

ICAR's Accuracy Task Force – The Reason for its Establishment.

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Abstract

Accuracy is a key concept in animal recording. The ICAR Board has recently decided to establish an Accuracy Task Force with two objectives; (a) to develop a scientifically sound philosophical basis for ICAR to use in establishing accuracy guidelines for the collection of animal recording data that is incorporated into information services that support; breeding, farm management, traceability/supply chain/quality assurance, and health/welfare, and (b) to provide statistical tools and guidelines, for use by ICAR Groups in establishing accuracy guidelines relevant to their particular area of expertise.

This paper provides the background thinking that gave rise to the establishment of this Task Force.

The decisions that are made based on data collected from a laboratory, or even in-line testing, include decisions covering: bulk milk quality, farmer payment, breeding, quality assurance and disease control. In each case the accuracy of the decision will be a reflection of the accumulation of *errors* arising from each step in the process that results in the information used for decision-making.

That is; Accuracy of Information (e.g. Breeding Index, Bulk Milk SCC, ...) equals the Accumulated Accuracy of Identification, Sample Representation, Sample Contamination, Component Testing, Data Transmission, Data Storage, Data Retrieval, Statistical Model, and so on.

The key point being that sample contamination (carryover) is one part of a multistep process and depending on the decision being made and the accuracy of the other steps in the process may be having a relatively small or large impact on the accuracy of the decision.

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What is Accuracy

According to ISO 5725 (ISO, 2011) the terms **trueness** and **precision** are used to describe the **accuracy** of a measurement. Trueness refers to the closeness of the mean of the measurement results to the actual (true) value and precision refers to the closeness of agreement within individual results. Therefore, according to the ISO standard, the term "accuracy" refers to both trueness and precision. However, in animal recording the term accuracy is applied to information that results from a combination of the following somewhat simplified steps:

1. **Observations** (for example; the identification of the animal, a linear score, visual carcass grade),
2. **Direct measurements** using a recording device (for example; milk volume from a milk meter, weight from a set of scales, carcass grade from an image),
3. **Measurement of components** (sometimes based on a subsample) analyzed in a laboratory (for example; protein content by a Foss™ machine, presence of an antibody using an Elisa test, genotype using a SNP chip),
4. Collected **data is validated and stored** in a central database,

5. Data from several *animal tests* is extracted from the database, a **summary statistic is computed** for each (for example; a lactation yield, a disease status, a parentage validation) and the result is **stored back into the database** for subsequent use,
6. Data from many animals (and herds) is extracted from the database, summary statistics are computed, and the results are presented on reports which are used by herd owners to make a wide range of management decisions,
7. **Data from very large numbers of animals** (and herds), covering long time periods, are extracted from a local database and **combined with information from other databases** (for example, through Interbull or Interbeef) to **compute genetic evaluations** which are stored in the local database and **used in breeding decisions by farmers and breeding companies**.
8. **Data** is extracted from local database(s) and **used in research** to find ways of improving the accuracy, relevance and affordability of information services that can be provided through steps 1 to 7.

The accuracy of the information (e.g. Breeding Index, Bulk Milk SCC, ...) resulting from this multi-step process is the sum of the Accumulated Accuracy of Identification, Sample Representation, Sample Contamination, Component Testing, Data Transmission, Data Storage, Data Retrieval, Statistical Model, and so on.

ICAR, through the activities of its Groups, particularly the Sub-Committees and Working Groups, is developing and maintaining standards and guidelines for the steps, one to eight above, in this process. The ICAR standards and guidelines are relied on by ICAR's members to help ensure the accuracy of the information services they provide to farmers.

Thus accuracy is a very important issue for both ICAR's members and for ICAR's Groups.

However, animal farming and the organisations that provide services to animal farmers, are under severe economic pressure to find lower cost ways of providing information services. The last twenty years have seen a rapid and dramatic evolution of information, measurement and genomic technologies. Each of these technology developments has the potential to affect service costs and the accuracy of information services that can be delivered to farmers and the wider industry. The challenge for ICAR members is to find the best ways of exploiting developments in technology and incorporating them into new and improved information services to farmers. Accuracy and cost are both very important considerations in meeting this challenge. The challenge for ICAR is to ensure it is helping its members, in the best way possible, to assess and make decisions on their use of new and existing technologies. The establishment of the ICAR Task Force is a step that ICAR has taken with this goal in mind.

The purpose of this paper is to outline the reason that ICAR has taken the decision to establish an Accuracy Task Force.

ICAR's Current Accuracy Philosophy

ICAR and its members have, for many years, focused on ensuring high levels of accuracy and this can be seen in the current ICAR Guidelines (ICAR, 2012). A great deal of effort has gone into establishing standards and guidelines for ensuring the accuracy of identification, milk recording devices, milk analysis and genetic evaluations of dairy cattle. More recently this has been extended to parentage recording, genetic analysis, beef traits, conformation traits, functional traits, health traits and traits in other species including sheep, goats, buffalo

and alpaca.

An analysis of the ICAR guidelines has identified a number of related concepts, which are used by ICAR to help its members achieve high levels of accuracy in the information services they provide to their customers. These are summarised in table 1.

This list is not exhaustive and indicates that ICAR's standards and guidelines use a large number of related and overlapping concepts to achieve high levels of accuracy. One of the objectives of the Accuracy Task Force is to consider this list and establish a simpler and more coherent philosophy for accuracy.

Table 1. Key concepts, related to accuracy, contained in current ICAR Guidelines.

No.	Name	Description
1	Measurement precision	A combination of trueness & precision applied to a recording device or testing device.
2	Carryover	Influence of the previous animal on the sample collected, or test result, for the current sample.
3	Official record	A designation given to data, usually milk records, collected in accordance with ICAR guidelines. All other records being "unofficial" by definition.
4	Supervision	A letter designation to indicate the extent of external supervision of data collection - A, B, C.
5	Intervals	A coding system to indicate the interval in weeks between recordings and number per day - 3, 4, 6, 8 ... and 1x, 2x, 3x ..
6	Completeness	The extent to which all animals in a herd or contemporary group have data recorded and available for use in genetic analysis or other statistical summaries.
7	Timeliness	The delay that occurs between an event occurring and data being recorded into a database for later use.
8	Reliability	A measure of the accuracy of a genetic evaluation.
9	Availability	The extent to which data is incorporated information that is provided to help in a decision.
10	Evidence data	Data that provides evidence for the accuracy of recorded data.
11	Quality control	Systems, procedures and evidence to ensure accurate data is gathered and included in useful information services to customers.
12	Standardisation	Shared protocols for ensuring comparability of data collected, and information provided, by different organisations in different countries.
13	Transparency	Ready availability of information and statistics which enable outside observers to gain an accurate understanding of all the key factors giving rise to presented information.
14	Certificate of Quality	A document which is provided by ICAR as evidence that a member adheres the ICAR standards and guidelines.
15	Averaging	Repeated sampling to achieve greater accuracy.
16	Predictive value	Use of easily (cheaply) recorded data to predict data which is hard (expensive) to record.
17	Data editing	Selective use of data to improve accuracy of information, or to reduce the cost of providing information.
18	Use of data	The ways in which the data will be used and the decisions which will be taken based on information which includes the recorded data.

Scope of ICAR's Interests

ICAR's members are increasingly involved in collecting data, which is used for an ever-widening range of purposes with the same data being used to support more-and-more information products. The challenge for ICAR is to ensure its standards and guidelines provide a scientifically sound basis for its members to participate in the provision of this extended range of products and services.

Table 2 provides a non-exhaustive summary of the uses to which data collected by ICAR members is put. This summary illustrates the wide number of uses for data collected by ICAR members. In establishing standards and guidelines ICAR's Group need to consider these uses.

Table 2. Uses of data collected by ICAR members.

No.	Name	Use
1	Farm Management	Information services to herd owners which help them made a range of day-to-day management decisions.
2	Genetic Evaluation	Identification, ancestry, performance and genomic data provided for use in genetic evaluations.
3	Breeding Advice	Identification, genetic evaluations, trait data and ancestry used in combination with lists of bulls available through AI to provide individual animal mating advice.
4	Data Collection & Validation	Identification, location, age, sex data used to facilitate data collection and data validation.
5	Industry Statistics	Wide range of summaries for comparative, planning and information purposes.
6	Animal Health	Milk, blood and tissue sample collection facilitated for lab testing and health information provided to herd owner and veterinary advisors to reduce disease risks and costs.
7	Quality Assurance	Movement, calving, disease and other data used to provide milk and meat quality assurance.
8	Research & Development	Wide range of data provided to researchers for wide range of purposes and to support development, calibration and validation of new products.

The second objective for the Accuracy Task Force is to provide ICAR's Group with tools, statistical and others, they can use to guide their formulation of standards and guidelines for their respective areas of activity as they relate to these uses of the data collected by ICAR's members.

List of References

ICAR, 2012. ICAR Guidelines, approved by the General Assembly held in Cork, Ireland, in June 2012. http://www.icar.org/pages/recording_guidelines.htm. Accessed on 27th March 2014.

ISO, 2011. "Accuracy (trueness and precision) of measurement methods and results - Part 1: General principles and definitions." 37 pages. Accessed on 27th March 2014.