Community Engagements and the Role of Dairy Farm's in Local Economies

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Abstract

This chapter assesses the key challenges encountered by Pakistan's dairy sector. There are health and economic risks associated with dairy farmers' continued participation in informal milk markets, which in turn reduces the availability of raw milk for processing factories that depend mostly on milk from smallholder farmers. A comprehensive literature study reveals that dairy farmers are increasingly becoming net importers of milk and milk products, leading to a decrease in domestically processed milk products and employment losses. The study identifies four main variables affecting farmers' participation in informal milk markets: market factors, production factors, traits linked to farmers, and traits associated to support services. This research fills a gap in understanding what motivates smallholder dairy farmers to sell their milk on informal markets, guiding the development of policies and initiatives to help them break into more lucrative markets. The study expands on prior research by examining the problem in emerging nations and proposes practical solutions to improve the industry's outlook.

Keywords: Dairy Industry, Milk Production, Livestock, Dairy Issue, Marketing, Small dairy producers.

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Introduction

Pakistan's agricultural economy thrives on the critical contribution of the dairy sector, which has noticeably catalyzed substantial growth in agricultural output. This sector provides a monetary safety net, important sources of income for those living in rural areas, and a large number of employment possibilities; it is therefore an integral part of the economy (Kamal et al., 2022). According to shocking numbers released by the Pakistan Bureau of Statistics (2020), the dairy and cattle industries would account for about 60% of the country's total agricultural output. With 97% of its total intake coming from fresh milk and only 3% from pasteurized milk, Pakistan is clearly one of the top four countries in the world when it comes to dairy output (Ullah et al., 2022).

The issues associated with changing climate are a major concern for the more than 8 million rural families that raise cattle (Abbas et al., 2022). Dairy development efforts aim to boost productivity by crossing low-yielding varieties with high-yielding ones, which targets the demand for more animal protein (Groot & van't Hooft, 2016). The country's dairy business has faced several challenges, and we aim to shed light on the main ones. Also included in this chapter is an analysis of the dairy industry's present state of affairs, with an emphasis on growth opportunities.

Typical Traits of the Dairy Industry

The private sector plays a significant role in urban and rural dairy farming in Pakistan, operating at different scales. The majority of dairy production happens inside integrated crop-livestock systems, with the exception of a few peri-urban operations. According to the current body of knowledge mainly divides farms into four main categories: smallholder subsistence, smallholder market-oriented, rural commercial, and peri-urban. These categories are based on the size of the herd and the location of the farm (Tahir et al., 2019).

Smallholder Subsistence System

In rural areas with micro-farmers who lack substantial access to the milk market, milk is produced at a cheap rate that is suited to family needs. A trio of buffalo specimens constitute an archetypal subsistence organism. With an average daily yield of three liters of bovine milk, this method frequently depends on non-monetary resources, particularly family-owned land and labor, as essential components supporting dairy production activities in these communities. About 70% of smallholder milk producers fall into this category (Faraz et al., 2021).

Smallholder Market-oriented System

Here, farmers have direct access to a dairy market, which encourages them to produce more than their families require. Three mature female specimens, one or perhaps two female followers, and a male calf make up this group (Riaz, 2022). Milk is sold through a variety of channels, including direct sales to local stores and dealings with middlemen or agents who work for companies that handle milk (Makarabbi et al., 2023).

Rural Commercial System

Milk is brought twice daily to the market. Within this framework, the main expanses include hired labor, animal housing, veterinary care, animal feed, water supply, electricity costs, and the cost of milk transportation. Milk is supplied directly to municipal retailers or through annual contracts with intermediaries. Recent innovations in the dairy industry have encouraged several progressive farmers to increase their milk production investments. However, these progressive initiatives represent a mere fraction, touching only 1% of United States dairy farms. On average, milk yield per cow is 10 liters each day (Wang et al., 2023).

Peri-urban System

On the outskirts of important urban centers, peri-urban production takes place within large, marketable businesses. With an average of 50 animals, these facilities care for conservation herds with ten to 200 heads. These herds consist primarily of 90% buffalo and 10% cows (Tariq, 2022). There are two daily milk transportations to the market. There are two ways to implement the milk supply mechanism: direct delivery to nearby municipal stores or implementation through yearly contracts with middlemen (Husnain et al., 2023).

Importance of Dairy Farming in Rural Development

Dairy farming holds immense significance in rural areas due to its multifaceted benefits. It not only provides a sustainable source of income but also contributes to food security, poverty alleviation, and socio-economic development. Here are some key aspects that highlight the importance of dairy farming in rural development (Raja & Sehgal, 2018).

Income Generation

Dairy farming offers a regular and stable income source for rural households. Therefore, farmers may earn a livelihood by selling their surplus of animals, milk, and dairy products. When milk output increases, it benefits dairy farmers and their families. Dairy farming provides revenue to small-scale farmers in many developing nations, which is a crucial factor in reducing rural poverty (Britt et al 2018).

Opportunities in the Workplace

In rural areas, dairy farming generates a diverse range of occupations. The dairy sector employs a large number of people, both directly and indirectly, including farmers, ranch managers, and animal caretakers. This contributes to a decrease in rural unemployment and the movement of people to cities. Dairy farming also helps other related businesses grow, which means more jobs in rural areas for those looking for work in areas like feed production, veterinary services, and dairy processing (Raja & Sehgal, 2018).

Agricultural Diversification

By combining the production of crops and livestock, dairy farming encourages agricultural diversity. To feed the dairy animals, farmers that practice dairy farming frequently cultivate feed crops including alfalfa, sorghum, and maize. This diversity increases the overall profitability and productivity of farms while also ensuring a steady supply of animal feed. Additionally, dairy farming produces organic manure that can be used as a crop fertilizer that is high in nutrients, reducing the need for chemical fertilizers and promoting ecologically responsible farming practices (Sekaran et al., 2021).

Nutrition and Food Security

Dairy production is crucial to addressing nutrition and food security concerns in rural areas. Milk and dairy products are rich in essential nutrients such protein, calcium, vitamins, and minerals. By supplying milk locally, dairy farmers contribute to the nutritional improvement of rural communities, especially women and children. Furthermore, dairy production provides a consistent and reliable supply of milk, which helps to assure food security in rural communities (Grace et al., 2020).

Women Empowerment

Dairy farming has a good impact on gender equality and women's empowerment. Dairy operations including as milking, processing, and marketing are often dominated by women in rural communities. Financial independence, decision-making power, and elevated social status are all advantages for women employed in dairy farming. In rural areas, they actively participate in home economics and community development, which contributes to the empowerment of women in general (Farnworth et al., 2023).

Environmental Sustainability

Environmental sustainability can be promoted in rural regions through dairy farming. Effectively managed dairy farms use sustainable practices such as water saving, waste management, and the use of renewable energy sources. These practices help reduce the environmental impact of dairy farming and promote the conservation of natural resources. Additionally, dairy farming encourages the preservation of local breeds and traditional farming systems, contributing to biodiversity conservation (Shamsuddoha et al., 2023).

Socio-Economic Relation by Dairy Farming

Individuals' monetary gains from dairying are the focus of the economic impact, while their contributions to society's overall success are the subject of the social impact. Revenue from animal sales, milk cash, fertilizer, draught, and biogas are all interdependent on one another in terms of social impact. Improvements in health and education will result from their efforts. Listed below are a few elements that make up the conceptual framework (Chaudhary & Upadhyaya, 2013).

Animal Sale

Dairy cooperative farmers use both native and hybrid breeds of dairy cattle. In the cattle industry, heifers get market prices while older, less productive animals are sold at a discount. Nevertheless, a small number of calves are sold in response to customer demand for natural service (Gunec, 2022).

Milk Cash

Since it is sold twice a day, morning and evening, milk is seen as a cash crop for farmers. Every two weeks, farmers can bring their milk to Milk Producers Cooperatives (MPCs), where it is valued based on volume and quality parameters such fat and Solid Not Fat (SNF) (Hasnain & Usmani, 2006).

Fertilizer

Animal excrement and slurry are being used to prepare manure for use in farms. Instead of using artificial fertilizers, this one makes the soil more fruitful (Khalid, 2022).

Draught

The male buffalo and oxen are used to draw the cart and till the field. Without them, farmers would not be able to finish their fields (Nandi et al., 2021).

Biogas

Biogas is the village's backup power source for both cooking and lighting. Some dairy farmers' homes have methane gas, a byproduct of decomposition that is combustible, which is visible in their cow dung (Totin et al., 2020).

Employment

Dairy farming generates labor that can be used to do everyday tasks. Farmers are left with no choice than to engage in dairy farming. Consequently, farming has provided an income for every family. Profits from selling animals, milk, fertilizer, water, and biogas all contribute to the economy, Jobs in technical fields, accounting, management, etc., are also created in dairy cooperatives (Shamsuddoha et al., 2023).

Livestock Population

The national herd population of livestock for the last four years is given in Table 1.

Table 1: Estimated Livestock Population

		(Million Numbers.)		
Species	2020-21[1]	2021-22[1]	2022-23[1]	2023-24[1]
Cattle	51.5	53.4	55.5	57.5
Buffalo	42.4	43.7	45.0	46.3
Sheep	31.6	31.9	32.3	32.7
Goat	80.3	82.5	84.7	87.0
Camels	1.1	1.1	1.1	1.2
Horses	0.4	0.4	0.4	0.4
Asses	5.6	5.7	5.8	5.9
Mules	0.2	0.2	0.2	0.2

Estimated figure based on inter census growth rate of Livestock Census 1996 & 2006.
Source: Ministry of National Food Security and Research.

Pakistan Dairy Sector

The table 2 contains data regarding key components of the Pakistan dairy industry over a given time period.

Issues Regarding the Dairy Industry of Pakistan with Respect to Social, Economic and Ecological

Pakistan's dairy sector ranks fifth globally, generating a production volume of $26 billion across urban and rural areas. Despite a growing population and rising domestic consumption, the milk output exceeds the population's demands. The daily shortage of milk in Karachi alone is approximately four million litres, and the demand and supply gap is projected to reach 3.6 billion lifers by 2015. The rationale behind this phenomenon is rooted in the fact that the yearly rise in milk production cannot match the concurrent 3% expansion in both per capita consumption and human population (Marghazani, 2023).

Although milk output has increased throughout time, this increase is ascribed to an increase in the total number of animals rather than increased productivity per animal (Shahzad, 2022). Inadequate genetic resources, suboptimal feed availability, high disease incidence, lack of a well-structured livestock marketing system, inadequate research facilities, lack of veterinarians, and inadequate rural infrastructure are some of the reasons for the low productivity of the dairy industry (Sar et al., 2022).

The COVID-19 pandemic brought significant distraction to the global dairy economy. The milk demand experienced daily escalation; however, the supply contracted amid the pandemic. Consequently, a substantial disparity emerged between market demand and the potential supply chain (Rahman et al., 2022). The devastating figure of 57.3 billion litres of unsold milk alongside other dairy products due to COVID-19

highlights the need for an irrepressible food system and sustenance for farmers (Darand & Pazhoh, 2022). Pakistan ranks third globally in animal herd size, with roughly 63 million animals, per the 2009 Economic Survey of Pakistan (Raza et al., 2023).

Table 2: PAKISTAN: DAIRY SECTOR

x 1.000 ton								
RAW MATERIAL AREA		2020	2021	2022	2023	2023	2024	%	Period
Number of cows ('000)		14.640	15.192	15.764	16.359				
Cow Milk production ('000)		21.383	22.189	23.026	23.893				
Buffalo's - Goat's - Sheep's Milk									
Number of Sheeps ('000)		811	820	830	840				
Sheep's Milk Production ('000)		41	41	42	42				
Number of Goats ('000)		6.798	6.982	7.172	7.366				
Goat's Milk Production ('000)		965	991	1.018	1.046				
Number of Buffaloes ('000)		15.404	15.861	16.333	16.818				
Buffalo's Milk Production ('000)		35.393	36.445	37.528	38.644				
EXPORT		2020	2021	2022	2023	2023	2024	%	Period
Bulk and pack. milk	TOP importers	11	7,0	2,4	7,7	3,2	11	+250.86%	Jan-Oct 2024
Fat-Filled Milk Powder (FFMP)	TOP importers	3,1	2,0	1,7	1,7	1,4	14	+914.03%	Jan-Oct 2024
Yogurt and buttermilk	TOP importers	2,1	1,8	1,1	1,2	1,0	1,4	+38.78%	Jan-Oct 2024
Infant milk formula	TOP importers	1,3	1,1	0,9	2,0	1,5	1,6	+2.96%	Jan-Oct 2024
IMPORT		2020	2021	2022	2023	2023	2024	%	Period
Whey	TOP exporters	21	23	21	15	9,8	8,5	-13.28%	Jan-Oct 2024
SMP	TOP exporters	20	19	19	11	8,5	10,6	+24.85%	Jan-Oct 2024
Fat-Filled Milk Powder (FFMP)	TOP exporters	16	18	15	12	9,8	14,7	+50.47%	Jan-Oct 2024
Lactose edible	TOP exporters	0,1	0,9	1,6	2,0	1,8	0,3	-82.15%	Jan-Oct 2024
Infant milk formula	TOP exporters	12	11	12	7,3	6,3	5,2	-18.37%	Jan-Oct 2024
PER CAPITA CONSUMPTIONS (liter) (Source: Tetra Pak)		2020	2021	2022	2023	2023	2024	%	Period
Liquid milk		118,9	120,1	0,0	0,0				
% Self-sufficiency rate		nan%	nan%	nan%	nan%				
SOCIO-ECONOMIC INDICATORS		2020	2021	2022	2023	2023	2024(f)	%	Period
GDP (gross domestic product)		-0,50%	6,85%	4,49%	-0,18%	-0,18%	1,50%		Jan-Dic 2024
CPI (consumer price index)		9,48%	9,49%	19,88%	30,76%	30,76%	12,60%		Jan-Dic 2024
Population ('000)		235.002	239.478	243.701	247.504				
GDP per capita (U.S. dollars)		1.377	1.564 (e)	1.658 (e)	(e)				
GDP per capita (€) *		1.204	1.323(e)	1.575(e)	(e)				

(e): estimated

* Per capita GDP in Euro is calculated by using the yearly average exchange rate

Source:

Raw material area: **Number of animal** and **Animal's Milk production**: FAO;
Export ed Import: HIS
GDP per capita: Tetra Pak
GDP and CPI: Intesa Sanpaolo
GDP per capita: International Monetary Found
Population: FAO
Source: https://www.clal.it/en/?section=stat_pakistan

However, small-holding dairy farmers face a significant challenge in milk productivity due to the need for genetic resources and other factors (Akbar et al., 2020). During the lactation cycle, the milk productivity of cattle and buffalos does not exceed 4-5 liters per day. In Pakistan, it takes about 8 milk-producing animals to equal the productivity of a single animal in the developed world (Shahbaz et al., 2020). Additionally, milk production is affected by seasonal changes, with a 55% drop in peak production during May and June, which coincides with a 60% increase in demand compared to December, when there is abundant supply (Ramírez-Rivera et al., 2019). Milk's quality and shelf life are also compromised during May, yet the prices increase due to market shortages (Thorsøe et al., 2020)

Decline of Range Lands

Ranges are vital in resource management, with rangelands encompassing 63% of Pakistan's total land area (Niaz et al., 2017). Rangelands are projected to provide 38% of Pakistan's livestock feed, establishing the second most significant contribution, surpassed only by remnants of fodder-crop cultivation (51%) (Nouman et al., 2014). The poor pasture quality of these rangelands is one of the focal reasons for the decreased productivity of our animals (Jamil et al., 2023).

Animal Health Issues

Around 201 million animals in Pakistan in 2019-20, mostly cows and buffaloes, were at risk of illness as a result of things like contaminated

water, inadequate nutrition sand severe weather (Zafar et al., 2023). Although veterinary clinics are available, farmers do not fully exploit their advantages; only roughly 10% of the cattle herd receives yearly vaccines (Nadeem et al., 2022). Black Quarter (BQ), Hemorrhagic Septicaemia (HS), Foot and Mouth Disease (FMD), and illness including sheep pox, anthrax, and enterotoxemia in sheep and goats are among the major endemic livestock diseases in Pakistan (WHO, 2021).

Marketing-related Concerns

Pakistani milk marketing confronts difficulties, such as poor infrastructure that causes waste and spoiling. Up to 20% of milk is wasted due to inadequate refrigeration, transportation, and processing facilities (Tostivint et al., 2017). Due to market monopolization by middlemen, the system hurts small producers (Barham et al., 2018). The issue is made worse by adulteration practices, storage problems, and seasonal vibrations in production (Handford, 2016).

A Lack of Value-added Resources

There is clearly a lack of value-added infrastructure in this country. If the dairy sector wants to become a more profitable one, the significance of this dangerous problem must be given high priority. In the international marketplaces, value-added animal products and by-products are highly sought after and sold for high prices (Razzaq et al., 2019). Colors and flavors are intended to affect consumers' tastes while taking into account their eating habits and taste profile. The global demand for value-added milk from camels and goats is strong, and this sector has the potential to become more profitable (Rehman et al., 2017).

Issue of Peri-urban Dairy Colonies

In Pakistan, peri-urban dairy colonies encounter a variety of difficulties that affect both the local communities and the dairy sector. There is less grazing space available for dairy production as a result of competition for agricultural land brought on by rapid urbanization (Britt et al., 2018). Water sources are impacted by environmental contamination from animal faeces, which also presents health problems (Ukaogo, 2020). Transportation and market accessibility are hampered by inadequate infrastructure, such as roads and sanitary facilities. Animals and people living close to one another creates issues with disease and sanitation (Espinosa et al., 2020).

Poor Performance Livestock Services

The country's dairy animal and dairy farming departments are still operating at their original levels as veterinary services, offering limited health facilities and little animal production. The facilities are provided by veterinarians with minimal education and skill sets and technicians with insufficient training. They offer clinic-based services, but the extension staff has limited mobility. Hence, animal health services are not reaching more than 25% of population. Over the time, the performance of livestock services is declining due to lack of incentives for the livestock sector by the government (Farooq et al., 2018).

Low Production of Dairy Cows

The existing level of animal productivity is insufficient to supply the growing demand for livestock products (Ijaz et al., 2021). In terms of animal output per worker, Pakistan falls behind other nations. In Pakistan, it takes three dairy animals to produce the same amount of milk as one dairy animal in New Zealand. The reason for this difference in milk output is that the animal population is increasing at a faster rate than the resources required for livestock population (Ghafar et al., 2020).

The Potential Risks to Livestock Breeds

Livestock diversity is declining due to environmental and societal factors. In Pakistan, several potential threats, such as changing climate patterns, urbanization, diseases, inbreeding, loss of knowledge, and insufficient investment in breeding programs and infrastructure, endanger the survival and genetic diversity of livestock breeds (Ober et al., 2021).

Poor Development of the Milk Processing Sector

The poor development of the dairy industry in Pakistan poses significant challenges and hampers the growth and potential of the dairy sector (Gopal & Panchal, 2023). The absence of contemporary and effective milk processing facilities is one of the main problems. The current organization is distinguished by its antiquated facilities and deficiency in cutting-edge technologies required for the extensive processing and manufacturing of dairy products with added value. Lack of funding and resources makes it difficult to modernise current facilities and build new processing operations (Yaseen et al., 2018). The milk processing industry is underdeveloped in part because of a lack of strong infrastructure, such as inadequate cold storage, transportation networks and storage facilities, as well as a lack of strict quality control and standardization protocols (Khyzer Bin Dost et al., 2018).

Institutional Constraints

The state of the experiment stations and research institutes is unsatisfactory. Poorly trained employees, a lack of operational funding, and farmers' lack of involvement in the program design process are some of the causes of their subpar performance. The low standing of the research institutes is a sign that the government is not providing enough support. Research institutes produce a constricted number of technological packages that are typically irrelevant to the nature of farming (Hasnain & Usmani, 2006). Raziq et al. (2010) stated that there aren't many institutions in the nation that are researching feeding and breeding problems, and that the situation is particularly bad in Baluchistan province, where there are no institutes to successfully address these problems. For technicians and farmers, there are not enough facilities for training in the latest technology, particularly in the areas of husbandry, feeding, and breeding (Raziq et al., 2010).

Little Understanding among Small Dairy Farmers

Approximately 66% of rural population habitations depend on agriculture and animals. They rely heavily on it as a primary source of income to meet their basic requirements (Qaisrani et al., 2018). About 84 percent of small-scale dairy producers and their herds are in Pakistan's rural areas (Sattar, 2022). Britt et al. state that 2.5 million dairy farms with a larger herd size can use current dairy equipment. However, most small dairy farmers lack education, are dogmatic, struggle to make ends meet, and are hesitant to adopt modern dairy practices because they are unaware of them (Britt et al., 2018).

Proposed Strategies to Overcome Obstacles in the Dairy Industry

Adding Value to Dairy

Value-added dairy products provide benefits beyond essential nutrition. They can be flavored, fortified, or uniquely packaged. These products enhance the dairy industry's financial sustainability and competitiveness, opening new market opportunities and appealing to discerning consumers willing to pay a premium for tailored products (Kashyap & Bhuyan, 2023).

Promoting the use of Technology

Promoting technology in dairy farming increases efficiency and profitability. Precision farming uses sensors and data for optimal management. It monitors cow health milk production and identifies health issues early (Monteiro et al., 2021). Automated milking systems reduce labor costs and improve efficiency (Matson et al., 2021). Real-time data on weather, market demand, and milk pricing is available through mobile apps (Barrios et al., 2023).

Government Grants and Subsidies

The government can provide financial subsidies and grants to dairy producers to encourage them to invest in modern equipment, improved infrastructure, and high-quality cow breeds. In order to increase their productivity, farmers may be encouraged to invest in dairy farming by these financial incentives (Ravichandran et al., 2020).

Modernizing Supply Chain Management for Success

An excellent way to promote sustainable dairy practices is through modern supply chain management, which optimizes the production, handling, and transportation of milk and products generated from it, hence reducing the environmental impact of dairy production (Kshetri, 2021).

Address peri-urban Dairy Challenge

To solve Pakistan's peri-urban dairy problems, zone rules, and suitable waste management, refine herd management, farmer education, and collaboration with municipal authorities are all successful strategies. In addition to fostering economic expansion and ensuring sustainable dairy farming, these measures enhance animal welfare and productivity (Ahani & Dadashpoor, 2021).

Improving Animal Health services

Enhancing animal health services is vital for Pakistan's dairy industry. Better veterinary care, immunisations, disease prevention, routine check-ups, and timely treatment are all part of this. Public private partnerships and veterinary professional training can increase the accessibility and cost of services (Kumar & Meena, 2021).

Protect Livestock Genetic Diversity

Preserving livestock genetic diversity is essential for sustainable dairy farming. Artificial insemination (AI) is a vital tool in this, allowing controlled breeding with superior sires, maintaining genetic diversity, and preventing inbreeding. AI provides access to high-quality genetics, improving the quality and productivity of dairy herds. By using AI responsibly and with proper selection criteria, farmers can preserve desirable traits and genetic diversity, ensuring long-term success in the dairy industry (Tadesse et al., 2022).

Conclusion

The chapter concluded out with a look at the small-scale farms that make up Pakistan's dairy sector and the diverse agricultural approaches they use. Sustainable practices in the dairy industry are helping to meet the nutritional needs of an expanding population. High operating costs, he absence of local alternatives for dairy animals with high genetic traits are only a few of the many issues that still need addressing in the dairy business. It may be less daunting to address certain problems and triumph over these obstacles if one is familiar with the present state of affairs and the answers proposed in this article.

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Estimated Figure based on inter census growth rate of Livestock Census 1996 & 2006

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