Quality Management Throughout the Value-Added Chain

The Basis for Mutual Success

After intensive discussions between automotive manufacturers and suppliers in the VDA (German Association of the Automotive Industry) managing board, an agreement for the safeguarding of joint quality in the German automotive industry was developed in 2005. Through a stronger process-orientation and synchronisation of the supply chain, the German automotive manufacturers and suppliers were able to recapture their quality leadership.

1 Initial Situation

Over the past two decades, the strategy of German automotive manufacturers has been marked by the concentration on their own core competencies. This has led to an increasingly strong transfer of development and production responsibility from the vehicle manufacturers to competent (mega) suppliers. The conscious structural change in the supplier industry due to the creation of module or system suppliers also caused intransparency regarding the OEM requirements for small and medium-sized companies in the automotive supply chain, which in the course of globalisation now extends over the entire globe. The above-mentioned developments were intensified by increasing product complexity, high cost pressure and the increasing quality demands of the end customer, **Figure 1**.

Innovations, especially in the electronics sector, were launched in series products without having completely considered their complexity and interactions. In 2002, the situation for the German automotive industry was critical. The reputation of the German automotive industry for bringing reliable and innovative vehicles onto the market was crumbling. Product recalls and poor performance in customer surveys and in the TÜV and ADAC defects reports revealed a considerable need for action.

In 2003, the VDA heralded in a new phase with the first summit on the quality of German vehicles – Tradition and Claim. This new phase can best be described with the phrase "back to the roots". Until that time, the quality securers of the German automotive and supplier industry wanted to leave the level of certification and auditing. "Automotive Excellence" was preached strategically by the QM Commission, and the principle of self-evaluation was upheld. Unfortunately, but for a few exceptions, the advantages of this strategy could not be believably communicated to the management boards and executive levels. For this reason, the QM Commission focused its attention on strengthening the process orientation along the supply chains.

Furthermore, with the ISO/TS 16949, an international QM system standard that served as the basis for a process-oriented approach in the automotive industry was created. Now it was necessary to coordinate, orientate and re-synchronise the manufacturers and suppliers along the supply chain.

The approaches for the strategic fields of activity were described by the following questions:

- How is a mature product developed?
- How is a robust product manufactured?
- What are the criteria for excellent customer service?

Consequently, the project teams to address the standardisation of minimum requirements and regulations in the product development process and product manufacturing process were first established.

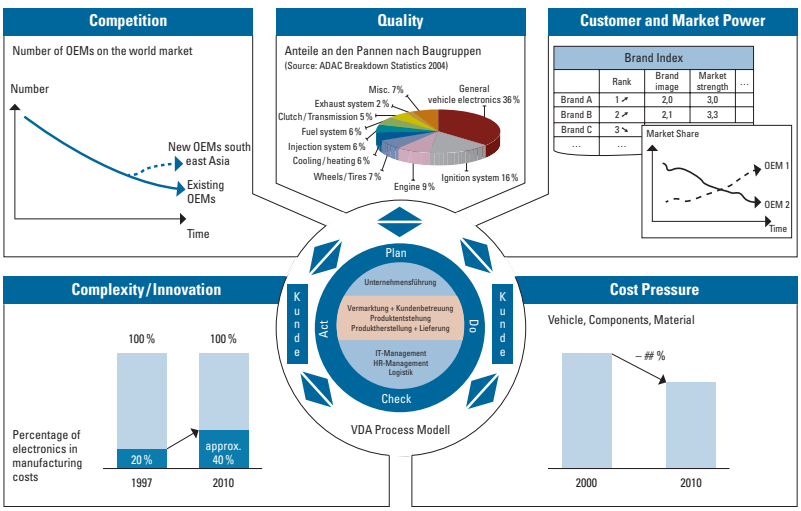

Figure 1: The initial situation in the automotive industry

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The VDA Quality Management Commission

The Quality Management Commission (QM Commission), whose members, as QM managers, all belong to the top management of their respective companies in the automotive industry, is commissioned by the VDA board and is understood to be a joint platform for the development and implementation of Q-standards and Q-methods within the automotive industry. The QM Commission controls the quality management activities in strategically important fields of action.

For this purpose, working groups (WG), staffed with experts from the quality management of the manufacturers and the suppliers, are appointed by the QM Commission and address predetermined topics and work out standards.

Therefore, the fields of action are set by managers from industry and are implemented into guidelines and standards by experts from industry.

The Quality Management Centre (QMC), part of the VDA since 1997 and a financially independent contractual partner of certification bodies, is the operative arm of the QM Commission. The agreed projects are controlled by the QMC and are presented in the QM Commission at regular intervals.

2 The Hour of Birth of Worldwide Standards

The emphases of the quality offensive for the joint quality management in the supply chain were initially the sectors of product development, product manufacturing and delivery.

Similarly, through the ruling of the VDA managing board and the work in WG 13, a standard for the evaluation of development processes of software-dominated systems was established with Automotive SPICE.

Integrated quality assurance is becoming an integral part of all activities. Quality assurance and preventive error avoidance are already moving forward in the product development process, due to early integration of the suppliers. The subject of preventive methods in the process landscape is also one of the building blocks of the quality offensive that are extensively covered within the standards.

This is about the inspection of the reliability of the complete system and selected new parts via interface analyses.

In addition, there is the prototype comparison. Interactions between the parts and the reliability under production conditions have to be inspected. Innovations, especially in the electronics sector, have to be made controllable.

Today, the VDA has the following new standards for safeguarding quality in the supply chain:

- Maturity Level Assurance for New Parts (MLA)
- Automotive VDA Component Requirement Specification Standard Structure (CRS)
- Robust Production Process (RPP).

As a supplement to the superordinated processes of the MLA and RPP, the forthcoming VDA volume 13, Automotive SPICE [1], supports the development process with an objective process assessment of the software development and the process improvements for software-based systems resulting from it.

The new VDA volumes on Preventive Q-Methods contain valuable references for the expedient application and for the economical benefits of preventive Q-methods for the process landscape [2; 3].

Preventive Q-methods contribute fundamentally to successful corporate management, in order to fulfil the customer demands, to implement robust processes and to bring reliable products onto the market.

3 The Maturity Level Assurance Method (MLA)

With the creation of a new standard in the product development process, it was the defined objective of the VDA QM Commission to improve the start-up quality, delivery quality and field quality of all parts, components and systems and thus to safeguard the product maturity for the series production start-up.

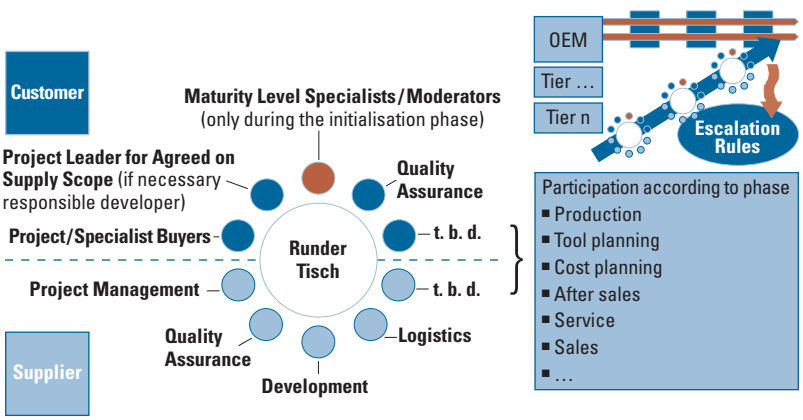
In essence, the MLA contains a measuring method for the identification of the maturity level at agreed milestones in the development process.

The maturity level assurance method creates a common understanding of requirements and responsibilities on the customer-supplier interface. The main objective is to optimise the processes in the supply chain by harmonizing contents (for example, maturity points and measuring criteria in the form of checklists) and controlled responsibilities.

This controlled communication in the product development regulates the cooperation between manufacturers and suppliers through the round table model, Figure 2, and safeguards the maturity level of critical parts.

Consequently, the maturity level assurance [4] makes an essential contribution to the increase in product quality and customer satisfaction while at the same time reducing warranty and goodwill costs, Figure 3.

The MLA integrates the parties involved in the complete supply chain early in the product realization process and



In coordination meetings between the customer and supplier at the "round table", the individual **Measuring criteria are evaluated, the corresponding measures defined, scheduled, tracked and checked for their effectiveness** using checklists.

Figure 2: The fundamental elements and approaches of the MLA for new parts

offers active intervention and control possibilities, such as approaches to risk management in the selection of the supplier, determination of the critical supplier path as well as the escalation methods, and therefore the possibility to counteract in time.

The MLA is relevant above all for new parts with a high maturity level risk (A-parts). Depending on the phase, participants from production, tool planning, cost planning, after-sales service and sales are integrated. This involves advanced quality planning and early integration of the complete supply chain for risk-classified delivery scopes. Each party must know their role and observe their responsibility in the numerous processes from product development up to production and delivery. This begins with the innovation release for series production development and ends after the start of production (SOP) with the responsibility transfer to the series production. Here, the individual phases of the maturity level are set according to clear and simple criteria, evaluated with the traffic light colours red, yellow and green, and appropriately controlled. For this purpose, the target group-oriented and problem-oriented reporting hierarchy as well as the escalation structure had to be defined, implemented and set down in status reports beforehand. New products, model upgrading or change projects are taken into consideration within the milestone evaluation in projects.

4 Automotive VDA Component Requirement Specification (CRS) Standard Structure

The CRS is used in the framework of the Maturity Level Assurance for New Parts for Requirements Management for the Awarding Scope, **Figure 4**.

This VDA guideline describes the result of the joint agreement on a standardised structure for a component requirement specification (CRS) between automotive manufacturers and suppliers. A standardised requirement specification preparation process at the OEM and/or the supplier is not included in this VDA volume.

The objective of the procedure and structure described in the VDA volume is, through a systematic inspection of all requirements placed on a product, to obtain the clearest and most complete requirement profile for the product and therefore also for its production process.

The structure of the component requirement specification can be used in the complete supply chain between customers and suppliers. In a manner of speaking it represents a standardised interface between customers and suppliers in the information process.

The organisation was arranged in a modular manner.

In the "universal module", there are general and universal requirements and agreements for the CRS, while in the "component-specific module" the requirements on the product itself are described.

The quality of the description of the requirements to be met by a product in the component requirement specification is a basic prerequisite for the effective development of reliable products and processes.

The component requirement specification becomes more important especially in view of the increasing requirements regarding vehicle reliability and therefore also component reliability during the service life.

Ultimately, the use of this system has to be in the interest of all parties involved in the process, in order to avoid economic consequences – caused by product failures in the field – through an early common definition, communication of and compliance with the requirements.

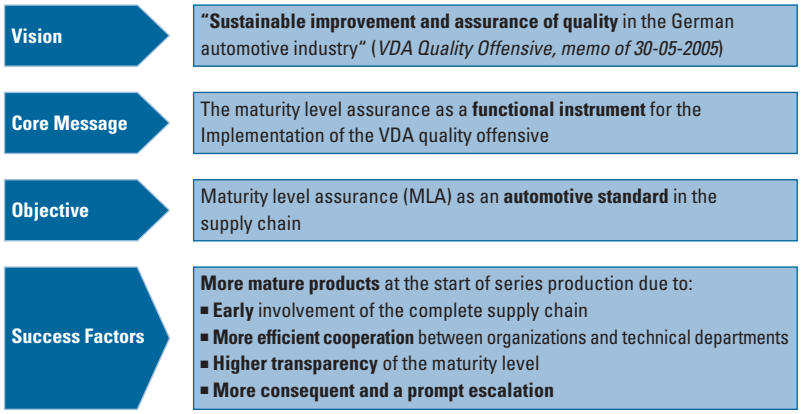


Figure 3: The decisive success factors of the MLA automotive standard

5 Robust Production Processes

The new VDA standard "Robust Production Process" (RPP), **Figure 5**, concentrates

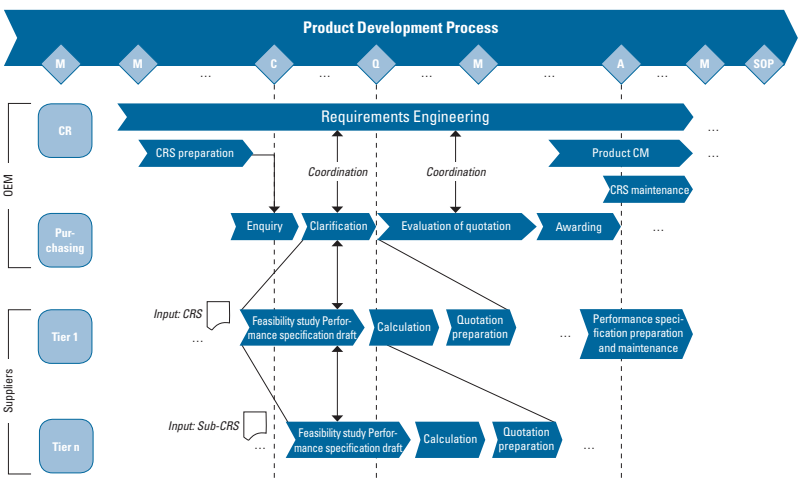


Figure 4: The component requirement specification process in the supply chain

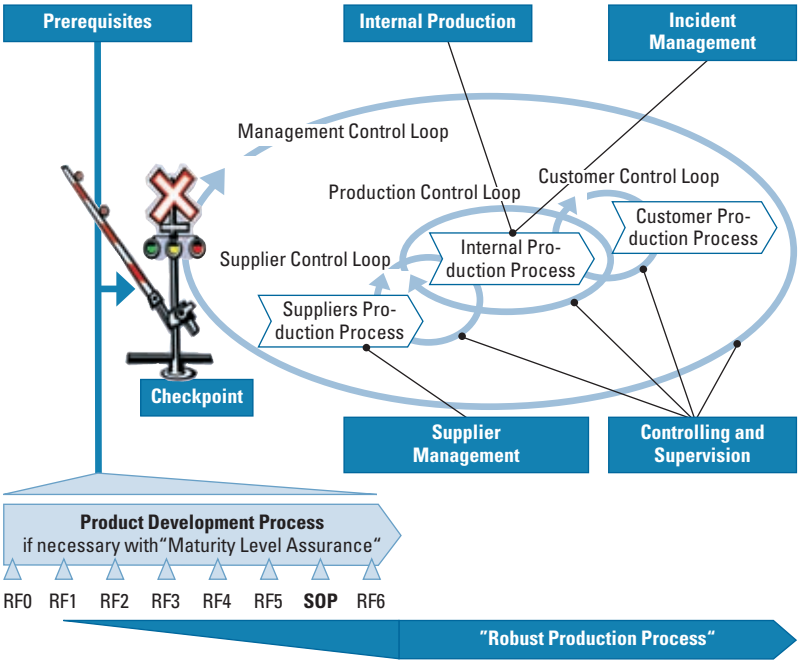


Figure 5: The complete concept of the robust production process

on the product realisation, starting with SOP (start of production). The objective is to safeguard the production processes through the determination of minimum requirements in the complete supply chain.

For this, the emphasis is placed on the preventive safeguarding against unwanted negative influencing variables, and on effective control loops. By using the RPP in the OEM's and suppliers' complete supply chain, the quality of the products with regard to function, delivery reliability and dependability will be improved and safeguarded in such a manner that the competitiveness of German automotive manufacturers can be sustainably strengthened. Economically, this also results in a reduction of the testing, error and field costs.

The new VDA RPP standard [6] provides assistance in answering the following questions:

- How is RPP achieved?
- How can RPP be evaluated?
- How are influencing variables and errors dealt with?
- How can existing production processes be improved?

The complete concept is divided according to the chronological assignment of the activities before and after SOP. The first step is the implementation of the necessary prerequisites. This is followed by the release or evaluation of the RPP at the checkpoint and the subsequent production operation with process controlling (in terms of recording/measuring, managing and controlling), represented by the four control loops: management control loop, supplier control loop, production control loop and customer control loop from the point of view of the respective user.

The prerequisites for the RPP have to be planned and implemented in the PDP (Product Development Process) to an essential degree.

The RPP volume is therefore closely interlocked with the VDA standard "Maturity Level Assurance for New Parts" (MLA).

In addition, important conditions are listed that should be ensured as the basis for a functional quality management in a good corporate culture. In particular, a culture of trust, particularly when handling successes and failures, process orientation and quality increase, error prevention and avoidance, sustainability and continuous improvement are important conditions for success.

Management as well as the individual employees are responsible for the implementation and further development of a lived corporate culture.

The RPP volume lists minimum requirements and gives recommendations for:

- preventive failure management (risk management)
- reactive failure management
- supplier management
- controlling and managing
- basic standards for internal production processes.

For clear recording, representation and reporting (for example, for the management), cockpits with traffic light depictions are recommended. This is supplemented in the annex with an overview matrix of further applicable standards, such as ISO/TS 16949 and other VDA standards, multifaceted checklists and proven and tested practical examples for the individual topics.

RPP is ideal for implementation with MLA, but it can also – as has already been successfully tested in some pilots – be used in existing production processes for the evaluation and identification of

AutoMarxx

ADAC Automarkenindex December 2007

Auto Brand	Brand Image 25 %	Brand Strength 10 %	Customer Satisfaction 15 %	Vehicle Quality 30 %	Technology Trends 10 %	Brand Trends 10 %	Final Grade	Rank
Audi	2,3 •	3,3 ↗	1,6 ↗	1,6 •	1,8 ↗	2,4 •	2,03	1 •
Mercedes	2,4 •	3,1 •	1,7 ↗	1,6 •	2,0 ↗	2,7 ↗	2,13	2 ↗
BMW	2,3 •	3,4 ↘	1,5 ↗	1,9 •	1,8 ↘	3,2 ↘	2,20	3 ↘
Volkswagen	2,9 •	2,4 •	1,9 ↗	1,9 ↗	2,0 •	3,2 ↗	2,32	4
Porsche	3,1 ↘	4,1 ↗	1,3 ↗	1,5 •	3,4 ↘	1,8 •	2,34	5 ↘
Toyota	3,0 ↗	4,1 ↘	1,4 ↘	2,1 •	2,3 ↗	2,3 •	2,46	6 •

Figure 6: German manufacturers ahead of Toyota: ADAC brand index

possible improvement potential and for risk minimization in sub-areas in the supply chain.

6 With Quality to Mutual Success

The fact that the German automotive manufacturers have been able to retake the quality leadership is due to a stronger process orientation in the development process, focusing on the supply chains, on the installation of robust production processes on the production lines and on the implementation of sustainable error elimination processes for customer problems.

Clear assessments and binding rules between manufacturers and suppliers facilitate and improve the cooperation in all phases of product development and product manufacturing.

Support is provided for this by the newly issued VDA-QMC standards.

- establishment and advancement of a world-wide standard for QM systems in automotive engineering with the ISO/TS 16949
- creation and distribution of national standards in automotive engineering with VDA volume 6.2 for automotive service providers, VDA volume 6.4 for production equipment manufacturers
- creation of transparency in the development process through the integration of the supply chain in the development process

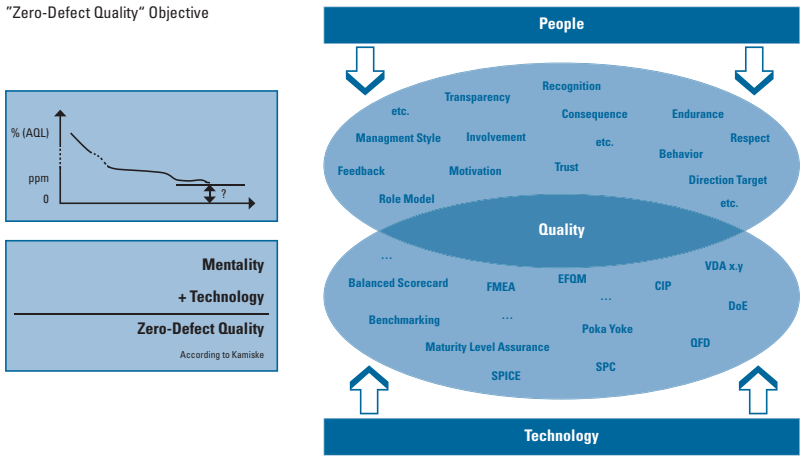


Figure 7: Zero-defect quality is not possible without the appropriate mentalities

- commitments between the vehicle manufacturer industry and the supplier industry for the safeguarding of quality
- new standards through MLA – CRS – RPP
- objectifying the process evaluation for software developments
- preventive Q-Methods in the process landscape.

7 Further Fields of Action

This universal approach has already resulted in success. Due to a stronger process orientation and synchronisation of the supply chain, the German car manufacturers and suppliers were able to regain their quality leadership in 2007, **Figure 6**. The members of the VDA Quality Management Commission will continue to work on the necessary standardisation of the process landscape in automotive engineering. Findings in the cooperation between manufacturers and suppliers will be made known to a wider basis through pilot projects in the sense of "best practice sharing".

Within the framework of the VDA QM Commission quality offensive, the focus in 2008 will be on an attitude change to a zero-defect culture and the development of a process model for marketing and customer service. **Figure 7** clearly shows that, besides the technical tools, the appropriate mentalities are also indispensable for achieving zero-defect quality.

The VDA and its committees will do everything to sustainably implement the standards for mature products and for robust production processes.

Support for the companies in the development of a zero-defect culture and the development of a methodology for excellent customer service will also help German automotive manufacturers, together with their suppliers, to continue to develop, produce and market the best vehicles in the world.

VDA Quality Philosophy

In June 2005, the VDA managing board defined three guiding principles:

- The quality of German products – especially in the premium sector – is the basis for customer satisfaction and trust, and therefore for global success.
- All parties involved in the supply chain assume responsibility for the quality of German products. Quality is indivisible.
- The quality of our vehicles is the product of joint standards, linked workflows and transparent communication. Quality requires the bonding of experience and vision, of costs and benefit, of ideas and methods.

References

[1] VDA-Band 13: Automotive SPICE, Prozessassessment
[2] VDA-Band 4: Sicherung der Qualität vor Serieneinsatz
[3] VDA-Band 14: Präventive Qualitätsmanagement-Methoden in der Prozesslandschaft
[4] VDA-Band: Komponentenlastenheft (KLH)
[5] VDA-Band: Reifegradabsicherung für Neuteile (RGA)
[6] VDA-Band: Robuster Produktionsprozess (RPP)
[7] VDA-Band 6.2: QM-Systemaudit, Dienstleistungen
[8] VDA-Band 6.4: QM-Systemaudit, Produktionsmittel