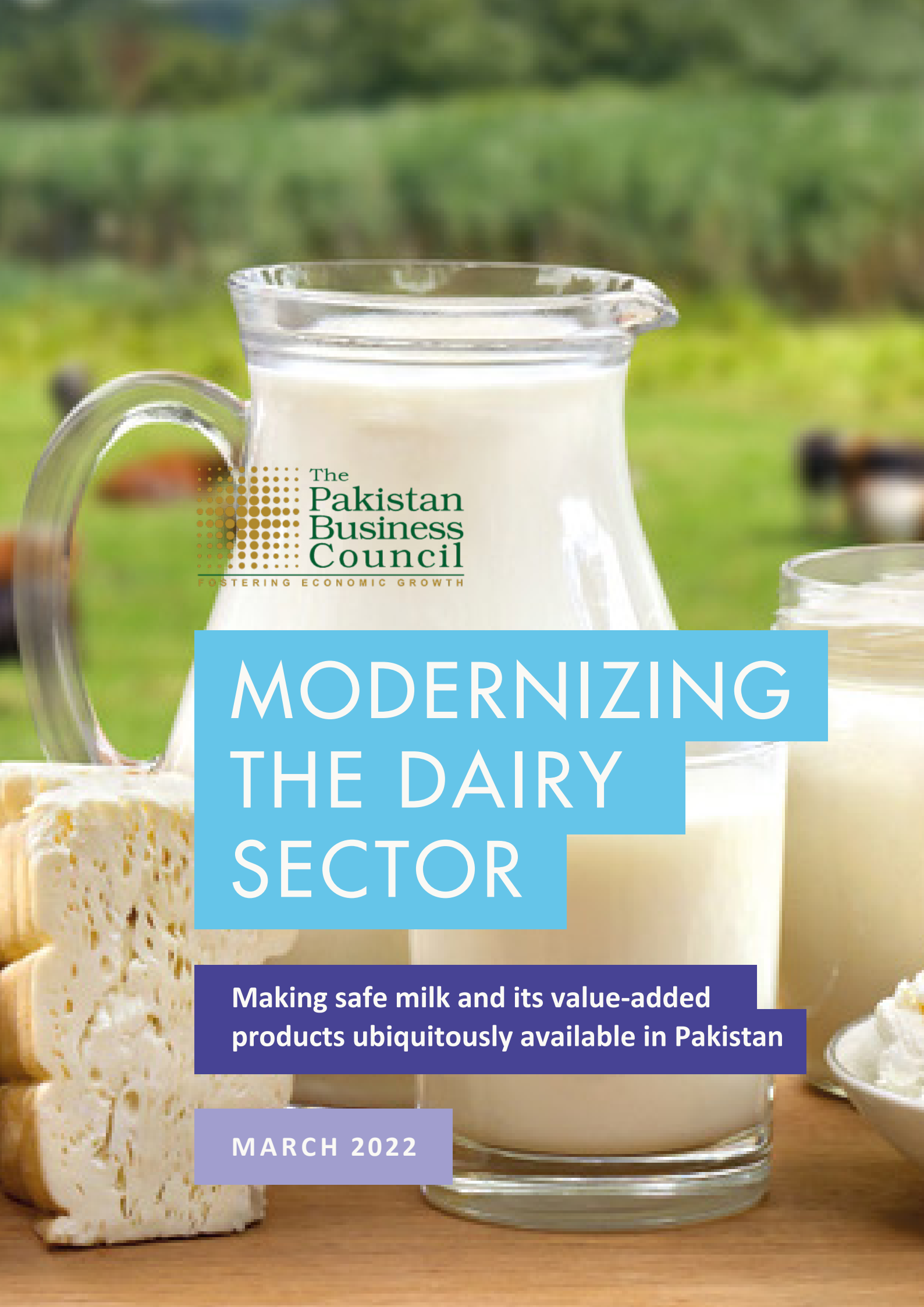

The Pakistan Business Council
FOSTERING ECONOMIC GROWTH

# MODERNIZING THE DAIRY SECTOR

**Making safe milk and its value-added products ubiquitously available in Pakistan**

MARCH 2022

# MODERNIZING THE DAIRY SECTOR

**Making safe milk and its value-added products ubiquitously available in Pakistan**

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# The Pakistan Business Council: An Overview

The Pakistan Business Council (PBC) is a business policy advocacy platform, established in 2005 by 14 (now 87) of Pakistan's largest private-sector businesses and conglomerates, including multinationals. PBC businesses cover nearly all sectors of the formal economy. It is a professionally-run organization headed by a full-time chief executive officer.

The PBC is a not-for-profit entity, registered under Section 42 of the Companies Ordinance 1984. The PBC is a pan-industry advocacy group. It is not a trade body nor does it advocate for any specific business sector. Rather, its key advocacy thrust is on easing barriers to allow Pakistani businesses to compete in regional and global arenas. The PBC conducts research and holds conferences and seminars to facilitate the flow of relevant information to all stakeholders in order to help create an informed view on the major issues faced by Pakistan.

The PBC works closely with relevant government departments, ministries, regulators and institutions, as well as other stakeholders including professional bodies, to develop consensus on major issues which impact the conduct of business in and from Pakistan. The PBC has submitted key position papers and recommendations to the government on legislation and other government policies affecting businesses. It also serves on various taskforces and committees of the Government of Pakistan as well as those of the State Bank, the SECP and other regulators with the objective to provide policy assistance on new initiatives and reforms.

# The PBC's Founding Objectives

The major objectives of the PBC as stated in its founding documents are:

- To provide for the formation and exchange of views on any question connected with the conduct of business in and from Pakistan.
- To conduct, organize, set up, administer and manage campaigns, surveys, focus groups, workshops, seminars and field works for carrying out research and raising awareness in regard to matters affecting businesses in Pakistan.
- To acquire, collect, compile, analyze, publish and provide statistics, data analysis and other information relating to businesses of any kind, nature or description and on opportunities for such businesses within and outside Pakistan.
- To promote and facilitate the integration of businesses in Pakistan into the World economy and to encourage in the development and growth of Pakistani multinationals.
- To interact with governments in the economic development of Pakistan and to facilitate, foster and further the economic, social and human resource development of Pakistan.

The PBC is a Section 42 not-for-profit Company Limited by Guarantee. Its working is overseen by a Board of Directors. More information on the PBC, its members, and its workings, can be found on its website: www.pbc.org.pk

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# List of Acronyms

| | |
|---|---|
| AI | Artificial Insemination |
| CAGR | Compounded Annual Growth Rate |
| CDC | Center for Disease Control |
| DRAP | Drug Regulatory Authority of Pakistan |
| EU | European Union |
| FDA | Food and Drug Administration |
| FMD | Foot-and-Mouth Disease |
| FSSAI | Food Safety and Standards Authority of India |
| FTA | Free Trade Agreement |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GST | General Sales Tax |
| HACCP | Hazard Analysis and Critical Control Point |
| HS | Hemorrhagic Septicemia |
| MCC | Milk Collection Center |
| MPG | Milk Producer Groups |
| MPI | Ministry of Primary Industries |
| NAIP | Nationwide Artificial Insemination Program |
| NDDB | National Dairy Development Board |
| NRM | Natural Resource Management |
| PARC | Pakistan Agriculture Research Council |
| PDDC | Pakistan Dairy Development Company |
| PFA | Punjab Food Authority |
| PSQCA | Pakistan Standards and Quality Control Authority |
| RCS | Regulated Control Scheme |
| RMC | Regional Milk Collection Center |
| SMP | Skimmed Milk Powder |
| TQM | Total Quality Management |
| UHT | Ultra-High Temperature |
| USA | United States of America |
| VAT | Value-Added Tax |
| VMC | Village Milk Collection Center |
| WMP | Whole Milk Powder |

# Foreword

This study entitled **'Modernizing the Dairy Sector: Making safe milk and its value-added products ubiquitously available in Pakistan'** has been completed by The Pakistan Business Council (PBC) as part of its **"Make-in-Pakistan"** initiative.

Developing the dairy sector is important not just because Pakistan is an agricultural economy with a substantial reliance on livestock (60 percent contribution to the agriculture sector) as an income source, but also to ensure that the people of Pakistan are well-nourished. While the dairy industry in Pakistan has progressed with the introduction of UHT milk in packaged form, there is room to increase the percentage of processed milk sold for health safety reasons, while also increasing the volume of milk produced for making value added products as well as to avoid seasonal shortages of milk. In the medium term, there is additionally the potential to serve the dairy deficient regional markets: China and the Middle East.

What is required is to improve the yield and eventually milk production in the country, formalize the supply chain by enacting provincial pasteurization laws, develop artificial insemination infrastructure and vaccination services and improve price competitiveness of processed dairy products as compared to unpackaged ones.

Investing in the dairy sector promises significant socio-economic benefits to small farmers. Livestock owners in Pakistan predominantly have small landholdings, and livestock provides a viable source of income to them. Furthermore, developing a modern dairy sector will give consumers access to safe and nutritious milk and other dairy products. This is important to combat the prevalent undernutrition. From an environmental impact perspective, livestock is an emitter of methane gas which is a greenhouse gas. By improving farming practices, there will be positive impact on reducing greenhouse gases.

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papers and recommendations to the government on legislation and other government policies affecting business. It also serves on various taskforces and committees of the Government of Pakistan as well as those of the State Bank, SECP and other regulators with the objective to provide policy assistance on new initiatives and reforms.

This sector report is intended to inform Pakistan's overall industrialization policy.

**Ehsan A. Malik**
**CEO, The Pakistan Business Council**

# Executive Summary

The development of the dairy sector is important for the growth of Pakistan's agricultural economy, which includes a significant contribution of 60 percent by the livestock sector.[1] With just five percent of the total milk stock being currently processed, there is an opportunity to increase the availability of locally made dairy products. Measures can be taken to increase the volume of milk being channeled through the formal supply-chain. There is potential to increase volume by improving productivity of animals, hence increasing overall milk production; curtailing wastage and adulteration; improving the cold-chain; and converting fresh milk to powder form for augmented shelf-life. The availability of powdered milk also helps alleviate seasonal milk shortages particularly in the summer months. By encouraging the formal dairy sector to process more milk into value-added products, consumers in Pakistan will have safe and nutritious milk and dairy products available for better nourishment. The formal dairy sector is also better positioned to reduce the environmental impact of dairy farming which is gaining considerable attention, especially in Europe, because methane produced by livestock is now regarded as a significant contributor to climate change. This report discusses the potential and provides policy recommendations to modernize the dairy sector of Pakistan.

Pakistan faces shortage of milk due to the seasonal fluctuation in demand and supply which emanates from high demand and low production during the summer months. At present, the demand-supply gap is covered by informal market players adulterating milk to increase volume and by the import of milk powder by the dairy companies. The seasonal shortage of milk can be reduced by adopting dairy farming practices such as storing silage for use during summers and installing cooling systems for dairy animals to reduce heat stress.

The milk yield of Pakistan's local breeds is about four times lower than that of the high-yielding international breeds. Dairy farmers can either import high-yielding breeds or genetically improve the local breeds through the process of artificial insemination. In Pakistan, this technology is not commonly used due to the lack of animal traceability, unavailability of quality male animal germplasm and lack of awareness. The productivity of dairy animals is also affected by limited access to vaccines and veterinary extension services. Government initiatives to improve milk yield have been ineffective, primarily due to the limited scale of programs implemented so far.

A small percentage of the total milk produced reaches the processing units for conversion into packaged milk and value-added dairy products. Of the total milk produced, about half reaches the market and is tradable, while the other half is consumed at source by farmers. Approximately, only four percent of total milk produced (eight percent of the tradable milk) is processed into pasteurized and UHT treated milk and another one percent is used in the production of other value-added dairy products. Around 15 percent of the total milk produced, estimated at current market price of PKR 1 trillion[2], is wasted in Pakistan due to improper storage and handling. On the other hand, in Holland, just one percent of the total milk produced is wasted, 85 percent is collected by the dairy processors directly from the farm for processing and the remaining 14 percent is processed into cheese at the farm under the audit of the

[1] Ministry of Finance. Economic Survey of Pakistan 2020-21 Agriculture
[2] Estimation based on milk production of 63,684,000 tonnes, wastage of 15 percent (Economic survey 2020-21) and market price of PKR 110 per liter of loose milk.

government[3]. These numbers indicate that wastages are low where most of the milk is processed. This is further validated by the fact that, in Pakistan, the entire quantity of milk that is collected by the dairy processing companies is processed into value-added products with no wastage. This is because the dairy processing companies have a cold chain infrastructure in place which ensures that milk is properly stored and transported to preserve quality. Therefore, in order to reduce wastage of milk in Pakistan, it is important to encourage dairy processing by implementing and enforcing pasteurization laws by provinces for preservation of milk, and developing the cold chain infrastructure.

Dairy products produced by Pakistan are uncompetitive as compared to those produced in other regional countries. The dairy sector can learn from Turkey and India to improve productivity, farm-level agglomeration, increasing the average herd size, reducing the cost of fodder and encouraging the use of technology. This will help in achieving economies of scale at the farm level and lower farm gate prices of milk, making Pakistan's dairy sector price competitive.

While increasing the production of milk is necessary, its environmental impact requires attention. Dairy farms produce greenhouse gases which adversely impact the environment. However, emissions could be reduced by adopting certain livestock management practices including, grazing animals on pasture, improving manure and land management, efficient irrigation systems and tailored diet for the animals. Improving the production efficiency of dairy animals also results in lower GHG emissions. With the milk yield increasing from 6,000 to 10,000 kilogram per cow, the GHG emissions reduce by about 16 percent. The government in collaboration with the private sector, especially the multi-national companies engaged in milk processing, packing and marketing, can create awareness regarding the environmental impact of dairy activities and encourage the sector to adopt sustainable measures.

The federal and provincial governments need to formulate a long-term dairy plan to be consistently implemented over time. Sectoral growth strategies applied by Turkey and India provide good guidance for increasing dairy production. With appropriate policy measures focusing on improving animal productivity, formalization of the sector and increasing price competitiveness, Pakistan can ensure sufficient production of milk and value-added dairy products. The key policy recommendations are summarized below (detailed policy recommendations are provided in Section 11).

- **Conduct a national livestock census** once every five years in order to formulate, implement and scale growth strategies that are more effective than those based on estimated data.

- **Restrict export of animal feed** and its components, including maize and encourage its utilization to make a balanced diet for animals in order to improve milk yield.

- **Ease import of animal vaccines** by minimizing documentation and time delays in completion of import procedures.

- **Increase import duty on milk powder** and encourage dairy processing companies to produce it locally during the period of milk shortage. The imposition of import duties may be kept conditional on Pakistan first producing enough milk powder to sustain consumption in the summer months.

[3] Friesland Campina, Holland

- **Ensure the implementation of the pasteurization law in Pakistan** by establishing pasteurization infrastructure at milk sourcing points in the rural areas to encourage dairy processing and reduce wastage of milk in Pakistan.

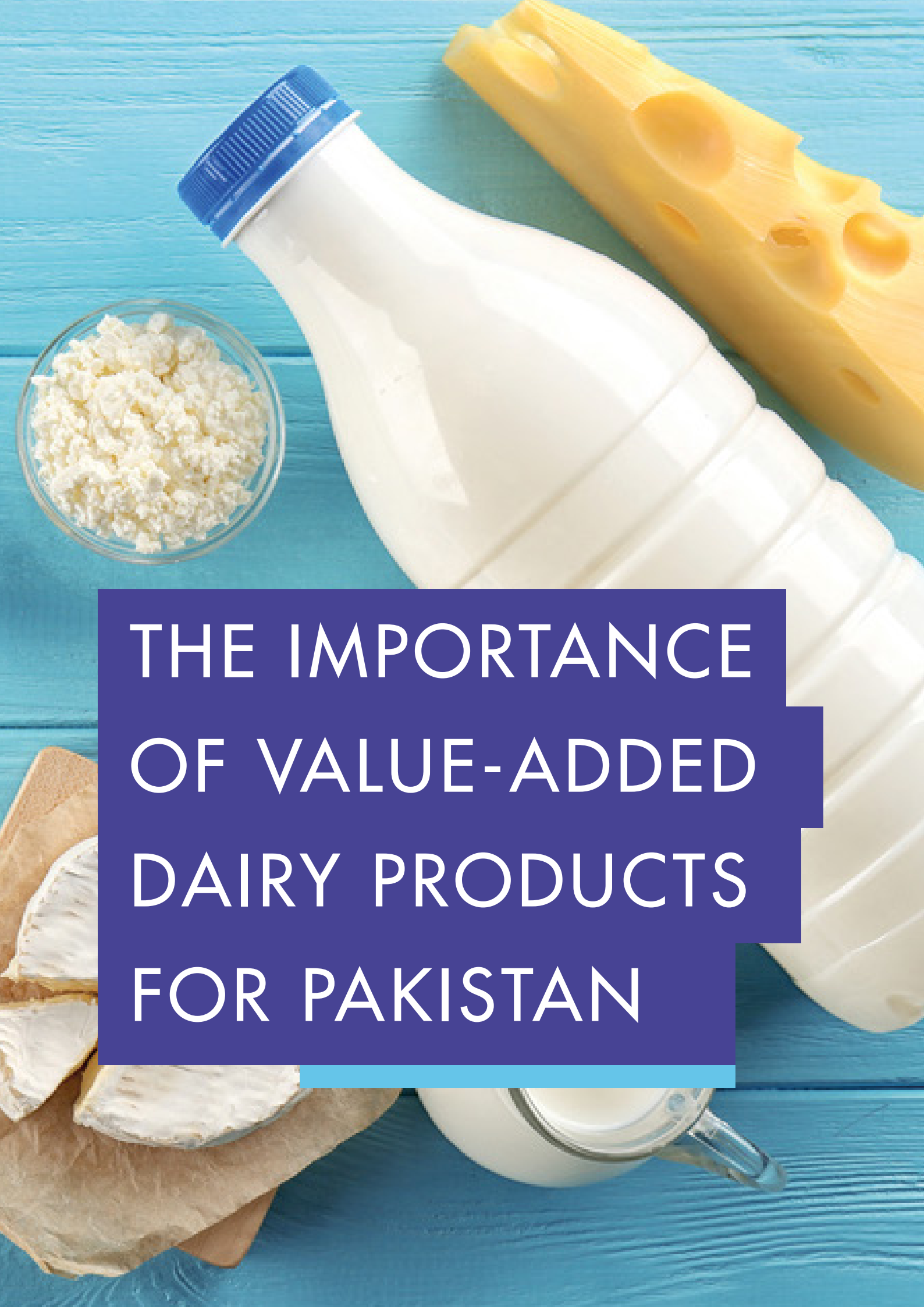
- **Roll-out a nation-wide FMD vaccination drive** to improve animal productivity and milk production in Pakistan. The federal government, in coordination with the federating units, needs to ensure adequate availability and effective administration of animal vaccines across the country.

- **Encourage consumption of pasteurized and UHT treated milk** by carrying out awareness campaigns among the general public regarding the harmful effects of raw adulterated milk and health benefits of pasteurized and UHT treated milk. To make this happen, consistent efforts are required by the federal and provincial governments to run such awareness campaigns through various mediums.

- **Create awareness regarding the environmental impact of the dairy sector** to reduce GHG emissions that contribute to climate change. The provincial governments can create awareness regarding the environmental impact of dairy activities and encourage the sector to adopt mitigating measures. The provincial livestock departments' advisory wing should run the awareness campaigns across the provinces through various mediums.

- **Provide subsidized financing** to small and medium sized farms to import high-yielding dairy breeds and for capital investments to set up large farms. Larger farm size will generate economies of scale for dairy farms. This will attract farm level investments in the sector and eventually increase milk production.

- **Formulate a National Dairy Plan** under the overarching policy contours that are mentioned above in order to support their implementation across provinces. The plan should be implemented in phases over a period of 20 years. The phases should consist of a series of initiatives such as: improved breeding programs and access to silage, control on sale of adulterated milk, establishment of milk collection centers and access to working capital financing. The proposed dairy plan should be formulated by the Federal Government in collaboration with the provincial governments and implemented by the provincial governments. The implementation of this plan will require consistent commitment by the present and future governments.



# THE IMPORTANCE OF VALUE-ADDED DAIRY PRODUCTS FOR PAKISTAN

# 1. The Importance of Value-Added Dairy Products for Pakistan

Milk is the second most consumed liquid after water in Pakistan - which underscores the importance of having safe and reliable access to milk throughout the year. There is a perennial shortage of milk due to seasonal fluctuation in the demand and supply of milk in Pakistan. For reducing the seasonal effects on the availability of milk, it is important that the milk is processed, stored and supplied throughout the year. Effects of seasonality emanate from high demand of milk and other dairy products in the summer months, while milk production reduces during this period. On the other hand, demand for milk reduces in winters when production normalizes. This variability creates a shortage of milk during summer months and excess production during winters. Fresh milk is perishable unless it is processed and stored. There are a range of treatments that add value to milk and create a wide range of value-added dairy products. [4] Untreated milk[5] contains toxins and bacteria which spoils the milk in a short span of time. Most advanced countries prohibit the use of untreated milk as pasteurization impedes bacterial growth in milk and makes it safe for human consumption. Processed and packaged milk helps overcome the challenges of seasonal demand and supply. It provides milk a shelf life of up to six months and helps overcome the demand-supply gap.

Pakistan reportedly has one of the largest cattle herds in the world, but despite official numbers of milk production there is a shortage of available milk in the country. The demand-supply gap during the summer months is narrowed through the sale of adulterated milk which is harmful for human consumption and needs to be eliminated. One of the most efficient method of overcoming this problem is to utilize Whole Milk Powder (WMP) or Skimmed Milk Powder (SMP) to safely reconstitute milk in order to overcome seasonal shortages and therefore, sale of adulterated milk. WMP and SMP are globally considered safe for human consumption as ingredients for milk and suitable for transportation and storage over long period of time. In many countries, WMP and SMP are the only viable source of milk since these countries can't sustain large cattle herds due to climatic and geographical limitations.

Increasing milk processing is important for Pakistan since it provides a consistent supply of value-added dairy products. In Pakistan's context, packaged milk[6] is considered a value-added dairy product since only a small percentage of the milk produced in the country is converted into packaged form. On account of its collection, processing, packaging, marketing and distribution costs, packaged milk is unable to compete with raw unprocessed and unpackaged milk on price, even if it is of more consistent quality, with a longer shelf life. This is because the consumer is price sensitive which makes it difficult for the dairy processing companies to compete with raw, unprocessed milk, which is comparatively cheaper. The problem is aggravated by many local retailers selling raw, unprocessed milk which is contaminated. It lowers costs for the local retailers and makes it difficult for the dairy processing companies to compete on price. Adulterated milk cannot be used to make value-added dairy products such as butter, cheese, whey, yoghurt, ice cream, etc. Better milk production and processing will lower the import bill for value-added dairy

[4] Value added dairy products include: Pasteurized and UHT treated milk (packaged milk), cheese, yogurt, milk powder (whole and skimmed), butter, ice creams and whey.
[5] Raw milk that is not pasteurized or UHT treated.
[6] Pasteurized and UHT treated milk

products such as milk powders and cheese, while creating a range of jobs in the country.

Processed liquid milk and milk powder are two value added dairy products that help overcome two fundamental issues of the dairy sector in Pakistan, a) seasonality of milk supply and b) sale and consumption of adulterated milk.

# SEASONALITY IN DEMAND AND SUPPLY OF MILK

# 2. Seasonality in Demand and Supply of Milk

Seasonality of milk demand and supply creates both shortage and over-supply of milk, neither of which are ideal for the industry. Documenting and addressing these gaps are important guides in recommending solutions to the issue of seasonality.

## 2.1 Seasonality in Demand for Milk

Consumption of milk in Pakistan increases in summer months. This surge in demand for milk is due to higher demand of dairy products and cold desserts including: frozen dairy desserts such as ice cream and kulfi, and drinks such as lassi and almond mixed milk. Moreover, tea constitutes the baseline for milk consumption in Pakistan, which remains consistent throughout the year. Approximately, 70 percent of tradable milk produced in Pakistan is used in tea making.[7] The demand for value-added dairy products is increasing and is expected to continue to increase in the foreseeable future[8] due to a rising population, increasing incomes and changes in consumer preferences towards dairy products[9] .This will put further pressure on the demand of milk, especially during the summer months.

The seasonal shortage of milk in the summer months needs to be addressed as it is one of the major challenges faced by the dairy sector in Pakistan. Demand being greater than supply gives producers, processors and investors opportunities to expand production, processing and investments in the sector.

## 2.2 Seasonality in Supply of Milk

The supply of milk in Pakistan fluctuates between seasons, with the lowest production during the summer months. Between the months of January to March, milk production reaches the maximum level when the imported cattle[10] breeds at corporate dairy farms produce 32-33 liters per day, whereas production is lowest at 26-27 liters in the months of May to September. There is a 20 percent reduction in milk production during the summer months. Approximately, 70 percent of the total milk is produced during the seven months of the year between October-April, whereas 30 percent is produced in the other five months.[11]

Milk production depends on many factors, including the breeding cycle of dairy animals, availability of green fodder and the impact of weather. Lactating animals produce more milk after calving which is usually during four months after January or August. Availability of green fodder is at the lowest during summer months and heat stress during summers have an adverse impact on milk yield of the dairy animal, resulting in overall low milk production.

[7] Tetra Pak interview
[8] Population growth rate: 2%
[9] LUMS. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry.
[10] Group of cows
[11] Industry estimate

### 2.2.1 Limited availability of Green Fodder

Animal feed is the primary determinant of animal productivity and milk production, and therefore is a fundamental component of input cost of dairy farming. Approximate share of feed cost in the total cost of dairy farming is 60 percent for cattle and 80 percent for buffalo.[12] Box 1 below discusses feed sources in Pakistan.

#### Box 1 – Feed Sources

Green fodder is cultivated on 6.1 million acres (2.4 million hectares) in Pakistan, which is only 9% of total cropped area of 67.9 million acres (27.4 million hectares). The land cultivated for green fodder is insufficient to feed dairy animals which leads to poor animal health and low milk yield. Corporate dairy farms use a combination of green fodder and silage as feed to ensure high milk yield. Silage is also used when there is a shortage of green fodder.

The sources of feed for dairy animals includes green fodder, silage, concentrates and other substitutes. On average, to produce 1 liter of milk every day, dairy animals require 5 kilograms of fodder.

**Green Fodder:** Green fodder has a reduced supply for roughly five months of the year, between June to July and October to December.

**Silage:** Silage is used as feed during the period when green fodder is not available. Corporate dairy farms store and preserve silage to be used during summer months. Most of the small dairy farmers are unaware of techniques relating to production and storage of silage.

**Concentrates:** Concentrated feed formula is locally called wanda. Concentrated formula needs to be a part of an animal's diet to ensure high milk yield.

**Other substitutes to green fodder:** Other substitutes include by-products of wheat and sugar-cane. Cultivation of soya bean as feed is gaining popularity in Pakistan but it would take quite a while for dairy farmers to adopt soya bean as animal feed.

Source: Fodder Research Program, NARC

[12] Nishat Dairy Farm

Feeding practices for small and corporate farms differ substantially which have an impact on milk yield and quality. Small farmers mostly provide fodder, crop residues or leave their animals for grazing on rangelands. Some farmers grow fodder at their farms, others purchase it daily from the market. Most small farmers don't have access to high quality and balanced nutritious diet for their animals, that is silage or concentrates. High-quality feed input which is used as silage in Pakistan includes: cotton seed cake, wheat bran, maize cake, and soybean. Some farmers are not aware of the benefits of providing silage and concentrated diet to their animals for higher yield, while many cannot afford comparatively expensive silage. This lowers milk quality and yield.

Table 1 highlights that around half of the existing livestock consumes fodder and crop residue as feed input and about 40 percent uses grazing land.

| Source | Contribution (%) |
|---|---|
| Fodder and crop residues | 51 |
| Forage/grazing | 38 |
| Cereal by-products | 6 |
| Post-harvest grazing | 3 |
| Oilcakes, meals, animal protein | 2 |

Table 1 - Contribution of Different Sources of Feed as Feed Input in Pakistan

Source: Fodder Research Program, NARC

Corporate dairy farms which are either medium or large sized, use green fodder crops, wheat straw, and concentrate feeds or silage as feed for the dairy animals. Since, corporate farms have either imported or crossbred cattle, it is feasible for them to provide good quality balanced diet to the dairy animals in order to maintain high yields.

For dairy farmers, sufficient green fodder is available during January to May and August to September, that is seven months during the year. Fodder shortage occurs during the remaining five months of the year. Fluctuations in supply of green fodder is depicted in Figure 1 below.

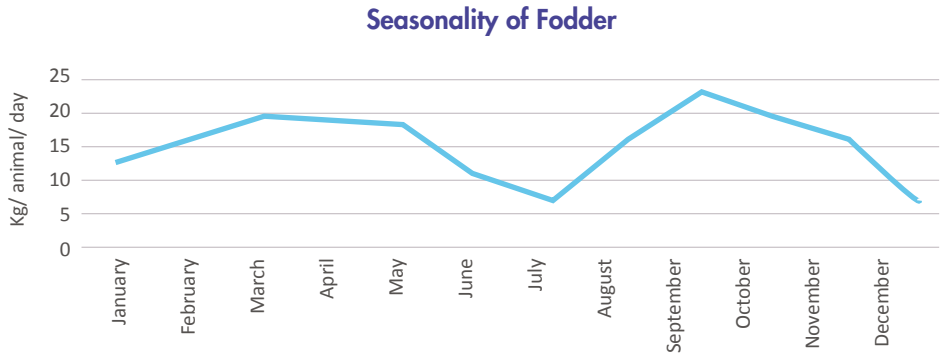



Figure 1 – Seasonality of Fodder
Source: NARC. Fodder Research Program

During this time, most small dairy farmers face issues of fodder shortage which lowers milk yield of dairy animals. Corporate dairy farms procure inputs for silage during flush season, which is used for production, preservation and storage for use during months of shortage. This method results in consistent supply of feed to dairy animals and resultantly limits the impact of unavailability of green fodder on milk yield. Small dairy farmers do not have awareness and resources to produce and store silage for use during lean periods.

Although, silage can ensure consistent supply of fodder to the dairy animals during the period of shortage of green fodder, its consumption can result in the presence of aflatoxin in the milk. Aflatoxin is a mycotoxin produced primarily by the fungus or mold as a result of spoilage. Aflatoxin is considered toxic and serious consideration needs to be given to control the amount of aflatoxin in animal feed.

In addition to seasonal shortages, fodder prices have also increased considerably in the last few years. Prices of concentrate feed (locally known as wanda) have more than doubled in the last three years from PKR 1,100 to PKR 2,400 per kilogram.[13] Since, five kilograms of fodder is required to produce one liter of milk,[14] a higher input cost significantly reduces margins for farmers if the selling price of milk does not increase. Moreover, due to an increase in exports of maize and wheat husk, there has been an increase in their prices as well. The cost push effect eventually increases milk prices and lowers its demand.

Export policies of the government should not be at the expense of domestic supply of feed which hinders productivity of the dairy sector. Export of basic feed items results in a significant increase in domestic prices of feed inputs which have a multiplier effect on the final selling price of milk. It has a damaging impact on the entire dairy value chain. Government should discourage exports of basic feed inputs for cattle and buffaloes. Considering the existing shortage and high prices of animal feed, it is important to promote local high protein source feeds like soybean, alfalfa, canola among others and discourage export of existing feed inputs. At the same time, duty rates on input feed such as canola should be reduced. Poor feed intake due to unavailability of feed sources as a result of shortage of green fodder and/or increase in prices of feed inputs can adversely affect the lactation cycle of dairy animals and reduce milk yield.

[13] Buffalo Breeders Association
[14] Sindh Livestock Department.

### 2.2.2 Lactation Cycle

The lactation cycle of dairy animals is also a factor which impacts milk production. Milk yield varies during the lactation cycle of a dairy animal. Poor feed intake can shorten the lactation period and increase calving intervals. The calving season for local cattle breeds such as Sahiwal is January – February and for buffaloes and crossbred cattle, it is August – September.[15] The lactation cycle begins soon after female cows/buffaloes give birth. Milk yield is the highest during the first four months after calving. After that, milk yield starts to decline.

During the initial months following the birth of the calf when the yield is high, cattle have higher dietary requirements.[16] Ensuring sufficient supply of nutritious feed for buffaloes and crossbred cattle is critical to maintain high yield since peak production months coincide with the period when there is a shortage of green fodder (refer to Figure 1 on fodder seasonality). Some dairy farmers utilize concentrates and silage for animal nutrition during the period in which green fodder is not available. Most small dairy farmers are unable to provide good quality and sufficient feed during the fodder shortage period, and this adversely affects milk yield and production.

Poor and insufficient intake of feed post-calving reduces peak yield.[17] A high peak yield results in high overall yield, throughout the lactation cycle. Studies indicate that for one-kilogram increase in peak yield, an additional 100 to 200 kilograms of milk can be produced during the lactation period. However, a high peak yield requires a well-balanced feeding program.[18]

### 2.2.3 Heat Stress

Dairy animals in Pakistan, are prone to heat stress during the summer months which results in reduced milk yield. Heat stress is caused by high environmental temperatures, leading to a rise in body temperature of dairy animals.[19] Temperatures above 35  C causes heat stress in lactating dairy cows. High yielding cattle are more prone to heat stress and this lowers their milk output.[20]

Heat stress causes dairy animals to adapt themselves to climatic conditions. As a biological response, animals reduce their feed intake to reduce their body temperature and cool themselves. Lower feed and nutrients for dairy animals also reduces milk synthesis process and reduces milk yield. In addition, heat stress also causes nutrient imbalances, disturbances in enzymatic activities, blood metabolites, hormonal secretions, and lowers natural immunity thereby, increasing animal susceptibility to disease.[21]

Corporate dairy farms in Pakistan invest in cooling infrastructure for the dairy animals. The animals are kept in sheds which are cooled by using fans. The dairy animals are also regularly showered so

[15] Hassan.F. et.al. (2007). Seasonality of calving in Nili-Ravi buffaloes, pure-bred Sahiwal and cross-bred cattle in Pakistan. Italian Journal of Animal Sciences, 6(2)
[16] The Cattle Site. Managing Cow Lactation Cycles. URL: https://www.thecattlesite.com/articles/4248/managing-cow-lactation-cycles/
[17] The Cattle Site. Managing Cow Lactation Cycles. URL: https://www.thecattlesite.com/articles/4248/managing-cow-lactation-cycles/
[18] Milk Production. Cow Comfort Article Series. Milking. URL: http://www.milkproduction.com/Library/Scientific-articles/Housing/Cow-comfort-15/
[19] Akbar, M. Shafiq, M. Yaqoob, M.F. Iqbal, K. Ishaq, M. Kamran, S. Shamas, A. Sikander and M. Hashim. 2021. Heat stress and its management in dairy cattle: Current scenario in South Asia. Pakistan Journal of Agricultural Research, 34(2): 407-413.
[20] Angel SP, Amitha JP, Rashamol VP, Vandana GD, Savitha ST, Afsal A, Bagath M, Krishnan G, Sejian V (2018) Climate Change and Cattle Production: Impact and Adaptation. Journal of Veterinary Medicine and Research 5:1134.
[21] Akbar, M. Shafiq, M. Yaqoob, M.F. Iqbal, K. Ishaq, M. Kamran, S. Shamas, A. Sikander and M. Hashim. 2021. Heat stress and its management in dairy cattle: Current scenario in South Asia. Pakistan Journal of Agricultural Research, 34(2): 407-413.

that the heat stress is reduced. Dairy farmers, who are unable to provide cooling systems for their dairy animals, take their animals, especially buffaloes, to nearby water streams during the day-time to cool the animals. However, most farmers are deprived of water resources resulting in low milk yield of their animals.

## 2.3 Narrowing the Demand – Supply Gap

The demand – supply gap can be narrowed by domestically producing more milk powder in the flush season and reconstituting it during the lean milk production months to meet high demand. In addition, adopting professional herd management and better feeding practices can also assist in overcoming this challenge.

Dairy processors address the milk demand supply gap by importing SMP and reconstituting it to produce packaged milk by adding water to meet the demand for milk during the summer months. This practice is followed to produce approximately 60 percent of the total packaged milk sold during the summer months, the balance of 40 percent is met through liquid milk procured from the dairy farms. Furthermore, import of SMP by Pakistan increases when the international prices of SMP decreases, as depicted in Annexure.

Utilizing milk powder is a good option to address supply issues in the near future. Powdered milk has a longer shelf life, requires less storage space, and lower transportation costs, which results in cost efficiencies and convenience. Raw milk is spray dried to produce milk powder in which the nutrients remain the same as in liquid milk however, they are concentrated in powdered form.[22]

Milk powder also provides options for companies to create value added variants of milk by changing the nutrient values during reconstitution. Powdered milk is quite similar to liquid milk in taste[23] and it contains several nutrients, such as, vitamin B12, thiamin, and high amounts of protein.[24] Low fat content variants with high calcium content, is considered nutritious by many global consumers. In addition to the nutritious characteristics of milk powder, its demand has increased due to changing lifestyles and increased awareness. The global market for milk powder has been growing for the last 20 years as depicted in Figure 2.

[22] Dairy Australia. Is Powdered Milk as Nutritious as Chilled Milk? https://www.dairy.com.au/dairy-matters/you-ask-we-answer/is-powdered-milk-as-nutritious-as-chilled-milk
[23] Kalyankar S.D., Deshmukh M.A., Chopde S.S., Khedkar C.D., Lule V.K. and Deosarkar S.S. (2016) Milk Powder. In: Caballero, B., Finglas, P., and Toldr , F. (eds.) The Encyclopedia of Food and Health vol. 3, pp. 724-728. Oxford: Academic Press.
[24] Mordor Intelligence. Milk powder market –growth, trends, covid-19 impact and forecasts (2021-2026)

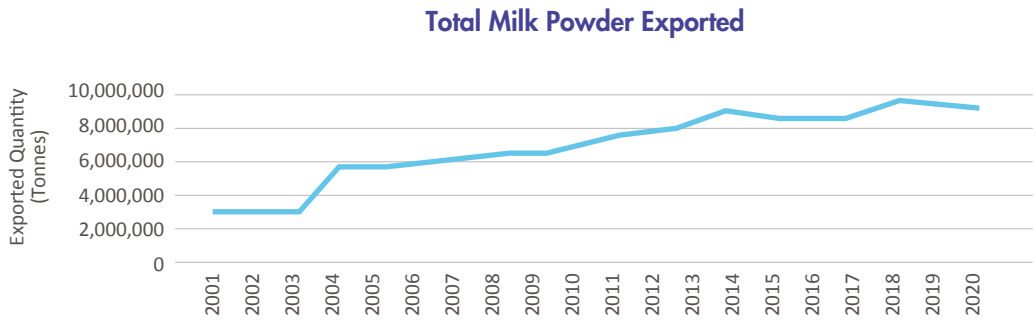



Figure 2 – Total Exported Quantity of Milk Powder
Source: ITC Trade Map

Europe is expected to maintain the highest market share whereas the market share of Asia-Pacific region is expected to grow rapidly in coming years.[25] China, the Netherlands and Germany are the major importers of milk powder, including SMP, WMP and whey powder.[26]

### 2.3.1 Reviewing Regional Practices to Manage Supply Shortages

#### China's increasing demand for milk powder

In China, when the supply of milk exceeds demand during winter months, the price of raw milk falls. The processing companies use this as an opportunity to convert raw milk into powder which is widely used in the production of value-added dairy products such as dairy beverages, reconstituted milk, yogurt and ice cream. High demand in summers is also met by importing milk powder.

Infant milk powder is the third largest dairy product demanded in China, whose production grew the most during 2019. Due to the high demand of infant milk powder in China, the government has enforced stringent regulations regarding product safety, traceability and quality to improve consumer confidence in milk powders. There was a global concern over quality after discovery of melamine in some batches of an infant formula produced in China. Through strict regulation of the market for infant milk powders, the government aims to further increase the market share of domestic producers of milk powders to 80 percent of China's total infant milk powder market, as envisioned in 'The National Dairy Industry Development Plan.'[27] The consumption of milk powders is expected to continue to increase in the future as consumption of dairy products increases and the processing industry grows.[28]

[25] Mordor Intelligence. Milk powder market –growth, trends, covid-19 impact and forecasts (2021-2026)
[26] ITC Trade Map
[27] PWC. The ongoing modernization of China's dairy sector. 2019
[28] USDA & GAIN. 2020. Dairy and Products Annual - China

## Government support for increasing domestic production of milk powder in Turkey

Milk powder is a significant dairy product for Turkey considering its impact on the domestic dairy market. During the period when there is surplus of milk production, the government subsidizes milk powder producers to encourage them to use the surplus and produce milk powder domestically.[29] In an attempt to protect domestic dairy farmers, Turkey imposes import duties up to 180 percent on milk powders.[30]

For the domestic dairy industry to grow and to reduce import dependency, Pakistan needs to discourage imports and promote the domestic production of powdered milk as practiced by China and Turkey. Changes in import policy for powdered milk will provide an incentive for the local dairy farmers to increase investments in production. First and foremost, Pakistan needs to ensure sufficient domestic production of raw milk. For this to happen, sectoral issues that hamper milk production need to be addressed.

[29] Kýrdar, S .S. & Karaca, O.B. 2017. An Overview of the Turkish Dairy Sector. Indian Journal of Dairy Science. 70(3)
[30] Yilmaz, O. T. 2017. A Study of Milk Support Policies in the European Union and in Turkey. European Journal of Interdisciplinary Studies. Vol. 9. Issue 1

# ADULTERATION IN RAW MILK

# 3. Adulteration in Raw Milk

Most cattle farmers in Pakistan have under 10 animals. Many of these dairy farmers retain 50 percent of the milk produced for household and livestock consumption and the remaining 50 percent is sold and considered as 'tradable milk'. Of the total tradeable milk, eight percent goes to the processing industry for production of packaged milk and two percent is used in the production of other value-added dairy products. Therefore, this is a very small quantity of the total milk produced that actually reaches the processing units. The bulk of the milk, which reaches the market is adulterated and consumed by the general public, eventually leading to undernutrition.

The informal market players, mostly middlemen and retail shops, adulterate milk due to an absence of quality checks, making the milk unsafe for human consumption. Middlemen purchase raw milk from small dairy farmers based on volume rather than quality.[31] Thereafter, the middlemen are responsible to ensure that the milk is transported without spoilage. Milk is a highly perishable commodity, which requires a quick and efficient collection system, especially during summer months. Approximately, 15 percent of the total milk produced, estimated at current market price of PKR 1 trillion[32], is wasted in Pakistan due to improper storage and handling due to a weak cold chain infrastructure. On the other hand, in Holland, just one percent of the total milk produced is wasted, 85 percent is collected by the dairy processors directly from the farm for processing and the remaining 14 percent is processed into cheese at the farm[33]. These numbers indicate that wastages are low where most of the milk is processed. This is further validated by the fact that, in Pakistan, the entire quantity of milk that is collected by the dairy processing companies is processed into value-added products with no wastage. This is because the dairy processing companies have a cold chain infrastructure in place which ensures that milk is properly stored and transported to avoid spoilage. The middlemen adulterate the milk because most dairy farmers do not have access to the cold storage and transportation facilities that would preserve the quality of milk. The middlemen add ice and water, generally one kilogram to every 10 kilogram of milk to prolong its life. This process dilutes the milk by as much as 30 percent.[34] Furthermore, the ice used in this process is made from untreated water sources and it contaminates the milk. To prevent spoilage during transit, the middlemen add bacterial inhibitors, such as penicillin to the raw milk. [35] Several other adulterants and chemicals are also added to the milk by vendors which can be hazardous to human health. [36] Box 2 lists the common adulterants added to milk in Pakistan.

[31] FAO (2011). Dairy Development in Pakistan, by Umm e Zia, T. Mahmood and M.R. Ali. Rome.
[32] Estimation based on milk production of 63,684,000 tonnes, wastage of 15 percent (Economic survey 2020-21) and market price of PKR 110 per liter of loose milk.
[33] Friesland Campina, Holland
[34] Nestle. 2017. Drops of the Divine. A Story of Milk in Pakistan
[35] FAO (2011). Dairy Development in Pakistan, by Umm e Zia, T. Mahmood and M.R. Ali. Rome.
[36] Arif et. al. (2019). Chemical composition, adulteration, total microbial load, and heavy metal in raw milk samples collected from dairy farms and urban areas in Lahore District, Pakistan. Journal of Food Safety.

## Box 2 – Milk Adulterants

Milk vendors add the following adulterants to change the quantity and quality of milk:

1. Water – to increase the volume of milk
2. Thickening agents such as starch, rice flour, arrowroot and/or constitutional agents like glucose, cane sugar, sodium salts, urea - to thicken the milk after adding water
3. Calcium thioglycolate or Potassium thioglycolate and urea - to whiten the milk and maintain the protein level
4. Urea – to enhance heat stability
5. Vegetable oil – to increase fat level

Source: HSOA Journal of Dairy Research and Technology

In the informal market, there is no food safety system to prevent adulteration. Even though, the provincial governments have enforced adulteration inspections for controlling the sale of unsafe milk, there are no quality checks at the source and across the supply chain. This indicates that the food safety system governing the informal market has been reactive rather than preventive. This approach relies on the government with no responsibility on the stakeholders in the informal market.

Quality checks are conducted on just five percent of total milk produced in Pakistan. The processing companies conduct quality tests on raw milk which is collected at the village level before it is sent for further processing. The private dairy processing companies have established milk collection centers at the village level, called Village Milk Collection Centers (VMCs). Farmers bring milk to the VMCs, after which it undergoes a series of tests. An organoleptic test is conducted immediately at collection. Other tests include checks for adulteration and antibiotics. Milk that passes inspection is poured into a chilling unit at the VMC. Collection trucks collect milk from the VMCs daily. The trucks' insulated vessels are designed to protect the milk from the sun and keep it at a temperature that is between four to seven degrees Celsius. The milk passes through 30 quality tests before it reaches the Regional Milk Collection Centers (RMCs). Additional 22 tests are conducted for adulterants before the milk is sent to the processing unit.[37]

List of qualitative and quantitative tests that are conducted at the VMCs and RMCs is provided in Table 2. These tests include physical, organoleptic, chemical and physiochemical tests.[38]

[37] Nestle. 2017. Drops of the Divine. A Story of Milk in Pakistan
[38] Tahir. M.N. et al., Current standing and future challenges of dairying in Pakistan: A status update

| Test Category | Type of Test |
|---|---|
| Physical | Clot on Boiling, pH, Specific Gravity, Temperature, Total Solids |
| Organoleptic | Appearance, Consistency, Smell, Taste |
| Chemical | Acidity, Ammonium sulfate, Formalin, Hydrogen, Salt, Sodium |
| Physiochemical | Aflatoxin, Antibiotics, Alcohol Precipitation Test, Butyro-Refractometer Value, Detergent, Fat, Free Sugars, Glucose, Methylene Blue Dye Reduction, Protein, Sorbitol, Starch, Total Plate Count, Urea, Whey Protein |

Table 2 – Qualitative and Quantitative Tests

Source: Tahir. M.N. et al., Current Standing and Future Challenges of Dairying in Pakistan: A Status Update

Efforts are underway by the Punjab Government to control the sale of adulterated milk in the province by conducting spot-checks on the milk retail centers for checking quality. But these measure are only marginally effective in curbing the practice of milk adulteration. On the other hand, dairy processing companies have made significant investments in remote milk producing areas and have developed quality-based procurement processes.

In order to have stringent control on adulterated milk, the government needs to ensure enforcement and implementation of the Minimum Pasteurization Law in Pakistan. This will make pasteurization a legal requirement for all milk producers and will help formalize the dairy sector. The more milk that goes into value-addition, the lesser will be the chances of adulteration and this will increase the consumption of safe and nutritious milk, while increasing price competitiveness.

# IMPROVING ANIMAL YIELDS

# 4. Improving Animal Yields

Pakistan has a sizable livestock population with approximately 94 million cattle (group of cows) and buffaloes[39] and has the second largest buffalo herd after India and the seventh largest cattle herd.[40] Veracity of this data is unconfirmed and contested by academics and the processing industry, since these figures are based on a static 3.4 percent growth rate applied on the numbers reported in the Livestock Census conducted in 2006. No livestock survey has been conducted since 2006. Regardless of possible errors in data estimations, uncontrovertibly Pakistan has one of the largest dairy livestock in the world. The official livestock population for the last five years is mentioned in Table 3 below.

| Livestock population (Million) | | | | | |
|---|---|---|---|---|---|
| | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
| Cattle | 44.4 | 46.1 | 47.8 | 49.6 | 51.5 |
| Buffalo | 37.7 | 38.8 | 40 | 41.2 | 42.4 |
| **Total Dairy Animals** | **82.1** | **84.9** | **87.8** | **90.8** | **93.9** |

Table 3 – Livestock Population

Source: Economic Survey of Pakistan

Cattle in Pakistan is reared by households on a small scale, primarily to produce milk. Of the estimated 12.5 million households, [41] 79 percent households have a cow or a buffalo. Most households have under 10 dairy animals. Only seven percent have a holding size of over fifty cows and buffaloes. Approximately, 80 percent of bovine animals are reared in the rural areas and 15 percent in peri-urban regions.[42] Despite the largest dairy livestock in the world, the sector is unable to produce sufficient quantity of milk for local population. This can be attributed to issues pertaining to low milk yield.

## 4.1 Cattle

Milk yield of domestic cattle breeds in Pakistan is ranked 95th in the world.[43] With over 50 million cattle in Pakistan, comprising of almost half the dairy livestock, an improvement in milk yield will have a sizeable impact on milk production in the country. The most popular local cattle breed in Pakistan is the Sahiwal breed whose milk yield is on average 1,700 liters per year (approximately seven liters per day during lactation period of 235 days). Whereas, Holstein breed of cattle which is

[39] Ministry of Finance. Economic Survey of Pakistan 2020-21
[40] FAO Statistics 2019
[41] Estimated based on the following assumptions: Total population 220 million, average household size 6.68, 38% of the total household rear livestock (as in 2006)
[42] Livestock census 2006
[43] FAO Statistics Database 2019.

considered the highest milk yielding cattle breed in the world, has a yield of 7,500 liters per year (approximately 25 liters per day during a lactation period of 300 days). The difference in milk yield between the domestic and high-yielding international breeds is around four times. Pakistan can benefit by upgrading its domestic herd over the next few years. Box 3 describes the characteristics of major local and international high-yielding dairy cattle breeds.

## Box 3 – Cattle Breeds

### Local Cattle Breeds[44] [45]

**Sahiwal breed,** originates from Sahiwal district of Punjab and is also found in Okara, Pakpattan, Multan, and Faisalabad. This breed is medium-sized and has a fleshy body. The female animal has a reddish dun color, while the male animal has a darker color around the orbit, neck, and hindquarters. The average lactation length of the Sahiwal breed is 235 days and the milk yield is 1,500 to 2,200 liters per lactation period with a fat content of 4.5 percent. It has a calving interval of 440 days and good heat tolerance. The Sahiwal breed is used both as a pure breed, for upgrading of unimproved cattle and for crossbreeding with European breeds.

**Red Sindhi breed,** originates from a mountainous region called `Mahal Kohistan', spread over parts of Karachi, Thattha and Dadu districts in Sindh. This breed is medium-sized with red body color. The average lactation period of the Red Sindhi breed is 265 days and the milk yield varies from 1,200 to 2,000 liters per lactation period with a calving interval of 495 days.

**Cholistani breed,** originates from Cholistan region including Bahawalnagar, Bahawalpur, and Rahimyar Khan districts. This breed is large-sized with a white body color and speckled red, brown or black all over the body including head. The average milk yield varies from 1,200 to 1,800 liters per lactation period with a calving interval of 425 days.

[44] Breeds, Livestock and Dairy Development Board.
[45] Small-scale Dairy Farming Manual, Volume 2, Husbandry Unit 2, Breeds of Dairy Cattle and Buffalo, FAO

### International High-Yielding Cattle Breeds

**Holstein / Friesian breed,** originates from Fries Land in Holland. This breed is large-sized with a white body color and with black or red patches. Milk yield varies from 7,200 to 12,000 liters per lactation. Range of average daily milk production may be 22-30 liters. High-yielding cows of this breed may produce 80-112 liters per day. The fat content in the milk is 3.5 percent. The average lactation length of the Holstein / Friesian breed is short due to high yield. Heat tolerance of this breed is low[46] which is why heat management is very important for this breed to survive in extreme weather during summer months in Pakistan.

**Jersey breed,** originates from France and was first brought to Jersey Island, UK. Jersey is small sized and can save up to 13 to 18 percent in feed expenses as they have a unique biological ability to utilize the energy in feed for milk production. This makes them comparatively efficient feed convertors.[47] Jersey cattle produces 7,000 to 8,000 liters per lactation period. Milk produced by a Jersey cow has 15-20 percent more protein, 15-18 percent more calcium, and 10-12 percent more phosphorous, and it also has considerably higher levels of vitamin B12 than milk from other cattle.[48]

Attempts have been made to improve the yield of local dairy breeds through cross-breeding and artificial insemination in Pakistan, but the results so far have been unsatisfactory. Corporate dairy farms import high yielding cattle such as Holstein-Friesian and Jersey for higher milk production. High-yielding cattle breeds require modern management practices and good quality fodder through-out the year to maintain higher yield. Milk yields of imported cattle at corporate farms in Pakistan is approximately 25 liters per day. Cost of feed is 60 percent of the total cost of rearing these imported breeds throughout the year. For the Sahiwal breed, the cost of feed increases up to 80 percent of the total cost of rearing.

Cross breeding of local cattle with high yielding imported breeds also has the potential to increase the production of milk in Pakistan. In addition to imported cattle, some corporate farms keep a herd of cross-bred Holstein and Jersey. At the farm level, milk yield can be increased to 12 liters per animal per day by shifting from local cow breeds to crossbred cows. Presently, artificial insemination facilities provided by the government departments are insufficient because of their low coverage. It is important to extend cross breeding programs throughout the country in order to have a sizeable impact on milk production.

[46] Breeds, Livestock and Dairy Development Board.
[47] Jersey Canada. https://jerseycanada.com/
[48] US Jersey. Why Jersey? https://www.usjersey.com/Portals/0/AJCA/2_Docs/WhyJerseys2013.pdf

Table 4 below shows a comparison of milk yields and cost of rearing for local, imported and cross-bred cattle in Pakistan. The given figures are averages.

| | Local Breed | Imported Breed | Crossbreed (Local & Imported Breed) |
|---|---|---|---|
| Milk Yield/ Day (liters) | 6 | 25 | 12 |
| Cost of Rearing/ Animal (PKR)[49] | 300,000 | 314,000 | 306,000 |

Table 4: Comparison of milk yields and cost of rearing for local, imported and cross-bred cattle in Pakistan

Source: Nestle Pakistan

To increase milk production in India, during the early 1970s, the government policies emphasized on improving productivity of domestic cattle breeds through the practice of crossbreeding with imported high-yielding breeds. This resulted in the import of high yielding breeds from Europe and the United States of America including primarily Holstein Friesian, Jersey and Brown Swiss breed , and cross-breeding them with Indian domestic cattle.[50] The implementation of crossbreeding policies has led to the contribution of crossbred cows in total milk production to exceed 50 percent.[51] In Pakistan, contribution of imported and crossbred cattle in total milk production is just one percent.[52] India's case provides evidence to the policymakers in Pakistan that formulation of a dairy plan and crossbreeding programs with a greater coverage of implementation will increase milk productivity and production.

## 4.2 Buffaloes

Although, buffaloes produce approximately 61 percent of the total milk produced in the country, [53] buffalo farming at commercial level is not common in Pakistan because of greater impact of heat stress, reproductive issues and lower feed efficiency of buffaloes.[54]

The impact of heat stress on buffaloes is greater than that on cattle, which reduces the milk yield by 67 percent. Buffaloes produce approximately 16 to 18 liters of milk per day when the day temperature is between 20 to 24 degrees Celsius, whereas milk yield reduces to four to six liters per day when the temperature rises to 40 degrees Celsius during June-August. Buffaloes need to be reared in areas with cooler climate, therefore, in Pakistan during the summer months the farmers usually take necessary measures and keep the buffaloes in shaded areas or bathe them several times a day.[55]

[49] estimated cost of rearing from day 1 till calving (2 years)
[50] Wakchaure, R. et.al. 2015. Development of crossbred cattle in India: A review. International Journal of Emerging Technology and Advanced Engineering. Volume 5, Issue 10
[51] Tetra Pak. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry.
[52] Tahir, M.N. (2019). Current Standing and Future Challenges of Dairying in Pakistan'
[53] Buffalo Breeders Association Pakistan
[54] Tahir, M.N. (2019). Current Standing and Future Challenges of Dairying in Pakistan'
[55] The Express Tribune. 2019. Prolonged heat affects buffalo farming. https://tribune.com.pk/story/1998874/prolonged-heat-affects-buffalo-farming

Furthermore, buffaloes have poor reproductive efficiency due to several physiological and management issues that result in lower fertility. The dairy farmers do not prioritize re-breeding buffaloes because of higher cost of milk for the calves and cost of labor and land for management of a larger herd.[56] Buffaloes require greater quantity of feed than cattle to produce the same quantity of milk. The share of feed cost is 80 percent of the total cost of milk production, which reduces their commercial viability.

There are noticeable differences in the nutritive value of cows and buffalo milk which makes buffalo milk suitable for processing of fat-based and solid non-fat based value-added dairy products.[57] Buffalo milk contains more than twice as much fat as cow milk on average. Buffalo milk contains 7.5 grams of fat in 100 grams of milk, whereas cow milk contains around 3.3 grams of fat content in the same quantity of milk.[58] This makes buffalo milk suitable for processing of cheese, butter and several confectionaries. In order to ensure high yield from buffaloes, it is important to implement certain herd management practices including: balanced feed throughout the year, animal hygiene, managing heat stress, animal insemination and improved animal housing.[59]

## 4.3 Challenges in improving yields

Better breeds and animal care leads to better milk yields. There are certain challenges faced by the dairy sector in improving domestic breeds and providing better animal care services. The government has tried to support the private sector in doing both these activities in the past, but the government programs have been ineffective, primarily due to small scale of implementation. Greater results can be achieved through consolidation and working with progressive private sector participants, which will help raise overall productivity of the sector.

### 4.3.1 Inadequate Artificial Insemination Infrastructure

Genetic improvement through artificial insemination (AI) is considered to be an effective method to increase the number of high yielding breeds. In Pakistan, this technology is not prevalent due to a few factors which include lack of animal traceability (animal identification and recording system), unavailability of quality male animal germplasm to farmers and lack of awareness regarding the breeding process and its advantages.

[56]Qureshi, M.S., 2012. Breeding, Management and Environmental Issues at Peri-Urban Dairy Farms. Milk Production – Advanced genetic Traits, Cellular Mechanism, Animal Management and Health.
[57] H Wahid and Y Rosnina, Buffalo: Asia. 2016. Universiti Putra Malaysia, Selangor, Malaysia
[58] FAO. Milk and dairy products in human nutrition
[59] M. Guo, University of Vermont, USA and G. Hendricks, University of Massachusetts, USA. Improving buffalo milk. 2010

At present, AI facilities provided by the provincial government departments are ineffective. The government programs are fragmented and cover a small proportion of adult female cattle and buffalo population. For a considerable impact of AI on milk production, these initiatives need to be scaled to cover all districts so that small dairy farmers can benefit from genetic improvements. Since small farmers are currently unaware of AI technology they keep the male cattle for mating and for draught purposes. This imposes a cost on cattle farmer to feed these animals.[60] Many farmers sell or cull the male animals for meat.

Corporate dairy farms in Pakistan give considerable attention and importance to improving the quality of their herd and implement AI and selective breeding. These farms employ veterinary doctors to manage animal health, AI activities and handle issues related to animal immunization.[61] Government programs should focus on working with these farms, since they are willing to use AI and can invest adequately in these programs. With greater ownership from the private sector, AI will increase the effectiveness of these programs and eventually help transfer technology to smaller scale farms, and increase overall productive output of the country.

In the long term, improvement in animal genetics provides potential to improve the yield and milk production in the country. There is a need to extend crossbreeding programs throughout the country to achieve an increase in milk production. The provincial livestock departments of Punjab and Sindh have an important role to play in this regard.

### 4.3.2 Limited Access to Vaccines and Veterinary Extension Services

The productivity of dairy animals in Pakistan is also affected by limited access to vaccines and veterinary extension services. The major infectious diseases that affect dairy animals in Pakistan are foot-and-mouth disease (FMD) and Hemorrhagic Septicemia (HS). These diseases result in high animal mortality and reduced milk and meat yield. It is estimated that there is reduction of milk and meat production by 20-25 percent as a result of the spread of infectious diseases in bovine animals.[62] This underscores the importance of timely access to veterinary care for dairy animals including administration of vaccines and medicines to prevent and cure infectious diseases that lead to a reduction in milk yield.

The provincial livestock departments in Pakistan are responsible for providing veterinary extension services. These services include health treatment, vaccination and artificial insemination. Unfortunately, the service delivery by the provincial government is limited with low confidence shown in them by dairy farmers. Only 40 percent farmers have access to livestock extension services.[63] Furthermore, these health programs lack need-based applied research and have poor

[60] Tetra Pak. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry.
[61] Tetra Pak. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry.
[62] Tetra Pak - Dairy Hub Training Booklet
[63] Wynn PC, McGill DM, Aslam N, Tufail S, Latif S, Ishaq M, et al. 2017. The Impact of Extension Programs to Increase the Productivity of the Small-Holder Dairy Farming Industry of Pakistan. International Journal Animal Science. Vol. 1 (2)

monitoring and evaluation.[64] Lack of mass vaccination programs and inadequate facilities for storage and transportation of vaccines are also some of the reasons for the low scale of vaccination in Pakistan.[65] Moreover, data regarding outbreaks of infectious diseases is unavailable which makes it even harder to combat FMD and other diseases.[66]

Corporate farms struggle to receive approval from the Drug Regulatory Authority of Pakistan (DRAP) for the use of internationally developed vaccines. Vaccines which are administered to the bovine animals are required to be registered with DRAP. The vaccine registration process is lengthy and cumbersome. As a result, corporate farms must wait a long time for approvals. Since vaccines are supposed to be administered in a timely manner, this delay in approval negatively impacts health of the animals and their productive output. Ease of importing high quality vaccine is critical for improving the well-being and productivity of dairy animals.

Currently, FMD vaccine is imported by Pakistan, which is un-affordable for many subsistence farmers. The provincial governments dilute imported vaccines and distribute these among farmers at a more affordable rate, but the government's coverage is very low. Since the FMD vaccine is imported in limited quantities, they fail to cater to the entire dairy animal population in Pakistan. In order to make vaccines available to all dairy farmers at reasonable cost, the Sindh Government is in the process of beginning domestic production of vaccines under a public-private partnership model.[67] Although, this is a step in the right direction, it will take time to materialize. Till then, the government can work to make approval processes of imported vaccines shorter and convenient for dairy farms. Apart from government initiatives, several donor projects were also executed in Pakistan to enable widespread availability of FMD vaccines but these projects were not sustainable and were discontinued. Since, FMD vaccine is supposed to be administered once every year, such projects do not provide a long-term solution for eradicating FMD.

China, India and Turkey established FMD vaccination manufacturing plants in the 1970's and Iran did the same during the 1980's.[68] Pakistan needs to speed up its efforts for mass vaccination and for that, it is important that the government work in coordination with the private sector to simplify the vaccine approval process, allow import of the required vaccines or manufacture them locally on a large scale to ensure their availability to all dairy farms. Furthermore, expansion and modernization of veterinary services and educating farmers regarding infectious diseases is essential to ensure high milk yield.

[64] Planning Commission of Pakistan, Ministry of Planning, Development & Special Initiatives. 2020. Cluster Development Based Agriculture Transformation Plan Vision-2025. Milk Cluster Feasibility and Transformation Study
[65] The Nation. 2020. Treatment of Haemorrhagic Septicaemia. https://nation.com.pk/18-Mar-2020/treatment-of-haemorrhagic-septicaemia
[66] Naveed A, et al. Foot-and-Mouth Disease: A Strategic Analysis for the Control of Disease. Vaccines & Vaccination. Medwin Publishers. 2018, 3(2): 000125
[67] Planning Commission of Pakistan, Ministry of Planning, Development & Special Initiatives. 2020. Cluster Development Based Agriculture Transformation Plan Vision-2025. Milk Cluster Feasibility and Transformation Study
[68] Livestock Department Government of Sindh. Foot and Mouth Disease Vaccine Production Project. Expression of Interest Document. 2020

### 4.3.3 Initiatives by countries to improve animal breeds

#### Initiatives by India

With the introduction of AI technique, the crossbreeding program was extended to every district of India. The 'National Dairy Plan' was aimed at improving breeds with the production of high-genetic bulls. Resultantly, milk production in India has grown by a CAGR of five percent since 2015. Furthermore, 'Nationwide Artificial Insemination Program' was introduced for 600 districts of India in 2019 which covers approximately 12 million bovine animals. Approximately, 1.1 million artificial inseminations were conducted during the initial four months of the program.[69]

#### Initiatives by China

Ministry of Agriculture, China provides dairy cow semen to farmers at a subsidized rate to improve the breeding stock. The subsidy policy is aimed to cover doses for approximately 8.4 million breeding cows including Holstein, Jersey, Simmental, Brown Swiss, Yak, SanHe and buffalo. The Ministry has also subsidized a program to provide approximately 3,000 embryos but its uptake has been low by the corporate farms because of their preference for imported embryos, which provide better quality.[70]

#### Box 4 – Most Common Animal Diseases and their Prevention

Milk production in Pakistan is severely affected by FMD. Hemorrhagic Septicemia is the leading cause of mortality in cattle and buffaloes.

**Foot-and-Mouth disease (FMD):** Foot-and-Mouth disease is the most critical contagious disease that impacts the dairy sector of Pakistan in terms of low animal yield, high animal mortality and limits access to international markets. FMD is a disease caused by a virus which has seven serotypes with more than 80 subtypes. In the past, FMD was a seasonal disease but now the animals can get infected throughout the year. To prevent the occurrence of this infection, dairy animals are required to be vaccinated twice a year, in February-March and September-October. A vaccine which is effective for an entire year is also available.

**Hemorrhagic Septicemia (HS):** This is an infectious disease which causes death of dairy animals due to swelling of throat and tongue and causes high fever. Although both cattle and buffaloes are affected but buffaloes are considered to be more vulnerable. The disease outbreaks usually occur during the rainy season. To prevent the occurrence of this infection, animals are required to be vaccinated twice a year. First dose is administered in May-June and second during November - December. The Animal Health Program of the Pakistan Agriculture Research Council (PARC) has developed a vaccine for this disease which provides one-year protection with protective efficacy of over 95 percent.

Source: Tetra Pak - Dairy Hub Training Booklet & PARC Animal Health Program

[69] FICCI. 2020. Development of Dairy Sector in India
[70] Livestock Dialogue. Major Policy Developments in the Dairy Sector for Selected Asian countries

# PRICE COMPETITIVENESS

# 5. Price Competitiveness

Milk produced in Pakistan is not price competitive compared to regional countries such as, India, China and Turkey.

Table 5 highlights a comparison of Pakistan's farm gate price of milk with three of the top regional producers of milk. Pakistan's farm gate price is significantly higher than regional competitors. As compared with Turkey, farm gate price in Pakistan is more than twice that of Turkey.

| | Pakistan | India | China | Turkey |
|---|---|---|---|---|
| Milk Farm Gate Price (USD/ kg) | 0.62[71] | 0.40[72] | 0.53[73] | 0.28[74] |

Table 5 – Comparison of Regional Farm Gate Milk Prices

Source: Various

## 5.1 Productivity of Dairy Animals

Productivity of dairy animals in Pakistan is quite low and nearly half that of Turkey and almost one-quarter compared to China. This signifies that these countries can produce a greater quantity of milk by managing the same number of dairy animals, which brings down the cost of production of milk. Table 6 below mentions annual milk yield for Pakistan and the other three countries.

| | Pakistan | India | China | Turkey |
|---|---|---|---|---|
| Milk Yield (kg / animal)[75] | 1,461 | 1,698 | 5,647 | 3,158 |

Table 6 – Comparison of Milk Yield

Source: FAO Statistics Database

In Turkey, 44.4 percent of the herds consisted of imported breeds, 42.2 percent of cross breeds and just 13.5 percent of domestic breeds. As mentioned in the section above, imported breeds have the highest yields for developing countries followed by cross breeds. This highlights why Turkey has one of the highest annual yields in the region.[76]

[71] Industry sources- based on per kg price, that is, PKR 105 (in Punjab)
[72] The Economic Times. 2020. Farmers in Maharashta hold protest as milk prices fall 40% after Covid outbreak.
[73] CLAL database
[74] CEIC database
[75] FAO Statistics Database
[76] Kýrdar. S.S. & Karaca. O.B. 2017. Overview of Turkish dairy sector. Indian Journal of Dairy Science. Vol 70. Issue 03

## 5.2 Aggregation of Farms

As mentioned in the sections above, most dairy farms in Pakistan rear small-sized herds of five dairy animals on average. This prevents the small farms to benefit from economies of scale. Dairy farms in India, on the other hand, have cost advantages due to widely established farmer co-operatives. The number of co-operatives in India have increased from 13,000 in 1980 to 190,000 in 2019.[77] Most of the dairy co-operatives in India focus on increasing animal productivity and returns to the farmers. Dairy farmers have adopted an integrated cooperative structure which procures, processes, and markets produce resulting in increased bargaining power of the farmers and reduction in cost of inputs including animal feed, veterinary care and other necessary inputs. It is an efficient mechanism to resolve production challenges including access to affordable inputs and marketing of produce of small dairy farms by pooling resources.

## 5.3 Herd Size

Small dairy farms lack sufficient resources and expertise to implement best practices for efficient milk production. Increasing herd size will result in cost efficiencies due to economies of scale, and assist in lowering farm gate prices of milk in Pakistan.

Evidence from China suggests that the number of dairy farms have declined post-2008 as government policy has focused on increasing herd size per farm and therefore farm productivity. As a result, the number of small farms has reduced by 75 percent during 2007-2018, while the average farm size has increased. In addition, there is a preference of dairy processing companies to procure milk from large scale farms through long-term contractual arrangements (similar to trends in the USA and Western Europe). This has led the government in China to incentivize the establishment of large scale farms and larger herd sizes. Farms with more than 100 cows has increased from 20 to 60 percent during a period of ten years.[78]

Turkey is also working on progressing from smaller herds to large herds by implementing a farm restructuring program since the 1980's. More recently, the Turkish Agricultural Bank launched a financing scheme and offered long-term loans with zero interest rates for dairy cow breeders. This incentive has resulted in the emergence of large-scale farms.[79]

[77] FCCI. 2020. Development of dairy sector in India
[78] PWC. The on-going modernization of china dairy sector
[79] Dairy Global. Turkish Government Supports its Dairy Farmers.
https://www.dairyglobal.net/Articles/General/2016/4/Turkish-government-supports-its-dairy-farmers-2796689W/

## 5.4 Fodder Cost

The cost of animal feed is approximately 60 percent of total cost of inputs for dairy farming. By introducing cost-efficient varieties of dairy animals which have higher feed to milk ratio, dairy farms can become price competitive. In order to be globally competitive, the price of silage needs to be at par with international prices.

There is limited utilization of a highly nutritious diet by small dairy farmers who mostly rely on green fodder to feed their animals. Seasonal shortages of green fodder, as discussed in the previous sections, coupled with high cost of silage and concentrates prevents small farms to use high quality feed inputs. To have globally competitive milk production, high quality feed which is rich in protein is essential for dairy farming. Maize is used as an input of silage mix and is a good source of nutrition for animals. Allowing export of maize has increased the domestic prices of maize which has resulted in high cost of production for dairy farms. Furthermore, the imposition of taxes and duties on the import of soybean has made it expensive to use as animal feed. Until greater self-sufficiency in domestic production of maize and soybean can be achieved, Pakistan should consider reducing duties and taxes on soybean, restricting the export of maize and increasing production of maize and soybean to bring down feed cost in Pakistan. This would improve the competitiveness of Pakistan's dairy sector.

## 5.5 Farm Mechanization

To increase productivity, Pakistan will need to adopt better technology at almost all stages of production. The adoption of technology will help in:

- Developing high-yielding animal varieties
- Developing feed mixes for improving yields
- Developing technology to measure behavioral, production and physiological indicators of dairy animals
- Developing mechanized milking systems
- Developing computerized herd management system for record-keeping of production and monitoring animal health
- Developing other on-farm management practices for livestock

China has made significant improvements in farm mechanization to reduce cost of production. Government policies have encouraged the use of mechanized milking process. Resultantly, almost all milking is now mechanized. Mechanized milking improves milk quality and food safety since this method is more hygienic than the hand milking technique.

## 5.6 Subsidies on Inputs

The dairy sector in Pakistan receives no subsidies as opposed to the top regional dairy producing countries such as Turkey. Input subsidies result in low production costs and therefore a competitive farm gate price of milk.

The Turkish government is presently implementing a strategy plan for agriculture and is reforming subsidies to uplift the dairy sector. Over seven billion Turkish Lira is paid to dairy farmers by the Turkish government every year in the form of subsidies. Approximately, 50 Turkish Lira per animal per year is paid by the government which is used to provide nutrient-rich fodder for the dairy animals, improve farm infrastructure and set-up modern farm equipment. This helps dairy farms in modernizing farming practices up to standards of the European Union. Furthermore, dairy farmers also receive approximately 200 Turkish Lira per animal per year for improvement of animal health by using vaccinations and improved veterinary care.[80] This contribution by the government significantly lowers the cost of production and improves price competitiveness. Turkey also subsidizes import of dairy cattle.

There is sufficient evidence to suggest that aggregation, increase in herd size, improved genetics, mechanized farming techniques and input subsidies have led to reduction in cost of production and increase in productivity of dairy animals.

[80] Dairy Global. Turkish Government Supports its Dairy Farmers.
https://www.dairyglobal.net/Articles/General/2016/4/Turkish-government-supports-its-dairy-farmers-2796689W/

# VALUE-ADDED DAIRY PRODUCTS

# 6. Value-Added Dairy Products

Of the total milk produced in Pakistan, 50 percent is tradeable while the rest is consumed by dairy farmers and by the cattle. Of the tradeable milk, approximately, two percent is utilized by processing companies for production of value-added dairy products such as butter, cream, cheese, yoghurt and ice cream among others. A larger quantity, that is eight percent of tradeable milk, is processed into pasteurized and UHT treated milk.[81] Most of the milk in Pakistan is untreated and utilized without any significant value addition.

## 6.1 Pasteurized Milk

Most corporate farms sell their milk to dairy processing companies. Some have also installed small-scale processing units on their farms to pasteurize milk and sell it directly in the market. A processing unit consists of chilling, pasteurizing and packaging units. While the large dairy processing companies produce UHT treated milk, corporate farms can only convert raw milk to pasteurized milk. Box 5 briefly discusses the common pasteurization process.

### Box 5 – What is Pasteurization

Pasteurization is heat treatment of raw milk to reduce the number of pathogenic micro-organisms to a level at which they do not constitute a health hazard. This heat treatment gives milk a shelf life of four days.

Raw milk is chilled in collection chillers at 4 °C immediately after collection by the dairy processing companies. The chilled milk is moved from the chiller to the pasteurization unit and is heated at 72 °C for 15 seconds to significantly reduce milk spoiling micro-organisms and all pathogenic bacteria. The milk is immediately cooled to 4 °C before it is used for production of various value-added dairy products or packaged for sale.

Source: Tetra Pak Dairy Processing Handbook & FAO Milk and Dairy Products in Human Nutrition

Pasteurization of milk is important because raw milk is a perishable commodity and can be quickly damaged by a variety of micro-organisms, including pathogenic bacteria that spoils the milk. Milk can be contaminated at different stages of production due to poor handling, poor storage conditions, contaminated water and inadequate temperature control. The extent of contamination depends on the hygienic measures taken before, during and after the milking process and storage. The contaminants in milk can cause severe health issues due to food-borne illnesses that are caused by bacteria which enter the body through contaminated milk. Infections caused by untreated milk and methods to minimize their impact are provided in Table 7.[82]

[81] Approximately, 4 percent of total milk is used in the production of packaged milk and 1 percent is used in the production of other value-added products such as cheese, yogurt and others.
[82] Ahmed sham. M. et al., 2017. Review on Milk and Milk Product Safety, Quality Assurance and Control. International Journal on Livestock Production

| Milk borne infections | Way of minimization/ elimination |
|---|---|
| • Bovine Tuberculosis | By improvements in: |
| • Brucellosis | • Animal husbandry |
| • Anthrax | • Environmental cleanliness in dairies and processing plants |
| • Salmonellosis | • Pasteurization of milk |
| • Listeriosis | |
| • Leptospira Infection | |
| • Q Fever | |
| • Foot and Mouth Disease | |
| • Toxoplasmosis | |
| • Hypersensitivity reactions | |

Table 7 – Milk Borne Infections and Way of Minimization/ Elimination

Source: Ahmed sham. M. et al., 2017. Review on Milk and Milk Product Safety, Quality Assurance and Control

Raw milk has a short shelf-life and if not chilled within four hours, it gets spoilt due to bacterial growth. This spoilage takes place due to the absence of cold storages or pasteurization units at the farm level. Although private processors have established VMCs and RMCs equipped with chillers, this facility is available at a very limited level. This results in spoilage during summers and milk adulteration. Milk pasteurization is the solution to overcome spoilage and adulteration. Pasteurized milk is a safe and nutritious option which improves milk shelf life and assures consistent quality. Pasteurization of raw milk at village level will reduce sale of adulterated milk which has an adverse impact on health.

The purpose of pasteurization is to minimize and eliminate pathogens without affecting the nutritional value of milk. Milk pasteurization is an internationally accepted method of processing raw milk into safer milk and other dairy products. It is important to promote pasteurization at the village level in Pakistan and for this the government needs to install small pasteurization units. The establishment of milk pasteurization units at the village level will improve the milk marketing system and will lead to an improvement in value of milk for the farmer and the downstream players in the value chain.

For this to happen, there needs to be an enabling environment for wide-spread pasteurization leaving no space for the sale of adulterated milk. At the minimum a pasteurization law needs to be enforced.

### 6.1.1 Minimum Pasteurization Law

It is important to have in place a legal framework by implementing and enforcing of a minimum pasteurization law in the country to ensure that safe milk reaches consumers. The enforcement of minimum pasteurization law in Pakistan will bring several benefits not only to the sector but to the economy as well. Supply of adulterated milk will reduce which will significantly reduce nutrition issues. Moreover, increase in pasteurization will reduce milk wastage which is approximately 15 percent of total milk produced. As opposed to the sale of adulterated milk, which is undocumented, the sale of pasteurized milk will have greater documentation. Milk production will be aggregated at the pasteurization units, lowering collection costs. Milk pasteurization will not only lead to an increase in the production of safe milk but will also result in an increase in production of other value-added dairy products in Pakistan.

Pasteurization is presently practiced on a very limited scale and therefore, does not have a considerable impact on the sector. Pasteurization to control the sale of adulterated milk needs to be a long-term policy intervention which is enforced. India implemented a minimum pasteurization law in the early 1960's and Turkey adopted this law twenty years ago which has played a considerable role in developing Turkey's dairy sector.[83]

To ensure effective implementation of this law, the government needs to develop an infrastructure to accommodate pasteurization units and quality testing labs. Presently, most of the dairy farmers are not aware of the pasteurization process and its benefits. The government will need to create awareness regarding pasteurization, the process and its benefits among farmers, especially small farmers. The government also needs to ensure that the practice of pasteurization does not put a burden on small farmers, since it would be compulsory after the implementation of the minimum pasteurization law. In India, dairy farmers were organized in dairy co-operatives which had collective bargaining power to protect their interests once the law was implemented. The demand for processed milk is price sensitive and needs to be considered when implementing the law.

The government can benefit from the experiences of implementing Minimum Pasteurization Laws in India and Turkey. In India, the state established farmer co-operatives and the farmers pooled in money to setup pasteurization units. Approximately 50-60 percent of the total milk produced in India is UHT packaged milk because of a small informal sector and high levels of pasteurization. In Turkey, the government provides milk incentive premiums to dairy farmers who have registered themselves in the Farmer Registration System of the dairy sector to encourage them to pasteurize milk. Subsequently, the government was also able to register milk production and increase documentation. Recording of milk production through registration was helpful to quantify and analyze the supply and demand of milk and adopt suitable strategies to address issues related to milk shortages during summer months.[84]

[83] Business Recorder. 2020. An Interview with Sarfaraz Rehman, Dairy Expert. https://www.brecorder.com/news/40023511
[84] Yilmaz. O.T., 2017. A study of milk support policies in the European Union and in Turkey. European Journal of Interdisciplinary Studies

While pasteurization is the first step towards formalizing the dairy sector, it might not be suitable for certain areas of the country. This is because Pakistan has prolonged summers, the dairy sector is clustered in Punjab from where the milk is supplied across the country and pasteurized milk requires very robust supply chain infrastructure to maintain temperature. In such areas, UHT milk would be considered a more suitable and feasible alternative to pasteurized milk.

The provincial food authorities are responsible to introduce legislation which improves access to safe food for citizens. The livestock department of Punjab and the Punjab Food Authority (PFA) have finalized an action plan for the implementation of a minimum pasteurization law to ensure the provision of pasteurized and safe milk to consumers in the province.[85] According to the PFA regulations introduced in 2018, the minimum pasteurization law will come into force by July 2022 in the province of Punjab.[86] The eventual implementation and formalization of a minimum pasteurization law will support the formalization of the dairy sector of Pakistan and increase value added production. But for the law to be effective, stakeholders need to be taken on board and experiences of other countries should also be taken into consideration.

## 6.2 Ultra-High Temperature (UHT) Treated Milk

The dairy processing companies procure raw milk from dairy farmers or corporate farms for processing raw milk into UHT treated milk. UHT treated milk has a longer shelf life than pasteurized milk due to an intensive heating procedure and aseptic packaging which enables it to be transported over long distances and stored over a longer period at ambient temperatures. Box 6 explains in detail the heat treatment, packaging and storage of UHT milk.

### Box 6 – What is UHT Treatment

Ultra-High Temperature treatment is heating the raw milk at temperature 135 - 150 $^{o}$C for 1 -2 seconds to eliminate all pathogenic micro-organisms that might develop in the milk. The milk is cooled to room temperature immediately after 1-2 seconds of heating. This heat treatment gives milk a longer shelf life than pasteurized milk.

The milk is packaged in sterile, hermetically sealed containers that can be stored without refrigeration for months. In Pakistan, due to the absence of cold chain infrastructure, the shelf life of UHT treated milk packed in aseptic packaging is three months. In the rest of the world, the shelf life is nine months due to the existence of a developed cold chain infrastructure. Once the UHT milk package is opened, it needs to be immediately refrigerated or the milk spoils.

Source: Tetra Pak Dairy Processing Handbook & FAO Milk and Dairy Products in Human Nutrition

[85] Express Tribune. 2019. Plan for Pasteurization Policy Finalized in Punjab. https://tribune.com.pk/story/1978571/plan-pasteurisation-policy-finalised-punjab
[86] Business Recorder. 2019. Minimum Pasteurization Law coming into force by July 2022. https://www.brecorder.com/news/498946

UHT treated milk is either used in tea making or in the confectionary industry in urban areas of Pakistan. As per industry sources, approximately 70 percent of milk in Pakistan is used for tea making while the remaining 30 percent is used for direct consumption or for the production of confectionaries. The consumption of tea is not seasonal and therefore the demand for UHT treated milk remains constant throughout the year. Within the UHT milk category, the market share for full cream milk is approximately 99 percent, whereas low fat milk is a niche product. While the urban consumers use full cream milk for tea making, the uptake of low-fat milk is increasing gradually as health-conscious urban consumers are changing their milk preferences.[87]

There is a significant price differential between the prices of UHT, pasteurized and loose milk. The price of UHT milk in Pakistan is approximately PKR 160 per liter whereas, the price of pasteurized milk and loose milk is approximately PKR 140 and PKR 110 per liter respectively.[88] Table 8 provides the breakdown of costs in the production of one liter of UHT packaged milk.

| Cost Component | Indicative Cost Split in the Production of 1 Liter UHT Milk (%) |
|---|---|
| Raw Material | 45 |
| Packaging | 15 |
| Processing | 6 |
| Overheads | 20 |
| Distributor/Retailer Margin | 14 |

Table 8 - Indicative cost contribution in the production of one liter UHT treated milk pack

Source: Dairy Industry

Since the demand for milk is price elastic, this difference in cost and hence the gap in retail price of milk adversely impacts the uptake of pasteurized and UHT treated milk which is safer and unadulterated as compared with loose milk, which can be adulterated and become harmful for human health. Increasing consumer awareness regarding the consumption of packaged milk and addressing misconceptions regarding packaged milk and its nutritious value is important to increase the uptake of packaged milk in Pakistan. The government can play a role in creating awareness and reducing the price through implementing the minimum pasteurization law and creating a level playing field for the private sector through introducing cost reduction mechanism.

In developed economies, approximately all milk produced is packaged either in the form of pasteurized or UHT treated milk. In Australia, it is illegal to sell raw milk for human consumption. In a few EU countries, such as Denmark, Belgium, Germany, Switzerland and Holland, on-farm sale of milk is permitted, however farmers must pass stringent quality tests before the milk can be sold to consumers. In the United States of America (USA), the federal government and the states play a

[87] Business Recorder. 2019. Minimum Pasteurization Law coming into force by July 2022. https://www.brecorder.com/news/498946
[88] Industry sources

significant role in governing milk safety. The Food and Drug Administration (FDA) in the USA made pasteurization mandatory for interstate sale of milk. Raw milk is not allowed to cross state borders for sale to the end consumer. While the federal government has regulated the interstate sale of milk, the individual states have implemented their own laws. Many states have prohibited the sale of unpasteurized milk. A limited number of states allow sale of raw milk directly to consumers. The Center for Disease Control (CDC) has emphasized that legalization of the intrastate sale of raw milk is expected to increase the disease burden associated with consumption of raw milk and has also documented fewer milk-related illnesses in states that have prohibited sales of raw milk.[89]

Unlike Pakistan, the sale of raw milk in the developed countries is highly regulated. In New Zealand, although most milk sold is pasteurized, farmers are allowed to sell raw milk either at their farm or via home delivery directly to the consumers without involvement of an intermediary. Farmers intending to sell raw milk are required to be registered with the Ministry of Primary Industries (MPI) and need to produce and sell milk under a Regulated Control Scheme (RCS). Farmers need to meet certain requirements as mentioned in the RCS to minimize risks to public health so that the risks of producing and selling raw milk can be identified, monitored, evaluated and managed. Farmers need to test for pathogens, keep sales records, and keep their animals in good health. The sale of raw milk is strictly regulated by the Raw Milk for Sale to Consumers Regulations 2015 which outlines certain requirements for sale.[90] This indicates that the government of New Zealand recognizes that raw milk is a high-risk food carrying an increased risk of food borne disease as compared to pasteurized milk.

## 6.3 Cheese

Globally, the consumption of cheese has increased in recent years due to changing dietary habits and increasing incomes in Southeast Asia. Since many emerging cheese markets do not have established cheese industries, they rely on the import of cheese. Large quantities of cheddar and mozzarella are imported each year and are used as ingredients by fast foods and restaurants.

The USA and Germany accounted for 37 percent of total world's production of cheese in 2018. The USA is the largest global producer of cheese accounting for 27 percent of the world's total cheese, followed by Germany which is the second largest cheese producer in the world having 10 percent share in total world production of cheese. Among the top ten producers of cheese in the world, five belong to the EU accounting for 30 percent of the world's total cheese production. Approximately 80 percent of total cheese produced is made from cow's milk and the remaining from goat, sheep and buffalo milk. In USA and Germany, cheese production utilizes more than 40 percent of the milk produced. [91]

[89] Centers for Disease Control and Prevention. Public Health Professionals Gateway. Raw Milk: A Research Anthology of Legal and Public Health Resources.
[90] Ministry for Primary Industries New Zealand. Selling Raw Drinking Milk to Consumers.
[91] World Cheese Market 2000-2020. PM Food & Dairy Consulting.

Table 9 mentions tops ten producers of cheese in the world.

| Top producers | Quantity produced (tons) |
|---|---|
| United States of America | 6,315,293 |
| Germany | 2,422,712 |
| France | 1,738,665 |
| Italy | 1,213,506 |
| Netherlands | 953,000 |
| Poland | 742,886 |
| Russian Federation | 702,318 |
| Egypt | 607,202 |
| Canada | 593,078 |
| United Kingdom | 470,000 |
| **World** | **23,483,289** |

Table 9 – Top Producers of Cheese

Source: FAO Statistics Database 2018

According to anecdotal evidence, the demand for cheese is growing in Pakistan. The imposition of regulatory duties and currency depreciation has encouraged local production of cheese, since imported cheese has become quite expensive. At the same time, domestic consumption of cheese has also been steadily increasing over the last decade. This growth is attributed to an increase in consumption of cheese by fast-food chains and restaurants in Pakistan. The household consumption of cheese in cooking is still quite low.

Pakistan imported USD 6.2 million worth of cheese in 2020. [92] Local production of cheese is important for import substitution and to meet the increasing demand for cheese. As a result, several joint ventures are taking place in the value-added segment of the dairy sector. Given that the production of value-added dairy products like cheese requires expertise to develop and maintain quality, dairy processors in Pakistan are establishing international partnerships. The dairy processing companies in Pakistan have opted for mozzarella as a starting point for local cheese production as its manufacturing takes approximately 8-10 hours of processing time and between 24-36 hours of curing time. This makes mozzarella easier to manufacture, store, and ship as compared with other cheese varieties. Evidence suggests that buffalo milk is more suitable for production of cheese than cattle milk. On account of its composition, buffalo milk is more appropriate for soft and hard types of cheeses as it has higher fat content as compared to cow's milk. Moreover, buffalo milk acidifies better than cow's milk.

[92] ITC Trade Map

Moreover, cheese manufacturing provides two major dairy bi-products, Whey water and Milk Fat. The fat is used to manufacture butter. The whey collected from cheese production is a valuable raw material as whey products are used in a wide range of food products, such as processed meat, health foods and confectionery.

## 6.4 Powdered Milk

The global milk powder market was valued at USD 27 billion in 2021.[93] In the last few years, the market has been growing at a Compounded Annual Growth Rate (CAGR) of approximately four percent[94] and is expected to grow further given the rising demand of milk powder due to changing dietary habits and improving economic conditions in the emerging countries. Two major types of milk powders that dominate the milk powder market are WMP and SMP which are described in Box 7 below.

### Box 7 – Types of Milk Powders

Milk powder is a dry dairy product, manufactured by dehydrating milk using evaporation. The purpose of making milk powder is to increase the shelf life of milk without refrigerating it and reducing its volume. Two major types of milk powder include:

**Whole milk powder**

WMP is obtained by removing water from pasteurized and homogenized whole milk. WMP must contain 26 to 40 percent of milkfat (by weight) and not more than 5 percent moisture (by weight). Milk that is intended to be turned into WMP is pasteurized at 80 to 85 degrees Celsius. WMP is mostly used to prepare soups, sauces, bakery and confectionary food items.

**Skimmed milk powder**

SMP is obtained by removing water from pasteurized skim milk. SMP must contain 1.5 percent or less milkfat (by weight) and 5 percent or less moisture (by weight). Milk that is intended to be turned into SMP is pasteurized at 80 to 85 degrees Celsius. SMP is mostly used to prepare low fat dairy products.

Source: Tetra Pak Dairy Processing Handbook

The milk powder market is currently being driven by its longer shelf life when compared with liquid milk (both pasteurized and UHT treated), convenience in storage and transportation across long distances. Furthermore, increased participation of women in the workforce has driven the growth in demand for infant milk powders. Increasing incomes in emerging countries and changing lifestyles has encouraged people to depend on packaged and processed foods for their convenience. This has led to an increase in the demand for milk powder.[95]

The global milk powder market is expected to expand further due to a shift in consumer preference for alternatives to liquid milk. Powdered milk is globally acceptable to be used in infant foods because of the presence of several nutrients such as vitamin B12, thiamin, vitamin C, and high protein.[96]

Milk powder is preferred for use in several food products. It serves as a key ingredient in nutrient-rich healthy food products, which are high in protein and essential vitamins. Whole milk powder is commonly used in the food processing industry. Milk powders are used for emulsification in salad dressings, soups, sauces and baked goods. It is also used as foaming agents in the preparation of cakes, mousses and ice creams. Milk powders are also used to make infant formula for children, sports and nutrition foods, dry mixes and fermented milk products. [97] The development of flavored milk powder has led to the creation of new opportunities in the market.

World production of milk powders (WMP & SMP) was reported to be 8.5 million tons in 2018 out of which 53 percent was SMP and 47 percent was WMP. Leading producer of skimmed and whole milk powder combined was New Zealand with 1.8 million tons that is 21 percent of world production. New Zealand leads the production of whole milk powder, and the United States of America leads the production of skimmed milk powder. Table 10 mentions the top ten producers of WMP and SMP that constitutes 77 percent of the total world production of whole and skimmed milk powder.

[95] IMARC Group. Milk Powder Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026
[96] Mordor Intelligence. Milk Powder Market – Growth, Trends, Covid-19 Impact and Forecasts (2021-2026)
[97] IMARC Group. Milk Powder Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026

| Whole milk powder | | Skimmed milk powder | |
|---|---|---|---|
| **Top Producer** | **Quantity produced (tons)** | **Top Producer** | **Quantity produced (tons)** |
| New Zealand | 1,420,000 | United States of America | 1,060,000 |
| Brazil | 585,000 | France | 562,377 |
| Argentina | 192,178 | Germany | 396,178 |
| France | 181,123 | New Zealand | 390,000 |
| Mexico | 148,934 | India | 286,493 |
| Uruguay | 146,000 | Australia | 190,926 |
| Netherlands | 119,227 | Belgium | 190,000 |
| Germany | 96,681 | Poland | 177,156 |
| Australia | 82,499 | Ireland | 133,800 |
| Denmark | 80,000 | Belarus | 120,600 |
| **World** | **3,972,294** | **World** | **4,562,099** |

Table 10 – Top Producers of WMP and SMP

Source: FAO Statistics Database 2018

Some countries are actively trying to increase their production of milk powders. For instance, the Government of Turkey subsidizes milk powder producers to encourage them to produce milk powder domestically.[98] To protect the domestic dairy farmers, Turkey has also imposed import duties of 180 percent on milk powders.[99]

Nearly 5.5 million tons of WMP & SMP was imported globally in 2020. The leading importer of both WMP & SMP is China having an approximate 18 percent share in global imports of milk powders. Table 11 lists the top ten importers of WMP & SMP that contribute 62 and 55 percent of the total global imports, respectively.

[98] Kýrdar, S .S. & Karaca, O.B. 2017. An Overview of the Turkish Dairy Sector. Indian Journal of Dairy Science. 70(3)
[99] Yilmaz, O. T. 2017. A Study of Milk Support Policies in the European Union and in Turkey. European Journal of Interdisciplinary Studies. Vol. 9. Issue 1

| Whole milk powder | | Skimmed milk powder | |
|---|---|---|---|
| **Top Importer** | **Quantity Imported (tons)** | **Top Importer** | **Quantity Imported (tons)** |
| China | 633,693 | China | 335,599 |
| Algeria | 228,562 | Indonesia | 197,349 |
| Saudi Arabia | 142,282 | Netherlands | 184,149 |
| Nigeria | 135,749 | Philippines | 179,495 |
| United Arab Emirates | 104,865 | Mexico | 164,030 |
| Brazil | 88,823 | Nigeria | 122,286 |
| Sri Lanka | 87,875 | Algeria | 121,395 |
| Bangladesh | 71,186 | Malaysia | 117,142 |
| Oman | 68,560 | Viet Nam | 99,947 |
| Thailand | 57,764 | Belgium | 80,584 |
| **World** | **2,609,060** | **World** | **2,922,354** |

Table 11 – Top Importers of WMP and SMP

Source: ITC Trade Map 2020

In China, the consumption of milk powders is expected to continue increasing in the future as consumption of dairy products increases and the processing industry grows. Furthermore, recently the consumption of milk powders increased rapidly due to a positive change in consumer perceptions regarding milk powders.[100]

In Pakistan, due to a seasonal variation in the supply and demand of milk, SMP is imported to bridge the supply gap. The government needs to incentivize the production of SMP in Pakistan as it is critical to bridge the milk supply shortfall, reduce milk adulteration and for import substitution. Also, for the domestic dairy industry to grow, Pakistan needs to discourage import and promote domestic production of powdered milk, as is being practiced by China and Turkey.

Production of value-added dairy products will have a sizable impact on the national Gross Domestic Product (GDP). It will create new jobs throughout the value chain and provide linkages between farmers and urban processing centers. With appropriate policy measures, Pakistan can ensure sufficient production of milk. Also, Pakistan can create opportunities in the global market to increase its dairy exports to the regional markets.

[100] USDA & GAIN. 2020. Dairy and Products Annual - China

# GOVERNMENT INTERVENTIONS IN THE SECTOR

# 7. Government Interventions in the Sector

The Government of Pakistan has taken different regulatory and fiscal policy measures to promote the dairy sector. This section will discuss laws and regulations implemented by the federal and provincial governments and the fiscal regime for the sector.

## 7.1 Regulatory Regime

Policy support provided by the Government of Pakistan in the form of favorable policies provides an enabling environment for growth. This has encouraged milk processors to enter the market but with rapidly changing dynamics of the domestic and global market, there is a need to revisit existing policies and regulations and create a long-term strategic plan. This section will discuss the regulatory regime introduced by the government for the growth of the dairy sector.

### 7.1.1 Livestock Development Policy

The Livestock Development Policy was introduced by the Government of Pakistan in 2007. The policy encouraged the establishment of large corporate dairy farms by providing various incentives including exemption of import duties and tax on dividends, availability of government-owned land for lease and dairy financing.

The overall thrust of the policy was to foster private sector-led development of corporate farms with public sector providing an enabling environment to increase animal yield, milk production and increasing farm size through a move from subsistence to commercial farming. The emphasis of the policy was to increase animal productivity rather than creating larger herd size. Productivity of cattle would be enhanced by improvement in breeding programs and provision of better health care services to livestock farmers. Furthermore, the policy aimed to target the entire value chain and implement a plan covering all segments to enhance productivity and profitability of the sector. The plan also provided an institutional framework for the implementation of the policy with specific roles for the federal, provincial and local governments.

The policy recognizes the fact that milk powder is imported into Pakistan from countries which provide production and export subsidies to the dairy farmers, providing them a price advantage. It acknowledged that this has an adverse impact on Pakistan's dairy industry and that further efforts are needed to ensure a level playing field for the local dairy industry. Furthermore, the policy measures included improving the provision of high-yielding fodder varieties. While feed was not being exported when this policy was being devised, any new policy should aim to address this issue. It has a great impact on the dairy sector competitiveness since higher feed cost translates into higher input costs for all value-added dairy products.

De-regulation of milk prices, which are set by the local governments at district level, is important to remove distortions. Fixed prices are not based on the cost of production and dis-incentivize investments.

One of the policy measures included in the policy was deregulation of milk prices, which the government has not implemented yet.

The policy highlights three measures for developing high-yielding breeds: progeny testing program for buffalo and cattle, upgrading genetics of local breeds through cross-breeding and artificial insemination. All three measures need to be scaled up throughout the country to have an impact on the overall yield of dairy animals. At present, breed improvement programs are being implemented on a very small scale and most of the dairy farmers do not have access to progeny testing, crossbreeding and artificial insemination facilities.

The policy also mentions improving availability of vaccines through the development of vaccine production facilities and improvement of veterinary vaccines and diagnostic services. Since large corporate farms import dairy cattle, suitable vaccines are unavailable in Pakistan which leads them to import vaccines. The policy needs to be updated with measures allowing smooth import and registration of vaccines.

To encourage large scale corporate dairy farming as mentioned in the policy, the government plans to develop a dairy zone in each district. The zone will have proper infrastructure and facilities to support the dairy business and the land will be leased on a five-year basis. This needs to be implemented to enable sector growth.

### 7.1.2 The West Pakistan Pure Food Ordinance[101]

The Pure Food Ordinance was introduced in 1960 and it relates to the preparation and the sale of foods. All provinces/ regions have adopted this law with certain amendments. The Ordinance aims to ensure that food that is being supplied to people is pure and unadulterated. It also prohibits any person to mix, color, stain or powder any food, if the mixing involves violation of prescribed rules or is likely to make the food injurious for health. The law also prohibits sale, preparation, manufacture, import or export of such food for human consumption, which is unsound, unwholesome, or injurious to health, in addition to misbranded food items. Besides, the law sets rules for labeling, storage and packing of food and sets out certain hygiene standards and provides for inspection and laboratory analysis. The responsibility for enforcement of this Ordinance lies with the local authority that is designated by the government. The ordinance also instructs to seize and destroy the food, apparatus, utensil or vessel if found unsound, unwholesome or unfit for human consumption by the representative of the designated local authority.

[101] The West Pakistan Pure Food Ordinance. https://phkh.nhsrc.pk/sites/default/files/2021-01/Pure%20Food%20Ordinance%20West%20Pakistan%201960.pdf

### 7.1.3 The Pakistan Standards and Quality Control Authority Act

This Act was introduced by the Federal Government in 1996 and stipulates the establishment of Pakistan Standards and Quality Control Authority (PSQCA), which is the apex body to formulate and enforce quality control standards. It also has the mandate to inspect and test products including food items, for quality, specification and characteristics during use, and for import and export purposes.

### 7.1.4 The Livestock Breeding Act (Provincial Law)[102]

Passed by the Punjab Assembly in 2014, this Act regulates livestock breeding services to improve the genetic potential of breeds and protect the indigenous breeds of livestock in Punjab. The Livestock Breeding Services Authority was established under this Act by the Punjab Livestock Department. The authority regulates provision of breeding services, raises awareness regarding breeding and conserves and develops local genetic resources as specified in the Act. In accordance with the Punjab Livestock Breeding Act 2014, the Livestock Breeding Service Authority issued Standards and Procedures for Breeding Animals in 2015. The standards include Standard Operating Procedures for selection of breeding males for artificial insemination and natural service, physical infrastructure for semen production facilities, semen collection and preservation standards, artificial insemination training and training institutions, artificial insemination services and the guidelines for import and use of semen.

The Livestock Breeding Act was passed by the Sindh Assembly in 2017 with similar provisions as in the Punjab Livestock Breeding Act 2014. With appropriate funding and implementation mechanism adopted by the provincial governments, this could be an effective regulation to help improve genetics of livestock.

### 7.1.5 The Punjab Animals Feed Stuff and Compound Feed Act (Provincial Law)

This Act was introduced in 2016 to regulate the manufacture, storage, supply, transport for sale and marketing of feed stuff and compound feed in Punjab. This regulation regulates standards of production and quality of feed stuff and to check adulteration and misbranding of livestock feed stuff and compound feed ingredients. This Act provides a list of feed stuff to be used in manufacturing compound feed. As per the Act, the production and sale of feed without a valid license and proper branding and labelling is prohibited. The Feed Stuff and Compound Feed Rules were issued in 2017 by the provincial government. The rules include conditions for issuance of license for manufacturing and sale of feed stuff and compound feed, license fee, procedure of

[102] Punjab Laws. The Livestock Breeding Act. http://punjablaws.gov.pk/laws/2567.html

packing and marking, seizure of samples or sealing of the premises, procedure for analysis of samples and standards for approval of analytical laboratories.

### 7.1.6 The Punjab Animal Health Act[103]

This Act was introduced in 2019 to regulate prevention, control, containment and eradication of animal diseases in order to meet international standards of import/ export of animals and animal products. As per the Act the government is authorized to declare an area as an eradication area where the government is undertaking vaccination drives and disease treatment as necessary for eradication of the disease. The government is also authorized to declare an area disease-free after the area is verified through independent inspectors once in every five-year period. Under this Act, the government prescribes rules for traceability of animals including maintenance of information for the animals. The Act outlines clauses regarding vaccination and other preventive measures regarding controlled areas, movement of animals in controlled areas, duty of certain persons to report the existence of scheduled diseases, separation of infected animals, quarantine units, welfare of animals, cleansing and disinfection, post-mortem examination in case of death due to disease and disposal of infected carcass.

## 7.2 Fiscal Regime

Between 2006-2016, dairy sector was zero-rated, which meant 17 percent General Sales Tax (GST) which was charged as input tax was refundable. In 2016, the zero-rating was removed and the exemption regime was implemented where the input tax was non-refundable. This had a negative impact on the industry's growth and profitability. The incidence of tax resulted in reduction in total volume of packaged milk sold. Prior to zero rating, the sales volumes for packaged milk were increasing year-on-year, however it started to decline immediately after the zero-rating was withdrawn. This indicates that consumers of packaged milk are price sensitive and even with increasing domestic market size, many consumers quickly shift to untreated milk alternatives if prices are increased. Zero-rated regime has now been restored for the dairy sector.

[103] Punjab Laws. The Punjab Animal Health Act 2019. http://punjablaws.gov.pk/laws/2754.html

Table 12 below provides GST rates applicable on value-added dairy products for the last five years.

| Category | Year | | | | | Proposed Amended Finance Bill (Dec 29, 2021) |
|---|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 | |
| UHT Milk | Exempt | Exempt | Exempt | Exempt | Exempt (Jan-Jun 2021)<br>Zero Rated<br>(From July 2021) | Zero rate |
| Dairy Drink | Exempt | Exempt | Exempt | Exempt | Exempt (Jan-Jun 2021)<br>Zero Rated<br>(From July 2021) | Zero rate |
| Milk Powder | N/A | N/A | 17% (From Jan to Jun 2019)<br>10% (From July 2019) | 10% | 10% | 17% |
| UHT Cream | 10% | 10% | 10% | 10% | 10% | 17% |
| Desi Ghee | 10% | 10% | 10% | 10% | 10% | 17% |
| Ice Cream | 17% | 17% | 17% | 17% | 17% | 17% |
| Cheese | 10% | 10% | 10% | 10% | 10% | 17% |

Table 12 – Five-year trend of GST rates on value-added dairy products

Source: Friesland Campina Engro Pakistan Limited

Applying a zero-rated tax regime on sale of milk is a standard practice around the world. The reason for this is that milk is a crucial nutritional supplement for the population and part of the staple diet. The Household Integrated Economic Survey published by the Pakistan Bureau of Statistics confirms that an average household in Pakistan spends 27 percent of its food related expenditure on milk, which is two and half times what it spends on wheat flour. This alludes to the importance of ensuring a steady supply of milk at a reasonable cost.

If compared with other countries, in China milk is exempted of Value-Added Tax (VAT), [104] in UK it is zero-rated[105] and also in India pasteurized milk is zero-rated. [106] Therefore, continuing the existing zero-rated tax regime for packaged milk in Pakistan serves a key nutritional requirement of the consumers and is aligned with the global practice.

The government has also imposed duties up to 45 percent (import duty 20 percent and regulatory duty 25 percent) to discourage import of milk powder.

Table 13 below provides various duty rates applicable on milk and milk powder for the last five years.

| Product Category | Tax/Duty | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 |
|---|---|---|---|---|---|---|
| Milk (packaged/unpackaged) | Custom Duty | 20% | 20% | 20% | 20% | 20% |
| | Additional Custom Duty | 1% | 2% | 7% | 7% | 6% |
| | Regulatory Duty | 0% | 0% | 0% | 0% | 0% |
| | Corporate Income Tax | 30% | 29% | 29% | 29% | 29% |
| Milk Powder (under brand name & retail packing) | Custom Duty | 20% | 20% | 20% | 20% | 20% |
| | Additional Custom Duty | 1% | 2% | 7% | 7% | 6% |
| | Regulatory Duty | 25% | 25% | 25% | 25% | 25% |
| | Corporate Income Tax | 30% | 29% | 29% | 29% | 29% |
| Milk Powder (non-branded name & bulk packing) | Custom Duty | 20% | 20% | 20% | 20% | 20% |
| | Additional Custom Duty | 1% | 2% | 7% | 7% | 6% |
| | Regulatory Duty | 25% | 25% | 25% | 25% | 25% |
| | Corporate Income Tax | 30% | 29% | 29% | 29% | 29% |

Table 13 – Five-year trend of various duties on milk and milk powder

Source: Nestle Pakistan

## 7.3 Government Programs and Initiatives for the Sector

The Government of Pakistan, on the federal and the provincial levels have introduced several programs and initiatives for the dairy sector, these include:

- The government in collaboration with the Pakistan Dairy Development Company (PDDC) initiated a project to increase milk production by enabling dairy farmers to access financing. The farmers received financing from various commercial banks under a tripartite agreement between the PDDC, dairy farmers and the banks.

[104] KPMG. China VAT Essentials Guide 2021
[105] The Government of UK. Food Products (VAT Notice 701/14)
[106] India Filings. GST Rate for Milk, Dairy Products, Eggs and Honey

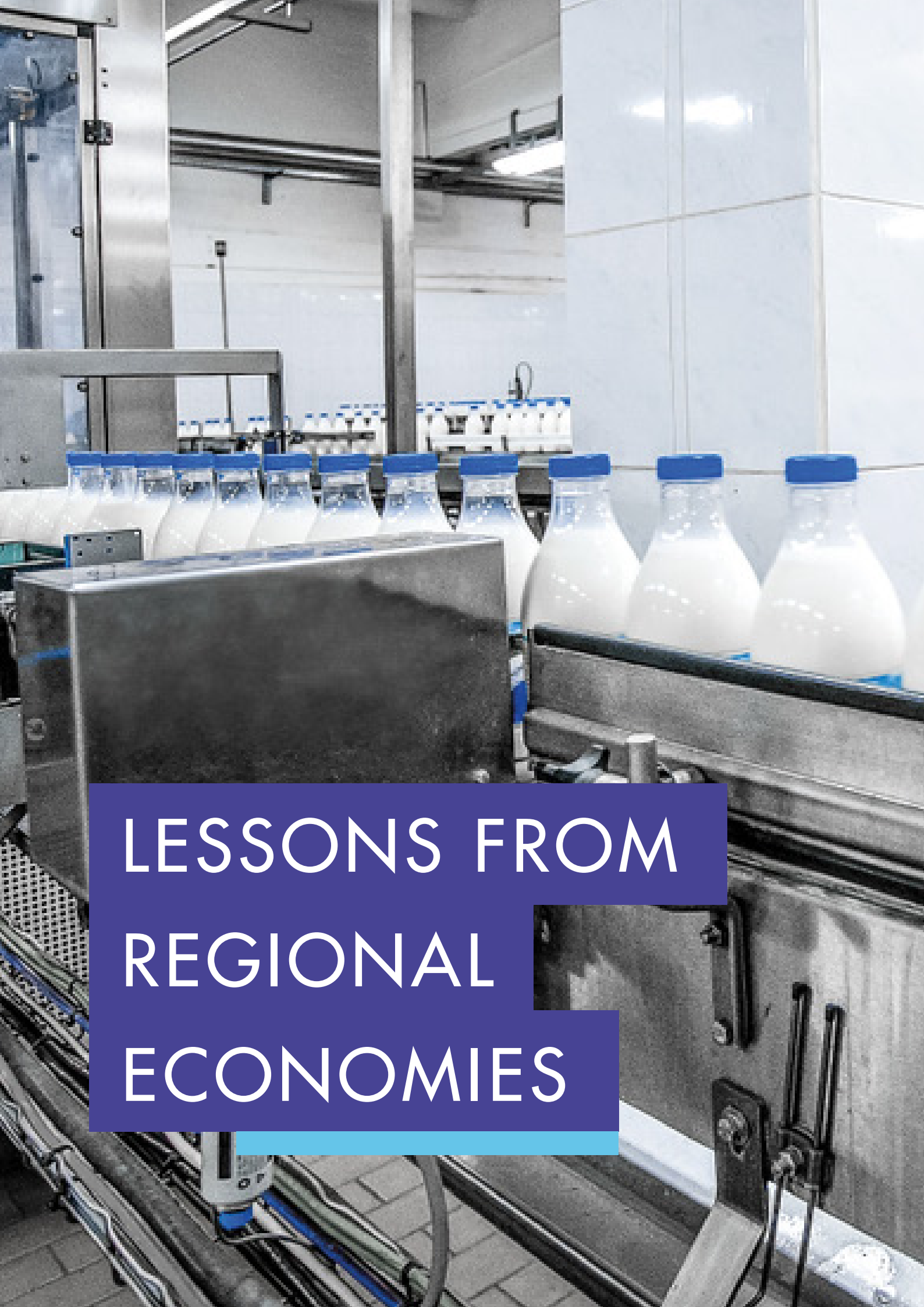
- A five-year project named 'Milk Collection, Processing, Dairy Production and Development Program' was initiated by the government to provide dairy animals of improved genetic potential to the small dairy farmers to improve milk yields and production. Under the program, Milk Producer Groups (MPGs) were established in all provinces, milk cooling tanks were installed, and fodder was provided to the members of the MPGs. The program was small-scaled and reached few dairy farmers. The program was discontinued after five years, and its impact was short-lived.

- Another five-year program known as the 'Prime Minister's Special Initiative for Livestock' was launched to increase productivity of livestock through improved access to extension services by small dairy farmers. Veterinary services and vaccines were made available to farmers at reduced cost. Training on veterinary services and animal husbandry was imparted to the rural community members and female livestock farmers. This was another initiative that was discontinued after five years with a short-term impact on the dairy sector.

- Under the project 'Improving Reproduction Efficiency of Cattle & Buffaloes in Small Holder's Production System', a semen production center and an embryo transfer technology center were established which collected superior quality semen and embryos and conducted artificial insemination. This was implemented only at Okara Military Dairy Farms.

In addition to the above discussed programs, the government provided certain initiatives to the dairy sector to increase production. These initiatives included duty free import of veterinary dairy and livestock equipment, allowing import of high yielding animals, semen and embryos for the genetic improvement of local breeds, allowing import of high-quality feed stuff, imposing duties to discourage import of SMP and whey powder. Recently, the government has approved a plan to import the American bull semen and distribute it among the dairy farmers free of cost. The government made significant efforts to eradicate rudder pest disease and is now also taking steps to diagnose and control FMD. These initiatives led to an increase in investment by the private sector in dairy farming and processing.

The government has introduced and implemented various programs to enable growth of the dairy sector, but all such initiatives were implemented on a small scale for a short-term. Therefore, the impact was not sustainable. The livestock policy, if revised to address the present challenges and implemented in its entirety, has the potential to achieve a tangible impact.



# LESSONS FROM REGIONAL ECONOMIES

# 8. Lessons from Regional Economies

This section discusses the case studies of regional countries which have increased their production over the last two decades with dedicated long-term efforts by their respective governments and private sectors. As a result, these countries have been able to increase their output manifold and have developed their export markets.

## 8.1 Turkey – Achieving highest growth of dairy sector in the region

In Asia, Turkey is the third largest producer[107] and exporter of milk and dairy products. Turkey's dairy exports have grown rapidly over the last twenty years at a CAGR of 15 percent, which is greater than any other country in Asia. Figure 3 below shows growth in dairy exports of Turkey.

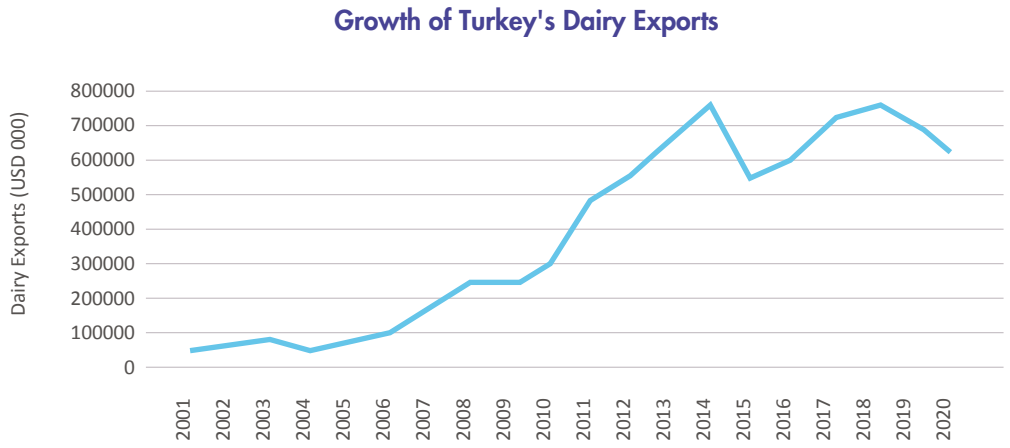



Figure 3 – Growth of Turkey's Dairy Export
Source: ITC Trade Map

The increase in dairy exports of Turkey is attributed to an increase in milk production and the production of a wide variety of value-added dairy products. Milk production increased due to an increase in the number of dairy farms and higher annual milk yield per cow.

Animal yields are high in Turkey because most of the livestock consists of international breeds and cross-bred cattle. Approximately 44.4 percent of livestock consists of international high-yielding varieties, 42.2 percent are cross-bred cattle and only 13.5 percent are domestic breeds (local breeds have lower yields than the international or cross-bred cattle). Furthermore, improved breeding techniques and feeding systems have led to sizeable increases in yields. Milk yield per cow increased from 1,670 liters in 2001 to 3,158 liters in 2019.[108]

[107] Production of cow milk
[108] FAO statistics 2019

With increasing milk production, the government of Turkey ensured that milk is traceable, and sales are registered. For this, the government initiated a process of registration of farmers and their sales. Since, the Milk Collection Centers (MCCs) are the primary control point for food safety, it was compulsory for dairy farmers to get their sales registered at the MCCs. This resulted in milk production being recorded. The government provides a milk incentive premium to farmers who sell milk to the MCCs. This premium is paid for every liter of raw milk delivered to specified dairy processing plants, which have a capacity of higher than 1,000 tons/year.[109] Payment of a premium ensured an increase in milk production and processing, thereby reducing the ratio of informal or street sales which are unregistered. Informal sale of raw milk has reduced to only 11 percent of the total milk sold in Turkey.[110]

UHT treated milk accounts for 44 percent of the total milk produced in Turkey, whereas the share of pasteurized milk is 2 percent. Cheese has 33 percent share in total dairy produce. Most popular cheese types in Turkey are traditional white, semi-soft, and feta type cheese. Yogurt and Ayran (a drink made of yogurt and salt) is the third largest segment of the dairy market with a share of approximately 18 percent. Figure 4 shows the market share of major dairy products in Turkey.

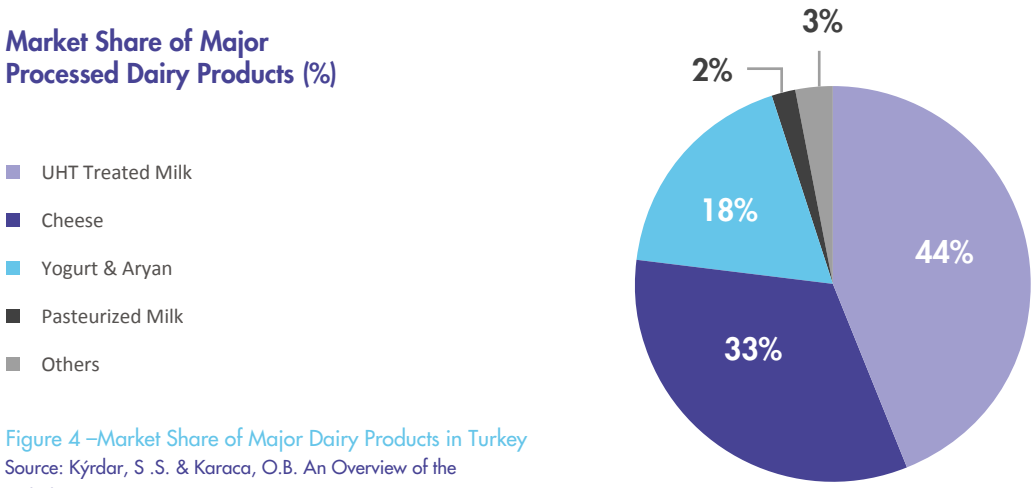



Figure 4 –Market Share of Major Dairy Products in Turkey
Source: Kýrdar, S .S. & Karaca, O.B. An Overview of the Turkish Dairy Sector 2017

Since milk yields are high in Turkey, there is a seasonal surplus of milk. The government determines the surplus amount through the milk sales registration mechanism in place at the MCCs and subsidizes the milk powder producers to purchase the surplus milk from the farmers at a price set by the government. The surplus milk is then converted into milk powder to be used in the production of various value-added dairy products and confectionaries.[111]

In addition to raising consumer awareness, income growth and changes in dietary habits, increase in milk production is also driven by an increase in milk consumption in Turkey. The 'School Milk Project' was launched in 2011 by the Ministry of Food, Agriculture and Livestock in order to increase domestic demand of milk and milk processing in Turkey. As a result, several modern milk

[109] Gonenc. S. & Tanrivermis. H. 2008. An overview of Turkish dairy sector. International Journal of Dairy Technology. Vol.61. No.1
[110] Kýrdar, S .S. & Karaca, O.B. 2017. An Overview of the Turkish Dairy Sector. Indian Journal of Dairy Science. Vol. 70. No.3
[111] ibid

processing plants have emerged and high-tech investments in the dairy sector have increased. [112]

The government of Turkey implemented a farm restructuring program to enable the establishment of large corporate farms. Under this program, the Turkish Agricultural Bank offered long-term loans with zero interest rates for dairy-related activities. As a result of this incentive, several large-scale farms and dairy processing units were established. The government is presently implementing an agricultural plan until 2023 and is reforming subsidies to boost the dairy sector. Each year the Turkish government pays over seven billion Turkish Lira to farmers in the form of subsidies. The dairy farmers receive approximately 0.09 Turkish Lira per liter of milk sold as registered milk, around 50 Turkish Lira per cattle head on annual basis to support farm modernization as per the EU standards and an estimated amount of 200 Turkish Lira per cattle head per year to finance vaccinations in order to improve and maintain animal health.[113]

The government of Turkey has recognized China as one of the world's largest dairy importers in the world with an import market of nearly USD 7 billion[114] and has taken necessary steps to eliminate obstacles to export and open market access for its dairy processing companies. Turkey exported dairy products worth USD 14.7 million to China in 2020 which grew by an annual growth rate of 137 percent from USD 0.4 million in 2019.[115] The government now aims to continue its efforts to ensure market diversification and to increase market share of its dairy products in China.

Pakistan can adopt strategies implemented by Turkey to increase consumption of safe and processed milk, focus on improved breeding programs to increase milk yields and promote large herd size to provide farmers with economies of scale. A demand push for safe and processed milk could drive pasteurization as well.

## 8.2 India – Implementing long-term programs to increase milk production

Operation Flood which was initiated by the National Dairy Development Board (NDDB) in 1970 and which is one of the largest rural development programs in the world was implemented across India over a period of 26 years. This program made India emerge as the world's largest milk producer with 182 million tons of milk produced in 2019.[116] Figure 5 illustrates the growth in milk production through the years. The impact of Operation Flood is quite evident in the increase in milk production since 1970.

[112] ibid
[113] Dairy Global. Turkish Government supports its dairy farmers.
https://www.dairyglobal.net/Articles/General/2016/4/Turkish-government-supports-its-dairy-farmers-2796689W/
[114] ITC. Trade Map 2020
[115] ITC. Trade Map 2020
[116] FAO Statistics Database. Includes milk produced by cow and buffalo

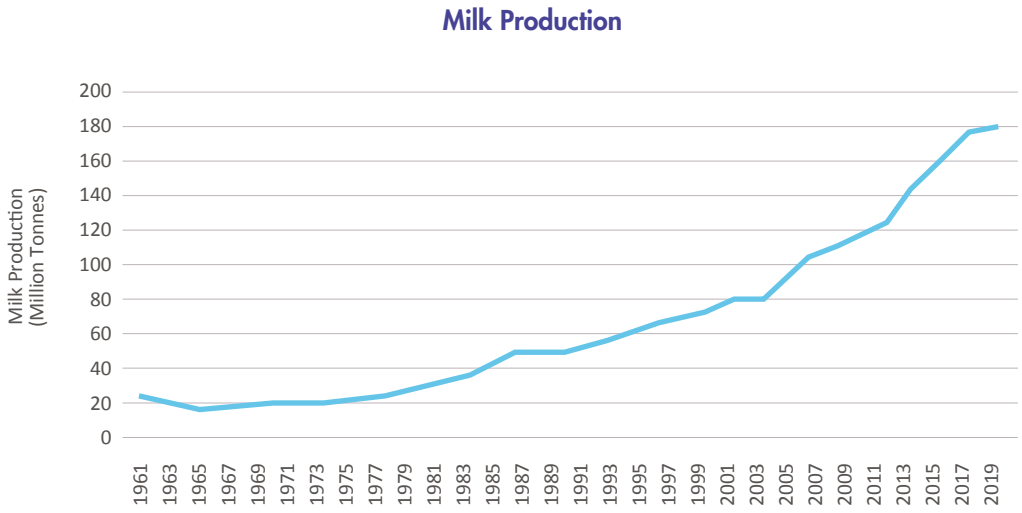



Figure 5 – Milk Production in India
Source: FAO Statistics Database

Operation Flood was implemented in three phases, each of which aimed at achieving the set objectives. This program introduced dairy co-operatives with the objectives of increasing milk production and providing fair prices for consumers. In the first phase, the program linked milk producers directly with the urban consumers. Phase two increased the number of milk sheds (collection centers) and expanded urban markets. By the end of phase two, there was a self-sustaining system of 43,000 village co-operatives covering 4.25 million milk producers and domestic milk-powder production increased. Producers' co-operatives increased direct marketing of milk by several million liters a day. Phase three enabled dairy co-operatives to expand and strengthen the procurement and marketing infrastructure to increase volumes of milk. The reach of veterinary, feed, artificial-insemination services and dairy farming education for cooperative members expanded as well.[117]

During the program, the government of India implemented certain policy measures to protect the growing dairy industry which included: restricting dairy imports and only allowing imports through food aid received by the country. Dairy products received via food aid programs were sold and their proceeds were used to finance co-operatives development initiatives.[118]

[117] Rajendran. K &Mohanty. S. 2004. Dairy cooperatives and milk marketing in India. Journal of Food Distribution Research 35(2)
[118] FICCI. 2020. Development of Dairy Sector in India

Box 8 below details co-operative structure in India.

### Box 8 – Dairy Co-Operatives in India

There are approximately two million dairy co-operatives in India that collect 50 million kilograms of milk on a daily basis from 17 million dairy farmers. Co-operative structure in India is four-tiered.

**Tier – I: Village Society:** A voluntary association of milk producers in a village who wish to market their milk collectively after becoming members.

**Tier – II: District Union:** It is owned by all the dairy co-operative societies in the district. The union procures all the milk procured by the dairy cooperative societies, processes and markets liquid milk and other dairy products. District union also provides veterinary services, feed and artificial insemination services.

**Tier – III: State Federation:** This level of Co-operative markets liquid milk and other dairy products of member unions through a common brand name.

**Tier – IV: National Federation:** National Co-operative Dairy Federation (NCDFI) co-ordinates the marketing efforts of all the state level co-operatives.

At present the state co-operatives in Gujarat (Amul), Karnataka (Nandini), Tamil Nadu (Aavin), Rajasthan (Saras), Punjab (Verka) and Bihar (Sudha) are experiencing growth in milk procurement and distribution of their respective brands.

Source: FICCI. 2020. Development of Dairy Sector in India

Operation Flood improved access to good quality milk for the consumers throughout the country and eliminated the need for middlemen by establishing a direct link between producers and consumers. Also due to the co-operative structure, the production and marketing of milk became economically viable for dairy farmers. This helped to reduce fluctuations in milk price. After Operation Flood, the dairy sector of India emerged as a primary source of income for about 70 million rural households – most of which comprise of landless and/ or small farmers. [119]

The government of India took steps to control milk adulteration in the country. The Food Safety and Standards Authority of India (FSSAI) conducted a survey to estimate the amount of adulterated milk produced in India. The published survey 'National Milk Safety and Quality Survey 2018' provided insights on the type of adulterants found in milk and helped in identifying hot spots and directing

[119] FICCI. 2020. Development of Dairy Sector in India

efforts for surveillance and enforcement in such areas.

National Dairy Plan was implemented by the Government of India across fourteen milk producing states over a period of eight years. The objective was to increase productivity of dairy animals thereby increasing milk production, provide market access to dairy farmers, improve yield by implementing breed development and improvement programs and enhancing the reach of the cooperative structure. The program achieved most of these objectives and resulted in growth of milk by a CAGR of five percent during the program period.

The Indian government launched the largest artificial insemination program, in September 2019, called 'Nationwide Artificial Insemination Program (NAIP)' in 600 districts of the country. Under this program the government provided complete assistance for undertaking breed improvement. The program intends to achieve 70 percent coverage throughout the country.

## 8.3 China – The largest global dairy importer

The 'Dairy Industry Policy' introduced by the government of China in 2009 established that milk consumption is a key indicator of standard of living. China also has a prevalent health issue of stunting which led the government to encourage consumption of milk and other dairy products. As a result, dairy consumption is rapidly increasing in China, with imports constituting 30 percent of Chinese domestic market, making China the largest importer of dairy products in the world. The growth of dairy imports by China is depicted in Figure 6 below.

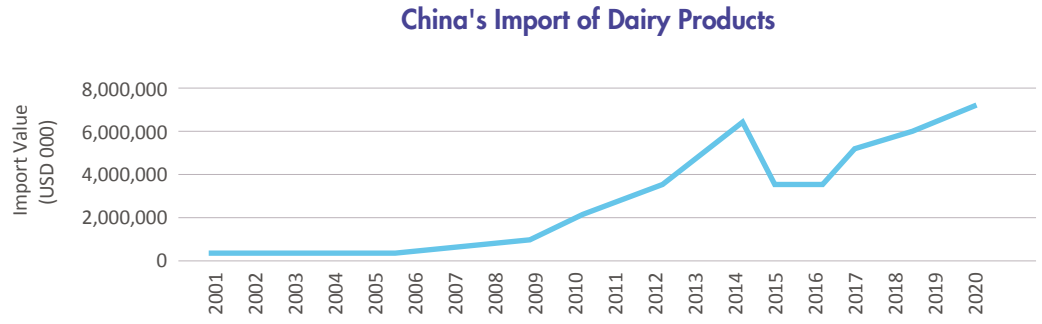



Figure 6 – China's Import of Dairy Products
Source: ITC Trade Map

During the last twenty years, dairy imports of China have increased by a CAGR of 20 percent to USD 7.2 billion in 2020 from USD 218 million in 2001. China's import of dairy products increased sharply after 2008 as a result of melamine milk scandal that occurred during that year. Traces of melamine were found in some infant milk formulas which resulted in a global scare. Few dairy processing companies were adding melamine, which is a toxic industrial chemical used in plastic, to artificially increase the protein content in infant formula. As a result of consuming the contaminated infant formula, 300,000 babies were poisoned and six lost their lives due to health complications after consuming the contaminated milk.[120] This incident damaged the reputation of the Chinese dairy industry and led to a shift from the consumption of local dairy products to imported dairy products by consumers.

Following the milk scandal, the government introduced stringent food safety laws and signed Free Trade Agreements (FTAs). To regulate food safety, the government of China issued a series of regulations and laws to tighten milk quality control, notably, the Food Safety Law of the People's Republic of China, which came into effect in June 2009. Furthermore, the government of China signed FTAs with New Zealand and Australia which is another reason for a rapid increase in Chinese dairy imports after 2008. Furthermore, as depicted in the figure above, imports fell by almost 50 percent in 2015. This was due to a decrease in imports from New Zealand to USD 1.7 billion from USD 4 billion in 2014. This was because of a shift of consumer demand towards healthier food products[121] and the use of previously imported stocks of milk powder.[122] Additionally, New Zealand's leading dairy company Fonterra discovered contamination in the whey powder it produced. As a result, China restricted imports of whey powder from New Zealand. This issue had a negative psychological impact on Chinese importers and consumers, and it affected the market share of New Zealand in China. The government of New Zealand and Fonterra took corrective action and consequently New Zealand's reputation recovered resulting in increase of imports by China after 2015.[123]

China primarily imports milk and cream in concentrated form which includes milk powders with a share of 46 percent in total dairy imports during 2020. Table 14 depicts a product-wise breakdown of total dairy imports of China in the year 2020.[124]

[120] Forbes. The 2008 milk scandal revisited. 2014. https://www.forbes.com/sites/yanzhonghuang/2014/07/16/the-2008-milk-scandal-revisited/?sh=6beb4bc14105
[121] NZ Herald. 2017. China's changing and NZ needs to change too. URL:
https://www.nzherald.co.nz/business/chinas-changing-and-nz-needs-to-change-too/OJ2IRIMPY5G2MWQQM6ZAWT22DE/
[122] FAO Milk and Milk Products 2015
[123] Xu.J. & Wu. Y. 2018. A Comparative Study on the Role of New Zealand and Australia in Sustainable Dairy Competition in the Chinese Market After the Dairy Safety Scandals. International Journal of Environmental Research & Public Health.
[124] ITC Trade Map 2020

| HS Code | Product | Imported Value (USD 000) |
|---|---|---|
| 401 | Milk and cream, not concentrated nor containing added sugar or other sweetening matter | 1,308,781 |
| 402 | Milk and cream, concentrated or containing added sugar or other sweetening matter | 3,331,361 |
| 403 | Buttermilk, curdled milk and cream, yogurt, kephir and other fermented or acidified milk | 57,884 |
| 404 | Whey | 817,798 |
| 405 | Butter, incl. dehydrated butter and ghee | 546,183 |
| 406 | Cheese and curd | 590,341 |
| | Others[125] | 636,395 |
| | **Total** | **7,288,743** |

Table 14 – Product-Wise Breakdown of Total Dairy Imports of China

Source: ITC Trade Map 2020

In China, WMP and SMP are commonly used in the food processing industry for production of value-added dairy products such as, reconstituted milk, yogurt, ice cream, dairy beverages, and bakery goods. Chinese dairy processing companies prefer to use imported milk powders. The consumption of imported WMP is expected to continue increasing in the foreseeable future and the booming food processing industry will drive consumption of SMP.[126]

New Zealand is the top trading partner for China with 50 percent share in total dairy imports during 2020. Table 15 mentions top 10 import sources for China.[127]

[125] Includes: 0407 – Birds Eggs (in shell); 0408 – Birds Eggs (not in shell); 0409 – Natural Honey; 0410 – Turtles Eggs
[126] GAIN & USDA. 2020. Dairy and Products Annual China.
[127] ITC Trade Map 2020

| Importing Countries | Imported Value (USD 000) |
|---|---|
| New Zealand | 3,629,096 |
| Australia | 633,030 |
| Germany | 446,266 |
| Indonesia | 413,615 |
| France | 407,195 |
| United States of America | 312,986 |
| Netherlands | 196,156 |
| Poland | 133,790 |
| Malaysia | 131,192 |
| Ireland | 125,390 |
| **World** | **7,288,743** |

Table 15 – Top Import Sources for China

Source: ITC Trade Map 2020

New Zealand is China's largest source of dairy products with a considerable competitive advantage. At present, New Zealand is the largest supplier of infant formula, especially after the melamine milk scandal and the FTA in 2008.[128]

China provides market access to the USA and various EU countries to meet its demand for dairy products. In 2020, China signed an economic and trade agreement with USA which provided it an expanded access to China's growing market for imported dairy and infant formula products. Following this, China reduced tariffs on dairy products from USA and launched a tariff exclusion process that allowed importers to apply for tariff exclusions for specific consignments from USA. If an exclusion application is approved, tariffs imposed on dairy products from the USA are exempted for one year from the date of approval. Although only Milk and Cream in Solid Forms (HS 04021000) and Whey and Modified Whey (HS 04041000) are eligible for exclusion application under this process, while other dairy products may also be included in importers' applications for tariff exclusion with justifications. China is the world largest importer of whey products due to strong demand for animal feed and USA is the largest exporter to China for whey. The tariff exclusion will have a positive impact on USA's exports to China. Moreover, to diversify import sources of dairy products, China has recently granted market access to Vietnam, Kazakhstan, Croatia, Serbia, and Slovakia.[129]

[128] Xu.J. & Wu. Y. 2018. A Comparative Study on the Role of New Zealand and Australia in Sustainable Dairy Competition in the Chinese Market After the Dairy Safety Scandals. International Journal of Environmental Research & Public Health.
[129] GAIN & USDA. 2020. Dairy and Products Annual China.

# ENVIRONMENTAL IMPACT OF DAIRY ACTIVITIES

# 9. Environmental Impact of Dairy Activities

Milk production impacts the environment, and the intensity of the impact depends on the scale of dairy farming activity and farming practices. The challenge for the dairy sector is to meet consumer demand and simultaneously control environmental impact of dairy activities. This section will discuss the various ways in which the dairy sector impacts the environment and methods to reduce the impact.

The world is experiencing climate change and unfortunately the dairy sector is one of the contributors. Livestock activities have an impact on subsoil water, rivers, and lakes by adding solid waste and pollutants. Dairy animals and their manure produce Greenhouse Gas (GHG) which result in a rise in temperatures. GHG emissions increase with an increase in dairy herd numbers and milk production (driven by an increase in the number of dairy animals).

Improving the production efficiency of dairy animals result in lower GHG emissions per animal. Better efficiency results in more consumed feed being converted into milk production rather than maintenance, thus resulting in lower GHG emissions.[130] A research article published by the United States National Institutes of Health (NIH) reports that an increasing milk yield per dairy animal per year results in lower GHG emissions per kilogram of milk produced. The study shows that GHG reduced by 16 percent from 1.06 kilogram CO2 equivalents (CO2eq) to 0.89 kilogram CO2eq with the milk yield increasing from 6,000 to 10,000 kilogram per cow. [131]

Intensity in GHG emissions from dairy animals vary between developed and developing countries due to the difference in livestock management practices. The intensity in developed countries is lower as compared to that in the developing countries.[132] Improved animal genetics and livestock management, combined with better feeding practices lead to reduction in GHG emissions. In Pakistan, dairy animals are kept in small compounds which makes handling of manure difficult. Moreover, animal waste is often disposed-off in water reservoirs which results in contamination of public drinking water. The small dairy farmers do not have awareness regarding environmental consequences of dairy farming. The government also needs to consider the environment when formulating/ revising policies for the sector.

Instead of keeping the dairy animals in congested compounds, they can be grazed and raised on pasture. This will eliminate the need to deliver feed and water in the compounds and remove waste. Pastured cows feed themselves and deposit most of their waste directly to the soil where it breaks down naturally and fertilizes the soil, but they still produce methane as those kept in the compounds[133]. This is only possible in countries with pasture/ grazing lands available, unlike Pakistan since it does not have sufficient grazing land. An alternative could be to improve waste management at the farm.

[130] FAO. 2019. Climate change and the global dairy cattle sector.
[131] Zehetmeier M, Baudracco J, Hoffmann H, Heibenhuber A. 2012. Does increasing milk yield per cow reduce greenhouse gas emissions? A system approach. Animal, 6(1):154-66
[132] FAO. 2019. Climate change and the global dairy cattle sector.
[133] Food Print. The Food Print of Dairy. https://foodprint.org/reports/the-foodprint-of-dairy/

In Australia, dairy farmers are proactive in managing the environmental impact of dairy activities. They undertake certain practices to reduce the impact by fencing-off waterways to improve water quality, manure management and land management for conservation of pastures. Recycling water and efficient irrigation systems also reduce the adverse environmental impact. Farmers participate in the Natural Resource Management (NRM) survey to keep these practices in check. Furthermore, several programs have been developed to help dairy farmers in managing their environmental footprint. The Australian dairy industry is consistently making efforts to reduce GHG emissions by 30 percent across the dairy sector in 15 years (from the 2015 baseline to 2030).[134]

Researchers in Europe have found a solution to reduce methane gas emissions by dairy animals. A Swiss-British startup Mootral has developed an edible supplement with garlic and citrus extracts which is fed to the cattle after mixing it with regular feed. The supplement helps to inhibit the microbes in a cow's stomach from making methane, which is usually produced as a byproduct of digesting fibrous plant material like grass[135]. As per the results of lab simulations, methane emissions reduced by 50 percent. In Mootral field tests, methane emissions fell by 38 percent. [136] The trial also found that milk yield increased by 8 percent with no impact on the milk's taste and smell. Furthermore, the dairy cows were less stressed as the stench of garlic kept the flies away. These results were achieved after feeding 15 grams of supplement to cows every day. Several other methane-reducing supplements are being researched and tested on dairy cattle, one of which is seaweed supplement which could reduce methane emissions by 60 percent. [137]

The government in collaboration with the private sector can create awareness regarding the environmental impact of the dairy sector and encourage dairies to adopt measures to minimize the impact.

[134] Dairy Australia. Is dairy farming bad for the environment. 2021. https://www.dairy.com.au/dairy-matters/you-ask-we-answer/is-dairy-farming-bad-for-the-environment
[135] CNN Business. 2021. This supplement can reduce methane in cows and make farmers money. https://edition.cnn.com/2021/05/18/business/cow-burps-methane-feed-supplement-mootral-spc-intl/index.html
[136] International Livestock Research Institute. 2020. Garlic – A potent (if pungent) 'Gas X' methane reducer for cows?' https://www.ilri.org/news/garlic%E2%80%94-potent-if-pungent-%E2%80%98gas-x%E2%80%99-methane-reducer-cows
[137] Dairy Reporter. 2020. Garlic in cows' feed keeps gases down and milk yields up. https://www.dairyreporter.com/Article/2020/01/06/Garlic-in-cow-feed-keeps-gases-down-and-milk-yields-up

# IMPACT OF LIMITED SUPPLY OF DAIRY PRODUCTS ON NUTRITION, HUMAN CAPITAL AND ECONOMY

# 10. Impact of Limited Supply of Dairy Products on Nutrition, Human Capital and Economy

Pakistan's per capita consumption of milk is very low at 0.26 liters per day.[138] Approximately 75% of the urban population and 70% of the rural population consumes less than the recommended average quantity of milk to be consumed in a 2,350 calories diet. Children belonging to the age group of 10-14 years constitute the largest proportion of this segment.[139] This is due to limited availability of value-added dairy products. The scarcity of value-added dairy products concomitant with price sensitivity of a large segment of the population, creates a market for adulterated milk which has an adverse impact on human health. Without sufficient output of milk, Pakistan will find it difficult to produce other value-added products such as, cheese, milk powder, butter and other dairy based items. Larger milk output from the formal sector will help lower the cost of pasteurized milk and prices of downstream value-added products making them more accessible for a larger segment of the population.

Pakistan suffers from an acute level of undernutrition with over 40 percent of children under five years being stunted out of which 34.8 percent reside in the urban areas and 43.2 percent in the rural areas. Approximately, 18 percent suffer from wasting and 29 percent are underweight. An estimated 52 percent of children under five years of age are vitamin A deficient, 63 percent have a deficiency of vitamin D and 29 percent, and 19 percent are deficient in iron and zinc, respectively.[140]

### Box 9 – Forms of Undernutrition

There are four forms of undernutrition which makes children vulnerable to disease and death

**i. Wasting -** Low weight-for-height is known as wasting. It indicates severe weight loss because a person has not had enough food to eat and/or they have had an infectious disease.

**ii. Stunting -** Low height-for-age is known as stunting. It is the result of chronic or recurrent undernutrition, usually associated with inappropriate infant and young child feeding and care in early life and poor maternal health and nutrition. Stunting hinders physical and cognitive growth in children.

**iii. Underweight -** Children with low weight-for-age are known as underweight. A child who is underweight may be stunted, wasted, or both.

**iv. Deficiencies in vitamins and minerals –** Inadequacies in intake of vitamins and minerals represents a major threat to health. Micronutrients enable the body to produce enzymes, hormones, and other substances that are essential for proper growth and development. Iodine, vitamin A, and iron are most important for human health and their deficiency adds to undernutrition particularly in children.

Source: World Health Organization

[138] Tetra Pak. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry
[139] Tetra Pak. 2016. Pakistan's Dairy Sector: Lessons from the Past to Build a Resilient Dairy Industry
[140] Ministry of National Health and Services. National Nutrition Survey 2018

Value-added dairy products have a potential to improve nutrition. Adequate dietary intake is important during the first 6 to 18 months when the child's growth rate is high. At six months, intake of nutrient rich animal-sourced foods is essential for growth and mental development.[141] Value-added dairy products are efficient in delivering vital nutrients and improving growth for young children, whose nutrition is critical during early years.[142] Evidence also suggests positive causality between milk consumption and weight and height. Significant improvements in height and weight were seen in children consuming milk as compared with those with very limited or no consumption of milk.[143] Readily available affordable value-added dairy products may be the easiest solution to overcome challenges associated with undernutrition and loss of cognitive and physical growth.

Milk contains several essential nutrients which are vital for growth, including protein, potassium, calcium, vitamin A and zinc. Some value-added dairy products also contain vitamin D.[144] Although, these nutrients are not exclusive to milk and can also be obtained from other types of food, however, milk is one of the most affordable and convenient option for many households to obtain all the growth-enabling nutrients.[145] In Pakistan, consumption of milk is less than the average recommended quantity which results in undernutrition that accentuates the issue of stunting, low weight and micronutrient deficiencies.[146] Undernutrition has a negative impact on the quality of workforce and costs Pakistan approximately USD 7.6 billion annually or a loss of three percent to the national GDP[147]. Access to an adequate and balanced diet is significant for mental and physical growth of children and protection from diseases in adult life. Good nutrition and a healthy productive population are both recognized as a critical prerequisite for socio-economic development and poverty reduction.

Pakistan needs to provide dairy producers greater incentives to utilize advance technologies and production methods to increase production of value-added dairy products and to bolster dairy consumption. Pakistan needs to redouble its efforts to provide unadulterated milk and other value-added dairy products to its population. One of the best methods to provide safe and nutritious milk is to increase access to packaged milk that is either pasteurized or UHT treated, and other value-added dairy products.

During the last decade, China determined that milk intake is critical for productivity, overall health and wellbeing of its population and is implementing programs to increase consumption of milk and dairy products. Moreover, in several countries including Turkey and the EU, school milk distribution programs are quite common. It is a type of consumer subsidy which is given to encourage milk consumption among children. This practice of distributing milk to students in school began in 1999 in the EU countries. In Denmark, milk consumption increased by 40 percent after the implementation of this program. This program was extended in the EU to include other value-added dairy products such as yoghurt, cheese and buttermilk.[148]

[141] FAO. Milk and dairy products in human nutrition.
[142] FAO. Milk and dairy hold potential for improving nutrition of world's poor.
[143] Herber, C. et. al. (2020). Association between milk consumption and child growth for children aged 6-59 months. Nature Research Scientific Reports
[144] Grenov B, Larnkj r A, M lgaard C, Michaelsen KF. 2020. Role of Milk and Dairy Products in Growth of the Child. Nestle Nutrition Institute Workshop Series.
[145] Hill.A. 2021. Does milk help kids grow? Healthline. https://www.healthline.com/nutrition/does-milk-help-you-grow
[146] National Nutrition Survey 2018
[147] UN World Food Programme. 2016. https://www.wfp.org/news/malnutrition-costs-pakistan-us76-billion-annually-new-study-reveals
[148] Yilmaz. O.T., 2017. A study of milk support policies in the European Union and in Turkey. European Journal of Interdisciplinary Studies

# POLICY RECOMMENDATIONS

# 11. Policy Recommendations

The Livestock Policy was introduced in 2007 after which it has not been updated. A fresh review is needed to revise the policy and formulate a dairy plan for the country. The government, while keeping in consideration the current challenges and international practices for growth, needs to adopt strategies for increasing the production of milk and value-added dairy products. The federal government should work in collaboration with the provincial governments to revise the existing policy and devise a dairy plan to be implemented across the country. The key actions recommended are as follows:

## Conduct a national livestock census

The last livestock census was conducted in 2006 and from that time onwards the officially reported figures are based on estimations. Devising and implementing sector growth strategies based on estimated data is not effective. Livestock census should be conducted every five years, as practiced in India. In order to formulate, implement and scale sector growth strategies, it is important to have an updated record of herd size and average yield by type of livestock and region.

## Restrict export of animal feed

The government should impose export restrictions on animal feed and components of animal feed, including maize and hay. Instead of exporting it, the government should put emphasis on utilizing components of animal feed to make a balanced diet for animals in order to improve milk yield. The export of feed results in insufficient supply of feed for dairy animals domestically, thereby increasing feed cost, affecting both milk output and productivity.

## Ease import of animal vaccines

The government should make the process of importing of animal vaccines easier and convenient for the dairy farms by minimizing documentation and time delays in completion of import procedures. Corporate farms struggle to receive approval from DRAP for the use of internationally developed vaccines, it is important to simplify the procedure since large dairy farms rear international high yielding dairy breeds which require different vaccines that are currently unavailable in Pakistan. This will have a positive impact on animal health and milk yield.

## Increase import duty on milk powder

Regional economies such as India and Turkey have imposed high import duties on milk powder to support their domestic dairy industry and incentivize farm level investments. The government should increase import duties on milk powder and encourage domestic dairy processing companies to procure milk from dairy farmers and convert it into milk powder to be reconstituted back to liquid milk during the period of milk shortage. The imposition of import duties would be conditional on Pakistan first producing enough milk powder to sustain consumption in the summer months.

## Establish pasteurization infrastructure

Even though the formulation of Minimum Pasteurization Law is the first step to encourage pasteurization and control the sale of adulterated milk in Pakistan, ensuring its implementation is critical. The law will come into force in Punjab by July 2022 and to support the implementation of the Minimum Pasteurization Law, establishment of pasteurization units at the village level is very important. This will encourage dairy processing and reduce wastage of milk in Pakistan. Moreover, the government also needs to take measures to monitor prices of pasteurized milk as the demand for processed milk is highly price elastic.

## Roll-out a nation-wide FMD vaccination drive

Eradication of livestock diseases is critical to improve animal productivity and overall milk production in the country. The prevalence of bovine diseases, in particular FMD, limits yield due to poor herd health. The federal government, in coordination with the provincial governments, needs to ensure adequate availability and effective administration of animal vaccines across the country. In addition, the government should also establish diagnostic laboratories so that animal diseases are timely diagnosed and reported to minimize impact on animal health and yield.

## Encourage consumption of pasteurized and UHT treated milk

The government should carry out awareness campaigns among the general public regarding the harmful effects of raw adulterated milk, as well as highlight the advantages of pasteurized and UHT treated milk. This will help remove misconceptions regarding processed milk and increase consumption of pasteurized and UHT treated milk. This will also help increase the pace of implementation of the Minimum Pasteurization Law in the country when consumer demand will become one of the drivers for increased pasteurization. To make this happen, consistent efforts are required by the federal and provincial governments to run such awareness campaigns across the country through various mediums.

## Create awareness regarding the environmental impact of the dairy sector

Reducing the environmental impact of the dairy sector is crucial as dairy farming activities contribute to GHG emissions. However, the emissions could be reduced by adopting certain livestock management practices and improving the production efficiency of dairy animals. The provincial governments can create awareness regarding the environmental impact of dairy activities and encourage the sector to adopt mitigating measures. The provincial livestock departments' advisory wing should run the awareness campaigns across the provinces through various mediums.

## Finance small farms

Agriculture loan disbursement in 2020 amounted to PKR 1.2 trillion out of which only 10 percent was disbursed to the small livestock farmers for dairy and meat production. Furthermore, number of loans to small farmers account for 49 percent of the total agriculture loans disbursed.[149] This indicates that small farmers usually receive small loans as working capital financing. The government should provide subsidized credit to the small and medium sized farms to increase their herd size by importing high-yielding dairy breeds and for capital investments to set up large farms. Larger farm size will generate economies of scale for dairy farms. It is important that mark-up for the loans is concessional, and financing is only available to eligible farms after thorough due diligence. This will attract farm level investments in the sector and eventually increase milk production.

## Formulate a National Dairy Plan

It is important to formulate a detailed National Dairy Plan under the overarching policy contours that are mentioned above in order to support their implementation across provinces. The plan should be implemented in phases with definite outcomes across Pakistan over a period of 20 years. The phases should consist of multi-pronged series of initiatives focusing on increasing milk yields, controlling supply of adulterated milk and improving access of dairy farmers to organized formal markets. This will gradually increase production of milk and value-added dairy products. The plan can include initiatives such as:

[149] State Bank of Pakistan. Banking Statistics of Pakistan. 2020

- **Improved breeding programs** such as artificial insemination with greater coverage will enable the development of high-yielding dairy breeds using internationally accredited practices of progeny testing and pedigree selection. This will help accelerate genetic progress over a larger livestock population which will gradually improve milk yields.

- **Access to silage** by the small dairy farmers by disseminating trainings on animal nutrition, silage-making and feed preservation by the livestock extension departments. Improved animal nutrition will help improve milk yield.

- **Access to quality fodder seeds** of high yielding improved varieties to those dairy farmers who are landowners so that they can produce animal fodder.

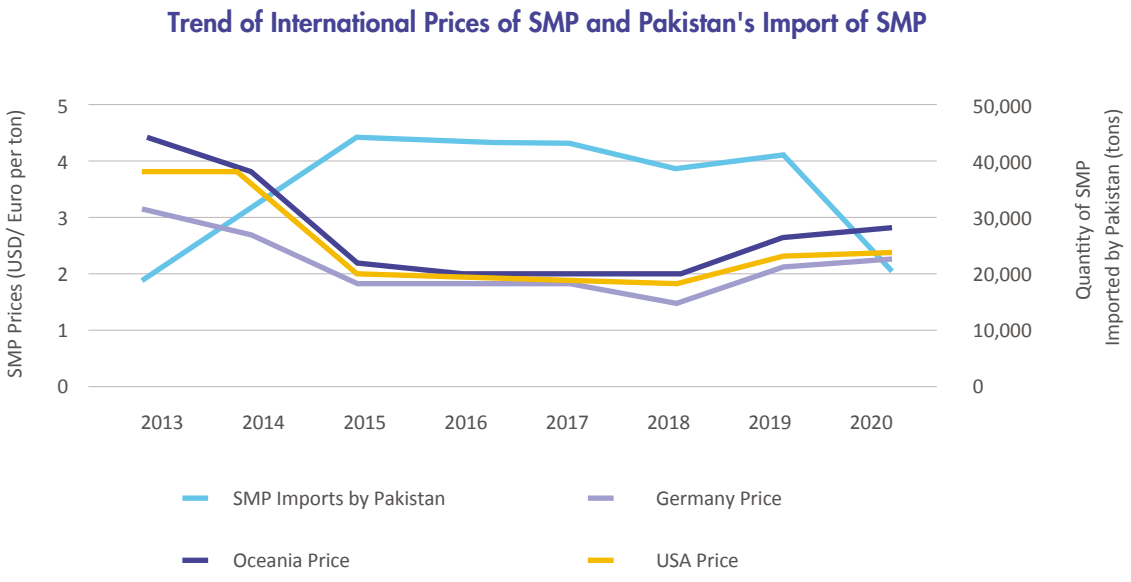
- **Survey of adulterated milk** in the milk producing regions will help identify types of adulterants and hotspots for immediate action.

- **Milk collection centers set-up on a public-private partnership model** with the government setting up the center with installed pasteurization units and the private sector operating the center. This will ensure good supply of pasteurized milk and improve farmers' access to the formal market. It is important to ensure transparent procurement and fair and timely payments to the farmers.

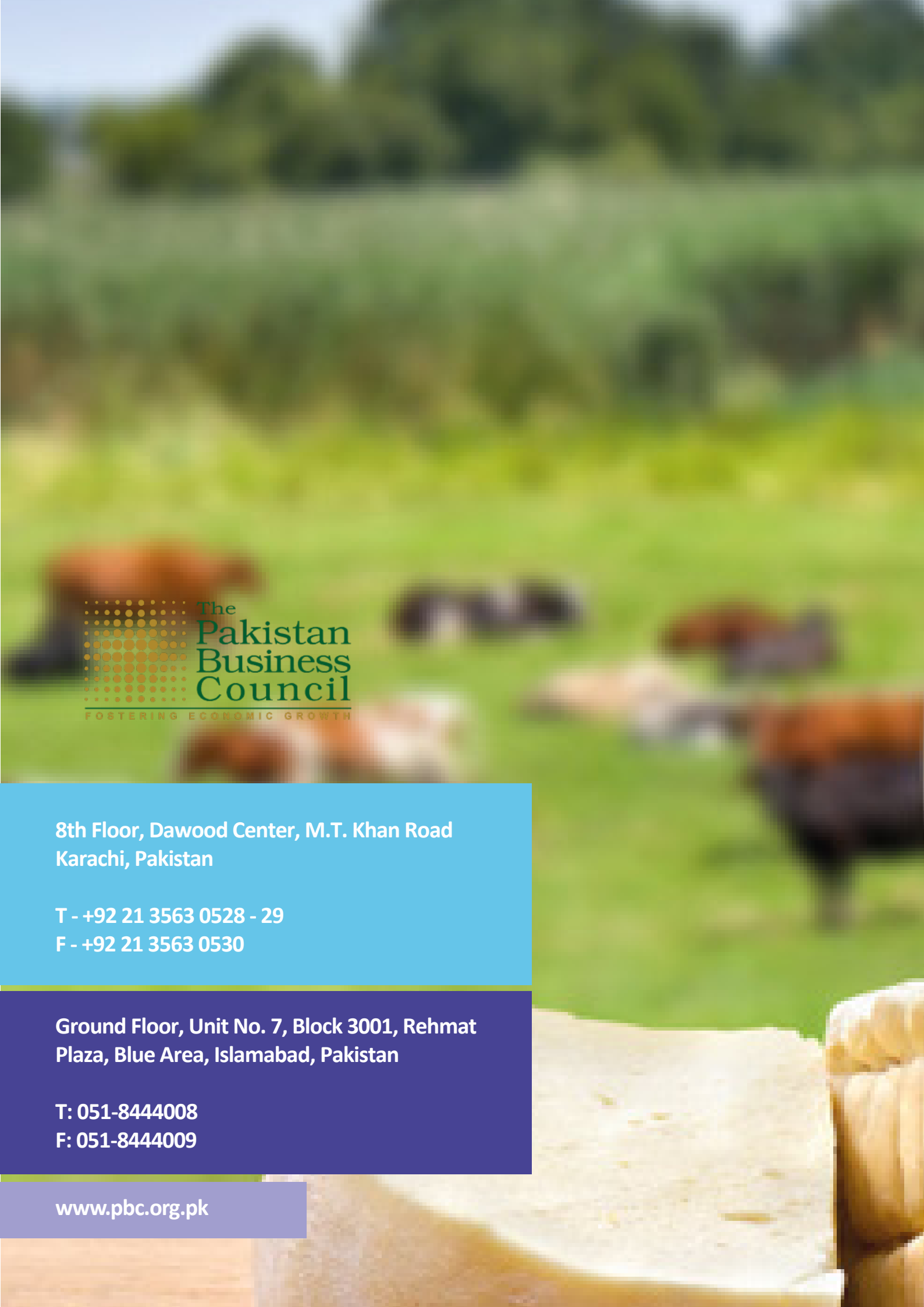
- **Working capital financing** to support development of farm infrastructure which is suitable for raising milking animals and reducing animal stress, will eventually improving milk yield. The mark-up rate can be concessional with an appropriate credit limit. Pakistan should provide low mark-up loans to generate investments to improve farm infrastructure.

The proposed dairy plan should be formulated by the Federal Government in collaboration with the provincial governments and implemented by the provincial governments. The implementation of this plan will require consistent commitment by the present and future governments.

# Annexure




Source: ITC Trade Map & CLAL



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