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Review of challenges and opportunities for dairy cattle farming under mixed system of Homa Bay County, Western Kenya

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The objective of this review was to determine challenges and opportunities facing dairy cattle production in Homa Bay County, which lies within the Lake Victoria basin. Three cattle production systems were included: farms keeping indigenous breeds; farms keeping crosses of indigenous and exotic breeds and farms keeping exotic breeds. Both primary and secondary data were collected using questionnaires, key informant interview, published grey literature sources and institutional websites. Quantitative data was analyzed using descriptive statistics and One-way analysis of variance used as inferential analysis at 5% level of significance, while qualitative data were summarized using themes. Among the different cattle breeds raised, milk was predominantly produced by indigenous type. Most farms owned about 4 acres of land, with farms keeping indigenous breeds owning 7 herds of cattle while farms keeping crosses and pure exotic breeds kept 4 and 3 herds of cattle, respectively. Daily milk yield from exotic breeds was 18 L, while indigenous breed produced 1.7 L. Milk was sold to neighbours, local markets and for household consumption. Farmers faced challenges with regard to quality and unavailability of feeds during drought periods, controlling livestock diseases, sources of information and breeding services. The County government and its development partners implemented projects on dairy productivity: fixed-time artificial insemination project and introduction of Brachiaria grass which is drought resistant and have high protein content. This report presents findings which are important for policy making on dairy farming and lessons on how public and private sector partnership can alleviate challenges facing dairy farming.

Key words: Challenges and opportunities, dairy cattle farming, western Kenya.

INTRODUCTION

Dairy cattle farming in Kenya contributes about 14% of Agricultural Gross Domestic Product with an estimated annual growth rate of 4.1% (Behnke and Muthami, 2011). In addition, it is the most rapidly expanding dairy sector within sub-Saharan Africa, and with over 85% of the dairy cattle population raised within Eastern Africa region (Odero-Waitituh, 2017). The current dairy cattle population in Kenya is estimated at 4.3 million herds and they produce about 3.43 billion liters of milk annually, which constitutes about 18% of the paltry 3% contribution of sub-Sahara African countries global milk production (Behnke and Muthami, 2011). Indeed, smallholder dairy

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farming plays an important part in the dairy value chain within Sub-Saharan Africa, where three technological approaches have been used to improve productivity (Chagunda et al., 2016). These include applying agricultural ecological processes such as continuous housing of cows, practicing cut-and-carry feeding system, introduction of purpose bred forages, pastures and agro-forestry within the dairy systems, utilization of modern livestock breeding techniques including importation of dairy breeds and crossbreeding of indigenous cattle with exotic breeds, and other types of socio-economic intensification.

It is reported that smallholder dairy farmers own over 80% of the dairy cattle population in Kenya, and they produce over 56% of total milk output in the country (Kaitibie et al., 2010; Odero-Waitituh, 2017). These cattle are raised under both intensive and semi intensive systems with the predominant breeds kept comprising of Friesian, Guernsey, Ayrshire, Jersey and their crosses (Bebe et al., 2003). These production systems are not unique to Kenya, but have been reported to be practiced in different parts of the World where they play a significant role in production of milk which support family incomes and the economies (Devendra, 2001). In addition, milk is also produced from the numerous herds of indigenous cattle raised by many smallholder and pastoralist communities within the country (Onono et al., 2013). According to Bebe et al. (2003), the management decisions on breeding objectives by the Kenyan smallholder dairy cattle farmers are guided by a number of factors including level of milk yield, high butterfat yield, heavier body weight, unselective feeding behavior under zero grazing units, hardiness and disease resistance. In these farms, the Friesian, Ayrshire, and Jersey cattle breeds are preferred because of the high level of milk yield as compared to the zebu, which is preferred for their hardiness and disease resistance.

Since liberalization of the dairy industry in Kenya in early 1990s, marketing of fresh milk and other value-added products have been controlled by market forces. Accordingly, milk supplied to the formal sector declined due to unpredictable prices and delayed payment by some milk processors (Odero-Waitituh, 2017). This also led to the emergence of another market segment characterized by farmers who sell milk through informal marketing channels which handle raw milk and other dairy products and they often fail to conform to milk market regulations (Institute of Economic Affairs, 2001). It is estimated that about 80% of milk produced by smallholder farmers is neither processed nor packaged, but is purchased by consumer in raw form through informal milk outlets (Institute of Economic Affairs, 2001; Kaitibie et al., 2010). Marketing of milk through these informal channels is associated with numerous disadvantages including loss of benefits associated with value addition, reduced opportunities for employment creation, lack of quality standards to control adulteration, poor controls in ensuring hygienic and clean healthy products that are produced and distributed, reduced safety standards to consumers, poor keeping quality for milk and reduction in contribution of export earnings from surplus milk that is produced.

Although the smallholder cattle production activities contribute enormously to the economies of the farming communities in Kenya, these enterprises are greatly hampered by a number of challenges including poor access to breeding services, inadequate and poor quality feeds for the dairy cattle, occurrence of livestock diseases, poor access to credit facilities and lack of markets for the fresh milk which is often characterized by inadequate processing of raw milk and the numerous informal milk markets characterized by hawking of raw fresh milk (Bebe et al., 2003b, 2008; Odero-Waitituh, 2017). Much of the available literature on dairy farming in Kenya are based on reports and peer reviewed publications from the highland agro ecosystems where dairying has been practiced for several years, however, there is a paucity of studies that have reported milk production and challenges facing dairy farming within the mixed production systems in the lowland areas of western Kenya, where milk is still obtained from farms predominated by indigenous cattle and crosses between indigenous and exotic breeds, with only a few farms keeping pure exotic breeds. This paper presents baseline information on the level of production in these systems; in addition, it reviews the prevailing challenges facing this production system and the opportunities that are available to be exploited for improved milk production. The findings will be useful for policy makers and organizations that support livelihoods of the rural communities through implementation of projects that target activities along the dairy value chains under similar production settings.

MATERIALS AND METHODS

Study area and design

A cross sectional study design was used for collection of primary data from farms, while secondary data was obtained from published and grey literature sources. The study was conducted in Homa Bay County in western Kenya, located within the Lake Victoria basin, and its geographical coordinates are 0° 31’ 0’’ South and 34° 27’ 0’’ East. The primary data was only collected from Rangwe sub-County which is one of the eight sub Counties in Homa Bay, but secondary data and key informant interview focused on an area that covers two sub-Counties: Rangwe and Kasipul/Kabondo sub Counties. The cross sectional study design has been described to be useful when collecting data from systems where minimal information is available about the parameters that are being investigated (Kothari and Garg, 2014). These regions were selected because of the emerging dairy farming practices which are partly supported by the partnerships between County government of Homa Bay and its development partners to accelerate development along the dairy value chain.

Selection of study units and data collection

The farms targeted for data collection were keeping indigenous cattle

breeds, crosses between indigenous and exotic breeds and farms keeping pure exotic breeds of cattle (Jahnke, 1982; KARI/ODA, 1995). Additionally, key informant interview was done with the County Director of Veterinary Services. The farmers who participated were selected by the field animal health assistants in Rangwe Sub County; with the farms drawn across all Wards within the Sub County. A total of 52 cattle farmers were interviewed of which 34 were raising indigenous breeds, 15 raising cross breeds and 3 raising exotic breeds of cattle. Data was collected from these farmers using a pre-tested semi structured questionnaire, while an interview guide was used to collect data from the County Director of Veterinary Services. The cattle farmers questionnaire included questions on the size of household land ownership in acres, the cattle herd sizes per household, the average milk yield per cow per day in liters, the average price of milk per liter in Kenya shillings, the average fees farmers were charged for veterinary services, the average cattle market prices and fees charged for artificial insemination services, and the challenges associated with cattle rearing in the region. In addition, the County Director of Veterinary Services was asked to list the diseases that impacted farmers' livelihoods, and which of these diseases occurred in farms at a higher frequency. Similarly, they also listed the opportunities that existed for improvement of cattle production in the region based on the different types of projects the County government had initiated that targeted improvements on both crop and livestock sectors. Additional information on types of investment projects on crop and livestock sub-sectors were obtained from the official website of Homa Bay County government, and its development partner institutions like the International Livestock Research Institute (ILRI).

Data management and analysis

The quantitative data that was obtained from cattle farmers and grey literature sources were analyzed through computing the descriptive statistical measures including mean, range and percentages. Inferential statistical measures were also computed to test the level of significance between the mean differences for continuous quantitative variables between farms that were keeping exotic, crosses and indigenous breed of cattle. These quantitative variables included cattle herd sizes, daily milk yield, fees charged for veterinary services, market prices for mature cattle, fees charged for artificial insemination services, family land ownership in acres and market prices for milk. This analysis was achieved by performing One-way analysis of variance and for all statistical analysis which was done using Genstat statistical package (VSN International, 2011) at 95% level of confidence. For the qualitative variables that included description of different challenges facing cattle farming and existing opportunities for dairy cattle improvements through projects initiated by the County government, and its partners, the framework analytical approach was used to summarize the data using thematic analysis as described by Gale et al. (2009, 2013). The data collected from the County veterinary services on disease challenges facing the cattle farming communities were used to triangulate findings that were obtained from cattle farmers on various disease challenges that existed in the region.

RESULTS

Review of livestock population and milk output in Homa Bay County

Most of the dairy animals raised in Homa Bay County were of indigenous breed of cattle, estimated at 180,048 herds of cattle, constituting about 97% of animal population; however, there was a smaller population of exotic breeds of dairy cattle comprising about 4,848 herds of cattle which were raised under intensive farming systems that constitute about 3% of the animal population (Table 1). In addition, some farmers also kept dairy goats. These animals produced about 18 million liters of milk annually, of which the indigenous breed of cattle produced about 12 million liters comprising about 69% of total milk produced, with the exotic breed producing 5 million liters, which was 30% of the total milk produced. The dairy goats on the other hand produce 50,400 L of milk. This level of milk production created shortages since the estimated demand for milk in Homa Bay County was about 34 million liters annually, resulting in an estimated shortage of about 16 million liters of milk, which comprised about 45% of the level of milk production.

Description of dairy cattle demographics in Rangwe sub-County

Most of the farms included in the study owned about 4 acres of land (Table 2). However, the herd sizes were 7 (2 to 18) for those farms keeping indigenous breeds of cattle, 4 (2 to 6) for those keeping cross breeds and 3 (2 to 4) for those keeping exotic breeds of cattle. The farms keeping exotic breeds had cows producing averagely 18.33 L of milk daily, with farms keeping cross breeds producing about 7.2 L daily. Those with exotic breeds of cattle sold their milk at a premium price of ksh 75 L^{-1}, with the indigenous farms selling their milk at ksh 68 per liter. The farms keeping exotic breeds generally incurred higher cost on veterinary services than in other systems; similarly, the market prices of dairy cattle in the exotic farms averaged Ksh 51,667 compared with Ksh 13,383 for farms keeping indigenous breed. The artificial insemination services were only practiced on farms keeping exotic and cross breeds. The average land ownership by these cattle farmers and market prices for selling a liter of milk were not statistically different across the systems ($P > 0.05$) (Table 3). However, cattle herd sizes, daily milk yield per cow, average fee charged for veterinary services, market prices for purchasing cattle and charges levied for artificial insemination services were statistically different between the studied production systems ($P < 0.05$).

Description of challenges affecting cattle farming in Rangwe sub-County

The sources of income for households in the three cattle production systems (indigenous, crosses and exotic cattle breeds) included crop and livestock farming, small businesses and employment (Table 4). Milk which was the main output from the farms was sold to neighbours and used for household consumption. In addition, for the farms keeping crosses and exotic breeds of cattle, they would sell the excess milk to consumers within the local market places. These farms fed cattle on extensive

Table 1. Cattle demographics and level of production for Kasipul/ Kabondo and Rangwe sub-Counties (Adapted from a report by Stirling Consultants Limited, 2014).

Types of variable	Kasipul/Kabondo sub-County	Rangwe sub-County	Total
Average number of farms	48,400	12,360	60,760
Dairy animal population			
Exotic cattle	4,429	419	4,848
Indigenous cattle	95,794	84,254	180,048
Dairy goats	481	-	481
Total population	100,704	84,671	185,375
Level of milk production			
Exotic cattle	5,092,243	534,750	5,626,993
Indigenous cattle	8,260,436	4,600,000	12,860,436
Dairy goats	50,400	-	50,400
Total production	13,403,079	5,134,750	18,557,829
Demand for milk	23,136,000	10,900,000	34,036,000

Table 2. Descriptive analysis for variables associated with different dairy cattle farming systems in Homa Bay County.

Types of variable	Indigenous (n=34)	Crosses (n=15)	Exotic (n=3)
Land size (acres)	4.68 (1 - 11)	3.7 (2 - 6)	4 (3 - 5)
Cattle herd sizes	7 (2 - 18)	4 (2 - 6)	3 (2 - 4)
Daily milk yield (L)	1.7 (0.5 - 3)	7.2 (4 - 9)	18.33 (16 - 21)
Price of milk per liter (ksh)	68 (60 - 80)	73 (60 - 90)	75 (70 - 80)
Veterinary fee (ksh)	390 (150 - 500)	554 (300 - 1000)	1000 (500 - 1500)
Cattle market prices (ksh)	13,383 (8,000 - 20,000)	28,800 (24,000 - 40,000)	51,667(45,000 - 60,000)
Artificial insemination charges (ksh)	-	867 (500 - 1500)	1,334 (1000 - 1500)

Table 3. Univariate analysis for variables associated with different cattle farming systems in Homa Bay County.

Types of variable	Breed			P value
	Indigenous (n = 34)	Cross (n = 15)	Exotic (n = 3)	
Land sizes in acres	4.67	4.93	5.00	0.936
Cattle herd sizes	6.65	3.87	3.00	0.023
Daily milk yield per cow (L)	1.71	7.20	18.33	0.001
Prices of milk per liter (ksh)	79.13	72.67	80.00	0.054
Veterinary charges (ksh)	390.90	546.70	1500.00	0.001
Cattle market prices (ksh)	13,382.00	25,600.00	50,000.00	0.001
AI charges (ksh)	-	866.67	1,333.33	0.024

AI: Artificial insemination

grazing and crop residues, but for the farms keeping cross and exotic breeds, they would also feed commercial feeds including hay, salt licks and planted fodder trees. The challenges associated with these sources of feeds included frequent and prolonged drought conditions, water shortages, high costs of feeds and inadequate advice on dairy cattle feeding and feed formulations for the farms keeping exotic breeds. The

Table 4. Summary of challenges associated with dairy cattle farming in Homa Bay County.

Thematic areas	Farms keeping indigenous breed of cattle (n=34)	Farms keeping cross breeds of cattle (n=15)	Farms keeping exotic breed of cattle (n=3)
Source of Income	Crop and livestock farming, small businesses and employment	Crop and livestock farming, small businesses and employment	Crop and livestock farming, small businesses and employment
Buyers of milk	Household use and sale to neighbours	Household use, sale to neighbours and local markets	Household use, sale to neighbours and local markets
Sources of animal feeds	Extensive grazing and feeding crop residues	Planting fodder crops, extensive grazing, commercial feeds	Planting fodder crops, extensive grazing, commercial feeds: hay, mineral licks
Challenges with feed sources	Frequent and prolonged droughts and reduced pasture	Frequent and prolonged droughts, water shortages, unavailability of good quality pastures and fodder	Prolonged droughts, water shortages, unavailability of good quality pastures and fodder, high costs of commercial feeds, inadequate advice on dairy cattle feeding regimes and feed formulation
Sources of water	River, borehole	River, borehole	Borehole, tap water
Methods of Controlling diseases	Regular spraying, treatment of sick animals, vaccinations which are organized by County government	Vaccinations, regular spraying, deworming, treatment	Vaccinations, treatment, regular spraying, deworming, regular monitoring of the herd by veterinary officer
Veterinary services	Agrovets, untrained veterinary personnel	Agrovets, animal health assistants, veterinary officers	Veterinary officers, animal health assistants
Sources of information for livestock farming	Other farmers, agrovets, untrained veterinary personnel	Agrovets, Animal health assistants, Veterinary officers and, seminars	Agricultural seminars, Animal health assistants, Veterinary officers
Sources of breeding services	Natural mating	Both natural and Artificial insemination services	Artificial insemination services
General challenges on dairy cattle farming	Drought, ticks, diseases, water shortage	Prolonged drought, water shortage, livestock diseases, lack of milk markets, poor road networks for milk transport, high veterinary costs, high AI prices	Unpredictable weather, diseases, poor quality feeds, high costs of commercial feeds, poor milk markets, limited capital to expand farm, inadequate veterinary officers, high veterinary costs, unreliable AI services, inadequate knowledge on proper livestock feeding

farms mostly obtained water from rivers and boreholes, except for farms keeping exotic breeds that relied on tap water. Disease control in these farms was often achieved through vaccinations which were conducted by the County government, regular spraying of cattle by farmers to control ectoparasites, treatment of sick cattle, and deworming. In addition, for the farms keeping exotic breeds, regular monitoring by veterinary officers was reported. Veterinary services were provided by owners of agrovets shops (shops selling agricultural inputs), and

animal health assistants, but for farms keeping indigenous breeds, untrained veterinary personnel were often used. The main sources of information for livestock keeping and management included owners of agrovet shops, animal health assistants, veterinary officers, attendance of agricultural seminars; however, for the farms keeping indigenous cattle breeds, they would use untrained veterinary personnel as sources of information, which was a constraint to dairy development in the area since these untrained personnel cannot provide the right information on disease control and the correct dosages of veterinary medicines. The farms keeping exotic breeds mostly used artificial insemination as a breeding technique; however, for the indigenous farms, the preferred breeding method was natural mating. The general challenges that faced these farms included presence of diseases, frequent drought conditions, lack of market for milk, poor road network for transportation of milk to markets, high costs for veterinary and breeding services, high cost of commercial feeds, shortage of capital to expand the farms, inadequate veterinary officers, unreliable artificial insemination services, and lack of knowledge on proper feeding of livestock.

Disease challenges that affected cattle production in the Homa Bay County included tick-borne diseases (East Coast fever, Anaplasmosis, Babesiosis and heart water), trypanosomiasis, lumpy skin disease and foot and mouth disease. According to the County Director of Veterinary Services, Anaplasmosis, Babesiosis, heart water and East Coast fever were the most commonly reported cattle diseases in farms in that order. But lumpy skin disease, foot and mouth disease were not frequently reported in farms.

Partnerships with County government of Homa Bay to support crop and livestock sub-sectors

Opportunities were presented through investment by County government and its partners in agricultural activities (Table 5). For example, the country government of Homa Bay had invested in promotion of technology transfer by modifying the environment through investment in building green houses and provision of seed and fertilizer subsidies given to crop farmers. Within the livestock sub sector, the County government implemented an accelerated value chain development with the aim of increasing milk production which bridges the gap between the estimated demand and the current level of milk production. Furthermore, the introduction of Brachiaria grass to smallholder livestock farmers, which is a drought resistant source of fodder with high protein content, would alleviate challenges of supply for quality in water harvesting through construction of water pans to alleviate challenges associated with frequent and prolonged dry spells, which hampers availability of livestock feeds.

DISCUSSION

Indigenous cattle population were the main source of milk produced within Homa Bay County, but there is a significant contribution in milk production from the emerging farms that are keeping exotic breed of cattle with their crosses and dairy goats. However, the level of milk production within the County cannot match the estimated demand for milk, the shortage which is mostly supplied with processed milk distributed by the major milk processing companies in Kenya (Stirling Consultants Limited, 2014). Reliance on indigenous cattle breed for milk production is also a bottleneck for dairy development in the region, since the level of milk yield from these breeds of cattle is generally low, a finding which was previously reported for other cattle systems in Kenya (Muhuyi et al., 1999; Onono et al., 2013). In these areas, improved breeding techniques such as the use of artificial insemination and embryo transfer are less frequently used, except for the few farms that have adopted the use of these techniques for improved livestock breeding (Karanja, 2003; ILRI, 2016). Indeed, the farms which were using these techniques for breeding generally had a higher level of milk production, as compared to the farms keeping indigenous cattle breeds and who were practicing natural mating. Furthermore, the accelerated dairy value chain project which is implemented through a partnership between the County government of Homa Bay and the International Livestock Research Institute which aims at upgrading genetics of the indigenous cattle through fixed time artificial insemination will go a long way in increasing the dairy productivity (ILRI, 2016). In these farms, the average number of cattle raised for the farms keeping exotic breeds were 3 herds of cattle in a land holding of about 4 acres, and this estimate compared favorably with the description of smallholder dairy farms reported in central Kenya, which have a median farm size of three acres and a median of three dairy cattle kept per farm, with an average milk production of about 6 kg per day (Gitau et al., 1994).

The review has further identified several challenges affecting dairy cattle production in Homa Bay County. The main challenges for dairy cattle production included frequent droughts, lack of quality feeds and high costs of commercial feeds, high costs of veterinary services and unreliable services provision, and presence of livestock diseases. The diseases of cattle reported in these areas include Anaplasmosis, Babesiosis, and Heart water, in addition to East Coast fever and trypanosomiasis, of which majority of the diseases were tick-borne infections. Indeed, from a study on molecular detection of tick-borne pathogen diversities in ticks from livestock and reptiles along the shores and adjacent islands of Lake Victoria and Baringo in Kenya, disease causing pathogens responsible for causation of the listed diseases were identified (Omondi et al., 2017). These diseases have been reported to occur with a high frequency across

Table 5. Summary of partnership activities by the County government of Homa Bay in crop and livestock sub-sectors.

Thematic area	Description of investment activities
Crop farming	Investment in green houses in each of the 40 wards aimed at transferring and promoting technology to modify the environment to support crop production. In addition, cereal seeds (11.65 metric tons) and 800 L of liquid fertilizers distributed to farmers. Tractors with digs and furrows were purchased to be hired by farmers to cultivate land in all the sub-Counties at subsidized costs
Fish farming	Construction and supplied fish farming inputs for more than 160 fish ponds across the County, and of these 140 ponds harvested earning farmers up to 9 million Kenyan shillings
Water harvesting	The livestock department undertaken construction of water pans for vegetable production, and also to increase production and increase water availability during the dry spells
Dairy cattle farming	The International Livestock Research Institute (ILRI) has partnered with the County government of Homa Bay to promote dairy production at household level by providing opportunities to smallholders for accelerated breeding through fixed-time artificial insemination, to enable upgrading dairy animals. Furthermore, partnership between International Crops for Research Institute for Semi-Arid Arid Tropics (ICRISAT) and the International Potato Center (CIP) and ILRI, a drought resistant and high-quality fodder-grass with high protein content called Brachiaria introduced to small-scale farmers as a source of cattle feed.
Poultry farming	Up to 302 egg incubators issued to various farmer groups to enhance people's incomes, which has increased poultry production by 60%

different production systems in Kenya. For example, Okuthe and Buyu (2006), reported the occurrence of Anaplasmosis, East Coast fever and Babesiosis in smallholder farms within the highlands of Rift valley, while the occurrence of East Coast fever have been reported in the central parts of Kenya, where they have been reported to be the cause of high mortality in calves (Gitau et al., 1997). With regard to the high costs and unreliable veterinary services delivery to the indigenous cattle farmers, the findings are in agreement with challenges which have been reported for animal health delivery systems in sub Saharan Africa. Indeed, bottlenecks associated with the provision of veterinary services and provision of extension services to livestock farmers in sub Saharan Africa, and Kenya in particular have previously been described, whereby the supply of veterinary services for the most part are through non qualified personnel, with several non-governmental organizations supporting delivery of veterinary services through community based animal health workers or disease reporters who have no basic training in animal health. Apart from the disease control interventions by the County government, there were no programmatic interventions to control the widespread livestock diseases by the development partners. This is in contrast to interventions on livestock within the arid and semi arid lands in Kenya, where livestock development projects have always focused on enhancing veterinary services delivery besides the supply of feeds (Leonard, 2000; Okwiri et al., 2002; Abdilatif et al., 2018).

Cattle were mostly raised on extensive grazing, but for the exotic dairy cattle breeds, they were entirely under zero grazing systems of management. These results therefore reveal different level of intensification with projects targeting both ecological and genetic approaches (Chagunda et al., 2016). These levels of intensifications are characterized by projects targeting upgrading of genetics of local indigenous cattle breeds through the fixed time artificial insemination and introduction of Brachiaria grass which is a high quality fodder grass tolerant to drought conditions and a high protein content (ILRI, 2016; USAID, 2017). In addition, the County government of Homa Bay had implemented the construction of water pans within the County to mitigate the frequent occurrence of dry spells. The success of this project would help alleviate challenges of perennial dry conditions and poor feed quality as well as their unavailability during droughts that affect cattle productivity. Indeed, the presence of these challenges greatly impacts milk production which is a consequence of feeding poor quality feeds, coupled with the poor genetic potential of animals. Also, the milk produced from these farms were mainly sold to neighbours and in local market places with the excess consumed in households.

Indeed, the post liberalization period of the dairy industry sector in Kenya had reportedly resulted to smallholder farmers selling their milk through non formal outlets, characterized by poor enforcement of regulations,

and which market outlets were still used by farmers for milk marketing (Kaitibie et al., 2010).

Conclusions

Indigenous cattle breed currently produces most of the milk in Homa Bay County, however there are farms keeping exotic breed of cattle with potential for high milk production. Some of the challenges facing these cattle farmers include poor quality feeds and their unavailability during the drought periods, occurrence of livestock diseases that affects productivity, poor veterinary services provision for the farms keeping indigenous cattle which are the main source of milk consumed within the County; and lack of a robust extension service provision within the areas which also results to inadequate provision of advise to farmers on feeding especially for exotic pure breeds of cattle. Opportunities that exist include public - private partnerships between the County government and nongovernmental actors which have the potential to alleviate challenges of unavailability of feeds and poor livestock feed quality alongside upgrading of livestock genetics through the dairy value chain enhancement project to improve quality of dairy animals and enhanced milk yield in cattle herds. Although this report has presented a set of challenges facing these farmers and various interventions currently provided to the farmers, future studies should evaluate level of effectiveness of these public - private partnerships on development and on the alleviation of challenges that currently face livestock farmers under similar settings. In addition, the roles of other dairy value chain actors should be investigated to identify the factors that influence the pricing of milk.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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