Practical aspects in milk recording in Central and Eastern Europe and its effects on the guidelines

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Abstract

During the last decade we have seen many technological innovations, a rapid development in farming tools, organisational and economic changes among ICAR members, along with a rapid change in customer profiles. These advances require new services, both in our approach to maintaining milk-recording standards and in the ability of the relevant bodies responsible for the creation of ICAR Guidelines to react to these developments in a timely way. Central and Eastern European countries adopt different structures in relation to herd size and in the organisation of milk recording. Therefore they have different needs when it comes to the daily work of performance recording. This requires specialised responses if we are to adopt ICAR Guidelines and satisfy the methodology for milk recording on a national level. The main goal of this study was to analyse key processes relevant to milk recording (mostly covered in Section 2 of ICAR Guidelines) among eight selected countries in Central and Eastern Europe with different approaches to milk-recording in dairy cattle. Due to the organisational changes in Hungary, results from only seven countries have been made available. Arising from this analysis we will be able to summarise the effect of the conditions in those countries on ICAR Guidelines, trends and practical recommendations for milk recording. One of the main goals is to look to the future in formulating a strategic plan for these organisations in the area of milk recording methodology and organisation. We have created a questionnaire which covers all the relevant processes in milk recording, which will provide a clear view of strategic planning for the future.

Key words: Central and Eastern Europe, ICAR Guidelines, milk recording, questionnaire, processes in milk recording, practical recommendations for milk recording.

Introduction

The paper covers the situation in seven countries in Central and Eastern Europe with different structures in relation to herd size, to the organisation of milk recording and to the different needs thereof. The seven attending countries have different needs when it comes to the daily work of performance recording. This requires specialised responses if we are to adopt ICAR Guidelines and satisfy the methodology for milk recording on a national level. The main goal of this study was to analyse key processes relevant to milk recording (mostly covered in Section 2 of ICAR Guidelines) among eight selected countries in Central and Eastern Europe with different approaches to milk-recording in dairy cattle. Due to the organisational changes in Hungary, results from only seven countries have been made available. Arising from this analysis we will be able to summarise the effect of the conditions in those countries on ICAR Guidelines, trends and practical recommendations for milk recording. One of the main goals is to look to the future in formulating a strategic plan for these organisations in the area of milk-recording methodology and organisation. This paper is the first part of a study which also tests the feasibility of extending and researching the circumstances outside Central and Eastern Europe. It is planned that on the basis of the experiences from these seven countries, this study will be adapted for more countries with the aim of presenting these findings at the next ICAR meeting which will take place in 2015 in Poland.

Material and methods

A questionnaire has been created which covers all relevant processes in milk recording: sampling, cattle identification, identification of samples, database storage, lactation calculation, quality of milk recording, different traits recorded in milk recording, automatic milking systems and electronic milk meters.

Available data and organisational structure

The basic overview of the scope of the study is shown in Table 1. This study covered the circumstances in seven countries. There are two large populations of dairy cows in Germany and Poland. The number of cows involved in milk recording varied in size from 85,000 dairy cows in Slovenia to 3,681,146 dairy cows in Germany.

Table 1. Basic overview of countries participating in the project.

Country	Number of dairy cows		% of cows in MR	No of MR[1] organisations
	All	Milk recording		
Czech Republic	372,748	350,162	93.9	1+13[2]
Germany	4,267,611	3,681,146	86.3	12
Poland	2,299,083	700,995	30.5	1
Austria	520,664	405,077	77.8	8
Slovakia	146,274	116,965	80.0	1
Croatia	167,941	101,637	60.5	1
Slovenia	110,000	85,000	77.3	1

1 No. of organisations responsible for milk recording

2 Czech Republic holds 1 organisation responsible for milk recording and 13 organisations for sample taking

Countries in Central Eastern Europe have different shares of cows included in milk recording. These indicators vary from 30.5% in Poland to 93.9% in the Czech Republic. The result of the analysis covers all cases and situations for entire countries. In cases where parts of the questionnaire differ, the situation is highlighted and explained. There are different organisational structures within Central and Eastern Europe in the field of milk recording. On the one hand, highly centralised services in milk recording exist in Slovakia, Croatia, Poland, and the Czech Republic (excluding sample taking), while on the other hand a more local organisational approach covers the needs of each region in Germany and Austria.

Planning milk recording

Due to the nature of the recording scheme, events have to be planned over an entire year and must be scheduled with farms according to the Guidelines. For this purpose stringent plans, differing in approach, are implemented.

An example of a very sophisticated scheme is the organisation in the Czech Republic (CRV Czech Republic is one of thirteen organisations responsible for sample taking). The monthly schedule is arranged into local organisation units. Every third week of each month, there is a working meeting, where the local manager plans the test days for the upcoming month. This takes into account the logistics of samples, requirements for analysis, organisational aspects and so on. A record of this plan is entered into an internal internet application, which is kept by the Czech Moravian Breeders' Corporation, Inc. (the organisation responsible for all aspects of identification, production recording and estimation of breeding values) and is used for regular checks to ensure the quality of the work of technicians engaged in taking samples.

In addition to regular monthly meetings the technicians generally know the date of the last recording session for each farm and maintain detailed travelling plans to keep track of intervals and recording frequencies. With these tools the schedule is more flexible and easier to handle for the single employee. Of course an evaluation is necessary and overseen by the regional manager in the meetings.

Contacting the farmer has to be more or less unannounced. Due to the local farming structure – e.g. family farms in Austria or companies with employees – this process is done after the previous milking like in Austria, Germany and Slovenia or mainly one or two days in advance.

Data capturing

Paper and clip board is still the most common method used for milk recording. But in each country (excluding Slovenia), data captured electronically via PDAs is also used. These portable devices seem to have superseded the notebook, which is with different technical ways implemented or planned to implement in the Czech Republic and Germany (Table 2).

Automated data collection for AMS based on ADIS-ADED is partly in use in Germany, while other countries use this data format for exporting AMS results and importing them to their database via one-way communication.

The German solution needs the required support of manufacturers and from a technical perspective offers the most challenging method. But on the other hand it is also the only chance to implement managerial assistance like benchmarking on a real time basis for these farms. At any rate in the field of milk recording it is the only clear view for the future to implement such technical solutions to provide best service and optimal information to members with milking robots.

Table 2. Tools for data capture in milk recording.

	Paper	Data handler	Laptop	Automatic data capturing from milking robots
Austria	X	X		ADIS-ADED one way data capturing
Croatia	B method	A method		B method on robotic farm
Czech Republic	X	X	X	
Germany	X	X	X	complete data set, ADIS-ADED data exchange
Poland	X	X		
Slovakia	X	X		
Slovenia	X			X

In this field ICAR is reliant on the support of its members and its steps to harmonise the efforts and communication with the industry.

Milk recording in case of milking robots

Almost all countries use 24-hour test days for sample taking. Austria uses 20 to 24-hour test days. Table 3 shows the different approaches in the case of a number of samples, which are taken during the test day. Four countries use only one sample during the test days while Germany, Poland and Austria analyse all samples separately during the test day. Different practices were found concerning the number of days used for milk yield production. Some of the countries use only one day, but others use a multiple number of days for milk production.

Key aspects of methodology are the combination of milk production data with analyses of milk content. Table 4 shows that three countries combine contents from the test day with the milk production from the test day, i.e. there are two types of milk production (one for protein and fat production calculation, and the other for officially published milk yield production). This is used in Germany, Poland and Austria. Two countries use information only from the test day for contents in milk and milk yield production (Czech Republic and Slovakia) and two countries (Slovenia and Croatia) combine milk production from multiple days with the milk content from the test day. A short description of lactation calculation is seen in Table 5.

Most countries have developed a simple interface or automatic data exchange from milking robots. One country uses the paper form but is planning to implement the interface and automatic data exchange. Some of the countries capture additional data on paper. For example Austria uses data export via USB-Stick or mail as ADIS ADED data, whereas Germany uses ADIS ADED. Poland records milk yield data from milking robots electronically in addition to manually recorded data about events (calving, beginning of dry

period, diseases, heat temperature on the test day, etc.) and it is planned that these manually recorded events will be recorded in the future automatically.

One important aspect to note is the data communication with the robots. Further development will be influenced by the willingness of manufacturers to communicate with milk recording organisations. It is evident from the analyses that some of the countries from Central and Eastern Europe covered in this analysis are interested in establishing a common standard for milking robots. Austria aims to start an automatic data exchange together with some German recording organisations, which use the same database. Croatia and Slovakia have only a small number of farms with milking robots. There are different approaches and opinions concerning the number of samples taken in the case of milking robots. Some of the countries do not support the approach of using only one sample whilst others conduct the appropriate analyses that support the sole sample approach.

When recording the duration of milk flow the situation is different for participating countries in this questionnaire. Some of the countries record milk flow duration for all cows in milk recording while others do not.

A very important element for the future is data exchange with milking robots for other traits in some of the countries. Germany fully supports automatic data acquisition, Poland is planning to capture milking speeds and time spent in the box to monitor primiparous temperaments. It is a necessary requirement to run appropriate research projects before implementing these new traits in Poland. Croatia is focusing on conductivity.

Table 3. Basic overview of milk recording in milking robots.

Country	Test day[1]	Samples[2]	Milk yield production, period[3]
Czech Republic	24 hours	one	One day (test day only).
Germany	24 hours	Many, separately	For the calculation of the milk yield for the test day, all milkings are used from a 48h period and calculated over an average 24h yield. For the calculation of lactation yield all milkings are used (for 305 or 365 days).
Poland	24 hours	All within 24 hours of test day, and separately	Poland uses the rules adopted by Germany, with the exception of the 305 days lactation
Austria	20 to 24 hours	Many, separately	Test days and 168 hours (7 days) before the test day.
Slovakia	24 hours	One	One day (test day only).
Croatia	24 hours	One	Test day + 4 days before the test day.
Slovenia	24 hours	One	Test day + 2 days before the test day.

1 The duration of sample taking

2 Number of samples taken and how these samples are analysed

3 Time period used for test day milk yield production calculation

Table 4. How milk production data is combined with milk content analysis.

Country	Test day[1]	Test day + multiple production[2]	Test day for milk contents and milk production[3]
Czech Republic			x
Germany	x		
Poland	x		
Austria	x		
Slovakia			x
Croatia		x	
Slovenia		x	

1 Combination of milk contents from the test day with the milk production from the test day. There are two types of milk production, one for protein and fat production calculation, and the other for officially published milk yield production

2 Combination of milk production from multiple days with the milk content from the test day

3 Information is only available from the test day for milk content and milk yield production

Table 5. Different approaches for designing the calculation of milking robots in table 4.

Country	Calculation of milk yield and protein and fat production
1st possible option Czech Republic	One sample, milk production from the test day and Test Interval Method
2nd possible option Croatia	To estimate daily milk yield use the ICAR procedures Using data from more than one day (Lazenby et al., 2002). Sum of milk yields from 4 days (test-day + three days before) is divided by the sum of hours between each milking for all milkings within 4 days. The resulting number (sum of yields / sum of hours) is multiplied by 24 to obtain the estimated daily milk yield. Fat and protein production is calculated according to procedure Estimation of fat and protein yield (Galesloot and Peeters , 2000). Fat % est = Fat % obs + b * (Milk_est – Milk_obs) For milk lactation quantities, use the Test Interval Method, to interpolate between the two estimated test days and daily milk yields, which is in turn multiplied by the duration of the recording period (number of days between consecutive test days).
3rd possible option Germany	For lactation calculation to be used, contents are determined from the multiplication of the contents of the testing date with the average 24-hour milkings of each associated part. Testing periods and the number days in the part testing periods

Electronic milk meters and milk recording on farms

ICAR approved electronic milk meters from different manufactures are very common in the recording business. The results from this equipment are used in a similar way to the portable meters owned by the MROs.

LactoCorders are only used in Germany for routine purposes, and in Austria only for advisory purposes. Slovenia uses LactoCorders and the electronic milk meter from TruTest. Other countries just use those electronic meters installed in the parlours.

Regardless of method used adapting to technical innovation will be a necessary strategy for the MROs. For many reasons, clear guidance from ICAR in relation to this issue will be useful for its members.

In most countries alternative recording is the most common method used in milk recording, but the A-method, as with A4 and A8, are widespread. It is surely not surprising that the B-method is also in operation. The Czech Republic does not accept the B-method for the estimation of breeding values and herdbooks. For lactation calculation all countries use the test interval method. For alternative milking most attendants use interval correction coefficients published by ICAR, either for milk yield and/or for calculating milk solids. Only Austria answered that the milk kg quantity from single milkings are simply doubled for calculating the daily milk amount.

Sampling

In the case of the AT method, a fixed amount of milk is used. Some of the countries analyse separately all the samples from milking robots. A very sophisticated system of sampling is used in Germany and in the Czech Republic where, in some situations mixed samples are used with a proportional amount of milk in each sample. An example of a different approach for sampling comes from the Czech Republic. Sampling in milk recording in the CR (method A4):

- Halved sample (same amount of milk from the morning and evening milking), in the case of A4 when the interval between morning and evening milking is at an interval of 10 – 14 hours
- One-third sample in the case of three milkings per day, the same amount of milk from each milking in cases where the interval between the two milkings is 8 plus/minus 0.5 hours
- One-fourth sample in the case of four milkings per day, if the interval between the two milkings is 6 hours
- In other possible cases in milk recording in cattle, it is necessary to take a proportional sample, i.e. from 1 litre of milk milked a sample of 1 millilitre of milk is taken

Sampling in milk recording in the CR (production for all milkings and alternating sampling, milk production per test day (all milkings) and am/pm samples):

- Interval of 8 hour milkings – 3 milkings per day, sample alternates (one month in the evening and the other month in the morning, etc.), a sample from noon is not taken
- Interval of 11 and 13 hour milkings - 2 milkings per day, a sample is taken in one month from the evening milking and in the other month from the morning, etc.)
- Interval of 10 and 14 hour milkings - 2 milkings per day, a sample is taken in one month from the evening milking and in the other month from the morning, etc.)
- Interval 12 hours – alternating sampling without corrections or adjustments

Identification of samples and animals

The most important methods for sample identification are the position in stand and bar code. Only one country (Germany) uses the position in stand and bar code. Three countries use bar code only, three countries use only the position in stand and are already planning to implement either bar code or RFID. Germany and Poland are planning to implement RFID sample identification in the future.

All countries use official IDs for milk recording purposes. Conventional plastic eartags are used in all countries. RFID is used in the Czech Republic and Germany to a limited extent and bar code is used in Germany, Croatia and in Austria. The farm transponder, an additional method of identification is used in the Czech Republic, Germany, Poland, Austria, Slovakia and Slovenia. Transponders are not used as an additional tool for milk recording in Croatia. Mostly the transponder´s number is part of the dataset and it is registered with the official number. Farms are identified according to EU regulations.

Transport

Five countries in the questionnaire use Bronopol for preserving samples, one country uses Azidiol and Germany uses different sample preservation methods from milk recording organisations (Liquid Bronopol, sodium azide, azidiol and Bronopol+kathon).

There are different options for transporting samples from the herd to the laboratory, as shown in table 6. The Czech Republic uses only one option, while other countries mostly combine different possibilities when transporting samples. In the case of a lorry with refrigerator, the route has established collection points. The appropriate temperature interval ranges from 1 to 8 Celsius in participating countries. The situation is different with regard to the number of laboratories. In some countries laboratories used for milk analyses in milk recording are very sophisticated (e.g. 1 lab in Croatia and 2 labs in the Czech Republic), and other countries rely on regional laboratories (e.g. 14 labs in Germany). There are 4 labs in Poland that only work for milk recording purposes.

Table 6 Transport of samples and sample logistics.

Country	Mail A[1]	Mail B[2]	Lorry[3]	Lorry[4]	Technician[5]
Czech Republic			x		
Germany			x	X	x
Poland	x			X	x
Austria	x		x		x
Slovakia	x 30%		x 70%		
Croatia			x		
Slovenia		x	x		x

1 By mail, without special packaging, at the appropriate temperature
2 By mail, with special packaging, at the appropriate temperature
3 Lorry (truck) with refrigerator
4 Lorry (truck) without refrigerator
5 Technician transports samples directly to the laboratory after milk-recording

Milk-recording quality checks

Countries covered in this analysis very often use external organisations to check the quality of milk recording with a variety of approaches, e.g. the governmental organisation in the Czech Republic (Czech Breeding Inspection), the same in Poland and a private organisation in Austria, which is part of a quality management system that carries out inspections once a year.

A crucial part of quality assurance is regular inspections of technicians, the people responsible for taking milk recording samples. These checks were done by all organisations in this analysis. There are two approaches:

1. A specialized team of auditors (supervisors) carry out the inspections, e.g. in the Czech Republic (Czech Moravian Breeders Corporation, Inc.)
2. Managers of regional offices conduct the inspections, e.g. in Slovenia, the head of milk recording in Germany, the head of the cattle breeding department in Croatia.

Poland combines both approaches. These checks are extensively performed, e.g. in Croatia - a minimum of once a year per farm, in Poland - random checks with the condition that each technician must be checked once a year and monthly checks in Slovenia. These checks are a very important way of guaranteeing the quality of milk recording.

ISO accreditation/certification for different parts of milk recording, identification and breeding value estimation

Slovenia, Germany and Slovakia use ISO standards for identification, milk-recording, data processing, laboratory milk analyses, laboratory DNA analyses and estimation of breeding values. The remaining countries, including the Czech Republic, Poland, Austria and Croatia employ ISO for milk analyses and DNA analyses in laboratories. Austria employs ISO for identification, the Czech Republic partly for milk recording and Poland for data processing. It is evident that it is standard to have ISO accreditation as a minimum requirement in laboratories for adequate milk and DNA analyses.

Verifying the test day results

In verifying the results of milk recording and as a means of quality assurance for the organisations, supervisory controls are carried out at 1% to 10% of the cows or 1% to even 15% of the farms as shown in Table 7. The sample of the farms is either selected at random or leading herds are chosen. In the Czech Republic a specific emphasis is placed on fat content outside the intervals for the creation of the sample, which is a cost effective way of identifying herds and useful for repeated recording.

In Poland, herds are appointed for repeat recording when one trait (e.g. milk kg, fat %, protein %) deviates from the accepted parameter in 25% of cases. The result of this repeat recording must be confirmed by an operator, after analysing the example from the farm. In most countries all cows are included in repeated milking; in Slovakia only selected animals are repeated.

Table 7. Supervisory and repeated test.

	Share of cows	Share of farms	Time between the test day and supervisory control	Animals
Austria	2 %	2 %	12 or 24 hours	all
Czech Republic	1 %	1 %	48 hours (2 days)	all or selected
Germany		2.5% risk based	12 hours (next milking)	All or part of the herd (i.e. feeding group)
Poland		3.2 %	up to 5 days	all or selected[1]
Slovakia	10 %	15 %	the next day	selected
Slovenia	2.5 to 5 %	1 %	12 to 24 hours	all

1 in herds with more than 20 cows, any animals may be chosen

For evaluation of the supervisory control different sets of traits are used. In the Czech Republic, Poland and Slovenia the fat content is included in the evaluation of the results. So Czech herds are allowed to deviate 13% in fat or 15% in milk.

In Poland the record of dubious results for each separate trait (milk kg, fat and protein) within the herd is taken into consideration with a threshold of 25%. But in terms of comparison between current test milking results and the previous ones, there are different thresholds depending on MR method and the trait.

In Slovenia the milk amount may differ by 5% while fat has to be within 0.15%-points and protein even within 0.10%-points. In this respect, both milk solids are related to the average of all dairy cows.

In Austria a deviation in milk kg above 10% leads to action being taken, i.e. an action that leads to a decisive intervention at the location, under conditions where the next milking also needs to be recorded.

In all countries, at the very least, fat measurements or even complete laboratory results (fat, protein and somatic cells) are delivered to the technician and the farmer as a report detailing the supervisory control.

Another effective way to evaluate recording results for solids is a comparison with the bulk tank. From the countries in our report this is mostly done voluntary and for information purposes to satisfy requirements of MROs and farmers, and especially to answer questions regarding different readings.

Technicians – training and certification

In all countries new technicians have to run through an initial training program, following the guidelines of the organisation handbooks. At the end of this program they are certified in the following countries: Austria (partly), Croatia, Germany, Poland, Slovakia and Slovenia.

To maintain performance standards and staff knowledge levels, annual training programs with relevant content are provided. For example, in Austria each MRO holds up to 3 training days per year with theoretical lessons relating to questions regarding milk recording operations, focusing in particular on new service features and reports, changes to recording itself, udder health and feeding. In addition to these regular meetings, the regional manager keeps record of information provided.

A more extensive training scheme is in use in Poland, where the technicians at the beginning of their work must undertake an initial training program and pass the basic exam, verified every 5 years. Additionally they have regular monthly meetings that cover explanations connected with current work, data input, introduction of any modifications and short topical trainings.

Each MRO aims to keep its staff informed to optimum levels, trained to the demands of the recording process and provide additional knowledge to its farmers.

Data processing

The big challenge in data processing is to implement fast, reliable systems, to safeguard data security, not only from the technical side but from the human side too. Therefore it is usual for most countries to carry out anonymous analyses at the laboratory. For instance, currently in the Czech Republic farm data is already being merged with the results from the lab database. But there are no risks as accreditation asks staff to be discreet at all times. Plans are underway to introduce anonymous analysis of the samples. All other MROs merge the collected information in their data processing centre. In these countries the lab only holds the sample ID but not the cow or the farm ID.

Software development for the special needs of milk recording is mainly done by the MROs themselves. In Austria the database is outsourced to a central organisation, which runs and supports all recording organisations together. In short, the methods are adapted to suit each customer. They are developed together with various Austrian and German organisations as a result of the decision made ten years ago to develop the database in cooperation with partner organisations. It reduces development costs and allows maximum flexibility to suit local needs. In Germany the vit calculation centre also covers seven MROs.

Once the recorded figures are entered in the database, several plausibility checks need to be passed. These are done either at the entry level or as a first step of data processing. As in Austria, half of the recordings are carried out using a PDA as a last step in verifying input, with non-plausible information corrected directly on the farm. In Austria, data captured manually (paper) is entered via PC or laptop in the online database, which in turn rejects incorrect entries at the stage of saving information. In this case the data is corrected immediately.

Of course mistakes can occur during data processing, leading to a list of errors that need to be solved. These errors are usually marked with numerical codes and sometimes with comments in the text. These warning reports are sent to the technician, who is responsible for fixing the problem; otherwise the results are excluded from the database.

Additional traits

Carrying the identified milk sample to the laboratory accounts for a large part of milk recording costs. Thus additional analysis brings additional benefit to farmers and enhances the reputation of the MRO. As a possible way of analysing additional traits issued by the lab equipment, some countries simply provide standard results.

An example is provided by the Czech Republic where outside analysis from milk recording shows citric acid and free fatty acids.

Poland provides BHB and acetone for ketosis risk indication (Poland analyses BHB and acetone, but this data is equated to other information in order to calculate the possibility of ketosis risk, so BHB and acetone level data is not presented to the farmer directly). The

freezing point is used internally for checking a sample's quality. In Germany all mentioned analyses are carried out.

In future, some attendants plan to start using additional milk traits like pH for internal sample quality checks (Austria). For SARA, Poland is considering the use of either FFA or citric acid. Slovenia is thinking about introducing FFA, acetone and freezing point.

Delivering results to the farmer

Our farmers want to use recording results to effectively managing their herds. For this we deliver the information as printed reports, as a data file and via web applications. Germany and Slovakia even provide farm management software for their members. In Austria an innovation was implemented last year that provides milk-recording results via a smartphone app for their members.

From a practical point of view, two aspects need to be considered. First, a practical presentation of the results is required to include an overview and detail. For this paper reports or web pages are very useful. In this way the farmer can always see his whole herd. Second, the introduction of smartphone technologies is a promising development for the field. Some Austrian and German MROs have made an app for android and iOS phones available, enabling more interactive results.

Especially for mobile phones and web applications, the possibilities have increased for presenting results and making them available for management decisions. For all MROs, it is essential to provide recording results in the most user-friendly way possible and to simplify the delivery of the information to the herd manager. For this reason mobile phone apps are a welcome addition to the field.

Other services offered by the organisation responsible for milk recording

Some of the organisations responsible for milk recording have diversified their activities and have also become active in other businesses, e.g. milk payments, veterinary drug sales, meat performance recording for dual purpose breeds, feeding advisory groups and others. This could be a very valuable venture, and could bring stability and inject the industry with new profitable business.

Conclusion

All organisations in the regions of Central and Eastern Europe offer services that are tailored to the specific needs and requirements of their particular countries. A sophisticated system of planning exists in all countries, ensuring quality without external influences. There is a trend for automatization in milk-recording and Germany has an inexpensive way of capturing the data of other traits, which is especially evident in Germany.

There is a need to improve consistency among different parts of the ICAR Guidelines, additional information that could be made available on ICAR webpages, including a system verifying results, different lactation calculation methods and milking speeds for automatic milking systems (accuracy and reliability, single protocol showing changes effected in the dataset of the automatic milking systems).

Concerning the real time analyses and its use in milk recording, these results are not accepted. Some of the countries are ready to accept it for official milk recording, but only if error limits are adhered to. Some countries have only small herds and in these cases this approach is expensive.

In the case of electronic milk meters countries follow classical conventional methods (e.g. A4, AT, etc.).

Different approaches are used for sampling; in the case of milking robots some of the countries take one sample, while others take all samples and analyse them separately. Conditions and opinions are not consistent. Germany does not support the approach of using one sample, while other countries have statistical analyses to support such a method. The most sophisticated system of sampling has been implemented in the Czech Republic.

With regard to identification, countries use mostly classical conventional eartags as an additional tool transponder on the farm. The number of transponders, together with official ID parts of the file are processed in the data processing centre.

Different approaches are also in evidence when transporting samples. For example, the Czech Republic has a unique national system that uses a refrigerated lorry with to arrive at the collection centre while other countries use different methods.

All countries implement a sophisticated system of training and quality checks of the work undertaken by sampling technicians. Concerning the repeated tests, the most efficient, cost effective approach uses indicators, which have a connection with the quality of sample taking (e.g. fat in milk).

A similar data processing design, with extensive plausibility checks and similar approaches on how to merge data also exists.

Looking to the future, there is a need to implement new traits for milk recording schemes (BHB, acid citric) and new business (eartag printing, advisory groups and veterinary drug sales in some countries). For future development, there also needs to be a focus on improving the way in which data is delivered to the farmer and a focus on developing new smart phone/tablet technologies.