# Automated Quality Evaluation of 8D Reports in Context of Complaint Processing

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## ABSTRACT

Regarding the handling of complaints by customers, 8D reports are used for analysis and correction of errors that occur in the production process. However, the quality of these reports is often inadequate and leads to longer processing time and errors. Due to time and capacity restrictions in most cases, 8D reports undergo inadequate internal quality testing. Consequently, the aim of optimizing internal processing fails and poor 8D reports with insufficient solutions are sent to the customer. In this paper, we describe problems with faulty 8D reports in detail, and then present a system that automates quality checking of 8D reports based on these facts. This paper focusses on the basic structure of the developed system and how it improves the quality level of 8D reports within the complaint handling process.

## 1 PROBLEM-SOLVING PROCESS WITH 8D

Eight disciplines of the 8D method help to work systematically through the process of complaint handling in the context of quality management for external and internal complaints. Meanwhile, the problem-solving approach with the 8D method has been established in various industries and is essential for supplier companies, particularly in the automotive industry [1,2]. Parallel to the execution of the eight steps, the results are documented in a document – the 8D report.

By submitting an 8D report to the customer after a product complaint, the supplier can credibly prove that he cared seriously and diligently for eliminating the error. Not only does customer satisfaction increase through transparent problem-solving, internal and production processes are also sustainably optimized. Thus the application of the 8D method provides a profitable instrument for both sides, in light of an industry with ever increasing quality requirements [1,3].

Despite the importance of quality requirements and the 8D method, there are still too many errors in execution of the 8D method. The resulting, faulty 8D reports seem rather counterproductive and restrict the supplier-customer relationship, instead of improving it [3,4]. Nevertheless, the 8D-method is an approved in-strument in quality management and has high acceptance as WILDE proves in his survey from 2007 (*Fig. 1*).
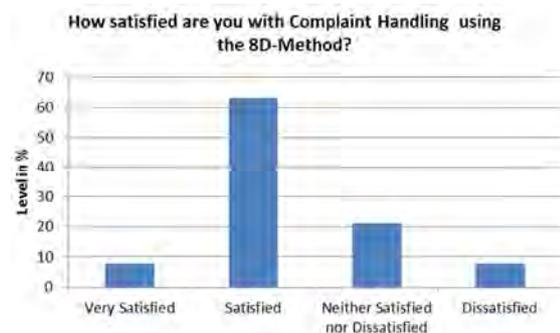


*Fig. 1 Satisfaction of the 8D method [5]*

## 2 THE 8D METHOD

When a customer (internal or external) makes a complaint, the standard problem solving approach in the producing industry sets the 8D method in motion. The 8D method is an ordered systematical way to fix problems sustainably. The name-giving eight disciplines are built upon each other and are worked through step by step (*Fig. 2*).
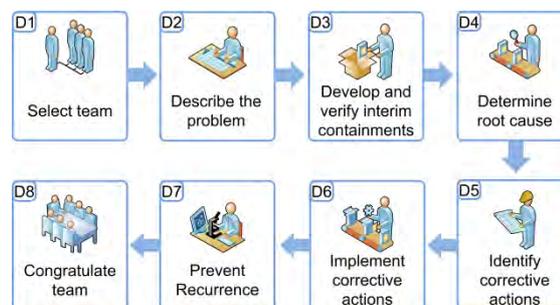


*Fig. 2 Disciplines of the 8D method*

The focus of the method is on identifying and removing the root cause of the problem and not just removing or masking the symptoms. Only then is it guaranteed that the 8D method is helpful, optimizes internal processes and satisfies the customer.

## 3 INTEGRATION INTO THE COM-PLAINT HANDLING PROCESS

The 8D report is filled out step by step during the execution of the 8D method. Modern Computer Aided Quality (CAQ) Software offers a digital form to fill out [7]. After finishing the 8D method, the content of the form can be transformed in the 8D report into any file format (e. g. pdf, xml, xls). The complete report can finally be sent to the customer.

The automated quality check is planned to be the final step before sending the report to the customer. The evaluation is executed and controlled by a quality manager, who is responsible for the complaint processing. If the quality of the evaluated report is poor, it goes back in revision and must be edited. A report with a good evaluation result can be released and sent to the customer (*Fig. 3*).
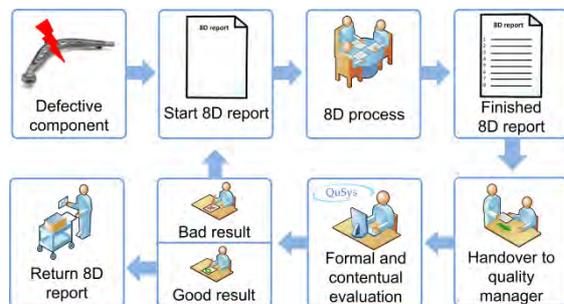


*Fig. 3 Classification in the complaint handling process*

## 4 PROBLEMS WITHIN 8D REPORTS

Many discussions with informed experts and surveys show that companies have problems carrying out the 8D method properly without any problems (*Fig. 4*). The survey from WILDE includes 41 companies questioned from the automotive sector.
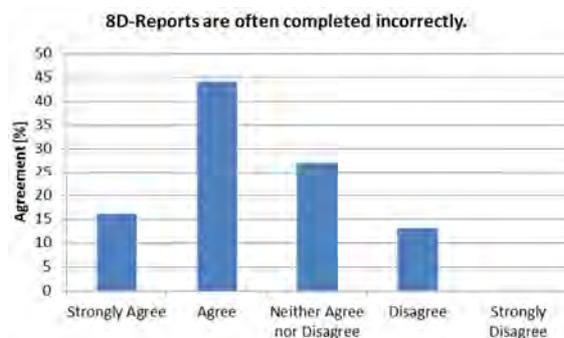


*Fig. 4 Incorrectness of 8D reports [5]*

Due to personnel capacity restrictions and instructions of the higher management, who do not see a direct increase in value, the 8D method is neglected. For a useful execution of

the 8D method inter alia the lack of knowledge in methodology of employees must be assured e. g. by advanced vocational trainings.

The good quality of an executed 8D method can be seen in the completed 8D report. If there is any quality control in practice at all, they are only spot checks. The manual evaluation is very intensive and time-consuming. First research ideas only take the automated formal evaluation into consideration [8]. Desirable would be a system which automatically checks the quality of all completed 8D reports especially concerning content and that gives feedback on which areas of the report and which processes can be improved. On this basis, well-directed measures and trainings could be established to improve the quality of 8D processing sustainably.

## 5 AUTOMATED EVALUATION OF 8D REPORTS

The first step to automate evaluation is to identify quality criteria. In cooperation with industrial companies, 21 criteria that describe the quality of the 8D report and form the basis of the evaluation were identified. The criteria are split up into an analysis of form and content. Each criterion is assigned to one or more disciplines of the 8D method (*Fig. 5*).

| discipline | criterion | type |
| --- | --- | --- |
| 1-8 | integrity | formal |
| 2-8 | faultlessness | formal |
| 2-8 | readability | formal |
| 2-8 | speech intelligibility | formal |
| 1 | team size | content |
| 1 | team competence | content |
| 1 | team experience | content |
| 1,2,3,8 | binding | content |
| 2 | unambiguity | content |
| 2 | quantification | content |
| 2 | assignment | content |
| 2-7 | attachment | content |
| 2-7 | solidity | content |
| 2-7 | context | content |
| 2-7 | reliability | content |
| 2-7 | reference | content |
| 3,5,6 | responsibility | content |
| 4 | accordance | content |
| 4 | conclusion | content |
| 4 | causality | content |
| 5 | relevance | content |

*Fig. 5 Quality criteria of the 8D report*

Each criterion is evaluated individually. The criteria are transformed with a metric which calculates an index as evaluation result. According to that a metric is a mathematical function that represents the result of an 8D step by a numerical value. This value can be interpret-

ed as the degree of compliance of a quality characteristic of the 8D step.

All calculated results are summed up with the help of an aggregation model to a final result. Before evaluating the content of the report, the formal evaluation makes sure that the texts cause no problems concerning their form and style. With too many spelling mistakes a proper content evaluation cannot be guaranteed.

The relevant company information for the evaluation is predefined in a meta model. This information is necessary for analysis of the content of an 8D report. The structure of the system is shown in *Fig. 6.*
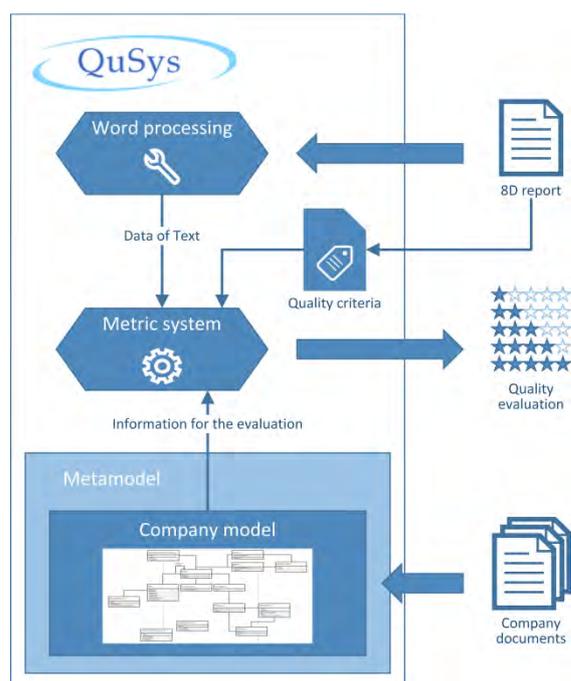


*Fig. 6 Structure of the automated evaluation system*

## 6    IMPLEMENTATION

The system was implemented as a software demonstrator in the Visual Studio 2015 Environment with the programming language C#. It is capable of loading and evaluating 8D reports in the Excel-format in German language.

After loading information for the content evaluation into an internal data base, a specific company model is created. During the evaluation, the metrics access the model and pull all information that is needed. This information can be found in company documents like internal catalogs of measures or bill of materials. Documents of different types (xml, qdx, xls, pdf) can be loaded into the system.

Within the evaluation, the company model can be filled in by hand. If the system does not recognize some specific terms or expressions

it creates a list with unknown words. Subsequently, these words can be organized in the model by the user and are taken into consideration for next evaluations. This way the system learns and widens its state of knowledge.

In dependence of the availability of company information, characteristics and individual settings of a company, the quality criteria can be weighed. To sustain comparability between the evaluations, the importance (weight) of each criterion is defined initially before use.

Assuming that the formal quality is adequate, the automated evaluation runs through the disciplines and evaluates each text of the discipline separately. The result of the evaluation is given in a total index from zero to five. In an additional detailed view, the index of a single discipline or quality criteria is shown. Notes and comments by the system provide an explanation for a specific index. Thus the user can easily understand problems of the report. All evaluated reports are stored in the internal database. For statistical analysis and controlling the progress, the user can display the overall view or average index of evaluated 8D reports.

## 7    RESULTS

We used initial tests to verify the basic functionality and the mathematical functions. In addition to that we selected three 8D reports to validate the system. In our discretion we picked one good (report 1), one medium (report 2) and one bad (report 3) report. Five experts evaluated the quality of these reports independently. They gave points from 0 to 5 for each discipline (D1-D8) and the total result (8D). We generated the average and compared it to the evaluations of the automated system. First results are very promising, especially for the total result (Fig. 7).

## 8    SUMMARY AND OUTLOOK

The presented solution is supposed to support a high quality and efficient complaint handling process. In contrast to the current state of the art, every 8D report that leaves the company is checked. Inadequate reports are identified automatically and can be improved. Apart from this, the system reveals weaknesses in 8D processing which makes well-directed training measurements possible. Due to that, not only the continuous improvement process is supported but also the customer relationship, because only good 8D reports are sent to the customer.
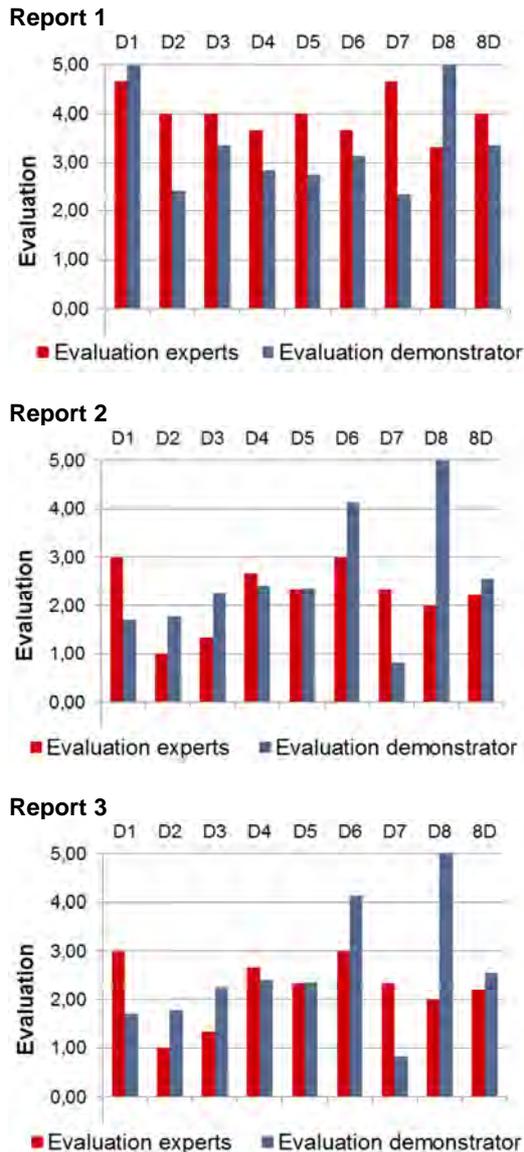
**Report 1**



**Report 2**



**Report 3**



*Fig. 7 Evaluation results of three 8D reports*

In the next steps metrics and algorithms are adjusted according to the results of the verification and validation. Following that, there will be a final extensive validation with experts from practice.

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