

## INRiM Key Performance Indicators

INRiM wishes to review the performance of its institute using certain Key Performance Indicators (KPIs) that reflect the character of the institute as National Metrology Institute (NMI) within Italy. The INRiM performance review process is envisaged to consist of two steps:

1. Scoring of the INRiM sectors or groups along KPIs, based on certain metrics for each KPI,
2. Review by the INRiM management of sectors and groups with unexpected scoring in the first step.

A Committee of international experts, complemented with representatives of the INRiM Scientific Council, has been asked by the INRiM president *to develop KPIs and metrics for the first step of the performance review, and provide recommendations for the overall performance review process.*

The outline of this note is as follows. After some introductory remarks, a set of three KPIs is proposed, each with three quantitative metrics, for use by INRiM in the first performance review step. Subsequently discussion points are suggested for the second step in the KPI review process, followed by some concluding general considerations.

### Introductory remarks

The proposed INRiM review process has been extensively discussed within the INRiM Committee for the KPIs. It is greatly appreciated that INRiM is proposing such a performance evaluation, based on certain key performance indicators, as it is believed that this will support strengthening the future position of INRiM.

At the same time, a few words of caution are in place. The first step as proposed by INRiM, as a pure 'mathematical' exercise based on available data, has serious risks as numbers alone cannot tell the full story and fail important nuances that are needed for an evaluation that fully reflects the actual performance of the INRiM sectors and groups. The method for example does not allow to include important metrics that can only be quantified via human interpretation, such as alignment with the INRiM 2030 vision. The value of the first evaluation step therefore may be limited and could demand for a more detailed evaluation – as in the second step of the proposed INRiM KPI process and a possible additional external evaluation. This is the background for the further recommendations that are given in the second part of this note.

### KPIs and metrics for the first review step

Based on the core mission of INRiM, the following three main KPIs have been identified:

1. Research
2. NMI function
3. Impact

In the following sections, three quantitative metrics for each of these three KPIs are proposed. No method is given to come to one overall rating for the KPIs. This would require to somehow combine scores that are largely different in nature and would require normalization that might lead to loss of relevant information and additional inaccuracies. Eventually, one KPI per area may be obtained by summing the KPIs, normalized to e.g. the total score of the Institute, with weights to be assigned on the basis of strategic choices of the INRiM President.

It is suggested to perform the analysis on the different Sectors within INRiM if they are sufficiently homogenous and scientifically coherent. Alternatively, on groups inside Sectors when this is not the case (according to a decision of the INRiM president and the Science Director, following indications of RdD and RS).

For the calculation of the metrics, data should be taken from the last 3 years, e.g. 1 January 2018 – 31 December 2020, as the present INRiM organizational structure is only in place for 3 years. In future exercises, data from the past 5 years may be used. When data from the KCDB is needed, the latest KCDB information should be used. For the R&D and industry projects, the full project size should be counted of all projects started in the past 3 years. Projects that started more than 3 years ago and are running still in the most recent 3-year period are not taken into account. For projects that started recently, the full project size is used in the formula (and not the size per year).

Next to the KPI metrics, the size of each sector or group for which the KPIs are calculated should be mentioned – total size in permanent staff (number of scientists, number of technical staff) and number of temporary staff such as PhDs – since many metrics will scale with the sector / group size.

### **KPI 1 – Research**

An analysis has been performed of indicators for scientific performance, taking into account the existing ANVUR evaluation. Following this analysis, the following three metrics are proposed for KPI 1 – Research: publications, research funding and plenary / keynote talks.

#### 1a. Publications

Based on all publications in the past 3 years calculate:

$$\text{Sum [ } k ( \text{IF} / 2 ) + C \text{ ] / (years from publication) ]}$$

where  $k = 1$  if first or last author is of INRiM, and  $k = \frac{1}{2}$  otherwise;  $C =$  the number of citations;  $\text{IF} =$  the impact factor of the journal of publication.

#### 1b. Research funding

Based on all research projects *started* in the last 3 years, calculate:

$$\text{Sum [ project size for INRiM in k€ * K ]}$$

where  $K = 1$  when INRiM is leading the project, and otherwise  $K = 0.8$ .

The research projects can have regional, national, or international funding (such as EMPIR).

#### 1c. Plenary / keynote talks

Based on the presentations given in the past 3 years, calculate:

$$\text{Total number of plenary and keynote talks.}$$

A talk is considered a plenary or keynote talk if it is scheduled in this way in the program and if and only if all or part of the travel costs and lodging (for physical conferences), or conference fee are covered by the inviting institution.

### **KPI 2 – NMI function**

The NMI function is key to INRiM and therefore deserves a separate KPI. The following three metrics are proposed for KPI 2 – NMI function: CMCs, comparisons, and NMI service income.

#### 2a. Calibration and Measurement Capabilities (CMCs)

For the service categories that are relevant to each INRiM sector or group calculate, using the data from the KCDB:

$$\text{(total number of INRiM CMCs in the relevant categories) / (average total number of CMCs of NMIs for these categories).}$$

For the denominator it is suggested to take the European NMIs as reference, as these are the primary peers for INRiM. This choice will furthermore ensure adequate averaging over large, intermediate and small size NMIs.

It is noted that for areas with limited CMCs (such as time and frequency, length) this metric will not be very discriminatory.

### 2b. Comparisons

For the key comparisons (KCs) and supplementary comparison (SCs) led by an INRiM sector or group, and for the pilot studies (PS) where this sector or group is active, calculate:

$$1 * \#KCs + 0.8 * \#SCs + 0.3 * \#PS \text{ (led by INRiM)} + 0.1 * \#PS \text{ (INRiM participation)}.$$

It is noted that the regular participation in KCs and SCs is already accounted for in the CMC number (metric 2a), as such regular participation is a mandatory requirement for having a CMC in a particular technical area.

### 2c. NMI service income

For the income generated by NMI services, that is calibration and test certificates, and reference materials, calculate:

$$\text{Sum of [ service incomes in kEuro * K ]}$$

where K = 1 for calibration or measurement certificates, or reference materials, and K = 0.8 for test certificates.

### **KPI 3: Impact**

The following three metrics are proposed for KPI 3 – Impact: consultancy and training income, courses, participation in standardisation.

#### 3a. Consultancy and training income

Based on all consultancy, training and applied industry projects (not already included in metric 1b) that started in the last 3 years, calculate:

$$\text{Sum [ project size for INRiM in k€ * K ]}$$

where K = 1 when INRiM is leading the project, and otherwise K = 0.8.

#### 3b. Courses

For all courses and training given by each INRiM group calculate:

$$\text{Sum [ #hours * (1 * \#PhD + 0.2 * \#MSc) ]}$$

where #PhD and #MSc are the number of PhD and MSc students respectively, participating in the training or course.

The number of hours (#hours) should be taken as those hours of a training or course that are given by the INRiM group. Only when the complete training or course is given by the group, all hours of the training or course can be counted.

#### 3c. Participation in standardization

Evaluate the contribution to standardization for each group by calculating:

$$\text{Sum [ \#NCs + \#EU + \#INT + \#leads of new standards or review of existing standards ]}$$

Where #NCs is the number of national technical committees where the group is active in; similarly, the #EU and #INT for European and international technical committees; #leads is the number of groups writing a new standard or updating an existing standard that INRiM is leading as either chair or secretary.

It is noted that if a group is active in a technical committee both nationally and in Europe this indeed is counted twice.

## **Recommendations on additional KPIs and second review step**

The first review step consists of metrics that are important *and* easily quantifiable without significant human interpretation. As already indicated in the introduction, some very important metrics have reluctantly been left out of the first review step, simply because they are not easily quantifiable. Another limitation of the metrics in the first step is that they intrinsically are backward looking, and good scoring on these metrics thus not necessarily gives an indication of the importance for the future of INRiM as depicted in the INRiM 2030 vision.

The additional KPIs and related considerations given below therefore hopefully are of use as discussion points in the second step of the INRiM performance review process.

### **Additional KPIs**

Two KPIs were considered important but could not be implemented in the first review step as they could not be easily quantified: contribution to realization of the INRiM 2030 vision and esteem.

#### Contribution to realization of the INRiM 2030 vision

The extent to which the sector / group activities align with and contribute to the INRiM 2030 vision is considered the most important KPI missing in the first review step. The INRiM 2030 vision is considered instrumental in reaching more coherence in the INRiM activities and in reaching sufficient mass in areas that are important for the Italian society.

This KPI does not allow easy quantitative metrics, but a qualitative impression regarding this KPI can be achieved by discussing how a sector or group contributes to each of the 7 focal points of the INRiM 2030 vision, and what its potential is to strengthen and extend these contributions.

#### Esteem

Esteem is another KPI that gives a good indication on how well a sector or group is performing. It can be evaluated via a broad spectrum of indicators, such as: fellow or senior membership of professional organisations, leadership roles in Euramet or BIPM or nationally (e.g. standardization), prizes and awards, key note talks at (large) international conferences, peer review of other NMIs, (associate) editor of leading scientific journals, calibrations performed for customers outside Italy, etc.

### **Recommendations on the three KPIs**

Several elements related to the three main KPIs could not be easily quantified and thus are not included in the first review step but may be useful in the discussions of the second step of the INRiM performance review.

#### Research

Next to the three metrics indicated for the first review step, other elements that may be used to evaluate the performance in research are:

- Advancing state of the art in measurement science via realisation and implementation of the new SI, other new primary standards and new measurement facilities for derived standards,
- Collaboration in joint research projects, including cooperations with (Italian) universities,
- IP, patents, licenses.

#### NMI function

Next to the three metrics indicated for the first review step, other elements that may be used to evaluate the performance in the NMI function are:

- Number of completed successful KCs, SCs and Pilot Studies (i.e. with all  $E_n$  values smaller than 1), related to the total number of comparisons in the field.

- Number of errors in certificates or number of customer complaints.
- Number of ACCREDIA calibration and test labs served by the sector or group.
- Unique customers, with great national importance (military, health, ....) and possibly even a unique EU facility.
- Number of international clients served by the sector or group.
- National accreditation: interlaboratory comparisons (ILC income), technical experts 17025 review (number)
- Participation in EURAMET technical committees (TCs) and CIPM consultative committees.
- Leadership in national and international TCs, working groups, task groups, European Metrology Networks.

### Impact

Having impact is very important, but also difficult to determine. Next to the three metrics indicated for the first review step, answering the following questions may give further insight in the impact performance:

- How many companies is the sector /group supporting, over the whole country, and at EU level?
- What is the wider impact of the customers served? (multiplication factor; a single INRiM calibration may be the basis for thousands of calibrations in the field).
- How satisfied are stakeholders and customers on the sector / group activities?

### **General recommendations**

The INRiM Committee for the KPIs greatly appreciates the steps INRiM is presently planning for a performance evaluation. It is suggested to review the planned process after the first implementation, and subsequently repeat the performance review regularly, e.g. every 3 years. The Committee furthermore notes that the internal review will gain significantly in value and credibility if it is complemented by an additional external performance review, e.g. every 4 – 5 years. Next to the three main KPIs, such an external review should at least also consider the KPI of contributions to the INRiM 2030 vision. To support this, sectors may be asked to develop a ten-year roadmap for their sector in light of the INRiM 2030 vision.

INRiM aims to be of significant relevance to the Italian society but proving the actual impact of the INRiM activities is not easy. INRiM may develop activities to get more insight in this, for example via recording customer satisfaction (e.g. Net Promotor Score) and development of impact case studies. Finally, when it comes to calibration services, it may be relevant to evaluate the INRiM internal cost for the separate calibration services.

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