Assessing ex-ante impact of the complementary dairy improvement interventions required to make Rwanda's existing dairy development programmes and policies even more successful

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Abstract

Rwanda has already achieved much in shaping an enabling policy framework for dairy development. While the overall impact of the existing dairy improvement policies and programmes, such as the Girinka "one cow per rural household", has been remarkably positive in improving the dairy sector, there is still significant under-investment in livestock development. This study explored the complementary investment interventions needed to enhance Rwanda's existing dairy improvement efforts. This was done by conducting an ex-ante impact analysis of the complementary dairy development investment interventions. Results show that the difference in milk production and the Gross Domestic Production (GDP) contribution between the "with additional intervention" and the business as usual (no additional dairy improvement interventions) scenarios is remarkable, 37% and 22% respectively. The magnitude of the intervention impacts on production and GDP contribution, however, vary for different livestock production zones and systems.

Key words: Rwanda, Dairy, Livestock sector analysis, Investment

1. Introduction

Agriculture is a key sector in Rwanda contributing 33% of the total GDP in 2014 (NISR, 2015). The sector also provides employment to over 80% of the labour force, 90% of the country's food requirements and over 95% of exports. Although food crops dominate the sector accounting for 68.8% of total agricultural GDP, the government of Rwanda recognizes the importance of the livestock sector and its contributions to the national GDP; in reducing poverty, ensuring nutritional security; and boosting the export earnings. This is exhibited in the achievement registered primarily by the dairy sector, but also by other meat commodity chains namely cattle, goat, sheep, chicken and pig. In the national vision of modernizing several development sectors by the year 2020, livestock is given pre-eminence. The achievements made by 2020 will guide the nations Vision 2050 that goes beyond income considerations to include the high levels of living standards desired by Rwandans.

Rwanda has very conducive agro-ecological conditions to support transformation of livestock production and rural livelihoods. Despite severe land constraints, the livestock sector, particularly the dairy sector provides major opportunities to further increase its contribution to economic growth (having already achieved greater than 6% annual GDP growth for the last 10 years) while improving incomes to reduce poverty and improve the nutritional security of rural people.

Rwanda has already achieved much in shaping an enabling policy framework for dairy development. This has resulted from many interventions and support programs from the government and various development partners over the past decade. The policy framework governing operations of the dairy sector has been focusing chiefly on raising milk production to address low per capita milk availability. Following a land reform policy (2004) and Act (2005), the dairy farming approach shifted from extensive communal grazing systems to more intensive smallholder systems. The core elements of the policy are focused on increasing production through the following channels: changes to grazing systems, improved breeds and genetic profile of dairy cows, incentives for creation of farmer associations, integrated livestock/farming systems, improved animal feed and performance, decentralized service delivery; increased linkages between training, research and extension; and overall creation of an enabling environment for the dairy industry. However, the great potential for transforming dairying in Rwanda has been demonstrated by the "One Cow per Family" or "Girinka program", which has not only greatly increased milk production, but has proven to be the key to sustainably improving vegetable and legume production on once infertile hillsides by providing ample manure. Moreover, with rapidly growing population, increasing urbanization and rising incomes, the demand for meat, milk and eggs is expected to increase significantly for the foreseeable future in Rwanda, thus offering continuing opportunities for livestock development in the long run. According to Argent

et al. (2014)1, since the beginning of the programme in 2006 up until the year 2012, the Girinka programme has distributed more than 130,000 cross breed cows to poor households. A study by Christian (2014), shows the Girinka programme has improved average annual rural household incomes by roughly 115,325 Rwandan francs (or about $175).

While the overall impact of the Girinka programme in improving the dairy sector has been remarkably positive, follow up to identify complementary investment interventions for further dairy sector transformation are necessary to meet rapidly growing demand for animal sourced foods (ASF). Despite such policies and the growing importance of livestock in rural economies and in consumer diets through animal source foods (ASFs), like many countries in Africa, there is still significant under-investment in livestock development in Rwanda. This under-investment could be a major constraint to modernizing the livestock sector, preventing it from making an even more substantial contribution to national development goals (Herrero, M. et al., 2015). Moreover, livestock ministers usually lack convincing quantitative data or evidence of potential impact to get sufficient financial resources from ministries of finance to invest in the livestock sector (Shapiro, B. et al., 2015).

The main objective of the current study is to identify and assess the impact of additional priority dairy improvement interventions required for further transformation of the Rwandan dairy sector. To attract more substantial investments from finance ministers and private sector investors ex ante impact results are needed which make clear that the returns from investment in combined technologies and policies can compete with investment returns in other sectors.

In this study, we tried to explore the complementary investment interventions needed to Rwanda's existing dairy improvement interventions such as "Girinka" dairy policy by conducting ex ante impact analysis of complementary dairy development investment interventions.

[1] The Rwanda Ministry of Agriculture estimate the number of cross breed cows distributed through the Girinka programme to 250, 000 (MINAGRI, 2015)

2. Methodology and data

The study used the Livestock Sector Investment and Policy Toolkit (LSIPT) to build the herd and sector model (HESM) to then carry out the analysis to produce the LSA.

2.1. The Livestock Sector Investment and Policy Toolkit (LSIPT) methodology

Spearheaded by the InterAfrican Bureau for Animal Resources (AU-IBAR), LSIPT was developed by livestock experts at French Agricultural research for development (CIRAD), Food and agricultural Organization (FAO) and the World Bank. It had been tested in Mali and Zambia and is now operational and has been applied in Ethiopia, Tanzania, Rwanda and India by the International Livestock Research Institute (ILRI) and national collaborators from the ministries of agriculture and/or livestock.

LSIPT integrates micro, meso, and macro analysis for quantitative and qualitative assessment of household vulnerability, the role of livestock in strategy for poverty reduction, and the contribution of livestock to the overall economy. It accounts for the multiple functions of livestock, including: - those of cultural importance; the contribution to food security and nutrition; and the supplier of draught power and manure for soil fertility.

LSIPT provides a systematic framework for organizing accessible quantitative data (mostly from secondary sources) and includes tools to carry out analyses which help to understand the production potential of the sector, and its contribution to agricultural and overall economic growth (GDP), as well as reduction in rural poverty and food insecurity. Furthermore, LSIPT enables the running of alternative technology and policy scenarios to gauge the supply response of potential government investments in research and extension (such as technologies that impact on feed availability, animal health, etc.), as well as private sector investments over 5 to 15-year projection periods. The scenario analysis is transparent and readily understandable, and thus useful to policy makers and development investors. Moreover, analysis of potential impacts from changes in key aspects of policy, such as the enactment of food quality standards and regulations required to compete in formal markets (including export markets) can also be evaluated with the Alive toolkit. Further description of the LSIPT methodology is given in the diagram (below).

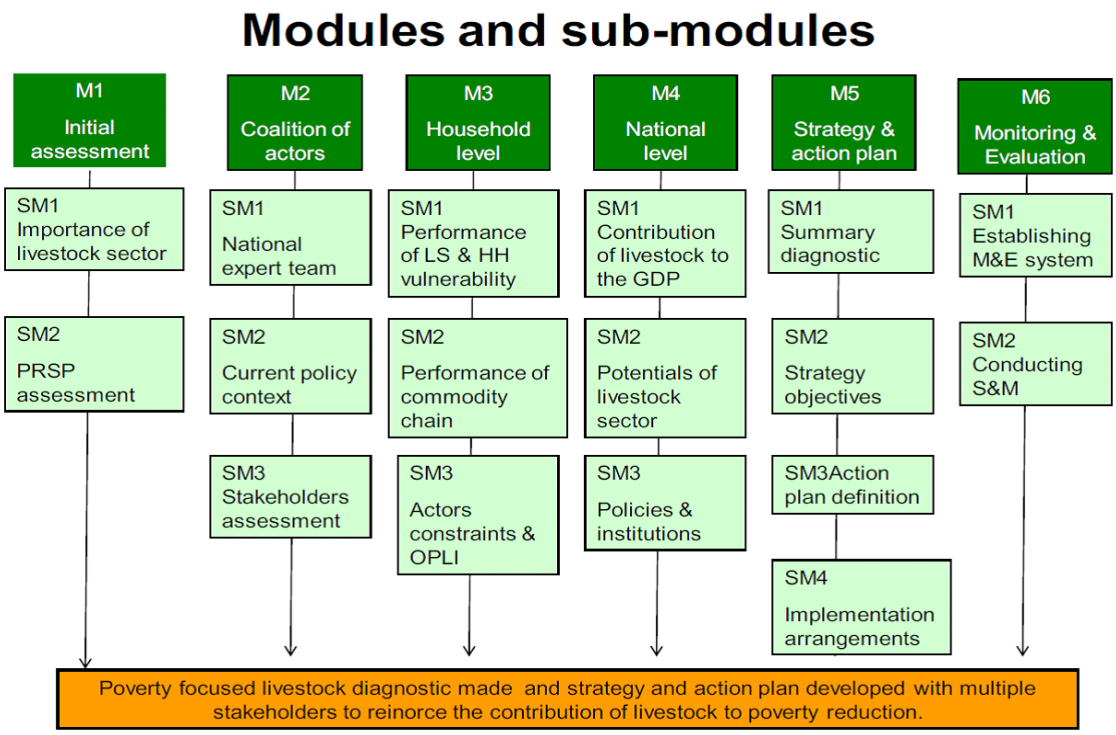

Figure 1: Diagram showing the different modules and sub-modules of LSIPT

The core elements of LSIPT are the modules 3, 4 and 5. Module 3 assesses the productivity at household, value chain, and production systems level. These micro and meso data figures are then consolidated and extrapolated to the national level in module 4. Once this data base is established, the participatory tools of module 5 can be used to identify, with all stakeholders, the priority sectors, target groups, and the most effective technology and policy interventions, to ensure optimal use scarce human and financial resources. Once the interventions are identified, financial, economic, social and environmental impacts can be rapidly assessed using the database established in modules 3 and 4.

Finally using the tools, the implementation arrangements can be established

on a mutually agreed upon basis. Key data needed for Module 3 and 4 include:

- A typology of the main different production systems prevailing in the country, with their respective number of livestock keeping households and livestock numbers
- Main livestock performance data for each production system, in particular a breakdown by age group and sex, reproductive performance, mortality by age group and sex, average milk production and live-weight and carcass weight

- A breakdown of the costs and margins in the value chains for the different commodities
- Dry matter yields of grass and crop lands (for crop-residues) of the main agro-ecological zones.

Available data and parameters required for the herd models was collected from published papers and consultancy reports, as well as other "grey" literature. Gaps were filled through consultations with national experts. For the household survey data, there is expected to be available survey data collected by the Central Statistics Bureaus and research organizations in the respective countries, but this data needs to be assessed to determine how representative the surveys are, and gaps filled in as needed.

2.2. Livestock Systems classification in Rwanda and rationale

The livestock sector analysis is organized along livestock systems and priority livestock value chains. The livestock systems are classified based on the livestock production zones which reflect a group of livestock farming practices sharing similar characteristics of climatic conditions (rainfall, altitude and temperature).

To facilitate the use of an analytical model created for this Livestock Sector Analysis (LSA) study, a typology of the different livestock systems was developed. Variation in annual rainfall and altitude was used to classify the major livestock production systems in Rwanda into 3 zones. This was done based on the Rwanda land use map (Kagera 2012) which organizes Rwanda into three major rainfall regimes, which do not only reflect changes in rainfall but also portray the existing agro ecological regions into three major altitude categories (D. C. Clay and Dejaegher, 1987). Keeping the livestock production zones to a smaller number based on the predominant ecological variations (rainfall and altitude) improves the manageability and effectiveness of the sector analysis.

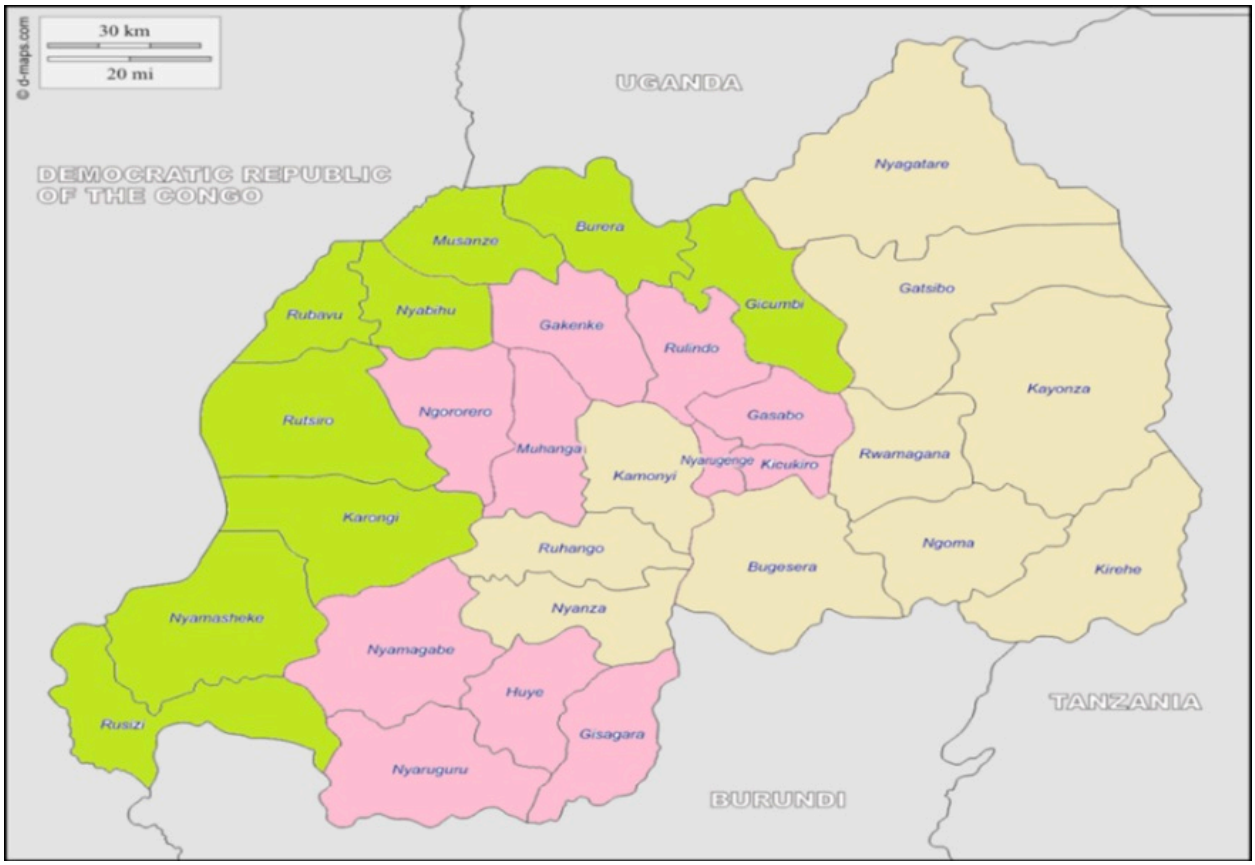

Figure 2: Geographic distribution of major livestock production zones in Rwanda

(LRLA, MRMA and HRHA) by district

The three livestock production zones include (Figure 2):

- Low rainfall Low altitude (LRLA) livestock production zone: 800–1000 mm and 1450 to 1500 meters ABSL (above sea level)
- Medium rainfall Medium altitude (MRMA) livestock production zone: 1000–1400 mm and 1500–1800 meter above sea level
- High rainfall High altitude (HRHA) livestock production zone: 1400–1800 mm and >1800 meter above sea level

3. Results and discussion

3.1. Ex-ante Future projection of livestock population, milk production and GDP (2031/32), Business as Usual (BAU)

Projected Livestock population (2031/32), Business as Usual (BAU)

The herd and sector model in LSIPT were used to project the livestock population, livestock products and livestock GDP for 15 years. The baseline analysis of the Livestock Sector Analysis (LSA) (the 2016/17 situation given the same year level of investments and available technologies and policies) shows that Rwanda has a total of 1.4 million cattle (43% local and 57% pure and crossbreeds).

Under the business as usual (BAU) scenario, i.e., with no additional investment interventions to improve productivity of the sector for the coming 15 years, in 2031/32 there is a significant population growth of the cross-breed cattle, by about 137%, and decline of local breed cattle, by about 47%. The decline of local cattle breeds is much attributed to the Girinka program that is replacing the local cattle breeds by high yielding crosses. Overall the growth rates of the cross breeds are higher than the locals across all species. (Table 1)

Table 1: Comparison of baseline current and projected livestock populations, 2016/17–2031/32

Livestock Species	**Livestock population (heads)**		**% Change**
	2016/17	**2031/32**	
Local	592,322	316,603	-47%
Cross	798,897	1,889,769	137
Cattle	1,391,219	2,206,372	59%
Milk Production (MT)			
Local	70,715	37,762	-47%
Cross	675,874	1,590,585	135%
Milk	746,589	1,628,347	118%

Projected Milk production and GDP contribution (2031/32), Business as Usual (BAU)

In order to estimate the quantities of future production, BAU 2031/32 of livestock products, the baseline livestock productivity parameters are applied to the projected livestock population. The volume of milk is estimated and valued to estimate contributions to the national economy or GDP of Rwanda. The results in Table 1 shows, under the BAU scenario, milk production increased from 747 thousand MT to 1,628 thousand MT which shows a 118% growth, even though the milk that come from the local breeds dropped by 47%. The contribution of the Local cows to the national milk in 2031/32 BAU is only 37,762 MT, which is 2.3% of the total milk. Cow milk contribution in 2031/32 is projected to reach 43 % of the total livestock value added or livestock GDP.

Nevertheless, not enough is produced under the BAU scenario in 2031/32 to feed and meet the animal source food needs of the growing human population of Rwanda. This growth, which is due to the increasing number of cross breed cattle, mostly attributed to the Girinka programme, is only half of the milk required to meet the FAO recommended per capita milk consumption, i.e., 200 litres/person.

3.2. Summary of Dairy improvement Interventions and key targets and assumptions

The key complementary dairy improvement interventions identified to improve the dairy sector in Rwanda are improving the capacity of milk collection, marketing and processing; increasing feed availability; and improving access to extension service. The additional dairy improvement interventions are summarized into 5 categories, namely feed, health, extension, genetics, and marketing and processing, and are presented in the Appendix. Dairy improvement intervention can be practiced all over the country and in all the livestock production zones. The key targets and assumptions in the three dairy farming systems considered for the study are presented subsequently.

Family Dairy production

- Parturition rate increase by 10% (Argent, et.al. 2014[2])
- Mortality to decrease rate by 20% to 40%
- Lactation length (Days) to increase from 270 to 300
- Daily milk production to increase by 30% (Argent, et.al. 2014)
- Expense for purchase of forage seeds and forage cuttings increases
- Amount of purchased concentrate/processed feed to increase by at least 2–3 kg/day/lactating cow. At least 50% of crossbred cow owners in the country

[2] Argent J., Augsburg B., Raul I. 2014. Livestock asset transfers with and without training: Evidence from Rwanda. Journal of Economic Behavior & Organization 108. PP 19–39.

assumed to feed 2–3 kg/day/cow by the 5th year (2021) and 80% by the 10th year.

- Expenditure for veterinary services will double Grazing based commercial dairy (Gishwati rangeland milkshed[3])
- Parturition rate to increase to 85% (0.85)
- Mortality to decrease by 25% to 50%
- The number of cattle per herd/farm assumed to remain the same (zero growth rate)
- Lactation length (Days) to extend from 270 to 300
- Daily milk production increases from the current average 10 lit/day to 18 lit/day
- Amount of purchased concentrate/processed feed to increase by at least 4 kg/day/lactating cow.
- Expenditure on veterinary services and forage seed purchase will double

non-grazing based commercial dairy (Commercial non-grazing based dairy)

- Parturition rate increases to 90%
- Mortality decreases by 10% to 20%
- The growth rate of crossbred animals in this production system will be about 4%
- Lactation length (Days) to increase from 280 to 300
- Daily milk production to increase from the current average 15 lit/day to 25 lit/day
- Amount of purchased concentrate/processed feed to increase by at least 5 kg/day/lactating cow
- Expenditure on veterinary services will increase by 50%.

3.3. Ex-ante Impact of proposed dairy complementary investments (Population, production and GDP change)

Impact of Dairy Improvement Intervention on Cattle Numbers

The dairy improvement interventions will result in increases in household income, livestock productivity, national production and GDP contribution. The livestock numbers would also increase, if they had not been checked through increased offtake rate. Therefore, the livestock number between the business as usual (BAU) and with additional intervention remain the same (except the specialized dairy and fattening systems), though in the with additional intervention situation the offtake rate, meat production and milk production increases.

The population of the local breed cattle is expected to decline (Table 2) given the GOR livestock development strategy, where the local breeds will be gradually replaced by either crossbred or pure breeds. In this regard, the Girinka project of MINAGRI through its “One Cow per Family Program” is transforming dairying in Rwanda, through the

[3] The assumptions below are mainly dependent on the ability of the milkshed to collect the milk produced in the Gishwati rangeland. Here, it is assumed that all the infrastructure (road, MCCs, etc.) will be in place to increase marketing and collection of milk from the milk shade to 80% in five years from the current very low level.

provision of cross bred cows. Targeting even more increase in crossbred cattle, the number of crossbred cattle is projected to increase by 139% over the next 15 years (between 2016/17 and 2–31/32) while the number of local breed cattle will decrease by 45 to 48%. The decrease in local breed cattle will be less in the low rainfall low altitude area compared to the other production zones, having 45% decline.

Table 2: Changes in cattle numbers between the base year (2016/17) and 2031/32 with the additional interventions scenario

Production zone	**Breeds**	**Base year 2016/17**	**with additional intervention 2031/32**	**% change**
Low rainfall low altitude (LRLA)	Local breeds	209,497	116,075	-45
	Crossbreeds	292,822	700,517	139
Medium rainfall medium altitude (MRMA)	Local breeds	235,092	123,129	-48
	Crossbreds	285,171	682,214	139
High rainfall high altitude (HRHA)	Local breeds	147,176	76,842	-48
	Crossbreds	203,932	487,866	139
Specialized system				
Fattening system (OF)	Both breeds	0	112,383	
Grazing based dairy (Gishwati)	Crossbreds	13,772	13,772	0
Non-grazing-based dairy	Crossbreds	3,199	5,399	69
Total		**1,391,219**	**2,318,198**	**66**

Impact of Proposed Interventions on Milk Production

Due to the dairy improvement interventions, the 2031/32 milk production in the with additional intervention scenarios will be 31–132% higher than the BAU scenarios. Meanwhile, the change in milk production in the local breeds will only be between 9 to 16% (Table 3).

Table 3: Milk production and percent changes between the BAU and with additional intervention scenarios – local breeds vs. crossbreds by typology zones

Cattle	**Breed (production system)**	**National milk production (*000 liter)**		**% change (with vs. BAU)**
		2031/32 BAU interventions	**2031/32 with additional intervention**	
LRLA	Local breeds	13,790	15,043	9
	Crossbreds (Family dairy)	544,218	712,253	31
MRMA	Local breeds	14,761	17,107	16
	Crossbreds (Family dairy)	580,428	835,685	44
HRHA	Local breeds	9,212	10,153	10
	Crossbreds (Family dairy)	439,642	575,370	31
Cattle Specialized dairy				
Grazing based dairy (Gishwati)	Crossbreds	15,721	32,652	108
Non-grazing dairy	Crossbreds	10,576	24,507	132
Total milk production		1,628,348	2,222,770	37

The table above shows that, by 2031/32, the total milk produced in the BAU and with additional investment scenarios will be about 1.6 and 2.2 billion litres, respectively. It is a 37% increase from the milk production projected for the BAU scenarios to the with additional investment scenarios. The results also show that most of the milk is coming from crossbred cattle (Figure 3). Crossbred cattle produce about 2.18 billion litres and take 98% share of the total milk produced. Local breed cattle take only 2% share of the total milk with a volume of about 42 million litres.

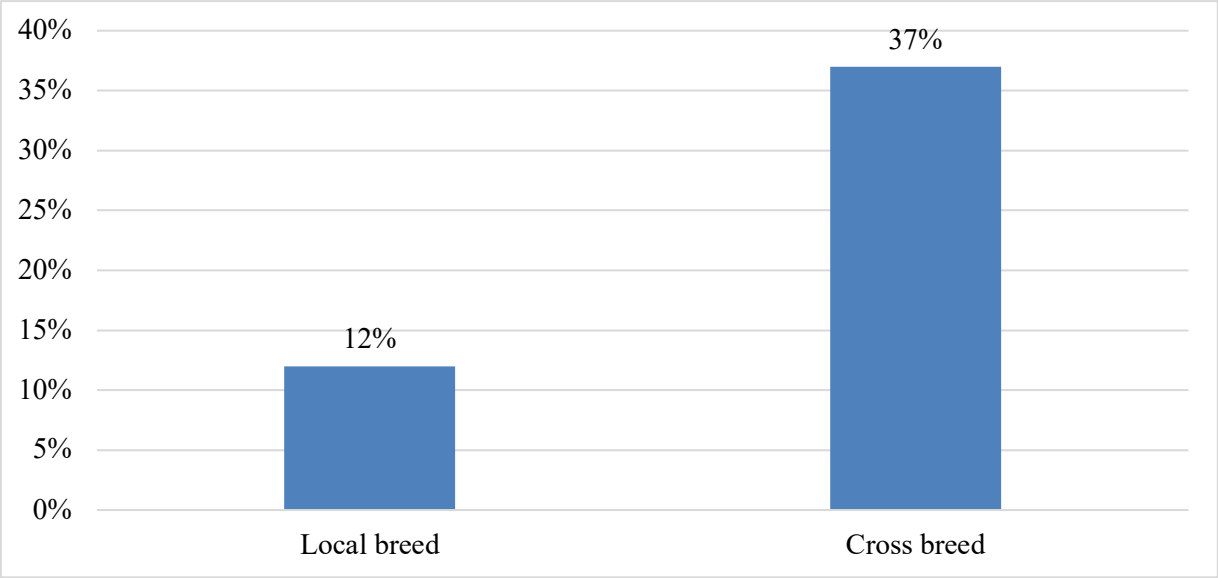

Figure 3: Percent change in milk production between the 2031/32 with intervention and BAU scenarios for local and crossbred cattle

The percent change in milk production between the with investment and BAU scenarios is about 12% and 37% for local and crossbred cattle, respectively.

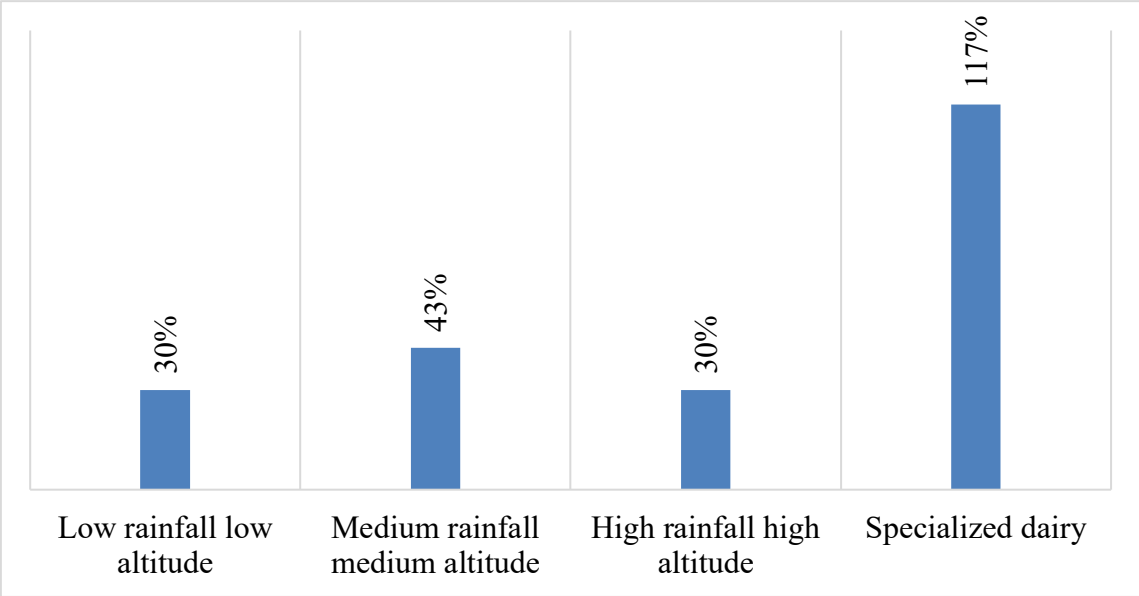

Figure 4: Percent change in milk production between the 2031/32 with intervention and BAU scenarios for the different production zones/systems

More increase in milk production is observed in the crossbred than local breed cattle.

When the different production zones/systems are compared in terms of percent change of milk production, specialized dairy system take the lead (Figure 4). However, in absolute volume of milk produced, family dairy systems contribute a lot to the change in milk production. The total amount of additional milk produced due to the additional

dairy improvement intervention will be about 594 million litres. Out of this total additional milk produced, about 564 million litres is produced by the family dairy systems and about 31 million litres is produced by the specialized dairy systems.

Impact of Proposed Intervention on the Contribution of Milk to National GDP

The dairy improvement interventions resulted in 6–14% and 16–29% increases in GDP contribution of milk from crossbred and local breed cattle. In terms of production systems, changes in GDP contribution between the with additional intervention and the BAU scenarios is highest (80–184%) for the specialized dairy systems than the family dairy systems (16–29%).

Table 4: Milk contribution to GDP and changes with interventions

	Breed (production system)	**GDP contribution of milk (in millions)**		**% change (with vs. BAU)**
		2031/32 without interventions	**2031/32 with interventions**	
Low rainfall low altitude	Local breeds	2139	2274	6%
	Crossbreds (Family dairy)	80691	93750	16%
Medium rainfall medium altitude	Local breeds	2292	2608	14%
	Crossbreds (Family dairy)	87010	111978	29%
High rainfall high altitude	Local breeds	1517	1631	8%
	Crossbreds (Family dairy)	70114	82739	18%
Cattle Specialized dairy				
Grazing based dairy (Gishwati)	Crossbred	2343	4223	80%
Non-grazing dairy	Crossbred	974	2762	184%
Total		247,080	301,965	22%

The percent change in GDP contribution between the with investment and BAU scenarios is much higher for crossbred than local cattle (Figure 5). By 2031, the contribution of milk from crossbred cattle to GDP in the with additional investment scenario will be 23% more than the BAU scenario of the same year.

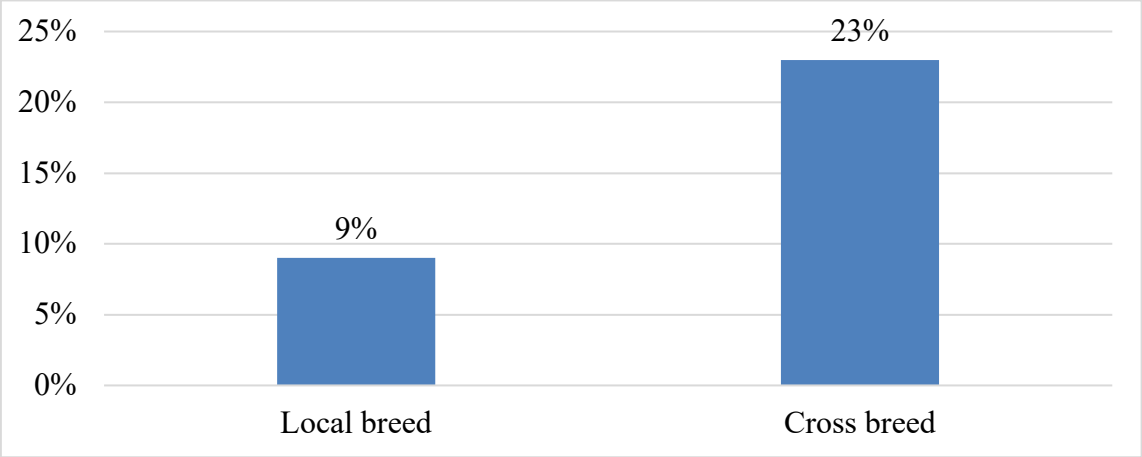

Figure 5: Percent change in GDP contribution between the 2031/32 with intervention and BAU scenarios for local and crossbred cattle

Similar to the production, the percent change in the contribution of milk to GDP is higher for specialized dairy than the family dairy systems (Figure 6). However, in absolute values, the change in GDP contribution of milk is much higher for family dairy system (51.2 billion RWF) than the specialized (3.6 billion RWF). The total amount of change in GDP contribution of milk due to the additional interventions is about 54.8 billion RWF.

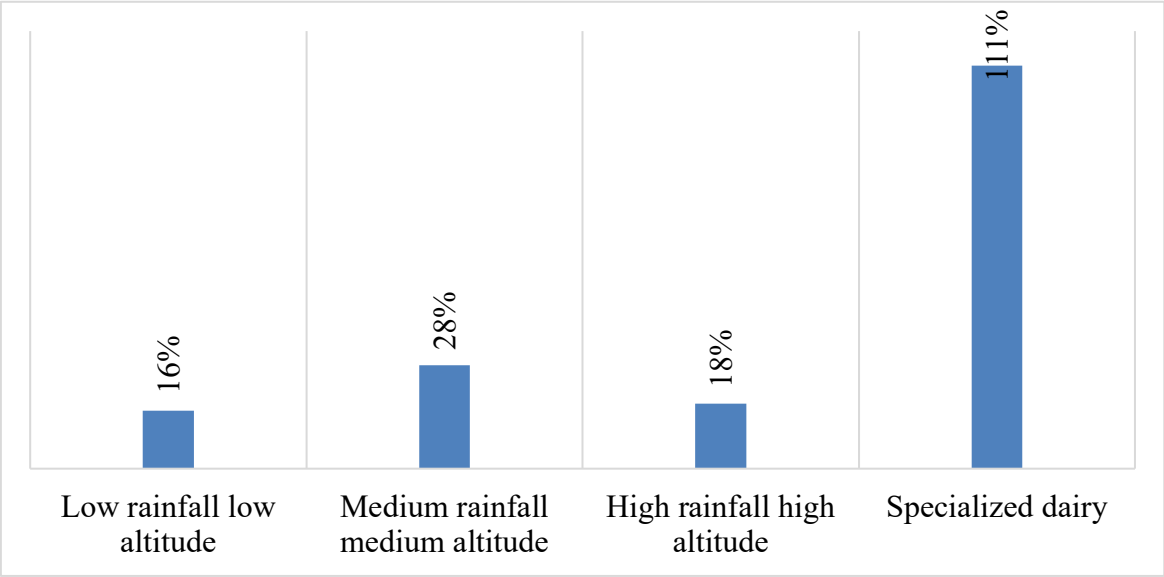

Figure 6: Percent change in GDP contribution between the 2031/32 with intervention and BAU scenarios for the different production zones/systems

Per capita milk availability/consumption

In 2016/17 the per capita milk production/availability in Rwanda is projected to be 63 kg and it is projected to grow to 100 kg in the BAU scenario by 2031/32. Nevertheless, a 55% gap remains between national per capita production and the FAO recommended per capita milk consumption level for a healthy adult life. However, with the additional LSA investment intervention in milk production improvement, the gap is expected to be smaller at 38% in 2031/32. With the LSA intervention, the country could thus increase production to meet sixty two percent (62%) of the FAO recommended per capita consumption level.

Figure 7 below makes the comparison between the FAO projected recommendation, the 2030 global and developing countries average per capita milk consumption levels, or 220 kg, 90 kg and 66 kg, respectively (FAO: World Agriculture: Towards 2015/2030), and the LSA 2031/32 per capita milk production/availability in Rwanda. The milk Rwanda could produce with the LSA intervention in 2031/32 exceeds the global average by 51% and that of the average for developing countries by 200%. This means milk and dairy products could be exported from Rwanda.

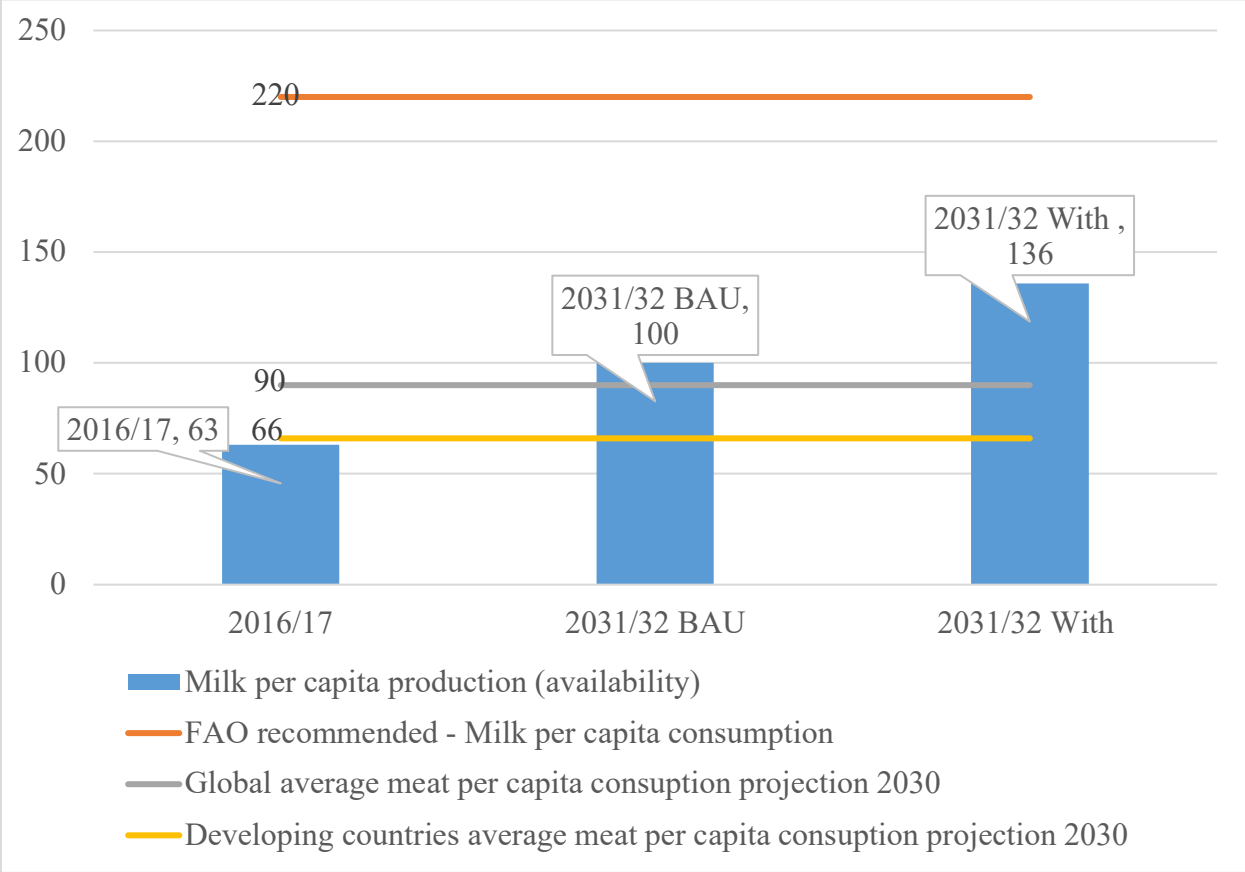

Figure 7: Per capita milk availability/consumption in Kg

4. Conclusion and recommendations

The study used the Livestock Sector Investment and Policy Toolkit (LSIPT) to build the herd and the sector model (HESM) to carry out the analysis and produce the Livestock Sector Analysis (LSA). LSIPT integrates micro, meso, and macro analysis for quantitative and qualitative assessment of household vulnerability, the role of livestock in strategy for poverty reduction, and the contribution of livestock to the overall economy. LSIPT provides a systematic framework for organizing accessible quantitative data (mostly from secondary sources) and includes tools to carry out analyses which help to understand the production potential of the sector, and its contribution to agricultural and overall economic growth (GDP), as well as reduction in rural poverty and food insecurity. Furthermore, LSIPT enables the running of alternative technology and policy scenarios to gauge the supply response of potential government investments in research and extension (such as technologies that impact on feed availability, animal health, etc.), as well as private sector investments over 5 to 15-year projection periods.

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Nevertheless, not enough is produced under the BAU scenario in 2031/32 to feed and meet the animal source food needs of the growing human population of Rwanda. This growth, which is due to the increasing number of cross breed cattle, mostly attributed the Girinka programme, is only half of the milk required to meet the FAO recommended per capita milk consumption, i.e., 200 litres/person.

Thus, the study identified key complementary dairy improvement interventions to be targeted to improve five areas (feed, health, extension, genetics and marketing and processing). The key focus will be on improving the capacity of milk collection, marketing and processing; increasing feed availability; and improving access to

extension service. Assumptions and target production parameters are set for each cattle breed and production system; family based and commercial dairy farms.

The LSA dairy improvement interventions tested result in a huge increase in production and GDP contribution. The difference in milk production and GDP contribution between the "with additional intervention" and the BAU scenarios is 37% and 22%, respectively. The magnitude of the intervention impacts on production and GDP contribution, however, vary for the different production zones and systems. While most of the milk comes from the family systems, the specialized commercial dairy system has a higher impact than the family systems in terms of both production and GDP contribution.

In conclusion, although the existing dairy development policies and the Girinka project of MINAGRI through its "One Cow per Family Program" has transformed dairying in Rwanda, through the provision of cross bred cows, the support and follow up given to the program needs to be strengthened. Key policy and complementary investment actions to support increasing productivity would be: the enhancement of veterinary coverage through private vets and private-public partnerships to reduce mortality and morbidity, the promotion of fodder, and maize and soya bean production through allocation of lands; and the accelerated introduction of improved genetics once feed production and health services are in place. Additionally, special incentives (to improve the business climate, lower taxes, and increased training) could promote more value addition through processing and product transformation, combined with a clearer role of the public and private sector.

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Annex

Dairy improvement interventions

Feed
• Promote improved grass and leguminous feed production[4] in all accessible areas including
• Backyard, hedge and live fence. Feeds like Pennisetum, Brachiaria, Leucaena, Sesbana
• Calliandra, Chloris gayana, Panicum Maximum, and desmodium species, are candidates for production
• Improve production, marketing and quality control of forage and forage seeds through strengthening existing regulatory bodies
• Improve quality control of processed feeds and industrial by-products used as feed in the dairy system
• Increase the use of crop residues e.g.: maize drying on the field to be used and conserved for animal feed
• Improve the grazing land (like in Gishwati) by over sowing with improved grass and leguminous forage seeds; and use of fertilizer where applicable
• Increasing access to water – prioritizing water shortage areas
• Promote over sowing of grazing land with improved grass and leguminous forage seeds and use of fertilizer where applicable
• Promote allocation of land for production of improved pasture/forage
• Investment in forage seed production
• Increase the efficient use of forages and crop residues (e.g. conservation)
• Establish feed additives (minerals, vitamins, amino acids) manufacturing industry
• Increase the availability of cereal grains (including through importation)
• Promote the use of concentrates by producers
• Mobilizing farmers associations to organize group purchase and distribution of processed feed
• Research on:
  • Successful forages species according to zones
  • The real quantity of forages and post-harvest that Rwanda can produce in comparison to actual and projected demands

[4] Based on the works of González et al. (2016[8]) in countries including Rwanda, adoption rate of improved forages technology is expected to reach 60%, and 80% in the first 5, and 10 years.

Animal Health

- Coverage of health service will reach 100% in the coming 5 years
- Farmers adopting the recommended rate of tick control treatments will reach 60% in the coming 5 years and 80% in 10th year
- All animals will receive vaccination against endemic (ECF, BQ, brucellosis, Rabies,) and epidemic diseases (FMD, LSD, RVF)
- Increase the percent of farmers that adopt mastitis control and management technologies to 60% in 5 years, and 80% in 10 years.
- Within five years, enforce regulations to ensure FMD and CBPP free Rwanda
- Rate (%) of animal/animal product movement permits issued will reach 100% in five years
- Strengthen capacity for disease surveillance, quarantines, and supervise mass vaccination programs
- Strengthen veterinary diagnosis laboratories
- Promoting the increased engagement of private vet service providers

Extension

- Provide farmers intensive training on dairy cattle management (feeding, breeding, deworming, tick control, hygiene and milk handling and transport). It is expected that this intensive diary improvement training will reach out to 80% of the farmers in 10 years
- Increase the number of MCCs and cooperatives providing dairy input supply, animal health, extension and financial services. Increase the current number by 38%–80% in the first 5, and 100% in 10 years.
- Build the capacity of extension agents
- Use of farmer's associations to increase delivery of extension services

Genetics

- The population of local cattle will decrease while the number of crossbred and the total number of cattle increases
- The number of local cattle is projected to decrease by an annual growth rate of about -4%.
- The annual growth rate of the crossbreed cattle will be 8%, 6% and 4% in the first (2016–2021), second (2021–2026) and third (2026–2031) segments of each of the set of five years and will remain the same after that
- The overall cattle population will grow at 3% the first five years; and 2% and 0.5% the second and third five years. The current cattle population growth rate is around 3% (RAB, report)
- Improve the efficiency of AI service through promoting private AI practitioners and training of technicians
- Continue research on exotic breeds

- Performance (and pedigree) recording
- In 2016/17 (118,000 (15%) of the reproductive females in the country are targeted to be inseminated, and the number of animals inseminated is projected to rise to 70% in the coming five years
- Coverage of AI service at the base year targeted only 20% reproductive females.

Marketing and processing

- The priority interventions related to marketing and processing of milk include:
- Increase the functional capacity and utilization of existing MCCs
- Strengthen existing dairy cooperatives and establish new 150 cooperatives
- Enhance the capacity of MCCs to test antibiotic residues, mastitis and start to fully enforce existing milk quality standards at MCCs in the coming 5 years
- Establish functional linkage between private milk traders, MCCs, cooperatives and processing plants as observed in Gcimbu district, Kageyo dairy cooperative
- Practice grading and quality-based pricing of milk and milk products
- Percent of milk collected in the formal market will increase from the current 12% to 80% in 5 year and 100% in 10 years
- Attract local and international investors in milk cold chain and milk processing
- Improve feeder roads to and from MCCs/MCPs
- Encourage establishment of new milk processing plants (pasteurized milk, UHT and powdered milk) that can process 675 MT of milk/day. Currently only 280 MT of milk/day is processed.