

CURRENT TRENDS IN DAIRY INDUSTRY AND SCOPE OF CHEESE MAKING IN PAKISTAN



October, 2022

**Research and Publication unit,
Planning and Research Department**

Zarai Taraqati Bank Ltd.



Table of Contents		
S.No	Title	Page
	ABSTRACT	2
1	INTRODUCTION	2
1.1	Value of Dairy sector in food security	4
1.2	Role of Dairy sector in Socio-Economic	4
1.3	Milk Production Trends in Pakistan	6
2	RECENT TRENDS IN DAIRY SUPPLY CHAIN	10
2.1	Classification of Milk Producers	12
2.2	Dairy Value Added Products in Pakistan	13
3	CHEESE MAKING AND ITS SCOPE IN PAKISTAN	15
3.1	Characteristics of Some Famous Varieties of Cheese	16
3.2	Cheese Market in Pakistan	19
3.3	Existing Cheese Production in Pakistan	19
3.4	Existing Cheese Making Companies in Pakistan	19
4	CONCLUSIONS	20
5	ROLE OF ZARAI TARAQIATI BANK LIMITED	21
8	REFERENCES	21

CURRENT TRENDS IN DAIRY INDUSTRY AND SCOPE OF CHEESE MAKING BUSINESS IN PAKISTAN

ABSTRACT

The current Research study was conducted by Planning & Research Department using top desk research approach. The Study was divided into three half's

- (a) Current Trends in Dairy Industry
- (b) Value Chain of Dairy Products
- (c) Scope of Cheese making business in Pakistan.

The Research Methodology used to conduct this study is review of literature. Three categories of Research Reviews have been conducted:

- (i) Statistical Review
- (ii) Scholars Articles
- (iii) Integrated/Linkages approach.

Statistical Review has been gathered from statistical data published in latest Economic Survey of Pakistan, Bureau of Agricultural Statistics, Directorates of agriculture Information, Agriculture Extension Departments Reports, Pakistan Bureau of Statistics (PBS), Pakistan Dairy Development Company, and Small and Medium Enterprise Development Authority (SMEDA).

Scholars Articles the descriptive portion of this research study was made by Reviewing different Research articles published by academia and dairy and livestock scientists in highly recognized international and HEC approved Research Journals.

Integrated/Linkages approach: the data on dairy value chain and cheese making is collected in coordination with University of Veterinary and animal Sciences Lahore (UVAS) from Professors working in cheese making Laboratory from the Project "Dairy Value Chain" Furthermore Role of ZTBL is elaborated in promotion of Dairy and Livestock Industry in Pakistan.

1. INTRODUCTION

Over 750 million people are engaged in milk production around the world, mostly smallholders fulfilling their livelihood needs, food security and nutrition. World milk production was 522 million tonnes in 1987 while it escalated to 828 million tonnes in 2017 and augmented to 838 million tonnes having the share (82% cow milk, 14% buffalo milk, 2% goat milk, 1% sheep and 0.3% camel milk) in 2018 (FAO,2019). Milk production in developing countries of South Asia jumped after 1970, and the region has become a key player in world milk production. The region consisted of 745 million dairy animals that accounted for 21% of dairy animals in the world. The region was also home to 25% of cattle and buffaloes, 15% of sheep and goats, and 7% of camels in the world. Currently it is contributing about 200 million tonnes of milk that accounts around 20% of global milk production despite low milk yield of the dairy animals (Siddiqui, 2017).

Agricultural sector is the backbone of Pakistan's economy. Agriculture sector having a lion share in country's GDP and contributes about 19.2 percent. This sector provides employment to around 38.5 percent of the labor force. More than 70 percent of the Pakistani population directly or indirectly depends upon agriculture for subsistence/livelihood. (Economic Survey of Pakistan, 2021-22).

The livestock sector in Pakistan contributes about of 60.07 percent in agriculture and nearly 11.53 percent contribution in Agricultural Gross Domestic Product (AGDP) also achieved a growth of 3.06 percent. However, Pakistan is ranked fourth in milk production worldwide after China, India and USA. The share of livestock in the agriculture sector is significant due to its overall contribution. It plays a vital role in poverty reduction strategies, and this sector may be developed very quickly as all required inputs for this sector are available in adequate quantities in the country. More than 8 million rural families are engaged in livestock production and deriving more than 35-40 percent of their income from this source. Gross value addition of livestock increased to Rs 1,505 billion (2020-21) from Rs 1,461 billion (2019-20), an increase of 3.0 percent. ([Economic Survey of Pakistan, 2021-22](#)).

Pakistan is the 4th largest milk producing country in the world. Approximately 80% milk is produced at small scale in rural areas, 15% peri-urban and 5% in the urban areas. Average annual milk production during 1960s and 1970s was 6.6 million tonnes and 8.1 million tonnes respectively. This increased from 12 million tonnes (1985-86), to 48 million tonnes in 2019-20.

Milk composition has also changed between 1985-86 with a marginal increase in cow milk and reduction in buffalo milk (67% buffalo, 31% cow and 2% goat, sheep and camel in 1985-86, to 60% buffalo, 36% cow and 4% goat, sheep and camel in 2018-19. About 97% milk is marketed in raw form and rest is processed (UHT), with 15 to 20% wastage in some areas.

Average household holdings are 2-3 cattle/buffaloes and 3-4 sheep/goats per family which help them to earn around 35-40 percent of their income [Economic Survey of Pakistan 2006-07] in Pakistan. Moreover 84% of households have a herd size of 1-4 animals while 14% have 10 and only 2% have more than 10. In terms of sheer quantity, the number of buffaloes, cows and goats has risen three times whereas the number of sheep and camel has doubled.

The province Punjab has the largest buffalo population, with 64 percent of the total, followed by Sindh with 26 percent, Khyber Pakhtunkhwa (KPK) with 7 percent, and Baluchistan with only 1.2 percent. Punjab also has the largest cattle population, with 48 percent of the total, followed by Sindh with 23 percent, KPK with 20 percent, and Baluchistan with 7 percent [Livestock census report (2006)]. The Punjab and Sindh are the major milk producing provinces, with annual production of 25.62 million and 9.35 million liters respectively. KPK produces an estimated 4.88 million liters per year, and Baluchistan 0.81 million liters ([PDDC, 2006](#)). Provincially, annual per capita consumption is highest in Sindh, at 246 kg. In Punjab it is about 132 kg, in KPK about 86 kg, and in Baluchistan about 108 kg. The average milk yield of the cow and buffalo is 14 and 10 liters per day respectively. It is still 5-6 times less than the developed world.

The average cow is productive for about 8 years, whereas a buffalo is productive for about 9 years. It worth noting that eight Pakistani milking animals producing milk is equal to one milking animal of the developed world. Average per capita milk availability (PCMA) during 1970's and 1980's was 56 kg and 55 kg, respectively. It rose to 70 kg per annum during 1990's and was 100 kg/annum in 2017-18.

During the last three decades, per capita milk availability has risen almost three times in Pakistan. Imports of milk and milking products were Rs.0.3 billion in 1975-76, which rose to

Rs.1.4 billion in 1990-91 and Rs.3 billion in 2007-08 while Rs.20 billion in 2017-18.

Furthermore, the livestock sector employs about 30 million people, the vast majority of whom live in the rural areas of the country. But, as population and urbanization increase, the demand for livestock products will also increase; thus, it will be difficult to meet this demand over the next few years.

1.1.Value of Dairy Sector in Food Security:

Dairy production remains one of the most important sectors across the globe, concerning food security. Livestock/Dairy products provide an important source of nourishment for billions of rural and urban households. Livestock contributes to food for people, in the form of milk, meat, and eggs. Livestock directly contribute to nutrition security. Milk, meat, and eggs, the “animal-source foods,” though expensive sources of energy, are one of the best sources of high quality protein and micronutrients that are essential for normal development and good health.

1.2.Role of Dairy sector in Socio-Economic:

Livestock/Dairy Sector play multiple roles in supporting livelihoods. One of the most important is as a source of household income. Dairy/livestock sector provides income and employment for producers and others working in, sometimes complex, value chains. These socio-economic roles and others are increasing in importance as the sector grows because of increasing human populations. Although livestock ownership is often seen as a sign of wealth – household typically move up the ‘livestock ladder’ from poultry to goats or sheep, to cattle/buffalo. Livestock’s share of income was highest in the poorest income quintile, which shows that they are important to the poor as well. The growth in demand for milk and meat, mainly driven by urban consumers in developing countries, has been increasing in the last few decades and is projected to double by 2050. This rising demand for milk, meat, fish and eggs has generated jobs all along the livestock value chain, from input sales through animal production, trading and processing to retail sales.

The national herd population of livestock for the last three years is given in Table given below:

Species	2019-20 ¹	2020-21 ¹	2021-22 ¹
Cattle	49.6	51.5	53.4
Buffalo	41.2	42.4	43.7
Sheep	31.2	31.6	31.9
Goat	78.2	80.3	82.5
Camels	1.1	1.1	1.1
Horses	0.4	0.4	0.4
Asses	5.5	5.6	5.7
Mules	0.2	0.2	0.2

¹: Estimated figure based on inter census growth rate of Livestock Census 1996 & 2006

Source: Ministry of National Food Security & Research

The position of milk and meat production for the last three years is given in Table given below.

Species	2019-20 ¹	2020-21 ¹	2021-22 ¹
Milk (Gross Production)	61,690	63,684	65,745
Cow	22,508	23,357	24,238
Buffalo	37,256	38,363	39,503

Sheep ²	41	41	42
Goat	965	991	1,018
Camel ²	920	932	944
Milk (Human Consumption)³	49,737	51,340	52,996
Cow	18,007	18,686	19,390
Buffalo	29,805	30,691	31,603
Sheep	41	41	42
Goat	965	991	1,018
Camel	920	932	944
Meat⁴	4,708	4,955	5,219
Beef	2,303	2,380	2,461
Mutton	748	765	782
Poultry meat	1,657	1,809	1,977

- 1: The figures for milk and meat production for the indicated years are calculated by applying milk production parameters to the projected population of respective years based on the inter census growth rate of Livestock Census 1996 & 2006.
- 2: The figures for the milk production for the indicated years are calculated after adding the production of milk from camel and sheep to the figures reported in the Livestock Census 2006.
- 3: Milk for human consumption is derived by subtracting 20 percent wastage (15 percent faulty transportation and lack of chilling facilities and 5 percent in suckling calf nourishment) of the gross milk production of cows and buffalo.
- 4: The figures for meat production are of red meat and do not include the edible offal's.

Source: Ministry of National Food Security & Research

Pakistan is endowed with diverse livestock genetic resources. In fact it is postulated that one of the centers of animal domestication lay in this part of the world. Pakistan has a large livestock population, well adapted to the local environmental conditions. Current population of farm animals in Pakistan consist of 23.34 million buffaloes, 22.42 million cattle, 24.24 million sheep, 49.14 million goats and 0.77 million camels. Pakistani buffaloes are riverine type and belong to two breeds i.e. Nili-Ravi and Kundi. Nili-Ravi is the best dairy buffalo breed of the world. There are ten distinct breeds of cattle found in Pakistan. However, these breeds probably only make up 30 percent of the population and the rest of the population is generally classified as non-descript. Cattle breeds of Pakistan are Sahiwal, Red Sindhi, Cholistani, Dhanni, Tharparker, Bhagnari, Djal, Lohani, Rojhan and Kankrej. There are 30 local breeds of sheep in the country. Important sheep breeds are Bucchi, Lohi, Thalli and Salt Range in Punjab; Bumbi, Kachhi and Kooka in Sindh; Balkhi, Damani and Kaghani in KPK and Baluchi, Bibrik, Harnai and Rakhsani in Balochistan. For goats, 37 breeds have been described. The important goat breeds include Beetal, Dera Din Panah and Teddy in Punjab, Barbari and Kamori in Sindh, Kaghani and Jatal in KPK. and Khurassani, Lehri and Pahari in Balochistan. Twenty one breeds of running, baggage and dairy camels have been described. Based on unique geographical location, Pakistan's potential of livestock business is enormous with a friendly business environment. All these are the encouraging factors that favor the country to serve as an economic gate way for China, Russia, South Asia and East Asia especially after the China Pakistan Economic Corridor (CPEC). The nature has abundantly gifted the Pakistan with variety of livestock resources. Our

livestock and poultry industry is progressing gradually and playing a key role towards economic growth. (Talib, 2016)

Eid al-Adha is one of the most important Muslim festivals celebrated worldwide. Muslims traditionally slaughter animals such as sheep, goats, buffalo, cattle, and camels on a sacred day to commemorate the mercy of Allah, who spared Prophet Ibrahim from having to kill his son, Ishmael. Muslims around the world gather on Eid al-Adha to sacrifice their livestock. This observance culminates in the Hajj, and every household who has financial ability sacrifices a male domestic ruminant (such as a yearling ram) in honor of Ibrahim and as a demonstration of obedience to Allah. Three days of celebration and feasting follow Eid al-Adha.

The Eid al-Adha period has a significant impact on the supply of and demand for small ruminants. Two weeks before the Eid al-Adha celebration, some people begin selling livestock on the roadside, although they do not normally sell livestock. These individuals are called roadside livestock sellers or roadside traders. The roadside is chosen for its strategic position to display their livestock. The stalls are usually opened in urban or peri-urban areas. To the best of our knowledge, no previous study examined the characteristics and behavior of roadside traders on religious festival. Such trade activities have come to constitute local wisdom over a period of time and support the need for sacrificial animals, especially in areas dominated by Muslims. Research on the characteristics and patterns of the marketing adopted by livestock traders may help regulate this market and achieve higher collective benefit. The research results can be used as a basis for the implementation of social marketing strategies to improve food safety awareness. Production, procurement, and sales of livestock in the most favorable conditions guarantee better access to inputs (proximity to the market, and higher income) and technical information (health and production). Marketing chains can be used as tracers of the livestock distribution, which is essential for the regulation of animal movements and animal trafficking. Pakistanis sacrificed around 5.8 million animals worth \$1 billion on the Muslim festival of Eid Al-Adha this year, 28 percent lower than previous year 2020 because of covid pandemic. Besides of all sacrifices Pakistan never found any decline in animal production because of genetic, breeding traits and favorable environment and habitat conditions for the local breeds of cows and goats. According to the Pakistan Economic Survey 2016-17, goat production increased to 77.8m in 2016-17 from 68.4m in 2015-14 and 66.6m in 2014-13. Cattle production rose to 42.8m in 2015-16 from 41.2m in 2013-14 and 39.7m in 2013-14, followed by 36.6m buffalo production in 2015-16 as compared to 35.6m in 2014-15 and 34.6m in 2013-14. Live animals and meat are the major livestock export commodities of Pakistan. Pakistan Exports of live animals was US\$8.92 Million during 2021, according to the United Nations COMTRADE database on international trade.

1.3.Milk Production Trends in Pakistan:

Over 750 million people are engaged in milk production around the world, mostly smallholders fulfilling their livelihood needs, food security and nutrition. World milk production was 522 million tonnes in 1987 while it escalated to 828 million tonnes in 2017 and augmented to 838 million tonnes having the share (82% cow milk, 14% buffalo milk, 2% goat milk, 1% sheep and 0.3% camel milk) in 2018 [FAO,2019]. Milk production in developing countries of South Asia jumped after 1970, and the region has become a key player in world milk production. The region consisted of 745 million dairy animals that accounted for 21% of dairy animals in the world. The region was also home to 25% of cattle and buffaloes, 15% of sheep and goats, and 7% of camels in the world. Currently it is contributing about 200 million tonnes of milk that accounts around 20% of global milk production despite low milk yield of the dairy animals (Siddiqui, 2017).

In Pakistan, livestock plays an important role and grew at a rate of 4% in 2018-19, accounting for about 60.5% of agriculture value added and 11.2% of GDP. The importance of the sector can be realized from the fact that it is not only a source of foreign exchange earnings, but also a source of income for over 8 million rural families. Within the livestock sector, milk is the largest single commodity. Overtime, the higher growth in the livestock sector was mainly attributed to milk production. (PIDE, 2022, a)

Pakistan is the 4th largest milk producing country in the world. Approximately 80% milk is produced at small scale in rural areas ,15% peri- urban and 5% in the urban areas. Average annual milk production during 1960s and 1970s was 6.6 million tonnes and 8.1 million tonnes respectively. This increased from 12 million tonnes (1985-86), to 48 million tonnes in 2018-19, a record increase in three decades.

Milk composition has also changed between 1985-86 with a marginal increase in cow milk and reduction in buffalo milk (67% buffalo, 31% cow and 2% goat, sheep and camel in 1985-86, to 60% buffalo, 36% cow and 4% goat, sheep and camel in 2018-19. About 97% milk is marketed in raw form and rest is processed (UHT), with 15 to 20% wastage in some areas.

Average household holdings are 2-3 cattle/buffaloes and 3-4 sheep/goats per family which help them to earn around 35-40 percent of their income [Economic Survey of Pakistan 2006-07] in Pakistan. Moreover 84% of households have a herd size of 1-4 animals while 14% have 10 and only 2% have more than 10. In terms of sheer quantity, the number of buffaloes, cows and goats has risen three times whereas the number of sheep and camel has doubled.

The province Punjab has the largest buffalo population, with 64 percent of the total, followed by Sindh with 26 percent, Khyber Pakhtunkhwa (KPK) with 7 percent, and Baluchistan with only 1.2 percent. Punjab also has the largest cattle population, with 48 percent of the total, followed by Sindh with 23 percent, KPK with 20 percent, and Baluchistan with 7 percent [Livestock census report (2006)]. The Punjab and Sindh are the major milk producing provinces, with annual production of 25.62 million and 9.35 million liters respectively. KPK produces an estimated 4.88 million liters per year, and Baluchistan 0.81 million liters (PDDC, 2006). Provincially, annual per capita consumption is highest in Sindh, at 246 kg. In Punjab it is about 132 kg, in KPK about 86 kg, and in Baluchistan about 108 kg. The average milk yield of the cow and buffalo is 14 and 10 liters per day respectively. It is still 5-6 times less than the developed world.

The average cow is productive for about 8 years, whereas a buffalo is productive for about 9 years. It worth noting that eight Pakistani milking animals producing milk is equal to one milking animal of the developed world. Average per capita milk availability (PCMA) during 1970's and 1980's, was 56 kg and 55 kg, respectively. It rose to 70 kg per annum during 1990's and was 100 kg/annum in 2017-18. (PIDE, 2022. b)

Productivity of Dairy Animals a production comparative analysis:

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 below mentions annual milk yield for Pakistan and the other three countries.

	Pakistan	India	China	Turkey
Milk Yield (kg / animal)	1,461	1,698	5,647	3,158

Source: FAO Statistics Database

Milk production systems: general characteristics

Unlike the production systems in the developed countries like United States of America, milk production systems in Pakistan have similar characteristics to the most developing countries of subcontinent; smallholders with subsistence- or market oriented-level farming keeping the major share followed by peri-urban or commercial- level farming. Dairy farming in Pakistan is practiced mainly by the private sector on various scales, in both urban and rural settings. However, the sector is generally characterized as fragmented and subsistence. With the exception of some peri-urban units, most dairy farming is practiced in mixed crop-livestock systems.

Classically, dairy production systems in Pakistan fall into five main systems of milk production based on location, herd size, and level of management. These are smallholder subsistence, smallholder market-oriented, rural commercial, peri-urban and large peri-urban. Figure given below shows percentage contribution of different milk production systems in total annual milk production. These systems are explained in the following subsections.

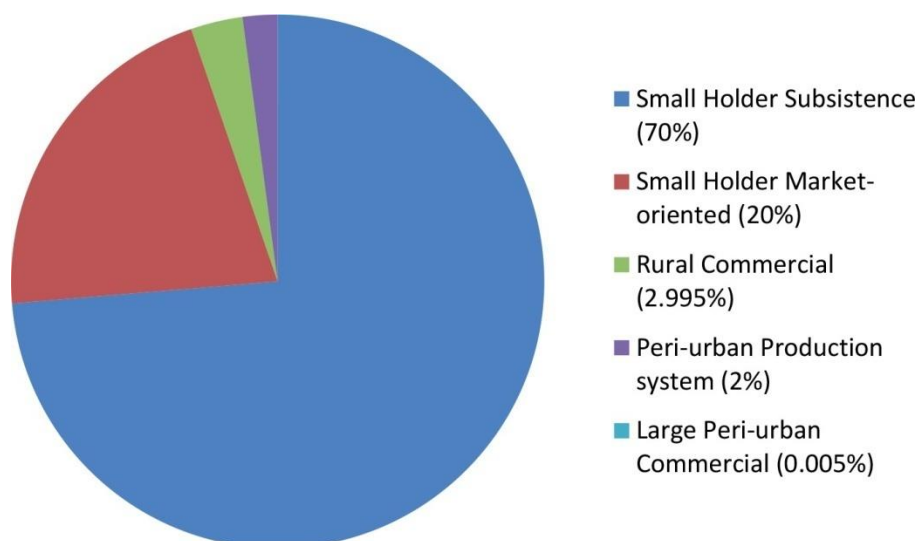


Figure 1

Annual milk production from various milk production systems in Pakistan in 2016, based on Livestock Censes and annual growth trends

Smallholder subsistence production system

Smallholders produce milk to meet family requirements at minimal cost and have limited access to substantial milk market. The average subsistence unit consists of about three buffaloes, with at least two in milking. Average milk yields per animal are 3 L/day. The main inputs into these households' dairy production are often noncash resources, such as family-owned land and labor. Some 70% of smallholder milk producers fall into this category. Most of the milk produced is utilized as fluid for fulfilling the family needs, and the rest is converted into butter and ghee.

This system implies the use of household labor and therefore high labor-intensive

occupation. Almost 50–60% of the feed requirements of these animals are fulfilled from grazing along with wheat straw and some green fodder. No purchased concentrates are offered. The proportional contribution of this system is declining and is replaced by smallholder market-oriented production system.

Smallholder market-oriented production system

As presented earlier, rural subsistence production system is changing into rural market-oriented smallholder production system with passage of years. This system is identified by its typical number of animal holdings and surplus milk production than the family requirements. There are usually 5–7 animals per household, both cows and buffaloes. Of these, there are usually 3–4 adult lactating animals along with one or two heifers and one or two male calves. Breeding bulls are normally absent. Feeding requirements of lactating animals are fulfilled from fodder along with wheat straw and seed cake. More than 70% of milk produced is sold either directly to retail shops or through intermediaries. This system is practiced by those smallholders who have access to nearby livestock markets, and they are encouraged to produce in excess of family requirements.

Rural commercial production system

In 2006, dairy sector in Pakistan moved toward commercial side and this encouraged some progressive farmers to invest in milk production. A typical rural commercial dairy farm running on commercial basis consists of about 30 animals of which 70% are females, including some cows. Approximately 40% of these adult females are in milk during most of the year. Fodder crops provided 50% and straws about 35% of the feed requirements and concentrates made the rest of it. More than 90% of the milk produced at the farm is sold. Average milk yields per animal are 10 L/day. Potential channels for the marketing of milk in this system have changed from traditional system to selling to the commercial milk collection companies. This system presents the second largest source of milk collection by commercial dairy companies after large peri-urban commercial farming.

Peri-urban production system

Peri-urban production occurs in commercial-scale units located on the peripheries of major urban centers. With growing demand for milk in urban areas, rural commercial dairy farming moved toward peri-urban areas. These maintain herd sizes ranging from 20 to 200 (small) and from 200 to 2000 (large) head, and averaging 50 animals; 90% buffaloes and 10% cows with nearly 90% of adult females in production. These units employ family and hired labor, the latter being paid at local urban rates. Milk is delivered to the market twice a day. Major overheads in this system include hired labor costs, animal shelter, veterinary care, feed, water and electricity bills, and milk transport. Milk is usually sold through direct sale to retail shops in the city after de-creaming with the target to sell almost total produced milk. Male calves are disposed off within first 2 weeks of birth. These animals are fed chopped green fodder and wheat straw and concentrate mixture with target to sell almost total milk produced. The current number of dairy farms falling into this category accounts for 200 units situated across the country.

Large peri-urban commercial dairy farming (key farms, mega farms, corporate farms, etc.)

A rapid increase in urbanization during the last two to three decades has encouraged shifting of peri-urban dairy farming to large peri-urban commercial dairy farming (corporate

farming). The owners of these farms aim at getting maximum milk production with economical and quality feeding and good management. These farms are categorized as high inputs-high outputs production systems with no limits on provision of feeding (good quality green fodder or silage along with concentrate mixture) as well as other inputs (medicine, machinery, mechanization, etc.). Dairy animals maintained at these farms are considered elite animals from pure Holstein Friesian and crosses of Holstein Friesian and Jersey breeds; and their yields per day are considerably higher (25 L/day) than those maintained under other production systems. These farms are usually coupled with small-level milk processing (chilling, pasteurization, and packaging), and finished product is disposed of through outlets or departmental stores or supplied to dairy companies (chilled, unprocessed). These modern dairy farms represent less than 1% of total dairy animals and milk production in the country; however, peri-urban (Sections 2.4) and large peri-urban collectively make about 1% of the total. These farms are mostly located in the cultivated areas of the country especially central Punjab province (14) and Sindh (1) (data provided by the sector). The average number of exotic animals kept at these farms is between 2000 and 5000, and the farms with more than 5000 animals also exist. The farms produce large quantities of fluid milk ranging from 0.02 to 0.1 million L/day.

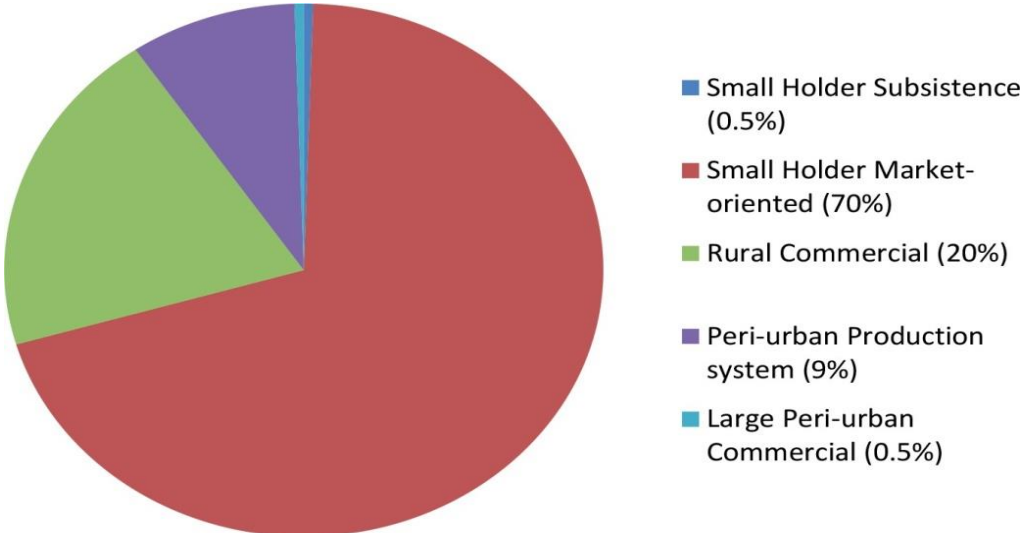


Figure 2. Annual saleable milk production from various milk production systems in Pakistan in 2016, based on and the data provided by the sector.

2. RECENT TRENDS IN DAIRY SUPPLY CHAIN

Dairy supply chain comprises on six core activities such as production, transportation, processing, packaging, storage and consumption. It is required to synchronize these activities of the various dairy supply chain partners. It is challenging phenomenon that Pakistani dairy supply chain core activities has been segregated and there still no any mechanism introduced for integration. Particularly, it is complicated issue to design an efficient, hygienic and economic dairy supply chain for developing countries. There are quite important viable complications existed in the dairy supply chain, firstly it is difficult to establish a sound milk collection and transportation system. Small dairy holders produced little quantities of milk and that are situated in the remote areas.

Fig. 3 represented core activities of dairy supply chain

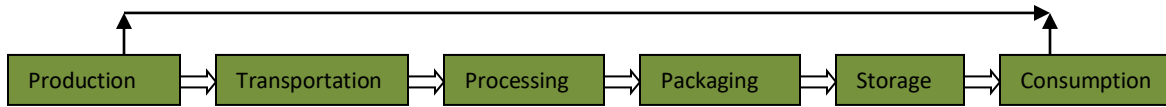


Fig 3. Core activities of Dairy Supply Chain in Pakistan

Pakistan dairy supply chain is very complicated, there is about 40% milk surplus after home consumption, calves suckling and then farmers have just way of indigenous home processing to the urban market. In fact 20% milk is being wasted in transportation, calving and lack of proper cooling and storage mechanisms. It is estimation that 2% urban market get milk from formal channel and remaining 98% get from the informal channel of milkman. Importantly, Pakistani farmers sell their morning timing milk either to the milk collection center, milk trader or milkman and evening milk they consume on their own value added products such as butter, Desi Ghee, yogurt or Lassi. A commercial rural farms sell their surplus milk to milkman (traditionally it is called Gawalla) or deliver at the village milk collection point that are developed by food processing companies (i.e Nestle, Engro Foods etc). While Commercial urban farm are more attractive and they sell their milk directly to consumers on much more attractive price. Generally in Pakistan processing of milk is handled by formal channel or food processing firms. There are different sorts of processed milk such as pasteurized milk, liquid milk, UHT milk in tetra pack. Similarly there are some other processed milk products i.e Cheese ,Ice cream, Yogurt and Butter. Although, informal channel produces Lassi which is very popular in Pakistan and India. Beside this informal channel used milk for sweets and khoya etc. This formal and informal channel of milk distribution framework of supply chain depicted in Fig 4:

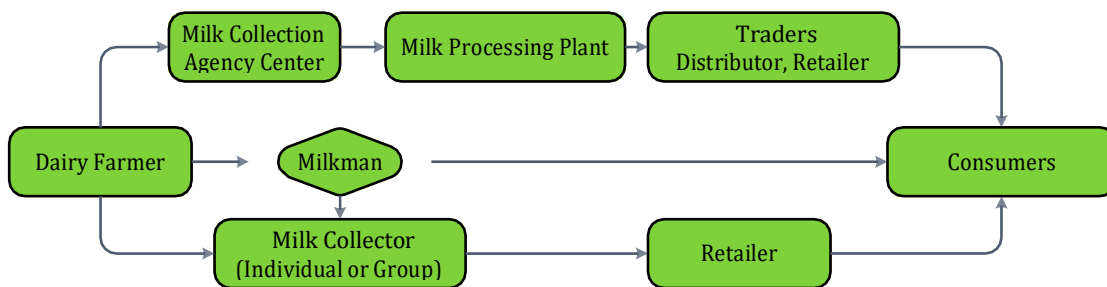
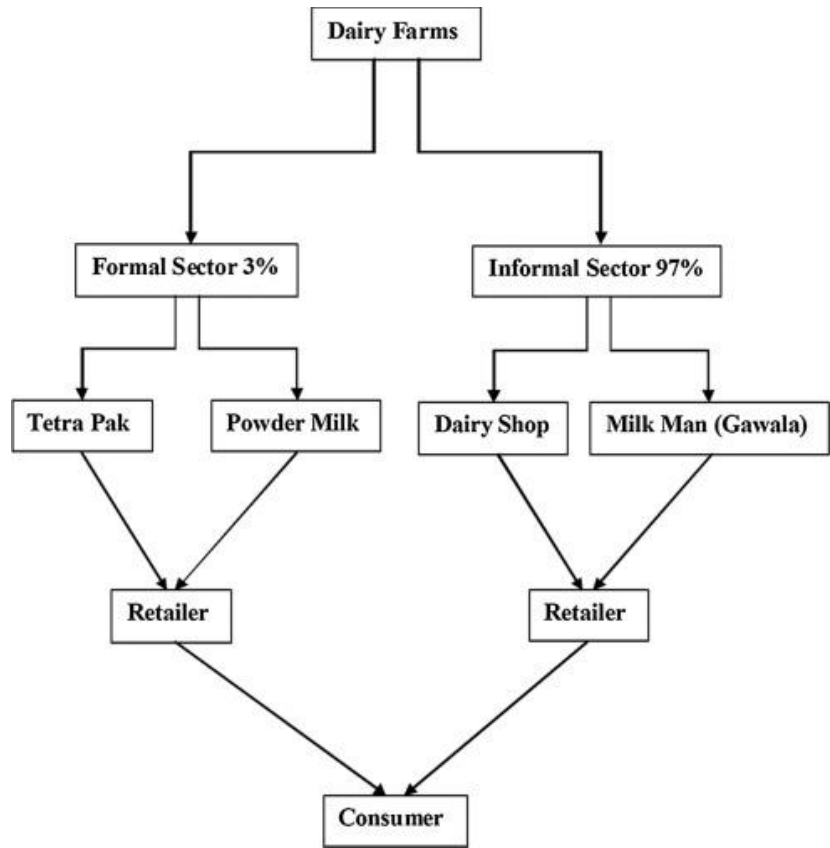


Fig 4: Traditional Dairy Supply Chain in Pakistan

Milk collectors (Gawala or Dhodi) have been playing important roles in collection, marketing and distribution of Pakistan dairy sector supply chain. Milk Collector community has been increasing rapidly and it crossed a million in number. Generally this community has been divided into three classes such as small milk collector that individuals collect about 200-400 kg milk per day from various remote areas of Pakistan. It commonly used long term contract or predetermined prices to farmers for their milk. Sometime milk collector makes advanced payment to the farmers. Medium milk collectors collect 400-800 kg milk per day but their milk collection strategies are similar with small Gawallas. Large scale milk collector collect 1.5 ton to 3 ton per day and they collect this milk quantity from small or medium Gawallas and sell that milk to retailers or shopkeeper. This community has been greatly involved in the milk adulteration and also exploited to farmers. They have greater bargaining

power in the dairy supply chain in respect of finance and information. Dairy supply chain informal channel has unfair advantages over the formal channel and contributing to providing poor quality of milk to detriment of consumers in Pakistan. Specifically, farmers have been suffering losses in the shape of money, wastage of milk and so on. More explanatory structure of milk supply chain is stated beneath in Fig.5. Power phenomenon is not a challenging issue in developing countries but it also existed in developed world. Particularly buyers (i.e supermarket) have different kinds of power such as listing & slotting fee, de- listing or threat of delisting, late payment, below cost selling and promotion of personal brands etc that have negative effects on the performance of suppliers. Meanwhile, buyers power abuses have this kind of effects on consumers such as loss of choice, push prices, low new products and mislead about sustainability concerns.



2.1.Classification of Milk Producers

Milk producers are the most key component of milk supply chain in Pakistan.

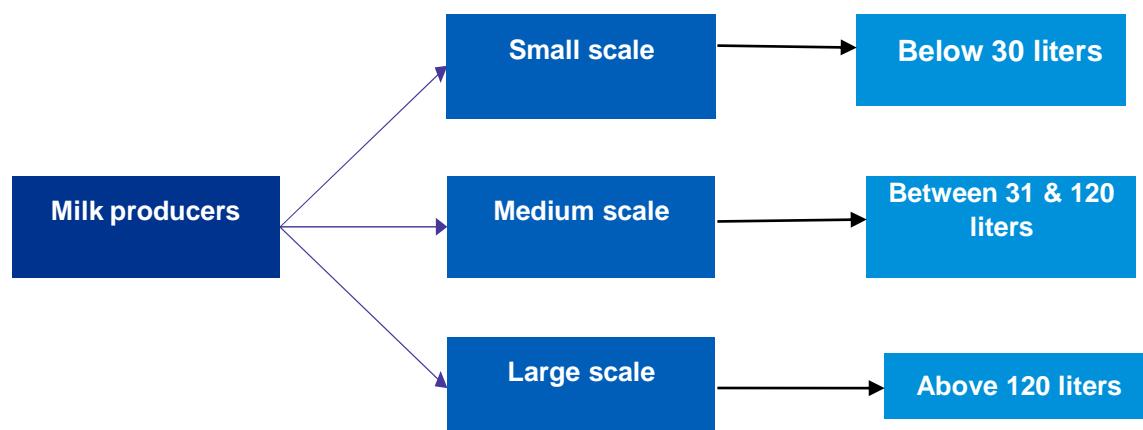
The Milk producers have been classified based on the level of production into three main categories, in Pakistan which are as follows:

- Small scale producer;
- Medium scale producer; or
- Large scale producer.

The criteria to categorize producers in these respective categories are given below:

- Small scale producers are those producers whose daily milk production yield does not exceed 30 liters;
- Medium scale producers are those whose daily milk production yield ranges between 31

to 120 liters; and
— Large scale producers are those whose daily milk production yield exceeds 120 liter



2.2.Dairy Value Added Products in Pakistan:

Value added products are produced by some modification or enhancement via addition or segregation of liquid wholesome milk. Value-added products include cheese, paneer, ghee, yoghurt and probiotic drinks etc. These products are produced by alteration and enrichment via use of additives, microbial fermentation or simply mixing with liquid milk.

Value addition can be a great tool for doubling the farmer's income, and making more profit out of liquid milk with the use of certain techniques. It can work as a tool for increasing the inclination of farmers towards dairy industry. With increasing consumer awareness in recent times, people are more aware regarding healthy nutrition and diet which has increased the market scope of value added functional dairy foods.

Lassi and Yogurt

Farmers produce Lassi and yogurt at the household level mainly for household consumption, butnot for market. The milk shops also produce Lassi and yogurt and sell them at their shops.



Ghee, Cream, and Butter

Table major brands of dairy products sold in Pakistan. Some processing companies produce dairy products such as butter, margarine and cheese, and sell them at supermarkets and other retail shops. Some milk shops sell ghee with price of Rs.450 to 500/kg at their shops. Some sweet shops also produce ghee, butter, and Khoya and sell their products at their shops. Farmers produce ghee, cream, and butter at the household level, and some of them sell their products to market.



Khoya

Khoya is a product made after boiling milk for hours. The quality of Khoya can be kept good for 15 to 16 hours in summer and 30 hours in winter without refrigerating it. Khoya can be one of the good income sources for those farmers.



Major Brands and Companies of Dairy Products in Pakistan:

Products	Brand Name	Company	Made in
Butter	Nurpur	Nurpur Foods	Pakistan
	Lurpak	Danish Dairy Board	(middle east)
Margarine	Blue Band	Unilever Pakistan	Pakistan
	Dawn	Dawn Margarine	Malaysia
	Mumtaz	United Foods	UAE
	Nawar	United Foods	UAE
Cheese	Nurpur	Nurpur Foods	Pakistan
	Happy Cow		Austria
	President	United Foods	Saudi Arabia
	Baga		Austria
	Societe		France
	Cottage Cheese	Cottage Foods	Pakistan
Cheese (Mozzarella, Cheddar)	Adam's	Adam's Milk Foods	Pakistan

3. CHEESE MAKING AND ITS SCOPE IN PAKISTAN

Cheese is considered an important food item with high nutritional value and is available in great diversity of flavors, texture, tastes, varieties and shapes. Around 2000 individual varieties¹³ of cheeses are being produced in the world, classified on the basis of their form, manufacturing, ripening and chemical composition. Cheese is more compact with longer shelf life as compared to any other dairy product, hence contributing to its worth and value for portability, long life and high content of fat, protein and minerals.

Cheese manufacturing is one of the classical examples of milk preservation. It is formed by coagulation of the protein 'Casein' which is mainly present in milk obtained primarily from cows, buffalo and very little from goats and sheep. Fat content present in milk along with protein are found in various proportions. During cheese production, the milk is usually acidified, and coagulated by adding the enzyme after which, solids are separated and pressed into final form of cheese.

History of cheese making dates back to 6000-7000 BC. According to an ancient legend, it was made accidentally by an Arabian merchant who put his supply of milk into a pouch made from a sheep's stomach, as he set out on the day's journey across the desert. The rennet in the lining of the pouch, combined with the heat of the sun, caused the milk to separate into curd and whey. That night he found that the whey satisfied his thirst, and the cheese (curd) had a delightful flavor that satisfied his hunger. Travelers from Asia are believed to bring the art of cheese making to Europe. Italy is believed to have become the cheese-making center of Europe in subsequent years. Cheese making continued to flourish in Europe and became an established food. Cheese making practices quickly spread in the world, but until the 19th century it remained a local farm industry. It wasn't until 1851 that the first cheese factory in United States was built in New York, and subsequently to the world.

There are many definitions of cheese, however, Food and Agricultural Organization (FAO) Code of Principles defines cheese as 'the fresh or matured product obtained by the drainage (of liquid) after the coagulation of milk, cream, skimmed or partly skimmed milk, butter milk or a combination thereof'. Another definition defines the types of cheeses made from the liquid whey obtained during the manufacturing process by defining; 'whey cheese is the product obtained by concentration or coagulation of whey with or without the addition of milk or milk fat'. There are many other definitions that define cheese as per updated cheese manufacturing techniques in detail; however, the general concept remains the same.

3.1.Characteristics of Some Famous Varieties of Cheese:

Mozzarella Cheese:

Mozzarella cheese is one of the most popular cheese varieties in the world because of its primary use on the pizza topping and other foods due to which its demand has increased manifold in the recent past. It is included in the group of “Pasta filata” or stretched cheese in which the curd is produced as normal process of cheese making then kept in hot water or whey to consolidate into a solid mass, subsequently, stretching of this mass converts the curd into a uniform and elastic cheese in consistency.



Stretching is a treatment that renders the curd elastic which is a unique quality attribute of Mozzarella cheese.

Its physical characteristics such as body, texture, melting ability, stretch ability and color are altered by the factors like milk composition, starter culture and ripening conditions prevalent during the cheese preparation process. It can be prepared from milk of various animal species such as cow, buffalo, goat and sheep. Traditionally, it was made from buffalo milk which was preferred due to its characteristic flavor. The flavor and texture of fresh Mozzarella is different from processed sliced or shredded as fresh Mozzarella is moist, soft, quick in melt and delicate in taste.



Cheddar Cheese:

Cheddar is a hard type of cheese which originated in the village of Cheddar, England. It has high nutritional value owing to the concentration of caseins which contain various levels of all essential amino acids, fat and small amounts of minerals (calcium, sodium, potassium) and vitamins (retinol, riboflavin, pyridoxine and cyanocobalamine). Owing to higher concentration of nutrients, it is an important component of balanced diet. Quality of Cheddar cheese depends upon starter cultures, manufacturing technology and composition of milk. The milk composition is influenced by the



species, physical characteristics, health, feed, weather conditions and lactation stage of milking animal. Cheese is prepared from milk having dynamically balanced mixture of protein, fat, carbohydrates, vitamins, minerals and water. During ripening, Cheddar cheese experiences momentous biochemical modifications and transformations because of different biochemical activities (e.g. glycolysis, proteolysis and lipolysis). As a result, fresh curd having bland flavor and rubbery texture is converted into a product with attractive flavor and smooth texture.

Cheddar cheese varies in flavor depending on the length of aging and their origin. As cheddar slowly ages, it loses moisture and its texture becomes drier and more crumbly. Sharpness becomes noticeable at 12 months (old cheddar) and 18 months (extra old cheddar). The optimal aging period is 5-6 years; however, for most uses three-year-old cheese is fine and five-year-old cheddar can be saved for special occasions.



Cream Cheese:

Cream cheese is considered to be a fresh type of cheese as it is not processed through aging. The flavor is subtle, fresh and sweet having light tangy taste. At room temperature, it spreads easily and has a smooth and creamy texture. It is made by adding cream to cow's milk which gives it richness but is not ripened, limiting its shelf life. It is usually white in color and is available in low fat or non-fat varieties.



Feta Cheese:

Feta cheese is one of the oldest cheeses which originated from Greece and is formally accepted as a 'Greek-Only Cheese'. It is soft and usually made from milk of sheep or both sheep and goat, however, recently cow's milk has also been used. It is white in color and a bit sour to the taste and rich in aroma.



Goat Cheese

Goat cheese comes in variety of forms, softness and distinctive flavors which is due to the tangy flavor of goat milk. It can also be made in hard aged varieties as well as semi firm cheeses like feta. It is common in the Middle East, Africa, and some Mediterranean countries, where the hardy goat survives in areas where cows cannot.



Its flavor is very strong and some consumers may find it disagreeable, however, in majority of cases, the particular flavor is sought after in famous goat dairies. Its strong flavor is caused by hormones when milk producing goats are kept with bucks. In addition, the cheese quality is influenced by what the goats are eating which other ruminants do not eat.

3.2.Cheese Market in Pakistan:

During the last half decade, the consumption and demand of cheese in Pakistan has increased many folds opening the opportunities for existing and potential investors to invest in cheese processing units. Dairy sector provides the best quality milk to provide raw material i.e. milk for cheese production which may play a major contributor in import substitution of cheese which has been showing increasing trend.

Since milk is the largest and single most important commodity in dairy, there is an opportunity for milk producers and processors to add value to the dairy industry by processing milk into cheese. Cheese is the product which is widely used in hotels, restaurants, fast food corners and airlines, shipping lines and households. The food processing industry of Pakistan is growing roughly at 10% to 15% annually. Growing popularity of Western-style cuisine, increasing urbanization, growing per capita income, and increasing two-income families are fueling this demand. Local pizza restaurants are opening almost in every corner of the road, which increases the demand for mozzarella and cheddar cheese, interestingly local pizza industry uses locally made mozzarella and cheddar cheese (Ratio: 50:50); hence one can easily find growth potential in the market.

Local demand for cheese has grown and local manufacturers are unable to meet supply-demand gap which is being filled by the imported cheese. There is a potential to capture certain market share by producing imported quality cheese at reasonable price. In recent years, Pakistani market is changing and developing rapidly in lifestyle. Many food products, once considered luxury in past, are being used regularly by a larger section of the middle and lower income groups i.e. pizza, burgers, lasagna etc. and cheese is main part of such items.

With the increasing popularity of pizza, use of Mozzarella cheese is increasing day by day due to the opening of multinational pizza restaurants. The quality of locally produced mozzarella is not compatible with the imported cheese. Though import of mozzarella in Pakistan is not known exactly but statistics collected from large multinational pizza restaurants shows that its import is more than 760 ton per annum.

3.3.Existing Cheese Production in Pakistan

In year 2015-16, around 53 million tons of milk was produced in which 62% was contributed by buffaloes and 34% by cows. Other species like sheep, goat and camel contribute to

remaining milk production. Out of total milk channelized for processing, very small quantities are used in the production of local products such as cheese (Paneer), and sweets (Khoya, Rubri, Burfi etc.). Worldwide, majority of cheese varieties are produced primarily from cow milk whereas buffalo milk ranks after it. About 80% of the world's buffalo milk is produced in India and Pakistan. According to FAO, buffalo is an important but 'under-valued asset' for production of milk and milk products such as cheese. On account of its composition, buffalo milk is more appropriate for soft and hard type of cheeses as it has higher in fat, lactose, caseins, calcium, magnesium and phosphate than cow. Similarly, the capacity of milk to be acidified is better for buffalo's milk as compared to cow.

There is limited production of cheese and other value added dairy products in Pakistan due to lack of knowledge and expertise, dietary habits of consumers and high end price of locally manufactured cheese as well as imported one. However, in recent years, it has been observed that many cheese manufacturing units have been established within dairy industries for pizza and other fast food industries due to its rising demand. Almost 5000 tons cheese is consumed annually whereas its production is 2500 tons per annum. Production of mozzarella cheese in Pakistan is only 90–100 tons per year in which imported enzyme cultures are used during production process, therefore, increasing its cost of production, hence retail price.

3.4.Existing Cheese Making Companies in Pakistan:

In Pakistan, since, the size of local market is growing due to changing eating habits, increasing per capita income, and growing number of two-income families, the sale of imported Mozzarella and other kinds of cheese to fulfill local market demands is being done e.g. at Metro. Some of following processing companies are producing cheese locally

- Haleeb foods have been operating to the industry since 2007 and produces cheddar cheese.
- Adam's Milk Foods (Pvt.) Ltd. is producing and selling different varieties of cheese locally.
- Noon Pakistan Ltd. commenced its operation in June 1972 and its products namely; milk powder, butter and cheese are marketed throughout Pakistan under the brand name of "Nurpur". It is currently producing cheddar and cottage cheese only and is planning for mozzarella cheese soon.

The value of **imports of commodity group "Cheese and curd"** to Pakistan totaled \$ **6.23 million** in 2020. Top trading partners (import of "Cheese and curd.") of Pakistan in 2020:

- Austria with a share of 30% (1.89 million US\$)
- Turkey with a share of 20% (1.27 million US\$)

- Denmark with a share of 14.5% (906 thousand US\$)
- Saudi Arabia with a share of 10.7% (670 thousand US\$)
- New Zealand with a share of 9.2% (574 thousand US\$)
- United Kingdom with a share of 3.31% (206 thousand US\$)
- France with a share of 2.73% (170 thousand US\$)
- Other Europe, nes with a share of 1.71% (107 thousand US\$)
- USA with a share of 1.52% (94 thousand US\$)
- Poland with a share of 1.49% (93 thousand US\$)

Imports structure of Cheese and curd to Pakistan in 2020 represented by the following main commodity groups:

- **56%** (3.53 million US\$): - Processed cheese, not grated/powdered
- **30%** (1.92 million US\$): - Grated/powdered cheese, of all kinds
- **11%** (687 thousand US\$): - Fresh (unripened/uncured) cheese
- **1.47%** (91 thousand US\$): - Other Cheese

The value of exports of commodity group "Cheese and curd." from Pakistan total \$ 73 thousand in 2020. Top export destinations of "Cheese and curd." from Pakistan in 2020:

- USA with a share of 98% (72 thousand US\$)
- Saudi Arabia with a share of 1.39% (1.02 thousand US\$)

4. CONCLUSION:

While reviewing all the literature and conducting research study on the topic following conclusions has been drawn by Research team, Planning and Research Department, ZTBL

- There is a dire need to improve milk collection system either by purchase of milk at farm gate or by limiting the role of middle man (doodhi). There is also a need to provide transportation facilities to transport milk from rural areas to urban areas, to increase post harvest life of milk, chillers may be established in rural areas with continuous power supply.
- Dairy value chain may be adopted by small and medium scale farmers only if there are proper training and awareness sessions especially for rural women may be arranged at the provincial/district level for the farming community.
- Pakistan is the fourth-largest producer of milk in the world, but a lot of milk is wasted due to a lack of cold storage facilities. Around 15 to 20 percent of the total milk produced is wasted due to improper storage and handling from the total milk produced in our country, only four percent milk is pasteurized and UHT treated and only one percent is used in the production of other value-added dairy products (Marrie, 2022). Though cheese having high nutritional value but in our country milk is only fulfilling the demand of growing population in the country and cheese is still far from the agenda. Even cheese making machinery is still not readily available in the country. Cheese Making may not

become a successful business in Pakistan until the value chain of dairy may not be added in the policy agenda and latest technology should effectively delivered to benefit small farmers at farm level and for such purpose, extension services should be improved and strengthened. Participation of farmer should be ensured. Research institutes should be interlinked with private sector to deliver mechanism and technologies upto gross root level.

5. ROLE OF ZARAI TARAQIATI BANK LIMITED (ZTBL):

Zarai Taraqati Bank Limited (ZTBL) is the only Agri. financial institution which is uplifting agriculture sector of the country through provision of credit facilities and dissemination of latest agriculture information to the farming communities. In order to develop the Dairy and livestock sector ZTBL has developed various financial/loaning products for the farmers. The brief detail of ZTBL dairy products are as under:

Dairy Value Chain: This scheme of ZTBL helps the farmers to have easy access towards credit and to facilitate dairy farmers in availing the agri. credit for the entire value chain of dairy sector.

Milk Cooling Tanks: It has been observed that over all milk production in the country is abundant but arrangements for its timely preservation and transportation to the available markets are not adequate with the result that the milk gets contaminated. ZTBL provides loans for milk cooling tanks may be considered, to the milk collectors and the existing dairy farms that lack this facility in those areas where electricity is available.

Financing for “Establishment of Silage Units:

Silage is fermented, high moisture stored fodder, which is used to feed dairy/livestock and other animals in dry season. In order to preserve & protect silage nutrients from field losses as well as to promote dairy/livestock sector by facilitating the farming community to provide loans for establishment of silage units to overcome the fodder shortage during scarcity/dry season for their animals, the Bank has launched the captioned scheme for the farming community.

6. REFERENCES/LITERATURE CITED

Food and Agriculture Organization. The State of Food and Agriculture: Livestock in the Balance; 2009.

Economic Survey of Pakistan 2021-22, GOP, https://www.finance.gov.pk/survey/chapters_21/02-Agriculture.pdf

Pakistan Dairy Development Company. 2006. The White Revolution-White paper on Pakistan's dairy sector.

Pakistan Institute of Development Economics, 2020a <https://pide.org.pk/blog/milk-production-in-pakistan/>

Pakistan Institute of development economics, 2022b, <https://pide.org.pk/blog/milk-production-in-pakistan/>

Sarwar M, Khan MA, Nisa MU, Zafar I. Dairy industry in Pakistan: A scenario. International Journal of Agriculture & Biology. 2002;4(3):420-428

Tahir, M. N. , Riaz, R., Bilal, M., & Nouman, H. M. (2019). Current Standing and Future Challenges of Dairying in Pakistan: A Status Update. In (Ed.), Milk Production, Processing and Marketing. IntechOpen. <https://doi.org/10.5772/intechopen.83494>

Raja RH. Pakistan Smallholder Dairy Production and Marketing. Islamabad: Ministry of Food, Agriculture and Livestock (Livestock Wing); 2003

GOP. Pakistan Livestock Census 2006. Vol. 2009. Lahore, Pakistan: Agricultural Census Organization, Statistics Division

Zia U. Analysis of Milk Marketing Chain. Rome: Publishing Policy and Support Branch, Office of Knowledge Exchange, Research and Extension; 2006

Khalid MI. Developments in the Livestock and Dairy Development Sector Punjab, Pakistan. Pakistan- India Legislators and Public Officials Dialogue on Sharing of Experiences on Governance and Democracy; November 20, 2016. Pakistan Institute of Legislative Development And Transparency: Dubai, UAE; 2016

SMEDA Study on Cheese: A Value Added Dairy Product Prospects for Pakistan

Marri, 2022, <https://www.brecorder.com/news/40175880/a-lot-of-milk-goes-waste-due-to-poor-cold-chain-infrastructure-sau-vc>

Sharma, K. and Singh, S.P. (2009). Knowledge of dairy farmers about improved buffalo husbandry management practices. Indian Research Journal of Extension Education., 9 (3)

Research & Editorial Board

Mr. Asad Ullah Habib	Head Planning Research & Technology Division
Mr. Nadeem Akhtar Malik	Head Planning and Research Department
Mr. Muhammad Fakhar Imam	Head Research & Publication Unit
Mr. Ahmed Hussain Khan	Head Information & Monitoring Unit
Ms. Aamna Imtiaz (OG-II)	Research and Publication Unit
Ms. Humma Nisar (OG-III)	Business Planning Unit

Author of the study:

Muhammad Fakhar Imam, Head, R&PU, P&RD, ZTBL, H.O. Islamabad