

Integrated IT Solutions in-between Farm Management Systems and Global Holstein Breeding

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Abstract

An integrated shared data base for I&R, milk recording, A.I. and herdbook minimizes double recording of data, data inconsistencies and costs. Based on a shared integrated data base additional services can be developed that are not possible with the data of just one participant. Precondition for creating these advantages in daily practice is independency and a detailed access logistic for every single user. Whoever brought data into the system should still be owner of the data and data share should require his explicit accordance. These are as well preconditions for the development of supra-national data systems. Modern dairy farms and organizations have need of intelligent integrated and cheap IT solutions. On the long run this is only possible by internationally working data centres that have the power to develop such solutions and keep the costs moderate by sharing them between as many users as possible. On the example of **vit** that has established such a system the advantages and new services are explained. In other countries like the Netherlands or Denmark shared central data bases exists as well but the high number national and international participants from all sectors of cattle breeding may be unique.

Based on new on-farm technologies more and more data are recorded by farmers themselves. To make these data technically available for the breeding sector needs recording and exchange standards. Even more important are incentives for the farmer to share their data. Very effective incentives are extra services from integrated data. The internet technology is the cheap basis for providing modern IT services. The technical aspects/problems are transferred to the experts in the data centres. Farmers and organizations can focus on their actual work. **vit** solutions like NetRind or BAP are good examples for such internet based service systems.

Integrated cattle database

To supply German cattle breeding organizations and dairy farmers with complete information for their breeding and management decisions large integrated data base systems were established already in the seventies covering all data collected by milk recording, herdbook and artificial insemination (A.I.). Complete data on e.g. fertility, culling reasons or calving ease are available in the integrated database already since that time. Nationally and internationally harmonized unique identification and registration (I&R) applications guarantee an optimum linkage of all data.

During the last years the traditional data sources were expanded for new traits and data not originating from milk recording systems, herdbook or A.I. but from the farmer directly or other sources. Detailed health and treatment data from the farmer and/or the veterinarian and hoof trimming data are examples for these new data. For economical across herd comparisons more information about feeding, housing and e.g. milking technics is necessary. Therefore data describing herd environments were added.

As breeding has become an international business national I&R systems had to be harmonized with international regulations. Interbull supports all national data centres with cross reference files to complete and correct pedigree data of foreign animals. That is one of the most important requirement for reliable international genetic evaluations. Interbull is now providing bull proofs for almost all relevant economic traits in dairy cattle breeding and the Interbull breeding values have substituted national breeding values in many decision processes.

Marker selection and in the near future genomic selection including huge amounts of genomic information (microsatellites, SNP) is a new challenge for the evaluation centres in the fields of data storage and genetic evaluations. The same information can be used for an improved ancestry verification or to detect and exclude carriers of genetic defects from breeding programs.

Technical and logistic requirements

In the past computer capacity and access technology were limiting factors for the use of shared data bases. Today the internet technology provides the infrastructure to have access to any data base in the world at any time with low costs.

The challenge today is to guaranty only authorized access and consistency of all data in the system. This will become even more important when farmers and other persons not just receive data, but record directly data for the central data base. Online data recording of e.g. milk kg is already standard in modern milking parlours. With improved sensors for fat, protein and udder health these daily farm data may substitute the traditional supervised milk recording. The direct integration of these farm recorded data offers new possibilities. Unsolved precondition are internationally standardized interfaces and data formats.

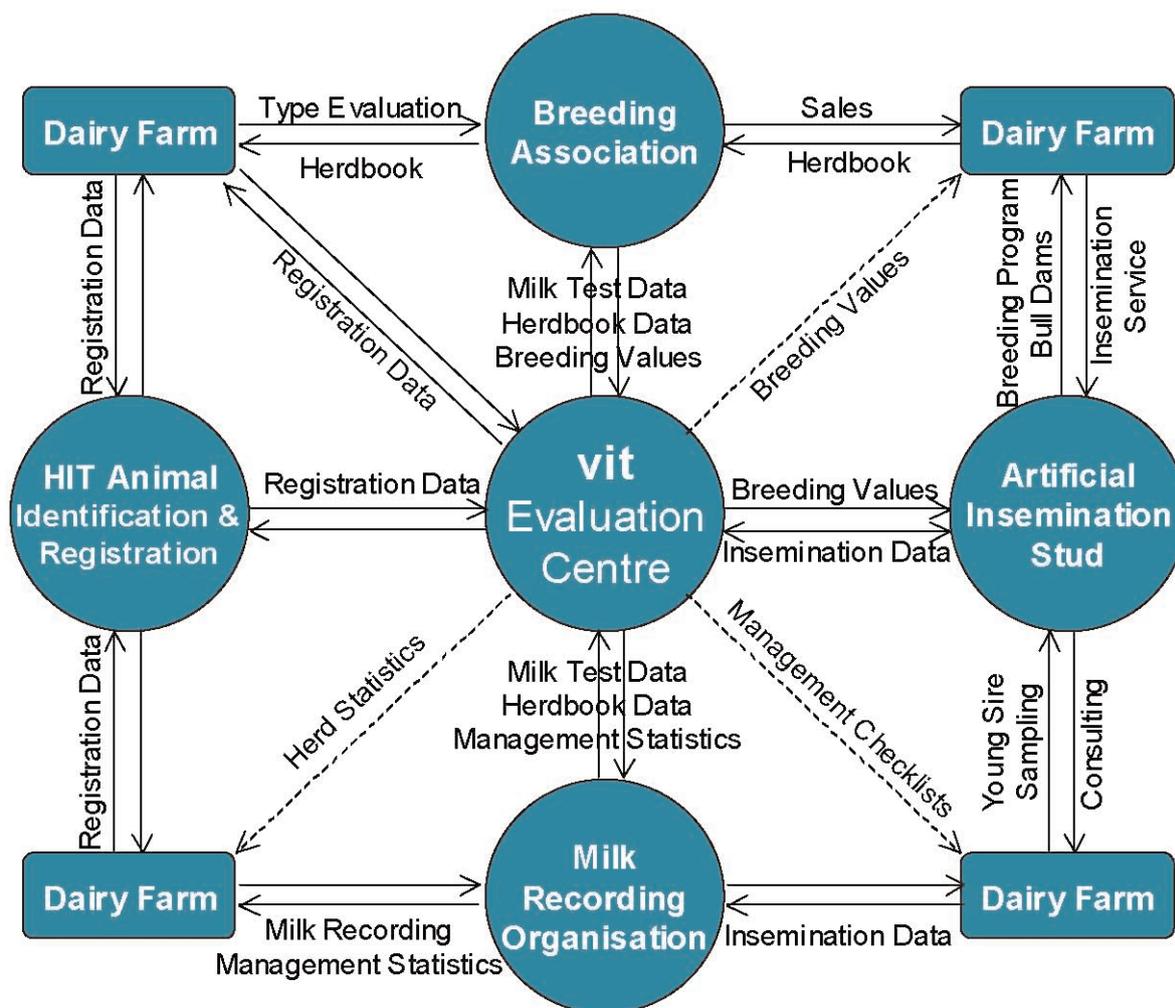
Integrated data base of vit

The computing centre **vit** in Verden/Germany provides I.T. services to German Holstein breeding organizations and their member farms since more than 40 years. In Germany cattle breeding is organized regionally on federal state basis. Milk recording is independent from herdbook and A.I. organizations. The organizations are recognized and supervised by the federal state authorities. To use electronic data processing in cattle breeding the regional milk recording and herdbook organizations organized joint data bases on federal state base since the sixties. **vit** originally was one of these regional data centres. During the nineties **vit** grew into a national cattle data base for dairy breeds because organizations from other federal states "outsourced" data processing to **vit**. Today **vit** keeps the herdbook data for all 14 regional Holstein associations, directly processes the milk recording data for 7 regional associations covering 70% of all milk

recorded Holsteins in Germany and registers 1,8 million 1st inseminations. CONVIS (Luxembourg) participates in all these services. On behalf of all federal state authorities and all dairy breed associations plus Luxembourg and Austria **vit** is responsible for genetic evaluation for the dairy breeds. **vit** as well holds the genome data base for dairy cattle. The routine marker assisted genetic evaluation and the upcoming evaluation of genomic breeding values is a duty of **vit**.

The development of **vit** from a regional data centre to a nationally and internationally working service partner for IT solutions in cattle breeding is based on the advantages a huge integrated data base and the derived services bring for all participants. The development took place in a “free market” and is based on independent clients that want to use the services of an integrated data system because of economical advantages.

*Figure: **vit** runs an integrated cattle data for many different German and international clients and offers integrated IT solutions for farmers and breeding organizations*



Standard services

Identification & Registration (I&R)

According to EU rules the registration of all cattle is compulsory since 1997. Unfortunately the national data base for I&R was not associated to the existing cattle data bases like in **vit**. Like in some other countries the German I&R data base is run by the veterinarian authorities. **vit** is responsible for I&R in one federal state (Lower Saxony). Besides, **vit** provides I&R services on behalf of the responsible institutions in other federal states.

The basic data from the national I&R data base are taken for all animals registered in the **vit** cattle data base (e.g. all Holstein herdbook animals).

Artificial insemination

vit registers all inseminations and natural services in milk recorded herds. Genetic evaluation for fertility – like for all traits with economic importance - on the base of all inseminations is ruled by law for all A.I. bulls. Data delivery should be carried out by the milk recording organizations. Because the majority of the inseminations in Germany is done by employees or commissioners from the A.I. organizations these are already recorded. Most A.I. organizations give the data directly to the central data centre. They benefit from plausibility checks with the integrated data and additional evaluations e.g. on quality of employees.

The reported inseminations/matings are the base for the paternal parentage of all new born calves. Parentage is only accepted in case of logical and distinct pregnancy length.

Milk recording

vit processes directly the milk recording data from 1,5 million cows. The reports after every (monthly) recording are sent by **vit** directly to the farmer on behalf of the recording organization. Different clients want specific services and so **vit** offers a wide range of different lists and outputs. Each organization and farmer can choose from these possibilities according to his needs. The reports include current information from genetic evaluation (breeding values), herd book (e.g. classification results) and artificial insemination (current insemination data).

The yearly reports include integrated information from outside the milk recording system (e.g. average genetic level of stock, used service sires) and comparisons across herds.

Herdbook

All Holstein associations in Germany and Luxembourg are using the integrated data base at **vit**. Based on data from I&R, milk recording and A.I. they add herdbook specific data like classifications and show results. A major role play services associated to sales of herdbook registered animals on auctions, for export and farm-to-farm (e.g. veterinary lists, blueprints for catalogues, ...). Technically possible but not common in Germany is direct access of farmers to the herdbook data at **vit**.

Genetic evaluations

Based on the integrated cattle data base **vit** carries out genetic evaluations for a wide range of traits from milk yield to temperament and fertility not just for Holsteins in Germany but as well for Luxembourg and Austria. All official breeding values for A.I. bulls are available on the homepage of **vit** together with detailed pedigree and performance information of the ancestors. Most evaluation models are animal models and the resulting cow breeding values are passed through to farmers via monthly milk recording reports.

Additional new integrated services

Besides the standard services **vit** has developed new services based on the integrated data especially for farmers but as well for cattle breeding organizations.

Integrated herd management programs

Using a PC based herd management program (HMP) for daily management of larger dairy herds has become standard.

In all HMP's many animal related and general farm data are recorded. These e.g. include heat detection, treatments of animals, feeding information or information on management and housing groups. These information have become very interesting across herds since genetic evaluation for functional traits including health traits has become important. Functional traits are meanwhile included up to 50% in the breeding goals and total merit indices of Holsteins around the world.

In modern milking parlours daily milk yield and other parameters like milkflow rate is recorded automatically. These detailed data are used currently exclusively on farm level. With the improvement of sensors and recording technics it may be possible that on-farm systems give all necessary information for the farmer that is created today by the traditional milk recording system with external milk laboratories. In such a scenario it becomes crucial for the whole breeding sector to have access to the data from HMP's and that these data are recorded using standards. Furthermore the farmer has to have a benefit from exchanging/sharing his data.

Since a long time **vit** offers a PC based HMP that guaranties optimum exchange of data between central data base and farm PC as well as best use of the integrated central data.

To minimize double recording of data, guaranty always current information and direct validation of all data **vit** has developed a new generation of HMP's. As the name NetRind already indicates this HMP is internet based, running at the data centre and therefore directly works with the integrated data. This has important advances for the farmer:

- only internet access as technical requirement,
- always the current version is available, no program updating and care about data storage,
- always working with the current data from the central data base, no up- and download of data,
- online check and consistency with the data in the central data base,
- possibility of online sharing (part of) herd information with others like veterinarian or feed adviser.

Artificial insemination and natural service

Comprehensive mating data are very useful for milk recording, herdbook and genetic evaluation. In Germany most inseminations carried out by the A.I. organizations are transferred directly to the central data base (see "Standard services").

For matings with natural service bulls and the growing percentage of do-it-yourself inseminations other solutions had to be found. A derivative from the internet based NetRind (see above) is such a solution. Farmers can online record/report mating data. Based on the current herd data a cow or heifer is selected from the farm animal list. For the mating bull as well a click in the list of registered A.I. bulls or registered farm owned mating bulls makes identification easy and minimizes reporting errors.

Integrated mating program

One of the most successful integrated IT solutions is the mating program BAP (Bull Advise Program). BAP is internet based and therefore includes the same technical advantages from low system requirements up to automatically data storage as NetRind (see above). The success of BAP is based on extra features of the integrated data base that most other stand alone mating programs do not offer:

- current data on entire farm stock (pedigree, milk recording data, classifications, inseminations, breeding values),
- precise consideration of inbreeding based on complete pedigree data for the relevant cows and bulls,
- mating based on genetics (breeding values) for cows; e.g. for production traits and cell count,
- access to all registered bulls (all bulls included in Interbull evaluations) with permanent updated proofs,
- gives reasons for exclusion of bulls
- based on the individual breeding goal of the farmer.

Because the mating program is a service from the central data base and was developed in cooperation with various organizations the goal is neutral mating advise and not marketing of bulls. The success of BAP with more than 600,000 mating advises last year demonstrates the advantages and need for such an integrated solution. Meanwhile there is interest from many other countries for the system.

Ancestry verification

Ancestry verification by genetic sampling (e.g. for animals born from embryo transfer) needs close cooperation of herdbook association, farmer and genetic laboratory. **vit** has established an internet based service to minimize efforts and mistakes. The sampling of an animal is initialised online. Directly it is checked whether the dam and the reported possible sire(s) are already sampled. A sampling sheet is printed and sent to the farmer already including all necessary data relevant for breeder, veterinarian and laboratory. The laboratory is informed online in advance. When the DNA sample is sent to the laboratory a record with the basic data exists already and the results are directly transferred to the central data base and verified.

This service is used by the herdbook associations for the random ancestry verification of herdbook registered calves, too.

When genomic selection will become a routine tool in breeding programs the importance of an integrated service for genetic sampling will even increase.

Not only farmers benefit from integrated IT solutions but breeding organizations, too.

Breed inspectors programs

For field staff of herdbook associations PDA based mobile information and reporting systems are very helpful. They reduce recoding efforts and minimize recording errors.

For classifiers the mobile program includes all herd data and e.g. the list of randomly selected test bull daughters and herd comparisons for progeny linear classification. A tour planning module is included.

In Germany trading of herdbook registered pedigree animals is a main task of herdbook associations. More than 200,000 sold breeding stock including 75,000 exported animals underline the need for powerful IT tools to support the daily work from selecting marketable animals up to statistical reports for the authorities. To assist field staff buying and selling pedigree animals mobile solutions were developed that give the employees access to the herd data including young stock and heifers. Selected or purchased animals are reported directly into the central data base and the herdbook offices can proceed directly with current data.

International data exchange

Holstein breeding is an international business. International data exchange is especially important for a country like Germany exporting many herdbook registered animals and playing a major role in the international semen business with a test capacity of 1,000 Holstein bulls per year.

vit as genetic evaluation centre manages the data exchange with Interbull and publishes the results on German base. The international breeding values are combined with already existing data (e.g. pedigree information) in the central data base.

Besides breeding values and information on A.I. bulls via Interbull the direct exchange of pedigree and performance data with the main Holstein countries is helpful. Correct identification of all animals is a precondition for successful international data exchange and the integration of foreign data into the national data base. To ensure this **vit** is registering on behalf of the herdbook associations all foreign Holstein animals in Germany. For bulls the base is the Interbull pedigree file. The advantage of central registration is direct access to Interbull cross reference files with verified data from the country of origin.

Conclusion

On the example of **vit** the evident advantages of an integrated data base and new intelligent IT solutions based are presented. To realize these advantages in practice it is a precondition that the service provider is independent from individual interests and all users still have full control on their own data. Good communication and explanation on the offered services is necessary especially to the farmers to get maximum par-

participation. A lot of extra profit can be realized by integrated IT solutions for farmers. The same is for organizations if they cooperate on national level and even more on international level. Today's IT standards and the worldwide access via internet gives us the technical tools to realize maximum benefits from integrated data.