Australia - Indonesia Cattle Genetics Project

Final Report

Activity ID	4-EH8K7IS
MLA Project ID	I.GNT.2001
Activity Title	Australia - Indonesia Local Cattle Genetics Project
Organisation Name	Meat & Livestock Australia Limited
Program Name	Indonesia-Australia Red Meat & Cattle Partnership

Executive Summary

In the last few decades Indonesia has made considerable investment and progress in improving the genetic quality of its imported and local cattle breeds. Indonesia identified challenges in the genetic improvement of local and native breeds, such as Peranakan Ongole (PO), Madura, Bali Cattle Breed, etc, as there has not been any systematic or large-scale effort to collectively manage these genetic improvement and breeding programs. More optimal pathways and programs needed to be developed, along with more robust data collection, recording and data management, to generate a sustained supply of quality replacement stock and improve the genetic make-up of native cattle.

The local cattle genetics improvement project aims to increase the Government of Indonesia (GoI) Ministry of Agriculture's capacity to manage its local seedstock breeding programs in the pre-designated breeding areas (*Wilsumbit*). The project would support improvements to the current breeding management system, building personnel capabilities and tools to support ongoing program delivery.

The project links with Indonesia's priority objectives of improving its food security through increasing cattle population as well as enhancing the skills, knowledge, and capabilities of its human resources in the agriculture sector. The project would complement and support MoA's national Cattle Breeding and Artificial Insemination Program (SIKOMANDAN). The project is also aligned with Australia's economic development objectives under the Department of Foreign Affairs and Trade (DFAT) Indonesia country strategy, the Indonesia-Australia Comprehensive Economic Partnership (IA-CEPA) and the Indonesia Australia Partnership on Food Security in the Red Meat and Cattle Sector (the Partnership).

Project activities were largely focused on strengthening key government officials' knowledge and skills on the design, delivery and evaluation of local livestock breeding programs. Other elements that the project covered included principles around animal husbandry/production practices, database management, genetics evaluation and animal health. Activities were delivered by both Australian and Indonesian experts remotely (particularly during COVID-19 Pandemic period) and in-person to ensure that learnings would be applicable to the Indonesian context.

Stakeholder consultations, workshops and information sharing

In the first year of the project, multiple workshops and consultations were held to gain in-depth understanding of Indonesia government's breeding policies and programs. Key aspects discussed included the breeding systems, structures and regulatory framework in Indonesia versus Australia; role of government versus private sector & smallholders in breeding programs and genetics; constraints around sustaining breeding and genetic programs, e.g. performance testing, database management, etc. These discussions help to sharpen the project focus areas and informed the design of the genetics training program.

Personnel training – breeding workshop short course

University of New England successfully delivered the 12-week Genetics Training Program to MoA Breeding Directorate and regional technical units – breeding centres (UPTs). The webinar sessions were consistently well-attended by around 55 -70 participants each time. In total 99 participants completed the short course, culminating in the virtual graduation workshop at the end of November 2021. Participants worked on case studies and designed breeding programs that can be tested and implemented in their respective workplaces. There were extended discussions around defining

breeding objectives, investments in genetic testing and data collection systems. Comparisons were made between Indonesia, Australia and other countries' production structures, livestock programs and roles of government versus private.

Further capacity building and information sharing – seminars & site visits

Topics included in the formal and informal sharing of information and knowledge included:

- Symposiums on Indonesia Breeding Systems, Genetic and Reproductive Technologies
- Sharing of Australia's industry structures, breeding systems, livestock data and cattle production resources – manuals, factsheets, guidelines, etc.
- Indonesia Cattle Corporate Village Program initiatives – informal discussions around import plans and breeder management
- Seminars on Indonesia livestock identification system IDENTIK and Australia's National Livestock Identification system NLIS.

Overall, activities were delivered as per agreed work plan. From a technical perspective, through the breeding & genetics training workshops, the project has been successful in drawing out the challenges and opportunities in Indonesia breeding and genetic enhancement programs. There is strong understanding of the importance of clearly defining breeding objectives, data management and program evaluation. The benefits of using locally-adapted livestock and protecting local heritage breeds were reinforced, and this is made more critical with the recent disease incursions. Government officials are realistic about the level and scale of change that they can effect through their breeding centres, and within the scope of the project it had not been possible to include greater participation from farmer groups or associations.

From a policy perspective, key government officials gained a good understanding of the differences between Indonesia and Australia's livestock systems and organisational structures, including northern vs southern production systems, data management and industry body investments, role of governments vs private enterprises in livestock management, etc. With the recent exotic animal disease outbreaks, the project has also been an effective conduit of information exchange on issues such as biosecurity, livestock identification and traceability. It would indeed be beneficial to reinforce the learnings with on-ground supply chain study tour in Australia to exchange information on best-practice cattle breeding, including in the context of biosecurity.

By and large, the project did manage to effectively share technical knowledge and information, as well as effect some operational change. It is however too early to determine the longer-term impact and sustainability. From a systems perspective, more focused effort and resources would be needed to set up a holistic and sustainable data collection and genetic improvement program, and some change in the mindset of the breeding centres would be required. Given the differences between Australia and Indonesia systems, embedding the learnings and adoption would happen more naturally with greater involvement of local academia and experts.

Encouragingly, some of the suggestions put forward by Indonesia counterparts such as inclusion of cooperative/farmer groups and replicating activities to small ruminants have now been supported by IA-RMCP. Recent exotic animal health disease outbreaks in Indonesia have also changed MoA's priorities in the short term. Breeding centres would benefit from getting additional support around biosecurity and animal health management – this request was previously put forward by Breeding Directorate and can be potentially explored under other initiatives such as Australia Indonesia-Health Security Partnership or FAO-managed programs on Disease Response Capacity. It is anticipated that these areas of cooperation can be further explored under the Agriculture MoU between DAFF and MoA.

Contents

Background and purpose

In the last few decades Indonesia has made considerable investment and progress in improving the genetic quality of its imported and local cattle breeds. This has been achieved through artificial insemination (AI) technology as well as the importation of high-quality bulls and cows for non-native cattle. Improving the genetic quality of imported breeds have been relatively straightforward given the substantive pedigree and lineage information, as well as Estimated Breeding Values recorded in established international breeding databases, e.g. BREEDPLAN. Indonesia identified challenges in the genetic improvement of local and native breeds, such as Peranakan Ongole (PO), Madura, Bali Cattle Breed, etc, as there has not been any systematic or large-scale effort to collectively manage these genetic improvement and breeding programs. Given the non-commercial nature of smallholder breeders, Indonesia government breeding centres have the role and function of providing high quality nucleus and replacement animals for the farmers in pre-designated breeding areas. More optimal pathways and programs need to be developed, along with more robust data collection, recording and data management, to generate a sustained supply of quality replacement stock and improve the genetic make-up of native cattle.

Australia has considerable experience in improving the genetic quality of livestock, especially in cattle. There have been several coordinated animal husbandry programs between Indonesia and Australia relating to the improvement of animal health and nutrition. The inclusion of a program of genetic improvement would facilitate valuable bilateral cooperation in the livestock sector and contribute to Indonesia's food security aspirations.

At the 22nd meeting of the Working Group on Agriculture, Food and Forestry (WGAFFC), Indonesia and Australia agreed to develop a bilateral initiative around improving Indonesia's local cattle genetics. MLA obtained the grant from the Australian Department of Agriculture, Fisheries and Forestry (DAFF previously DAWE) to manage and deliver this Activity in cooperation with the Government of Indonesia Ministry of Agriculture (MoA) Breeding Directorate.

Following technical consultations with the Directorate General of Livestock and Animal Health Services (DGLAHS), the consensus was to undertake a technical cooperation project to increase the MoA's capacity to manage its local seedstock breeding programs in the pre-designated breeding areas or Wilsumbit. The project would support improvements to the current breeding management system, building personnel capabilities and tools to support ongoing program delivery.

The project links with Indonesia's priority objectives of improving its food security through increasing cattle population as well as enhancing the skills, knowledge, and capabilities of its human resources in the agriculture sector. The project would complement and support MoA's national Cattle Breeding and Artificial Insemination Program (SIKOMANDAN). The project is also aligned with Australia's economic development objectives under the Department of Foreign Affairs and Trade (DFAT) Indonesia country strategy, the Indonesia-Australia Comprehensive Economic Partnership (IA-CEPA) and the Indonesia Australia Partnership on Food Security in the Red Meat and Cattle Sector (the Partnership).

Project Objectives

The local cattle genetics improvement project aims to increase the Government of Indonesia (GoI) Ministry of Agriculture's capacity to manage its local seedstock breeding programs in the pre-designated Wilsumbit. The project would support improvements to the current breeding management system, building personnel capabilities and tools to support ongoing program delivery.

The key activities would involve:
- stakeholder workshops to clarify GoI's breeding objectives
- consultation and information sharing with the Indonesia Government breeding program, with emphasis on local cattle genetics evaluation and improvement
- training of personnel to build skills in implementing successful breeding programs; and
- further capacity building and information sharing to advance capabilities in breeding and data management, including through delivery of a seminar and site visits to breeding centres by Australian experts to Indonesia

The project fits within the MoA Breeding Directorate's core role and function of setting Indonesia's breeding direction and improving the genetic quality and productive capacity of the Indonesia's breeding herd.

Project Activities - Approach

Project Activities are targeted at MoA Breeding Directorate and DGLAHS' Technical Units (Breeding Centres). Activity and implementation plans were developed, discussed and endorsed by MoA Breeding Directorate.

Project activities were largely focused on strengthening key government officials' knowledge and skills on the design, delivery and evaluation of local livestock breeding programs. Other elements that the project covered included principles around animal husbandry/production practices, database management, genetics evaluation and animal health. Project activities were designed to be agile and flexible to meet MoA Breeding Directorate needs. Requests such as information sharing on traceability/livestock identification systems, biosecurity and reproduction technologies were also incorporated. The intention is that upon the completion of the project, core MoA Breeding Directorate officials with responsibilities for policy development and decision making, comprehends the potential and understands the necessary actions required to effectively build Indonesia's livestock programs, particularly in relation to enhancing local livestock performance and productivity.

Activities were delivered by both Australian and Indonesian experts remotely (particularly during COVID-19 Pandemic period) and in-person to ensure that learnings would be applicable to the Indonesian context.

Activities were also complementary to the broader Australia-Indonesia government technical cooperation programs, such as the IA-RMCP and AIHSP.

Project Activities – Results Summary

Stakeholder consultations, workshops and information sharing

The project adopted a flexible, agile and consultative approach throughout, with various formal and informal consultations held to inform project activities. Stakeholders were involved in activity workplan development, reviews and refinements.

In the first year of the project, multiple workshops and consultations were held to gain in-depth understanding of Indonesia government's breeding policies and programs.

Key aspects discussed included

- the breeding systems, structures and regulatory framework in Indonesia versus Australia
- purpose of improving local cattle genetics in Indonesia; clarifying the breeding objectives – e.g. the need to establish the value proposition of improving genetic quality for heritage purposes vs beef production
- identifying opportunities around standardising selection criteria, data parameters and certification of local cattle so that there is a price premium for high-quality seedstock
- role of government versus private sector & smallholders in breeding programs and genetics, e.g. in complementing government breeding centre efforts, how to encourage local breed associations and private entities to make the appropriate selections to improve reproduction performance, carcass yield and/or maintain purity of local breeds
- outlining constraints around sustaining breeding and genetic programs, e.g. performance testing, database management, etc.

The two areas of focus for this project were narrowed down to:

- training and technical support on the design/development of a structured breeding program with emphasis on local cattle genetics evaluation and improvement
- supporting the development of a structured approach to data collection that would feed into Indonesia's genetics database(s) to record the progress of the breeding program

To maximise impact and sustainability, it was agreed that the Activity would focus on building the capabilities of core government officials within DGLAHS and up to two pilot technical units (UPTs). The final amended activity plan is included in **Attachment 1**.

As part of the development of the training package, various meetings and consultations were held over a five-month period mainly with the core Breeding Directorate group and experts to ensure that the training is relevant and fit-for-purpose.

Post-delivery of training, there were scope refinements in relation to the development of data collection tools and databases due to DGLAHS resource reallocation. It was agreed that this Project would prioritise the outputs to be around enhancing UPTs' skills and knowledge around designing and implementing local breeding programs, before progressing any work on improving database infrastructure. Against some of the challenging conditions of COVID-19 Pandemic and exotic animal disease outbreaks (particularly FMD and LSD), project activities comprised mainly of personnel training and expert sharing of knowledge through seminars and select site visits.

Personnel training – breeding workshop short course

University of New England successfully delivered the 12-week Genetics Training Program to MoA Breeding Directorate and regional technical units – breeding centres (UPTs). The webinar sessions were consistently well-attended by around 55 -70 participants each time. In total 99 participants completed the short course, culminating in the virtual graduation workshop at the end of November 2021. Training sessions were well-subscribed, with active online participation despite the virtual remote delivery and language differences.

In discussion with Breeding Directorate, UNE led the development of the interactive breeding and genetics training package (see **Table 1**). The package optimised UNE expertise in design of breeding programs and the local Indonesian expertise in local production systems and genetic resources. Case studies were used to acknowledge local difference in infrastructure, production systems and breeding objectives, but with the aim of guiding the development of an overall vision for Indonesia breeding program, with a plan for implementation to guide future investment in data recording, genetic evaluation, and selection and mating strategies.

Participants worked on case studies and designed breeding programs that can be tested and implemented in their respective workplaces. There were extended discussions around defining breeding objectives, investments in genetic testing and data collection systems.

Comparisons were made between Indonesia, Australia and other countries' production structures, livestock programs and roles of government versus private. There remained a strong interest in exploring the development of a cattle identification system like Australia's National Livestock Identification System.

Table 1. Breeding and genetics training summary

Session no and Topics covered	Discussion/Remarks/No of attendees
Introduction and Breeding Objectives	
<u>Session 1</u> Training Objectives; Overview of Genetic Improvement Strategies – presentation	Presentation and discussion: - Breeding program principles and theory - Understanding breeding goals, value and structure - Developing breeding program design - Roles of smallholders vs breeding institutions - Breeding traits and selection criteria - Determining ideal breeding objectives – who decides 104 participants
<u>Session 2</u> Breeding Objectives	Presentation: - Multiple Trait Breeding Objectives and Selection - Breeding objective models (excel) - Selection Index; formulas Case Study development: Describe for your breeding program the breeding objectives - Identify the traits to be considered - Whether these traits will be measured or informed by - correlated traits - Is the SNI suitable as a breeding objective? - Other considerations about breeding objectives

Session no and Topics covered	Discussion/Remarks/No of attendees
	77 participants divided into five groups that would work on specific case studies.
Session 3 Case studies	Presenting case studies - Improving Local Dairy Cattle Milk Production (quantity and quality) - Saneen goat milk production improvement – BBV Baturaden - Genetic Improvement for Bali Beef Cattle - Breeding Improvement for Sapi PO Kebuman 70 participants
Genetic Evaluation	
Session 4 Principles of Estimation of Breeding Values, Selection Index and Linear Models)	Presentation and discussion - Introduction to Genetic Evaluation; optimising genetic improvement - Optimising genetic improvmenet through clear definitions of Breeding Objectives + Selection criteria - Animal recording (Data) and animal management - Estimated Breeding Values (EBV) and Best Linear Unbiased Prediction (BLUP) - Trait measurement and recording performance - Progeny testing – managing selection with minimal data - Data management in Australia – role of private, government, breed societies 78 participants
Session 5 Estimation of Genetic Parameters and EBVs	Presentation - Genetic parameters; variance components - Evaluation of Multiple Traits - Genetic evaluation models (Excel); BLUP evaluation - Mechanics of breeding program design - Recording of performance; estimating heritability 67 participants
Session 6 Practical data recording and management (ABRI)	Presentation and discussion: - ABRI and Breedplan overview - Setting up Breeding Program- Practical Considerations - Recording Performance - Differences between Breedplan and NLIS - Differences between seedstock and other producers 66 participants
Session 7 Case Studies	Presenting case studies - How many records do we need to estimate genetic parameters? - How important is it to have an accurate estimation of heritability? And of correlation? - What are two main parameters that determine the accuracy of estimating heritability? 55 participants
Achieving genetic gain by multi trait selection	
Session 8	Presentation and discussion

Session no and Topics covered	Discussion/Remarks/No of attendees
Optimising Multiple Trait Selection	- Manipulating multiple trait response: economic weight, biology, accuracy of EBVs - Trait selection and inclusion in selection index - Swine Breeding program example 70 participants
Session 9 Case Studies	Presenting case studies - (con'td) from Session 7 - Multiple trait selection examples 60 participants
Breeding Programs	
Session 10 Breeding Program Design Principles (structure, reproductive technologies, balancing inbreeding and genetic gain)	Presentation and discussion - DNA technologies in animal breeding - Genomic selection and building reference population - Genetic gain progress - Government role in genomic selection 57 participants
Session 11 Role of genomics and genomic selection Crossbreeding	Presentation and discussion - DNA and genetic markers - Genomic Prediction and Selection - Building a reference population Presenting case studies - Aceh cattle breeding program design - Swine Breeding Program - Madura Cattle Breeding Program 60 participants
Session 12 Case studies	Presenting case studies (con't) - AI and Embryo centre – Belgian Blue X program - Pesisir Cattle Breeding Program and genetic improvement 54 participants

Further capacity building and information sharing – seminars & site visits

The project activities remained adaptive given the evolving operational environment during 2020-2023. Despite the challenges, a constant value has been the level of engagement and information sharing between Indonesia and Australia.

Topics included in the formal and informal sharing of information and knowledge included:

- Symposiums on Indonesia Breeding Systems, Genetic and Reproductive Technologies
- Sharing of Australia's industry structures, breeding systems, livestock data and cattle production resources – manuals, factsheets, guidelines, etc.
- Indonesia Cattle Corporate Village Program initiatives – informal discussions around import plans and breeder management
- Seminar on Australia's National Livestock Identification system
- Participation in the seminar on Indonesia's livestock identification IDENTIK system

- Information sharing on the Indonesia Biosecurity Project and discussions around options to improving biosecurity measures for priority breeding centre
- Regular updates on Indonesia-Australia initiatives, including RMCP and other MLA activities

UNE experts also participated in the RMCP semen standards seminar and site visits.

Although the seminar mainly focused on breeding technologies such as artificial insemination and semen collection and embryo technologies, some parts of the program were dedicated to selection and genetic improvement. The UNE team focused on the main part of starting up and running genetic improvement programs. Key observations from the August 2023 seminar and sites visits were:

- **Collect data to assess the value of imported temperate breeds compared to local breeds.**

Continued dissemination through AI centres of imported bulls will increase the concentration of temperate cattle genetics in Indonesia. This might not be a beneficial development for the Indonesian cattle population as it is unknown how well they will adapt to the tropical environment, with stressors such as ticks and low nutrition, which could impact reproductive performance and growth. Collecting performance data (e.g. growth and reproduction) of the different cattle breeds used within Indonesia will help to identify such problems, and also help understand the relative value of the various imported breeds, as well as their value relative to the local breeds.

- **Consider improving local breeds through selection in a nucleus herd.**

Local breeds are well-adapted to the Indonesian environment. The productivity of these breeds could be improved through a selective breeding program that uses a breeding objective relevant to Indonesian farmers. The progress made within the nucleus could be disseminated through the artificial insemination facilities. Ideally, performance of local breeds could be compared with progeny of imported breed to assess their relative merit.

- **Select on Estimated Breeding Values (EBVs) that are important to Indonesian farmers.**

From previous discussions, EBVs related to productivity (e.g., growth, milk production, reproduction) were most important for Indonesian farmers. Therefore, it is important to import bulls which have EBVs that meet these goals.

It is also important to consider traits that are correlated to the objective. For example, selection on higher growth may also increase the birth weight of calves. This could lead to dystocia, particularly when mated across smaller local cattle breeds. Therefore, one should consider all of the EBVs which may impact the farming system.

- **Identify the "trait codes" for each EBV when buying bulls.**

There was some confusion around the abbreviations used to represent the traits in the EBV tables. Many of the breed society websites have information on how to interpret the EBVs for the different traits.

Full report from the breeding & genetics short course and site visits are included in **Attachment 2**.

Discussion

Overall, activities were delivered as per agreed work plan. There was strong interest and continued engagement from Breeding Directorate core staff members throughout – this set a positive tone for the other breeding centre UPTs and participants. Technical and policy discussions form part of the knowledge-sharing and information exchange between Indonesia and Australian experts, and the project has paved the way for further interactions on other topics.

Based on end-of-project survey results (47 respondents from Breeding Directorate and UPT breeding centres),

- project activities have been beneficial, with 100% participants regularly using the information in their workplace.
- There is moderate uptake and adoption of breeding & genetic course materials with positive changes being observed in their workplace (>85% reported moderate and large changes).
- Around 85% participants felt that the project activities have driven change in perception, attitude or process in their program planning and delivery.
- Respondents are also of the option that information from project activity has helped to inform policy discussions and contributed to policy and regulations review.

Participants' key feedback and suggestions included

- Project activities were largely carried online. Conducting more offline and on-site activities to make the trainings more grounded and applicable.
- Interest in study tour and field visit to Australia to further understand non-government investment in genetics enhancement, functions of breed societies.
- Development of specialised application or genetic databases to support breeding & genetics improvement programs
- Expanding or replicating activities to small ruminants (sheep and goats)
- Workshops/seminars: Inclusion of local breed societies or associations, progressive cooperatives or smallholder farmer groups
- UNE team only had the opportunity to undertake short site visit to two breeding centres. More pilots across *wilsumbit* or breeding centres can be considered on a rotational basis so that experts can provide ongoing technical advice on various breeding/genetics improvement programs.

From a technical perspective, through the breeding & genetics training workshops, the project has been successful in drawing out the challenges and opportunities in Indonesia breeding and genetic enhancement programs. There is strong understanding of the importance of clearly defining breeding objectives, data management and program evaluation. The benefits of using locally-adapted livestock and protecting local heritage breeds were reinforced, and this is made more critical with the recent disease incursions. Government officials are realistic about the level and scale of change that they can effect through their breeding centres, and within the scope of the project it had not been possible to include greater participation from farmer groups or associations.

From a policy perspective, key government officials gained a good understanding of the differences between Indonesia and Australia's livestock systems and organisational structures, including northern vs southern production systems, data management and industry body investments, role of governments vs private enterprises in livestock management, etc. With the recent exotic animal disease outbreaks, the project has also been an effective conduit of information exchange on issues

such as biosecurity, livestock identification and traceability. It would indeed be beneficial to reinforce the learnings with on-ground supply chain study tour in Australia* to exchange information on best-practice cattle breeding, including in the context of biosecurity.

Due to an administrative issue there was not the opportunity for Indonesian government representatives to visit Australia.

Conclusions/Recommendations

By and large, the project does manage to effectively share technical knowledge and information, as well as effect some operational change. It is however too early to determine the longer-term impact and sustainability. From a systems perspective, more focused effort and resources would be needed to set up a holistic and sustainable data collection and genetic improvement program, and some change in the mindset of the breeding centres would be required. Given the differences between Australia and Indonesia systems, embedding the learnings and adoption would happen more naturally with greater involvement of local academia and experts.

Encouragingly, some of the suggestions put forward by Indonesia counterparts such as inclusion of cooperative/farmer groups and replicating activities to small ruminants have now been supported by IA-RMCP. Recent exotic animal health disease outbreaks in Indonesia have also changed MoA's priorities in the short term. Breeding centres would benefit from getting additional support around biosecurity and animal health management – this request was previously put forward by Breeding Directorate and can be potentially explored under other initiatives such as Australia Indonesia-Health Security Partnership or FAO-managed programs on Disease Response Capacity.

In spite of the challenging operating environment with pandemic and animal disease outbreaks, the Indonesia Cattle Genetics Improvement project has been successful in fostering deeper understanding of Indonesia and Australia livestock production and breeding systems, as well as creating stronger engagement between Indonesia and Australia technical experts, government officials and academics. With this network in place, there would be long-term benefits of using this platform to enhance the Indonesia-Australia technical cooperation and collaboration not only in the breeding and genetics space, but also into other areas of mutual interests such as data management, livestock identification and biosecurity. It is anticipated that these areas of cooperation can be further explored under the Agriculture MoU between DAFF and MoA.

Budget Expenditure

Grant value: AUD 192,000 GST inclusive

Expenditure breakdown (GST Exclusive) per October 2023

Meetings and consultations	AUD 103,500
Workshops and facilitation	AUD 26,380.01
Research and analysis	AUD 7,641.91
Total	AUD 137,521.92

Attachment

Attachment 1. Amended Workplan Status Summary

Attachment 2. Final Technical Project Report UNE