The 2019 Automotive FMEA

ON THE NEW FMEA HANDBOOK FROM AIAG & VDA FOR THE AUTOMOTIVE SUPPLY CHAIN

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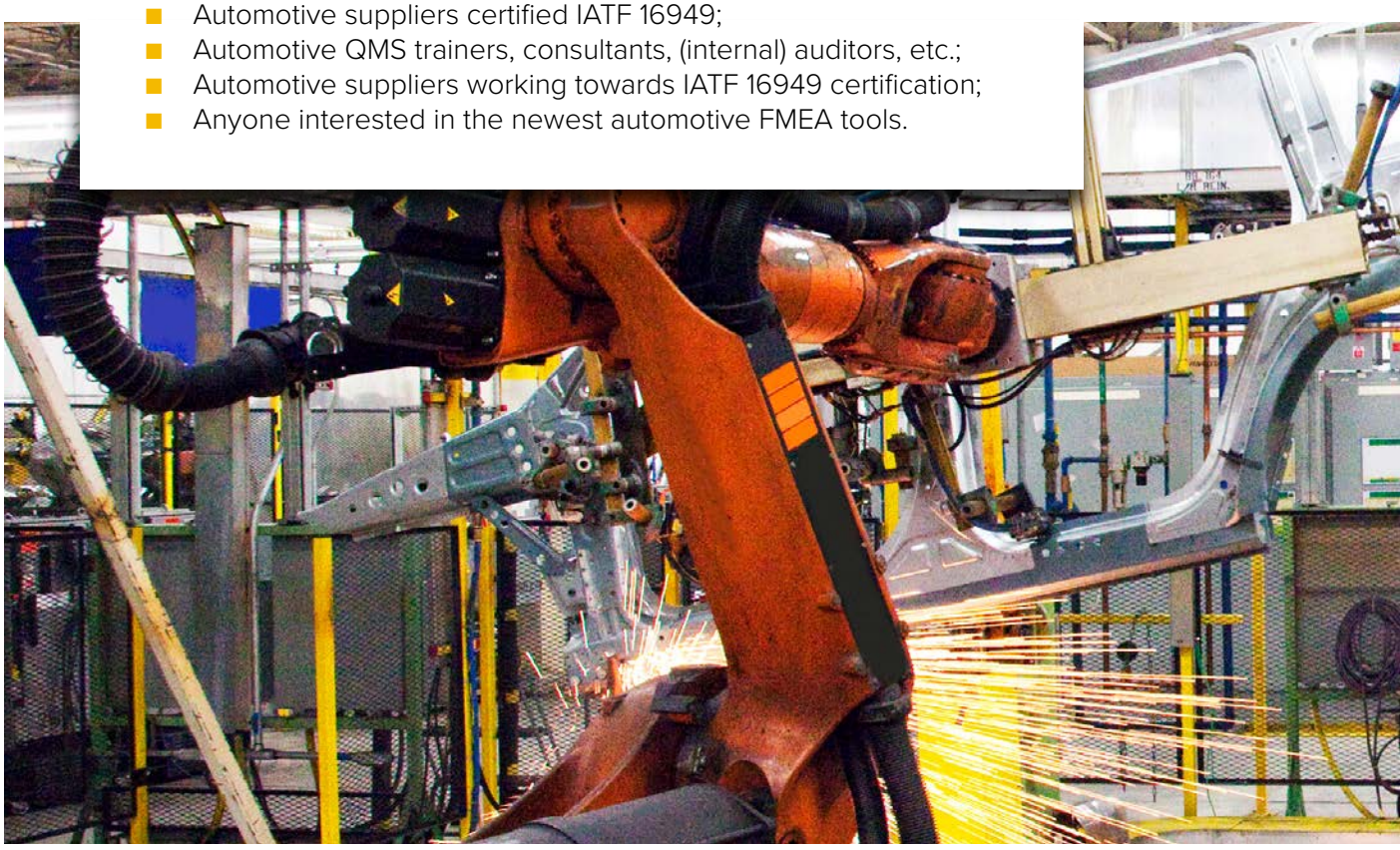
WHY THIS PAPER

For automotive manufacturing suppliers, technical risk analyses (regarding both design and manufacturing processes) are a mandatory part for automotive QMS certification IATF 16949, and the tool to manage those risks is the FMEA method. To conduct such risk analysis in practice, there's a specific reference manual among the set of books on automotive core tools, the so-called Blue Books (APQP, PPAP, MSA, SPC, and FMEA). The previous edition of the FMEA manual – "Potential Failure Mode and Effects Analysis (FMEA), Reference Manual, Fourth Edition, June 2008" – is now being replaced by a new joint publication from AIAG and VDA: the "AIAG & VDA FMEA Handbook, First Edition, June 2019." In this introductory paper, we summarize the changes and highlight what's new: a new analytical method, a new rating scale and new formats.

This introduction is intended for

- Automotive suppliers certified IATF 16949;
- Automotive QMS trainers, consultants, (internal) auditors, etc.;
- Automotive suppliers working towards IATF 16949 certification;
- Anyone interested in the newest automotive FMEA tools.



AN IMPROVED FMEA APPROACH

In today's context, automotive suppliers are confronted, more than ever, with a multitude of difficult product demands: higher quality, higher reliability, higher complexities (including increasing electronics and software demands), increasing regulations, with on top of all the need for further cost reduction. The new FMEA handbook is the result of a joint effort from the Automotive Industry Action Group (AIAG) and the Verband der Automobilindustry (VDA). Their intension being not only to improve the FMEA development process, but also to harmonize different regional versions into one single manual, providing a best-practice process approach to meet industry requirements, in particular for automotive suppliers.

AN IMPROVED FMEA APPROACH

To address technical risks and increase safety, during both design development activities and process development activities the FMEA method is used as living tool throughout the product/process realization process. FMEA is a multi-disciplinary (i.e., composed of the necessary different subject matter expertise), analytical, systematic method on system, subsystem, or component level in order to:

- list potential technical failures of a product, from design point of view;
- list potential technical failures of a process, from manufacturing point of view;
- analyze the potential causes and effects of such failures;
- recommended actions and/or controls to further mitigate, prevent, detect those potential failures.

Important here is that the FMEA activity should start early in the process of design development and process development respectively. Thus, reflecting from the beginning of the product design on what could go wrong if designed in a particular way. Then, ideally before actually buying/installing production equipment, reflecting on what could go wrong in the choices of the way of manufacturing.

And last but not least, FMEA is not supposed to be just a one-time exercise, but is to be reviewed in due time as product design and processes design evolve and mature. The FMEA report evolves into a living document, and therefore is an iterative process.

THE CHANGES

Let's first recap what hasn't changed.
The starting and preparation principles still hold. Before proceeding to the actual technical part, considering technical risks and how to minimize or avoid them, the FMEA team should begin with, as ever: identify the project (i.e.,what exactly are we going to examine?), gather all information needed, draw up the project planning, set analysis boundaries (what is included versus what is excluded),and set the FMEA baseline (from earlier Lessons Learned – remember: FMEAs are also supposed to serve as written technical notes about what may have gone wrong in the past and how it was addressed).

At the onset of the FMEA project, the starting point is the project planning, containing the topics as guided by the so-called Five T's: Intent, Timing, Team, Task, Tool. These principles remain. Namely, that team members do know the FMEA method, their role in the team and how to conduct such an exercise. That an FMEA should be conducted up front, according to the project plan and not afterwards after the facts, for instance to complete the documentation. That the team needs to be cross-functional, i.e. that all necessary expertise is represented by means of subject experts. That a framework is available for tasks and deliverables, and their follow-up. That all the team members possess the knowledge to use the selected FMEA tools or software. Hence for successful and useful completion, the FMEA team should be led by an experienced FMEA facilitator/leader.

Now, what has changed?

The main change is the introduction of a 7-step approach, a new framework to investigate failure modes and its potential causes following a process consisting of seven steps. This approach serves as a structured method to describe more precisely potential technical risks and their consequences.

The objective of each of these steps is as follows:

The purpose of **Step 1, Planning & Preparation,** is to define which FMEAs will be done throughout the project, of what type (system, subsystem, component), and what will be included and excluded respectively. During this phase, the details of project planning are worked out.

During **Step 2, Structure Analysis,** the scope of the FMEA is defined. This can be achieved using a variety of tools and/or visualizations: structure trees, block diagrams, boundary diagrams, physical parts, interface analyses, interaction analyses, etc.

The purpose of **Step 3, Function Analysis,** is to make sure that the functions specified by the technical specifications or requirements are fully understood, completely defined, and assigned to system elements. And that no functional items are missing. Useful tool: a parameter diagram (or P diagram), where parameters are the attributes of behavior of a function.

During **Step 4, Failure Analysis,** the actual potential causes, modes, and effects of technical failures are considered. The different types of failures modes and failure chains are to be evaluated and analyzed. Deep technical dive regarding what could go wrong, why, and how it would show or manifest.

In **Step 5, Risk Analysis,** the risk levels of the identified potential failures are assessed with regards to severity (S), occurrence (O), and detection (D). Subsequently, necessary actions are defined, and their priority. The idea is to identify what to address first, but keeping awareness of the lower-rated risks where no immediate action was decided.

The purpose of **Step 6, Optimization,** is to assess the effectiveness of the previously defined actions to mitigate the identified risks. That is, review if previously defined actions did indeed give the desired results and decide if yes/no adjustments are in order.

And finally **Step 7, Results Documentation,** which goal is to summarize and communicate the FMEA activities. In short, write and update the FMEA report as the project evolves.
The handbook provides templates and examples regarding the different successive steps.

Another change: AP replaces RPN.
Instead of Risk Priority Numbers (RPN) to rate Severity, Occurrence, and Detection, ranked after multiplication of the respective rating numbers, a new method is introduced: Action Priority (AP) levels with the possible rankings High, Medium, or Low. Given real-life limitations in time and resources, one must make choices regarding priorities and actions, hence ranking in a more pragmatic manner per the high-medium-low philosophy.

Furthermore, another new method is introduced in the new FMEA Handbook, called the **Supplemental FMEA** for Monitoring and System Response (FMEA-MSR): a new way for analysis of diagnostic detection and fault mitigation, that is assessment of potential failures under customer operation (i.e., at end-user or in-service stage).

Three categories of risks are to be assessed:

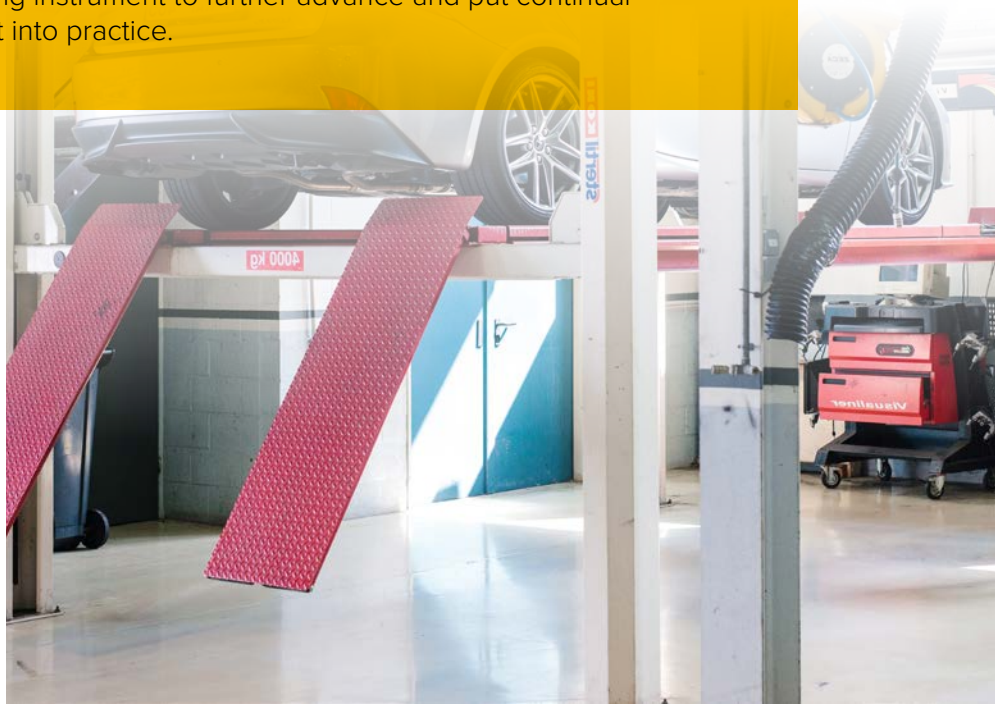
- Severity (S) of harm, loss of or degraded functionality, unacceptable quality, or regulatory noncompliance;
- Frequency (F) estimation of the potential failure in operational circumstances;
- Monitoring (M): possibilities for detection followed by automated response to limit or avoid a failure effect.

TRANSITIONING TO THE NEW FMEA METHOD

Important note: The new FMEA Handbook allows organizations to maintain existing FMEAs in their original form for subsequent revisions (see Section 1.3.5 in Handbook), but new projects must follow the new FMEA methodology. So, no need to "reformat" all current existing FMEAs, but if you start a new design development process or manufacturing development process, the new FMEA approach is to be used.

IN SUMMARY

Using the revised and extended FMEA method, bringing together best practices from separate manuals into one handbook, should result in an improved comprehension and mastery of the technical risks, which in turn leads to increased performance and thus ultimately increased customer satisfaction. The new FMEA tool is a new opportunity and interesting instrument to further advance and put continual improvement into practice.

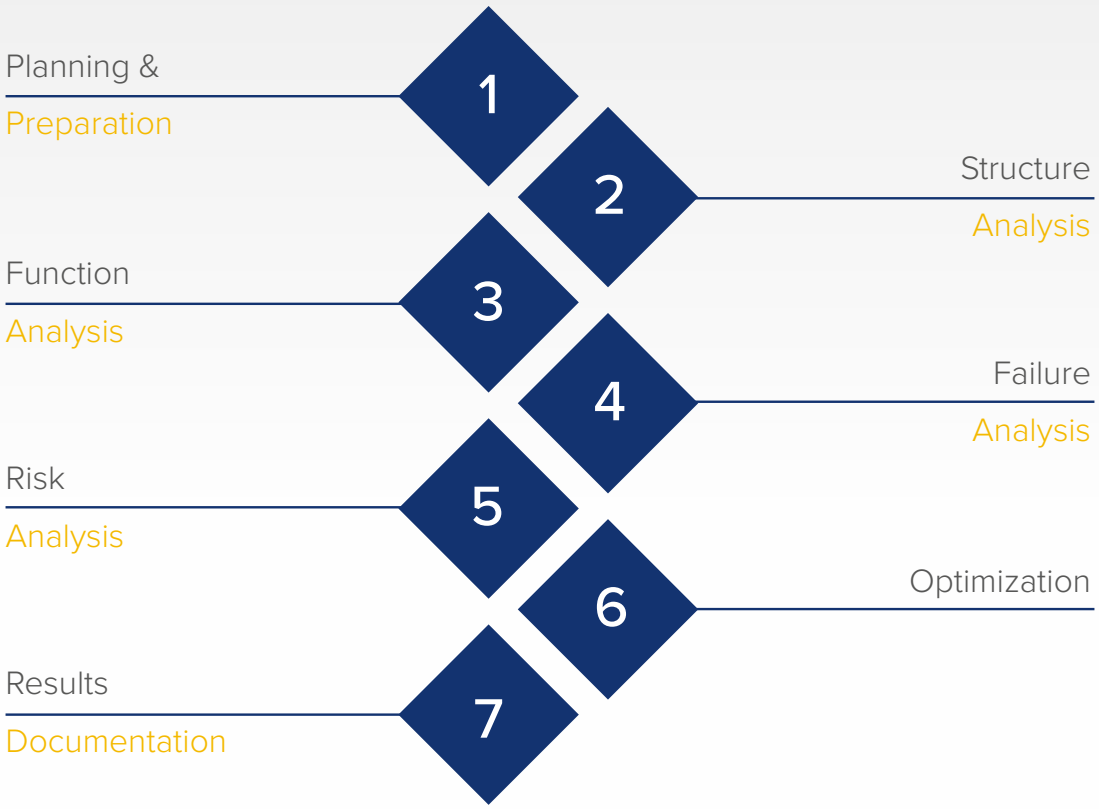


WHAT WE OFFER

Based on our extensive experience in automotive auditing and history as IATF Certification Body, we offer multiple options to help you gain accelerated understanding of and insight into the new FMEA method. We cover what has changed, why it has changed and how to get started with this new tool in practice.

You can choose from:
(1) An introductory, more general, information session with Q&A;
(2) A customized session to dive into company-specific FMEA cases and examples;
(3) On-site assistance in conducting FMEA exercises according to new method;
(4) On-demand, individualized trajectories to implement the new FMEA approach.

THE SEVEN FMEA STEPS



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