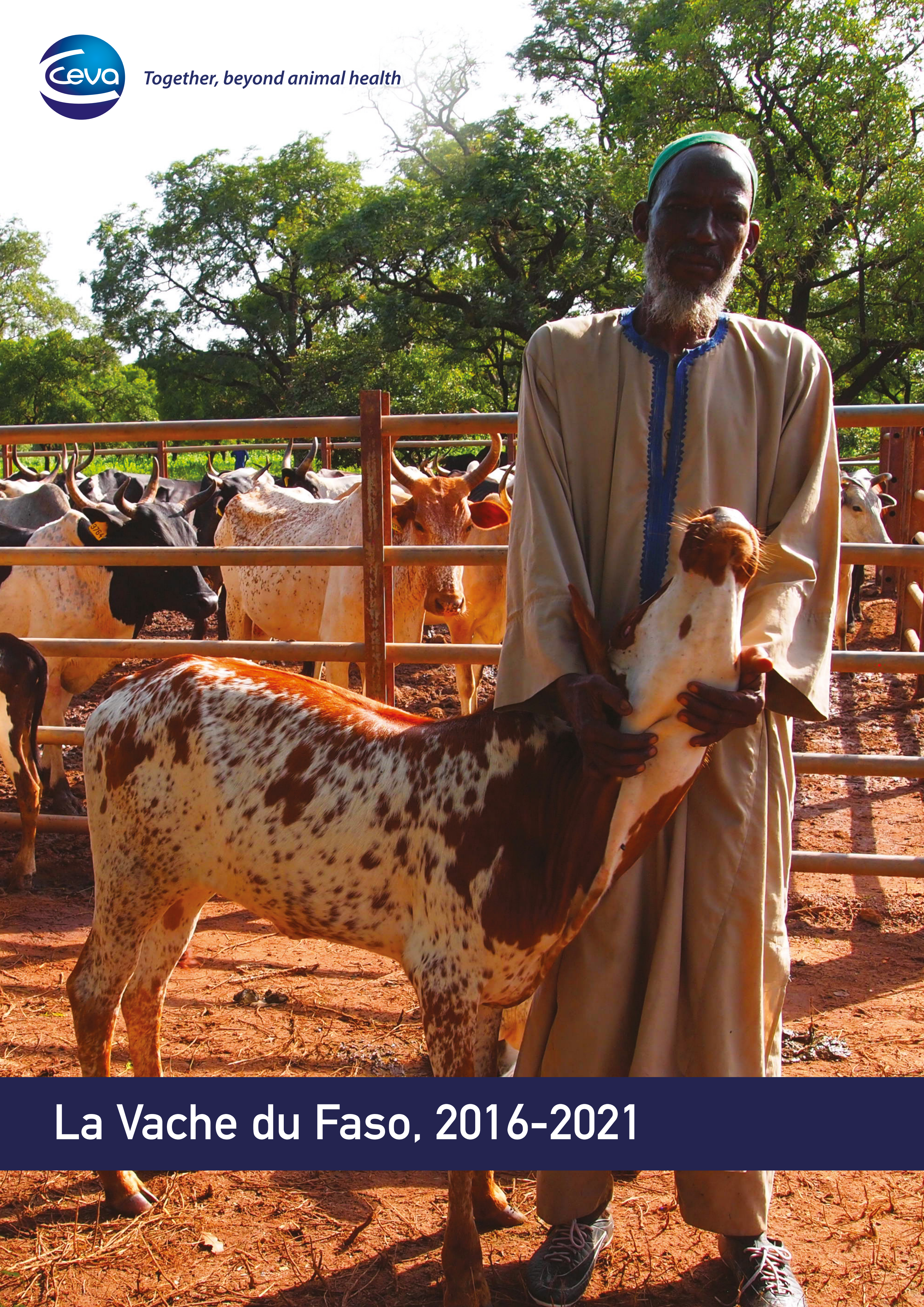
Together, beyond animal health



La Vache du Faso, 2016-2021

improving local dairy cattle genetic through crossbreeding...

La Vache du Faso

With support from :

BILL & MELINDA GATES foundation

“*Vache du Faso was part of a broader investment in which we partnered with Ceva to develop sustainable and scalable models for delivery of livestock inputs and services to small scale producers (SSPs) in sub-Saharan Africa (SSA). Improving animal health outcomes is crucial for the success of any genetic improvement strategy that’s why we are excited to see a leading animal health company like Ceva adopting such an integrated approach and are fully committed towards improving livestock productivity in SSA. Beyond the direct impact achieved during this project, Ceva has generated valuable insights about the supply and demand patterns of the animal genetics market in SSA which impact the affordability of services to SSPs and their willingness to pay.*”

Obai Khalifa - Senior Program Officer - Livestock group BMGF

“*CIRDES was a partner in the project «Vache du Faso» which aimed at improving milk production for the food and nutritional security of the populations. We remain available for future collaborations with CEVA Santé Animale in the development of animal health and production in our region.*”

CIRDES

“*It was a great honor to lead the local team of this project. Its success was based on synchronized minds and actions, and the many awareness meetings for farmers. I thank both local and international teams without whose efforts and professionalism we wouldn’t have achieved these results.*”

Dr Abdou Labo- Local Project Manager Vache du faso

“*The Vache du Faso initiative was a great technical and human adventure! Farmers were very open to changing their practices, attracted by the opportunity to get more productive animals. As in many other countries, “the cows rise farmers up” and drive their development. It is a great satisfaction to know that the animals born from this initiative will still be there in 10 years producing more than their siblings for the benefit of farmers.*”

Guy Charbonnier - Cattle Reproduction Senior Expert - Reprotech

“*This project shows that with the right technology and know-how artificial insemination results in subtropical climates can reach the success levels obtained in Europe, which has been of great value to the pastoralists in the wider region of Bobo Dioulasso as they continue to benefit from the improved milk production capacity of the crossbreeds born as a result of this initiative.*”

Dr Marie Ducrotoy - Senior Manager Development Projects and Partnerships

“*Local dairy production covers but a small part of demand in milk in most Sub-Saharan countries. The ‘Vache du Faso’ initiative has operationally demonstrated, thanks to rigorous monitoring and accurate evaluation, that crossbred heifers could be produced locally with the necessary investments, time commitment and buy in of local actors.*”

Dr Pierre Marie Borne - Programme Director Ceva Santé Animale

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Executive summary

Beginning in 2016 and lasting 3 years, the Vache du Faso (VdF) project – funded by the Bill & Melinda Gates Foundation and managed by Ceva - aimed to improve milk production in Burkina Faso. It planned to achieve this by crossbreeding hardy but low yielding local zebu cows with one of two French dairy breeds to produce productive crossbred dairy cows that were well adapted to the harsh local context.

The initial objective was to produce 2,400 first-generation crossbred (F1) calves (1,200 females and 1,200 males) from 5,000 local zebu cows through artificial insemination (AI) using imported frozen semen obtained from carefully chosen exotic bulls in France.

It is envisaged that when mature these crossbred cows will produce six-times as much milk as unimproved local cows. Currently, Burkina Faso is highly dependent on imported milk powder to meet local demand. Two traditional French dual-purpose breeds, the Tarentaise and the Montbéliarde were chosen to provide the semen for AI. This was based on their hardiness and ability to cope with the high temperatures, thrive on poor-quality feed and trek to access distant pastures, all of which are features of the Burkina Faso context.

In Burkina Faso and similar tropical countries, local zebu cows rarely cycle (so they do not ovulate) and heat detection is difficult. In these conditions, fixed-time AI is considered to be appropriate for breeding programs. This requires that a full hormonal procedure is used to allow synchronized ovarian cycles to be created in a group of animals so they can all be inseminated at the same time without the need to detect whether the cows are on heat.

The genetic strategy for the project was to stabilize the F2 and subsequent generations at 50% local zebu and 50% exotic dairy breeds to ensure the hardy characteristics of the local cattle was retained. To avoid inbreeding and uncontrolled breeding, especially dilution of the genetics of local zebu, crossbred males not required for breeding were to be castrated.

For the VdF project, both transhumant and more settled peri-urban farmers were required to present their best cows that met the project's criteria for AI, including being less than 10 years of age, with no heifers and no history of calving difficulties. After confirming they were not pregnant, most cows received a short, 8-day hormonal protocol prior to fixed-time AI, all at no cost to the farmer. Pregnancy diagnosis was performed at 42 days post-AI using mobile ultrasound equipment and of those cows found not to be pregnant, 50% of the best cows were subject to a second AI procedure. On average each cow underwent 1.26 inseminations. Cows also received a comprehensive package of preventive animal health treatments.

There was a shortage of experienced AI technicians in the country so AI technicians involved in the project received ongoing training and support from experts from France who had experience of managing cattle reproduction in sub-Saharan Africa.

Based on data recorded by the project team and also corrections made to the data to accommodate sources of error, especially underreporting of calves by the farmers, it is estimated that the project resulted in 5,479 cows being inseminated (exceeding the target of 5,000) leading to 2,242 pregnancies, 1,572 calvings with a 5% twinning rate and 1,655 crossbred calves surviving to one month of age. This is equivalent to a 34% conception rate (close to the project's target of 35%) and a 30% loss rate following a positive pregnancy diagnosis. The latter was higher than expected which contributed to the project falling short of its target of 2,400 crossbred calves. An outbreak of foot-and-mouth disease in 2018, which was associated with a significant decline in conception rates, was another factor contributing to the shortfall. Overall, 23% of inseminations resulted in calves surviving at least one month.

Underreporting of calves, especially male calves, was observed. This was likely because the farmers did not want to have their calves castrated, as was required by the project, preferring instead to have them available as future breeding bulls.

The intended genetic strategy proved not to be viable, despite considerable investment in human and physical capacity building. Also, plans to produce pure-bred exotic bulls and cows to support the ongoing breeding program failed due to the very low success rate from implanting pure-bred imported exotic embryos in local zebu cows (3 survivors from 31 embryos).

During the course of the project, a number of factors were identified that were deemed to be necessary for similar initiatives to succeed. These were: favorable local and national policies and the existence of the required public and private sector actors; selecting and targeting the right farmers who could provide the management and conditions to keep their cattle healthy and well nourished; having well trained and experienced AI technicians who have access to the necessary inputs and equipment; and secure upstream and downstream markets especially for feed and milk.

A simple scoring system was developed by the project team to enable others to determine whether fixed-term AI would be appropriate in different contexts.

I. Fixed-time AI : A solution to meet growing demand for milk in Burkina Faso

Burkina Faso is a large producer of cattle and one of the major exporters of meat in West Africa. Despite a huge national herd totaling approximately 9 million head (FAOSTAT, 2014), **dairy production** paradoxically remains **very low.** Milk self-sufficiency is far from being reached, although **consuming more animal milk could induce positive impacts** on the health of both infants and adults in the country, especially the ones suffering from stunting and malnutrition .

Because of the limited number of intensive commercial dairy farms in Burkina Faso, about **95% of the milk produced** comes from the **traditional sector**, dominated by **pastoral systems** based on transhumance and exclusively using **local breeds** such as Peulh zebus, Azawak and Goudali.

Traditional dairy production is currently estimated to average just **1-3 liters per day** and **110 liters per cow per year**. In comparison, in industrialized countries, the average production from dairy breeds is around **30 liters a day** for a **300-day** lactation period. This low yield is partly due to:
- The **low productivity** of the local zebus, which are, however, very well **adapted to the harsh local environment.**
- The **seasonality of production**, with a gap during the dry season, from December to May.
- The **difficultly of accessing quality feed** which induces nutritional deficits, especially during the dry season.
- **The priority given to suckling calves** rather than collecting milk for consumption and sales: farmers usually prefer to increase their number of cows rather than to improve their productivity.

Although the number of **intensive dairy units** is increasing, they still cannot meet the demand. They are located in three **peri-urban areas:** (1) Ouagadougou, (2) Bobo Dioulasso and Banfora and (3) Fada N'Gourma, where **milk processors are also located**. In these areas, traditional dairy farmers tend to organize themselves in groups in order to improve their **access to funding, animal healthcare** and **state services**, and increase the productivity of their herd and thereby their revenue. Currently, the milk produced locally only meets about **10% of the local demand**. It is mostly **consumed at home** by the pastoralist producers with only **20% being sold**.

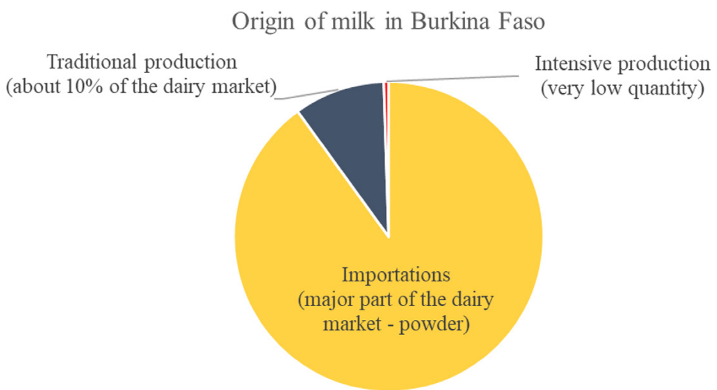


Figure 1: Estimation of milk production breakdown in Burkina Faso

Therefore, processing plants rely on **imported milk powder** to cope with production variations and the low availability of local milk during the dry season. It is estimated that **90% of the dairy products consumed in Burkina Faso are imported**, mainly as milk powder, costing between 6 and 10 billion FCFA (€9.1 to 15.2 million) annually for the approximately 40 million liters of milk equivalent imported.`

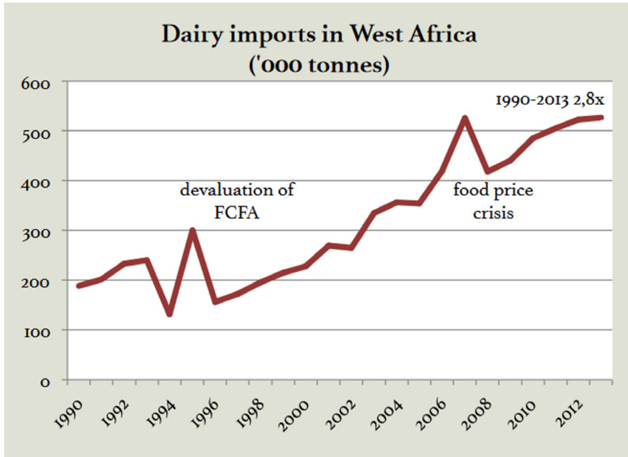


Figure 2 : Dairy imports in West Africa (Orasmaa et al., 2016)

Whereas the majority of Africa is struggling to meet local milk demand, some countries such as Kenya, South Africa and Rwanda have **managed to develop their dairy sector** and are now either self-sufficient or are amongst the main producers of milk in Sub-Saharan Africa (SSA) in terms of volumes.

Did you know?

Some Sub-Saharan African countries which managed to improve their milk production in the past decades have benefitted from particular conditions which favored this intensification.

For instance, dairy farming is most common in the highlands of Ethiopia, Kenya or Rwanda, where the agroclimatic conditions better suit improved cattle breeds or crossbred. First, they do not suffer from heat stress which may impact their fertility. These regions are also relatively free from the tsetse-borne parasitic disease trypanosomiasis which particularly affects cattle in warmer and more humid climates. Finally, the cool climate allows cattle to be in better condition as feed is usually available all year long.

These countries also benefitted from favorable policies allowing investments in the sector.

In Kenya for instance, the growing demand for milk and dairy products attracted both domestic and international investors. The expanding sector is characterized by a very sophisticated supply chain, including diverse public and private agro-inputs suppliers and services providers, millions of farmers (owning one to three improved cows), dynamic cooperatives (milk collection, marketing and distribution) and processors (four of whom control 85% of the milk intake).

In Rwanda, there are two main dairy systems: Improved Family Dairy (IFD) and Commercial Specialized Dairy (CSD). The first one is the dominant system (>95%), requiring less inputs and where a family keeps one or two milking improved cows (crossbreds or exotic). Milk is directly consumed by the household and the surplus is delivered to Milk Collection Centers or directly to a dairy processor. The other system refers to dairy production systems with high inputs and high milk productivity which produces less than 5% of the total volume of milk produced in Rwanda.

In Ethiopia, the number of dairy processing firms tripled over the last decade, driven by increases in expenditures on dairy products by urban consumers. At the production level, this shift has been reflected through improved access to livestock services, higher use of crossbred cows, increases in milk yields, the multiplication of larger commercial dairy farms, and a peri-urban sector supplying almost one-third of all liquid milk markets.

Figure 3: Traditional cattle farming in Burkina Faso

Similarly intensifying milk production in Burkina Faso to meet the growing demand would be extremely unlikely in the short term. The lack of structure of the sector, the predominance of pastoralists having low access to inputs and services, poor access to investments and credits, and the very few milk processing units are all major constraints to the development of the dairy sector. Furthermore, some of those eastern African countries, such as Rwanda or Kenya, benefit from climatic conditions very favorable for dairy production. By contrast, Burkina Faso is characterized by a warm climate, which may induce heat and nutritional stresses in cattle, thereby reducing their growth, milk yield and reproductive efficiency.

To meet the growing demand for milk in Burkina Faso, one solution is to **improve farmers' access to more productive breeds.**

To this end, three options exist:

- **Importing genetics:** this method could be very effective and provide quick returns on investments but is also very risky. It would be difficult to implement at large-scale in Burkina Faso since it would require huge investments and because improved productive breeds are often very sensitive to changes of environment and may not survive in the local context (climate, feed, parasitic pressure, farming practices, etc.),

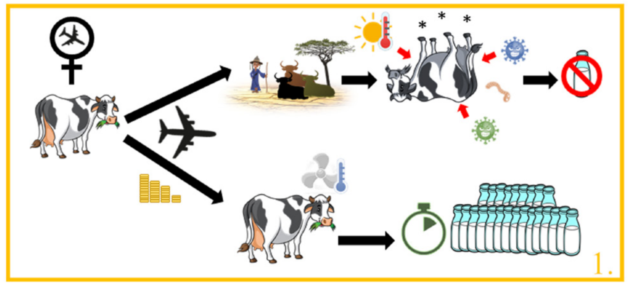


Figure 4: Option 1 to improve milk production

- Using **natural selection**, based on:
The **local breeds** having the best milk production performances: this model would maintain the local genetic biodiversity and ensure that the new generations are adapted to the local rearing conditions. However, it will take decades to observe significant impacts (especially considering the low milk yields of the local breeds) and will require the development of a whole network, beginning with the creation of a selection center (genetic and data management, collection units, etc.),

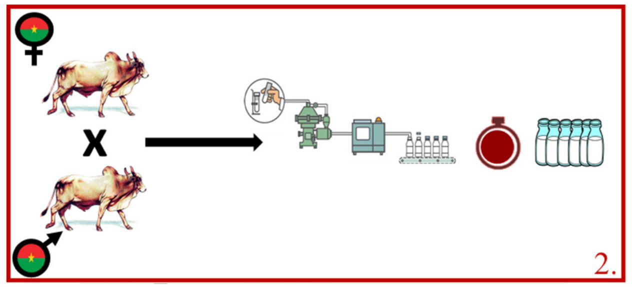


Figure 5: Option 2 to improve milk production

- **Genomics**, which consists of selecting breeds based on some genes of interest: this high-tech solution would be more accurate than the previous one but would meet the same issues. Furthermore, it would require a complete genome mapping of the local breeds, which does not exist at the moment, and to correlate it with performance results.

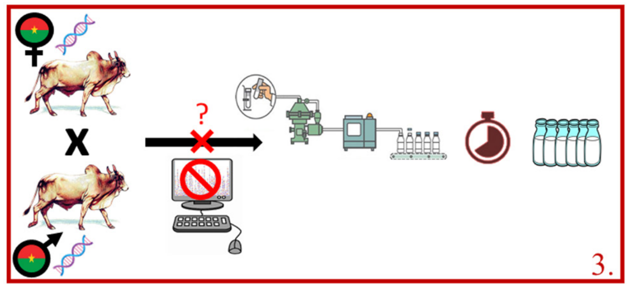


Figure 6: Option 3 to improve milk production

- Using **crossbreeding**, which consists of crossing hardy local breeds with productive exotic breeds. It allows farmers to get both hardy and productive hybrid F1 cows in a relatively short period of time (about 5 years) that are easier to manage than pure exotic breeds. It is also a good method to benefit from the hybrid vigor (heterosis) of the F1 crossbreeds (first generation of hybrid) which express improved performance compared to the parental generation.

Figure 7: Option 4 to improve milk production

Considering the specificities of livestock farming in Burkina Faso, using **crossbreeding** seems to be the **most appropriate option to improve dairy production in the short term (one generation) and meet the growing demand for milk.** Furthermore, this method has been tested many times across Africa and worldwide, showing interesting results.

Crossbreeding can be performed through different processes:

- **Natural mating** involves importing exotic bulls and letting them inseminate females. However, it is easier to directly import semen. This avoids the risks that the imported male will not survive in the local rearing conditions or that it is used for many years causing problems with inbreeding.

- **Artificial insemination (AI) with fresh semen** involves the existence or the creation of a collection center and for farmers to bring their cows to the center for insemination, which is quite complicated considering the wide distribution of farmers in Burkina Faso.
- **Artificial insemination with frozen semen** consists of depositing semen, previously collected from a bull, into the uterus of a cow when on heat. This can be done on the farm.

The last option mainly involves **technical and organizational constraints** which can be dealt with in Burkina Faso. That is why performing **crossbreeding through AI** with frozen semen seems more appropriate in this specific context.

Yet, **detecting when cows are on heat** to know exactly when to inseminate them is **particularly difficult** in Burkina Faso, since local zebus **rarely cycle** (they do not ovulate), or cycle but show very **discrete estrus signs**, mostly early in the morning or late at night when the air is cooler, since heat stress highly decreases estrus expression.

In these conditions, **synchronizing estrus** to practice **fixed-time AI** is **highly recommended**, so inseminators **know exactly when to perform AI**, which, as its name suggests, is done at a fixed time after synchronization, without having to detect estrus signs.

Finally, the synchronization protocol used must be adapted to the natural cycle of the targeted cows. Considering the context of the Vache du Faso project and the predominance of **non-cycling cows**, using a **full hormonal protocol which** allows an ovarian cycle to be created seemed indispensable.

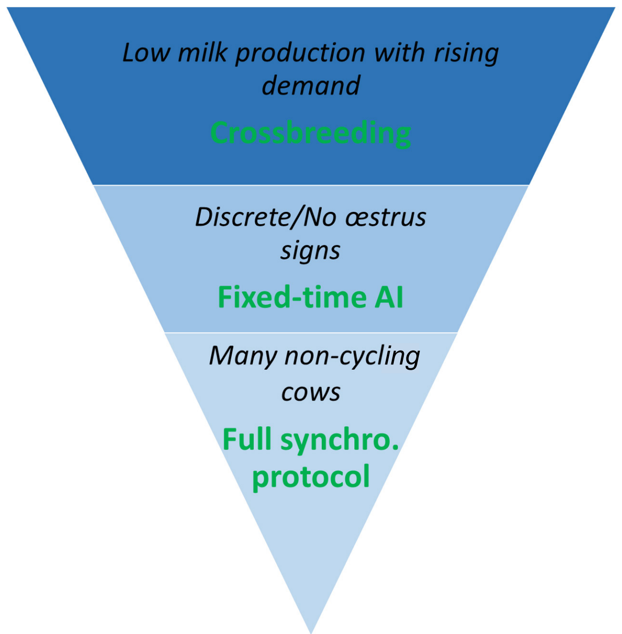


Figure 8: Strategy chosen to increase chances of success of the AI

The success of a fixed-time AI program depends on many interconnected parameters that should be controlled all along the process:
- **The farm management practices:** production system, nutrition, access to services, etc.,
- **The status of the cows:** genetics, physiological conditions, health etc.,
- **The quality of the AI:** synchronization protocol, AI technique, quality of semen, equipment etc.

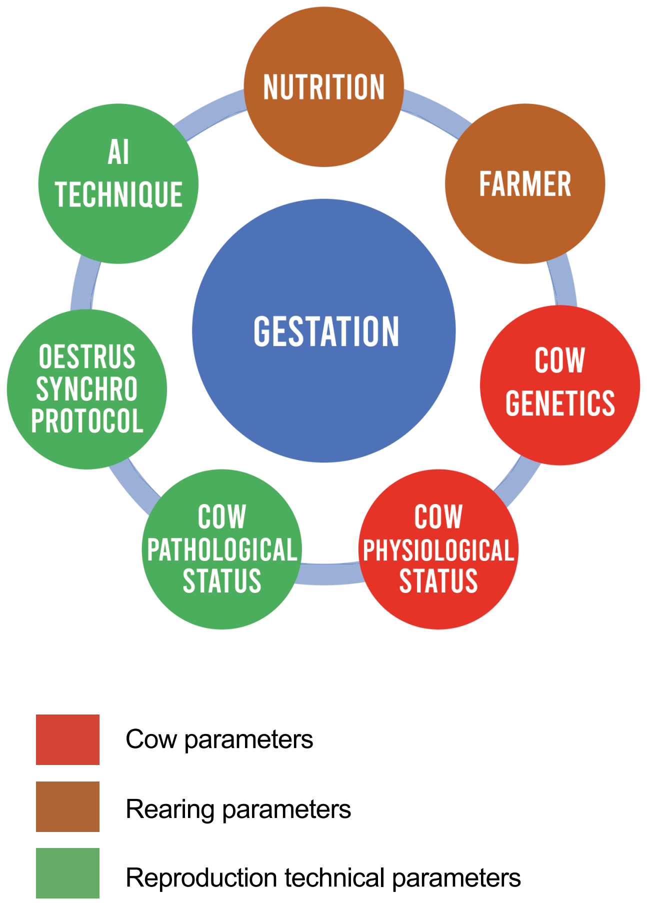


Figure 9: Parameters impacting the pregnancy rate

Figure 10 : Official launching of the Vache du Faso project

II. The Vache du Faso project

For 30 years, Ceva has been involved in the development of products to facilitate management of cattle breeding in tropical climates and has developed **world-beating expertise in cattle reproduction in the specific context of SSA**. Beginning in 2016, and thanks to the support from the Bill & Melinda Gates Foundation, Ceva has implemented a 3-year project in Burkina Faso aiming to improve milk production by crossbreeding local low-yielding zebu cows with more productive dairy breeds (Tarentaise/Montbéliarde), through fixed-time AI.

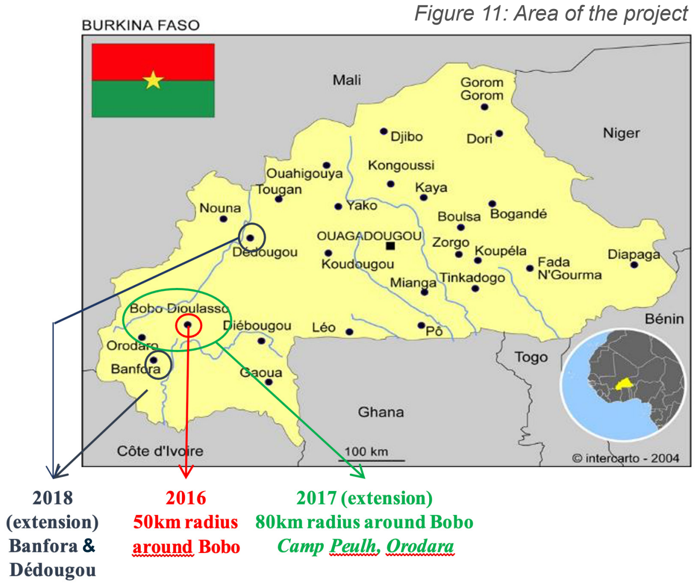
1. Aim of the project

The aim of the project was to produce **2,400 crossbred F1 calves** (1,200 females and 1,200 males) **by inseminating 5,000 local zebu cows with semen from carefully chosen exotic bulls**. While crossbreeding has no impact on the milk yield of the inseminated cow, crossbred calves that are born from AI will have characteristics of both their parents, including, **in females, the potential for higher milk yields.** The milk production of the F1 cows is expected to increase six-fold compared to the local zebu cows.

2. Geographical location

Initially, this project started near Bobo Dioulasso, which is the second biggest city in the country, and was **extended in 2018 in Banfora and Dedougou**, which are the main areas for milk production.4,280 (77%), 914 (17%) and 344 (6%) of the cows selected belonged to farmers whose households were located in and around Bobo Dioulasso, Banfora and Dedougou, respectively (data missing for 3 cows). The target of 5,000 cows was therefore exceeded.

Figure 11: Area of the project



3. Synchronization protocols

72% of the cows inseminated during the Vache du Faso project received a short or 'standard' protocol, completed over 8 days (see Figure 12), while the 28% remaining cows received different protocols of synchronization for field evaluation.

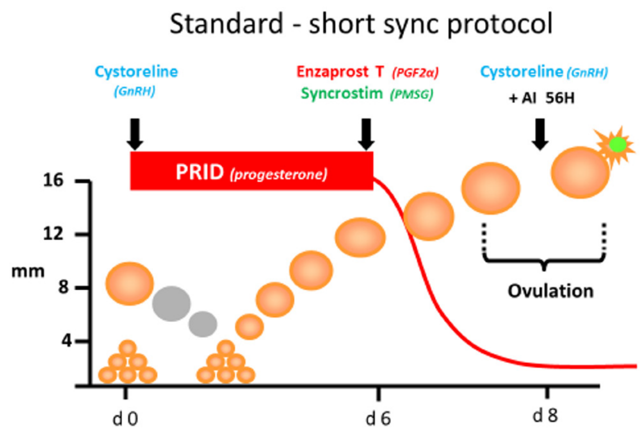


Figure 12: Short synchronization protocol used as 'standard' in 72% of cows

This full but short synchronization protocol used a full package of 4 hormones administered at fixed time intervals:

- A first shot of gonadotropin releasing hormone (**GnRH**) (Cystorelin®), which is administered before inserting the PRID® into the cow's vagina, to luteinize (degrade) the mature ovarian follicles, thereby allowing the emergence of new ones and reducing the risk of fertilizing old follicles that would be of lower quality.
- Then, the **progesterone** (PRID®), which is inserted to stop the estrus and ovulation.
- Next, the PRID is removed and **prostaglandin** (Enzaprost® T) is injected to cause the luteolysis of the dominating follicle, which becomes pre-ovulatory.
- Next **PMSG** (Syncrostim®), which is injected to support the maturation of the dominating follicle and induces the oestrus phase.
- Finally, a second shot of **GnRH**, which triggers ovulation and allows fixed-time AI 56 hours after removing the PRID.

A small-scale comparative trial on 395 cows during the first reproduction campaign was undertaken: it revealed no statistically significant difference between this 8-day protocol and a longer 12-day one (see Figure 14). Therefore, the short protocol was adopted **as it simplifies and shortens the field operations** for the AI technicians.

Figure 13: Preparation of the insemination on the field (Ceva, 2017)

Did you know?

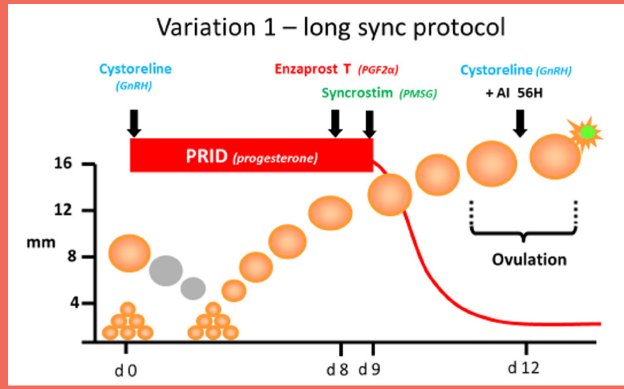


Figure 14: Long synchronization protocol used at the beginning of the project for comparison

This long protocol of synchronization is usually used for Bos taurus or taurine breeds (the European breeds without humps), but Ceva's experience in Brazil on Bos indicus cattle or zebu breeds (humped cattle found in Africa, Asia and South America) had shown the possibility to reduce the duration of progesterone treatment without impact on pregnancy rates. The results showed no statistically significant difference between the long and short protocol.

A variation of the short protocol was also brought in at different stages to test the impact of removing the shot of GnRH at D0 on pregnancy rates. Results show that removing the first shot of GnRH at D0 was significantly less effective (Figure 56).

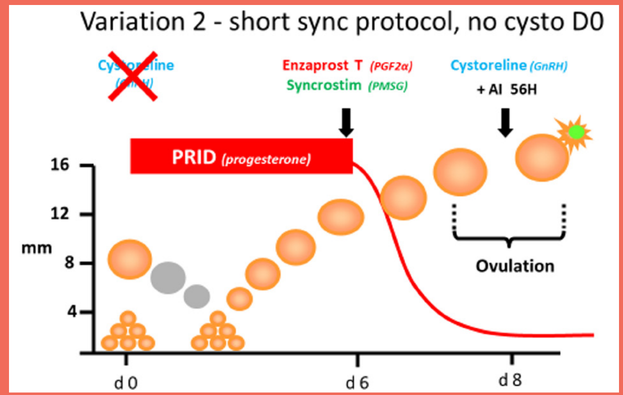


Figure 15: Variation of the short protocol used during the project

During the synchronization step, the AI technicians recorded different parameters related to the fertility status of the cows and the quality of the response to the synchronization protocol. Over half of the cows (53%) were found to be in anestrus at D0. This corroborates the reduced reproduction performance of Bos indicus cattle usually observed in tropical regions and the interest in using a full hormonal stimulation protocol including progesterone to stimulate ovarian activity.

4. Insemination campaigns

Between October 2016 and September 2019, the project implemented six separate insemination campaigns, identified as follows:

The **'EXT'** (short for extensive production systems) campaigns took place from September/October of the year denoted (e.g. EXT 2016) to April of the following year (e.g. 2017) and hence lasted 6 to 8 months. During this period, cows were generally placed under **greater physiological stress**, because it coincides with the **dry season** (October to April) when the lack of grazing impacts nutritional status and body condition.

These campaigns mainly targeted farms with a more **extensive mode of production** ('traditional transhumant' or 'traditional improved' – see Figure 28).

The **'PU'** (short for peri-urban production system) campaigns took place from April/May to September, which coincides with the wet season when cattle are in **better nutritional status and body condition**. These campaigns mainly targeted more intensive farms in **peri-urban settings and improved or sedentary farmers** (it did not include traditional transhumant farmers).

The roll-out, number of cows recruited, AI undertaken per season and timing of calvings resulting from each season are summarized in Figure 16.

		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Total cows	Total AI
2016-2017	Repro		*EXT 2016 (406 cows / 509 AI)*							*PU 2017 (242 cows / 316 AI)*				648	825
	Calving														
2017-2018	Repro	*EXT 2017 (1,389 cows / 1,846 AI)*								*PU 2018 (573 cows / 782 AI)*				1,962	2,628
	Calving	*EXT 2016*					*PU 2017*				*EXT 2017*				
2018-2019	Repro	*EXT 2018 (2,385 cows / 2,683 AI)*								*PU 2019 (546 cows / 785 AI)*				2,931	3,468
	Calving	*EXT 2017*					*PU 2018*				*EXT 2018*				
2018-2019	Repro														
	Calving	*EXT 2018*					*PU 2019*								
Total														5,541	6,921

Figure 16: Calendar of the reproduction campaigns and calving periods

5. Field activities

Field activities were divided in five main phases, repeated during each season of insemination:
- The recruitment/selection of farmers and their sensitization.
- The selection and recruitment of cows for AI.
- The heat synchronization and first AI.
- The pregnancy diagnosis and second synchronization/second AI for 50% of the non-pregnant cows after the first AI.
- The monitoring and evaluation of the activities.

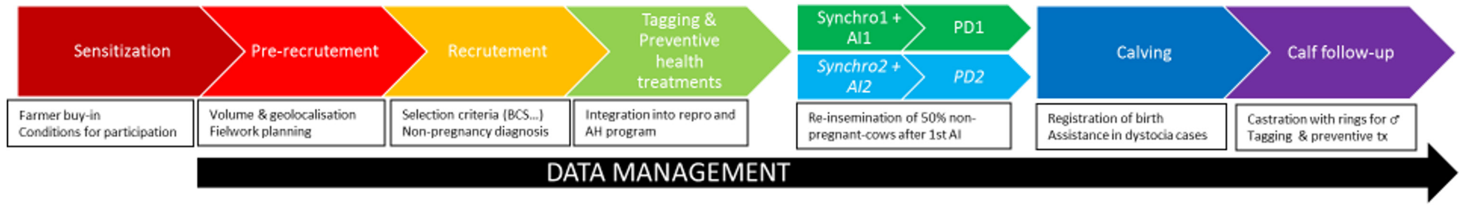


Figure 17: Sequencing of the field activities

The first phase consisted of organizing sensitization meetings with groups of farmers around the selected areas of intervention, to present to them the main objectives of the project and the expected outcomes. This helped farmers **understand the conditions of their participation in the project, the major role they would have to play** in its success and the risks and benefits they could experience. The farmers had to follow some rules in terms of management practices and monitoring, for instance, and these needed to be well understood before getting further involved. These meetings also allowed the project team to **collect some data** and draft a preliminary map of the area, to use as a baseline for the **segmentation and the selection of the targets.**

Figure 18: Sensitizing cattle farmers (Ceva, 2018)

Volunteer farmers were then selected among the different groups and organized in clusters from the same area to facilitate the planning of the project team field activities. These farmers had to **present eight of their best cows as candidates for AI**, according to specific criteria defined by the project team (cf. Chapter II.8). From these, only the **four best cows were recruited** after a diagnosis confirming that they were not pregnant (see below).

After selection, cows were **tagged and registered** in a database (age, tag code, farmer details, cow details, body score. They were then submitted to a modular preventive health program recommended by Ceva, which aimed at keeping cows and calves in the best physiological condition possible, both before and during pregnancy. It consisted mainly in deworming (Vermitan®), trypanocide (Veriben®, Veridium®) and ectoparasiticide (Vectocid®) treatments associated with vitamins supported by the project and farmers were sensitized to implement flushing with their own resources. The latter means feeding a high-calorie diet which facilitates the ovarian cycle *(see Figure 19 ; PD- = cows confirmed non-pregnant).*

These steps of carefully selecting cows and preparing them for AI are critical in the success of the whole protocol.

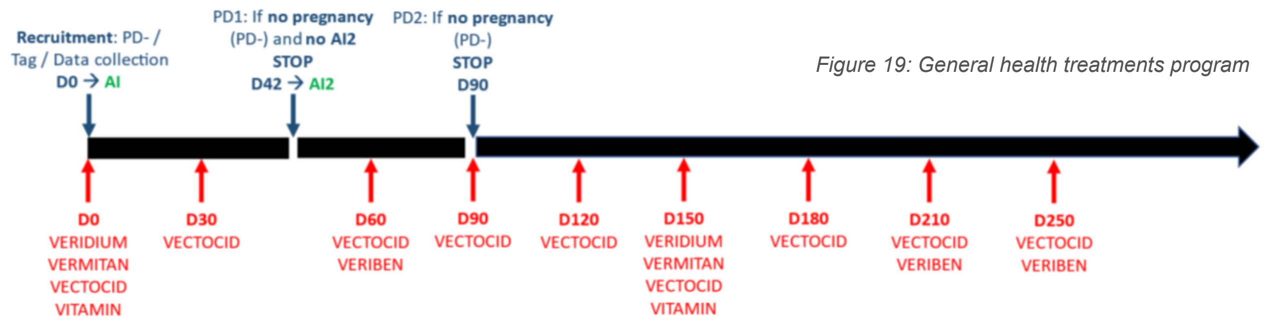


Figure 19: General health treatments program

Did you know?

VerY Diag, the first rapid field test for the diagnosis of bovine trypanosomosis, represents a major advance. It results from years of collaboration with a number of partners (GALVmed, CIRAD, University of Bordeaux), whom we want to thank.

VerY Diag responds to the need in the field of those concerned with animal health, particularly in Africa, where this disease is a major scourge for cattle farmers and is also presents a zoonotic risk.

It was used at the beginning of the field work and demonstrated the circulation of T. congolense et T. vivax.

Figure 20: VerY Diag – Field test for bovine trypanosomosis

Figure 21: VerY Diag: field test to diagnose trypanosomosis (Ceva, 2018)

After confirmation that selected cows were not pregnant using ultrasonography (see Figure 37), the phase of **synchronization and fixed-time AI** could begin.

These activities required the upstream logistic work to be perfectly planned, since each manipulation had to be done at very precise moments. The project team informed farmers in advance to be ready with their cows for each intervention. As a result of this careful planning, only 1% of the selected cows were not inseminated, which represents a very low rate of 'loss' (see Figure 22).

Forty-two days after the first AI, an **early pregnancy diagnosis by ultrasonography** was performed in order to determine if the intervention was a success. If not, a **second AI** was performed on about **50% of the confirmed non-pregnant cows**. All cows did not receive a second AI since the failure of the first one could indicate fertility problems. Only the best non-pregnant cows according to inseminators' evaluation were selected for the second AI to increase chances of success. On average this resulted in each cow receiving **1.26 AI** (1.40 for PU campaigns and 1.20 for EXT campaigns). The ratio evolved with time to include more cows from peri-urban farming systems as they showed better results.

	EXT 2016		PU 2017		EXT 2017		PU 2018		EXT 2018		PU 2019		Total	
	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2
Nb cows selected	406		242		1,389		573		2,385		546		5,541	
Nb AI	400	109	235	81	1,363	483	552	230	2,383	300	546	239	5,479	1,442
Total Nb AI	509		316		1,846		782		2,683		785		6,921	
% loss Select - AI	1.5%		2.9%		1.9%		3.7%		0.1%		0.0%		1.1%	
Nb AI/cow	1.27		1.34		1.35		1.42		1.13		1.44		1.26	

Figure 22: Number of cows selected and inseminated per campaign and overall

During the gestation period, farmers were expected to follow the project team's advice about **good management practices**, such as providing the appropriate feed and health treatments to their cows, according to their stage of pregnancy. They were also expected to **report any abortions and births** they observed and were assisted in case of complications, with dystocia for instance. After birth, the project team came to **identify newborn calves** (F1) and record some data, such as the tagging code of the cow that had given birth, the date and time of birth of the calf, its sex, its tagging code, and its distinctive features.

Figure 23: F1 calf being tagged for monitoring (Ceva, 2018)

6. Choice of exotic breeds for crossbreeding

Ceva paid great attention to the choice of the exotic breeds whose semen was used for insemination. It had to **correspond with the typology of farmers and the expected results** of the project. Based on previous studies carried out in SSA, the breeds selected for crossing with the Burkinabe cows in the project were two traditional French breeds, the **Tarentaise** and the **Montbéliarde**.

Figure 24: Pictures of a Tarentaise (Pellecier, 2011) and a Montbéliarde (Ceva, 2022)

Did you know?

France is the country of cheese made with the milk of traditional breeds. There are strict regulations and standard operating procedures in place dictating that only milk from very specific breeds of cows can be used to produce very specific regional cheeses. Over the years, genetic management and selection of local breeds has preserved very specific and rustic breed characteristics related to feeding and breeding behaviors, udder, teat and leg conformation, and ultra-violet (UV) sensitivity amongst other parameters.

Specific characteristics for the two breeds selected for the project are compared in the table below with two other exotic breeds previously imported into Nigeria, the Holstein and Jersey.

	Cattle breed			
	Tarentaise	Montbéliarde	Holstein	Jersey
Milk production	+ (5,000 kg)[1]	+++ (8,000 kg)	++++ (9,000 kg)	++ (7,000 kg)
Meat production	+++	++++	++	+
Adaptability to the African context	++++	+++	+	++
Feed conversion	+++	++	+	++++
Resistance to diseases	+++	+++	+	+++

[1] *This is artificially low due to French regulations specifying a milk production threshold per animal to maintain national herd size; milk production is predicted to be 7,000 kg under normal conditions*

Figure 25: Table of cattle exotic breeds' characteristics

The main advantage of the Montbéliarde and Tarentaise over their counterparts, the Holstein and Jersey respectively, is that they are **hardy, dual purpose** and have been demonstrated to **cope well with arid conditions, UV** and **high temperatures.** They have **smaller teats**, so are less prone to trauma during grazing, and are **better adapted to extensive grazing.** They are able to **walk long distances** and to **thrive on poor-quality pastures.**

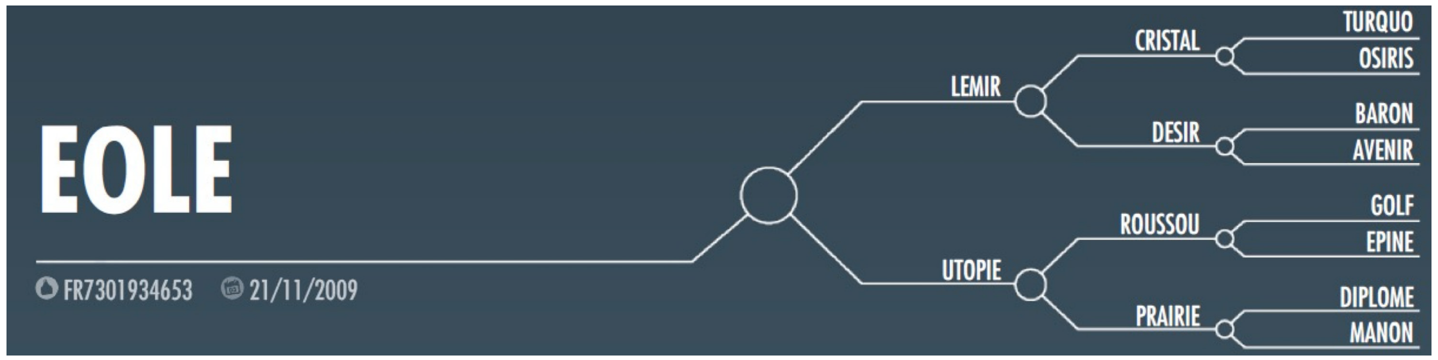
Of the French rustic breeds, Ceva selected the Tarentaise and Montbéliarde for being **hardy and for their ability to thrive under the most difficult of conditions**. This choice is also based on solid experience of crossbreeding with local breeds in other tropical and arid contexts (Egypt, Tunisia, India etc.), where **hybrid vigor/heterosis** has been demonstrated through improvements in **both milk and beef production** as compared to indigenous breeds when other management parameters such as nutrition are kept constant.

The semen used for AI conducted during the program originated from 8 Montbéliarde and 6 Tarentaise bulls to **maintain genetic diversity** and **reduce the risk of inbreeding** at the stage of breeding of the F1 calves (see Genetic strategy – chapter II.10).

Montbéliarde semen was preferentially used on **peri-urban** or **traditional improved farms**, and **Tarentaise** semen was preferentially used on **traditional transhumant** herds due to the breed hardy characteristics.

100 doses of sexed semen were ordered at the beginning of the program. Most of these doses (40) were used during the EXT 2016 campaign and the remainder used during subsequent seasons. Sexed semen is filtered to **retain only female spermatozoid to guarantee female calves**. This filtration system also reduces the concentration of sperm and therefore **reduces the probability of pregnancy**. For this reason and the fact that a sexed semen dose costs 28 USD versus 7 USD for standard, **sexed semen doses were not re-ordered** and conventional semen was used for the remainder of the project.

Figure 26: Picture of one of the Tarentaise breeder bulls (named Eole) whose semen was used during the AI program



7. Choice of farms

No specific criteria were defined for the choice of the farms: farmers from the three production systems existing in the area (see Figure 28) were eligible for selection. Overall, 3,534 of cows selected belonged to 735 **improved traditional** farmers, 1,172 to 212 **peri-urban** farmers and 831 to 127 **traditional transhumant** farmers (no data for 4 cows).

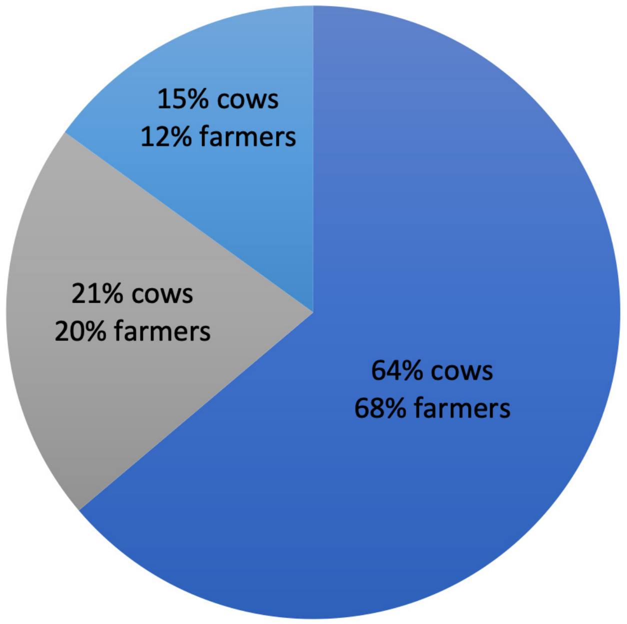


Figure 27: Proportion of farmers and cows per farming system

The vast majority of farmers belonged to the Fulani ethnic group (known as Peuhl in Burkina Faso).

	Peri-urban (PU)	Improved traditional (IT)	Traditional transhumant (TT)
Location	Urban or peri-urban areas	Peri-urban or rural areas	Rural areas
Access to market and inputs	Proximity of sanitary services, input providers and milk collection units	Near or far from services	Far from services
Economic activity	Cattle farming is a side business	Cattle farming is the main business	Cattle farming is the main business
Farming system	Semi-intensive	Extensive	Extensive transhumant
Feed supplementation	Yes	Yes / No	No
Herd size	Small	Medium / Large	Large

Figure 28. The three categories of production systems encountered in the program

During the project, a total of 1,074 farmers had an average of 3.8 cows inseminated. 76%, 18% and 6% of them participated in 1, 2 and 3 synchronization/insemination campaigns, respectively.

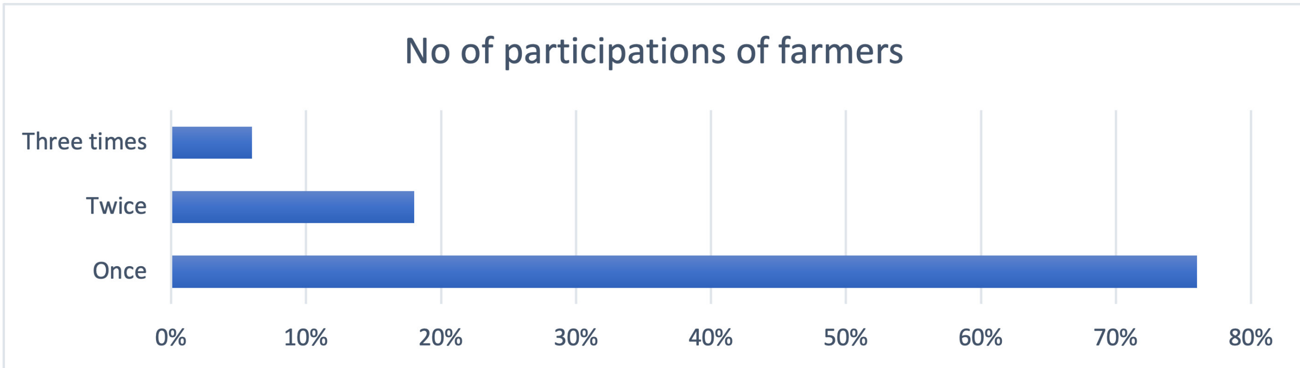


Figure 30: Farmers' number of participations in the program

Figure 29: Group of peri-urban farmers benefiting from the AI program near Bobo-Dioulasso (Ceva, 2018)

Farmers who participated in multiple AI campaigns tended to be peri-urban farmers, as their farms were more accessible to the field team.

However, peri-urban farmers had few animals which made it difficult to select more than 3 cows in good shape per farmer, especially during the last insemination campaign.

	EXT 2016	PU 2017	EXT 2017	PU 2018	EXT 2018	PU 2019	Total
Nb farmers	88	57	305	171	639	186	**1,446**
Nb cows	406	242	1,389	573	2,385	546	**5,541**
Nb cows/farmer	4.6	4.2	4.6	3.4	3.7	2.9	**3,8**

Figure 31: Average number of farmers and cows selected per campaign and overall

8. Training, importance of cow selection and AI team

During the program, the local project team (see below) benefited from training sessions during which **French AI experts** travelled to Burkina Faso and joined them during their field interventions. The experts provided one-on-one training with each AI technician to enable them to perfect their AI technique. **Training sessions took place every 6 months** during the first year of the program and **yearly thereafter.**

Figure 32: Practicing AI under the watchful eye of a reproduction expert (Ceva, 2018)

Training of farmers was organized at the beginning of the program on the critical importance of cow selection adhering to the following principles:
- **Age** (< 10 years).
- **No heifers** to minimize risk of abortion due to brucellosis.
- **No reported fertility issues** (e.g. long calving intervals).
- Previous **calving** at least **two months previously**.
- **Weaning of calves** at foot at least **2 weeks prior to insemination** to minimize the prolactin negative feedback loop of ovarian cyclicity.

It was highlighted that **not all cows are eligible for AI** and that critical selection based on the assessment of the above criteria was key as 'rubbish in equals rubbish out'. As AI was free for the farmers, they had 'nothing to lose' if AI were not successful, and in fact at the beginning of the program farmers wanted to test the team by presenting their worst cattle, hence the reason this specific training was emphasized.

The team also had to collect data on these parameters during the selection visit, as a guarantee of quality. **A body condition scoring (BCS) system** of 1 (skinny), 2 (medium), 3 (fat) was used to reflect the local diversity of body shapes. 97% of cows selected were considered to have a BCS of 2, but in hindsight, using the conventional body condition scoring systems (1 to 5 or 1 to 10) would have been more useful to compare with other contexts, although the local cows would have been ranked amongst the lowest scales of this system. As a general observation, cattle were generally in **poor body condition** throughout the project, due to poor nutrition. As a consequence, the body condition was not a decisive criterium in this program, as all the cows which were not too skinny were candidate for selection.

Figure 33: AI technicians collecting data during AI campaigns (Ceva, 2019)

Figure 34: Typical appearance of zebu Peulh cows (Ceva, 2016)

The vast majority (93%) of cows selected were of the zebu Peulh breed, with only 5% being Goudali and 3% crossbreeds.

The age of cattle at selection ranged from 1 to 18 years (!), but the prescribed age range (less than 10 years and no heifers) was respected 94% of the time, with an average age of 6.8 years. Only 91 (2%) cows selected were heifers, so this criterion was also generally respected.

70% of cows had a calving interval of 1 to 3 years, which is better than the 4 years reported in other studies for zebu cattle reared in extensive settings. It shows an effort towards rejecting cattle with potential fertility problems and long calving intervals.

99% of cows selected had calved more than 30 days prior to selection, and the mean and median interval between last calving and selection were 190 and 160 days, respectively. Weaning of calves at foot was not respected in 87% of cows. This was not ideal but reflects the realities of a pastoralist system where supplementation of feed for calves is not available and the emphasis is on herd numbers rather than production.

Figure 35 : Training on artificial insemination by international expert

The team employed by the project was composed of **four local private AI technicians, two of whom were experts** with over 20-years of experience, and **two of whom had intermediate expertise level.** Two public sector AI technicians joined the team for the EXT 2017 campaign, but their contribution was limited. Because of the lack of availability of skilled AI technicians in Burkina Faso, **four young recruits** joined the team during the PU 2018 campaign and were trained from scratch.

Data on the specific person conducting the AI is available for 85% of inseminations. **70% of all AI** were undertaken by the **two expert** AI technicians. The newly trained AI technicians did 10% of AI, mostly during the PU 2019 campaign so towards the end of the project. 5% of AI were undertaken by the international AI experts during the different training sessions.

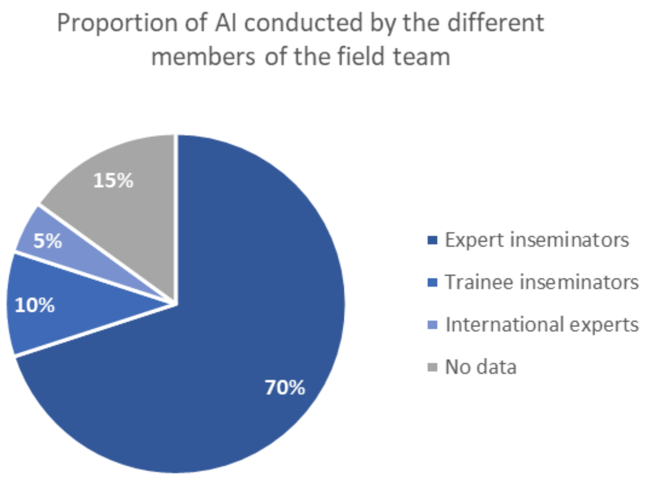


Figure 36: Proportion of AI conducted by the different members of the field team

9. Pregnancy diagnosis (PD) using ultrasonography

This tool was highly appreciated by farmers and **increased the accuracy of pregnancy diagnosis** at an early stage. The **specificity** of PD using ultrasound at least 35 days after first AI is **close to 100%** (i.e. close to no false negatives) for experienced operators. Three ultrasound scanners were available to the team and they were only used by the two expert AI technicians and the project manager who received extensive training on their use at the beginning of the program. The **sensitivity** of the scanner was found to be **99%**: 79 calves were born to cows found to be PD negative (i.e. false positives).

99% of the PD were undertaken using portable ultrasonographers specially designed for cattle (IMV Imaging). Only 1% were diagnosed by rectal palpation (13 cows).

The median interval in days between AI and pregnancy diagnosis was 41, demonstrating that the **team stuck close to the 42 days recommendation.** This was chosen to reduce the chance of false negatives compared to doing PD earlier (missing early signs of pregnancy) or later (embryonic death). The minimum interval was 28 days and maximum 97 days.

84% of PDs were undertaken 30 to 60 days after AI and 16% between 60 to 90 days after AI.

The reason for some PD not being undertaken at the recommended 42 days after AI is that many herds practiced **migration** in the quest for better grazing, and hence the team had to **wait for their return** to schedule the pregnancy diagnosis.

Figure 37: Field team being trained and using an ultrasonographer

10. Genetic strategy

Managing crossbred populations is difficult and requires thorough follow-up. The first generation cross (F1) is 50% zebu and 50% of the dairy exotic breed (either Tarentaise or Montbéliarde), but the genetic makeup of subsequent generations depends on the parents used. The situation gets even more complicated when the F2 generation is bred.

In addition, to **maintain genetic integrity** and ensure **continuation of highly adapted local breeds**, it is important that the local zebus not involved in the crossbreeding program are kept pure to maintain **agro-biodiversity** and that the **exotic genes** from the Tarentaise and Montbéliarde breeds **do not 'leak out'** into the general population, for example through uncontrolled breeding by crossbred bulls.

To avoid in-breeding issues, each F1 calf was identified and tagged about one month after their birth, and **males not required for breeding were systematically castrated** with rings.

This was part of the **genetic strategy** implemented by Ceva within the framework of a public-private partnership with the **CMAP**[2], which is a public sector actor under the Ministry of Livestock, mandated with the genetic improvement of the national cattle herd in Burkina Faso.

Figure 38: Placing a castration ring on a male calf (Ceva, 2018)

Figure 39: Meeting with CMAP (Ceva, 2018)

Figure 40: Meeting with CIRDES director in Burkina Faso (Ceva, 2016)

[2] *Centre de Multiplication des Animaux Performants*

The aim of this strategy with the CMAP (see Figure 41), which owns a selection center able to produce semen, was to **stabilize the F2 (and future) generations at 50% local and 50% exotic genetics.** This combination was considered to be optimal because the benefit of the adaption of the local genetics is not diluted by increasing the exotic genetics. CMAP was also tasked with avoiding **inbreeding.**

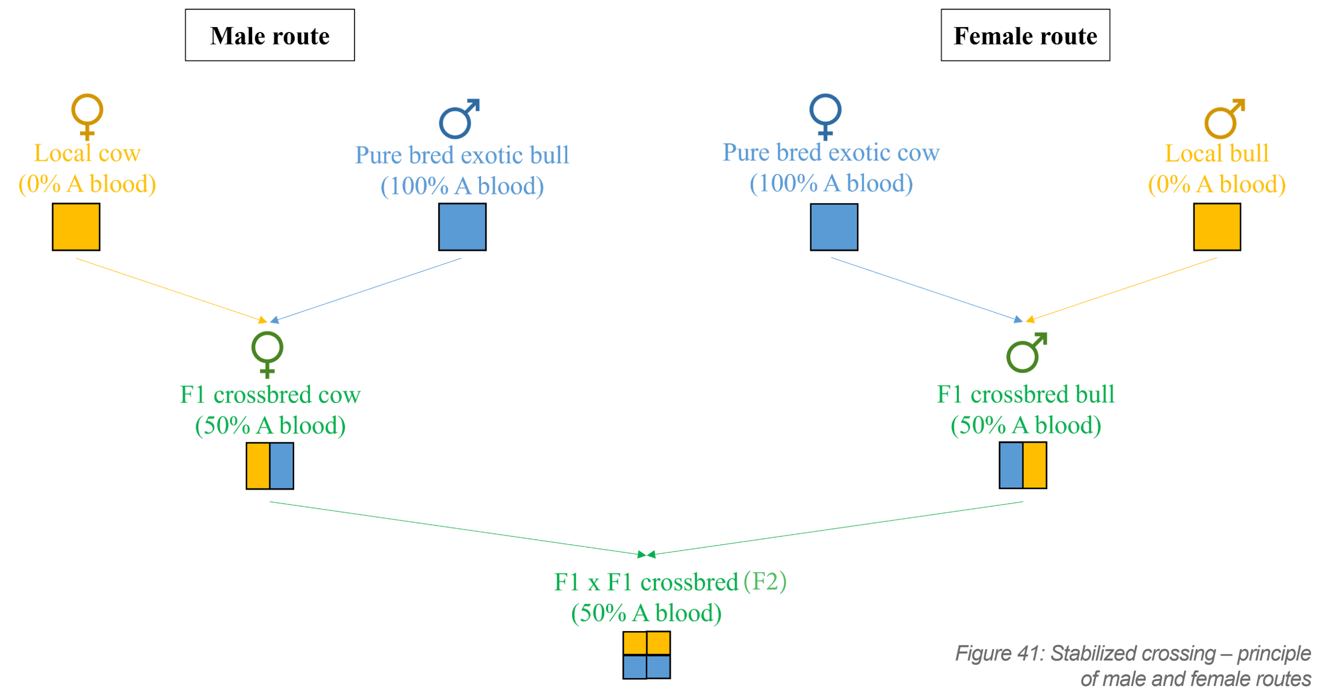


Figure 41: Stabilized crossing – principle of male and female routes

The collaborative agreement with CMAP aimed to (see Figure 42 bellow) :

- Select **F1 males** produced in the field (from different paternal origins) to use them as breeders for crossing with **F1 females (male route).**
- Perform **transfer** of pure Montbéliarde and Tarentaise **embryos** to local surrogate cows at the CMAP station to produce **pure bred exotic females** which could then be crossed with **local males** to produce F1 calves receiving their exotic genetics from the female line **(female route).**
- Use **F1 males from male and female** routes to produce **semen for insemination of F1 females** in the field, to stabilize the genetics at 50:50.

Ceva also sent cartilage samples from the ears of some recruited cows identified in the field to **CIRDES**[3], which is a French research center specialized in improving animal health and productivity, in order to **improve the genetic mapping of Burkinabe cows** by analyzing the DNA of the tissue samples collected.

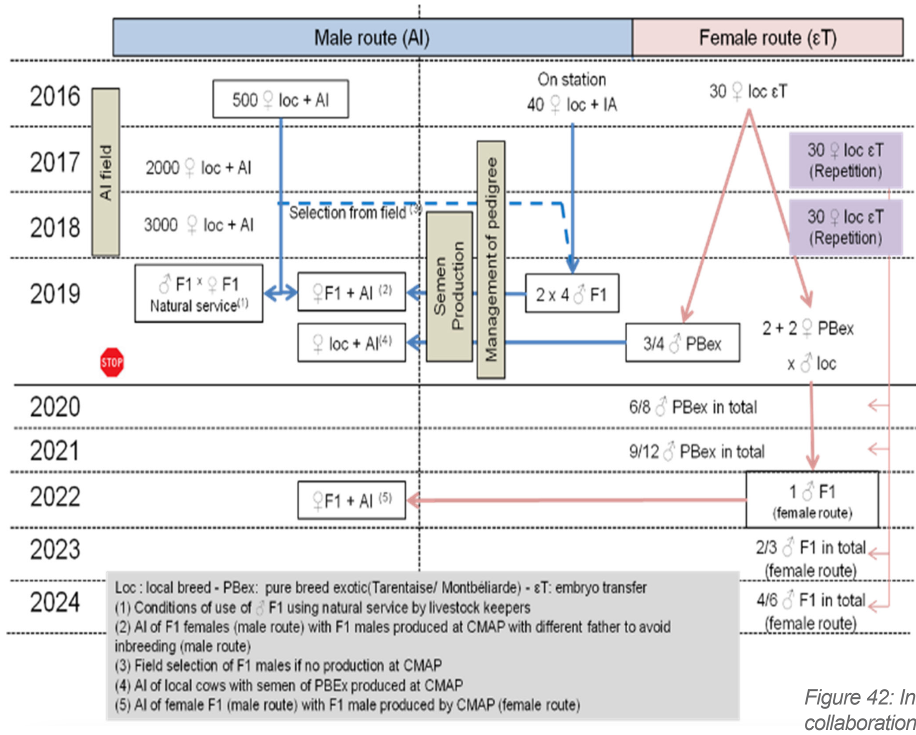


Figure 42: Initial genetic strategy in collaboration with CMAP

[3] *Centre International de Recherche-Développement sur l'Elevage en zone Subhumide*

III. Technical results of the Vache du Faso project

Figure 43: Team Vache du Faso after the EXT 2017 AI campaign (Ceva, 2017)

Over **three years and six campaigns**, the program **inseminated 5,479 cows**, which resulted in an estimated 2,242 pregnancies and 1,655 calves (cf. III.2) **surviving the first month of life**. These results are based on corrections applied by the project team to the figures actually reported by farmers (see chapter III. 1. 2).

A total of **1,149 calvings were recorded and 1,204 calves registered** into the program database (cf. Figure 45 - grey lines). These correspond to farmers' reports for calves that had survived beyond the first month of life. Overall, 1,098 calves were singletons, 96 were twins (48 births of twins), 6 were triplets (2 births of triplets) and 4 were quadruplets (1 birth of four calves). Each birth resulted overall in 1.05 calves corresponding to a **5% twinning rate.**

The **average conception rate of 34%** per AI (cf. Figure 45 - %PD+) is in line with the target of 35% set by the project and is considered to be acceptable for the extensive low input - low output system. It also takes into account the huge drop due to a **foot and mouth disease (FMD) outbreak** at the beginning of the EXT 2018 campaign in May 2018.

It is also important to note that the choice **not to select heifers** to avoid brucellosis issues may also **have lowered the conception results** as they are often more fertile than cows that have borne a few calves.


Figure 44: AI technician practicing an AI (Ceva, 2017)

1. Pregnancy and calving results

		EXT 2016		PU 2017		EXT 2017		PU 2018		EXT 2018		PU 2019		Total		Comments
		AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	AI1	AI2	
No. cows selected	*a*	406		242		1,389		573		2,385		546		5,541		Total number of cows selected by farmers, according to the selection criteria defined and validated by the VdF team
No. AI	*b* AI1 *b* AI2	400	109	235	81	1,363	483	552	230	2,383	300	546	239	**5,479**	1,442	AI1: Number of cows inseminated at least once amongst the selected ones (some of them died or were not presented for AI for diverse reasons) after AI1 /AI2 AI2: Number of cows re-inseminated (50% of the cows which were not pregnant after the first AI)
Total No. AI	*c*	509		316		1,846		782		2,683		785		6,921		Total number of inseminations performed, cumulating results for AI1 & AI2
% losses between selection and AI		1.5%		2.9%		1.9%		3.7%		0.1%		0.0%		1.1%		Proportion of initially selected cows which were not inseminated (death, not presented by farmers for AI) [= (*b* AI1 - *a*) / *a*]
% AI2		27%		34%		35%		42%		13%		44%		26%		Proportion of cows re-inseminated after AI1 [= *b* AI2 / *b* AI1]
No. AI / cow		1.27		1.34		1.35		1.42		1.13		1.44		1.26		Average number of inseminations performed per cow [= *c* / *b* AI1]
No. PD	*d AI* 1	395	104	229	76	1331	451	522	183	2254	259	501	209	5,232	1,282	Number of cows tested by ultrasonography about 42 days after AI1 / AI2 for assessing their pregnancy status
Total No. PD	*e*	499		305		1,782		705		2,513		710		6,514		Total number of cows tested by ultrasonography about 42 days after AI for assessing their pregnancy status, cumulating results for AI1 & AI2
% PD / AI		98%		97%		97%		90%		94%		90%		94%		Proportion of AI having been followed by a pregnancy diagnosis by ultrasonography, cumulating results for AI1 & AI2 [= *e* / *c*]
No. PD+	*f*	172	38	106	35	519	170	242	71	597	71	129	92	1,765	477	Number of cows diagnosed pregnant by ultrasonography 42 days after AI1 /AI2
% PD+		44%	37%	46%	46%	39%	38%	46%	39%	26%	27%	26%	44%	34%	37%	Proportion of cows diagnosed pregnant compared to the total number of pregnancy diagnosis performed 42 days after AI1 / AI2 using ultrasonography [= *f* / *d*]
No. PD+	g	210		141		689		313		668		221		**2,242**		Total number of cows diagnosed pregnant by ultrasonography 42 days after AI, cumulating results for AI1 & AI2
% PD+		42%		46%		39%		44%		27%		31%		**34%**		Proportion of cows diagnosed pregnant compared to the total number of pregnancy diagnosis performed 42 days after AI using ultrasonography, cumulating results for AI1 & AI2 [= *g* / *e*]
% PD+ / cow tested having received at least 1 AI		53%		62%		52%		60%		30%		44%		43%		Proportion of cows diagnosed pregnant compared to the total number of cows inseminated at least once and diagnosed 42 days after AI using ultrasonography, cumulating results for AI1 & AI2 [= *g* / *d* AI1]

		EXT 2016		PU 2017		EXT 2017		PU 2018		EXT 2018		PU 2019		Total		Comments
No. calvings reported	*h*	121		86		371		191		325		55		1,149		Number of calvings reported by farmers resulting in at least one calf alive at 1-month-old
Estimated no. of calvings[1]	*i*	156		110		484		229		428		165		**1,572**		Estimation of the total number of calvings during the project, based on the correction of the ratio female/male and on the supposition that 10% of births were not reported due to neonatal deaths (5%), failure to report calvings (5%), missing data for the last insemination campaign
No. calves alive at 1 month reported		127		92		390		199		337		59		1,204		Total number of one month-old calves reported by farmers (including twins, triplets and quadruplets)
Estimated no. of calves alive at 1 month[1]	*j*	163		115		512		242		449		174		**1,655**		Estimation of the total number of calves born during the project, based on the correction of the ratio female/male and on the supposition that 10% of births were not reported due to neonatal deaths (5%), failure to report calvings (5%), missing data for the last insemination campaign
Sex		F	M	F	M	F	M	F	M	F	M	F	M	F	M	Sex of the calves
No. females/males calves reported		75	52	40	52	233	157	110	89	206	131	31	28	695	509	Total number of one-month calves reported by farmers disaggregated by sex
Estimated no. of females/males calves		83	80	58	57	260	252	123	119	228	221	88	86	**840**	**815**	Estimation of the total number of one-month calves disaggregated by sex and calculated based on the correction of the ratio female/male and on the supposition that 10% of births were not reported due to neonatal deaths (5%), failure to report calvings (5%), missing data for the last insemination campaign
% loss since PD+ reported		42%		39%		46%		39%		51%		75%		49%		Proportion of cows diagnosed pregnant by ultrasonography at 42 days but which did not gave birth to calves still alive at 1 month, based on calvings reported by farmers [= (*h* -*g*) / *g*]
Estimated % of loss since PD+		26%		22%		30%		27%		36%		25%		**30%**		Proportion of cows diagnosed pregnant by ultrasonography at 42 days but which did not gave birth to calves still alive at 1 month, based on corrected and estimated data [= (*i* -*g*) / *g*]
Estimated % calving / AI		31%		35%		26%		29%		16%		21%		23%		Proportion of AI having resulted in the birth of at least one calf still alive at 1-month-old, based on corrected and estimated data [= *i* / *c*]
Estimated % calving / cow		39%		47%		36%		41%		18%		30%		29%		Proportion of cows inseminated at least once having given birth to at least one calf still alive at 1-month, based on corrected and estimated data [= *i* / *b* AI1]
Estimated % calves alive at 1 month / AI		32%		36%		28%		31%		17%		22%		24%		Proportion of AI having resulted in the birth of a calf still alive at 1 month, based on the corrected number of calvings [= *j* / *c*]
Estimated % calves alive at 1 month / cow		41%		49%		38%		44%		19%		32%		**30%**		Proportion of cows inseminated at least once having given birth to a calf still alive at 1 month, based on corrected and estimated data [= *j* / *b* AI1]

Raw data	Estimated/Corrected
Reported	Correction a) ratio males/females Estimation b) neonatal mortality and failure to report calvings Estimation c) missing data for PU 2019 campaign

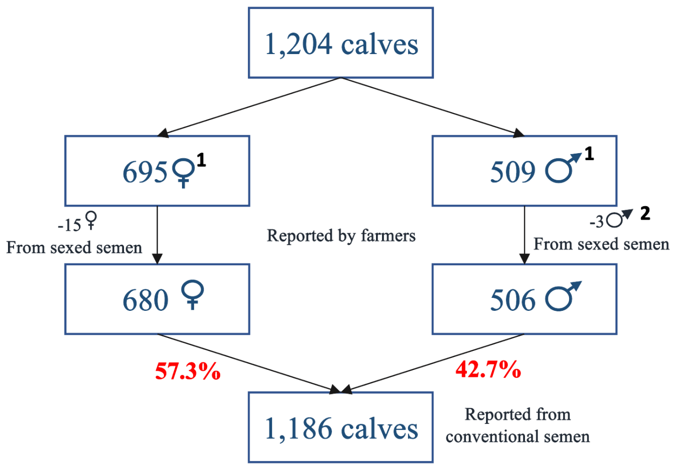
Figure 45: Results of pregnancy diagnosis and calving across reproduction campaigns

2. Corrections applied

Some corrections were applied to the total number of calves and calvings reported, based on the following assumptions

a. Birth of male calves under-reported

Number of calves are under-estimated due to farmer **reluctance to report birth of males**. **Castration was imposed** to prevent farmers using male F1 as breeder bulls and to limit the risk of inbreeding if these males are crossed with F1 females with the same paternal origin (see chapter II.10). Figure 46 beside illustrates after correction for calves from sexed semen that 57% of calves are female which is biological unlikely as the sex ration should be 1:1.



[1] No. of males/female calves reported by farmers (cf. Figure 43)
[2] Male calves reported, probably by mistake, after AI with (female) sexed sen

Figure 46: Corrected percentage male to female calves by excluding calves fr sexed semen

If one first assumes a 1:1 ratio of males to females for each campaign, then considers that 1.5% of AI were performed with (female) sexed semen and finally corrects the calving based on the assumption of a twinning rate of 5%, this gives a total of **1,406 calves surviving beyond one month of life having been produced by the program**, corresponding to **1,338 calvings** (cf. Figure 47). This suggests 189 male and 13 female calves were not reported.

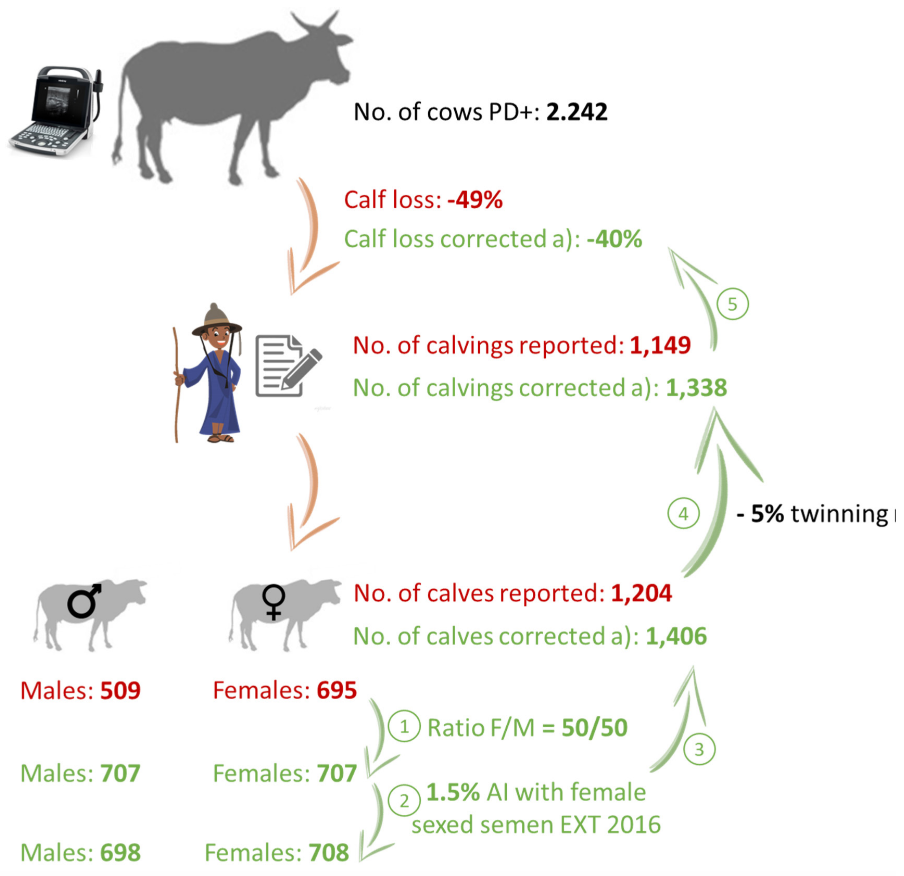


Figure 47: Correction a) of the ratio males/females

b. Calvings under-reported

The Vache du Faso team **reported calvings when they tagged the newborn calves**, either **one month after the farmers' call** to announce a birth or **one month after the presumed birth** (based on the date of the AI) if farmers did not call.

As a consequence, **calves which were not presented to the team or which did not survived their first month of life were not recorded** in the database.

Figure 48: Twin F1 calves born within the project framework (Ceva, 2018)

It also appeared that some farmers were reluctant to declare calvings and tended to **hide their newborn calves** during the team visits: they did not want them to be tagged and tracked by the team or the males to be castrated as mentioned above. Based on the feedback from the field team and when crossing results with the losses at 280 days, the calculation of the calving rate was revised based on a twin rate of 5%, a neonatalmortality rate of 5%, and a 5% failure to report calvings, leading to an estimated total number of **1,548 calves** resulting from **1,472 calvings.**

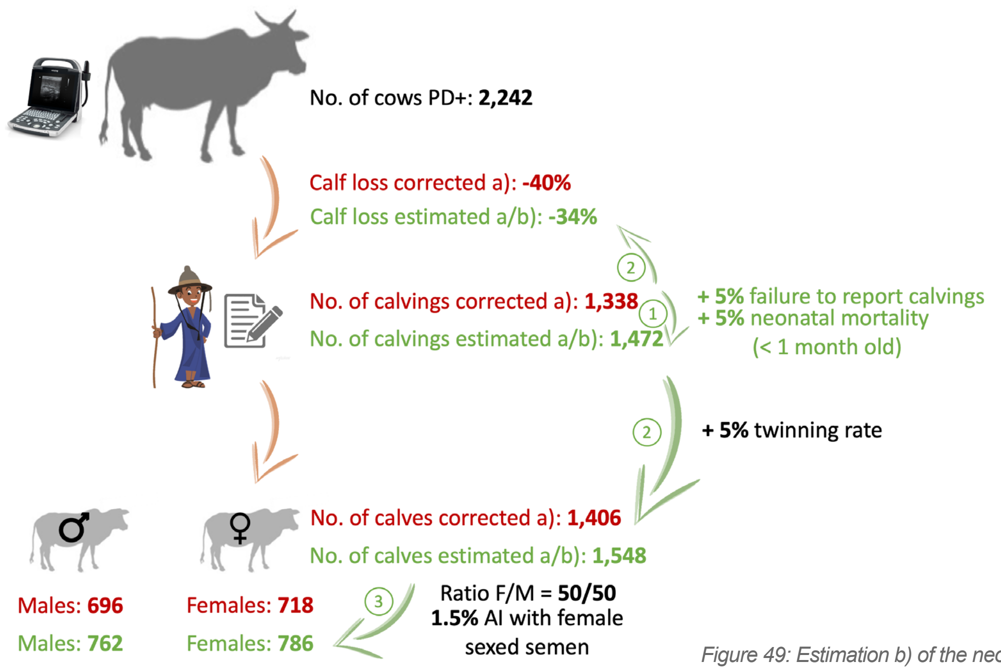


Figure 49: Estimation b) of the neonatal mortality and failure to report calvings

c. Data on calvings not complete for the PU 2019 campaign

There is a huge drop of the ratio of calves reported / PD+ (cf. Figure 45 - 'losses since PD+' in grey = 75%) during the PU 2019 campaign compared to the previous ones. It is likely that **all births were not recorded because the Vache du Faso project officially ended** in September 2019 and births resulting from the AI undertaken for this campaign occurred until May 2020. With the end of remuneration of the field team by the project, they probably focused on other priorities and therefore were **not available to go and visit farmers to confirm the presence of calves**. If the revised 25% 'calf loss rate' obtained for the two previous PU campaigns based on the corrections and estimations detailed in III.2. a/b is applied, the **number of calvings** should have been around 165 for the PU campaign 2019, instead of 65 as calculated considering the previous corrections (or 59 as initially reported by farmers).

By applying all the corrections detailed in the chapters III.2. a/b/c, it brings the estimated total number of calvings to **1,572**, resulting in the **birth of 1,655 calves during the whole project** (cf. Figure 50), including 174 births during the last campaign. It corresponds to an average loss rate of 30% after positive pregnancy diagnosis during the project (cf. Figure 45 – Estimated % of loss since PD+).

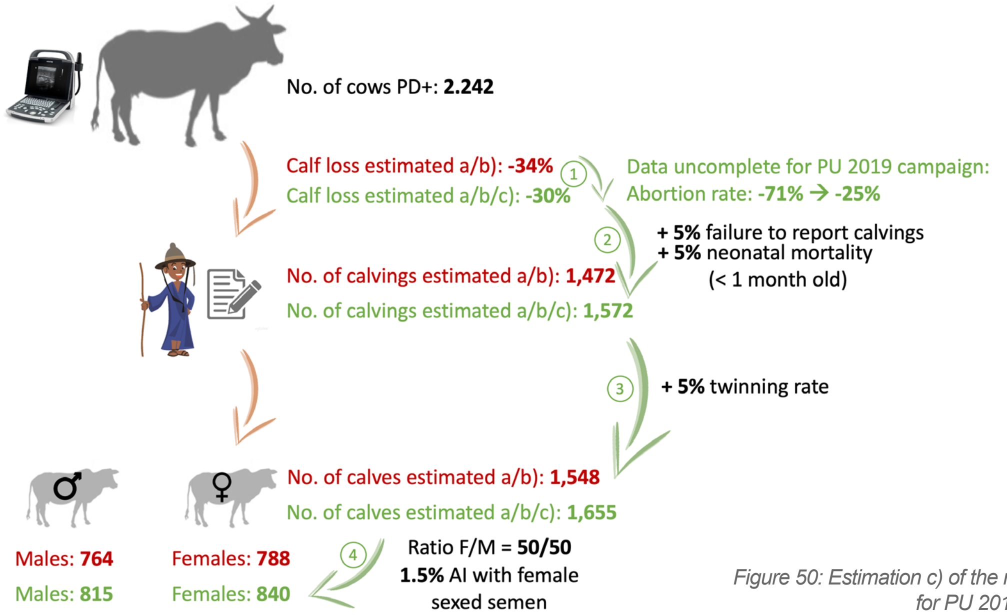


Figure 50: Estimation c) of the missing data for PU 2019 campaign

3. Limiting factors

a. FMD outbreak

The FMD outbreak during the EXT 2018 campaign impacted the cows' overall health and reproductive capacity dragging the conception rate down 15 points to 27%.

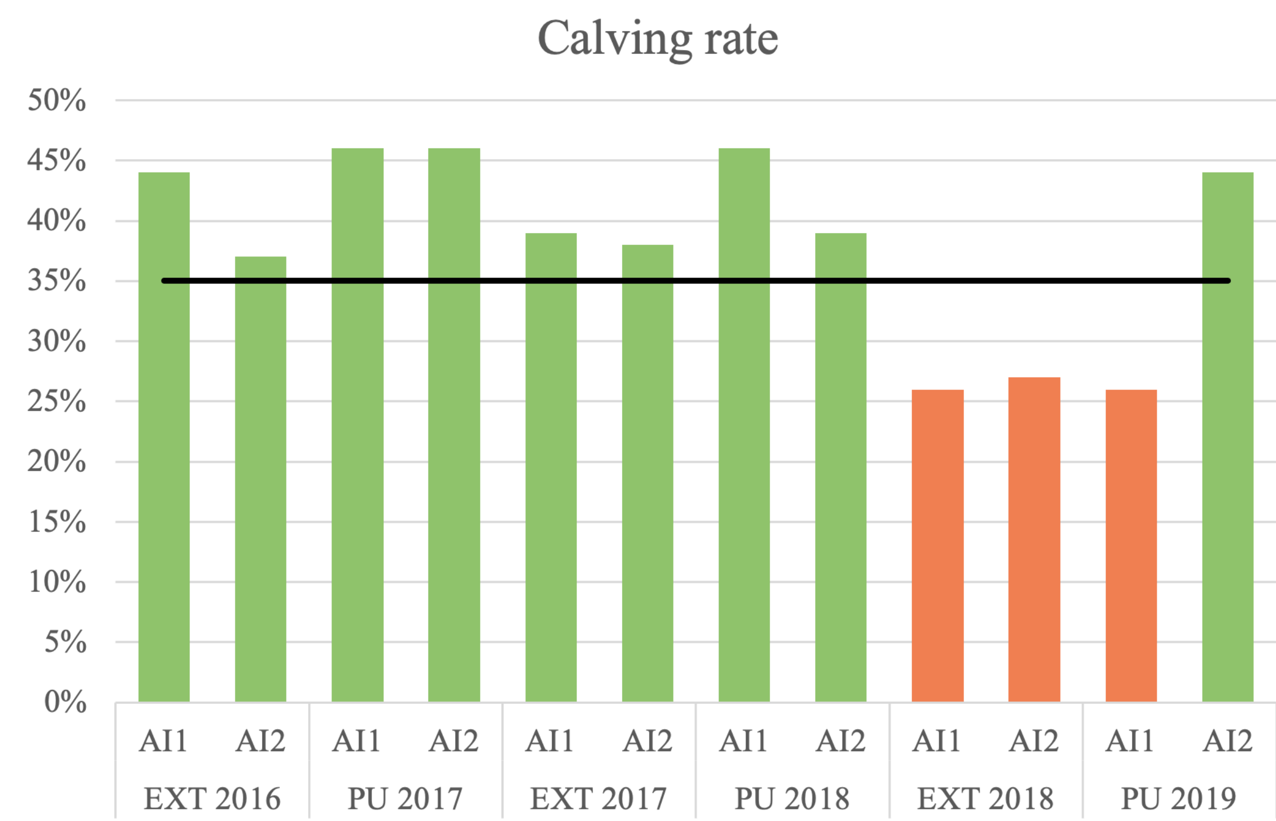


Figure 51: Results of PD falling below the 35% target during the FMD outbreak.

It lasted for a whole year and the results did not start to improve until the second round of AI of the PU 2019 campaign at the very end of the program. For the second round of AI (AI2) for that campaign, one can observe the pregnancy rate rising again as the effect of the FMD outbreak wore off and expert technicians took over the inseminations. These results show that **AI programs should be paused during FMD outbreaks** as the results do not justify the investment.

The poor results of the first round of AI for the PU 2019 campaign are partly due to the prolonged impact of the FMD outbreak and partly due to a **higher proportion of AI being undertaken by novice AI technicians.**

Before the huge drop in performance during the FMD outbreak, the **conception results** across the different campaigns was **high** (Figure 45 - %PD+) reaching **42% across all campaigns** (39% during EXT campaigns and 44% during PU campaigns) and **fairly homogeneous**, the latter reflecting the fact that the cow population was largely homogenous in breed (zebu Peulh), herd size and nutritional status.

The **probability of a pregnant cow being from a peri-urban farm was higher than from a traditional transhumant system** (cf. Figure 56), demonstrating the **association between pregnancy and production system.** This difference was less marked than for a pilot conducted in Ethiopia (EHIP under the PAID project), where big variations in conception rate were found between urban semi-intensive (70%), and rural extensive (54%) production systems. This highlights that differences in production systems were more marked there than in Burkina Faso, where all farms face similar challenges: (i) poor access to complementary feeds, (ii) very limited use of AI and therefore very few crossbreeds, and (iii) most farmers, even those categorized as peri-urban, are forced to practice short- or longer-range migration to find pasture during the dry season.

b. Lack of care of the cows after successful AI

Whilst the conception rates are at acceptable levels, **the average calving rate of 23%** per AI is much lower than expected; the initial projections assumed that all pregnancies would yield calves. The program failed to meet the target of 2,400 calves as **over a third of pregnancies did not result in the birth of a live calf surviving the first month of life**; a third of the technical effort upstream around the heat synchronization and technical aspects of AI was therefore lost.

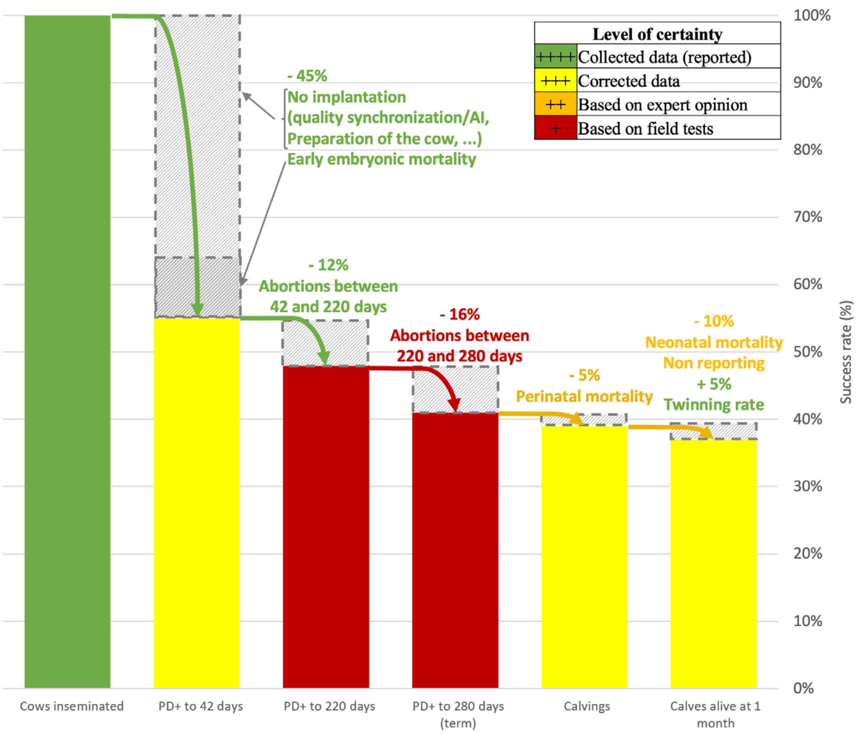


Figure 52: Progressive 'loss of calves' after AI in normal conditions (no FMD outbreak)

A small-scale re-examination of 121 pregnant cows at 220 days of gestation revealed that only 106 were still pregnant, which indicated that **12% of pregnancies were lost between the first and third trimester.** According to our model, a further **16% of pregnancies could be lost over the third trimester**. A further **5% of calves are stillborn or die before 3 days of birth** (perinatal mortality), which, when added to the **non-reporting** by farmers of calvings (see chapter III.2), amounts to a **loss of 10%**. Even after applying the twinning rate of 5%, the data show that for every 100 cows that each received an average of 1.26 inseminations as part of a complete heat synchronization and AI program, only 37 calves of 1 month of age were produced, and this dropped to 19 calves during the FMD outbreak.

Figure 53: Calves with their mother in a traditional and a peri-urban farm (Ceva, 2018)

This calf loss is much **higher than the usual overall 5% loss** observed in France and emphasizes the critical importance of not only **optimizing the technical conditions around AI** (green in Figure 54), but also of **working with farmers to optimize external factors** which have an impact on the capacity of a cow to retain a pregnancy, such as feeding and nutrition, management practices (transhumance) and health (red in Figure 54). The main limiting factor in this system was likely **poor access to adequate feed** (quantity and quality of fodder and complementary feed), resulting in physiological inability to maintain pregnancy.

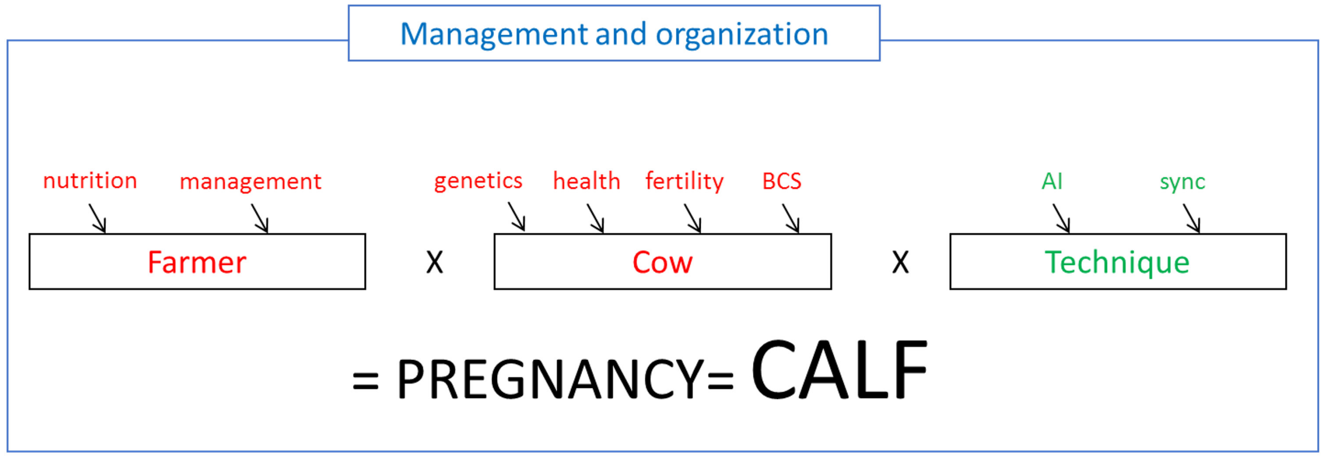


Figure 54: Critical factors of success for an AI program

Figure 55: Cattle farmer having received the ID card of its calf (Ceva, 2017)

The takeaway lesson from these results is that the program was very successful at getting cows into calf, but equal emphasis should have been placed on working with farmers to optimize external factors, especially nutrition and health, in order to increase calf output. **Ultimately, AI programs should target only production systems which are able to ensure the nutritional status of the cows presented for AI,** which is a great challenge in the African context, especially in the traditional extensive farming systems.

It is critical to remember that for an AI program to be successful it has to result in the production of healthy weaned calves, hence the importance to carefully select the right cows and to target farmers able to ensure their health and nutritional follow-up as well as those of their calves.

Factors to optimize pregnancy rate

Variable 1	x	Variable 2	=	Difference
No FMD outbreak	x	FMD outbreak	=	HIGHLY SIGNIFICANT 1.96 (1.76-2.18), p=0.000**
PU	x	TT	=	SIGNIFICANT 1.27 (1.04-1.57), p=0.018*
Cows aged 1 to 9 years	x	Cows older than 9 years	=	SIGNIFICANT 1.24 (1.00-1.54), p=0.042*
Standard sync protocol (full short)	x	Variation 2 sync protocol (short, no cysto D0)	=	SIGNIFICANT 1.19 (1.02-1.40), p=0.029
Expert AI technician	x	Intermediate/novice AI technician	=	HIGHLY SIGNIFICANT 1.31 (1.07-1.61), p=0.008**
Heat score of 1	x	Heat score of 2 or 3	=	HIGHLY SIGNIFICANT 1.57 (1.30-1.91), p=0.000**
AI score of 1	x	AI score of 2 or 3	=	HIGHLY SIGNIFICANT 1.63 (1.28-2.09), p=0.000**

** odds ratio: estimate 95% CI, p value,* stat significant at 5% level,** stat significant at 1% level*

Figure 56: Significant results of the statistical analysis of the odds of pregnancy

Among all the variables crossed, the factors listed in Figure 56 were found to statistically significantly improve the probability of pregnancy, and should therefore be taken into consideration for the design of an AI program as per the following recommendations:

- **Exclude cows 10 years or older** from the program.
- Focus the program on farms with a **management system compatible with AI**, i.e. in Burkina Faso, only peri-urban or traditional improved farms.
- **Use a full synchronization protocol**, as removing the first shot of GnRH at D0 was significantly less effective. However, the shorter full synchronization protocol can be selected if it is more convenient, as there is no impact on results compared to the long one, as long as two shots of GnRH are provided.
- Logically, results will be better if AI is performed by **expert technicians**, in a **disease-free environment**, and on **cows showing overt signs of estrus** (heat score) and **easy to inseminate** (easy to detect the cervix by palpation – AI score).

Results showed that cows inseminated during training periods had improved rates of pregnancy (two-fold compared to usual inseminations). Firstly, cow selection was more rigorously applied during training sessions, with only the best cows being selected for AI. Secondly, more time was allocated to the insemination of each cow and the technique was examined in detail and corrected if necessary. For instance, novice technicians sometimes deposit semen in the vagina of the cow instead of its uterus, because they cannot push the AI gun through the awkwardly shaped cervix which is a common finding in zebu cattle. This emphasizes the importance of applying these recommendations.

IV. Human resources organization

For the six reproduction campaigns undertaken under the auspices of the project, on average teams of **four to eight AI technicians** were able to process **30-40 cows per day** for each of the stages of the process – from recruitment, through two rounds of hormone treatment and insemination. This means that **each technician, on average, could process 5 or 6 cows per day**. In total for the whole project, 5,541 cows were recruited and 6,096 person-days were utilized to go through the various steps in the reproduction campaigns. This means that, on average, **each cow recruited required 1.1 days of technician time** to complete all the steps in a two-round AI process.

Overall, the local human resource requirements for the implementation of the cattle reproduction and health program over the course of the project were as follows:
- **One full-time local project manager** to ensure technical expertise and leadership of the local team.
- **Three full-time AI technicians and three full-time AI assistants** (for data entry and animal restraint), to work as three teams of 1 technician + 1 assistant.
- **Three full-time animal health technicians** to implement the preventive health program.
- **One full-time back-office manager and one part-time back-office assistant** for accounting, general administration, planning and organization of field visits and data entry.

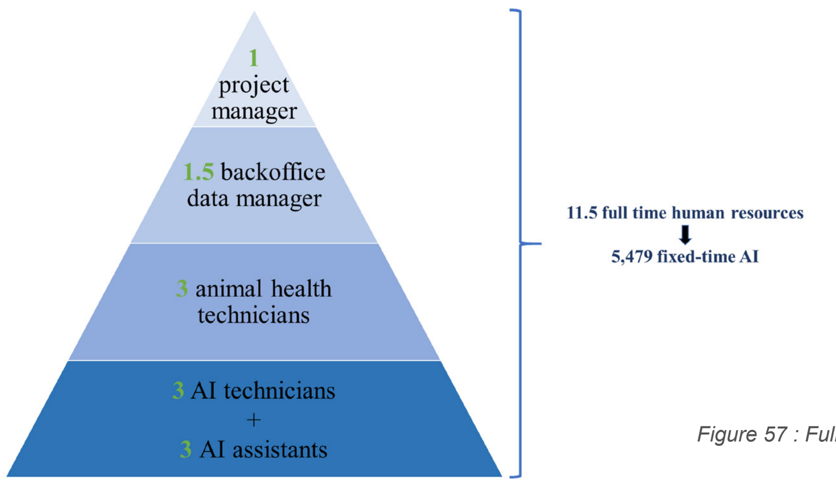


Figure 57 : Full-time local job equivalent for the 3 years of project

V. Economic results & privatization of the Vache du Faso service

The AI program was administered completely free of charge to farmers until October 2019, that is throughout the entire project phase.

The variable cost of implementation of a single AI program (hormones for a full program, semen, AI equipment and AI technician costs for 5 farm visits) was calculated to be USD 55, see Figure 58. Fixed costs including running costs (rent, office supplies, energy, logistics, administration) and management (HR costs for back-office management) were estimated at USD 15,000 per year. The project team conducted a marketing survey and estimated the annual demand for a private AI service at 1,300 AI per year, and the price of one AI was set at USD 70.

Item	Cost/AI (USD)
Semen (+ transport, custom duty & distribution)	11
Hormones (+ transport, custom duty & distribution)	26
AI equipment, tags, liquid nitrogen (obtained locally)	3
Inseminators (5 farm visits for 2 AI technicians)	15
Total variable costs	**55**
Estimated fixed costs	**15**

Figure 58 : Costs for a single AI program

The **local team set up a cooperative** to run the VdF program as a business after the project ended. They continued to offer a paying AI service to farmers in the Bobo Dioulasso region after September 2019 (end of the project). **Demand** came predominantly **from the peri-urban segment** and was for around 500 AI per year. **At this volume, the cost of AI would need to be USD 100** each due to lack of economies of scale, and VdF soon **ran into cash flow issues** despite trying to reduce fixed costs and increasing the price (farmers would not pay more than USD 70 which did not allow the team to make any margin for profit).

The reason for the demand being limited to the peri-urban segment is that **traditional farmers** in the Bobo Dioulasso region **do not yet have ready access to a market for milk**, and this highlights the importance of **implementing AI programs in contexts where there is a pre-existing market for milk** to ensure return on investment for the farmer.

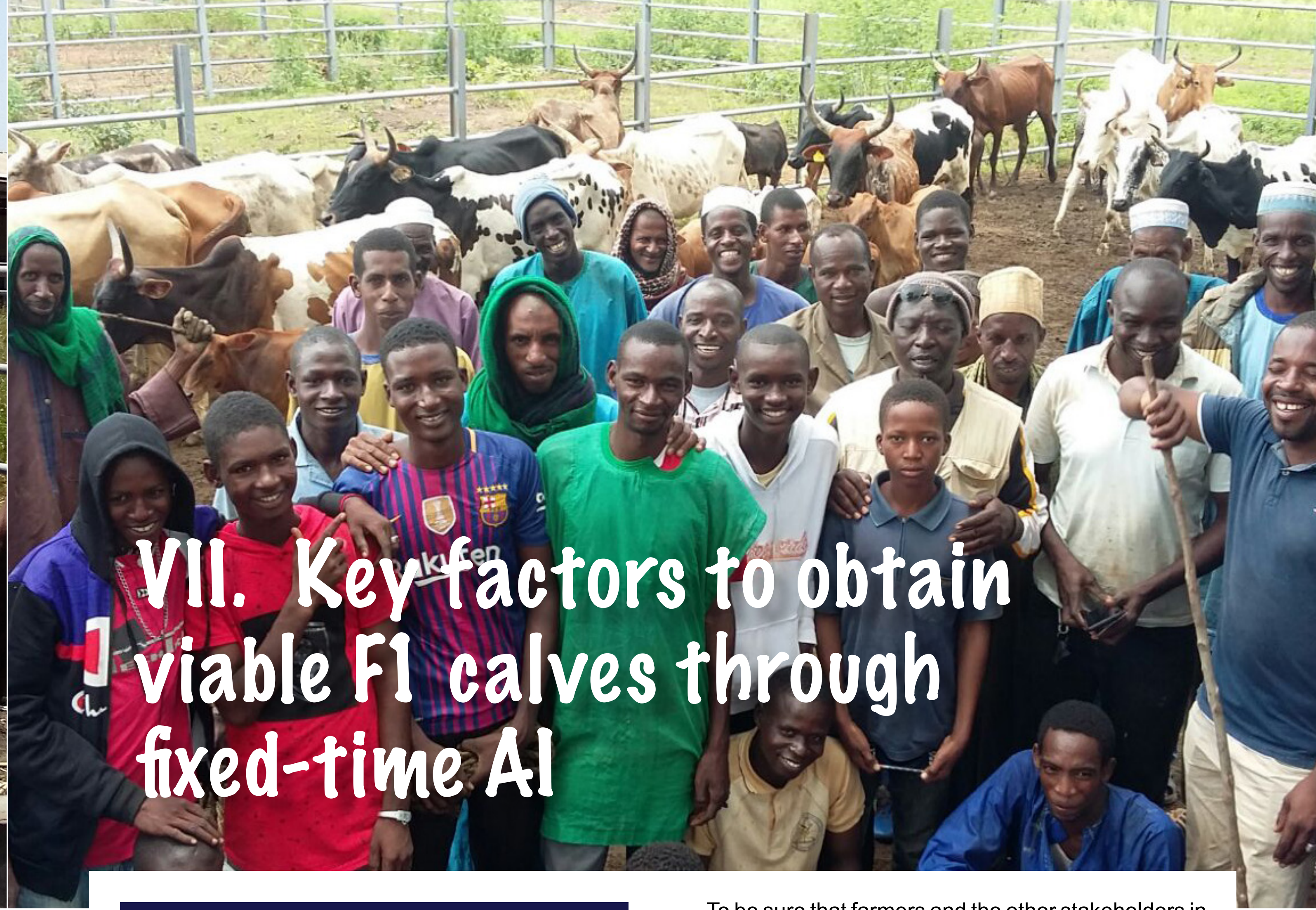
The other take-away is that the full **cost of an AI program is too high and the return on investment too spread out over time for the cost to be borne by the farmer alone** (see chapter VIII), even if the price of an AI program can be adapted according to the context.

Figure 59: CMAP facilities (Ceva, 2017)

VI. Genetic strategy - collaboration with CMAP

To produce F1 breeders via the female line, transfer of pure Montbéliarde and Tarentaise embryos was performed on local breeder females at the CMAP station. **31 embryo transfers** were undertaken over three years, leading to the **birth of 7 live calves** (23% birth rate) of which only **3 have survived** (1 Tarentaise male, 1 Tarentaise female and 1 Montbéliarde male). The males are used as breeder bulls but have not been crossed with local females to produce F1 from the maternal line as prescribed by the exit strategy. The level of investment is therefore not justifiable in a context where survival rates are so low. The ambition had been to cross the purebred female calves with local males to produce F1 males with the exotic genetic from the female calf, thereby promoting hybrid vigor when crossed with F1 females produced in the field inheriting exotic genetics from the male line.
The project also enabled the CMAP to **purchase 8 F1 male calves** with either Tarentaise or Montbéliarde exotic genetics from the F1 calves produced in Bobo Dioulasso.

These males were to be used as breeder bulls to produce semen for the insemination of the F1 females produced by the project (male line). To enable this to happen the project also funded the **refurbishment of the semen production unit and trained the station staff**, but regrettably the CMAP **only sporadically produces semen** due to limited funding available from the state to keep the lab running and cannot therefore deliver on this output.



VII. Key factors to obtain viable F1 calves through fixed-time AI

1. Implementing AI programs in favorable contexts

Before thinking about implementing a similar project elsewhere, it is critical to understand the structure of the sector and its strategic stakeholders. This analysis must be carried out at two levels:

- **The local level**, to determine the scope of the project:
  • Farming systems and characteristics, organization, management practices, location, size of the herds, breeds, technical capacity, etc.
  • Inputs and services providers: feed, health, etc.,
  • Markets for raw or processed products, access and interest in milk,

- **The national level**, to align with the broader strategies:
  • National policies regulating cattle reproduction and dairy production: management of the genetics, identification and monitoring of animals, sanitary follow-up, milk processing, etc.,
  • Public stakeholders directly or indirectly involved in AI programs and genetic monitoring.

Using marketing tools usually intended for developing businesses, such as segmenting the market for instance, is particularly effective during the diagnostic phase of the project:

- To be sure that farmers and the other stakeholders in the value chain (e.g. inseminators) can **benefit from their investments in fixed-time AI**, that there is a **market for their services and production** and to ensure the **sustainability of their business model.**

- To **exclusively target the segments** capable of taking advantage of this activity, thereby avoiding losing the investments made and helping to:
  • **Define 'custom-made' strategies** adapted to each targeted segment and adjust the modus operandi accordingly,
  • **Understand interactions within the sector** to encourage partnerships between stakeholders having similar or complementary objectives.

As emphasized by the VdF project results, fixed-time AI is not compatible with all contexts. Therefore, **adopting a business approach before implementing the project is critical to assess its feasibility and its sustainability**. Furthermore, it limits risks of failure by **highlighting and integrating all factors that could negatively impact results, and by finding solutions to mitigate them.** This approach should also be used at each step of the project to adapt the modus operandi according to the regular feedbacks from the field (customer satisfaction) and to any changes in the context. It also facilitates stakeholders' buy-in and enables a process of continuous improvement.

In all countries where milk production has rapidly increased over a short period of time, **major investments were made**, either by the **private or the public sector** (or both), to catalyse and encourage the emergence of the sector:
- Sensitization and subsidies to improve farmers' access to AI.
- Investments in livestock genetic programs.
- Reinforcement of the milk collection and processing networks.
- Promotion of irrigated crop production to secure feed supply.
- Implementation of customs barriers to protect the sector against massive importations of milk.

AI programs cannot be impactful and sustainable without enabling national policies to facilitate their implementation and **to create a safe environment encouraging people to invest.**

2. Selecting appropriate and well sensitized targets

Farmers are the core of AI programs. Indeed, except for the very technical manipulations aiming to get cows pregnant, which are carried out by AI specialists, the entire downstream and upstream process is under their responsibility. This is why farmers should be **properly selected** based on their **ability to provide appropriate rearing conditions** to their herd and **to value the crossbreds' improved characteristics afterwards.** They should also **be sensitized as early as possible** (at least one year before starting the insemination activities) to be ready when the time comes. To this end, it is important to proceed progressively and focus on the **crucial information** allowing them to optimize AI results.

The initial sensitization should consist of **clearly explaining the benefits of investing in AI** in the specific context of the intervention, but also **the possible limits it may** have in terms of results, prices, timeframe or commitment. Once farmers are aware of the project pros and cons, the second step of sensitization should consist **of giving them the criteria to identify eligible cows for AI** (cf. chapter II.8) which will vary from one context to another. Then, the third key topic of the sensitization should be the **good management and rearing practices**, both before and after AI, to ensure that cows are ready for insemination and can carry a pregnancy to term.

In the Vache du Faso project, all the information and conditions to benefit from the AI program were **stipulated in writing in a commitment letter signed by each farmer**. This letter symbolized the understanding and agreement, on both sides, of each one's roles in the success of the project, and the basis for the development of a trusting relationship.

It is important to make sure that targeted farmers have a **good technical level** allowing them to manage their herd in an appropriate way during the whole process, from selecting the right cows for insemination (not all cows are eligible for AI) to caring for the pregnant cows and their crossbred calves afterwards. Farmers must have a **secure access to the necessary inputs**, at least veterinary services and products as well as feed supply (land providing quality hay and silage in sufficient quantity or a trustworthy commercial fodder producer). They must also have access to a **stable and remunerative milk market** to get a return on their investments.

As previously mentioned, adopting a business approach is also crucial to ensure the sustainability of the project. That is why farmers **should directly invest their own money in the AI program**, even if a part is financially supported by another party. In this way, they will **get involved only if they fully understand the implications of the program and are convinced that this service could help them improve the performance of their herd.** Only then will they do the best they can for the success of the program.

In Burkina Faso, all the selected cattle farmers had similar technical level whatever the segment they belonged to: the only difference that significantly impacted the AI results was due to the practice or not of transhumance. However, in a similar project implemented in Ethiopia, the conception rate results varied significantly between urban semi-intensive (70%) and rural extensive (54%) production systems, highlighting the necessity to **segment the market and focus on the most appropriate targets to optimize the AI investments.**

3. The field team watchwords: rigor and efficiency

Managing an AI program requires having access to **the necessary resources**, especially in terms of human resources and competences. As an example, 10.5 full-time equivalent local employees were involved to proceed to the 6,921 AI conducted by the Vaches du Faso project, as well as one full-time equivalent manager to supervise the project from France. Indeed, **fixed-time AI is a method that requires extreme rigor** since, as its name suggests, each intervention must be performed at a very precise moment. Considering the number of cows to inseminate and the wide area to cover, the organization must be optimal.

Figure 60 : Team Vache du Faso

The first step to optimize the project efficiency is to **hire qualified people**, with sufficient technical background, as part of the field team. However, this basic requirement turns out to be quite challenging in countries where AI is not particularly widespread, such as in Burkina Faso, where there are very few operational private inseminators. In those countries, there is no choice but to hire junior inseminators that should be closely supported, especially during their first campaign (cf. chapter II.8).

Then, it is important to **train the team members** to ensure that they have the adequate skills to successfully carry out their different tasks. To this end, the Vache du Faso field team was continuously trained by the project manager, who was an expert in cattle reproduction under sub-Saharan conditions. International experts also regularly visited the team to assist technicians and inseminators with synchronization protocols and AI manipulations during field campaigns.

Capacity building is a continuous process: regular follow-up should be carried out to identify the potential gaps in training and help the team members gain expertise.

The third step to ensure the efficiency of field team is to **clearly allocate tasks to each member and to make sure they all understand their respective roles.**

Finally, the field team must have **access to the necessary equipment when needed.** It involves vehicles, semen, liquid nitrogen and ultrasound machines for instance, which facilitates early pregnancy diagnosis and saves time between two AI. The management of the **logistic, organization and equipment** was possible thanks to **thorough data management**, which is mandatory for such project, and which also permitted **follow-up of the genetic parameters and the program results.**

4. Securing the upstream supply and downstream market

AI programs are very technical and require **high investments** in terms of genetics, time, human resources and management. To prevent wasting those investments, it is critical to ensure that the upstream and downstream markets are secured.

Concerning the upstream part, the **access to feed is the most critical.** Indeed, in the Burkinabe context, cows are adapted to deal with the high temperatures and the lack of pasture during the dry season: the few nutrients they absorb are used to maintain their basic metabolic functions. As a consequence, without nutritional supplements, it is impossible for them to additionally carry a calf, especially if they must spend energy trekking long distances across the country. Before launching an AI program, solutions must be found to meet this challenge, either by **selecting only farmers owning pastureland** able to provide hay and silage in sufficient quantity, or by **signing agreement with commercial fodder producers** who can ensure a regular supply, especially during the dry season (implies sufficient financial resources).

In the same way, it is important not to get involved in such a program without **having access to a dependable and viable market for milk**. As explained in this report, AI is relatively costly and it is critical for producers to **have the most rapid return on investments possible** for their sustainability. It means that consumers must be ready to buy local milk rather than the imported powder milk they are used to in many regions, and to pay the fair price for it (likely to be higher than imported powder milk). Furthermore, as the dairy production is seasonal, it is also important to consider farmers' **access to processing units**, which are still very few in Burkina Faso at the moment and mainly located around big cities.

Figure 61 : Vache du Faso team ready to go on the field (Ceva, 2017)

Figure 62 : Training on artificial insemination by international expert (Ceva, 2018)

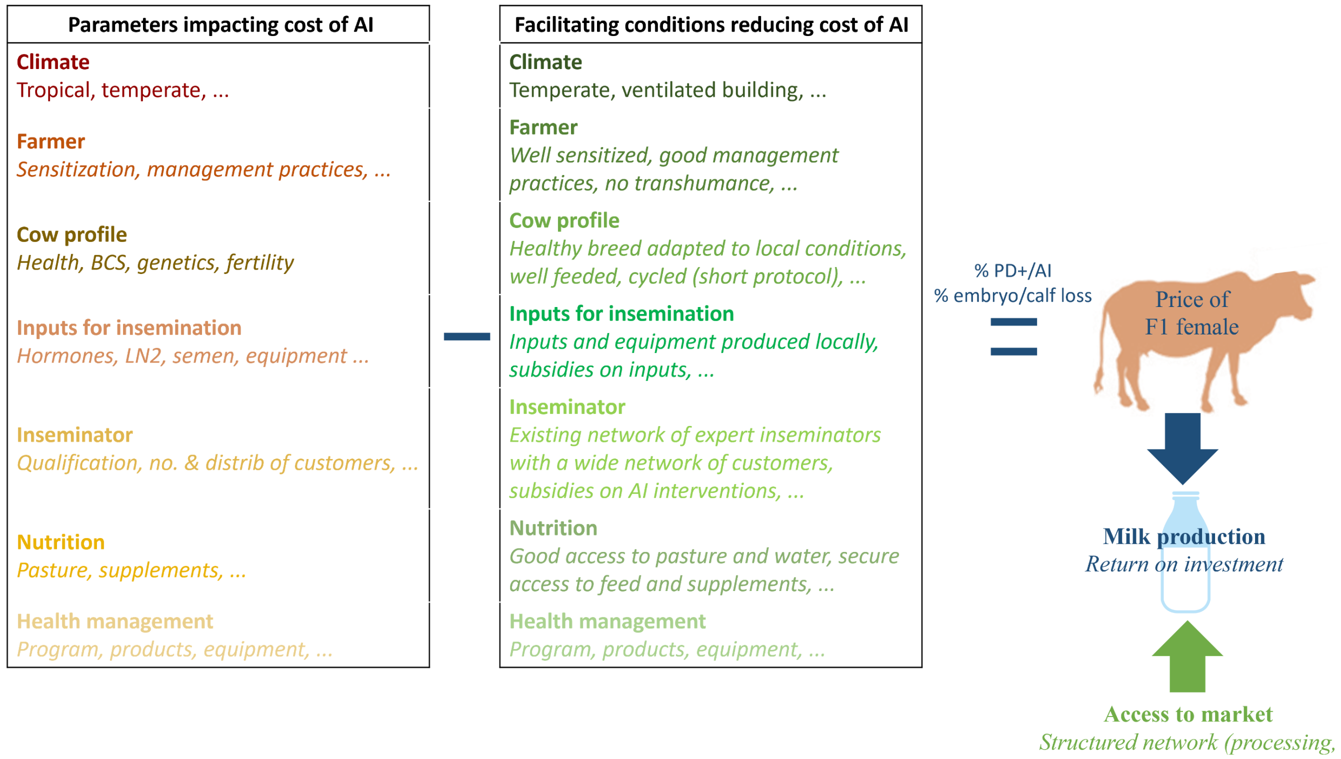
VIII. An economic equation difficult to solve

As highlighted in the chapter V, a major limitation of AI services for the private actor is that **genetic improvement has a high upfront cost and that the returns on investment through increased milk production are not immediately perceived:** they will come into play only when the F1 female resulting from the AI reaches sexual maturity and gives birth to its own calf.

This costly and lengthy economic dimension makes investing in genetic improvement programs **very risky for farmers** because of the **many parameters over which they have little or no control**, such as the occurrence of drought and disease outbreaks.
Costs of AI depend on the key success factors: the context, the targets, the insemination team and methods. Considering them while implementing an AI program will help to reduce costs by assessing its potential impact, identifying the levers that can optimize the investments and increasing its chances of success. Implementing the same genetic strategy will not produce similar results in different contexts, because of all the parameters impacting performances. However, mitigating steps can be taken for each one of the levers presented in the Figure 63 by **making the appropriate choices**.

The final **cost of each insemination will depend on both the cost of the program and its success rate, that is on the number of viable F1 female calves produced.** As an example, the main factors having impacted the economic equation in the Vache du Faso project were the poor access to quality feed and transhumance which weakened the pregnant cows and caused significant calf losses, despite the positive results obtained in getting cows pregnant. Burkina Faso is one of the most difficult contexts to implement AI programs while allowing farmers to generate profit from this activity. Indeed, the **cost of producing a F1 female calf can vary by a factor of ten, depending on some parameters that farmers can control** (cow management, AI program, etc.) and **others they have little or no influence over** (climate, cows' fertility, etc.). Unfortunately, **it is often in the most unfavorable countries that there are the major needs for this sector to be developed**, so where it is vital to propose appropriate solutions.

Figure 63: Levers impacting the price of AI programs



In all countries where there is now a developed AI service, such as in Ethiopia, Kenya or Rwanda, **massive public and/or private investments** were made to roll out AI programs at scale. They can take the form of **subsidies** (on semen, interventions, etc.) to limit upfront costs; **custom barriers** to limit milk importations from other countries; public insemination campaigns to improve farmers' access to the service; and programs to develop the chain of skills, the infrastructures (local production of semen, inputs, etc.) or the network (processing, distribution, etc.). In those countries, where there is also a favorable climate, which improves cows' fertility and their access to pasture, the cost of AI can be much lower (down to USD 30 in some places), compared to Burkina Faso where the price can reach USD 100 (non-cycling cows requiring the use of a full synchronization protocol, importation of inputs, etc.), without considering the success rate of the intervention. **Implementing facilitating conditions in a country enables mitigation of the risks along the value chain and encourages stakeholders to invest in the business.**

In countries which do not benefit from these favorable conditions, other solutions should be found to develop the dairy production and reach self-sufficiency. One option could be to follow a similar model as used for the Poulet du Faso project in Burkina Faso, that is to concentrate the **most technically demanding and critical parts** of the production cycle (in this case the preparation of cows, pregnancy and first months of life of the calf) **in a few farms (calving-units) that are able to provide the highest standards of management.** They would then **sell the weaned F1 female calves**, able to survive under lower standards of management, to local farmers who were ready to make the necessary investments to develop their dairy production. On the other hand, F1 males could be castrated and fattened to be sold, thereby reducing the overall costs of producing females. It would allow the initiative to benefit from economies of scale on certain services and inputs, and to focus the investments (training, equipment, sanitary and AI interventions, etc.) on a limited number of appropriate farmers. Some projections should be done to assess if this model could be profitable and under what conditions according to the context, or other solutions should be found.

Did you know?

In 1975, Morocco invested massively in a national dairy plan aiming to increase rapidly the volumes of milk produced, by improving the livestock genetics (importation of improved imported breeds), promoting irrigated crop production and developing a milk collection network. Subsidies were accessible to support this stimulus in a country where producing milk was not the priority for cattle farmers. The Moroccan government invested in milk processing to ensure a safe market for the dairy production, guaranteed the income distribution across the value chain and introduced customs barriers to protect the sector against massive importations. Thanks to this comprehensive push and pull approach, dairy production increase fourfold between 1970 and 2009.

However, subsidies and technical support started decreasing progressively from the 80', inducing an increase of the cost of inputs, especially feed, and unregulated genetic crossings, whereas the price of milk at the farm level was stagnating. Despite these difficulties, the Moroccan dairy industry has been able to emerge and now seems to provide the vast majority (96%) of the national needs in milk and derivatives.

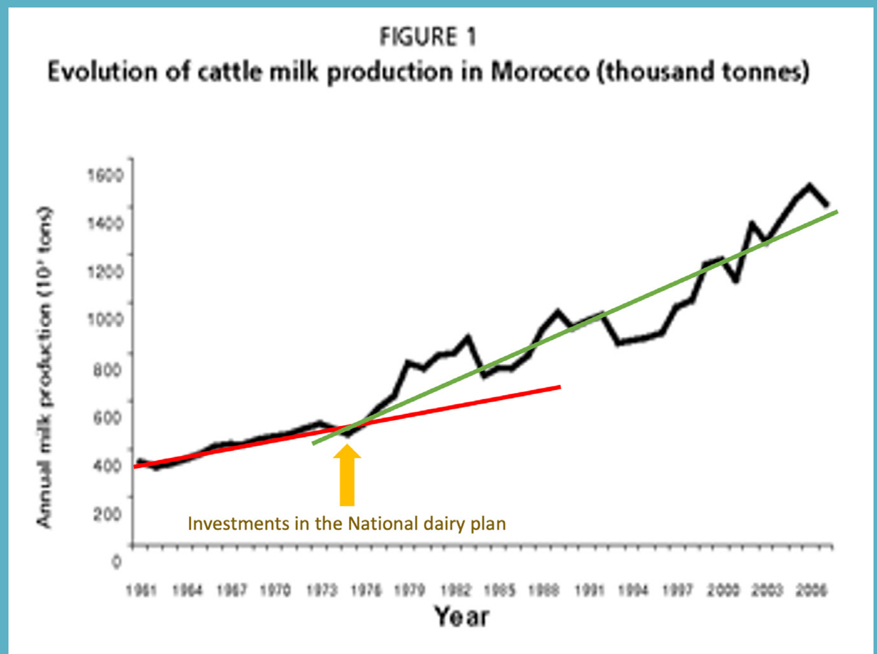


Figure 64: Evolution of cattle milk production in Morocco (MAMF, 2008)

IX. Conclusion

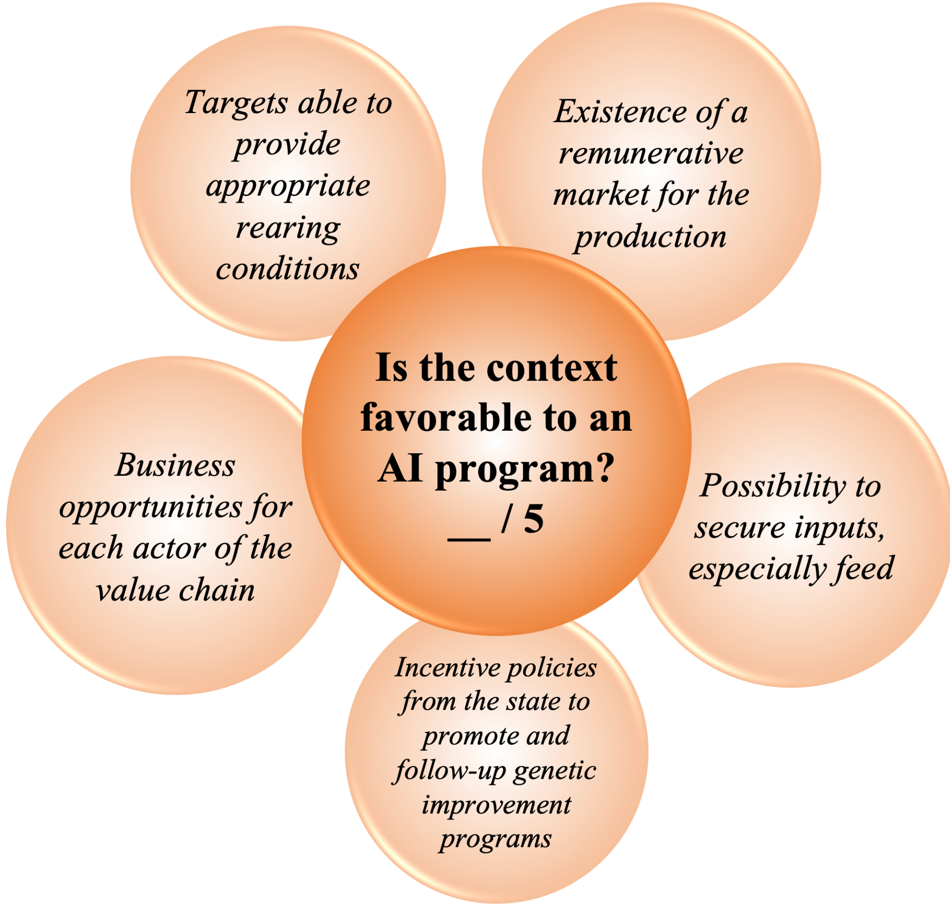
Ceva has long experience in managing and monitoring cattle reproduction programs in Sub-Saharan Africa and **recommends using fixed-time AI**, after the implementation of a **synchronization protocol** adapted to each context.

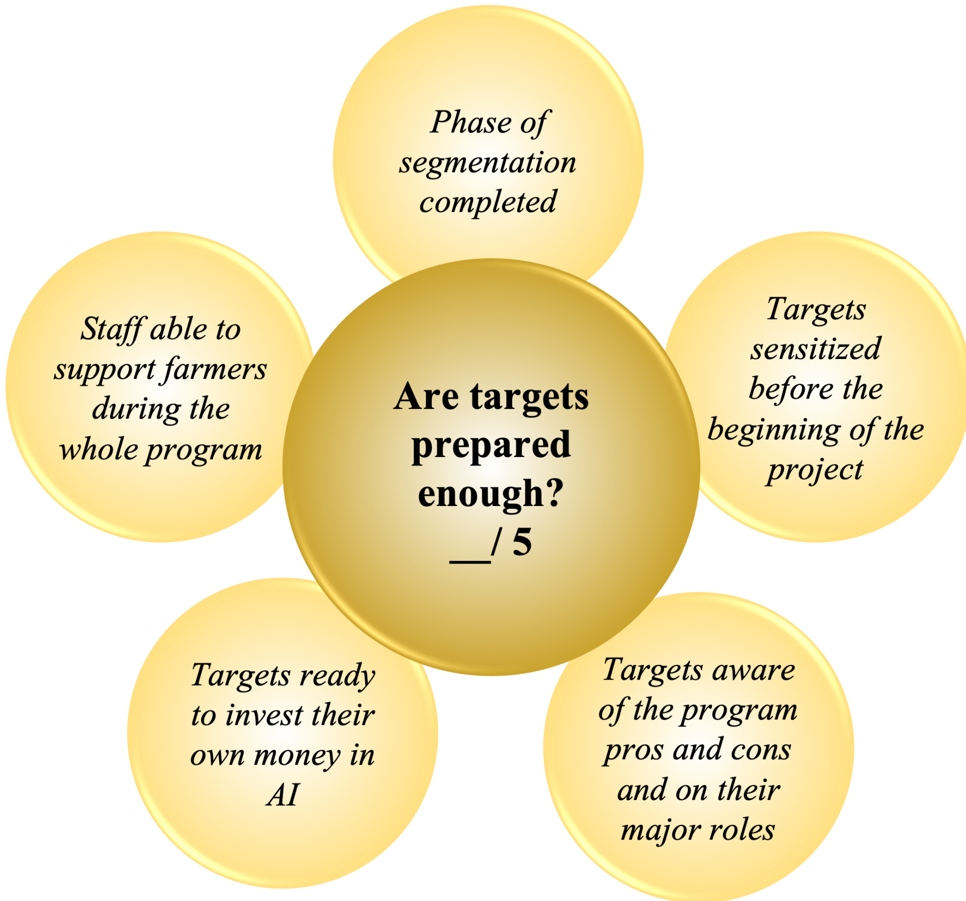
Ceva has the technical skills to reach the best conception rates in the most complicated contexts, such as in Burkina Faso for instance, where the average pregnancy rate reached more than 40% (before the FMD outbreak) despite the unfavorable conditions (warm climate, lack of facilitating national policies, traditional farming systems, farmers' low technical level, no heifers included, non-cycled cows, lack of access to quality feed, etc).

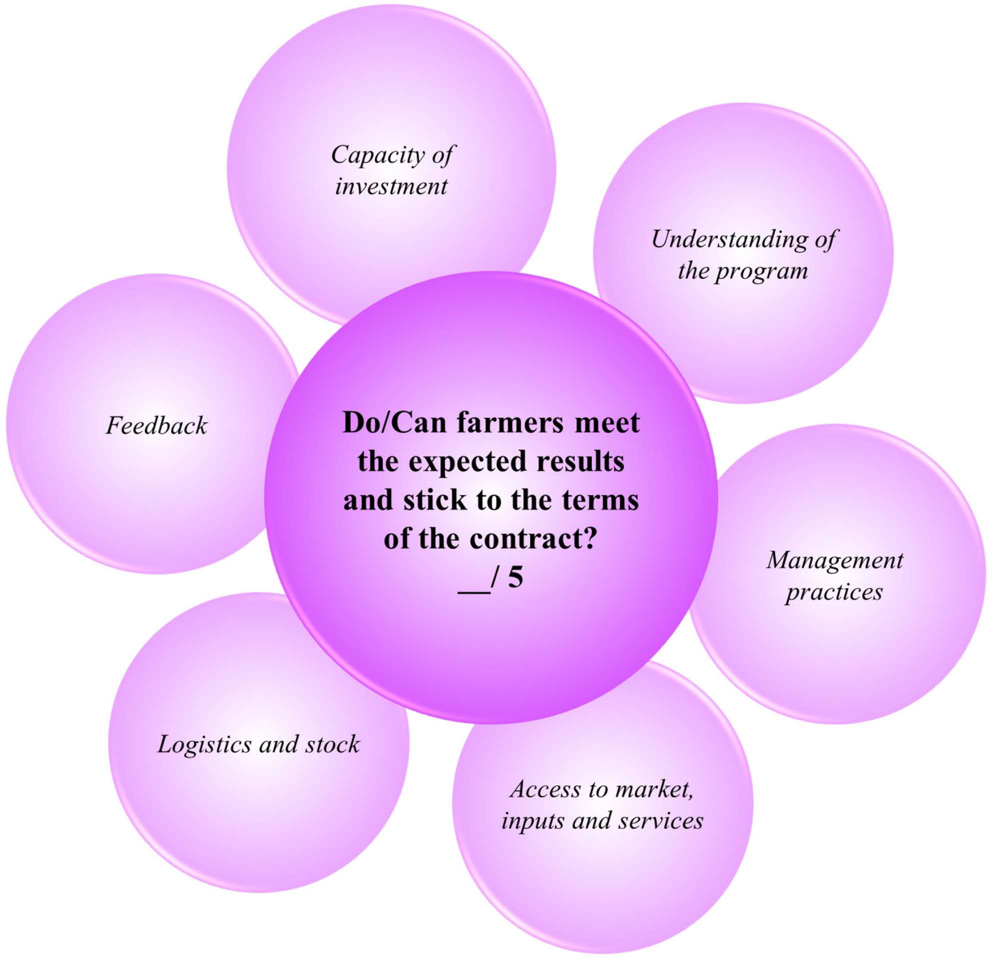
Yet, even if many countries desire support in this area of expertise, it is critical to focus efforts only in contexts where the key success factors mentioned above can be achieved, to ensure the investments made (time, money, human resources) yield healthy crossbred cows able to express their improved genetic characteristics.

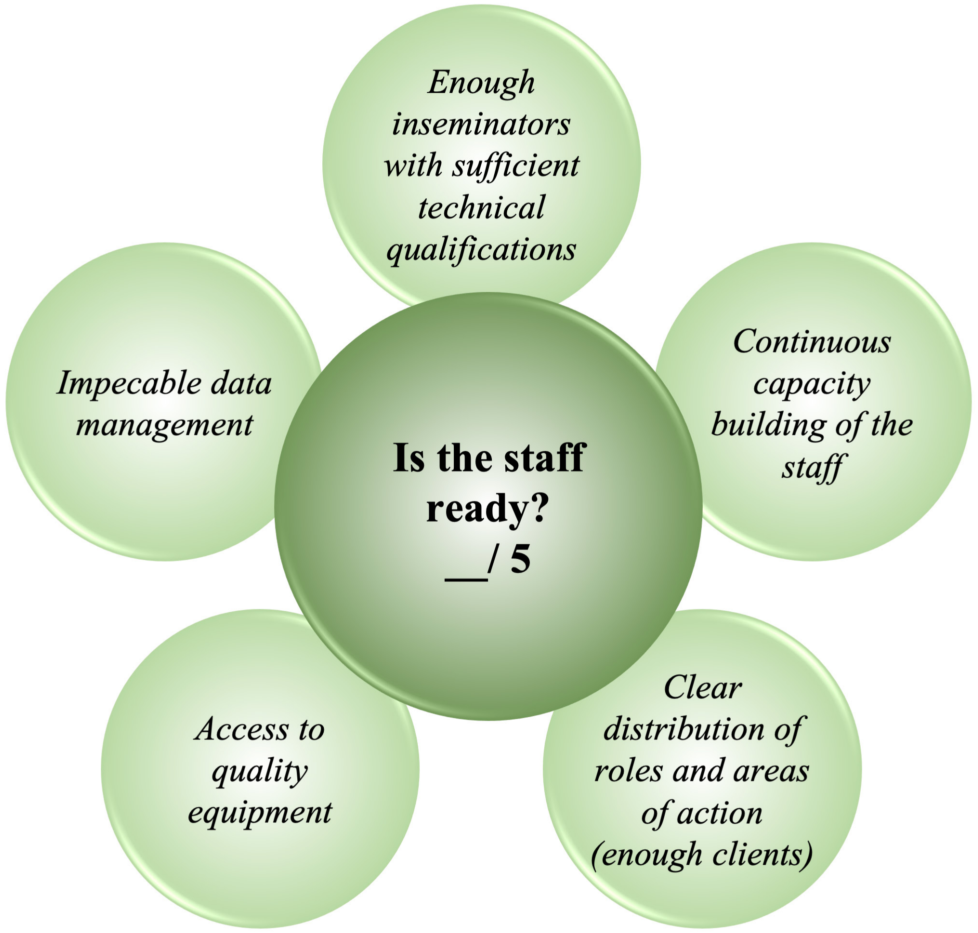
The prerequisites allowing the program to have **measurable impacts** on the development of the sector and on smallholder farmers' livelihood are the existence of national incentive policies, the **existence of a functioning value chain and the ability to sensitize and train farmers.**

A simple model, based on the key success factors, can be used to assess whether or not an AI program is operationally and technically adapted to its context. For this, a series of five categories are scored from 1 to 5. Under 15 points, the project should not be implemented as there are still too many issues that need to be fixed. As all factors are strongly interconnected, it means that if one of them is weak, it will inevitably impact the other factors and threaten the overall strategy. In contrast, if the total exceeds 15, it means that efforts should be focused where the main gaps are identified. This exercise should be done regularly in order for the project to evolve with the local context and for the team to rapidly act when weaknesses are brought to light. It is important to note that although this model combines the necessary operational conditions to carry out a fixed-time AI program, it is not sufficient to ensure its success.







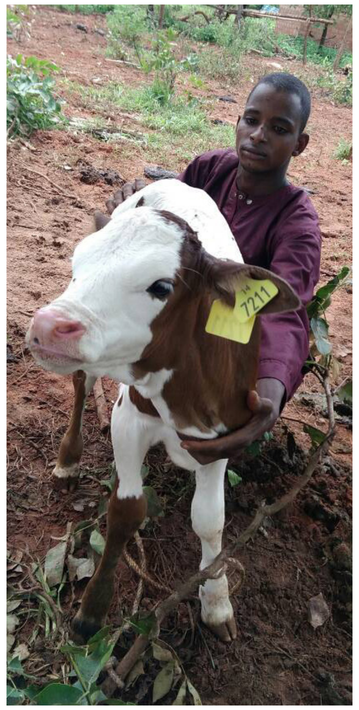


A people story







Local management

Dr. Abdoul Labo – Ceva – Local project manager – Local project management
Mrs. Naimatou Sereme – Vache du Faso – Administrative manager – Data management, fieldwork organization
Mrs. Hadjaratou Sanou - Vache du Faso – Assistant – Administration
Mr. Ousmane Samoura – Vache du Faso – Animal health technician – Delivery of preventive animal health program
Mr. Adam Nombre - Vache du Faso – Animal health technician – Delivery of preventive animal health program
Mr. Gaoussou Sidibe - Vache du Faso – Animal health technician – Delivery of preventive animal health program
Mr. Sindou Cisse - Vache du Faso – Animal health technician – Delivery of preventive animal health program
Mr. Ousmane Ouattara – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Alassane Sawadogo – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Moussa Deme – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Oumar Coulibaly – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Antoine Zorma – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Check Traore – Vache du Faso – AI technician – Delivery of reproduction program
Mr. Khalil Ouedraogo – Vache du Faso – AI technician – Delivery of reproduction program
Mrs. Edith Milogo – Vache du Faso – Cleaner – Cleaning the Vache du Faso HQ

Technical support

Mr. Guy Charbonnier – REPROTECH – Consultant specialist in genetics, reproduction and animal health – Technical support in reproduction & training
Mr. Cyril Gonzales – BCF technology / IMV imaging – Sales manager – Technical support in embryo transfer
Mr. John Sassel – IMV technologies – Business developer Sub-Saharan Africa – Supply of insemination equipment
Mr. Guy Delhomme – IMV technologies – Export & product manager – Supply of insemination equipment
Mr. Didier Hinry – Private AI technician – AI technician – Training of local team

Mr. Mauhamed Lamine Sy – AFRIK BOVIA – Founder and General manager – Importation, distribution of inputs (semen, hormones, etc.)
Mr. Mathieu Patriat – ALLFLEX – Sales manager – ID tag supplier
Mr. Oumarou Wango – CMAP – Director – Genetic exit strategy
Mrs. Diara Kocti – CMAP – Director – Genetic exit strategy
Mr. Mamoudou Diallo – CMAP – Technical manager – Genetic exit strategy
Mrs. Valentine Yapi – CIRDES – Director – Genetic database
Mr. Jean-Paul Brun – COOPEX – Sales manager – importation (semen)

Project management

Dr. Pierre-Marie Borne – Ceva – Director Public Affairs Africa and Middle East – Project director
Dr. Marie Ducrotoy – Ceva – Senior manager Dev. Projects & partnerships – Project manager
Mrs. Marie-Hélène Duffaud - Mr. Diego Raffo – Ceva – Financial controller
Mrs. Marie-Elodie Le Guen – Rapporteur

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