The 7 Most Frequent Errors in Capability Studies

Capability Studies provide proof that the respective measurement process (measuring device, operator, environment, etc.) is capable for the respective application. In order to give this proof, the Measurement System Analysis according to the QS-9000 guideline MSA is made. Many company guidelines for this kind of in-house tasks are based on the QS-9000 standard.

It is almost the same with the determination of the Extended Measurement Uncertainty according to GUM or VDA5 for Capability Studies. However, these procedures are not taken into account. Despite this fact, many errors are committed when evaluating measurement processes. Here is a list of the most frequent errors (the order does not signify the gravity of the error).

Error 	There is no company-wide standard calculation method. Different methods are applied such as • ARM or ANOVA • different reference sizes (specification limits, process variation, part variation, etc.)
Consequence 	Results are not comparable leading to misinterpretations and inevitably too many unnecessary discussions within the company and with customers.
Solution 	Determine one standard method whose use is binding company-wide. These standards must be validated.

Error 	In the Type 1 procedure (C_g ,C_{gk}), the uncertainty of the standard is unknown or too high.
Consequence 	The variance of the measurement values is too big but you cannot blame the measuring device or the operator.
Solution 	Only use calibrated standards or calibration masters whose Measurement Uncertainty amounts to less than 5 % of the tolerance.

Error 	Many non-validated Excel form sheets with macros for the determination of results are erroneous. Particularly the K factor is often wrong.
Consequence 	Depending on the constellation, the calculated results are wrong or imprecise which makes them useless.
Solution 	It is only with a great effort that Excel macros are to be validated. Otherwise use a validated standard software.

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Error 	It is often assumed that the calibration of a gage replaces the evaluation according to the Type 1 procedure.
Consequence 	Since the calibration is made under ideal conditions in the metrology lab, there are no factors like those that influence the real application.
Solution 	Use the Type 1 procedure, particularly when you deal with a relative measurement to ensure that the calibration can be adapted to national and international standards.

Error 	Too many MSA studies are conducted, especially in case of similar measuring tasks.
Consequence 	Too much effort linked with too high costs.
Solution 	In case of similar measuring tasks including the same measurement process, the results of one study can often be transferred to the other studies. In the Type 1, 2 and 3 procedure, a back calculation to one minimum reference size is possible. As long as the values do not go below this size in an application, a new study is not required. This fact leads to huge savings.

Error 	The measurement stability of a measurement process should not be underestimated. Without an adequate verification, you have to act on the assumption that the measurement process will change over the years due to different factors. It might become inappropriate for the application.
Consequence 	This error leads to a high uncertainty because the exact time when the measurement process became incapable cannot be determined later. Because of erroneous measurements, erroneous parts might have been already installed or delivered to customers. This may lead to high consequential costs and damages to the company's image.
Solution 	Run regular stability checks and document the results. Perhaps you can extend the calibration interval of the measuring device.

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Error 	Bad results (e.g. % GRR of 35 %) often lead to the conclusion that the used measuring device must be replaced by a high-quality, expensive one. This conclusion is due to the lack of knowledge of the measurement process.
Consequence 	Too many additional costs.
Solution 	Due to correct definitions, right measurement processes and comprehensive graphic displays of the measurement values and results, the major influencing factors and their impact on the process become transparent. Cost-efficient measures (cleaning, installation of a stopper to position the test object, training for operators, etc.) can be taken. The measurement process will improve without replacing the measuring device.

Many of the errors listed above can be avoided by using the Q-DAS® software solara®!

Here you can find more information about the correct realization of the Process Capability Study

- Book: Process Capability Study
- Book: Special Cases in the Evaluation of Measuring Processes
- Pocket Power: Measurement System Capability
- Flow Chart: easy2use | Measurement System Capability
- Q-DAS® Poster
  - Measurement System Capability
  - Measurement System Capability – Type-1 Study
  - Measurement System Capability – Type-2 or Type-3 Study
- Seminars
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