VDA | Verband der Automobilindustrie

Quality Management in the Automotive Industry

Assessment of Quality Management Methods

Guideline

1st Edition, November 2017
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Non-binding VDA recommendations concerning standards

The Association of the German Automotive Industry (VDA) recommends its members to use the following standards when implementing and upholding quality management systems.

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This VDA Volume is a recommendation which is available for general use. Anyone using it is responsible for ensuring that the information is always applied correctly.

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Translations

This publication will also be issued in other languages. The current status can be requested from VDA QMC.

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Berlin, September 2017

Verband der Automobilindustrie e.V. (VDA)

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1 Foreword

The quality management methods (QM methods) described in this volume are highly relevant because they focus on risk prevention, avoidance and protection, as well as on the sustained robust design of products and processes. They are explained by means of examples. QM methods are applied in order to systemize and compare quality planning, control and improvement within an organization. A QM method is only implemented optimally if it is applied “correctly”.

In practice, many areas are dissatisfied about the quality of results obtained using QM methods. Examples include a high number of failures in the field despite application of the FMEA method, or recurring claims despite use of the 8D method. Due to the fact that some QM methods are very complex, they are often applied incorrectly, incompletely or inefficiently. This volume describes an adapted procedure for assessing the quality of application of selected QM methods. The procedure can also be transferred to other QM methods.

The volume is a guideline that can be used to evaluate the quality of application of QM methods within an organization as well as the quality of results. to the management functions. Besides being implemented as a tool to assess QM methods, it can also be used to assess management functions.

The volume describes a general procedure as well as a standardized valuation logic for assessing QM methods. The QM methods addressed are advanced quality planning, statistical and problem-solving quality management methods. The QM method assessments provided can be adapted to specific user requirements.

It is to be noted that the guideline does not compete with existing audit methods, nor is it intended to be used in conjunction with external supplier or certification audits. Existing VDA Volumes on QM methods will also not be altered or replaced.

The form or application of the assessment of QM methods defined in this volume is neither binding nor mandatory. The original form may be used or modified by the organization concerned. Depending on the case at hand,

(e.g. legal requirements, customer requirements, safety-related scope, etc.), both the frequency of use and interpretation of results regarding the degree of compliance may be fixed individually.

2 Scope and purpose

In order to apply QM methods correctly, users must have sufficient knowledge about the products and processes as well as skills concerning the procedure, contents and purpose of the method. Assessors conducting the assessments are not required to have additional auditor qualifications.

“Assessment of QM Methods” allows the user to evaluate how effectively QM methods are applied and implemented within his organization. It is not intended as a tool for approving individual documents (e.g. an 8D report).

QM methods can be assessed at all company levels, from the shopfloor right through to management. It helps the user to conduct a self-assessment, and provides the management with facts about the awareness and sustainability of usage in the company.

The benefits of application are also evaluated by taking into account the content-related quality of the method output as well as interfaces to other processes.

“Assessment of QM Methods” examines the input variables, application and output of the methods. The assessment results gained are intended to be used as a basis for determining individual improvements regarding the application of QM methods. Renewed assessments show the progress made over time.

3 General description of the "Assessment of QM methods" model

The assessment procedures for the various methods and respective check-lists are structured in a similar way.

"Assessment of QM Methods" is available as a software-based tool, which. contains a questionnaire and an assessment report to display the quality of application and results of the respective QM method.

The assessment comprises two subject areas:

- Formal questions (see Point 3.1.1)
- Content-related questions (see Point 3.1.2)

Both subject areas are linked to one another but can be addressed and evaluated separately. They are divided into the following categories:

- MI: Method Input
- MA: Method Application
- MO: Method Output

The category "MA: Method Application" is divided into an individual number of steps in dependence on the QM method applied (e.g. the 8 steps of the 8D method). Further details are given in the descriptions of the respective QM methods (see Chapter 4).

Each question is assigned to one or more categories or method step

3.1 Assessment system

The assessment is based on the four following aspects:

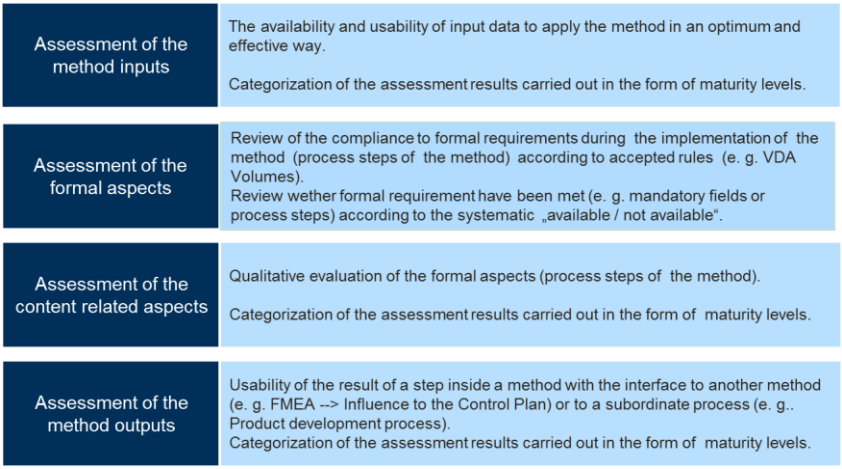


Fig. 1: Scope of the assessment

Assessment of the method input

The availability and usability of input data to apply the method in an effective way

The assessments of the method output and/or of the results of the complete method are based on relevant questions concerning formal and content-related aspects.

3.1.1 Formal questions

Formal questions assess the conformity to formal requirements of the QM method. The degree of fulfillment is assessed as follows:

- Non-conform: No
- Conform: Yes
- Not applicable: N.a.

3.1.2 Content-related questions

Content-related questions are structured to enable individual interpretation. This allows users to consider the individual context of his/her organization.

Content-related questions supplement the formal questions. These go into more detail and focus more on the quality of application of QM methods.

Formal questions	Content-related questions
Does a description exist for conducting a FMEA?	Are requirements documented and were they considered? (e.g. process description, regulations, work instructions)
Are project master data available for the FMEA as required by the form in VDA Volume 4 (see Chapter Product and Process FMEA, Annex A1)?	Is the scope for the product/or process defined?
	Is there a clear differentiation from other areas or P-FMEAs and are their interfaces defined internally / externally? (e.g. packaging, logistics, customer, supplier, etc.)
	Are subsequent users in touch with FMEA contact partners (e.g. feedback, modification requests, understanding)?

Fig. 2: Examples of formal and content-related assessment questions

Table 1: Scale for assessing conformity to content-related questions

Degree of fulfillment	Assessment
0	Non-conform
1/3	Partially*1
2/3	Largely*2
1	Fully
N.a.	Not applicable

*1) Here, insufficient means that more than approx. 1/3 and less than approx. 2/3 of the aspects of a content-related question have been met

*2) Here, largely means that more than approx. 2/3 of the aspects of a content-related question have been met

3.2 Evaluation

After assessing the various questions, single evaluations are summarized, clustered and analyzed. This enables conclusions concerning the quality of the input, application and output of the QM methods to be gained.

Results are shown in the form of a radar chart or bar chart based on the categories and method steps. Since questionnaires can be adapted individually, other types of diagram are also permitted.

The tool offers the opportunity to add further organization-specific questions.

4 Selected assessment of QM methods

4.1 Assessing advance quality planning QM methods

4.1.1 Failure Mode & Effect Analysis (FMEA)

FMEA is a structured, systematic method to identify failures and their associated risks at an early stage in product and process development.
The target is to minimize potential risks by defining appropriate measures. Further details can be found in VDA Volume 4 and AIAG FMEA.

The assessment of this QM method is divided into the following sections:

Method Input (MI):

Results from other QM methods (e.g. Design FMEA, 8D), as well as legal, customer and general requirements (e.g. procedures, requirement and functional specifications, acceptance criteria), are needed in order to prepare an FMEA.

Method Application (MA):

Method application is understood as the structured preparation of the FMEA. To take a generic approach to the assessment, the following 10 method steps according to DAMIC® (definition, analysis, actions decision, implementation, communication - see VDA Volume 4) were determined:

Table 2: Explanation of the method steps of FMEA

D: Definition	Define boundary conditions and requirements for the efficient implementation of the FMEA.
A: Analysis	Systematic determination of all requirements for plausibility, their ability to be verified and validated as well as their risks.
A SA: Structure Analysis	Hierarchical arrangement of the individual system elements to show their structural relationships.
A FuA Functional Analysis	Analysis of each structural element with regard to its function and malfunction in the system, based on the structure described by the system elements.
A FA: Failure Analysis	Failure analysis for each system element included in the system description.
A AR: Action taken/ Risk analysis	Prioritization of risks, analysis of avoidance and detection measures for the development of an optimal system/design of characteristic and/or process planning.
A Op: Optimization	Continuous improvement cycle until an acceptable result is reached (risk assessment, action definition, effectiveness check and documentation of each step).
De: Decision on the action to be taken	Development and decision of possible measures/action within the team
I: Implementation	Timely implementation and monitoring of the individual measures and their repeat evaluation.
D/C: Documentation and Communication	Documentation and archiving of all input/output variables and the contents of the FMEA as well as their communication (e.g. lessons learned, knowledge database).

Method Output (MO):

The method output describes the insights gained from applying the QM method and therefore the interaction between the QM method and down-stream processes, e.g. development of a control plan.

4.1.2 Control Plan (CP)

The control plan is used to monitor and control process and product characteristics. It is an integral part of advanced quality planning and includes all characteristics (at least the particular characteristics) requiring control, inspection methods, reaction plans, etc. for each step in the production process.

Further details are described in ISO/TS16949 and AIAG APQP.

The assessment of this QM method is divided into the following sections:

Method Input (MI):

Results from other QM methods (e.g. FMEA, 8D), as well as legal, customer and general requirements (e.g. procedures, requirement and functional specifications, acceptance criteria), are needed in order to elaborate a CP.

Method Application (MA):

Method application is understood as the structured preparation of a CP. To take a generic approach to the assessment, the three following method steps have been defined:

Table 3: Explanation of method steps to be taken with CP

D: Definition	Determination and consideration of all requirements that a CP must include, as well the required scope from the "method input" e. g. data of a requirement specification or a FMEA
C: Creation	Consideration of all data required in the "method input" and in the "definition" specified data, by using the provided format of CP.
D/C: Documentation & communication	All input/output values of the QM method (CP) as well their communication(e. g. Lessons Learned, knowledge database) are documented and archived appropriately.

Method Output (MO):

The method output describes the insights gained from applying the QM method and therefore the interaction between the QM method and downstream processes, e.g. SPC.

4.2 Assessing statistical QM methods

4.2.1 Machine Capability Analysis

The machine capability analysis is a statistical QM method used to assess whether a machine meets given quality requirements. The purpose is to put a system/machine into operation that is capable of manufacturing products reliably under serial conditions within the given specifications. In addition to the spread (C_m) of production process data, the position (C_{mk}) in relation to tolerance limits is also highly important. The method and corresponding indicators are described in VDA Volume 4.

The assessment of the method is divided into the following sections:

Method Input (MI):

Declaration of steps to be taken, relevant characteristics, forms used, necessary tools, etc., in the form of work instructions, process descriptions or similar.

Method Application (MA):

To take a generic approach to the assessment, the five following method steps have been defined:

Table 4: Explanation of steps to be taken in a machine capability analysis

Pre: Preparation for Production	The necessary pre-conditions are verified, such as experience of involved employees, availability of required resources, approval of tools, etc.
Pro: Production	Serial production in accordance with the correct process parameters, tools and materials
Me: Measurement	Relevant characteristics are measured concerning measurement equipment, inspection plan, sample size, etc.
A: Analysis	Results are analyzed and countermeasures defined according to a given response plan
D/C: Documentation / Communication	All input/output values of the QM method, such as machine parameters, release status, special events, measurement values, etc., are documented and archived appropriately.

Method Output (MO):

The method output describes the information gained from applying the QM method and the interaction between the QM method and downstream processes.

4.2.2 Process Capability Analysis

The process capability analysis is a statistical QM method for assessing a production process, taking into account various unavoidable influences, such as man, machine and the environment. In addition to the spread (e.g. C_p) of process data from a production, the position (e.g. C_{pk}) in relation to tolerance limits is also highly important. The method and corresponding indicators are described in VDA Volume 4.

The assessment of the QM method is divided into following sections:

Method Input (MI):

Declaration of steps to be taken, relevant characteristics, forms used, necessary tools, etc., in the form of work instructions, process descriptions or similar.

Method Application (MA):

To take a generic approach to the assessment, the five following method steps have been defined:

Table 5: Explanation of steps to be taken in a process capability study

Pre: Preparation for Production	The necessary pre-conditions are verified, such as experience of involved employees, availability of required resources, approval of tools, etc.
Pro: Production	Serial production in accordance with the correct process parameters, tools and materials
Me: Measurement	Relevant characteristics are measured concerning measurement equipment, inspection plan, sample size, etc.
A: Analysis	Results are analyzed and countermeasures defined according to a given response plan
D/C: Documentation / Communication	All input/output values of the QM method, such as machine parameters, release status, special events, measurement values, etc., are documented and archived appropriately.

Method Output (MO):

The method output describes the information gained from applying the QM method and the interaction between the QM method and downstream processes.

4.2.3 Statistical Process Control

The QM method statistical process control describes the monitoring and control of process and product characteristics using statistical methods. This aims at the early recognition of any process changes to enable corrective measures to be taken. The method and corresponding indicators are described in VDA Volume 4.

The assessment of the method is divided into following sections:

Method Input (MI):

Declaration of steps to be taken, relevant characteristics, forms used, necessary tools, etc., in the form of work instructions, process descriptions or similar.

Method Application (MA):

To take a generic approach to the assessment, the five following method steps have been defined:

Table 6: Explanation of steps to be taken with SPC

Pre: Preparation for Production	The necessary pre-conditions are verified, such as experience of involved employees, availability of required resources, approval of tools, etc.
Pro: Production	Serial production in accordance with the correct process parameters, tools and materials
Me: Measurement	Relevant characteristics are measured concerning measurement equipment, inspection plan, sample size, etc.
A: Analysis	Results are analyzed and countermeasures defined according to a given reaction plan
D/C: Documentation / Communication	All input/output values of the QM method, such as machine parameters, release status, special events, measurement values, etc., are documented and archived appropriately.

Method Output (MO):

The method output describes the information gained from applying the QM method and the interaction between the QM method and downstream processes.

4.3 Assessment of problem-solving QM methods

4.3.1 8D method

The 8D method can be applied in cases where the cause of a problem is unknown.

As a problem-solving process, the 8D method defines a series of steps to be taken as soon as it becomes obvious that there is a problem. If applied correctly, it helps to find a prompt and effective solution to a problem. The 8D method is also a standardized method based, in particular, on the following concepts: fact-oriented analysis and elimination of the root cause.

The progress made on applying the 8D method is also documented in an 8D report. If only some of the 8 steps are taken the 8D report also serves as an action plan to highlight the actions that still need to be taken.
The method is described in VDA Volume 4: 8D Method.

The assessment of the method is divided into the following categories or method steps, respectively:

Method Input (MI):

The method input, e.g. a claim or non-conformity in the process, determines whether the 8D method needs to be applied, or initiates the 8D process.

Method Application (MA):

Table 7: Explanation of steps to be taken in an 8D

D1: Team	A team is formed of members with relevant process/production knowledge, time, a willingness to cooperate, as well as expertise and experience in the necessary techniques in order to solve the problem and take corrective action.
D2: Problem Description	The problem experienced by the internal/ external customer is defined in detail, the root cause is determined and data quantified, collected and analyzed: the extent of the problem (quantity of affected parts, versions, vehicles, etc.) is ascertained.
D3: Containment Action	The defined containment action is documented. Measures are initiated to keep the effects of the process away from the Internal/external customer until a permanent solution is found.
D4: Root Cause Analysis	A search is made for all possible reasons why the problem arose/was not detected. Probable cause(s) are identified and verified by comparing the problem description with existing data to find out whether a probable cause is the root cause or if there are interdependencies. Assumptions are confirmed by conducting tests and experiments.
D5: Chosen Permanent Corrective Action	Optimum permanent corrective action is selected and verified, e.g. by conducting appropriate tests to ensure that the chosen permanent corrective action will truly solve the problem as far as the customer is concerned and will have no undesired side-effects.
D6: Implemented Permanent Corrective Action	Continuous control methods are determined to ensure that the root cause has been effectively eliminated. The plan of action is implemented, effects observed and any accompanying steps taken. The effectiveness of the corrective action is verified at the customer's.
D7: Preventive Action	Management and control systems are modified, as well as instructions and general procedures to prevent the same problems from recurring or similar problems from arising.
D8: Recognition of Team Success	Teamwork is complete, joint efforts and experience gained are recognized and pleasure is taken in the success.

Method Output (MO):

The method output describes the information gained from applying the QM method and therefore the interaction between the QM method and downstream processes.

4.3.2 Cause - Effect diagram (Ishikawa method)

The cause-effect diagram is mainly used to enable a team to identify the possible causes of a problem by collecting and visualizing information and data.

Method Input (MI):

The method input (problem with an unknown cause) defines/determines whether the cause - effect diagram is suitable for highlighting the actual problem.

Method Application (MA):

Table 8: Explanation of steps to be taken within the cause & effect diagram

M1: Team	A team is formed of members with relevant process production knowledge, time, a willingness to cooperate, as well as expertise and experience in the necessary techniques in order to identify the problem by applying the cause – effect diagram.
M2: Problem Description	The problem experienced by the internal/external customer Is defined in detail, the root cause is determined and data quantified, collected and analyzed. The extent of the problem (quantity of affected parts, versions, vehicles, etc.) is ascertained and evaluated.
M3: Identification of Potential Causes	To help identify potential causes, the letter “M” is often used as an aid (man, measuring equipment, method, environment, machines, materials, management)
M4: Application of Ishikawa Method	Potential causes are determined, e.g. by implementing the brainstorming method and classifying results into main cause groups until a plausible cause is identified.
M5: Verification of Each Cause	The causes are put into order of priority. Causes are then verified by applying the following methods, for example data analysis, Pareto diagrams, test series, failure reports, claims, trials and simulations.

Method Output (MO):

The method output describes the information gained from applying the QM method and therefore the interaction between the QM method and downstream processes, e.g. steps D5 to D8 in the 8D process.

4.3.3 5-Why method (5W)

The 5-why method is applied to determine the real cause of a problem or defect. The number of questions is not limited to five; rather more, this figure is of symbolic significance. It is crucial that questions continue to be asked until the root cause of a problem/defect is clearly identified. To verify whether the true cause of the problem has been found, the chain of 5-why questions is reversed and reformulated starting with the word “because”.

Method Input (MI):

The method input (problem of unknown cause) defines/determines whether the 5-why method is suitable for finding the real cause of the problem.

Method Application (MA):

Table 9: Explanation of steps to be taken with 5-Why (5W)

M1: Team	A team is formed of members with relevant process production knowledge, time, a willingness to cooperate, as well as expertise and experience in the necessary techniques in order to identify the problem by applying the 5-Why-Method
M2: Problem Description	The problem experienced by the internal/external customer Is defined in detail, the root cause is determined and data quantified, collected and analyzed. The extent of the problem (quantity of affected parts, versions, vehicles, etc.) is ascertained and evaluated.
M3: Identification of Potential Causes	A search is made for all possible reasons why the problem arose/was not detected. The probable cause(s) is detected and verified by comparing the problem description with existing data to find out whether a probable cause is the root cause or if there are interdependencies. The assumption is confirmed by conducting tests and experiments.
M4: Application of the 5-Why- Method	The “first why” hypothesis evaluation is narrowed down as soon as a hypothesis is made. This must be described using simple words that are not ambiguous (avoid unclear expressions). The question method is repeated until one/more cause(s) is/are found.
M5: Verification of Each Cause	The process is repeated backwards (using the word “because”) to confirm that the question method has been applied. correctly. Causes can also be verified by applying the following methods: data analyses, Pareto diagrams, test series, failure reports, claims, trials and simulations.

Method Output (MO):

The method output describes the information gained from applying the QM method and therefore the interaction between the QM method and down-stream processes, e.g. steps D5 to D8 in the 8D process.

5 List of abbreviations

AIAG	Automotive Industry Action Group
APQP	Advanced Product Quality Planning
DAMIC®	Definition, Analysis, Actions decision, Implementation Commuication
DIN	Deutsches Institut für Normung (German institute for standardization)
FMEA	Failure Mode & Effects Analysis
ISO	International Organization for Standardization
MA	Method Application
MCA	Machine Capability Analysis
MI	Method Input
MO	Method Output
PCA	Process Capability Analysis
CP	Control Plan (production)
QM	Quality Management
QMC	Quality Management Center
SPC	Statistical Process Control
VDA	Verband der Automobilindustrie (German Association of the Automotive Industry)

6 Questionnaires as a software application Methods assessments

Questionnaires for the respective QM methods assessments can be applied using a software tool.

The software can be downloaded free of charge from the VDA QMC Webshop after obtaining a license. To do this you must register in the shop and order the product. The license will then be emailed to you with a link to download or start the assessment tool.

The VDA Quality Management Method Assessments Tool is a web based technology software which requires a browser to run. This product requires no installation and can be started directly from the VDA tools server or after a download on your PC. It is available in German and English.

The license will be periodically validated by the server. Regardless of whether the tool is started from the link or from a PC no data other than the validation is sent to the server. Data that has been saved is retained by the browser memory function. This means that if you start the tool on the same PC but use another browser, the data cannot be accessed.

For data security regular backups should be made under the “Settings” function. This backup contains the complete data currently recorded in the tool. This data can then be copied or transported to another computer.

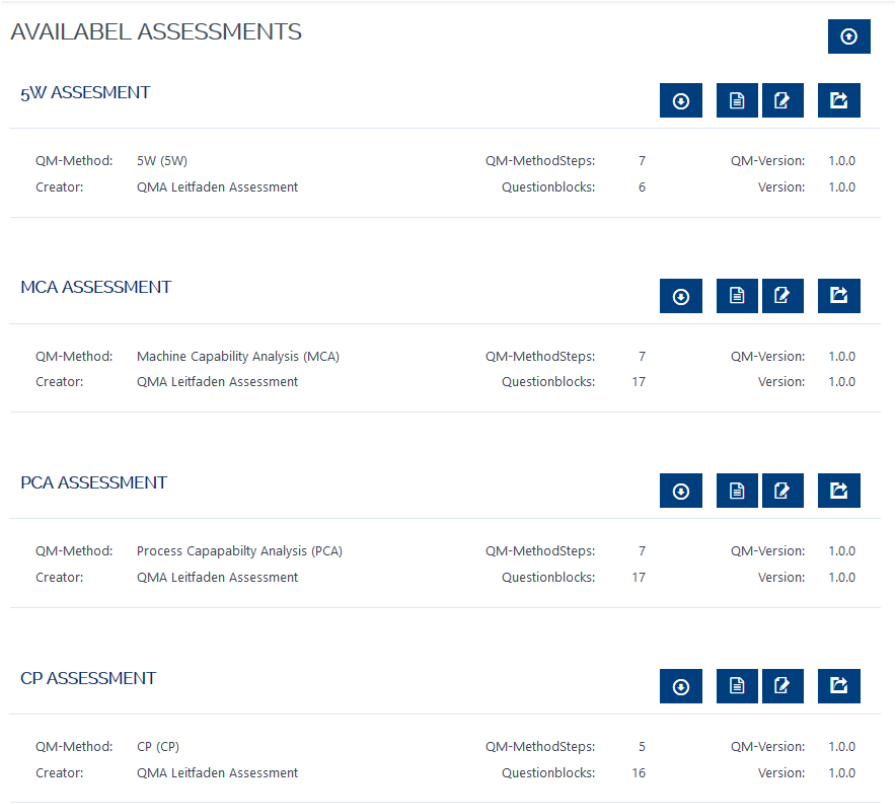
This tool allows you to perform the QM methods assessment described in this volume. You can also create a copy of your assessment and carry out changes. The tool is dynamic, you can add your own QM methods and use the tool for the evaluation of these assessments.

When you run the tool for the first time, you will get an overview of the number of available QM methods, assessments and evaluations on the start page.

Carrying out an Assessment

To carry out an assessment, follow these steps:

1. Select an assessment under “Assessment Execution” and start the evaluation

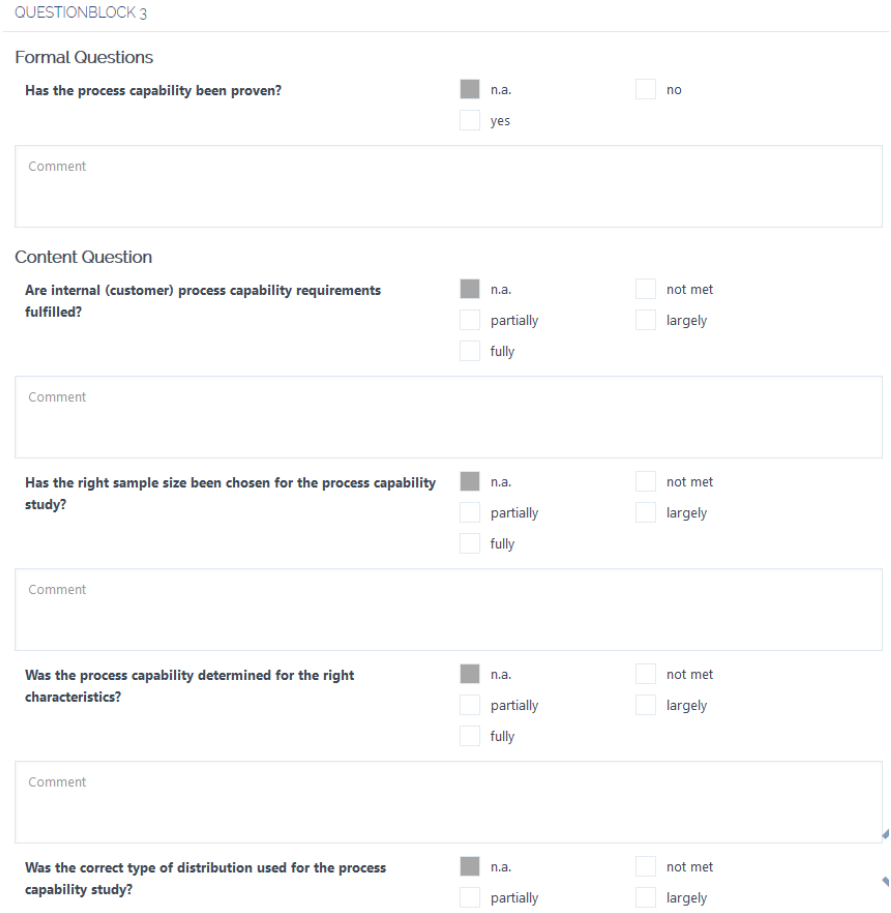


The assessment questions are shown

You can start data entry (execute assessment)

You can import assessments (upload)

2. You can save an assessment so that the current status is stored in the “Evaluation” area. From here you can load the assessment and edit or complete it further. Once all relevant fields have been filled in the assessment can be saved under “save and continue”. The assessment report is then created.



3. You now have the option to print the complete report or save the individual blocks of the report.

You can print the report as a pdf file

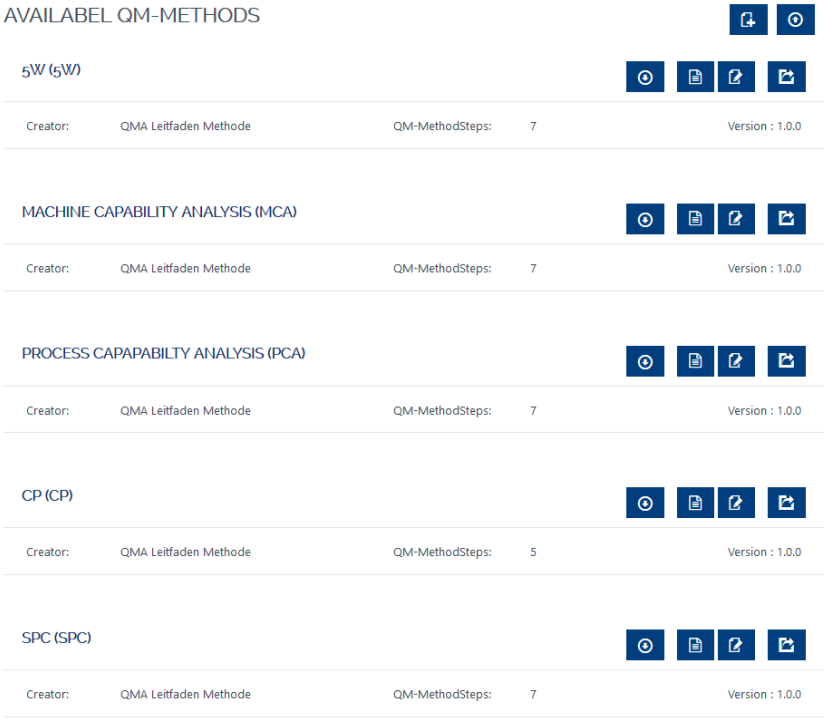
You can export tables to Excel

You can save graphs as image files

Creating your QM Methods

To create a QM Method, follow these steps:

1. Navigate to the “QM Method Administration” function. Here you can create new QM methods or edit existing methods. Standard methods can only be edited if you are using a copy.



You can display the method steps

You can create an assessment based on the QM method

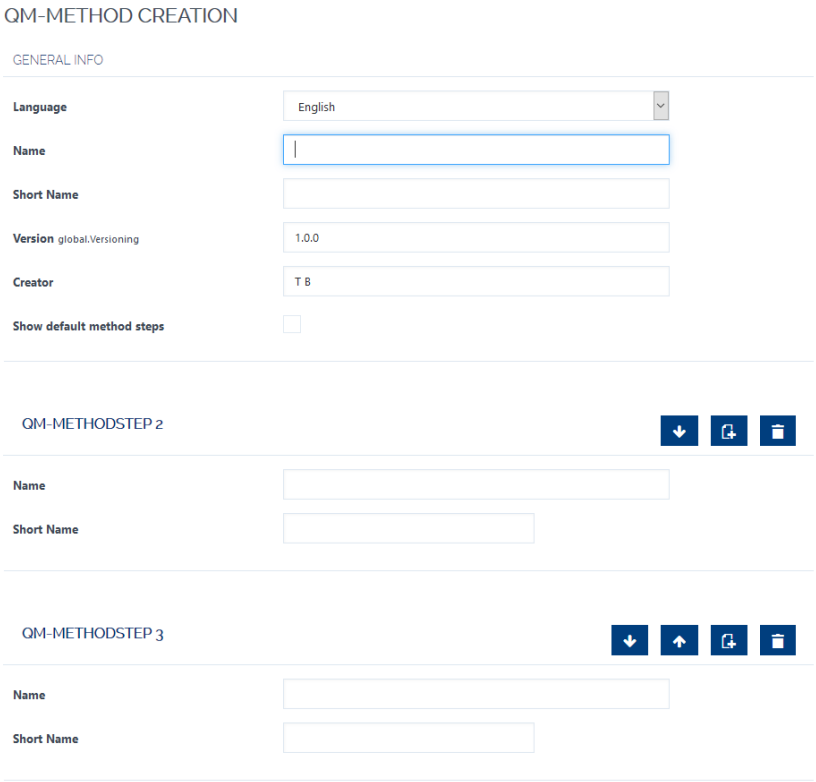
You can export a QM method

You can import a QM method

You can create a new QM method

You can edit an existing QM method

2. You can create each QM method in multiple languages. To do this, you only have to change your input language and edit the existing information.



3. Each QM method step consists of a name and a brief description. You must always specify both. The first QM method step is always defined and cannot be changed.

   You can add another QM method step

   You can move a QM method step down one position

   You can move a QM method step up one position

   You can delete the QM method step

4. After 'Save and Continue' the QM method is available in the new version for the creation of assessments.

Generating an assessment

Assessments are always generated using the “QM method administration” function as all assessments are based on a QM method. The assessment is managed through the “Administration” function. The QM method chosen to generate the assessment can no longer be edited. If it is necessary to edit or generate the assessment, carry out the following steps

1. Navigate to the “Assessment Administration” function. In this function you can edit an existing assessment. Standard assessments can only be edited as a copy.

2. Each QM assessment consists of question blocks as well as the assigned formal and content questions. Every question block must contain at least one formal question. The number of content questions can be defined. A QM method step must be assigned to each question.

You can add another question block or another question

You can move a question block or a question down one position

You can move a question block or a question up one position

You can delete a question block or a question

3. Use “Save and Continue”. The assessment is now ready for use in the new version.

Quality Management in the Automotive Industry

The current version of published VDA volumes regarding quality management in the automotive industry (QAI) can be found at

http://www.vda-qmc.de.

You can also place orders directly on this homepage.

Reference:

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