Background

Despite many years of importing European, American, and Australian dairy cattle breeds into Africa and low-income Asian countries and crossing them with the indigenous breeds, there has been limited improvement in milk production and reproductive performance especially in smallholder production systems. The main hindrance has been the absence of established systems for animal identification, registration, and data recording. Matching dairy genetics and the local production environments has been neglected. Although artificial insemination (AI) has been the preferred method for the delivery of genetics, the lack of infrastructure to support the cold-chain based AI delivery has hindered progress.

As a result, the dissemination of improved genetics has remained one sided, focusing on distributing semen and providing breeding services, without effective monitoring of outputs and outcomes. This dependence on the selection programs of the semen exporting countries and lack of monitoring and evaluation makes it difficult for smallholder farmers to access certified improved genetics that are suited to their production systems. Moreover, most developing countries lack the means to assess the performance of imported bulls and their livestock development policies promote genetics that are unsuitable for farmers.

Established in 2016 in Tanzania and Ethiopia before expanding to Kenya, Uganda, Rwanda and Nepal,
the Africa Asia Dairy Genetic Gains (AADGG) program is addressing these daily sector challenges. The program has developed and is promoting a digital data management and storage platform with digital data collection tools, analytics and genotyping strategies for recording herd and animal performance and generating homegrown genomic evaluation and animal rankings.

The efforts have resulted in the creation of the AADGG data platform, a robust, agile, and scalable data ecosystem which interfaces with various databases and provides near to real-time customized and general feedback and services tailored to stakeholders in the dairy value chain.

ADGG Dairy cattle exhibition in Dodoma, Tanzania, 2019.

The AADGG program objectives include:

1. Establishing an animal performance recording system.
2. Using the collected data to develop frameworks to evaluate and select crossbred bulls and cows of superior genetic merit for both artificial insemination (AI) and natural mating.
3. Piloting farmer centric feedback systems that empower farmers to improve dairy productivity.
4. Establishing partnerships between public, private, and non-governmental organization and producers, critical for the funding and expansion of the AADGG data capture and feedback system into a comprehensive regional platform (Ojango et al. 2022).

Design description and capability of ADGG platform

The AADGG platform (Figure 1) has the following components:

- **A database**: Performance and associated data is collected from smallholder farmers, medium- and large-scale private farms, utilizing digital tools such as open data kit (ODK) and mobile applications. This data is then consolidated in the National Dairy Performance Recording Centres (DPRCs) in countries, which oversee the use of the data platforms. The DPRCs host this platform on selected servers, that are the hubs for aggregating data from smallholder farmers via AADGG and other tools and databases. Data management, sharing, validation, and extraction is carried out in these hubs.
• **Data capture**: AADGG has developed and is testing a suite of digital data capture systems, including both online and offline applications and tools such as ODK (Oyieng et al. 2020). The AADGG and iCow (https://icow.co.ke/) platforms facilitate collection of field animal performance data and link it with the information in the DPRCs and digital extension services. In each country a qualified ICT expert supports the country platform and troubleshoots technical issues. In addition, a project tool to support medium- and large-scale dairy farmers (https://portal.adgg.ilri.org/medium-large-scale-farm) enables them to use their mobile phones to collect and submit data to the DPRC and manage it independently. Data from farms are geo-referenced and linked with correlated global weather and environmental data for prediction of genetic merits based on resilience, productivity, and environmental efficiency attributes (Ekine-Dzivenu et al. 2019) for all (imported and homebred) genetics. With this information, farmers can make better choices of dairy genetics, and better match genetics to their current and future production environments.

• **Data summaries**: The platform generates and presents basic statistical summaries of data collected as tables, charts and graphs for reference and monitoring.

• **Data integration from other databases**: The AADGG platform integrates data from sources and formats such as JSON, XML and CSV using a RESTFull API for authentication, processing, and access.

• **Data analysis and feedback**: The collected data is analysed and the results are used to generate feedback for stakeholders in the dairy sector. Farm-level feedback is sent to farmers’ mobile phones through the two (AADGG and iCow) platforms, and information for decision makers is shared as reports, information briefs, and posters.

• **Digital training tools**: E-learning tools that address the management of dairy reproduction, animal health and care of calves in a smallholder dairy enterprise have been developed for interactive learning (see AADGG dairy tool https://m.learn.ink/ilri).

• **User management**: The platform is secure and access to it is open only to authorized personnel and specific/designated persons and activities. For instance, designated individuals at the county level are granted access only to their respective countries’ data. Designated administrators, extension officers, decision makers and farmers, can access more comprehensive insights from the platform, including the customized auto-generated summaries. This allows the platform managers to not only interact with, but also to know what information the policy and regulatory decisions and choices are needed and how they are used. For example, summaries are available for animal categories (mature cows, heifers, calves, and bulls), specific breeds within each region

**Figure 1**: The structure of ADGG data platform.
of a country, and the number of recorded AI services each month. Only registered AI service providers can access the AI data, however. Additionally, the platform’s country landing pages (AADGG Data Platform https://portal.adgg.ilri.org/) provide real-time data summaries and a map of data collection sites.

**Scalability requirements:** The AADGG platform can be adapted for other livestock species with simple adjustments. However, its successful use requires oversight from ICT experts and policy support for data on animal identification and registration, database hosting and management, data sharing, and a robust institutional framework and organizational structure for the platform.

**References**


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