

A sustainable organization for measurement quality assurance of category based measurements

**Tasked with coordinating and ensuring
reliable and comparable measurements of
experiences, feelings, behaviours and
abilities.**

RISE REPORT 2023:8

Jeanette Melin, Marie-Louise
Möllerberg, Hanna Svensson,
Magnus P. Johansson, Nicklas
Korsell, Simon Karlsson,
Marit Preuter, Leslie Pendrill

Content

Content	1
Executive summary	2
1 A first draft	3
2 Category based measurements.....	4
3 Centre for Category Based Measurements – a knowledge platform.....	5
4 The future organization	6
5 From principles and missions to social impact.....	9
6 Closing words.....	11

Executive summary

Why?

Society's need for knowledge about experiences, feelings, behaviours and abilities is increasing. It is important to know how people and society feel or how a product or service is perceived, and to be able to compare how these change over time and between different areas, for example when making decisions about priorities, efforts and effects. In order for measurements of experiences, feelings, behaviours and abilities to be useful and provide reliable data, quality-assured measurement is required for so-called category based measurements¹. It is therefore necessary that basic measurement principles are applied, which is often not the case today in this field.

For the physical quantities (length, mass, time, etc.) there has long been an internationally established measurement quality infrastructure. In Sweden, it is mainly RISE as the National Metrological Institute which, through its national measurement sites, is responsible for ensuring access to quality-assured and traceable measurements for society. However, the corresponding measurement quality infrastructure is so far missing for category based measurements.

What?

RISE has been working for several years to develop methodology and working methods for measurement quality assurance of experiences, feelings, behaviours and abilities. Through dialogue over several years with actors at various levels, including in health care and academia, it has emerged that there is a great need for support for this development. RISE has therefore produced a first draft of a possible sustainable organization for measurement quality assurance of category based measurements.

A national centre for quality assurance of category based measurements would be tasked with coordinating and ensuring reliable and comparable measurements of experiences, feelings, behaviours and abilities. Such infrastructural support must make methodologies available to enable quality assurance for category based measurements. The organization must meet society's need for support by offering services based on internationally accepted metrological principles and scientific methods, as well as adopting a neutral and independent role.

How?

We have humility about the fact that it is a long process to establish an organization for category based measurements and that it needs to happen through a dynamic and iterative development in co-creation with the actors involved. We look forward to continuing to develop ideas and revise the proposal in dialogue in the coming years. It is also important to start a dialogue together with relevant actors about how the implementation of the organization can take place in the future.

¹ Properties such as experiences, feelings, behaviours and abilities are just as desirable as physical quantities to be able to be measured on continuous measuring scales, but this is not possible with classic measuring instruments. Instead, answers are usually obtained in categorical form, such as in a survey, with indices or observation protocols. However, the properties themselves are continuous and therefore, with the help of modern methods and tools, it is possible to create measurement values on a continuous scale for the properties, while at the same time ensuring a high measurement quality.

1 A first draft

Society's need for knowledge about latent characteristics, such as experiences, feelings, behaviours and abilities, is increasing. For example, it is important to gain knowledge about how people and society feel or how a product or service is experienced and how these change over time and between different areas. This requires quality-assured and reliable measurements and definitions of new "magnitudes" alongside the better-known physical quantities such as length and weight. The methods used today to measure these properties vary in metrological quality, which makes it difficult to fully compare measurement values over time or between different areas.

Measurements of latent characteristics where special methods and tools are applied to ensure measurement quality are called category based measurements (KBM). With this document, we want to highlight the opportunities a measurement quality infrastructure for KBM must meet the new needs for knowledge about experiences, behaviours or performances. The proposals in the document are a **first draft for a possible sustainable organization for measurement quality assurance of KBM** and are based on dialogue with relevant actors that has been going on for several years. In the document, we refer to the proposal as a KBM organization or simply (an) organization.

The overall mission of the organization should be to make available methodology for quality-assured measurement technology for KBM and to be an infrastructural support for creating reliable and comparable KBM. The document describes how the organization can take shape and illustrates the relationship and dependence between the organisation's capital and its various services required to meet society's needs. The document also describes how the work needs to be based on principles and, via Partnerships, Methods & tools and Services, can enable societal effects.

2 Category based measurements

In cooperation with business and the rest of society, RISE has long worked on developing new ways to measure regular quantities as well as new latent characteristics that are not yet defined in the SI system of units, for example experiences, behaviours or achievements. When latent characteristics are to be measured, they are expected, just like measurements of regular physical quantities, to be useful and provide reliable bases for making decisions about, for example, priorities, efforts and effects. It is therefore necessary that basic metrological principles, tools and methods be applied to KBM as well as to physical measurements.

For the traditional physical quantities and SI units, there has long been an established international measurement quality infrastructure that ensures that basic metrological principles are applied so that "a kilogram is a kilogram or a metre a metre all over the world". In Sweden, it is RISE as the National Metrological Institute that is responsible through its national measuring sites for ensuring and providing traceability to Swedish society, by developing national standards and participating in international comparative measurements². Swedish Ordinances 2011:811 and 2019:17 govern the national measurement site operations:

Section 10 A national measurement site must maintain a high standard with standards of sufficient scope and relevance. Traceability of measurement standards must be ensured and developed through international comparisons and research and development efforts.

For KBM, there is no corresponding measurement quality infrastructure. Duplicating the infrastructure that exists for the SI units is probably neither feasible nor entirely desirable. However, there is much to learn and be inspired by from the traditional national measuring site operations to create an organization for KBM.

RISE and its division Measurement in society are at the forefront nationally and internationally when it comes to applying basic metrological principles and developing methods for quality assurance of category based measurements. In addition to the development of methods, a long-term sustainable organization of the work is a prerequisite for the methods to have an impact in the long term throughout society.

² In an ordinance (2019:16) on national measuring sites, it is stated which bodies are national measuring sites in Sweden. RISE is responsible for 32 quantities and the Swedish Radiation Safety Authority for 4 quantities.

3 Centre for Category Based Measurements – a knowledge platform

Since 2020, RISE has been driving the development of category based measurements, among other things, through a so-called knowledge platform, the Centre for category based measurements. A knowledge platform must, in the long term, build new or strengthen existing competence, which in the long run can form the basis for the RISE Group's offer of innovative services to business and society as support for the challenges and transformations they face. The starting point is that the knowledge platforms that are developed should become nationally leading and internationally competitive.

The overall aim of the Centre for Category Based Measurements is to enable the development of generic methods and approaches for category based measurements that can be applied in different contexts.

The proposals in this document aim at the following objectives for the Centre for Category Based Measurement:

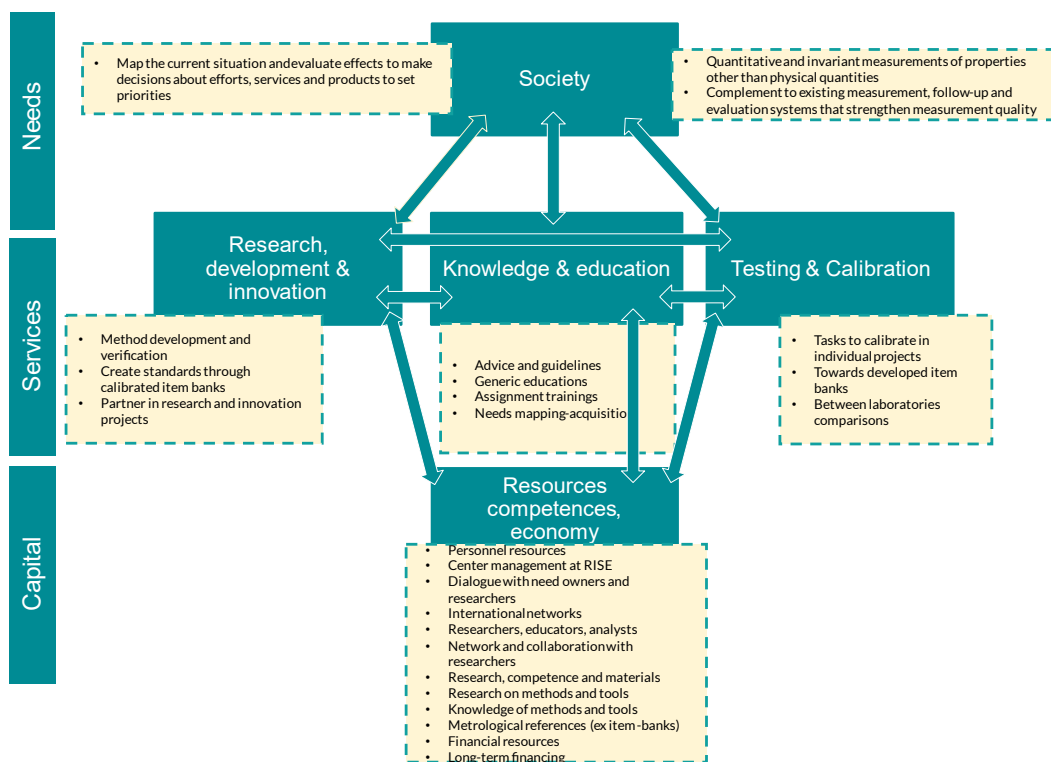
- **2022, year 3:** A first draft for sustainable organization of measurement quality assurance of category based measurements. This includes internal and external networks, actors and methods, primarily for health and social values, but not business model(s), trial models or reference materials.
- **2024, year 5:** A proposal for sustainable organization of measurement quality assurance by KBM. This includes ownership, business model(s), testing models and reference materials and methods.
- **2026, year 7:** Depending on what the proposal in year 5 ends up being, goals are set for year 7. This may also include anchoring and implementation plans.

In addition to the above, the knowledge platform also aims to produce a methodological and metrological framework, to develop item-banks³ that will be established at national level, and to run and participate in research and development projects.

³ An item bank is a set of tasks, for example questions in a test or statements in a survey, as well as regulations for its degree of difficulty. An item bank is analogous to a calibrated weight set and is used in turn to obtain comparable measurement values of people's abilities and experiences.

4 The future organization

A sustainable organization for KBM must meet society's *Needs* by offering the right *Services* with the right *Capital* and having the task of making available methodology for quality-assured measurement technology for KBM, and being an infrastructural support for creating reliable and comparable KBM. RISE has great generic competence regarding measurement quality assurance but does not fully have the domain knowledge required for practical application of the methods and to ensure that development and prioritization go in the desired direction. Therefore, a broad collaboration and a great commitment from relevant actors in society are required to enable a future organization. The proposed organization is illustrated in the diagram below.



Needs

The basis is that the organization must be able to meet the needs that exist in society. Owners of needs want to be able to map the current situation and evaluate effects in order to make decisions about interventions, services and products in order to set priorities. For this, quantitative and invariant measurements of properties other than physical quantities are required. The dialogues of recent years have shown that support and resources are required to enable these measurements and for various actors in society to be able to continue developing their measurement, follow-up and evaluation systems. In order to ensure that development goes in the right direction, dialogue and collaboration are required to collect and work with the actors concerned and those who own the needs.

Services

The services that an organization for KBM needs to offer could correspond to the services offered by the traditional national measuring sites. However, the content of the services needs to be adapted and will develop over time based on society's needs and the progress that is made. The services must maintain a high standard and be at the forefront both nationally and internationally in terms of method development, research and innovation.

- **Research, development and innovation** are about developing methodology, developing item banks and running and being a partner in research and innovation projects. Initially, this service will be of particular importance to enable testing and calibration services and the building of the organization.
- **Knowledge and training** are about making available and spreading tools and metrological knowledge, based on the needs that exist. This can, for example, involve developing advice and guidelines, 'boiling down' research into practical tools, providing methods and offering generic and tailored training and training packages.
- **Testing and calibration** are about assisting businesses with data to enable comparable and reliable measurements. Initially in individual projects and assignments, but in the future also through developed item banks to create comparability beyond a single study or investigation, for example between different contexts and geographical areas.

Capital

Different types of capital are required for the organization to be able to meet society's needs by offering the right services. There are also the personnel resources that are primarily responsible for ensuring that the services offered match the needs and that the right resources are made available. For this, it is suggested:

- **Centre management at RISE:** Dialogues in recent years have pointed out that a centre management for the organization should be located at RISE, due to its independent role as a research institute and the connection to the traditional national measuring site operations. Such a mission would also be well in line with RISE's overall mission to work for sustainable growth in Sweden by strengthening the competitiveness and renewal of the business world, as well as promoting the public sector's renewal and ability to contribute to solutions to society's challenges together with the business world.
- **Dialogue with needs owners and researchers:** To ensure that services match the needs and that development and prioritization within the organization are done in the right steps and in the right directions, it is necessary to have dialogues with both needs owners and researchers with both context and domain expertise.
- **International networks:** An important part of the traditional national measuring site work is international collaboration, which an organization for KBM also needs. Today, there are no corresponding international initiatives and collaborations as in traditional metrology, but there are similar contexts where we can get involved and be involved in driving forward and, if necessary, be the driving force in shaping new international collaborations.

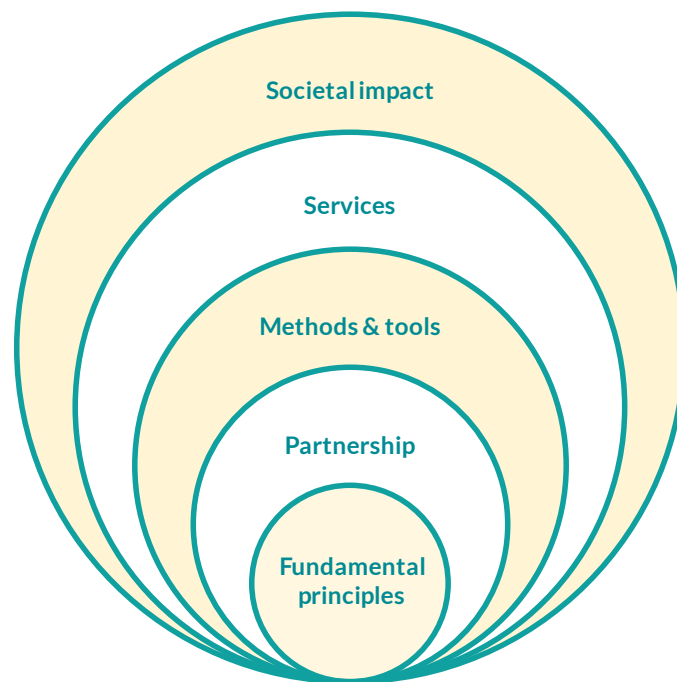
In addition, there are personnel resources that are necessary and primarily responsible for coordination between the services:

- **Researchers, trainers and analysts:** Researchers, trainers and analysts are needed who perform services and ensure a common thread between the services, for example that training and calibration are based on actual research, or that questions that need to be researched from the calibration services are captured.
- **Network and collaboration with researchers:** RISE knows general measurement methodology, but this knowledge needs to be supplemented with subject-specific knowledge and application. This is of great importance for both credibility and practical application.

Research, competence and materials create conditions for offering services that meet the needs, by developing metrological references such as item banks and methods. Another basic prerequisite is financial capital. Individual projects and assignments contribute to the financial conditions, but long-term funding is also required that enables coordination and coordination of the organization.

5 From principles and missions to social impact

Measurement quality assurance by KBM needs to build on *Fundamental principles* and go through *Partnerships, Methods & tools* and *Services* to enable *Social Impact*. In line with the overall mission of making available methodology for quality-assured measurement technology for KBM and being an infrastructural support for creating reliable and comparable KBM, these parts can be illustrated as an 'onion' as described below with a brief description of its 'layers'.



Fundamental principles

The innermost layer – or core – consists of the basic principles that a sustainable organization for KBM must be based on:

- a neutral and independent role
- measurement technology principles and scientific methods to ensure measurement quality for KBM
- development and innovation that are at the forefront so well nationally as well as internationally

Partnership

To enable the development of new measurements and measurement quality assurance of these that meet the needs of society, partnerships are required. Collaboration between centre management for the organization and active partners is central to success.

Methods and tools

A sustainable organization for KBM must work with, research and develop:

- The model of Man as a measuring instrument⁴ and Rasch Measurement Theory⁵.
- Metrological traceability and item banks.
- Specification equations for metrological traceability and validation.
- Opportunities to relate detectable differences (measurement uncertainties) to clinically meaningful differences.
- New types of calibration and testing services

Services

Based on basic principles and in partnership with relevant actors, services must be offered that meet a high standard and are at the forefront both nationally and internationally in terms of method development, research and innovation. An organization of KBM needs to offer services in the form of support and advice for:

- innovation and research projects, for example as a project partner or consultant (corresponding to research, development and innovation in the diagram above),
- knowledge transfer and training, both generically and for specific assignment requests (corresponding to Knowledge and training above),
- traditional testing and calibration for measurements as well as new methods of testing and calibration specifically for KBM (equivalent to Testing and calibration in services described above).

Societal impact

A sustainable organization for KBM must lead to social effects and impact. By providing quantitative and invariant measurements, the organization must be a support and a resource for society to be able to map the current situation and evaluate effects in order to make decisions about interventions, services and products in order to set priorities. The organization enables new values to be taken into account and can be followed in a different way than what has previously been possible through, for example:

- Comparisons between groups and/or within themselves over time to identify people, areas, businesses and so on that are in need of targeted interventions.
- Comparisons of the impact of interventions, services and products to prioritize the most efficient and effective intervention.

⁴ The model Man as a measuring instrument was developed by Leslie Pendrill and is inspired by a basic measurement system analysis within traditional metrology. The model Man as measuring instrument is important when making the link between KBM and traditional metrology. For more reading on the model see Pendrill, L. (2014). Man as a Measurement Instrument. NCSLI Measure, 9(4), 24–35.

⁵ Rasch Measurement Theory is a so-called item-response theory model that is particularly well suited to KBM because it enables the transformation of ordinal data into metrics for both task and person characteristics. For further reading see Rasch, G. (1960). Studies in mathematical psychology: I. Probabilistic models for some intelligence and attainment tests. Nielsen & Lydiche.

6 Closing words

This document describes a **first draft** for a sustainable organization for measurement quality assurance of category based measurements.

We have a humility about the fact that it is a long process to establish an organization for KBM and that it needs to happen through a dynamic and iterative development in co-creation with the actors involved. We look forward to continuing to develop ideas and revise the proposal in dialogue in the coming years. It is also important to start a dialogue together with relevant actors about how the implementation of the organization can take place in the future.

RISE has been working for several years to develop methodology and working methods for measurement quality assurance of experiences, feelings, behaviours and abilities. Through dialogue over several years with actors at various levels, including in health care and academia, it has emerged that there is a great need for support for this development. RISE has therefore produced a first draft of a possible sustainable organization for measurement quality assurance of category based measurements.

A national centre for quality assurance of category based measurements would be tasked with coordinating and ensuring reliable and comparable measurements of experiences, feelings, behaviours and abilities. Such infrastructural support must make methodologies available to enable quality assurance for category based measurements. The organization must meet society's need for support by offering services based on internationally accepted metrological principles and scientific methods, as well as adopting a neutral and independent role.

We look forward to continuing to develop ideas and revise the proposal in dialogue in the coming years with the actors involved.

RISE – Research Institutes of Sweden
ri.se / info@ri.se / 010-516 50 00
Box 857, 501 15 BORÅS

Grants Office/Informationscenter
RISE report 2023:8
ISBN 978-91-89757-51-6

