

METROLOGY SKILLS FRAMEWORK - SUMMARY PAPER

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Purpose: *This paper outlines the proposal for a global framework for metrology skills and is intended to generate discussion and engagement with interested parties. It has been developed through the Midlands Centre for Data Driven Metrology ([MCDDM](#))*

CONTEXT

Metrology underpins over £622 billion per year within the UK, delivering confidence to business and society, ensuring fairness in trade and giving the supplier and customer quantifiable levels of confidence in products, processes, and services¹. Metrology, through the SI and derived units is an international infrastructure of standards and traceability, with its own language and nomenclature, that is threaded throughout all trade, science and industry. Trust in the robustness of these measurements is vital, as failures of metrology can lead to £multi-million losses¹.

Like any technical discipline, metrology requires high levels of skill from the people involved. Metrology skills are needed for those directly involved but also for all engineers and scientists who specify requirements and make decisions based on measurement data. As we progress with digital and industry 4.0, the needs of measurement science and engineering are evolving; traditional skills are still important, but metrology has moved into the digital space, and skills must develop to support this.

Today, skills are developed via a range of different solutions including training & education, on-the-job learning, self-directed research, etc. These solutions are provided by a wide range of organisations from the individual, through to recognised academic and industrial training providers.

PROBLEM

The competency requirements, training, education and testing for metrology are not well organised² or documented. No internationally recognised standard for the competency of practitioners in metrology exists, leading to:

- Variations in competency across industry, resulting in knowledge gaps and associated problems;
- Inconsistency of training and development solutions between providers;
- Industrial and scientific companies each developing their own solution for the competence of metrology staff leading to duplicated effort and inconsistency;
- Unclear recognition of what a metrologist is or development paths for metrologists building their career;
- Uncertainty when recruiting

The field of non-destructive testing (NDT) had this same problem several years ago. To solve the issue, the industry developed the ISO 9712 framework³. This standard defines the competency requirements and framework for people carrying out NDT across a range of industries, as well as providing a common standard for training solutions.

SOLUTION

To address the gap in metrology, we are proposing the creation of a framework that defines the competency requirements for metrology people. This standard will include:

1. A standardised **framework** that defines and provides structure to metrology skills across different levels and disciplines (for example beginner, practitioner, advanced across areas such as flow, dimensional etc).
2. Definitions of the **competency requirements** for different tasks and disciplines within the framework.
3. Clear career development paths for metrologists
4. An **international standard** that formalises the framework and competency requirements, similar to the approach already adopted by the NDT community in ISO 9712.
5. An **assurance/accreditation** process to enable:
 - Demonstration of an internationally recognised level of competency & professionalism.
 - Training providers to demonstrate consistent quality of their products to the standard.
 - Organisations to have confidence when they recruit and train their staff.

Metrology is a vast subject, with diverse topics ranging from fundamental physics, to varied applications for each of the major measurement areas (time, length, mass etc.). For example, in length measurement, applications range from inspecting the size/shape of an industrial product or the length of a building site, to the size of bacteria. Each of these applications has its own technology and standards. Because of this variety, it is impractical to define the skills required by every discipline. However, by defining a framework to operate against, groups active in each area can develop standards and solutions for their field. The framework will then provide transferability between disciplines, as well as efficiency in covering the fundamentals.

Figure 1 shows the concept where each discipline (length, time, etc.) has a range of lower-level subject "nodes" included at different levels of skill (basic, intermediate, advanced). At each "node" in the framework (for example "Dimensional, Intermediate Skill, Coordinate Metrology"), competency requirements can be defined together with any assurance/accreditation processes and requirements.

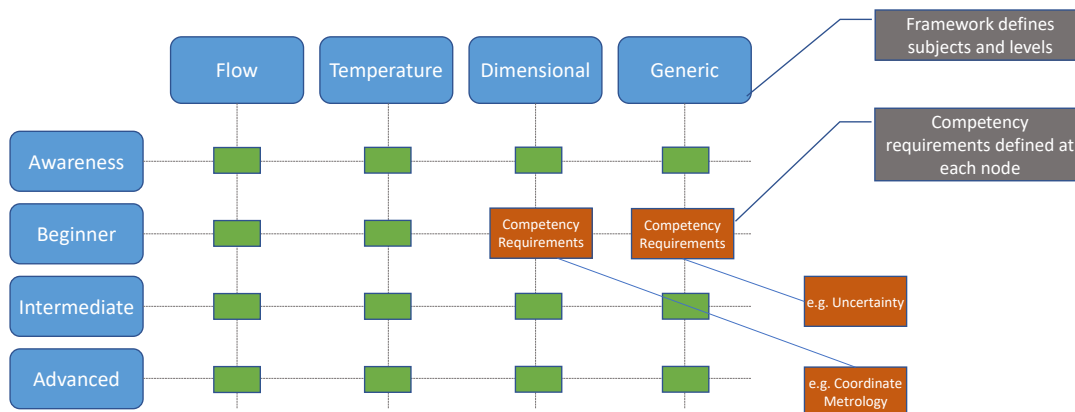


Figure 1 - Concept for the Metrology Skills Framework

NEXT STEPS

To make this solution happen will require a diverse team from industrial and scientific companies; academia, national laboratories, professional bodies, metrology technology OEMs and service providers. With this requirement in mind, the immediate objective is to form a working group with the necessary diversity, influence, collaboration and bias for action to make this goal a reality. Once a critical mass is formed it is expected that regular workshops will be used to develop the basic proposal for the framework, selected standards and the "route to market", be it via an international standard (e.g. ISO, ASME etc) or another robust route. To help this the aim will be to develop principles to support the framework and supporting information as follows:

1. It will not be "owned" by any one organisation. Rather, it will be a collaboration with the alignment to an international standard providing the necessary governance structure.
2. It will not be directly monetised. It will however provide a standardised framework against which different organisations are able to build products aligned to it.
3. It shall be international, so it has relevance across industry.

If you are interested in participating, please contact us for more information

REFERENCES

1. [UK Measurement Strategy: the value of measurement - supporting information \(publishing.service.gov.uk\)](#)
2. MCDDM Training event report & survey - [Training Workshop \(mcddm.ac.uk\)](#)
3. ISO 9712- Non-destructive testing — Qualification and certification of NDT personnel

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