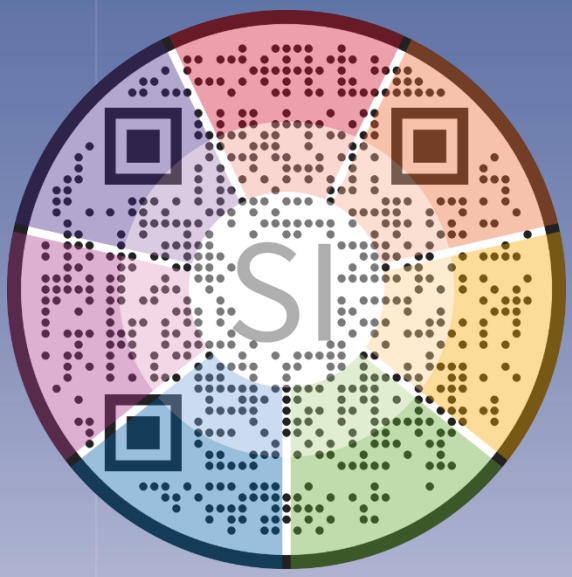
Bureau International des Poids et Mesures

Rapport BIPM-2023/01

EVALUATION REPORT – SURVEY ON DIGITAL TRANSFORMATIONS



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This document was prepared from the responses to the 2022 survey on digital transformation circulated to the delegates of all the CIPM Consultative Committees. A draft version for comment was released in October 2022.This version is the final one, taking into account comments received until 10 December 2022.

Report on the 2022 survey of CC participants regarding the digital transformation

1 Executive Summary

In 2021 the CIPM initiated a survey on the current and planned activities of National Metrology Institutes (NMIs) on digitalization. A questionnaire was designed and circulated to recent delegates of all CIPM Consultative Committees (CCs).

The survey was carried out in the first half of 2022 by circulating the questionnaire to **827** CC participants. In total, **174** questionnaires were **returned**. The average **return rate** was thus **21 %,** though this varied from question to question and between CCs.

The main findings of the survey are:

- **Digital transformation is of interest to many NMIs.**
  - **56 %** of all respondents have at least one digital transformation project or plans to start one.
  - At many NMIs **digital transformation** is still at an **early stage**. On average, **29 %** of CC members reported **stakeholder contact on digital topics** over the last 5 years - though this value **varies significantly between** CCs, ranging **from 43 %** (CCU) **to 12 %** (CCQM).
- **Digital Calibration Certificates (DCCs) are of particular interest to NMIs.**
  - Among the different DT topics, digital calibration certificates were the most mentioned topic of interest to NMIs. Of all respondents with digital projects, **68 %** reported work on **DCCs**.
  - Even amongst the respondents with little experience with DCCs (typically those without ongoing DCC projects), **39 %** considered that **DCCs would** be **beneficial** to their **customers**.
  - The best-known **format** for DCCs is **XML**.
- **How to provide a statement of metrological traceability in DCCs is not yet clear.**
  - Amongst the participants expressing an interest in DCCs, **only 15 %** were able to **articulate** how **metrological traceability** to the SI could be addressed **in a DCC**.
- **The KCDB Application Programming Interface (API) is still at an early stage of usage.**
  - On average, **7 % of the respondents had used the KCDB API**, and another **42 % planned to do** so.
  - **22 %** of the participants felt they have **sufficient information about the KCDB API**. This is less than a third of the participants indicating an active role in the KCDB.

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2 Introduction

At its 110th meeting (2021), the International Committee for Weights and Measures (CIPM) “supported the plan for a Consultative Committee survey on NMI/DI plans for digital calibration certificates and engagement with the Digital SI Framework.” (Decision CIPM/110-23(2021)). In line with this decision, the BIPM developed a questionnaire for distribution through the CIPM Consultative Committees (CCs), and the questionnaire was circulated in 2022 to delegates of all CCs.

The questionnaire comprised a total of 33 questions and covered the following aspects:

- Digital Calibration Certificates and SI traceability;
- Interactions with stakeholders;
- Technical details of digital transformation;
- Usage and visibility of the KCDB API.

The complete questionnaire and some automatically generated (MS Forms) reviews are available in Appendix A. Where appropriate the questionnaire allowed the participants to check more than one option to multiple-choice questions (#4, #5, #12).

The survey was carried out in two phases within a short time span: the questionnaire was distributed to delegates of the CCAUV and CCEM in November 2021, and the other CCs in June/July 2022. This report presents the results from all the CCs.

3 Participants and return rates

The questionnaire was sent out to recent delegates of the official Members and Observers of the ten CCs. The entries in the BIPM Meetings Office Database about the most recent delegations served as a basis for the mailing list, providing a total of 827 addressees. The following paragraphs provide an overview of the nature of the responses received, including the return rates by CC and by question.

1. **Could you please share your name and position in your institution, and your institute's name?**
2. **Could you please specify which CC you are working with?**
3. **In which of your metrology area's subfields are you active?**

3.1 Return rate by Consultive Committee

The survey was advertised in all CCs to encourage all members to participate. In total, 174 forms were returned, corresponding to an overall return rate of 21 %.

Online sources[1] indicate that return rates between 5 % and 30 % are normal for questionnaires sent out to internal participants (i.e. addressees known by the organizer)*, so* the return rate achieved for this survey *is* comparable to those of other online surveys*.* It is perhaps below expectations, however, given that the survey was initiated by the CIPM and widely communicated in advance.

Figure 1**Fehler! Verweisquelle konnte nicht gefunden werden.** shows the return rate for each CC. T he two CCs in the pilot survey (CCAUV and CCEM) had higher return rates than the others. The CCTF and CCU had the lowest values (about 10 %).

[1] https://www.smartsurvey.co.uk/blog/what-is-a-good-survey-response-rate

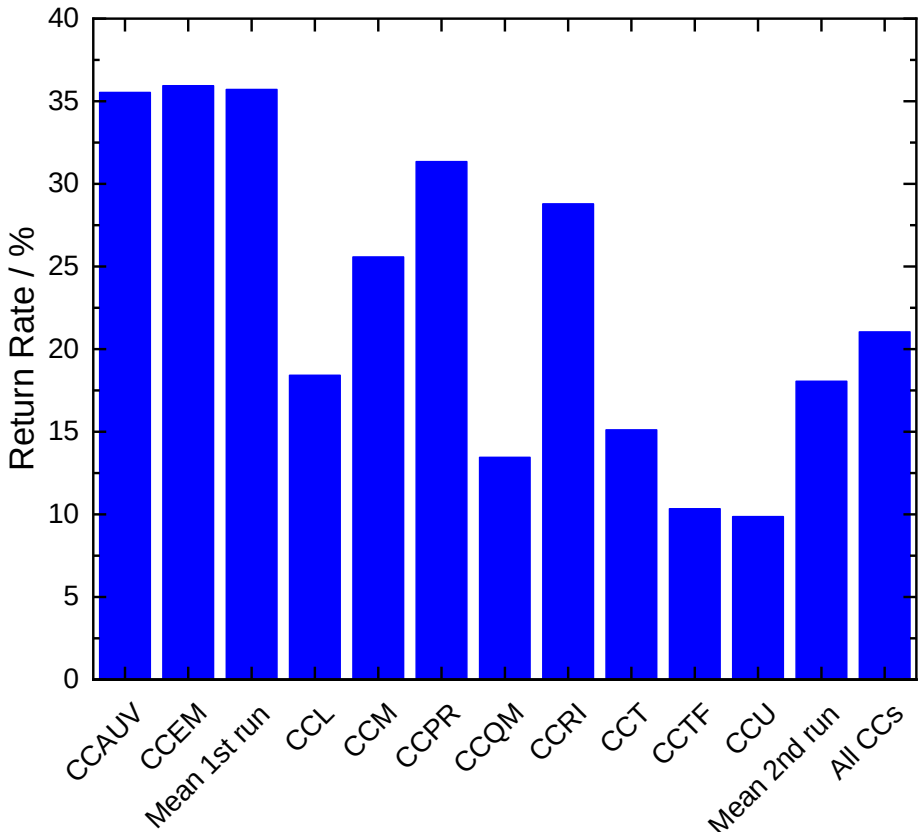


Figure 1: Return rates of the questionnaire per CC.

3.2 Position of respondents in their institute

Figure 2 indicates for each CC the position of the respondents within their institute. The responses were generally from senior NMI staff, with the categories *Director* to *Principal Scientist* accounting for more than 50 % of all returns.

Figure 2: Positions of respondents from each CC.

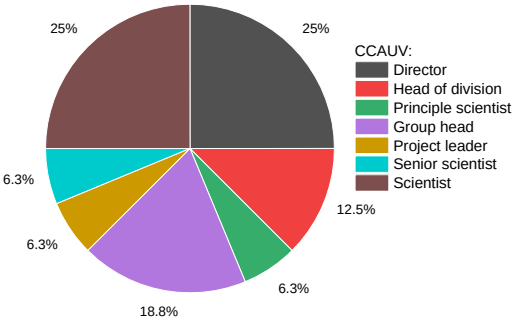


Figure 2a: Positions of respondents from CCAUV participants.

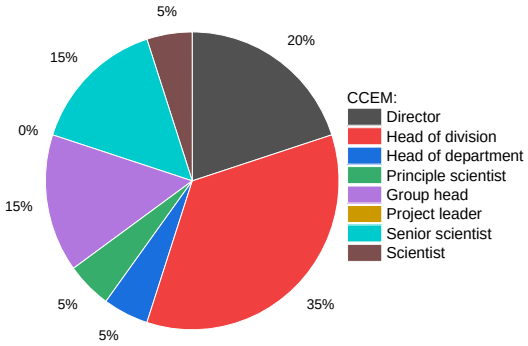


Figure 2b: Positions of respondents from CCEM participants.

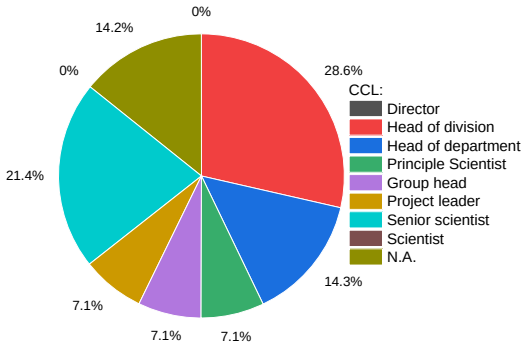


Figure 2c: Position of respondents of the CCL participants

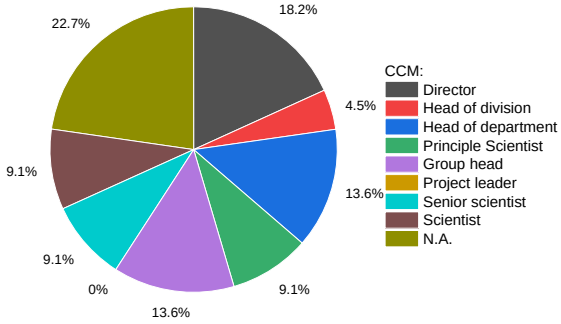


Figure 2d: Position of respondents of the CCM participants

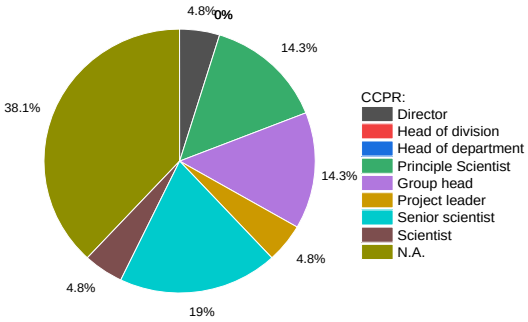


Figure 2e: Position of respondents of the CCPR participants

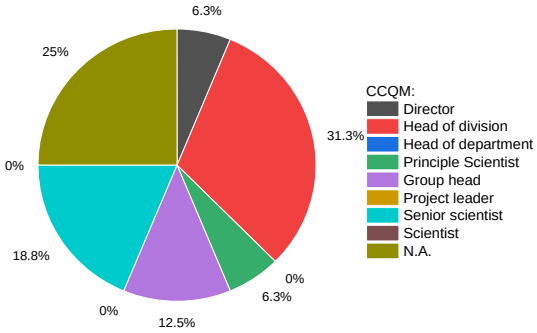


Figure 2f: Position of respondents of the CCQM participants

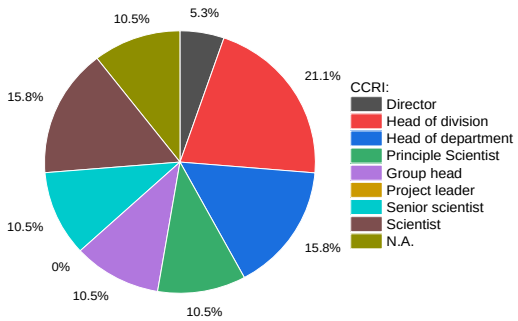


Figure 2g: Position of respondents of the CCRI participants

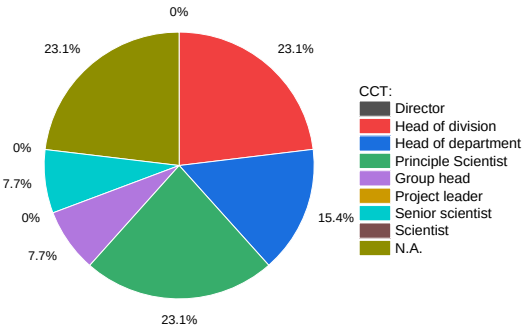


Figure 2h: Position of respondents of the CCT participants

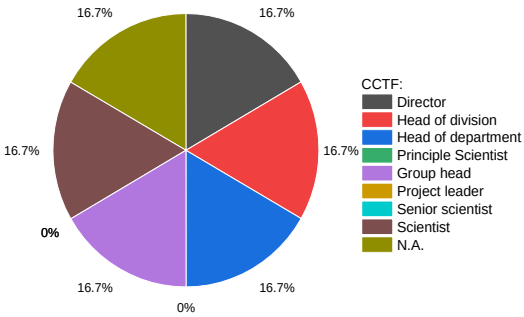


Figure 2i: Position of respondents of the CCTF participants

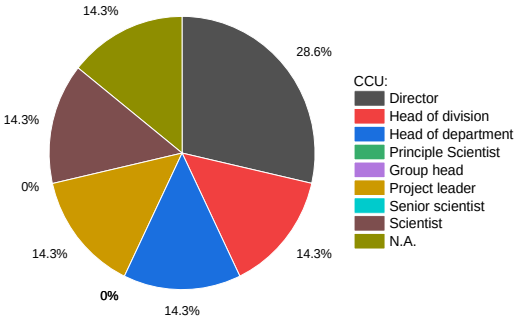


Figure 2j: Position of respondents of the CCU participants

3.3 Return rate by question

Not all questions were answered by all participants. Figure 3 gives the return rate for each question of the survey, shown for each CC.

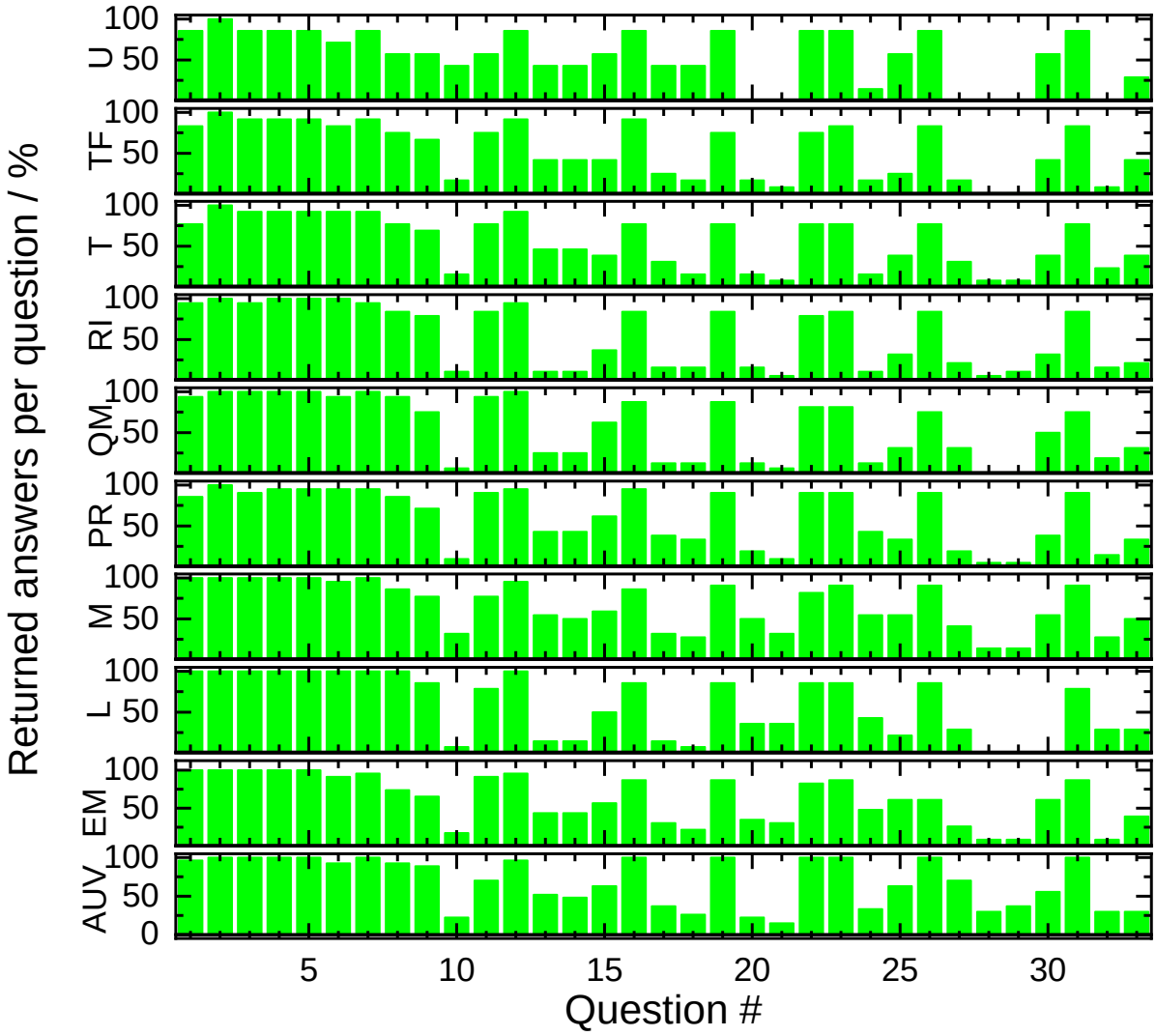


Figure 3: Return rates to specific questions across the different CCs

The highest response rates were to the more general questions (concerning the respondent, their involvement with the KCDB, and contacts with stakeholders). These included the three questions listed above (page 4), plus the following:

4. **Have you played any of the following roles with respect to the KCDB?**
   a. **Writer**
   b. **Reviewer**
   c. **RMO Secretary**
   d. **RMO TC/WG Chair**
   e. **CC WG Chair**
   f. **Pilot**
   g. **None of the above**
5. **Does your work involve:**
   a. **Research**
   b. **CIPM MRA activities**

   c. **Customer services**
   d. **Direct industry support activities**
   e. **Other activities**
6. **If you do customer service or direct industry support activities, are your services backed-up by KCDB-listed CMCs?**
7. **Do you have direct contact with stakeholders from industry or otherwise external to your own institution?**
8. **If yes, are you in a position to recognise your atakeholders' demands and needs?**

The more technical questions (listed below: #11, #13, #14, #20, #21, #24, #30, #32) had significantly lower return rates. Less than 50 % of returned questionnaires contained feedback on these more technical aspects.

11. Is your institute starting or progressing any project on digitalization and/or digital calibration certificates (DCCs) that are relevant to your CC area? If yes, please describe.

12. Have you received any enquiries from customers about digital calibration certificates or digital services, and if yes, what were they about?

13. If yes, for which quantity?

14. If yes, which standard did you follow for the format (e.g. format for a DCC, or machine readability)?

20. Could you please specify which specific format you are aware of?

21. If you know about specific DCCs, how would those state their SI traceability and where would they get their traceability from?

24. What is your status of knowledge about the Application Programming Interface for the KCDB (API-KCDB)?

30. Our approach to provide metrological traceability to our digital customer services in my CC area is based on: ……..

32. We provide metrological support to the digital transformation in: ……..

The question regarding the customer relevance and SI traceability in digital transformation work (#21) achieved the lowest score: only 19 participants returned an answer, corresponding to 15 % of the copies returned.

4 Level of Digital Transformation activity

A set of questions addressed the current level of activity of the NMIs regarding Digital Transformation. In particular, delegates were asked in question #11 whether they planned or are running projects on digital transformations and/or digital calibration certificates.

11. Is your institute starting or progressing any project on digitalization and/or digital calibration certificates (DCCs) that are relevant to your CC area? If yes, please describe.

Table 1 summarizes the responses to this question #11. It shows that on average more than half of the respondents have their own projects on digital transformations in place and that the majority of efforts on digital transformation are invested in the area of digital calibration certificates.

Table 1:Digital projects at the CC members based on returns on question #11

CC	Yes, DT projects in place / %	of them DCC-related / %	other types of projects / %
AUV	56	80	■sensor networks / 7 (1 return) ■DTX / 7 (1 return)
EM	65	80	■digital output instrumentation in electrical power network substations / 7 (1 return) ■digital customer portal, sensor networks, simulation, modelling, AI / 7 (1 return) ■RDM / 7 (1 return)
L	64	56	■remote calibration and digital twin / 11 (1 return)
M	50	91	■laboratory automation / 9 (1 return) ■RDM / 9 (1 return)
PR	57	58	■DVC / 8 (1 return)
QM	50	63	■automation / 13 (1 return)
RI	58	73	■AI / 9 (1 return)
T	46	100	■sensor networks / 17 (1 return) ■automation / 17 (1 return)
TF	58	57	■digital dashboard / 14 (1 return)
U	57	25	■machine readable standards / 25 (1 return)
Mean	***56***	***68***	***sensor networks, RDM, and automation***

5 DCCs and SI traceability

5.1 Topics with the highest importance

Questions #11 to #13 aimed to identify the digital transformation subjects of most interest in the NMI community.

11. Is your institute starting or progressing any project on digitalization and/or digital calibration certificates (DCCs) that are relevant to your CC area? If yes, please describe.

12. Have you received any enquiries from customers about digital calibration certificates or digital services, and if yes, what were they about?

13. If yes, for which quantity?

Most of the responses related to digital calibration certificates (DCCs); no other topic received a similar number of mentions.

5.2 DCC formats

Questions #20 to #22 focused on more technical details regarding DCCs.

19. Do you know about a specific format for a DCC?

20. Could you please specify which specific format you are aware of?

21. If you know about specific DCCs, how would those state their SI traceability and where would they get their traceability from?

22. If you don't know about specific DCCs, do you think any of your customers would benefit if you were able to issue DCCs; would you be able to improve your services to customers?

Table 1 lists the responses to questions #20 (DCC formats the participants are aware of), together with the participants' view as to whether the provision of DCCs would benefit the NMI's/DI's services to customers (#22). As already seen in Figure 3, the return rate to #20 was among the lowest of the whole survey.

The DCC format mentioned most often was XML, followed by the so-called PTB-format, PDF/A-3 lying in third position. Table 1 lists the DCC formats listed by survey participants (bearing in mind that the returned answers are not always comparable data formats).

On average, 39 % of the survey participants considered that providing a DCC would benefit their customers, whereas only 6 % said that there would be no benefit. The missing 55 % did not respond.

Table 1: DCC formats (question #20) and views on achievable customer benefits (question #22) by means of DCC provisions.

CC	Top score	Other scores	customers would benefit	
			Yes / %	No / %
AUV	PTB	Xml	37	7
EM	XML	PDF/A-3, PTB, FLUKE	48	4
L	XML	PTB, PDF/A-3	50	14
M	XML	JSON, PDF/A-3, PTB	27	9
PR	XML	PTB, PDF/A-3, JSON	62	0
QM	XML	text format	38	6

RI	PTB	DCR, DCA, DTC	32	11
T	XML	PTB	23	0
TF	XML	digitally signed PDF	42	8
U	-	-	29	0
Overall	***XML***	***PTB, PDF/A-3***	***39***	***6***

5.3 SI traceability

Even for the participants with some knowledge about DCCs (question #20), the question about SI traceability does not seem to have received much attention. Only 15 % of the participants returned answers on #21, as summarized in Table 2.

Table 2: SI traceability in digital calibration certificates. Numbers are based on returned responses to question #21.

CC	Returns to #20 in %	Fraction of returns to #21 compared to returns to #20	Details in examples
AUV	22	7 / 25	■Through statement to national standards ■https://gitlab1.ptb.de/d-ptb/d-si/xsd-d-si
EM	34	4 / 13	■List of standards used with calibration due date plus statement that these are calibrated at NMIs or accredited cal labs, etc.
L	36	3 / 60	■text field ■ 'digital traceability'
M	50	0 / 0	-
PR	19	0 / 0	-
QM	6	0 / 0	-
RI	16	0 / 0	-
T	15	0 / 0	-
TF	17	1 / 50	■hyperlink to KCDB UTC key comparison and CMC
U	0	0 / 0	-
Mean	***22***	***4 / 15***	***SI traceability seems not that much in focus of present DCC discussions yet***

6 Interaction with stakeholders

Several questions of the survey focused on the interaction of the NMIs with their stakeholders.

7. Do you have direct contact with stakeholders from industry or otherwise external to you own institution?

8. If yes, are you in a position to recognise your stakeholders' demands and needs?

9. If yes, have you been in a joint project with those stakeholders where digital transformation was one of the topics?

10. If yes, has this project engagement led to new plans to initiate digital services?

16. How often have you received an external request for DCCs/digital services?

17. What type of customers/stakeholders are asking for these digital services in your CC area?

18. Are you aware of any need/use/beneft from a specific subfield of your metrology area for digital calibration certificates and/or the digital SI? If yes, please specify subfield and need.

6.1 NMI experts in touch with stakeholders

Table 3 summarizes the responses received to question #8, asking whether the responder was in a position to recognize stakeholder needs, and question #9, asking whether they had been engaged with their stakeholders on projects involving DT. The third column of Table 3 shows the percentage of project engagement with stakeholders leading to new plans to initiate digital services.

Collaboration with stakeholders in a project involving digital transformation was reported by only 18 % of the survey participants, but for 94 % of those participants these collaborations have directly led to plans for the development of new digital services.

Table 3: NMI experts in touch with Stakeholders as based on feedback to questions #8, #9, #10.

CC	Percentage of 'YES' returns to #8 (Able to see stakeholder needs)	Percentage of 'YES' returns to #9 (Joint project involving DT)	Percentage of 'YES' returns to #10 relative to #9
AUV	89	22	100
EM	65	17	100
L	86	7	100
M	77	32	86
PR	71	10	100
QM	75	6	100
RI	79	11	100
T	69	15	50
TF	67	17	100
U	57	43	100
Mean	***74***	***18***	***94***

6.2 Number of customer demands for DT services

Question #16 focused on the number of customer demands for digital services received by the NMIs. Participants were asked to specify how often they received requests from customers over the last five years. Table 4 summarizes the results.

Table 4: Number of NMI customer requests for DT services as derived from feedback on question #16, reported as a percentage of the returned questionnaires per CC.

CC	One	a few	> 5	> 10	none	n.a.
AUV	4	19	15	0	63	0
EM	0	22	9	4	52	13
L	0	14	0	0	71	14
M	5	5	14	9	59	
PR	5	24	5	5	53	5
QM	0	6	6	0	75	12
RI	0	11	0	5	68	16
T	0	31	0	0	46	23
TF	0	17	0	8	67	8
U	0	14	0	29	43	14
Mean	***1***	***16***	***5***	***6***	***60***	***12***

It appears that the majority of CC members have not yet received requests for digital services from customers, or have only received a small number over the last five years.

6.3 NMI customer requests relating to DCCs and the SI Digital Framework

Questions #17 and #18 addressed the customer orientation of the NMIs with respect to digital transformation. Question #17 addressed the type of customers asking for digital services, and #18 the specific needs and benefits within different CC subfields. The feedback is summarized in Table 5. The return rate to both questions again varied between CCs, but in all cases was less than 50 %.

Table 5: Summary of NMI customer requests relating to digital calibration certificates and the SI digital framework in subfields of the metrology area.

CC	Return rate in % of the total feedback, #17/#18	Summary of customer demands
AUV	37/25	■Data-driven calibration is needed for the remote calibration of vibration sensors that are not retrievable/not accessible ■Beneficial for plug-and-play incorporation of calibrated sensors into the network without the need for human entry of calibration information ■On-site calibration of digital accelerometers
EM	30/22	■Automotive industry ■SME to large scale customers ■Multifunction calibrators and meters which covers multiple fields (DC voltage, DC current, DC resistance, AC voltage, AC current). The calibration report has large numbers of (easily over 100) measurement points ■Tests of pre-conformity RF anecoic chambers for application of electromagnetic tests on electrodomestic appliances

L	14/7	■Accreditated laboratories ■'Benefit: Yes but need: No'
M	32/27	■Automation of processes ■Increasing efficiency ■naming individual large industry customer
PR	38/29	■Big data handling ■spectral data sets with correlated quantities
QM	13/13	■Proficiency test data results in accreditation processes
RI	16/16	■Sensor networks
T	31/15	■Predictive performance in temperature and humidity
TF	25/17	■NPT and PTB services
U	43/43	■IoT ■TC125 health informatics ■Combining heterogeneous and complex information data for decisions in meteorology or medical diagnostics
Mean	***28/21***	

7 KCDB API

In 2020 the KCDB was updated with an Application Programming Interface (API) to facilitate machine-access to CMC data. This is an initial step on the path towards FAIR[2] data in the KCDB and CIPM MRA activities. One aim of the survey was to assess the interest of the KCDB API amongst the digitalization topics in the community. Two aspects were assessed in this survey: the current and planned usage of the KCDB API among the participants, and the visibility and knowledge about the tool.

23. What is your status of knowledge about the Application Programming Interface for the KCDB (KCDB API)?

a. I made use of it
b. I am informed about it
c. I am interested in it
d. I would need more information

24. If you are aware of the KCDB API, do you plan to make use of it for your CC area?

a. Will use it to retrieve CMC details
b. Dedicated plans when issuing own DCCs
c. Other use cases foreseen
d. No plans yet in place

7.1 Usage

Question #23 asked the participants to gauge their knowledge about the KCDB API, and #24 targeted their usage of the tool. Table 6 summarizes the results received.

Table 6: Knowledge about the API-KCDB as given by the feedback ratio of 'I am informed' and 'will need more information' to all CC responses and 'will use it' an 'no plans yet in place' with respect to those saying 'I am informed' about the API-KCDB.

CC	'am informed' / %	'need more information' / %	'used it / %'	'will use it' / %	'no plans in place' / %
AUV	30	46	0	22	78
EM	48	30	4	36	64
L	29	43	14	50	50
M	43	32	14	78	56
PR	24	43	10	0	100
QM	6	63	6	100	0
RI	16	58	0	33	33
T	15	46	0	0	100
TF	8	67	8	100	0
U	0	71	14	0	0
Mean	***22***	***50***	***7***	***42***	***48***

On average, only 7 % of the participants already use the KCDB API, but a further 42 % plan to use it in the future. About half of the participants do not have immediate plans to use it.

[2] FAIR data: Findable, Accessible, Interoperable and Reusable

On average only 22 % of the participants felt sufficiently informed about the KCDB API; 50 % responded that they needed further information.

This feedback suggests that promotion and training on the use of the KCDB API could increase its use in the community.

7.2 Visibility

The visibility of the KCDB API can be gauged by combining answers to question #4 (roles in the KCDB) and to questions #23, #24 (knowledge about and plans to use the API). Table 7 shows the results. Even though most of the participants play a role in the KCDB (68 % on average), only a minority are informed about the KCDB API (22 % on average) or have used it already (7 % on average). Nevertheless, 42 % of the informed participants declare they will use it in future time.

Table 7: Role in the KCDB (question #4) versus awareness of the API-KCDB (question #23) and plans to make use of it (question #24).

CC	Role in the KCDB / %	'am informed' / %	'used it / %'	'will use it' / %
AUV	74	30	0	22
EM	78	48	4	36
L	57	29	14	50
M	68	43	14	78
PR	91	24	10	0
QM	75	6	6	100
RI	90	16	0	33
T	62	15	0	0
TF	75	8	8	100
U	14	0	14	0
Mean	***68***	***22***	***7***	***42***

8 Conclusions

The results of this survey undertaken 2021/2022 provide a snapshot of the ongoing activities and future plans of the NMIs regarding digital transformation. At the time of this survey, many NMIs (56 % of the responses) are already involved in DT activities, and Digital Calibration Certificates are of particular interest.

The lack of coherence between the responses received to some of the key questions concerning DCCs - for example, the format to use for a DCC and the way to indicate SI traceability – underlines that the field is still young, and suggests that harmonization at an international level might be helpful.

There were also a number of individual calls for the BIPM to collaborate with the other international organizations – particularly the accreditation and standardization communities.

With regard to the KCDB API, it is probably unsurprising that it is used by only a small fraction of the delegates addressed by this survey, the objective of the Application Programming Interface being to allow programmers to incorporate an interface with the data in the KCDB.

More remarkable was the demonstration that amongst those NMIs already engaged with their stakeholders in joint projects involving digital transformation, a high fraction of them are already developing new digital services.

Sensor networks have been highlighted on a number of occasions by the CIPM and were listed as projects by respondents from three of the ten CCs (the CCAUV, CCEM, and CCT). The answers to question #29 show a large majority of respondents are currently discussing the issue of how to establish traceability to the SI for such networks. It will be interesting to see how this subject evolves.

Future surveys of the CC members would allow the BIPM to monitor the situation and keep abreast of the user needs in the different fields.

Annex A: Open comments

At the end of the questionnaire (question #33), the participants were given the possibility to provide open comments. The comments received are listed below.

33. If you have any comment or anything you would like to highlight on the topic in general or this survey, please leave your statement below.

Relating to the questionnaire itself one returned comment was:

*'I am not sure whether I have **interpreted all questions correctly**. Sometimes I responded "no idea" when the real answer is "we are thinking about it but haven't decided yet".'*

The other comments relate to digital transformation and services:

*'The implementation of **the DCCs will have many advantages** to approach **the SI** to the users, but it will be necessary to **push the users**, accredited laboratories or **the industry**, to move also to the digital transformations.'*

*'I recommend **BIPM to closely collaborate** with IEC and ISO in order to provide the society with a **common unique model for the digitization** of measurements.'*

'… It is important to include regulators to this process as early as possible.'

*'… Relevant **CMCs for digital services** may need to be established.'*

*'I am still to be convinced that the **effort required** to integrate our current practices with a **DCC** for example, will **ever be recovered**.'*

*'Bespoke/customised **calibration certificates** are proliferating in industry so if a **standardised** DCC is to be established this **needs to be done quickly**.'*

*'I think the main issue is **standardization of calibration processes** and results. At the NMI level there is a very **wide range of calibrations certificates for the same artefact** (especially for instrument calibrations rather than passive artefacts). I **doubt if DCCs can actually work unless there is uniformity** of what a calibration certificate should contain for each artefact.*

*I am also **concerned** that this whole field uses **many ill-defined or vague terms and concepts**, and there is a lot of **'hype'** that **hides the true value** of the activity.'*

*'**Close collaboration** among the NMIs are important to achieve **impactful outcomes**.'*

*'This area so **under development** that a **clear view** is really **difficult**. This makes that **answers** are also **difficult and unclear**.'*

*'**Standardisation** is required for **harmonisation**. Relevant **CMCs for digital services** may **need** to be established.'*

Annex B: Summary of the survey questions and results

An automatically generated summary by MS Forms with all questions is pasted on the following pages.

Survey across Consultative Committees on digital transformations

127	280:18	Active
Responses	Average time to complete	Status

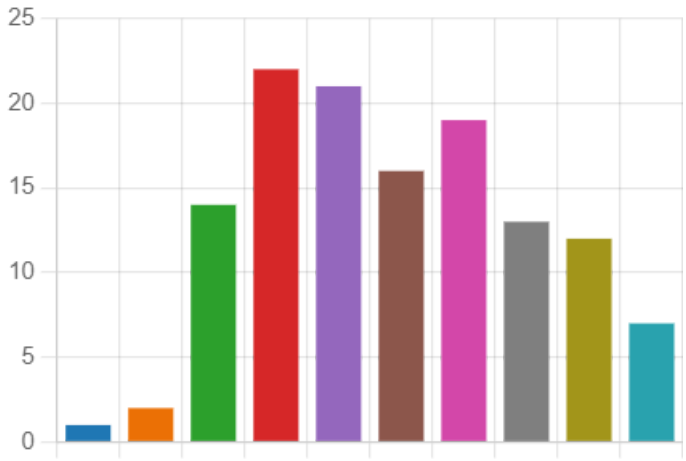
1. Could you please share your name and position in your institution, and your institute's name?

113
Responses

28 respondents (**25**%) answered **Head** for this question.

2. Could you please specify which CC you are working with

CCAUV	1
CCEM	2
CCL	14
CCM	22
CCPR	21
CCQM	16
CCRI	19
CCT	13
CCTF	12
CCU	7



3. In which of your metrology area's subfield are you active?

120
Responses

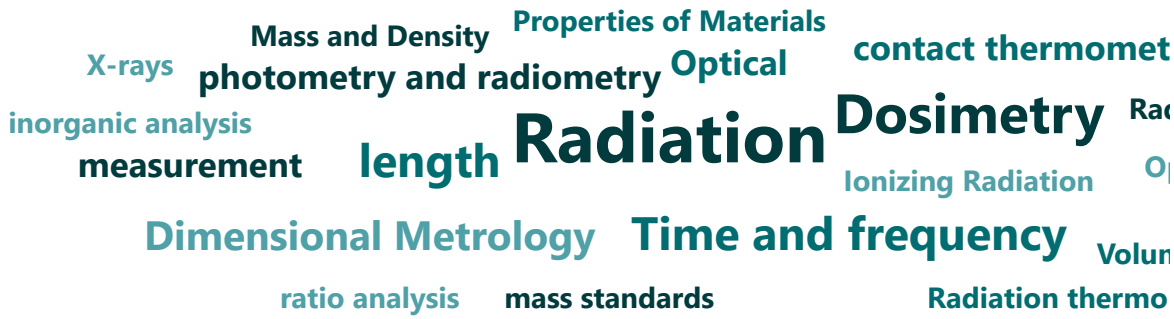
Latest Responses

"*Electricity related areas*"

"*EM fileds* "

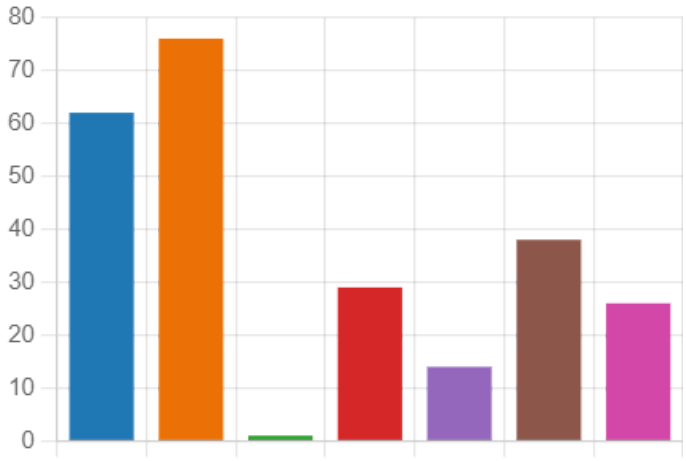
"*dimensional metrology*"

10 respondents (**8**%) answered **Radiation** for this question.



4. Have you played any of the following roles with respect to the KCDB?

Writer	62
Reviewer	76
RMO Secretary	1
RMO TC/WG Chair	29
CC WG Chair	14
Pilot	38
none	26



5. Does your work involve:

research	113
CIPM MRA activities	88
customer services	101
direct industry support activties	69
other activities	40

6. If you do customer service or direct industry support activities, are your services backed-up by KCDB-listed CMCs?

Yes	107
No	12

7. Do you have direct contact with stakeholders from industry or otherwise external to your own institution?

Yes	106
No	14
no idea	2

8. If yes, are you in a position to recognise your stakeholders' demands and needs?

Yes	93
No	2
not sure	11

9. If yes, have you been in a joint project with those stakeholders where digital transformation was one of the topics?

Yes	20
No	73

10. If yes, has this project engagement led to own plans to initiate digital services?

Yes	18
No	2

11. Is your institute starting or progressing any project on digitalisation and/or a digital calibration certificates (DCC) that are relevant to your CC area? If yes, please describe.

103
Responses

Latest Responses

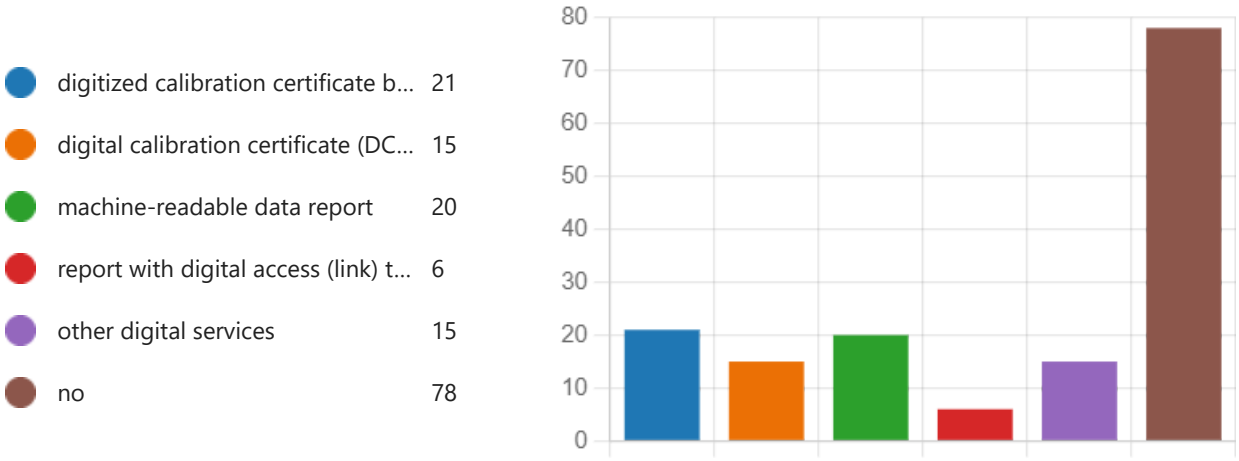
"Measurement digitization and XML representation/tagging"

"Yes, we have started working on DCC BY: 1. Convert any certif...

"Development of DCC for CMM and gauge block calibrations a...

29 respondents (**28**%) answered **digital** for this question.

12. Have you received any enquiries from customers about digital calibration certificates or digital services and if yes, what were they about?



13. If yes, for which quantity?

45
Responses

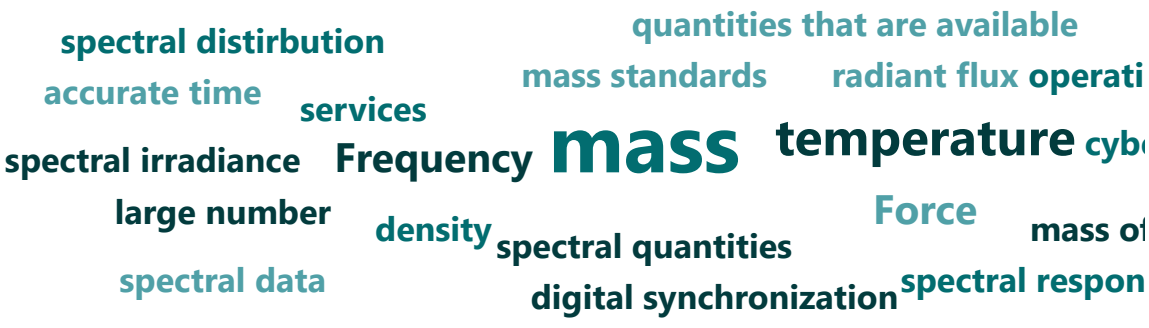
Latest Responses

"A large number of IEC standards users expect digital standards"

"NA"

"Evaluation of 3D data evaluation software: Software test of fit ...

8 respondents (**18**%) answered **mass** for this question.



14. If yes, which standard did you follow for the format (e.g. format for a DCC, or machine readability)?

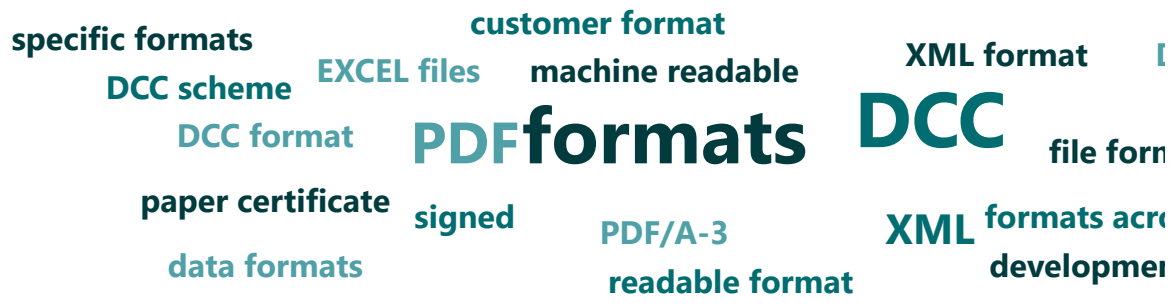
43
Responses

Latest Responses

"We use IEC and ISO standards available, regarding XML, we u...

"DCC"

9 respondents (**21**%) answered **formats** for this question.



15. If yes, did you collaborate with other NMIs on digital services or digital standards?

Yes	24
No	42

16. How often have you received an external request for DCCs/digital services?

one	2
a few in the last five years	19
more than a 5 during the last fiv...	5
more than a 10 during the last fi...	8
none	78

17. What type of customers/stakeholder are asking for these digital services in your CC area?

32
Responses

Latest Responses

"Industry standards users and national standardization organiz...

"Discussion in expert forum of accredited calibration laboratori...

11 respondents (**34**%) answered **calibration laboratories** for this question.

18. Are you aware of any need/use/benefit from a specific subfield of your metrology area for digital calibration certificates and/or the digital SI, if yes, please specify subfield and need?

26
Responses

Latest Responses

"data communication, IoT."

7 respondents (**27**%) answered **data** for this question.

19. Do you know about a specific format for an DCC, if yes, please specify the format?

Yes	30
No	80

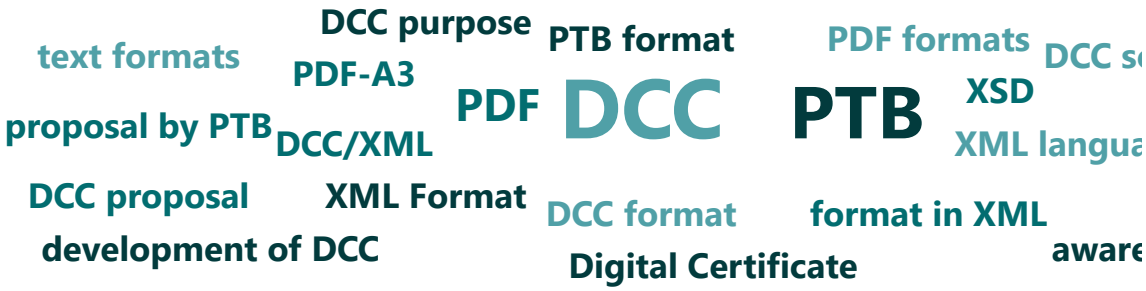
20. Could you please specify which specific format you are aware of?

30
Responses

Latest Responses

"*DCC proposal by PTB (https://www.ptb.de/dcc/)*"

11 respondents (**37**%) answered **DCC** for this question.



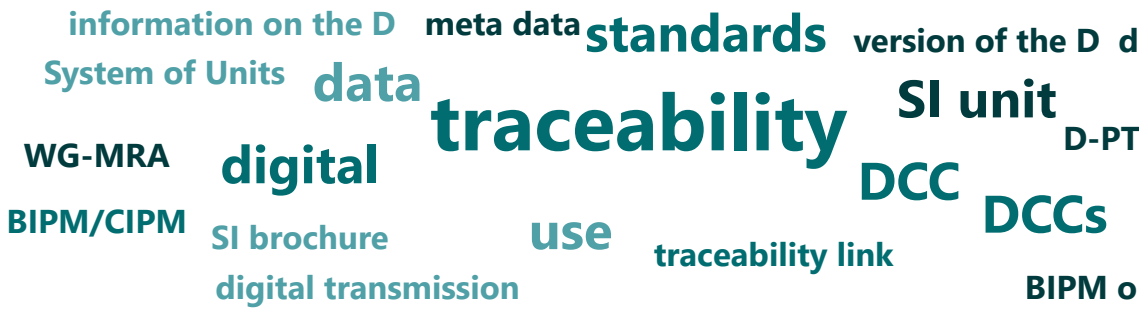
21. If you know about specific DCCs, how would those state their SI traceability and where would they get their traceability from?

19
Responses

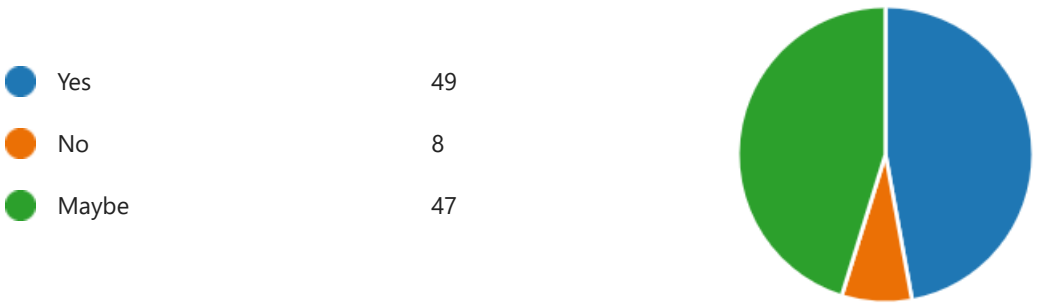
Latest Responses

"*The SI brochure can be downloaded from https://www.bipm.or...*

3 respondents (**16**%) answered **traceability** for this question.



22. If you don't know about specific DCCs, do you think any of your customers would benefit if you were able to issue DCCs; would you be able to improve your services to customers?



23. What is your status of knowledge about the Application Programming Interface for the KCDB (API-KCDB)?

I made use of it	11
I am informed about it	27
I am interested in it	8
I would need more information ...	63

24. If you are aware of the API-KCDB, do you plan to make use of it for your CC area

will use it to retrieve CMC detail...	10
dedicated plans when issuing o...	5
other use cases foreseen	0
no plan yet in place	21

25. Which other digital services are your customers asking for (if any)?

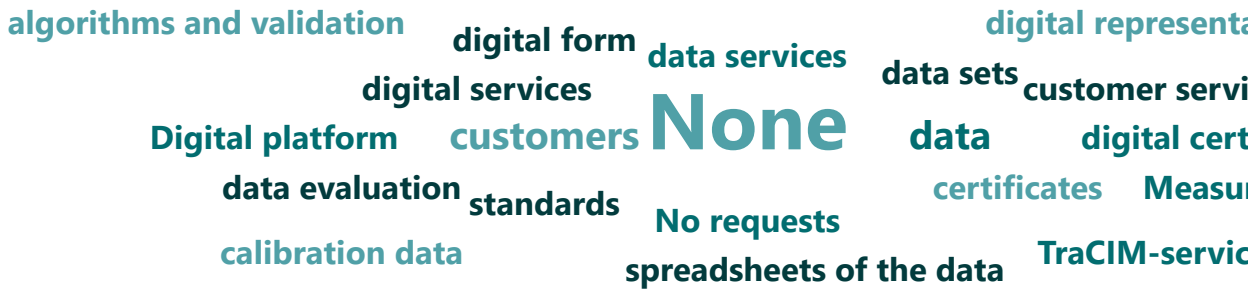
47
Responses

Latest Responses

"*Machine readable standards.*"

"*Evaluation of 3D data evaluation software: Software test of fit ...*

12 respondents (**26**%) answered **None** for this question.



26. Has your institute capabilities or intentions to issue calibration services for digital sensors in your CC area?

Yes	32
No	38
no idea	38

27. If yes and concerning digital sensors, are those part of a digital sensor network?

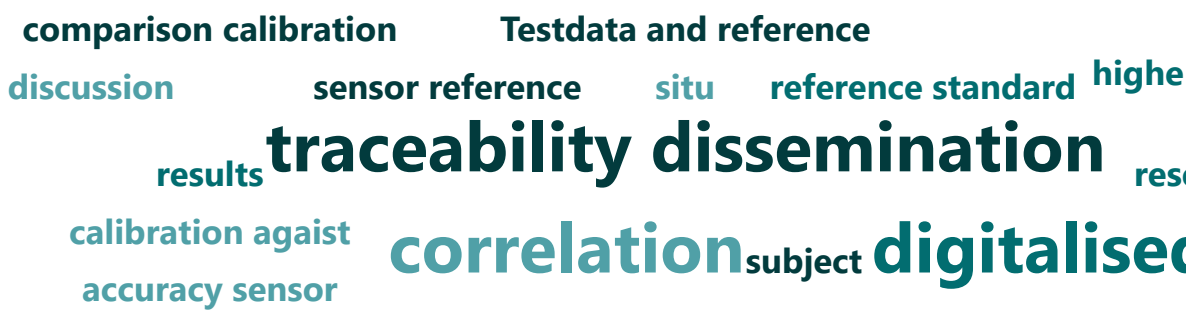
Yes	7
No	14
no idea	11

28. If digital sensors in a digital sensor network are to be calibrated, what procedure could be used to get the whole digital sensor network calibrated?

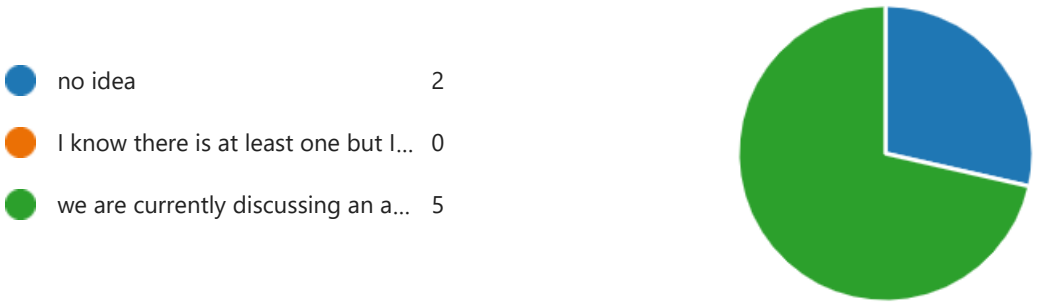
6
Responses

Latest Responses

2 respondents (**33**%) answered **traceability dissemination** for this question.



29. What route might be viable to get a customer's digital sensor network traceable to the SI by means of your institute's CMC-backed up services?



30. Our approach to provide metrological traceability to our digital customer services in my CC area is based on:

56
Responses

Latest Responses
"*Needs from the industry, science and metrology.*"

11 respondents (**20**%) answered **Digital** for this question.

31. Does your group/team/institute provide metrological services (including classical, analogue ones) to support the digital transformation elsewhere?

Yes	28
No	37
no idea	42

32. We provide metrological support to the digital transformation in:

24
Responses

Latest Responses

5 respondents (**21**%) answered **industry** for this question.

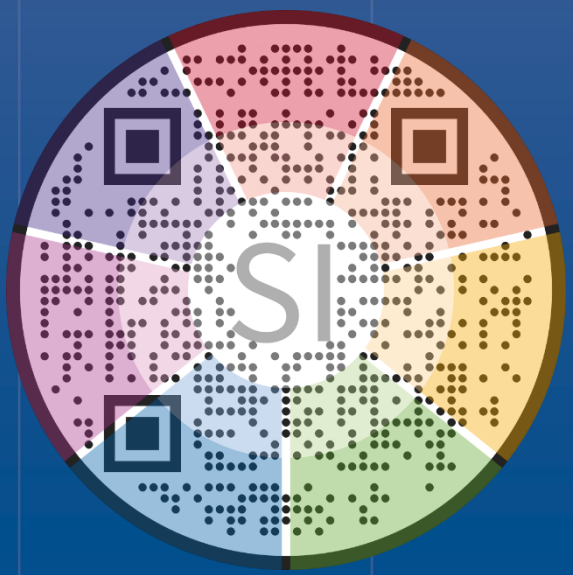
33. Do you have any comment or anything you would like to highlight to the topic in general or this survey, please leave your statement below:

44
Responses

Latest Responses

"IEC is jointly working with ISO on major digitization projects w...

10 respondents (**23**%) answered **no** for this question.



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