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# THE APMP-DXFG: A FOCUS GROUP ON DIGITAL TRANSFORMATION IN METROLOGY

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***Abstract*** – The Asia Pacific Metrology Programme created a special focus group to address the emerging trends of digitalisation and digital transformation in metrology at the end of 2021. The group will serve as a regional forum for coordination of activities and collaborations. It is tasked with: acquiring the latest information about international trends; identifying common challenges and prioritising tasks; and developing a work programme to address awareness, knowledge transfer and stakeholder liaison. This paper reports on the group's composition and structure, some initial activities, and some of the challenges encountered during the establishment phase.

***Keywords:*** Digital transformation, regional metrology organisation

## 1. INTRODUCTION

For many years, there has been a trend to digitalise and transform the internal operations and delivery of services in both the business world and in public administrations. Until recently, however, this trend had not touched our national and international quantity infrastructures. Now there is considerable interest in such activities.

The International Committee for Weights and Measures (CIPM), which directs metrological activities carried out by parties to the Metre Convention, recognised the need to enhance support for the SI in a digital world and established a task group on the "Digital SI" (108th meeting of the CIPM, Decision CIPM/108-28, Oct 2019). One of the task group's early activities was to organise an international online workshop, in February, 2021. This workshop brought many stakeholders together to discuss a proposed "SI Digital Framework", including representatives from all the regional metrology organisations (RMOs) [1].

In preparation for the workshop, the Asia Pacific Metrology Programme (APMP) Executive surveyed members, to determine their current activities and preparedness for digitalisation and digital transformation [2]. An analysis of the survey responses concluded that a coordinated international effort should be supported by the APMP. A mid-year APMP Executive meeting, held in June 2021 (*Resolution EC66-03*), recommended the establishment of a dedicated focus group. Calls went out for expressions of interest in membership and, at the 27th General Assembly, in November 2021, the APMP Focus Group on Digitalisation in Metrology (DXFG) was formally established [3].

This paper describes the background to the formation of the DXFG, and its plans and activities during the first months of its establishment phase.

## 2. THE DXFG COMPOSITION AND STRUCTURE

Following a call for interest, the APMP Executive received 30 membership nominations from 14 economies. Nominations were also received from two associate members (the United Kingdom and Kazakhstan). Immediately following establishment of the group, one more associate member joined (United Arab Emirates) and there was an application for membership from the NCSL International[1] technical committee 141 on Measurement Information Infrastructure, which was approved.

The call for nominations expressed a preference for candidates with some experience relevant to digital transformation, or a background in software development or other IT experience. So, candidates included such experience in their applications. A few (8) indicated prior software development experience, usually related to automation or data analysis.[2] A greater number referred to experience through various project roles and group memberships.

The DXFG is being managed as one group at present. However, smaller working groups will be formed around specific work plans once detailed objectives have been identified. Four thematic 'pillars' will be helpful to manage and plan our work going forward. They are:

**Liaison** involves engagement and network building with stakeholders, including: the APMP Technical Committees, APMP Developing Economies Committee, accreditation bodies and other quality infrastructure

[1]The founding name was "National Conference of Standards Laboratories".

[2]As a different proxy measure of experience relating to software development, 6 group members had pre-existing github accounts.

organisations, RMOs, the International Bureau of Weights and Measured (BIPM), and scientific organisations.

**Enablement** involves the development of capability: dissemination of information, awareness raising, identifying and addressing skills and knowledge deficits, professional development, collaborative projects, meetings, workshops and conferences.

**Technology** covers various technical resources and competencies, and the harmonisation of digital-tools used for collaborative work.

**Core** addresses the need to understand the scientific challenges that arise in digital transformation.

## 3. WHY HAVE A FOCUS GROUP?

This section briefly describes the context in which the DXFG came into being. It summarises the findings of the APMP survey, mentioned in the Introduction, and discuss international activity related to digital transformation in metrology. This background has informed decisions made during the establishment phase (described in §4).

### *3.1. APMP Survey on digital transformation*

The APMP survey of its members was carried out at the beginning of 2021. It was intended to identify activity relating to digitalisation. Responses were received from 13 member economies and 2 associate members. A high proportion (about $87\,\%$) reported some activity. However, many were at very early stages of digital transformation, such as planning and applying digital technology to existing metrological operations.

The most significant driver of digitalisation was associated with advanced manufacturing, transportation and energy sectors (about $41\,\%$), with the next most important driver being quality infrastructure bodies and regulators (about $31\,\%$). Nevertheless, only about $40\,\%$ indicated some form of direct request from customers, and this was usually a request for digital data instead of a paper report. Many NMIs expressed an intention to consult and engage with stakeholders but were yet to begin. In most economies (13/15), governments already had strategic plans for digital transformation, but none of the NMIs played any formal role in such national initiatives.

About half the institutes who responded had set up working groups for digital transformation. These were comprised mainly of metrologists and managerial staff with IT knowledge. Some institutes also indicated that programs and funding for digital transformation were available.

When asked to prioritise topics for digital transformation, two things stood out: the *Digital SI* and the *Digital Calibration Certificate*. Nevertheless, many respondents also noted that a major challenge was in "... understanding what digital transformation really means to metrology". Respondents also suggested that mixed messages from stakeholders made it difficult to meet expectations and that a lack of standards on digital reporting and the implementation of digital processes was also a problem.

There are advanced technological economies among APMP members but there is also a significant cohort of members still in development. One of the APMP's objectives is to help to narrow gaps in metrological capabilities between developed and developing economies. The DXFG must contribute to this objective. Although there were relatively few responses to the survey from developing economy members, respondents did agree that a cautious approach would be best for the developing nations. Once questions about best-practice and appropriate technologies have been settled, there will be opportunities for technology exchange and knowledge transfer from trail-blazing NMIs to those proceeding more slowly. The APMP has a dedicated *Future Proofing Taskforce* that could play a significant role in facilitating such exchanges of information.

A total of 10 conclusions were drawn from the survey [2]. Among them, obviously, was the need to set up a regional focus group to coordinate activities. The roles identified for this group were to:

- identify common challenges and plan to address them;
- raise awareness about digitalisation, through workshops and seminars;
- provide training opportunities where needed;
- maintain alignment with relevant activities at the BIPM, other RMOs and quality infrastructure bodies;
- help developing-economy NMIs to learn about and become involved in digitalisation.

### *3.2. International activity*

Perhaps the earliest concerted effort to address digital transformation of metrology infrastructure was a regular column published from 2013 onwards in the NCSL International (NCSLI) *Metrologist* magazine, called "Metrology Information Infrastructure". In 2015, a paper was presented to the Australasian Measurement Conference by the column's author, Mark Kuster, entitled "Toward a Measurement Information Infrastructure" [4]. This articulated many of the challenges posed by digitalisation and the various tasks that needed to be addressed to overcome those hurdles. In 2017, the NCSLI set up technical committee 141, on Measurement Information Infrastructure and Automation (MII), which now coordinates this work.

In Europe, digital transformation has been spearheaded by two joint research projects funded by the European Union. The SmartCom project, which ran from 2018 to 2021, intended to deliver a basis for the exchange of digital data about physical quantities (from a metrolog-

ical perspective) in digital networks [5]. The Metrology for the Factory of the Future project, which also ran from 2018 to 2021, considered an ultra-modern manufacturing environment with complicated flows of information and autonomous decision-making by digital systems [6]. The foundations laid by these two projects are now being developed by NMIs, particularly in Germany where the Physikalisch-Technische Bundesanstalt (PTB) has recently set up a whole department concerned with metrology for digital transformation [7]. Notably, one of the core objectives for this department is to achieve the active participation in digitalisation of all PTB employees. Another objective is to ensure uniformity in metrology. To this end, the PTB is energetically developing a machine-readable format for digital calibration certificates (DCCs) and promoting this as one of its "lighthouse" projects in digital transformation. The PTB is also coordinating a EURAMET project on the development of DCCs, which is looking more generally at DCC harmonisation requirements [8].

Against this backdrop, as already mentioned in the Introduction, the CIPM has set up a task group on the digital SI (D-SI). This group has taken on the challenge of establishing a fundamental digital framework for dependable exchange of data based on the International System of Units (SI) [9]. This endeavour will require widespread consultation and the solution chosen will need to be endorsed by many different international organisations.

## 4. DXFG ESTABLISHMENT PHASE

This section outlines establishment plans for the DXFG.

### *4.1. Collaboration platforms and organisational IT security issues*

One of the first challenges the group has faced is digital communication and information sharing. This has proved to be a substantial hurdle.

Group members are mostly embedded in organisations linked to public administrations. These organisations are sensitive to the risks posed by open channels of digital communication. So, in many cases, an employee's use of digital tools is tightly controlled.

Before the group was formally approved by the APMP General Assembly, the members needed to meet with some urgency to develop a proposal document. A public gmail account was set up, with accompanying cloud-based services. However, many members were not able to collaborate on documents stored in the Google cloud, because their organisations blocked access. To assess the extent of these restrictions, members were polled about their access to various digital services (video conferencing, collaborative document management tools, cloud storage, collaborative software development). The poll enabled the focus group to provide shared access to documents for most members, although not everyone could be accommodated.

The survey has highlighted potential difficulties ahead for group activities, because there are many restricted services. For instance, less than half of members have access to online git repositories, which will impede collaborative project work and hence capability development. This problem of restricted access is rooted in organisational policies, over which members have no control. It highlights the need for engagement and support from high-level leaders and managers within organisations.

### *4.2. Technical committee consultations*

The perceived importance of digitalisation and a sense of urgency to begin transformation led to the establishment of the DXFG. However, while there is activity in various quarters, the potential benefits of digital transformation need to be more clearly identified for APMP members.

One of the first tasks that the DXFG has taken on is to meet with each of the APMP technical committee (TC) chairs to discuss how digital transformation is perceived among the TC members and what advantages digitalisation may be able to offer. In this way, the DXFG hopes to identify interests that span specialist technical areas. Once individual interviews have been completed, the intention is to reach a consensus with TCs about planned activities for the DXFG.

At the time of writing, only a few interviews have taken place. So, the overall findings cannot be anticipated. Nevertheless, interest in digital transformation seems low. It appears that many metrologists would prefer decisions about digitalisation to be made elsewhere, and then simply communicated as new formal requirements. In other words, it appears that digital transformation is still perceived as a superficial rather than fundamental change and that one role for the DXFG would be to assist with technology and know-how to implement any necessary changes.

### *4.3. Fundamental concepts*

A prerequisite for digitalisation of metrological tasks is to have logical descriptions of the processes involved. Digitalisation of any activity requires this initial phase of analysis and discovery, which might be called business requirements analysis in the commercial world. However, metrology is a specialised field and skilled business analysts cannot be expected to capture the concepts. Even the seemingly straightforward task of defining digital representations for units continues to elude IT professionals (international standards for digital representation of numbers have been available for decades, but there is no equivalent for units). Other fundamental concepts, like metrological traceability and measurement uncertainty, must also be expressed in a clear logical form.

The CIPM task group on the digital SI is addressing such fundamental questions. However, the metrology community, and in particular groups like the DXFG, must support

this effort. It is critically important that conceptual foundations be widely and clearly understood.

For those reasons, the DXFG has a thematic pillar for core scientific concepts. This theme will try to distil important measurement science into digital forms. Initially, effort will be directed toward the CIPM task group to contribute the best outcome from their deliberations. Later, there will be a need to disseminate and encourage adoption of task group recommendations. Two members of the DXFG are members of a group of experts that are providing advice to the task group.

### *4.4. Information sharing and knowledge management*

The DXFG needs to develop ways of collecting and managing knowledge and disseminating information. A first step in this direction has been to arrange regular meetings with technical presentations that span our four broad themes. A meeting is held each month, lasting about 2 hours, and is recorded to allow members who cannot attend to review the presentations and discussions. These meetings are helping members to become aware of the many different facets of digital transformation as well as the activities of other groups around the world.

The DXFG will also manage and share information through a dedicated group website (`apmp-dxfg.org`). This website is not intended to showcase or publicise the DXFG, rather it will be a repository of information related to best practice, used to raise awareness, and to hold material about technical and scientific details. A github organisational site has also been set up with similar use in mind. Github is a popular tool for open software development projects, but it is also quite an effective platform for related activities, like the creation and maintenance of controlled vocabularies, ontologies, etc., where potential contributors have no common organisational affiliations. This platform seems well-suited to some focus group needs.

### *4.5. International networks*

The DXFG will maintain alignment with activities led by the BIPM and other RMOs. Members of the group support the CIPM task group on the digital SI and also contribute to an RMO group concerned with digital transformation. The group is active in the IMEKO committee TC6 on digital transformation and in the NCSLI MII committee.

The DXFG will consult with the International Laboratory Accreditation Cooperation (ILAC), and signatory bodies to the ILAC Mutual Recognition Agreement; and with the International Organization of Legal Metrology (OIML) and the metrology institutes/governmental institutes under their coordination. The specialist regional bodies: the Asia Pacific Accreditation Cooperation (APAC), the Asia Pacific Legal Metrology Forum (APLFM) and the Pacific Area Standards Congress (PASC), will also be consulted.

## 5. FINAL REMARKS

This brief report offers a glimpse of DXFG activities during the first months of its existence. At the conference, which is some 6 months from the time of writing, we should be able to present more details about our progress.


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