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Socio-Economic Impact of the Multi-Stakeholder Milk Innovation Platform on Actors in Banfora: Status and Prospects

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Executive summary

Since 2015, the Forum for Agricultural Research in Africa (FARA), in partnership with German Government represented by the "Centre for Development Research" (ZEF), University of Bonn, under the "One World No Hunger" initiative has undertaken to implement the "Programme of Accompanying Research for Agricultural Innovation (PARI)" in twelve African countries, including Burkina Faso. PARI believes that research and innovation initiatives in African agriculture have been successful, considering the concept of Integrated Agricultural Research for development (IAR4D) promoted by FARA. PARI supports agricultural research in scaling up agricultural innovations in Africa and thus contributes to the development of the agriculture sector. PARI is jointly implemented with Green Innovation Centres and soil protection and rehabilitation projects under the "One World No Hunger" initiative. It is within this overall framework of implementation of the activities of the said partnership that INERA is empowered in Burkina Faso to contribute to the achievement of a number of objectives, including, for 2017, conducting a study of the socio-economic impact of the Banfora milk innovation platform (IP) on stakeholders of the value chain and determining future investment needs for greater impact and sustainability.

This study complements the in-depth 2016 milk-IP case study, which contributed to the capitalization of IP knowledge and experiences across the country. The results show that the milk collection system works relatively well and ensures supply of 2,100 litres and 700 litres of milk per day in times of high and low production respectively on the entire network of collection points to three fast growing mini-dairies. IP gives member breeders an additional monetary gain of CFAF 20,500/year compared to non-IP members. However, production is negatively impacted by IP membership because cows are stabled while complementation is still low. The establishment of a mechanism to allow access to food concentrates (molasses, cottonseed seeds and cottonseed cake, corn bran, etc.) represents a major lever for improving milk production in the dry season. Further, the development of fodder production with quality species adapted to the area would also be a major asset to be explored by IP to develop milk production. Rations must be developed to allow farmers to participate with an assurance of profitability. One of the challenges to be addressed is improving the detection rate of zoonosis (tuberculosis and brucellosis) among milking cows to protect consumers.

General Introduction

Banfora's multi-stakeholder milk innovation platform has been operational since January 2013. It is now an innovation in view of the development of the milk value chain, which virtually covers the Cascades region. More can be done to improve the performance and incomes of members of this IP, which brings together producers, collectors and processors. Hence, the need to study its socio-economic impact on the actors in the value chain and identify the levers on which to act for greater impact and sustainability. This study will answer the following questions: (i) What is the socio-economic impact of the Banfora Milk Platform on actors in the milk value chain? (ii) What investments are needed to maximize the impact of the Banfora Milk Platform? The answers to these questions will help IP actors to measure the socio-economic impact of their innovation and also to take steps to correct shortcomings in order to substantially improve the income of beneficiaries. This report is built around four main points. The first two deal with the methodological approach of the study and the functional organisation of IP stakeholder groups respectively. The third point analyses the socio-economic impact of IP on the actors of the links involved while the fourth point seeks to identify the levers of investment for improved IP performance.

Methodology

This study began with a literature review on methods for evaluating the economic impact of an action. This was followed by an information session with the IP office. These first two phases enabled us to draft questionnaires that were used to collect data from producers, collectors and processors in the Cascades region.

Study area

The Cascades region was created by Act n ° 2001-013 / AN of July 2nd, 2001 creating regions. It is divided into two provinces (Comoé and Léraba) and has 2 cities, 3 urban communes, 14 rural communes, 17 departments and 270 villages.

Located in the far west of the country, the waterfall region is bordered to the north by the Hauts-Bassins region, south by the Republic of Côte d'Ivoire, to the east by the south-west region and to the south by the Republic of Mali. It is therefore a border area between Côte d'Ivoire and Mali. (See map N ° 1)

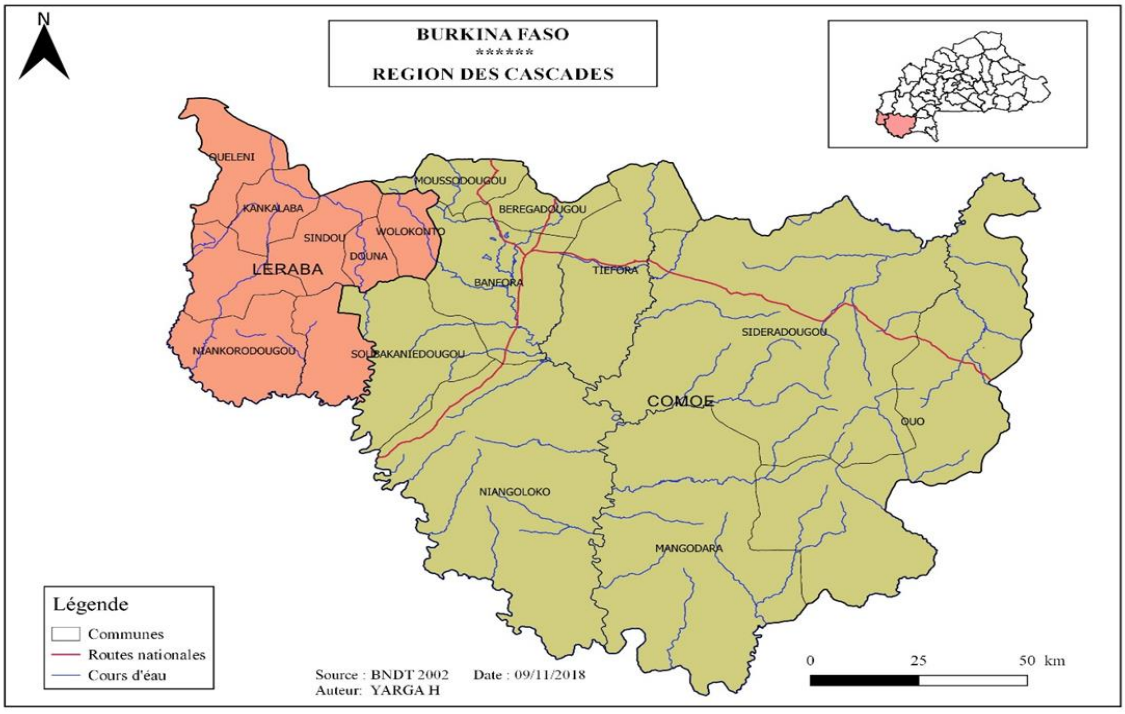
The region covers an area of 18 917 km2, or 6.7% of the national territory with a population of more than 700 000 inhabitants. Its county town is Banfora, located 85 km from Bobo-Dioulasso and 450 km from the capital, Ouagadougou.

The Cascades region abounds with huge potentialities that could contribute to its development if exploited.

In the agricultural sector, the region has a clear comparative advantage in the production of maize, fonio, rice and other food products such as Bambara groundnut, yam, cassava and nutmeg, compared to some parts of the country.

The livestock sector benefits from:

- A large and varied livestock;
- Existence of a significant biomass;
- Existence of permanent planes and water sources (excluding classified forests);
- Existence of transhumance routes toward the South;
- Existence of cattle feed (molasses, fodder, cottonseed cake, cashew processing waste), which is conducive to fattening.



Map 1: Study area.

Direct and indirect actors of the links of the Banfora milk value chain

Since 2013, the platform has been developing dairy production in the Cascades region and linking it to the market through a value chain approach. The currently functional links in this value chain are production, collection and processing. Also, plans are underway to establish links of livestock

feed production, and dairy product distribution and marketing. The region has more than 100 producers out of a potential of over 1,000. Producers supplying milk to the four milk IP processing units are scattered across the municipalities of the Cascades region including the town of Banfora. The transformation link is ensured by four processing units all located in the city of Banfora. In each commune, a milk collection centre, where the main collectors collect milk to be supplied to the processing unit, has been established. Marketing and consumption are indirect links provided by traders and the region's population respectively. These links are supported by technical support services and microfinance institutions. Collectors are people accredited by dairies to collect milk from collection points and deliver to dairies. Collection points are locations defined by cattle farmers to collect their production to facilitate delivery to mini-dairies.

Information session

The research team conducting this study organized a meeting with the management committee of the Banfora milk innovation platform. It was a face-to-face approach to inform the committee of the purpose and relevance of this study to their platform and to solicit the necessary primary data (number of actors in each link, geographical distribution of actors etc.). The discussion made it possible to obtain support and warmer welcome from all the actors. We used the opportunity to collect documents, such as the list of IP members, the list of milk collection centres, statistics on milk production and the processing of milk into milk products. This facilitated the work of the investigators.

Surveys

The non-probabilistic approach was used in the survey, as the study focuses on both IP-based actors with an exhaustive list and non-members with no list. In addition, at the end of the winter season, some actors in the list obtained move for one reason or another, making it difficult to apply a random choice. Furthermore, this approach was chosen to harmonize the choice of observation units that were interviewed for convenience. Data was collected by nine investigators who were recruited and trained on the harmonized understanding of the various questions and their translation into local languages. A real-life pre-survey helped to fine-tune the questionnaires.

Data analysis

Data collected were entered on the microcomputer using MS Excel 2013. The resulting database was verified and cleaned and then exported to Stata 12.0 for the various analyses.

Descriptive analysis

It involved examining the data and cross-referencing the structural and operational parameters in order to study the characteristics of the production systems. Microsoft Excel PivotTables were used.

Econometric analysis of impact

The literature review showed that random sampling, regression discontinuity, double difference, and matching (Gertel et al., 2011) are the commonly used methods in economic impact assessment. However, these methods require the creation of two groups of similar factors side by side even before implementation of the IP. One group should be intended to participate in the IP and the other should serve as the control. In this case, the evaluation should make it possible to determine the impact of participation or non-participation in the IP on the daily production of milk per cow according to the season. Given the absence of the two groups described above in the field, variance analysis was used as an alternative to analyze the impact of IP on the actors in the links involved. Prospection of future investment levers to improve IP performance was done using the econometric estimation of production regression on the parameters of milk production.

IP impact was measured here in terms of the variance between the average values of daily milk production and the selling price of a litre of milk. To do this, a test was used to compare the means of the groups (Carricano and Poujol, 2009). Secondly, productivity and average price per period and group allowed to deduce the impact of IP on the income of producers. Regarding the impact of IP on collectors and processors, a simulation of situations with and without IP under the principle of "Ceteris paribus" was carried out.

- The case of average milk production:

$\bar{X}_{(j)} = \frac{\sum_{i=1}^{n} n_{ij} q_{ij}}{Q_j}$ with $j = \begin{cases} 1, if\ the\ producer\ is\ a\ member\ of\ the\ platform \\ 0, if\ no \end{cases}$

$\bar{X}_{(j)}$ is the average daily production per cow of group j, n_{ij} is the average production per cow an individual i of group j; q_{ij} is the number of milking cows of the individual in group j and Q_j is the total number of milking cows of group j.

Assuming that the averages of the two groups are equal

$H_0 : \bar{X}_{(1)} - \bar{X}_{(0)} = 0$ there is no difference in productivity between members and numbers of the IP, against the alternative hypothesis:

$H_0 : \bar{X}_{(1)} - \bar{X}_{(0)} \neq 0$ there is a difference in productivity between members and numbers of the IP, we deduce from the significance of the average difference in productivities between the two groups of producers

The case of selling price of milk:

$\bar{Z}_{(j)} = \frac{\sum_{i=1}^{n} p_{ij} q_{ij}}{P_j}$ avec $j = \begin{cases} 1, & if\ the\ producer\ is\ a\ member\ of\ the\ platform \\ 0, & if\ no \end{cases}$

$\bar{Z}_{(j)}$ is the ave tttrage selling price of a litre of milk of group j, p_{ij} is the selling price of a litre of milk of an individual i of group j; q_{ij} is the quantity of milk sold per individual of group j and P_j is the sum of selling prices of milk by individuals of group j.

Assuming the averages of the two groups are equal

$H_0 : \bar{Z}_{(1)} - \bar{Z}_{(0)} = 0$ there is no difference in selling price between the two groups, against the alternative hypothesis $H_0 : \bar{Z}_{(1)} - \bar{Z}_{(0)} \neq 0$ there is a difference in selling of price of milk between the two groups, we deduce the significance of the difference from the average selling price between the two producer groups.

Economic analysis of the levers of action

The search for leverage to strengthen the performance of the Banfora Milk IP focuses exclusively on the production link. This is because the "collection and transformation" link samples are small (less than 30 observations).

To do this, the general linear regression method was used to regress milk productivity on the operational and organizational characteristics of producers. This is to find out the meaning and intensity of the influence of these variables on milk production. That is, the general econometric model below:

$$\boldsymbol{y_i = \beta_0 + \beta_i x_i + \varepsilon_i} \qquad (1)\ \text{(Bourbonnais, 2015)}$$

Where y_i is the vector of the observations of the dependent variable; β_0 is the constant of the model; β_i is a vector of the coefficients of the model; x_i is the matrix of explanatory variables and ε_i is the vector of random variables.

The dependent variable refers to dairy productivity named ***Prodlt.*** In other words, it is the amount of milk produced per cow and per day. Only the dry season is studied in this report, since in winter, livestock farming practices do not change much, with food sources provided by natural fodder.

The independent variables refer to the factors that can influence milk production of a farming household. These factors are:

- age of producer, named ***Age***;
- sex of producer, named ***Gender***
- number of dairy cows producing at the same time in the farm, named ***Nvach***

- participation in the IP, named ***Mpi***

- per capita expenditure for animal feed, named ***Depal;***

- expenditure on veterinary care per head of the farm, named ***Depsant***

- household size, named ***TailMg***

More specifically, equation (1) becomes:

$$\mathrm{Prodlt_i} = \beta_0 + \beta_1 \mathrm{Age_i} + \beta_2 \mathrm{Genre_i} + \beta_3 \mathrm{Nvach_i} + \beta_4 \mathrm{MPI_i} + \beta_5 Depal_i + \beta_6 Depsant_i + \beta_7 TailMg_i + \varepsilon_i \quad (2)$$

Results

Organization and functioning of actors of IP groups

The organization and functioning of producer members of the Milk IP are presented in terms of the characteristics of farming systems, size and composition of the farms of respondents, awareness and participation in the Milk IP, outlet for milk marketing, etc.

Characteristics of farming systems of sampled cattle farmers

The producers surveyed are mostly middle-aged (Table 1). Young farmers are also well represented (23%). This table shows that the people who manage milk production in farms in the study area are relatively young. Assuming that they are more open to change, this would be a sign of hope for the development of a dairy farm in the study area.

Table 1: Distribution of sampled producers according to collection point and age

Collection points	Age group				Grand total
	Young (18-30 yrs)	Middle age (31-45 yrs)	Old (46-60 yrs)	Very old (>60 yrs)	
Banfora	4	9	6		19
Diaraba-Koko	6	9	8	1	24
Kankounadeni	8	9	3	0	20
Madiasso	1	12	14	3	30
Soubakanièdougou	3	13	8	0	24
Tiéfora	9	12	8	1	30
Toumousseni	8	6	6	2	22
Grand total	39 (23%)	70 (41%)	53 (31%)	7 (4%)	169

Source: Survey data, January 2018

The majority of cattle farmers surveyed had attended Koranic school (Table 2). 37 per cent of them did not go to school. A few of them, nearly 14%, were literate in local language or had had primary education. The report also shows the predominance of producers from the Peulh ethnic group in the livestock sector. They were strongly Islamized and rarely sent their children to mainstream schools. Their main activity being taking animals to pasture in all seasons, they had very little time to devote to literacy in local languages.

Table 2: Distribution of sampled producers according to collection points and level of education

Collection points	Level of education				Total
	No	Primary	Literate	Koranic	
Banfora	6		1	12	19
Diaraba-Koko	11	1	6	6	24
Kankounadeni	14	1	0	5	20
Madiasso	3	4	0	23	30
Soubakanièdougou	18	1	2	3	24
Tiéfora	7	1	2	20	30
Toumousseni	3		5	14	22
Total	62 (37%)	8 (5%)	16 (9%)	83 (49%)	169

Source: Survey data, January 2018

Size, composition and activities of sampled farms

Overall, the farms surveyed are medium-sized with an average population of 10 (Table 3). The largest farms are found in Madiasso and Tiefora. The average number of agricultural workers (> 15 years) is 6 people with a balanced representation of men and women. As a result, there is a good workforce potential for performing pastoral and agricultural activities including milking and milk management. Children (<15 years) are on average 5 per farm, suggesting significant costs including school costs that could further legitimize the economic value of milk production.

Table 3: Average size and composition of sampled farms

Collection points	Household Size	Men >15 yrs	Women >15 yrs	Children < 15 yrs
Banfora	7.9	2.2	2.5	3.3
Diaraba-Koko	8.3	2.3	1.8	4.3
Kankounadeni	9.1	2.1	1.7	5.3

Madiasso	13.8	3.6	4.1	6.2
Soubakanièdougou	8.9	2.2	2.7	4.1
Tiéfora	11.8	3.9	3.0	4.9
Toumousseni	10.2	3.0	2.5	4.6
Average	10.3	2.9	2.7	4.7

Source: Survey data, January 2018

The vast majority of respondents say their main activity is livestock farming (85%). On the other hand, agro-pastoralists account for 9 per cent while those whose main activity is milk production represent 6 per cent (Table 4).

Table 4: Main activity of sampled producers

Collection points	Main activity			Total
	Livestock	Agriculture	Milk production	
Banfora	18	1	0	19
Diaraba-Koko	24	0	0	24
Kankounadeni	16	0	4	20
Madiasso	16	14	0	30
Soubakanièdougou	17	1	6	24
Tiéfora	30	0	0	30
Toumousseni	22	0	0	22
Total	143 (85%)	16 (9%)	10 (6%)	169

Source: Survey data, January 2018

The table shows that, at Madiasso, there is a balance between the respondents whose main activity is agriculture (14) and those whose main activity is livestock (16). Milk production is the main activity for ten respondents distributed between Kankounadéni and Soubakanièdougou

Awareness and participation in Milk IP

The vast majority of respondents (75%) participate in Milk IP activities (Table 5). Of those who are not members of the Milk IP, only 6 per cent are unaware of its existence compared to 19 per cent who are aware but do not participate in its activities. These findings show that activities of Milk IP are well communicated.

Table 5: Distribution of sampled producers according to their awareness and/or participation in IP-Milk.

Awareness of IP	Participation in IP		Total
	No	Yes	
No	10 (6%)	0	10 (6%)
Yes	32 (19%)	127 (75%)	159 (94%)
Total	42 (25%)	127 (75%)	169

Source: Survey data, January 2018

Milk marketing depending on participation or non-participation in IP

The milk collection centres put in place in the municipalities allow 69.3 per cent or 88 of IP respondents to have a particular buyer for their milk: the collector. The collector gathers the individual productions which he then delivers to the processing unit. On the other hand, only 7 per cent of non-IP producers have a loyal customer to whom their product is sold. The remaining 18 per cent shop around villages and local markets in search of buyers. This practice usually results in losses as the milk contained in calabashes eventually get spoiled because they are poorly preserved.

Table 6: Participation in IP and milk marketing

Access to specific market	Are you an IP member		Total
	No	Yes	
No	31 (18%)	39 (23%)	70 (41%)
Yes	11 (7%)	88 (52%)	99 (59%)
Total	42 (25%)	127 (75%)	169

Source: Survey data, January 2018

Table 6 shows that IP ensures milk flow. Only 23 per cent or 39 IP respondents do not have access to a market. This situation is due, in part, to the long distance (more than 80 km) to some collection centres (Madiasso, Tiéfora) from the processing unit (located in Banfora) and the low equipment level of collectors. The collectors are limited in the collection and transport of milk and the distance of the processing unit makes delivery time longer. They therefore go to Banfora as soon as possible in order to deliver quality milk to the processing unit. This makes it difficult to deliver milk from producers located at a relatively long distance from the collection centre.

Herd management

The average herd size is 61 head of cattle (Table 7). This average is lower among producers surveyed in Madiasso and Diaraba-Koko (46 and 48 head) and higher in Tiéfora and Toumousséni (75 and 80 head). The average number of cows represents about 2/3 of the herd. The number of cows milked at the time of the survey represents about 1/3 of the average number of cows in the

herd. In times of high production (HP), the average amount of milk per day per herd is 16 litres. The highest averages are found in Banfora and Toumosséni (20 and 22 litres) while the lowest averages are observed in Soubakanièdougou and Madiasso (12 litres). In low production period (LP), this production falls by about half. The average income generated by the sale of milk per herd is 3,581 FCFA per day during high production. As a result of the decline in milk production during periods of low production, incomes also fall by about half.

Table 7: Characteristics of sampled herds

Collection points	Herd size	Nb_Vach Herd	Nb_Vach_ Milk	Q Milk J HP	Q Milk LP	Rev_milk HP	Rev_milk _LP
Banfora	60	40	14	20	9	5534	2361
Diaraba-Koko	48	30	13	15	7	3531	1715
Kankounadeni	57	44	13	17	6	3073	1289
Madiasso	46	26	10	12	6	2393	1173
Soubakanièdougou	60	46	9	12	5	2333	1100
Tiéfora	75	53	17	17	7	3552	1339
Toumousseni	80	50	27	22	11	5432	2882
Total	61	41	14	16	7	3581	1639

Source: Survey data, January 2018

The average amount of milk per cow per day during high production (one litre) and low production (half a litre), shows the extensive nature of farming practices.

Analysis of dairy production per cow during high production (Table 8) shows that more small farmers record high levels of productivity compared to medium and large livestock producers. This would mean that small farmers tend to increase their milk productivity.

Table 8: Quantity of milk produced per cow based on herd size and collection points

Collection points	Categories of livestock farmers/ Quantity of milk per cow (litres)			Together
	Large	Medium	Small	

	High	Average	Low	High	Average	Low	High	Average	Low	
Banfora	4.0(1)	1.6 (4)	1.3 (5)	2.9 (1)		1.1 (7)	3.0(1)			1.6 (19)
Diaraba-Koko		1.6 (3)	0.9 (8)		2.0 (2)	1.0 (4)	3.8(3)	2.5 (3)	1.0 (1)	1.7 (24)
Kankou-nadeni		1.8 (4)	0.8 (6)			1.3 (3)	2.9(2)	1.5 (1)	1.1 (4)	1.4 (20)
Madiasso		1.7 (6)	0.9 (6)		2.4 (1)	0.9 (5)	2.7(1)	1.8 (5)	1.1 (6)	1.4 (30)
Soubaka-nièdougou		1.6 (2)	1.0 (5)	2.9 (1)	1.8 (3)	1.0 (8)	4.0(1)	1.8 (2)	0.9 (2)	1.4 (24)
Tiéfora		1.7 (5)	0.9 (16)			1.1 (3)		1.5 (1)	1.1 (5)	1.1 (30)
Toumousseni		1.5 (2)	0.7 (10)		1.7 (2)	0.8 (5)	3.0(1)	1.5 (1)	0.7 (1)	1.0 (22)
Grand total	4.0(1)	1.7 (26)	0.9 (56)	2.9 (2)	1.9 (8)	1.0(35)	3.3(9)	1.9(13)	1.0(19)	1.4 (169)

Source: Survey data, January 2018 **(**the figures in brackets represent the number of observations)

Feeding and health practices

Although livestock farming in the study area relies primarily on natural pastures, farmers add feed supplementation. Farmers mostly buy rock salt (78%) for mineral supplementation (Table 9). They also buy cottonseed cake as a nitrogen supplement. Cereal bran is the third resource purchased by half of respondents as a source of energy. Crop residues are starting to be purchased for the same supplementation, especially in Madiasso and Soubakanièdougou. Other resources exist but are rarely used (*nere* flour, salt lick, cottonseed and sugar cane molasses).

Table 9: Frequency of use of major livestock feeds

Collection points	Sampled	Salt	Cattle cake	Bran	Crop residues	Others	Total
Banfora	19	19	18	8	1	4	50
Diaraba-Koko	24	2	16	10	1	1	30
Kankounadeni	20	16	5	6	0	3	30
Madiasso	30	26	27	25	26	0	104
Soubakanièdougou	24	23	14	1	19	0	57
Tiéfora	30	31	22	21	0	2	76
Toumousseni	22	14	10	9	2	0	35
Total	169	131	112	80	49	10	382

Source: Survey data, January 2018

The health practices of cattle farmers surveyed are limited to following the vaccination schedule established by the veterinary services of the region, mainly internal and external deworming, trypanocidal treatments at the beginning and end of the rainy season, vaccination against epizootics (contagious bovine pleuropneumonia during dry and cold season, blackleg and brucellosis) and regular treatment against ticks. These interventions are programmed by the veterinary services. The status of screening practice is presented in Table 10.

Table 10: Brucellosis and tuberculosis test

Test Performed	Brucellosis test		Tuberculosis test	
	Frequency	Per cent	Frequency	Per cent
No	26	15.95	36	22.09
Yes	137	84.05	127	77.91
Total	163	100.00	163	100

Source: Survey data, January 2018

It is observed that 84 per cent and 80 per cent of cattle farmers tested their flocks for brucellosis and tuberculosis respectively. This is a remarkable achievement given that most of them are traditional cattle farmers and very suspicious of this kind of tests. However, the fact that 16 per cent of cattle farmers surveyed do not screen their herds for brucellosis and 22 per cent for tuberculosis is a major point to discuss with IP actors with regard to the risk of transmission of germs in case of failure of pasteurization or contamination of fluid milk. This minority may call into question the efforts of the vast majority who did the screening, as the milk of all cows heads to the same processing units and the animals graze the same areas.

Keeping flock in good condition for good milk production requires expenses.

Herd management costs and milk production constraints

The main sources of expenditure directly related to herd management are food, veterinary care, guarding and fines paid for animal damage to third parties. Table 12 shows the frequency of the sources of expenditure in the farms surveyed. Of all the respondents, only 4 farms at the Diaraba-Koko collection point said they did not record any expenses related to feeding their herds. This shows that the practice of supplementation in addition to natural grazing is commonly adopted by the respondents.

Thirteen (13) farmers surveyed did not record expenditures related to veterinary care in 2017. The majority of them came from the Kankounadéni collection centre. This could be as a result of a relative lull in epizootics in the area or a confirmation that some cattle farmers do not routinely screen their flocks.

Most of the respondents pay for their flocks to be guarded, especially in Madiasso and Soubakanièdougou. These two localities are densely populated agricultural areas with land pressure that has drastically reduced pastoral areas. This situation requires great vigilance in herd monitoring especially during the planting season. As a result, guarding by contract workers is developed in addition to family labor.

Regarding fines paid for damage caused by the animals, only respondents from Kankounadeni collection centre are exempt. On the other hand, in Soubakanièdougou and Madiasso, the majority of the respondents paid money in compensation for damage caused by their animals. The area borders the classified forests of Koflandé and Logoniégué and cattle incursions are frequently sanctioned by rangers. In addition, the small size of cattle tracks and uncultivated areas increases the risk of animal damage to crops, which results in fines.

Table 11: Frequency of expenditures directly linked to herds

Collection points	Sampled	Cattle feed	Veterinary expenses	Guarding expenses	Fines
Banfora	19	19	17	12	8
Diaraba-Koko	24	20	21	11	8
Kankounadeni	20	20	15	3	0
Madiasso	30	30	30	30	18
Soubakanièdougou	24	24	22	19	22
Tiéfora	30	30	30	23	16
Toumousseni	22	22	21	11	14
Grand total	169	165	156	109	86

Source: Survey data, January 2018

The practices discussed above (supplementation, veterinary care and guarding) sometimes generate high costs (Table 12). In general, guarding of herds is the highest cost incurred by cattle farmers (235,000 CFAF / year on average). It accounts for about one-third of average annual expenditures directly related to herd management. Banfora collection centre respondents pay the most (CFAF 1,038,128) for the management of their flocks. On the other hand, Kankounadéni centre pays the least for herd management (CFAF159,083). As Banfora is a town, livestock farming practices are more or less intensive, and extensive in Kankounadeni because of the existence of grazing areas.

Table 12: Cost related to feeding, veterinary care, guarding and fines

Collection points	Feed	Care	Guarding	Fines	Total

Banfora	236 737	186 853	273 750	340 788	1038128
Diaraba-Koko	115 200	197 571	203 182	57 500	573453
Kankounadéni	14 750	36 000	108 333	0	159083
Madiasso	265 652	134 150	153 233	60 889	613924
	121 248	284 886	437 237	95 273	938644
Soubakanièdougou					
Tiéfora	195 037	357 233	198 739	73 125	824134
Toumousseni	102 000	113 333	200 636	187 500	603469
Grand total	158 010	200 349	234 197	118 294	710850

Source: Survey data, January 2018

This state of affairs reveals in part the constraints linked to milk production.

There are many constraints to the development of milk production in the Cascades region. In order of frequency according to the results of the survey, they include (i) lack of water (68 per cent of respondents); (ii) access to livestock feed (29 per cent of respondents); (iii) insufficient and difficult access to natural pastures and inadequate livestock infrastructure and equipment. Although the Cascades region is one of the best watered regions in Burkina Faso, the main problem livestock farmers in this area face is lack of water for livestock watering. It is necessary to review the pastoral hydraulic policy in the area in view of the high concentration of cattle.

For better milk production in the Cascades region, an innovation platform for dairy producers has been put in place. Analysis of the impact of this platform will help to put in place sustainable strategies in terms of milk production and processing for the benefit of the actors in this sector and the population of the region.

Analysis of the impact of the innovation platform

Member breeders of the Banfora Milk Innovation Platform benefit from a better system for selling their milk through the milk collection centres. This ease of sale can motivate them to increase the productivity of dairy cows through better feeding and maintenance. The goal of this next development is to identify the impact of IP on productivity, selling price and dairy income.

IP impact on milk production and sale

Table 13 below shows that in high production, the average milk per cow of IP producers is 1.37 litres / day, compared to 1.30 litres / day for non-member producers. In low production, production of milk per cow is 0.62 litre / day, irrespective of the status of the producer. Also, from high to low production, milk volume per cow decreases by 52.30 per cent and 54.74 per cent respectively for non-member producers and members. This shows strong dependency of the two groups of natural pastoralists, and even more those who are members of the PI, on the dairy cow diet because of their sedentary lifestyle.

Table 13: Average milk production (litre/cow)

Producer group	High production	Low production	Variation (%)
Non- IP member	1.30	0.62	-52.30
IP member	1.37	0.62	-54.74
Sample	1.35	0.62	-54.07

Source: Survey data, January 2018

There is no difference in the averages of milk production, in low production, between the two groups of producers. Also, the difference in average productivity test shows that in high production, participation or non-participation in IP does not have a significant effect on milk production. However, milk IP processing units are a permanent outlet for milk producers and make it possible to set the purchase price per litre of milk. Hence, the question: what is the effect of IP on the selling price of milk?

Table 14 shows that there is a differential of 3 CFAF/litre in favor of IP producers in high production. On the other hand, in low production the same selling price differential is observed in favor of non-member producers. The difference in average selling prices between the two groups of producers constituting the sample studied is insignificant regardless of the production period.

Table 14: Average selling price of milk (in CFAF)

Producer group	High production	Low production
Non IP member	217	241
IP member	220	238
Sample	220	239

Source: Survey data, January 2018

From the foregoing, it appears that neither productivity nor the selling price of a litre of milk constitutes a discriminating factor between milk producers in terms of whether or not they participate in the Innovation Platform.

The income comparison test applied to the two groups of producers shows a differential of CFAF 20,520 / year for the benefit of IP members (Table 15). With the deduction of the share of milk

consumed, all members of the IP, numbering 360, generate an additional monetary income of 7,387,200 CFA / year compared to non-member producers.

Table 15 : Comparison of average milk income

	Milk innovation platform		
Producer group	**Non-member**	**Member**	**Difference**
Average annual income (CFAF)	416 458	436 978	20 520

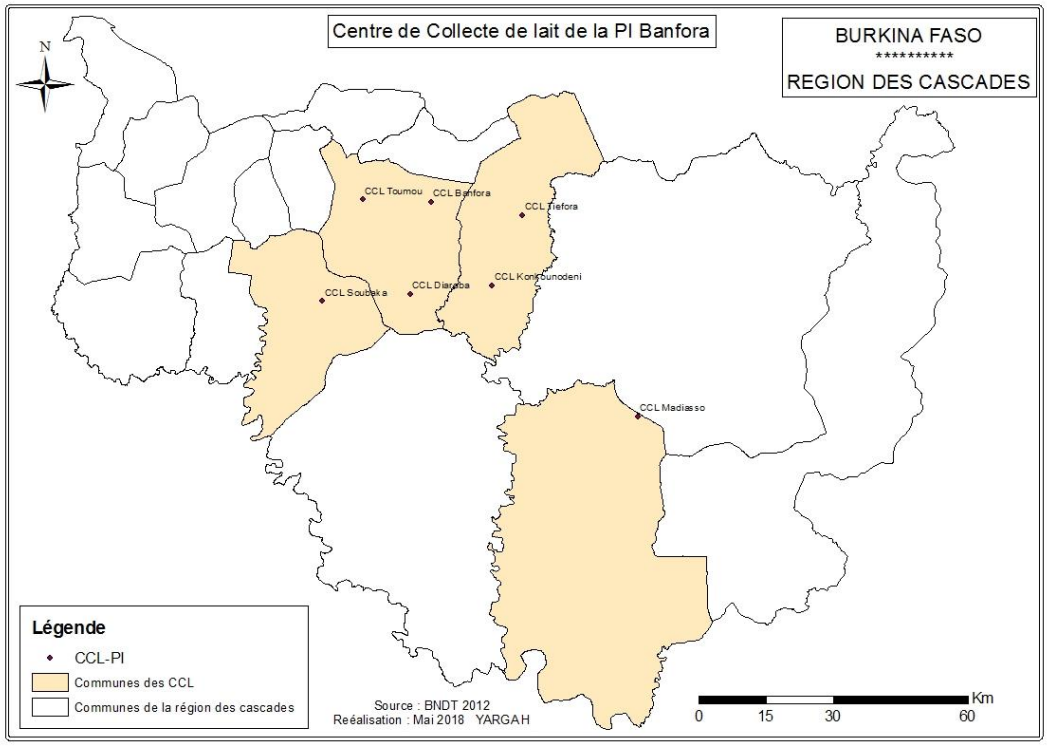
Source: Survey data, January 2018

Just like productivity and price, the difference in average cash incomes of the two groups of producers is not significant. All in all, participation in the IP is not yet, according to the data collected in this study, a discriminatory factor on milk productivity per cow, selling price of a litre of milk and annual monetary income. The current state of IP operation has not significantly improved milk productivity per cow, selling price of milk, and annual dairy income for the benefit of its member producers. How about the milk collection system put in place by the IP?

The Innovation Platform and milk coll+ection

The Banfora milk innovation platform set up a milk collection system, which was operationalized through the establishment of milk collection centres. This system creates permanent jobs for collectors and provides a substantial part of their monetary incomes. Collectors buy the milk from producers and then supply processing units. This section of the report assesses the impact of the Innovation Platform on the income of collectors. The assessment is preceded by an overview and characterization of the milk collection system.

The system consists of twenty-one (21) collectors, including eight (08) women, divided into seven (07) collection points (Map 1). These collectors are relatively young with an average age of forty-two (42) years, and five (05) years of experience in milk collection. Numbering seven, the leading collectors supplying milk to the IP processing units (PUs) source their milk from intermediate collectors in the collection areas. The IP impact analysis focuses on the income of collectors and the performance and constraints of the milk collection system.



Map 2: IP milk collection centres in Banfora

There are five (05) prongs to the characterization of the IP milk collection system: travel distances and means of collection; amount of milk collected according to season; producer prices and resale prices (to processing units); and system performance and constraints.

Collectors travel an average of 32 km to deliver milk to the IP PUs in Banfora. Means of transport used for this purpose include bicycles (29%), motorbikes (57%) and public transports (14%). All collectors reported using 20-litre churns as means of collection. Distance travelled for collection ranges from 0 to 30 km, with an average of 10 km.

Depending of the time of year, the quantity of milk collected varies from a peak production period between May and October to a low production period covering the rest of the year. Average quantities of milk collected generally increase from 33 litres per day during low production periods to 98 litres per day during peak production. Table 16 shows the changes in daily quantity for each catchment area.

Table 16: Average quantity collected

Catchment area	Peak production (litre)	Low production (litre)	Change (%)
Diaraba-Koko	69	19	-72.46
Kankounadéni	150	58	-61.33
Madiasso	166	50	-69.87
Soubaka	71	33	-53.52
Tiéfora	118	33	-72.03
Toumousséni	90	23	-74.44
Total	98	33	-66.32

Source: Survey data, January 2018

The quantity of milk collected is highly variable between the high and low production periods. The proportional decrease by collection area ranges from 53.52 percent in Soubaka to 74.44 percent in Toumousséni. Overall, decrease in quantities collected (all collection areas) is 66.32 percent. This changing quantity is the result of changes in farmers' output, based on the time of the year and the type of livestock feed used.

The purchase and resale prices of milk vary according to the production period. Generally speaking, prices paid to producers go up from CFAF 225 per litre during the peak period, to CFAF 234 per litre during the low period. The price of a litre of milk sold to PUs increases from CFAF 284 during the peak period, to CFAF 300 during the low period. Behind these figures lies a disparity in the purchase and resale prices from one collection area and period to another, as shown in table 17. The main reason for these disparities is the distance that separates producers from the points of collection.

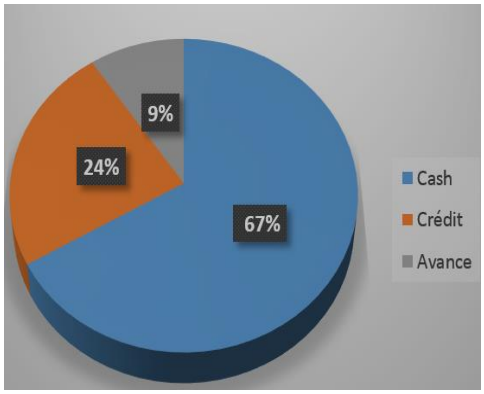
Table 17: Average prices of milk by period (CFAF)

Collection points	Producer price		Resale price to PUs	
	High production	Low production	High production	Low production
Diaraba-Koko	250	220	300	280
Kankounadéni	192	200	250	300
Madiasso	200	200	300	300
Soubaka	210	240	265	300
Tiéfora	238	269	300	325
Toumousséni	233	250	283	300
Total	225	235	282	300

Source: Survey data, January 2018

Cash is the most commonly used payment method in milk-related transactions among producers and collectors, with a frequency rate of 67% and 75% respectively. Credit comes second with 24% for producers and 15% for collectors. Prepayment is the least used method of payment as shown in figure 1 below.

Producers



Collectors

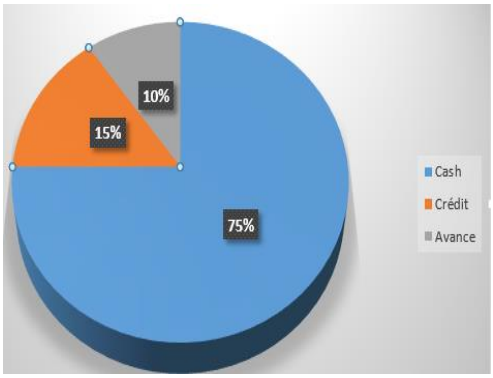


Figure 1. Methods of payment to producers and collectors

Source: Survey data, January 2018

Performance of the milk collection system

Data gathered from this study show that collectors collect 2,056 litres of milk per day during peak production and 683 litres a day during low production. Given that the maximum daily technical capacity of all IP PUs is 2,700 litres, there is a gap of 644 litres/day during peak production, and 2,017 litres/day during low production.

Table 18: Performance indicators for the milk collection system

Milk collection	Period	Quantity (litre)	Value (CFAF)	Performance
Actual collection	Peak production	2,056	104,362,560	76.15%
	Low production	683	36,882,000	25.30%
Technical capacity (PUs)	Peak production	2,700	137,052,000	100%
	Low production	2,700	145,800,000	

Source: Survey data, January 2018

The performance gaps identified are partly due to the limited capacity of collectors to collect sufficient quantities within a short space of time for delivery to PUs in good quality. Indeed, milk must be delivered no more than four (04) hours after milking, which creates a time constraint associated with the rudimentary state of the collection and transportation equipment used. Also, some of the milk collected for PUs is often not suitable for processing (fermented or bad milk). In 2017, an average amount of 138 litres of milk was unsuitable for processing. The poor performance of the collection system is partly attributable to some constraints facing collectors.

The main constraints facing collectors have to do with transportation, preservation, market, production and training. The transportation issues, which are the most persistent, relate to poor roads and transport. The issues with preservation have to do with the use of inadequate storage equipment (plastic churns). The considerable variation that occurs between peak production and low production puts collectors in a difficult position. In spite of the abovementioned constraints, collection is a source of substantial income for collectors.

IP impact on the income of collectors

Figure 2 below shows the income of collectors according to collection period and area. In a period of peak production, collectors generally earn an average of CFAF 27,812 per day. During the same period, milk income by collection area ranges between CFAF 19,800 and CFAF 49,800 per day. In a low production period, collectors earn an average income of CFAF 10,133 a day. In the same period, milk income by collection area ranges between CFAF 5,850 and CFAF 17,300 per day.

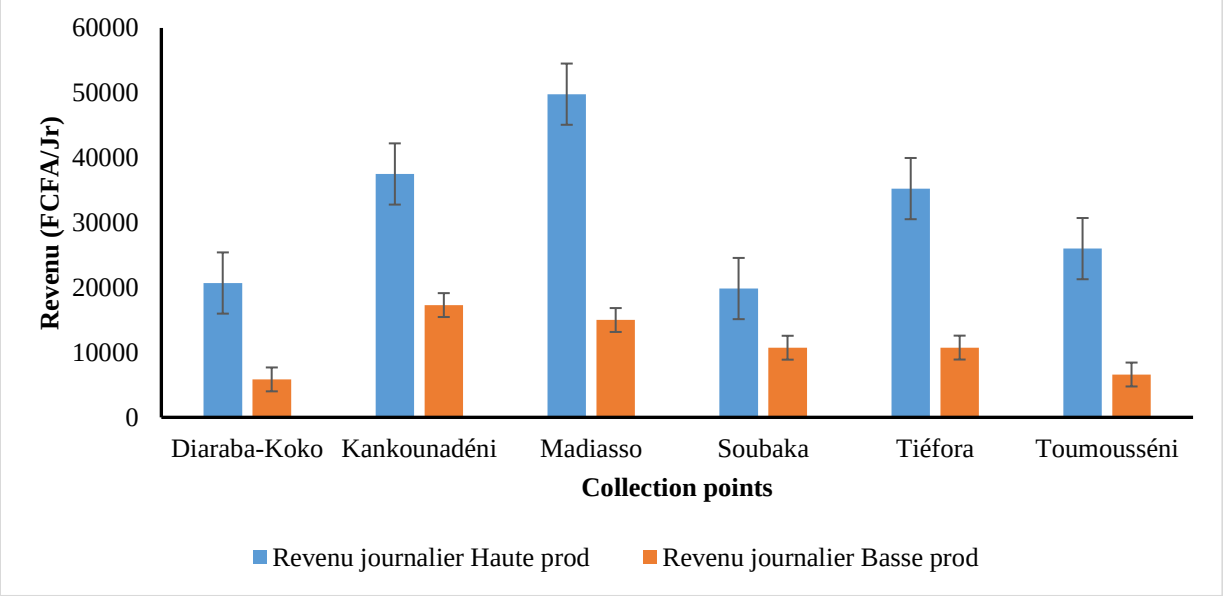


Figure 2: Average daily collector income by collection point

Source: Survey data, January 2018

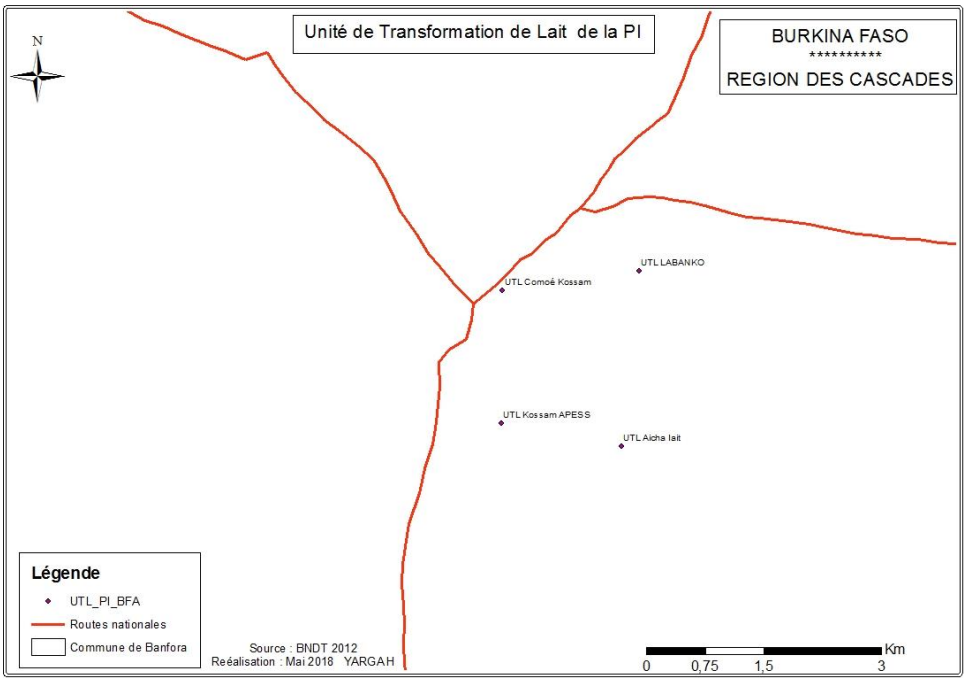
The IP milk collection system creates jobs and generates substantial income for young people and women. It provides a link between production and marketing and thus guarantees a market for producers. In order to ensure a more vibrant and effective collection system, collectors must be trained on how to preserve and transport milk and also be given the right equipment to ensure PUs are supplied with better quality milk in sufficient quantity.

IP impact on milk processing

Member processing units (PUs) of the Platform are mini dairies with a least ten (10) years' experience in milk processing. Since the establishment of the PI in 2013, these PUs have been

supplied in local milk by IP collectors. The question then arises of the impact of the Platform on its member PUs. The answer to this question lies in the overview and characterisation of these PUs.

The IP has a total of four (04) processing units (PUs) with a total technical processing capacity of 2,700 litres per day. As shown on map 2, these PUs are all located in the city of Banfora. They employ an average of eight (08) people, including five (05) women.



Map 3: IP milk processing units in Banfora

The data from this study show that PUs absorb 51.36 percent of the milk collected during peak production, and 95.17 percent during low production. Table 19 shows the actual and potential quantity and value of local milk consumed by IP PUs. The figures reveal that supply to PUs during peak production is less than half (45%) of their maximum technical capacity. During low production, they are supplied at 19% of their total capacity.

Table 19: Milk consumed by PUs

Consumption	Period	Quantity (litre)	Value (CFAF)	Performance
Actual consumption	Peak production	1,210	61,419,600	45%
	Low production	510	27,540,000	19%
Potential consumption	Peak production	2,700	137,052,000	100%
	Low production	2,700	145,800,000	

Source: Survey data, January 2018

It is worth noting that nearly half (41.15%) of the volume of milk from collectors could be going to other outlets rather than the ones they were intended for (the IP PUs). During low production, 25.33 percent of the milk collected is lost. Demand for milk by IP PUs has seen a substantial increase with the establishment of the milk collection and delivery system. Local milk demand by each of the PUs has at least doubled.

Figure 3 below shows the quantity of milk received by PUs according to season. Generally, during peak production, daily demand by all IP PUs increases by 112.28 percent, and by 104% during low production. The increase in daily demand for milk by PU ranges between 60 percent and 150 percent during peak production, and between 50 percent and 150 percent during low production.

Notwithstanding this high increase in demand for milk, all IP processing units continue to operate below their production capacity. During peak production, the coverage rate with regard to the technical capacity of PUs is between 32 percent and 60 percent, as against a rate of change between 12 percent and 21 percent.

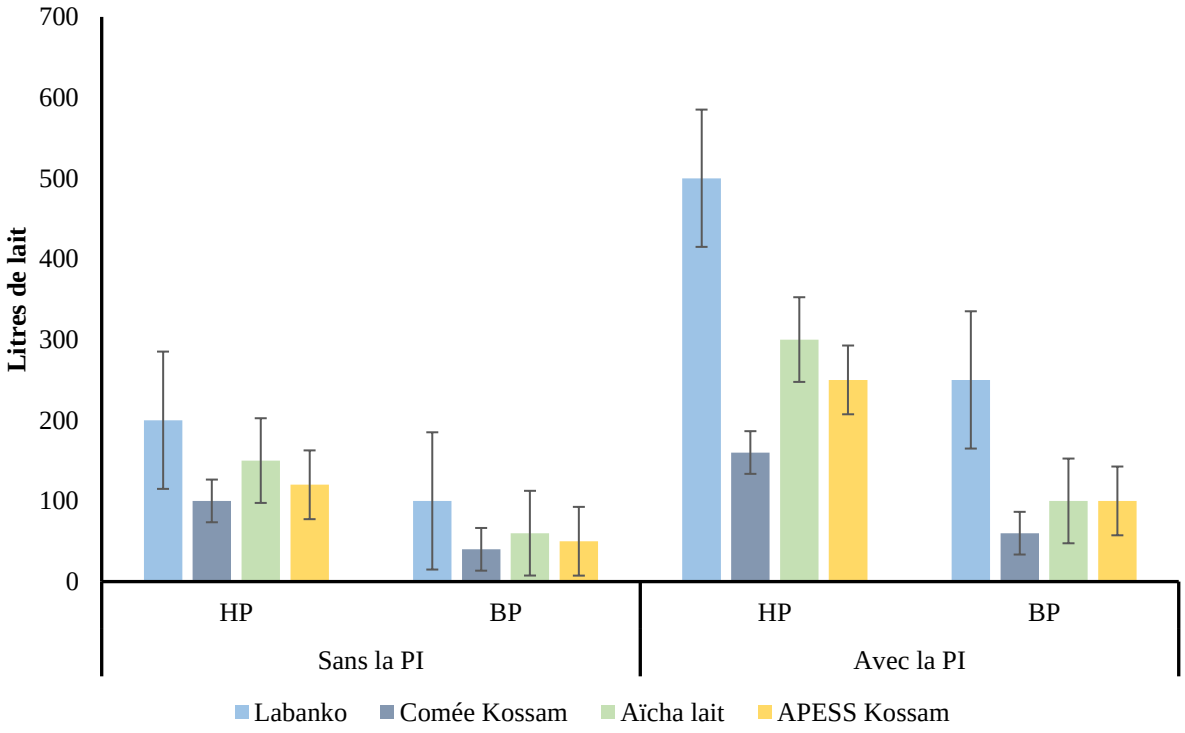


Figure 3: Changes in demand for milk by PUs
Source: Authors

From the fresh milk they receive, PUs bring onto the market four (04) types of dairy products. They are, in order of importance, yoghurt, whole fresh milk, butter and cheese. These products are sold mainly in the Cascades region (Comoé and Léraba) and the Hauts-Bassins region (Houet

and Kénédougou). The simulation in table 20 based on two main milk products at peak production (6 months) helps to understand the extent, in monetary income terms, of this increase.

Table 20: IP impact on supply of finished milk products

Main products	Quantity (litre)		Diff.	
	Without the IP	With the IP	Litres	CFAF
Fresh milk	61,560	124,200	42,120	25,272,000
Yoghurt	82,080	187,200	105,120	105,120,000

Source: Survey data, January 2018

The impact analysis of the IP regarding milk processing shows that the Platform contributes to higher supply of local milk to PUs, leading to a market share gain for local milk over imported powdered milk. However, this gain is extremely weakened by the inability to meet the local milk requirements of PUs and the sharp drop in supply of the product during the dry season.

Future Triggers

The regression estimate of milk production on the above-mentioned independent variables gives the results contained in table 21.

Table 21: Milk output regression on production inputs

Variables	Model
Age	0.00301
	(1.05)
Gender	0.00455
	(0.05)
NVach	-0.00390***
	(-3.86)
PUi	-0.0371
	(-0.51)
Depal	0.113*
	(2.35)
TailMg	-0.00306
	(-0.5)
-Cons	0.693***
	(4.67)
N:	163
F(6 ; 156):	4.02
Prob>F:	0.004
$\boldsymbol{R^2}$-Adjusted :	0.1155

The values in parentheses refer to the Student statistic

Significance: *= p > 0.1; **= p > 0.05 *** = p < 0.01

Table 21 provides the regression results on milk output during the dry season. The results show that the model is globally significant. There are two significant associated independent variables with critical probabilities at the 1% (p = 0.000) and 5% (p = 0.018) thresholds. These are the number of cows processed in the farm and the per capita expenditure on livestock feed respectively. Some variables in the model have negative effects that lead to lower milk output in the dry season. The marginal effects on output show that a reduction in the number of lactating cows by 1% leads to an increase in the quantity of milk produced by 0.4%. Moreover, in the dry season, IP producers are at a relative disadvantage (0.037 points), output-wise, compared to non-members. The larger the household, the lower the milk output. This reflects the importance of family consumption as most cattle farmers come from the Peulh (Fulani) ethnic group. Other independent variables have a positive and significant correlation with milk output, i.e. expenditure on livestock feed (*Depal*). A 1% increase in expenditure for livestock feed leads to an output growth of 11%. There is significant potential for agro-industrial by-products to improve the feeding regime of milk cows in the milk producing area of the Cascades region. There is for instance the sugar industry, which, through negotiated partnership, can supply cattle farmers with molasses in the dry season. Others include SOFITEX (a cotton-ginning plant in Banfora), small cottonseed processing plants, and the Faso flour mill, all of which can provide farms with seeds, cottonseed cakes and corn bran, if an efficient system is put in place with the help of the stakeholders.

Overall, although the model is globally significant, the independent variables used account for only 12 percent of the change in milk output. More relevant variables that influence milk output in agro-pastoral farms are yet to be investigated.

Discussion

Milk output in agro-pastoral farms is influenced by a number of factors, including: number of lactating cows on the farm, feeding regime, availability of natural pastures, diversification of income streams, etc. On agro-pastoral farms, animals are reared in an extensive system. Lactating cows with an average of fourteen (14) heads on the sampled farms are not well fed and thus continue to produce below their productive potential. The development of stabling for dairy cows (mainly in the dry season) for the purpose of intensifying their feeding on crop residues and fodder alongside feed concentrates, is desired. Rations should also be developed from available resources to ensure the cost-effectiveness of these feeding practices. However, the issue of water availability for animals has already been raised by famers as a constraint during the

surveys. The IP should work to address this constraint as cattle farmers are most often located in farming hamlets that are far removed from residential villages.

Moreover, IP producers are sedentary. As a result, in the dry season, the lack of fodder crop constitutes a limiting factor in milk production. In order to enhance the performance of the IP, it is desirable to establish a forage production link to ensure producers have the right quality and quantity of feed to meet their production option, especially during the dry season. This is feasible considering the favourable rainfall conditions in the study area compared to other regions of the country.

Conclusion and Recommendations

The focus of this study was to analyse the socio-economic impact of the Banfora Milk Innovation Platform. It also sought to examine investment opportunities towards improving the performance of this innovation. Specifically, the Platform's impact on productivity, collection and processing of milk were first reviewed, then the research on the determinants of milk output. It has emerged from this research that the IP has a significant potential to impact the socio-economic lives of producers, collectors and processors. In particular, the introduction of the collection link in the chain has facilitated the collection of milk for the supply of mini-dairies. This has also enabled women to save time for other domestic activities that they consider to be an improvement in their well-being. What more, thanks to the drive exhibited by the IP leaders, local milk production has gained more value and visibility in the region.

- Train milk producers in the production of forage of high nutritional value;
- Train cattle farmers on preservation and conversion of crop residues into feed;
- Establish feed production and processing sites for IP members;
- Raise milk producers' awareness of herd screening
- Improve the collection system through continuous training of collectors and procurement of adequate transportation equipment.
- Facilitate all-season access to water for farmers through the provision of boreholes and boullis.

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