HOW WE DEFINE, MEASURE AND ACHIEVE SW QUALITY

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15.5.2025

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Auditor of
Software & Cybersecurity
suppliers

Škoda Auto a.s.

GQD-2/3 - Quality control of purchased parts

WHAT WILL TODAY BE ABOUT?

- Introduction
- Requirements ŠKODA
- Monitoring activities
- Current challenges

130 YEARS OF HISTORY

1895

The story of the Škoda cars did not start on four wheels

Voiturrete A

1905

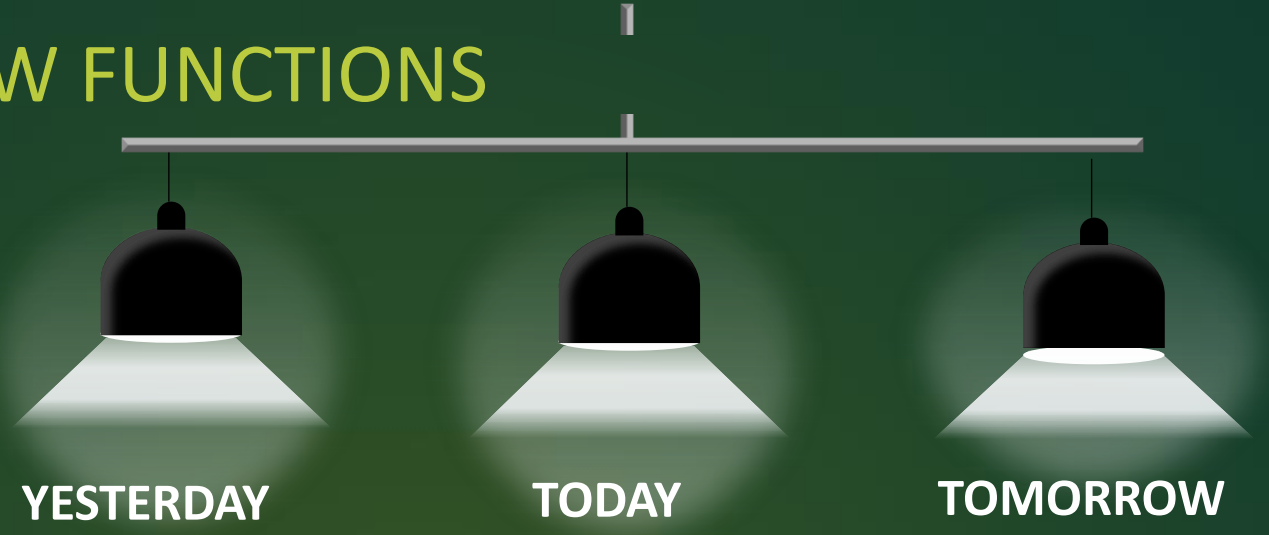
1925

Merger with Škoda Pilsen

SK became part of VW family

1991

COMPLEXITY OF SW FUNCTIONS



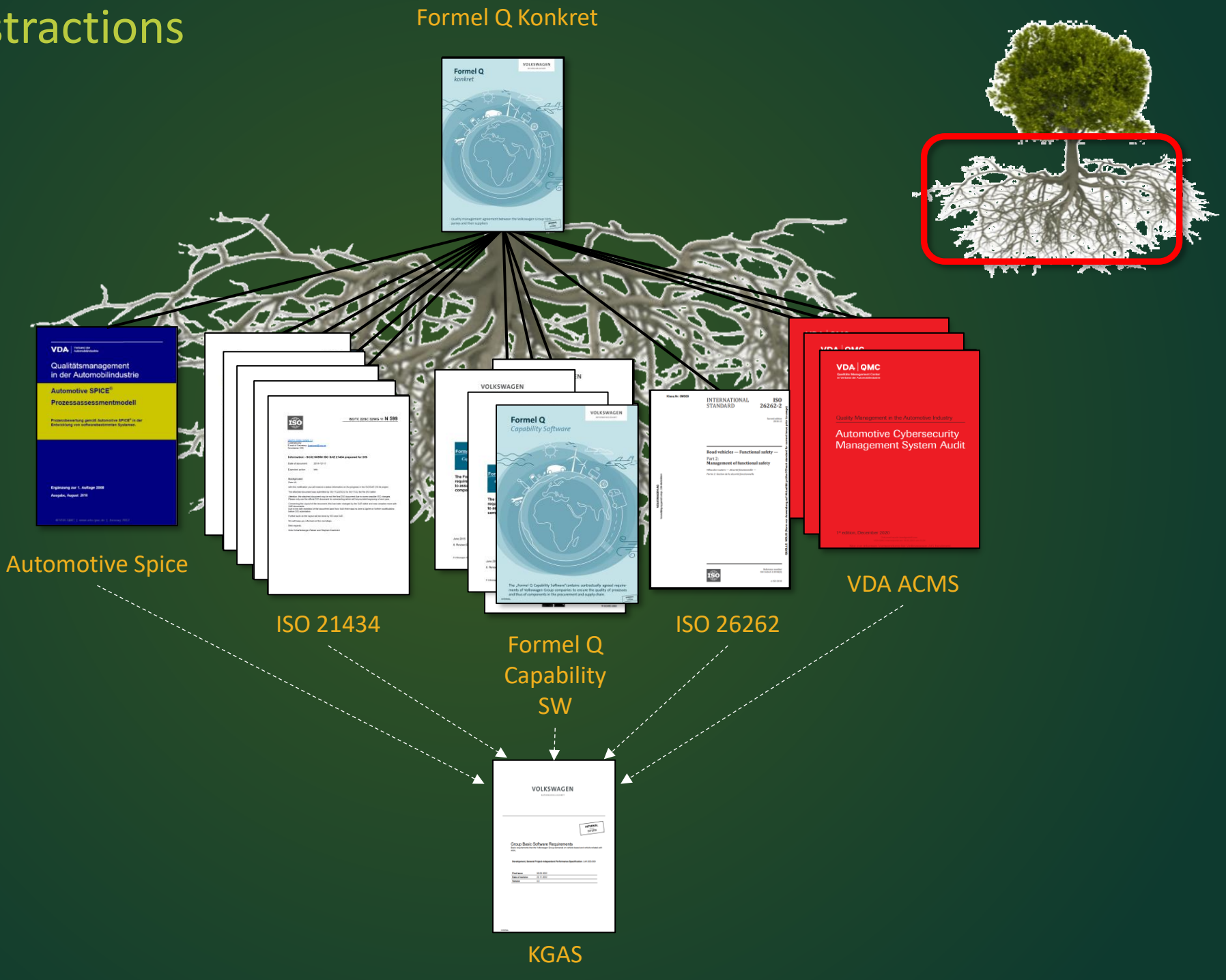
FUNCTIONS			
Horn	✓	✓	✓
Wipers	✓	✓	✓
Parking Assistent	✗	✓	✓
Connectivity	✗	✓	✓
Self-charging vehicle	✗	✗	✓
Autonomous Driving	✗	✗	✓

BASIC REQUIREMENTS TO SW QUALITY

TALL TREES NEED STRONG ROOTS

BASIC REQUIREMENTS TO SW QUALITY

Levels of abstractions



BASIC REQUIREMENTS TO SW QUALITY

LAH 893.909 (KGAS)

VOLKSWAGEN

AKTIENGESELLSCHAFT

INTERNAL
INTERN

Group Basic Software Requirements

Basic demands set by the Volkswagen Group on vehicle software and on software related to the vehicle/software determinated systems and its development processes.

Development, General Project-Independent Performance Specification: LAH.893.909

Author	Volkswagen AG, Audi AG, Porsche AG
Dept./OU	K-PQX-S (Volkswagen), I/GQ-F1 (Audi), EES3 (Porsche)
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Fax	-
E-mail	software.qualitaet.vwag.r.wob@volkswagen.de
First issue	06.09.2002
Date of revision	22.04.2020
Version	3.4
Baseline	3.27 (d) current
Freigabe	

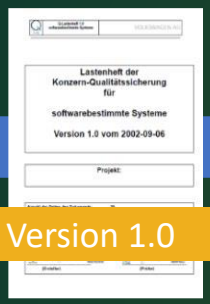
Wegner, Berend (K-PQX-S) 22.04.2020

Datum Unterschrift

- "Konzern Grundanforderungen Software" define the Volkswagen Group's requirements for the quality of software in vehicles.
- Contains an additional 450 requirements for development processes and work product
- Requires suppliers to achieve capability level 2 according to the Automotive Spice model
- Contains cybersecurity requirements in accordance with UNECE R 155 recommendations

BASIC REQUIREMENTS TO SW QUALITY

LAH 893.909 (KGAS)



Version 1.0

2002.09

Safety relevance

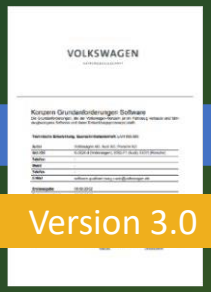
Automotive Spice

A-Spice requirements mentioned for the first time

Version 2.1

2008.05

KGAS v2.1 is the first version of the official Q-LAH for Volkswagen development processes

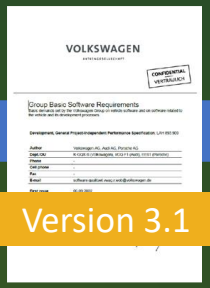


Version 3.0

2015.11

Functional Safety

Functional safety requirements have been added

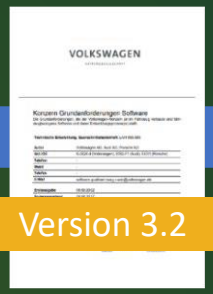


Version 3.1

2017.04

Cybersecurity

Cybersecurity requirements (CS) have been added as a new chapter

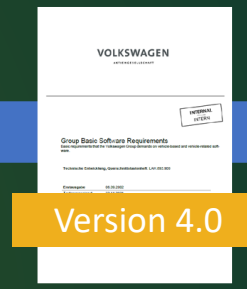


Version 3.2

2018.11

Free & Open-Source Software (FOSS)

FOSS requirements have been added as a new chapter

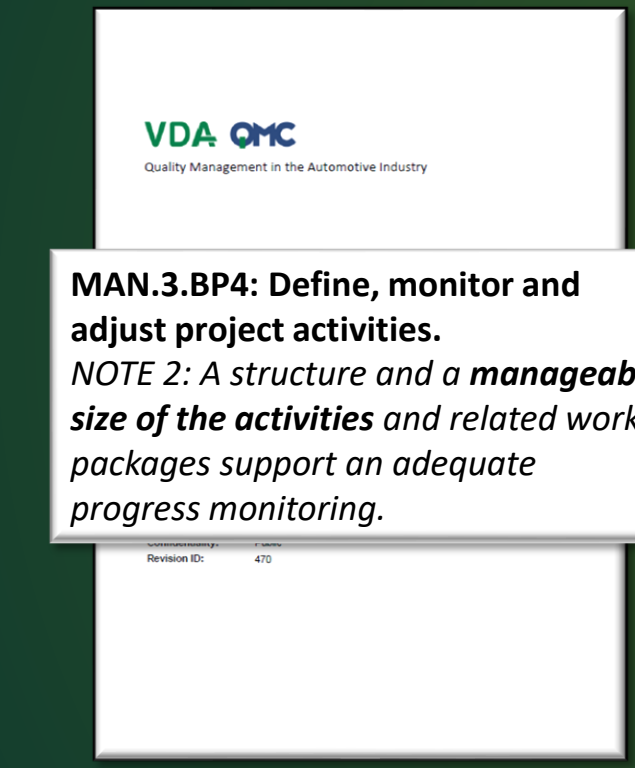


Version 4.0

2022.11

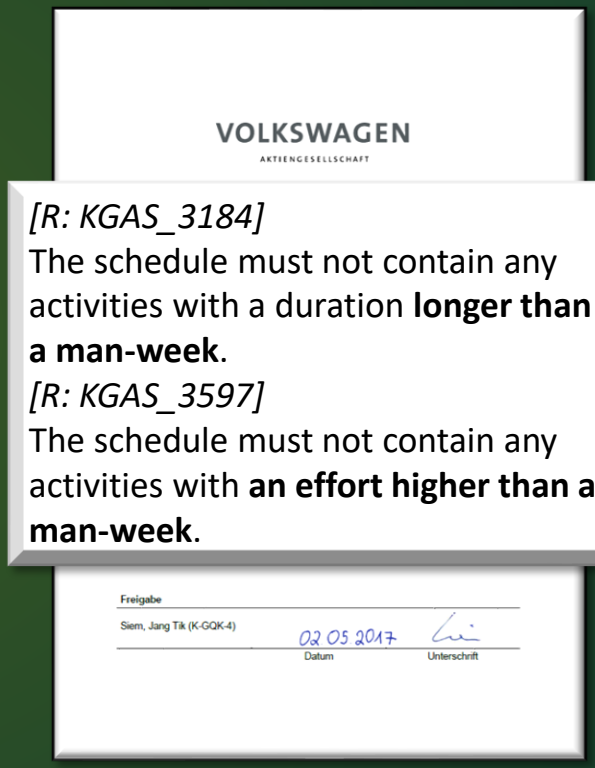
Continuous updates of work product and development processes requirements

BASIC REQUIREMENTS TO SW QUALITY
LAH 893.909 (KGAS)



MAN.3.BP4: Define, monitor and adjust project activities.
*NOTE 2: A structure and a **manageable size of the activities** and related work packages support an adequate progress monitoring.*

AUTOMOTIVE SPICE®



[R: KGAS_3184]
The schedule must not contain any activities with a duration **longer than a man-week**.
[R: KGAS_3597]
The schedule must not contain any activities with **an effort higher than a man-week**.

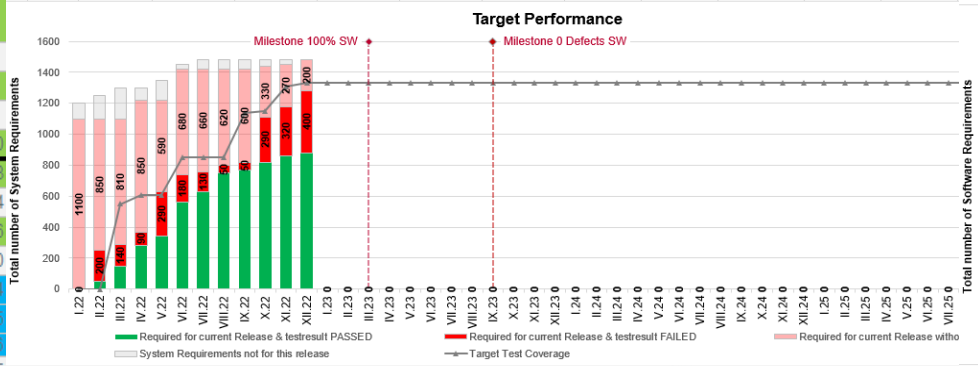
Specific requirements of VW KGAS

SQA REPORT

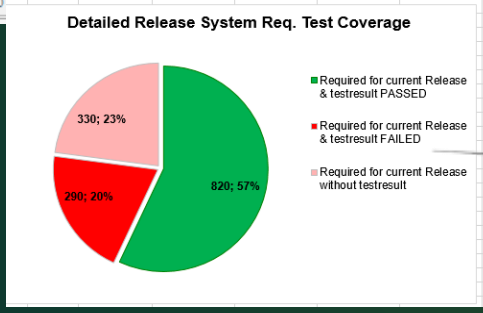
REPORTING AND MONITORING

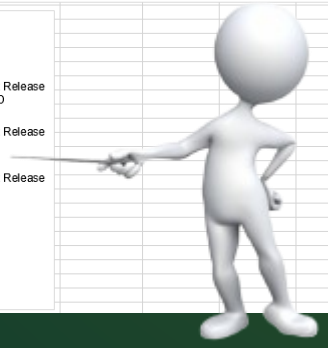
ID	Query	Prio	Process Area	Query Description	Sep.'21	Oct.'21	Nov.'21	Dec.'21	Jan.'22	Feb.'22	Mar.'22	Apr.'22
58	No. of Customer requirements from requirements specification	1	Customer Requirements	Alle nur Info	24 228	24 256	24 246	24 225	24 165			
61	No. of Customer requirements planned to be implemented	1	Customer Requirements	Forecast --> please fill out fields for all months								
62	No. of Customer requirements implemented	1	Customer Requirements	Relation 62/61 --> M1								
65	No. of Customer requirements implemented and linked to system requirements ↓	1	Customer Requirements	Relation 65/62 --> M2								
67	No. of System requirements identified	1	System Requirements		2 571	2 581	2 593	2 631	2 699			
68	No. of Software related System requirements identified	1	System Requirements		94	148	254	258	256			
71	No. of Software related System requirements reviewed	1	System Requirements	Relation 71/68 --> M3	94	143	232	243	585			
79	No. of SW related System requirements linked to system element(s) ↓	1	System Requirements	Relation 79/68 --> M4	92	121	202	205	203			
80	No. of SW related System requirements linked to SW requirements ↓	1	System Requirements	Relation 80/68 --> M5			254	258	251			
83	No. of System interfaces	1	System Architectural Design		437	933	996	21	22			
86	No. of SW requirements identified	1	Software Requirements	Plausi: Muss >= 68 sein	596	1 093	1 062	1 081	979			
88	No. of SW requirements reviewed	1	Software Requirements	Relation 88/86 --> M6	42	234	376	220	214			
92	No. of SW requirements linked to SW elements ↓	1	Software Requirements	Relation 92/86 --> M7	52	42	334	353	314			

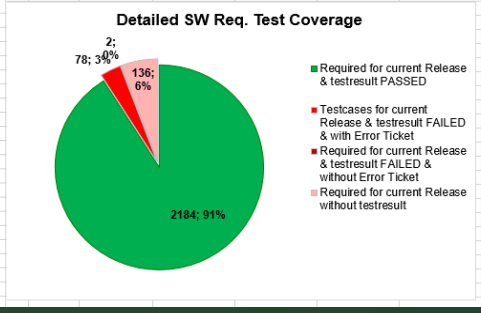
System Requirements Test Coverage Status QA Rating: Caution



Software Requirements Test Coverage Status QA Rating: Caution

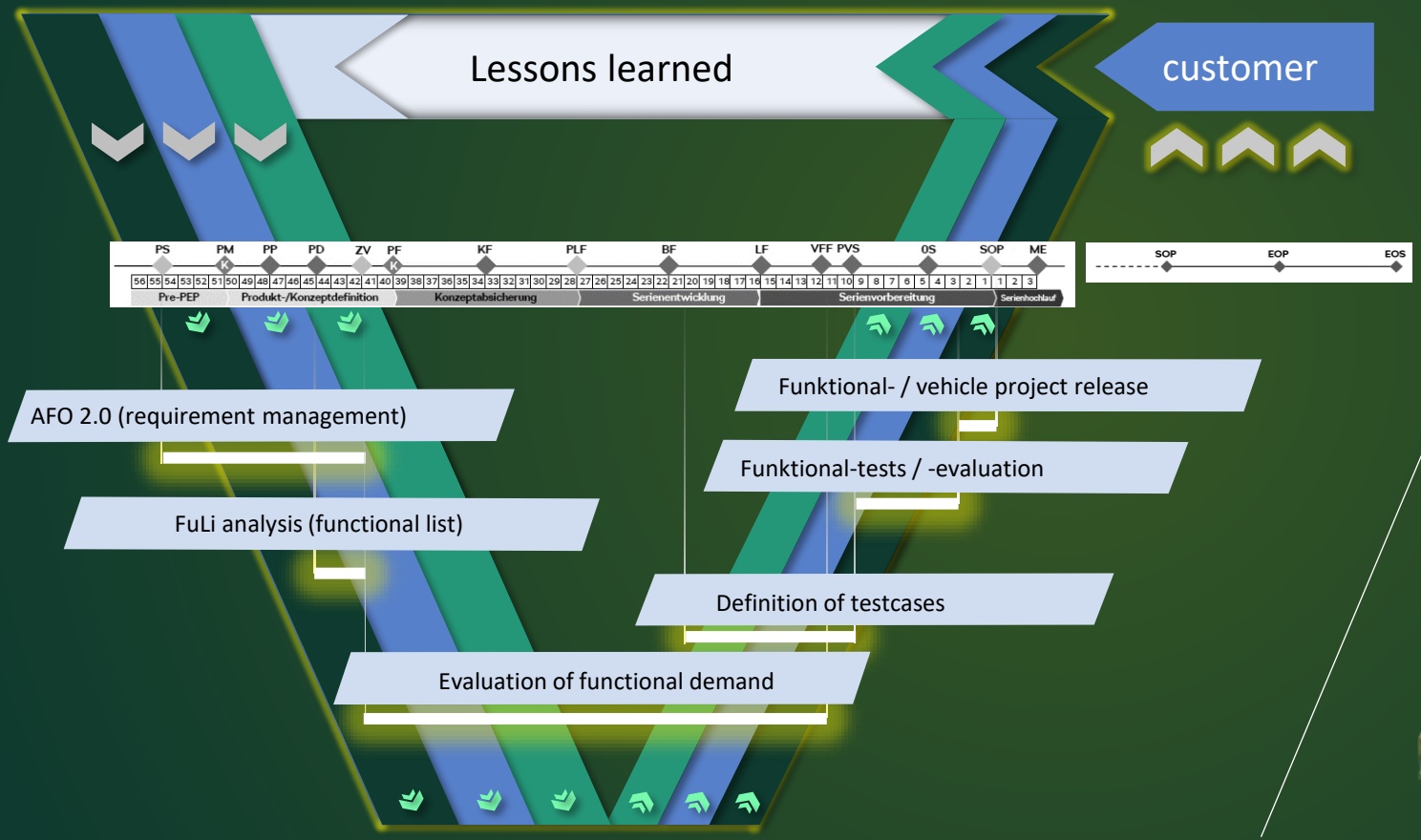






E-MEISTERBOCK

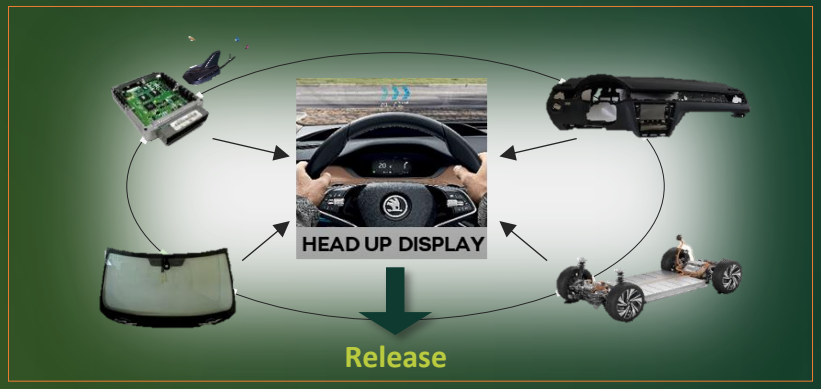
TESTING FROM CUSTOMER VIEW



- 7 cluster
- 297 functions
- 15 functional areas

E-MEISTERBOCK
FUSE

from the part-world → **+ FuOrQ[1]** → to the system world (FuSE[2])



4 expert groups

Elektrik
Interieur
Bodyworks
Powertrain

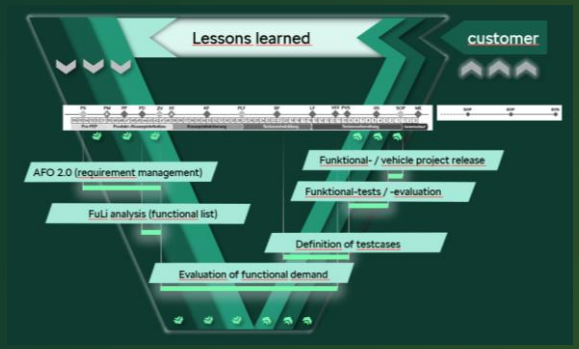
7 clusters

Infotainment & services
Vehicle safety & comfort
Connect & security
Powertrainmanagement
Vehicle operation
Energymngmnt. & charging
Automated driving

6 function systems

Driving system
Energy system
Body system
FAS-/HAF-System[3)]
Insasseninteraktion- & Infotainment-System[3)]
Date management system

E-MEISTERBOCK



Testing of customer experienceable functions and characteristics …

- Functionality (E-funktions, MOD, charging stations, connectivity)
- Kundentauglichkeit
- Disturbing noise
- Haptics, optics, odours

… in the whole Eco-System:

Clear defined, structured validation and release of vehicle functionality from the customer perspective …

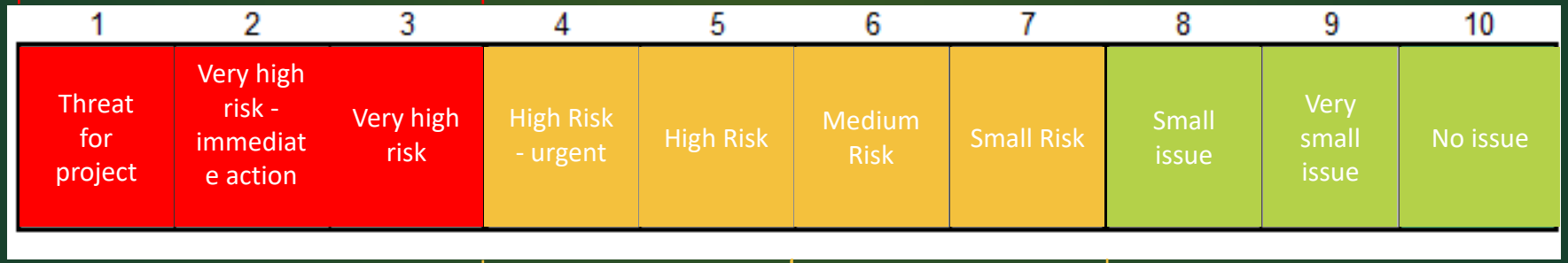
Function name	KW15.5	KW20.5	...	...	...	...	TPPA
Login-Enrollment							
Remote Control Air Conditioning							
Fahrzeug-Finder - Car Finder							
AC-Ladestecker entriegeln							
DC Sofort-Laden CCS DIN70121							
Combo-Ladestecker entriegeln							
AC Sofort-Laden ISO15118							
AC-Laden Basiskommunikation (PWM)							
DC-Laden CCS ISO15118							
Spurwechselassistent (SWA) 3.0							
TopView (TV) eEntry							
Intelligenter Parkassistent Basis							
Antilock Braking System (ABS)							
Bremsbelagsverschleißanzeige							
Auto Vehicle Hold							
Fahrerinformation Kühlmittelmangel							
Fahrstufenauswahl							

… as a part of Q-overall release of projects by Škoda-Auto

Project analysis – exPANding comPANies

Project analysis has been used for the 4th year as a specific control tool for the Quality area of Škoda Auto a.s. in your companies, thanks to which we have new projects under control together with the aim of timely detecting and eliminating risks for SOP.

Critical Supplier Program / increased supervision via Teams & PAN repetition within 4 weeks on site

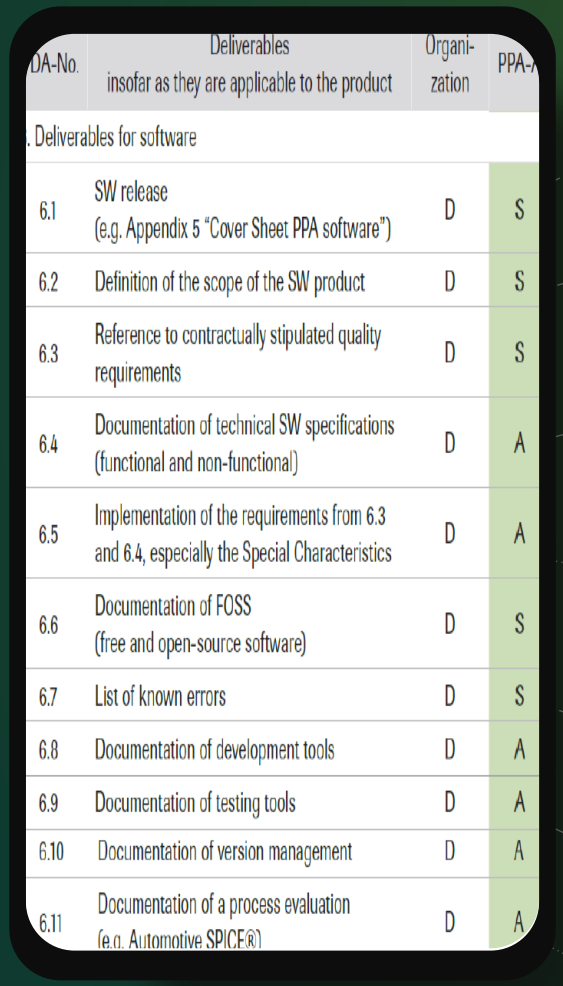


Increased supervision via Teams / on site / AP fulfillment & repetition of PAN within 5 weeks on site

Increased supervision via Teams / fulfillment of AP & repetition of PAN within 5 weeks online

VDA 2 & Automotive Spice

- **VDA 2 questions can be easily mapped to Automotive Spice processes and their required work products**
- **This means that there is no need to create additional evidence required for submission within the PPA.**



DA-No.	Deliverables insofar as they are applicable to the product	Organi-zation	PPA-A
. Deliverables for software			
6.1	SW release (e.g. Appendix 5 "Cover Sheet PPA software")	D	S
6.2	Definition of the scope of the SW product	D	S
6.3	Reference to contractually stipulated quality requirements	D	S
6.4	Documentation of technical SW specifications (functional and non-functional)	D	A
6.5	Implementation of the requirements from 6.3 and 6.4, especially the Special Characteristics	D	A
6.6	Documentation of FOSS (free and open-source software)	D	S
6.7	List of known errors	D	S
6.8	Documentation of development tools	D	A
6.9	Documentation of testing tools	D	A
6.10	Documentation of version management	D	A
6.11	Documentation of a process evaluation (e.g. Automotive SPICE®)	D	A

- **SPL.2 PRODUCT RELEASE**
- **MAN.3 PROJECT MANAGEMENT**
- **SYS.1 REQUIREMENT ELICITATION**
  SWE.1 SOFTWARE REQUIREMENT ANALYSIS
- **PA 2.1 PERFORMANCE MANAGEMENT PROCESS**
- **SUP.9 PROBLEM RESOLUTION MANAGEMENT**
- **SUP.8 CONFIGURATION MANAGEMENT**
- **SUP.1 QUALITY ASSURANCE**

6.11 Process Evaluation Proof (Automotive SPICE®)

- **The minimum scope is the self-assessment of the organization for the relevant project, including documentation of the implementation of the measures derived from the self-assessment. Evidence of the effectiveness of the measures is provided**

- **Existing project evaluation through evaluation activities according to Formel Q SW competency**
- **Closed corrective action plan for non-conformities from assessment activities**

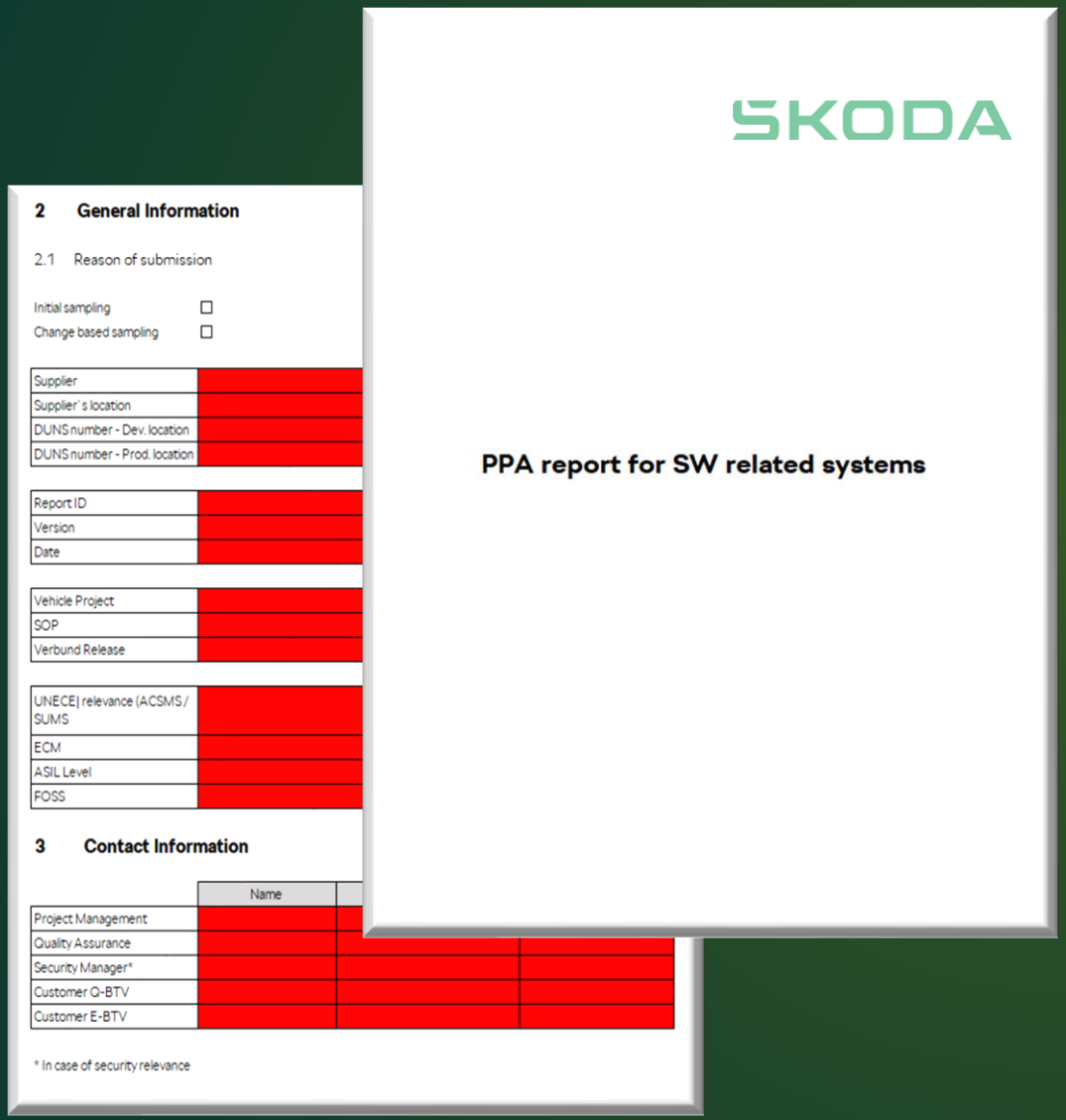
- **Escalation in the Critical Supplier Program**

Level 1 (PA 1.1)	MAN.3	ACQ.4	SUP.1	SUP.8	SUP.9	SUP.10	SYS.2	SYS.3	SYS.4	SYS.5	SWE.1	SWE.2	SWE.3	SWE.4	SWE.5	SWE.6
BP 1	L-	P+	L-	P-	F	F	P+	F	P+	L-	P-	P-	N	N	P+	P-
BP 2	L-	L+	P-	P+	L+	F	F	F	P+	L-	L-	P-	P-	P+	P+	P-
BP 3	L-	L+	P+	P+	P+	F	L+	F	P+	P+	P+	P-	P-	N	P+	N
BP 4	P-	P+	L+	F	P+	P+	F	F	P+	P+	P+	P+	P+	N	P+	N
BP 5	L-	P+	P+	L-	P+	P+	P+	F	P+	F	P+	P+	P+	N	N	P+
BP 6	L+		P-	P-	L+	P+	F	F	P-	L-	P+	P+	P+	N	N	P+
BP 7	P+			L-	L+	F	F	L-	F	L-	P+	P+	P+	N	P+	N
BP 8	P-			L-	L+	F	F	F	P-		P+	P-	N		P-	
BP 9	P+			L-	F				F			F			N	
BP 10	P+															

	MAN.3	ACQ.4	SUP.1	SUP.8	SUP.9	SUP.10	SYS.2	SYS.3	SYS.4	SYS.5	SWE.1	SWE.2	SWE.3	SWE.4	SWE.5	SWE.6
Level 1 (PA 1.1)	P	P	P	P	L	L	L	L	P	L	P	P	P	N	P	P
Level 2 (PA 2.1)	P	P	P	P	P	P	P	P	P	P	P	P	P	N	P	P
Level 2 (PA 2.2)	L	P	L	L	L	L	L	L	P	L	L	L	L	P	L	L
Level 3 (PA 3.1)																
Level 3 (PA 3.2)																

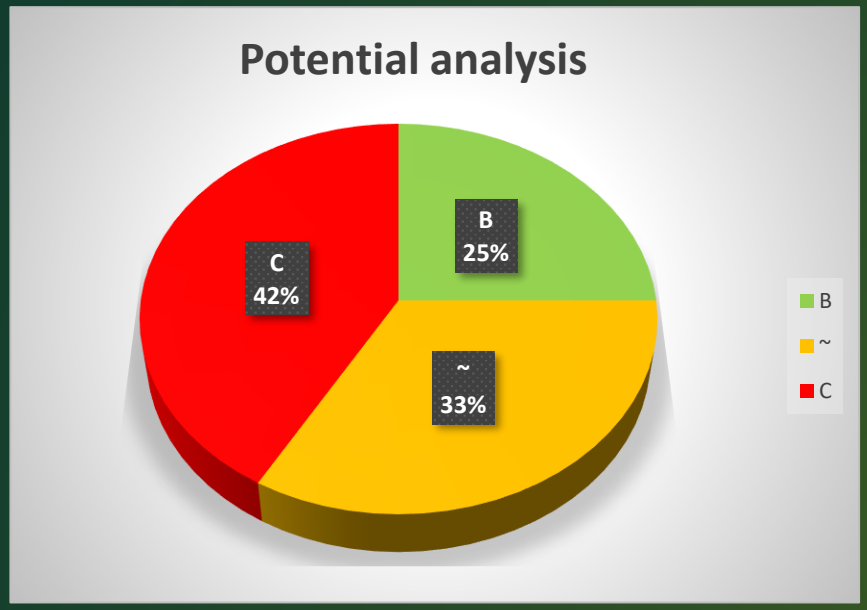
- **VDA 2**
- **ŠKODA**

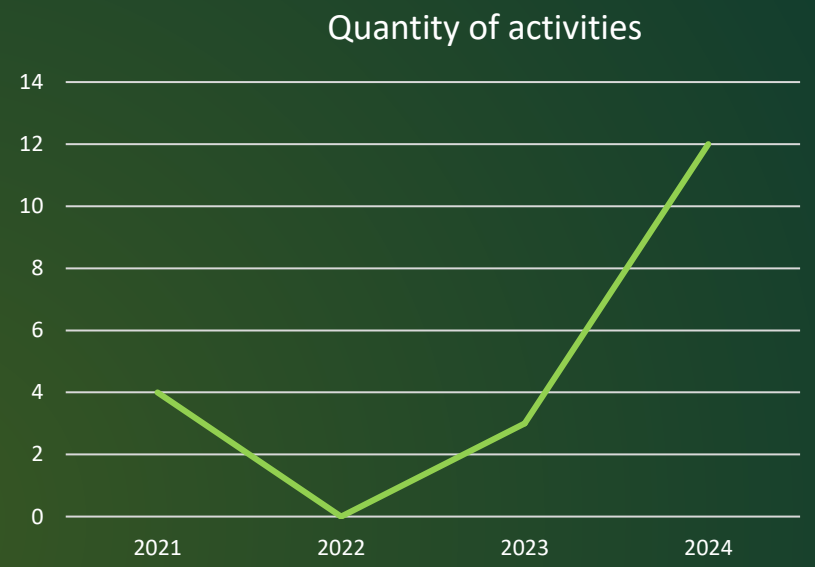
VDA 2 & Automotive Spice

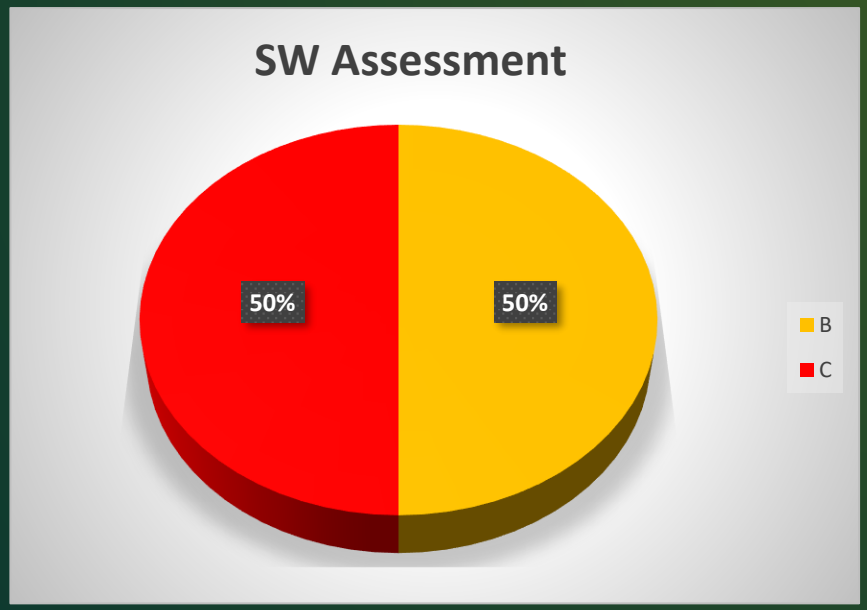


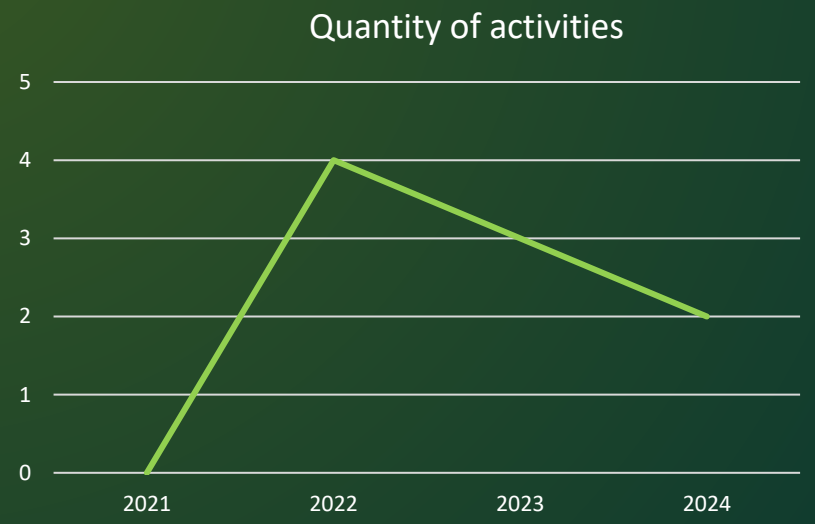
- The ŠKODA brand has its own form for submitting the necessary evidence within the PPF
- Its use is mandatory for suppliers of parts containing software
- Contains the minimum required scope for product and process release including thresholds and risk assessment
- It is available to all suppliers on the ONE KBP portal

STATISTICS


Potential analysis
B
25%
C
42%
~
33%
B
~
C


Quantity of activities
14
12
10
8
6
4
2
0
2021
2022
2023
2024


SW Assessment
50%
50%
B
C


Quantity of activities
5
4
3
2
1
0
2021
2022
2023
2024

HOT TOPICS

NEW SUPPLIERS

- **Insufficient derivation of customer needs**
- **Lack of transparency within the validation / verification results**
- **Insufficient risk identification approach regarding carry over components**
- **High density of customer & internal defects near SOP**

LEGACY CODE

SW RELEVANCE

WHAT SHOULD BE MONITORED ?

Thank you for your attention

Q & A