



## Transformational Assessment of Emerging Issues in the Kenyan Dairy Sector

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### Abstract

Kenya's dairy industry, dominated by the private sector, is one of the most competitive and largest in Africa. The sector is diverse and vital to the country's economy. However, the sector is primarily subsistence on small holds. Variety of challenges worsens the sector resulting in suboptimal production and profitability. The aim of this paper was to conduct a comprehensive assessment of Kenya's dairy sector in order to identify economic transformative interventions. This study looked at the Kenyan dairy sector through explorative approach. The study used extensive interviews with farmers, government officials, and Non-Governmental Organizations. Through a systematic search, the study reviewed scientific publications through online search engines conducted in the year 2010 to 2020. Google Scholar, Worldwide Science.org, Science Direct, and African Journal Online (AJOL) were the search engines used. Dairy farming, dairy, constraints, opportunities sustainability, and Kenya were the main search phrases utilized on peer-reviewed scientific publications. The study found out that various aspects of the dairy sector are mutually related and dynamic, with multiple limitations and are both industrial and social in nature. Climate change negatively effect on dairy production. Dairy production widely is a contributor to global biodiversity loss through acidification, eutrophication, climate change, freshwater usage, and eco toxicity. Dairy intensification is a concern in public health by posing biological, chemical, and physical occupational health risks. Gender especially women's roles and the overall intensity of labour usage is a major concern in dairy operation. The study concludes that given the complexity and interconnectedness of the industry's challenges, it is critical that dairy sector solutions focus on an accurate diagnosis of the sector's many aspects crisis. As a result, resolving the multisystem constraints that underpin value chain growth is an intrinsically complicated political process. Multi-stakeholder procedures are more than just technical inputs.

**Keywords:** Kenya; Dairy; Smallholder; Subsistence; Production; Emerging Issues; Transformation

### Introduction

Kenya's dairy industry, dominated by the private sector, is one of the most competitive and largest in Africa. The sector is diverse and vital to the country's economy, providing rural livelihoods as well as food and nutrition welfare. With an estimated value of KSh 184 billion, the sector contributes between 4 to 8 percent of the Gross Domestic Product (GDP). Dairy sector stakeholders comprise of players involved in the production, handling, shipping, storage, packaging, and marketing of milk and dairy products along the dairy value chain. Input and service providers, farmers, transporters, dealers, dairy farmer cooperative societies, milk processors, marketers, and retailers form the industry supply chain [1]. Land size, wealth, commercialization, and degree of risk vulnerability are four themes that describe the dairy sub-sector. Dairy farming in Kenya is constrained by subsistence orientation, resources, quantity, and quality of soil, expertise and labour, ineffective technology, and a high-risk profile. A smallholder may or may not own any of the measurements of smallness at the same time [2, 3]. The majority of dairy farmers are largely subsistence based and are yet to reap the benefits of income produced by involvement in the informal market system [4, 5]. Dairy sector players participate in horizontal integration (joint sales, marketing, joint input procurement, and promotion) to minimise the market-related repercussions of small-scale production and diverse product quality, and in vertical integration to control a product's supply or distribution, so enhancing its power in the marketplace, lowering costs, and generating greater revenue [6]. When the economic climate becomes more complex, new prospects and problems emerge, and as a result, the potential of subsistence to support livelihoods declines [7, 8]. The modern world, marked by rising population, urbanisation, income, globalisation, policy reforms,

technology, food sector restructuring, and climate change, necessitates the transition of subsistence farming [9, 10].

### Methodology of analysis

This study looked at the Kenyan dairy sector through explorative approach. During field trips, the study used extensive interviews with industry stakeholders including farmers, government officials, and Non-Governmental Organizations (NGOs). Through a systematic search, the study also reviewed scientific publications supplemented by grey literature. The source of systematic publications search was internet-based online search engines conducted in the year 2010 to 2020. The study followed the procedures for systematic literature search, as detailed by Phiri et al. [11]. Google Scholar, Worldwide Science.org, Science Direct, and African Journal Online (AJOL) were the search engines used. Dairy farming, dairy (cattle or cow), constraints (challenges or failures), opportunities, successes, or sustainability, and Kenya were among the search phrases (keywords) utilised. This study considered only peer-reviewed journal publications, theses, conference papers, project reports, and government reports. All publications

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**Received:** 20-Feb-2022, Manuscript No: JFLP-22-55015; **Editor assigned:** 22-Feb-2022, Pre QC No. JFLP-22-55015 (PQ); **Reviewed:** 08-Mar-2022, QC No. JFLP-22-55015; **Revised:** 14-Mar-2022, Manuscript No. JFLP-22-55015 (R); **Published:** 21-Mar-2022, DOI: 10.4172/2332-2608.1000334

**Citation:** Otieno GO (2022) Transformational Assessment of Emerging Issues in the Kenyan Dairy Sector. J Fisheries Livest Prod 10: 334.

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screening was by reading the titles, then the abstracts, and then the whole article if found to be relevant. The study also reviewed the sources of the listed papers to uncover similar papers that were noteworthy but overlooked by the search engine. The information extracted from the articles served as the foundation for this study.

## Results and discussions

### Biophysical Emergence

Climate change has a negative effect on dairy production, both directly and indirectly [12, 13]. Specific effects include rising temperatures, photoperiod fluctuations, and precipitation [14]. The harmful ecological effect of the dairy sector in Kenya involves the depletion of vegetation by overgrazing of natural pastures [15]. Extensive grazing from dairy farming across the country is leading to changes in land use, with more land required to feed dairy cows [16, 17]. Indirect consequences of climate change include decreased feed quality and quantity, water quantity and increased disease predisposition. The scarcity of feed is one of the most critical variables influencing milk output under heat stress. Milk cows' stress response systems occur when environmental temperatures exceed 35°C [18 19]. When compared to low output animals, high milk producing cows generate a lot of metabolic heat. As a result, dairy cattle that produce a lot of milk are more vulnerable to heat stress [19].

Higher temperatures and relative humidity cause thermal stress in dairy animals, resulting in slower growth, less milk and meat output, and hampered reproduction. Temperature stress reduces body weight, daily total body gain, and body weight gain. This is because Thermal stress reduces the intake of dry matter, which can have a negative impact on the animal's growth efficiency [20]. This also affects the economic and reproductive capability of heat-stressed animals [21, 22]. According to Padodara & Jacob [23] Heat stress had a stronger impact on exotic and crossbred species than on native ones. A temperature increase of 2-6 degrees Celsius caused by climate change might have a negative impact on animal development, puberty, and maturity [23]. The most critical element impacting milk production under heat stress is a lack of feed availability [18].

### Environmental Emergence

Many people believe that livestock farming are resource-intensive in terms of land usage, greenhouse gas emissions (GHGE), and water consumption per kilocalorie of food produced, with much larger environmental implications than plant-source diets [24]. There has been growing awareness of the environmental issues posed by agricultural production, continual economic competition resulting in lower farm revenue, and animal welfare issues have resulted in increased interest in sustainable animal food production during the last decade [25]. A sustainable production system incorporates all three characteristics of sustainability: environmental, economic, and social. According to one research, sustainable livestock production is "production that is environmentally sound, taking into consideration the environment and biodiversity, ethically and commercially viable" [26]. Sustainability in animal food production covers numerous ecological challenges, because if the environment is harmed, it cannot support production that relies on natural systems [27].

In terms of water and soil runoff, greenhouse emissions, and waste and manure management, the dairy business faces a number of environmental issues. However, there is little awareness of the sector's environmental repercussions [15, 28]. There are concerns that have been raised about surface water pollution from the dairy sector

because of bulking and processing practises despite the fact that there is a financial incentive to generate biogas from dairy waste. Plastics are widely used in the packaging of dairy products without paying sufficient attention to the reduction of these materials and/or the development of plastic recycling systems.

Modern dairy production has significant sustainability difficulties. One of the most pressing is greenhouse gas emissions (GHGs) to the atmosphere. Methane (CH<sub>4</sub>) The formation of gastro enteric fermentation in dairy cows is not only a source of energy loss for the animal, but it is also a contributor to GHG emissions [29]. In dairy cows, around 6% of total energy intake is lost as CH<sub>4</sub>, with around 95% lost from the mouth and 2-3% lost through faces [30]. Carbon dioxide (CO<sub>2</sub>) and nitrous oxide (NO) emissions are also significant contribution of GHG emissions [31]. Furthermore, dairy production can have a significant negative influence on watercourses owing to nitrogen and phosphorus emissions from manure spreading and overgrazed fields. The production of feed has an environmental impact and uses resources, the severity of which depends on the crop production system and local conditions [32, 33].

### Agro biodiversity emergence

Human environmental effects are endangering Earth's species and ecosystems at an alarming rate. Overhunting, invasive species, and pollution are already threatening the extinction of 25% of all mammal species and 13% of all bird species, as well as over 21,000 other plant and animal species [34-36]. Agriculture is widely acknowledged as a major contributor to global biodiversity loss [36]. Agriculture covers more than a third of the land area, with livestock accounting for 83% of the total [37]. Transformation of land area to agricultural land, as well as changes in agricultural land use and intensification, causes habitat loss and fragmentation, which has a direct influence on biodiversity. Agriculture indirectly affects biodiversity by contributing to acidification, eutrophication, climate change, freshwater usage, and eco toxicity [38]. Although agriculture is a major cause to biodiversity loss, it is also a key contributor to biodiversity [39]. The extent of high nature value farmland has reduced due to increased intensification and abandonment of less viable agricultural land [40]. Furthermore, amid conservation efforts, biodiversity loss on agricultural land is pervasive and particularly devastating [41]. Biodiversity is critical for achieving long-term sustainability in agricultural and food systems. As a result, it is critical to exploit biodiversity in a sustainable manner to guarantee that the requirements of current and future generations are satisfied. Indigenous communities are critical to the management of biodiversity in general, and agro biodiversity in particular (as its sole stewards), therefore including native people in participatory planning and budgeting provisions has emerged as critical to the process [42].

### Public Health Emergence

High demand for dairy products is driving global increase in dairy production hence rapid intensification of the dairy systems in many areas of the globe. There have been increasing concerns raised regarding the consequences of dairy intensification in public health. While greater production may benefit food security and livelihoods, it may also pose a number of health risks (FAO & IFCN, 2010; IDF 2016; OECD & FAO, 2016). Dairy farming has a range of potential biological, chemical, and physical occupational health risks, as well as potential protective effects from specific farm exposures. Occupational effects reported in the literature included zoonotic illnesses, antibiotic resistance bacteria and genes, respiratory problems, an increased risk of certain forms of cancer, and injuries that mostly result in musculoskeletal complaints.

Aside from the risk to farmers, farm labourers, and farm families, several occupational hazards may pose a larger risk to human health [43].

Zoonotic infections are a major cause of human illness and can have a negative impact on public health in terms of morbidity and mortality, as well as socioeconomically. Zoonotic diseases can significantly impair cattle production and agricultural profitability [44]. Cattle are reservoirs for a majority of zoonotic diseases that can cause human sickness [45]. Bovine zoonoses transmission to humans is through a number of methods, including cutaneous, inhalation, ingestion, and vector borne routes. A significant proportion of bovine zoonotic diseases may also be transmitted from human to human, however most are not very transmissible and hence do not generally cause big epidemics [44]. Dairy farm employees, farm inhabitants, veterinarians, and slaughterhouse workers are particularly vulnerable to zoonotic illnesses like *Leptospira spp*, *Salmonella spp*, *Escherichia coli*, *Campylobacter spp*, *Cryptosporidium spp*, *Brucella spp*, *Mycobacterium bovis*, *Coxiella burnetii*, *Trichophyton verrucosum*, *Trichophyton verrucosum*, and *Trichophyton verrucosum* [46, 47].

Dairy farm employees and individuals who come into direct touch with cattle or cow excreta may also be at higher risk of antibiotic resistance bacteria or genes being transmitted (Aitken *et al.*, 2016). The use of antimicrobials in animals, especially dairy cattle, has the potential to improve animal health and production. However, the usage of antimicrobials in both people and animals has resulted in the creation of antimicrobial resistant infections and antimicrobial resistant genes. It is unknown how much antibiotic usage in agriculture has contributed to the development of resistant bacterial strains [48, 49]. Antimicrobials are used to cure illnesses and to prevent them in food animals. Antimicrobials may, however, be administered to food animals in order to stimulate growth and boost feed efficiency [49, 50]. However, the use of antimicrobials for growth promotion in food producing animals has been prohibited in the European Union and other nations [51]. The bulk of antimicrobials used on dairy farms are used to treat mastitis [52]. Antimicrobials are also used to treat lameness, respiratory illness, reproductive difficulties, diarrhea or other digestive problems, and pink eye in cattle [48, 52]. However, compared to swine or poultry production, dairy cow production is less reliant on antimicrobials [43, 53].

### Gender Issues Emergence

Gender influences asset ownership and decision-making by men and women, as well as farm-level dairy management practices and gendered milk marketing participation [54]. In most situations, women's roles are largely dairy cow managers, with males doing the marketing. The overall intensity of labour usage has been highlighted as a major element in choices to develop the dairy production operation. Women are more active in everyday chores which include feeding, watering, and milking [55]. Women are also responsible for making the necessary preparations, such as warming the water used in the milking process, as well as monitoring employees to guarantee compliance with the approved standards for clean milk production. On the other hand, men are primarily involved in seasonal chores including deworming, spraying, planting forage, harvesting, storing, and processing fodder, acquiring inputs from agrovet depots, and arranging the supply of animal health services for cattle [55]. In general, Women have little preparation in terms of planning, knowledge, and abilities when starting or entering the milk trade enterprise, and are deterred further by the ease of merging commercial operations into difficult household tasks. Some of the obstacles raised as common characteristics for

female milk entrepreneurs include restricted access to financing facilities, the usage of rudimentary technology throughout the milking and marketing processes, and operating without licences and distant from retail centres [55].

Because they are in charge of the money, this division of roles and responsibilities increases the danger of violence by people [28]. Women hold few positions of leadership in dairy cooperatives, labor unions, and organizations. Dairy producer associations play an important role in the local dairy value chain. Women outnumber males in the number of producer groups in which they participate. Women handle the cows, while males own them. Females' are less in representation and engagement in dairy producer groups compared to males. Furthermore, female-headed dairying families are less likely to register with dairy producer associations than male-headed dairying households. Men are more likely to possess productive assets [56]. Land access, extension programmes, information and training, and credit issues affect women differently than men, limiting women-headed families from taking advantage of economic potential in the sector [28]. The majority of Kenyan milk processors have no formal gender equality policy. Only one in three processors have a gender policy, and the gender ratio among milk processing workers is around 80% males to 20% females. The high male ratio is because most dairy work involves hard physical labour, while others are field-based and need work at odd hours, which are unfavourable to women (PKF 2013). Although women are heavily active in milk trade, they tend to operate on a smaller scale and are less mobile than their male colleagues are. This is due to restricted access to cash, limited mobility, and significant home duty, as milk trading happens during the height of domestic duties, in the mornings and evenings [55]. Women may lose control over milk use and revenue from milk sales when milk sales grow and commercialization increases especially when milk is sold to formal markets [57, 58]. They would therefore prefer supplying to informal milk marketplaces because they have greater control over their earnings [58]. Participation in collective milk marketing may increase women's decision-making about production and control of income [59]. Female milk producers are also less likely, than their male colleagues, to attend training targeted at improving their technical and commercial skills necessary for the milk trading industry due to their limited mobility [55].

In Kenya, women's credit and savings funds are common. While loans from these women's organizations are used more for non-income generating activities, some groups seek financing for dairy production [60]. Through the creation of a cooperative or microfinance system, women have gained access to loans. The Kenya Women's Microfinance Bank and the Women's Enterprise Fund (WEF), which is a parastatal, provide various loan options for women. In terms of credit, female milk dealers depended on informal sources of credit such as friends and family, or milk supplied on credit by producers, as compared to male counterparts [55].

### Conclusion and Recommendation

This study's insightful results are derived from the collected literature on dairy value chains to give a holistic and non-sequential perspective of the industry as a path to inclusive value chain expansion for dairy products. According to the report, the many elements of developing challenges in the dairy business are mutually dependent. Given the complexity and interconnectedness of the industry's challenges, it is critical that dairy sector solutions focus on an accurate diagnosis of the sector's many aspects crisis. As a result, resolving the multisystem constraints that underpin value chain growth is an intrinsically complicated political process. Multi-stakeholder procedures are more

than just technical inputs. They are social commitments that rely on the effective mobilization of important value chain and non-chain stakeholders, as well as a versatile strategy to successfully adapt to shifting trends for transformational views throughout time.

## Acknowledgements

The Author is very grateful to German Academic Exchange Service (DAAD), African Economic Research Consortium (AERC) and Jomo Kenyatta University of Agriculture and Technology (JKUAT) for the support and financial aid.

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