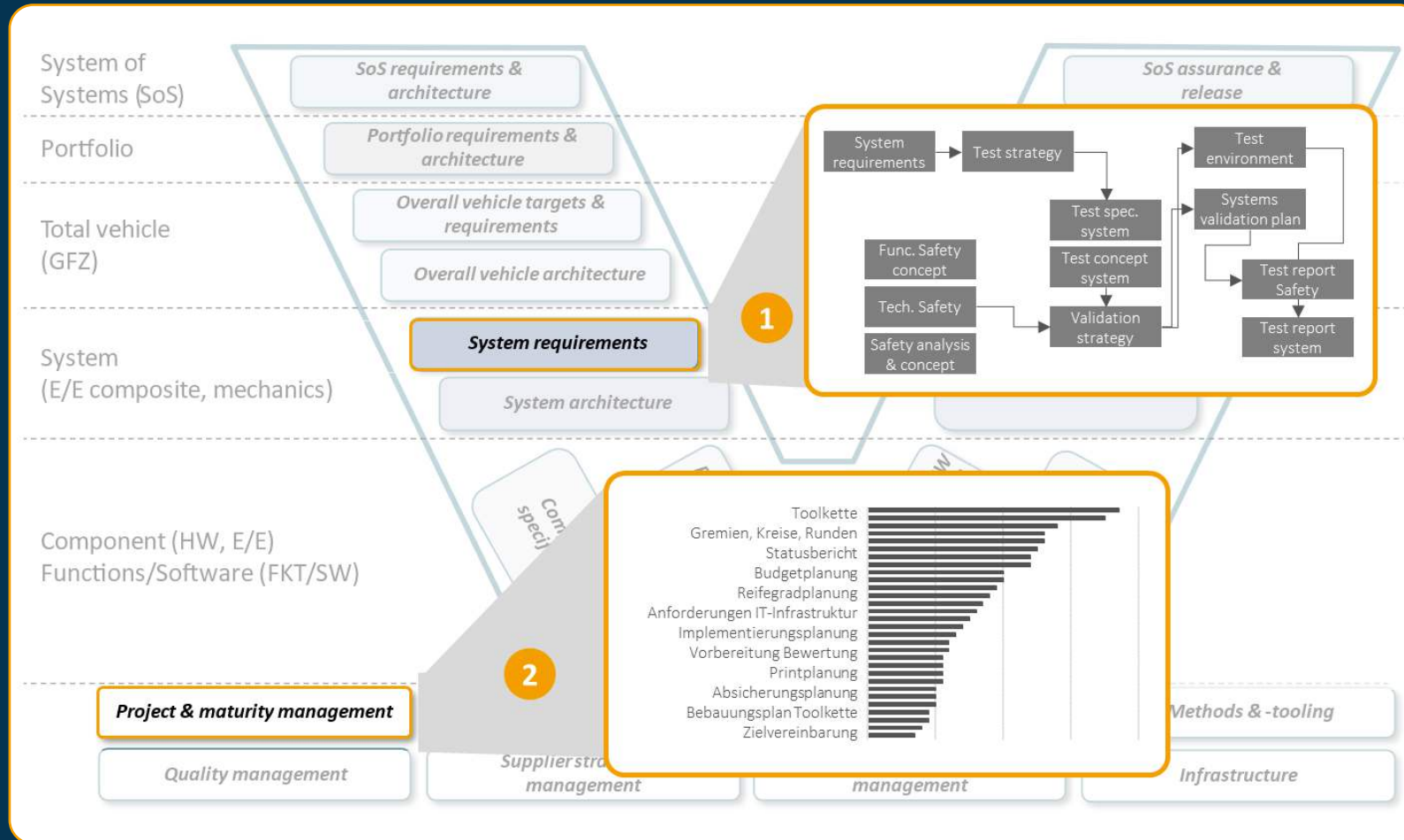
Significant anomalies

- **Integration & Safeguarding:** In total approx. 500 FTE, approx. 16% of the company total effort.
- **Problem management:** approx. 100 FTE
- **Requirements development:** In total approx. 90 FTE
- **Committees & reports:** In total approx. 60 FTE
- **Resource & budget planning:** approx. 30 FTE

Causes

- **Integration & validation:** Little consistency & target-oriented, many unplanned iterations, high effort at overall vehicle level due to redundancy of test targets with lower levels.
- **Problem management:** High ticket/problem volume without prequalification, high control/coordination effort.
- **Requirements development:** Process and work model strongly decentralized / unclear and little vertical consistency, therefore high effort

Two different approaches



1

Optimization of value streams in development

- **Scope:** value stream, information flow between work products
- **Approach:** Systemic, medium and long-term effect
- **Levers:** Optimization of data flow & consistent IT development, cut organizational structure & responsibility

2

Optimization of single Work Products

- **Scope:** Single work products
- **Approach:** Sharp focus on work product, day-to-day operations of developers, short-term impact
- **Levers:** Elimination of partial results, sharpening of responsibility, standardization, digitization, reduction of repetition, outsourcing