Ensuring the potential for an intended quality of a measurement result must be done before and during the measurement, not after it (when it is too late)

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Published online: 28 May 2009
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“Providing quality”, be it in a material thing or in a service, is a very fashionable slogan nowadays. Yet it is still difficult to realize it unambiguously, due to an insufficiently simple and clearly understandable definition of ‘quality’.

What is ‘quality’?

Meeting the end user’s requirement?

What if this is not precisely formulated, as is many times the case?

And, if it is, is it based on a real need?

Has the end user arrived at a justified, and justifiable, formulation?

Was the formulation specified so as to be understood unambiguously?

Fortunately for the quality of a measurement result, the new VIM [1] is very helpful in answering those questions.

A requirement on a measurement result can be formulated as a target measurement uncertainty (TMU): ‘measurement uncertainty specified as an upper limit and decided on the basis of the intended use of the measurement result’ [VIM-2.34] [1]. Thus, the TMU can be seen as a *measure* of the ‘fitness-for-intended-use’. That reflects the importance of a formulation of the use of that measurement result, which is understood by the analyst in terms of the intention of the end user.

The concept of TMU offers a tool which both serves

- the end user: it forces him/her to think about his/her intention of the use of a measurement result, and,

- the analyst: it enables him/her to examine how (s)he thinks to obtain a measurement result fit for the intended use, *prior* to the measurement i.e. at the time of its planning.

Whether the analyst will have any chance of achieving the right ‘quality’ expected by the end user can then be evaluated against a jointly agreed TMU, which is a numerical measure of the fitness-for-intended-use of that result.

The importance of the potential of the combination of a TMU and a fitness-for-intended-use cannot be overestimated. It couples better thinking by the end user (in terms of his/her real need) to the ability of the analyst (in terms of meeting that need).

The feeling of ‘quality’ is born in the perception of the end user that his/her need is met. The feeling of ‘quality’ is born in the perception of the analyst that (s)he might be able to meet that need.

There are various ways to build-in quality of the measurement result before the measurement (a priori): the choice of a ‘quality calibrator’, or the choice of a shorter ‘calibration hierarchy’ entailing a shorter metrological traceability chain of the measurement result, or the choice of a good measurement procedure including a good measuring instrument and entrusting the measurement to a good analyst.

A convincing feeling of ‘quality’ in both the minds of analyst and end user is good. But, let us note that a feeling of *exceeding* the claimed quality, makes the feeling of ‘quality’ really unavoidable, and, at the same time, highly satisfactory. Slightly exceeding the expectations of both the producer (the analyst) and the end user (the customer) of the measurement result, seems to be the simple secret of removing any doubt on the ‘quality’ of the measurement

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concerned. A feeling that the ‘quality’ is better than expected, ensures a real feeling of quality with both the receiver and the producer of the service ‘measurement’. It is worth noting that readily available simple(r) and cheap(er) measurement procedures that routinely achieve a better result than required by a TMU, are sufficient to generate a feeling of better than expected without any special effort (and ensuing cost) for the analyst.

We note that all of these considerations can, and should, be reflected upon *before* the measurement i.e. at the time of its planning. Evaluating by whatever statistical procedure the ‘quality’ of the measurement result(s) *after* the measurement (‘a posteriori’) is not of much help. The results are there, and cannot be changed anymore. At best ‘bad’ results can be removed which raises the very difficult question: ‘removed on the basis of what?’. But for improving the ‘quality’, it is too late. The measurement results are what they are and have to be taken as they are. Also: eliminating ‘bad’ measurement results, does not enable to recuperate lost time and money invested in making them.

TOYOTA became the maker of a ‘quality’ car by moving the care for ‘quality’ up stream to the stage of car assembly, a big change from the usual (statistical or other) evaluation of the quality of cars *after* they had run off the assembly line and, eventually, had to be put aside as being ‘not good enough’. Obviously, recuperation of lost time and money is impossible at that stage since the observation of lack-of-quality clearly comes *too late*. Human intervention at the time of planning, i.e. on beforehand, is a simple way to better quality, something which was observed even in the case of increased automation [2].

An unambiguous sense of ‘quality’ is generated when some form of exceeding the expected/required ‘quality’ is reached by planning on that *on beforehand* (‘a priori’). Couldn’t we agree that ‘exceeding an expectation’ to

whatever degree (and that needs not to be big), is an essential ingredient of any perception of ‘quality’?

A good formulation of basic concepts in the VIM (in this case, the formulation of the definition of the concept ‘TMU’), seems to lead to the clarification of a much needed other definition: that of the concept ‘quality of measurement results’:

“a quality measurement result is a measurement result which exceeds the expectation formulated as a target measurement uncertainty”.

Simple, as a definition of a concept in Metrology in Chemistry always must be...

Does that lead us to another tentative conclusion?

Does the introduction of metrological principles in chemical measurement lead to building-in quality on beforehand?

With the ensuing consequence of making the measurement results not only better, but even cheaper to obtain?

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