Analysing Pakistan's Modern Dairy Value-Chain Innovation

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About this paper

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About LANSA

Leveraging Agriculture for Nutrition in South Asia (LANSA) is an international research partnership. LANSA is finding out how agriculture and agri-food systems can be better designed to advance nutrition. LANSA is focused on policies, interventions and strategies that can improve the nutritional status of women and children in South Asia. LANSA is funded by UKaid from the UK government. The views expressed do not necessarily reflect the UK Government's official policies. For more information see www.lansasouthasia.org

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Abstract

Interventions in agri-food value chains are thought to potentially make important contributions towards enhancing agriculture's role in nutrition. Some frameworks have begun to identify sets of requirements for pro-nutrition value chains. Pakistan's dairy sector has been the focus of a business-driven innovation which introduced ultra-high temperature treated (UHT) milk in aseptic packaging. This was expected to relieve existing constraints in production and distribution, raise incomes for producers, and increase the supply of an affordable nutrient-dense food to consumers. While this innovation appeared to fulfil most requirements of a pro-nutrition value chain, it ultimately failed to act as a bridge between farmers and consumers. Instead, it led to the introduction of non-dairy products and imported raw materials. This case study examines the value-chain innovation by placing it in the context of the broader post-farmgate system for the supply and distribution of milk, including existing (traditional) value chains which predated the innovation. It shows that while existing frameworks take a relatively static view of whether an innovation prospectively fulfils certain requirements, businesses can alter entire value chains quickly in response to market conditions.

I. Introduction

Dairy in general, and fresh milk in particular, are important components of the diet in Pakistan. Dairy milk is reported to be the most widely-used nutrient-dense food for complementary or infant and young child feeding (IYCF) (Zuberi et al. 2016). The dairy sector in Pakistan has undergone a number of notable organisational changes in the last two decades or so. One of the most significant changes has been the introduction of modern value chains for processing and marketing milk, as well as growth in the market share of processed milk (Planning Commission 1983). Locally-produced processed milk (mostly UHT) emerged as a new product in this period in a market which was otherwise dominated by unprocessed "loose" milk on the one hand and imported powdered milk, on the other (Anjum et al. 1989). The introduction of aseptic packaging in the country in the late 1980s was the catalyst for the creation of the industry (Burki et al. 2004).[i]

While it has been known from the outset that dairy value-chain interventions in Pakistan have not been aimed explicitly at nutritional outcomes, there are good reasons for studying these in more detail. First, dairy milk is an important nutrient-dense food for IYCF, including among low-income households. Any changes in the dairy sector, therefore, will have an impact on the nutrition status of children in Pakistan. Second, market-based value-chain interventions in this sector have met some of the conditions (demand creation and sustainability) that are seen to be important for successful agri-food value interventions (Maestre et al. (2017). Third, this sector has strong agriculture-nutrition linkages.

This paper presents the case study of a promising agri-food value-chain innovation in a largely agricultural country with a high burden of undernutrition. The case study has been constructed using the emerging conceptual literature on agri-food value chains for nutrition. It examines the extent to which value-chain interventions in this sector facilitate the delivery of nutrient-dense food to the poor, and how it is done. What are the bottlenecks in this regard, and how might they be

overcome? It aims to draw lessons on the potential for business-driven agri-food value-chain interventions to improve nutrition in Pakistan and elsewhere. It further offers an opportunity for understanding the limitations of existing conceptual frameworks in prospectively identifying conditions and requirements for pro-nutrition value-chain interventions.

1.1 Evolution of the value-chain perspective

The value-chain perspective began to be recognised in the 1980s as an internal business development tool that firms were using to strategically position themselves under conditions of rapid technological and organisational change (Porter 1985). Companies became interested in identifying and advancing those elements of their business processes which would offer the greatest opportunities for value creation and appropriation. This perspective gained popularity in development studies in the 1990s through an influential paper by Kaplinsky (2000) who, in this strategic pursuit of entrepreneurial rent, identified a key characteristic of the emerging globalised economy.[ii] What businesses were doing in developed countries had implications for developing countries as value-chain management linked distant producers and consumers through a series of closely coordinated inter-firm and intra-firm transactions. The prescriptive element in these earlier studies was limited to directing industrial policy towards those sectors and activities in developing countries which could be expected to accrue value. But policy interest was to extend further:

'Value-chain approaches to development have been adopted by several developing agencies to encourage greater participation by poor people in modern value chains, including food value chains. These include agricultural value-chain development projects, which tend to focus on some forms of "upgrading" as a means of increasing returns to farmers (that is, changing their products, improving their processes, increasing the volume produced, changing their functions, or improving coordination to capture more value).' (Hawkes and Ruel 2012: 74)

The value-chain concept had made a long journey from being named as an element of business strategy to an avenue of development investment for market-driven poverty reduction. Having come this far, could value-chain interventions be used for addressing nutrition, particularly undernutrition? (ibid.) A number of possible answers were forthcoming. Maestre et al. (2017) reviewed these and summarised the requirements for pro-nutrition value-chain interventions. On the consumer side, the product in question needed to be nutritious and safe, there needed to be clear signalling of its nutritional value, and the intervention simultaneously needed to ensure that it was available, affordable and acceptable to the poor. On the production, distribution and supply side, it was important to know if, or to what extent, agents' incentives were aligned and whether they were able to capture the value of their activity.

Pakistan's dairy sector offers the case of an innovation which appeared, prospectively to fulfil most, if not all, of the requirements of pro-nutrition value chains outlined by Maestre et al. (2017) with respect to consumer choice as well as producer incentives. The introduction of modern milk processing using UHT technology was anticipated in various sector reviews as a promising route to overcoming bottlenecks in the expansion of production, supply and consumption of a popular and nutrient-dense food item. It is proposed to examine the value chain innovation by placing it in the context of the broader post-farmgate system for the supply and distribution of milk, including

existing (traditional) value chains which predated the innovation, which the innovation sought to replace. This comparative lens is a key element of the methodology for assessing the success or otherwise of the innovation.

1.2 Methods

This case study brings together evidence from a range of sources — secondary literature and data, key informant interviews from industry experts to chart the supply side, qualitative research in relatively low-income communities — to understand demand and consumer constraints, as also quantitative insights pertaining to complementary feeding, gathered from the Women's Work and Nutrition survey.

Key informant interviews were conducted with representatives of private businesses operating in the modern segment of the dairy value chain, farmers, milk traders and transporters, industry experts, and retailers of dairy products.[iii] A rural region which was known (from industry sources and secondary material) as an area where a dairy company had established its milk procurement system was purposively selected to observe the modern value chain at the supply end. Further, household and key informant interviews were carried out by two of the authors in selected low-income urban and rural communities to understand consumer behaviour with respect to milk.[iv,v]

1.3 Outline

Section 2 describes the operation of traditional and modern value chains for milk in the dairy sector and provides a historical account of the introduction of the value-chain innovation in the context of sector reviews and analyses. Section 3 describes the demand- and consumer-end preferences pertaining to milk in urban and rural areas of Pakistan. A qualitative assessment of the business-driven modern value-chain innovation is given in Section 4. The innovation consists of numerous actions along the value chain by multiple actors over time, and this assessment does not attempt to evaluate the impact of any of these. Rather, the focus is on patterns and trends in the modern value chain and its comparison with the traditional value chain that it sought to replace. Conclusions in Section 5 draw lessons for the dairy sector in Pakistan, more generally on the potential of business-driven innovations for nutrition improvement, and on the strengths and limitations of emerging conceptual frameworks for assessing the nutritional impact of value-chain interventions.

2. Traditional and Modern Value Chains

The traditional-modern dichotomy which "recognizes the existence of a modern sector (e.g., large commercial farms, agri-businesses, multinational food manufacturers, and modern supermarkets), a traditional sector (e.g., smallholder farmers and traders, wet markets, and 'mom and pop' stores) and the interaction between modern and traditional actors" (Gomez and Ricketts 2013: 139) is one way of framing the change envisaged through the introduction of the UHT innovation. The modern value chain led by agri-businesses was expected to take market share from the more traditional value chains dominated by smallholders and wet markets.

Though traditional value chains with small-scale operators have the advantage of supplying nutritious food at low prices, they are constrained by seasonal and other sources of variability in supply. A modern value chain is thought to potentially help overcome some of these constraints and ensure greater availability, particularly if it targets the 'bottom of the pyramid' through traditional channels of marketing and distribution.[vi] While the case study is focused on UHT milk, the other two informal value chains provide the context necessary for a proper understanding of the boxed milk value chain. This review of the UHT innovation is prefaced, therefore, by a description of other existing value chains from the point of view of context and comparison: what was the UHT innovation planning to displace or replace, and how did it actually perform in comparison with existing value chains?

There are, broadly speaking, three distinct value chains for the post-farmgate supply of milk to consumers: rural/small town loose milk, large city loose milk, and boxed UHT milk (Anjum et al. 1989, Burki et al. 2004). The other two informal value chains (loose milk supply to rural areas/small towns, and to a large city) represent pre-existing alternatives to the newly developed UHT value chain. The informal value chains supply fresh, unpasteurised loose milk, which has a short shelf live. The processed milk value chain, by contrast, transforms fresh milk into a more durable product with a longer shelf life. Loose milk is generally sold by retailers in plastic bags and accounts for around 90 per cent of all milk consumption.

## 2.1 Rural/small town loose milk

Historically, keeping livestock for milk has been a mainstay of rural society in Pakistan. In the Women's Work and Nutrition survey of 1,000 households in rural Sindh, for example, nearly all households reported consuming milk, but only under two-fifths reported buying it. The rest rely entirely on their own cattle or on free or reciprocal exchange with neighbours. Livestock is usually the most valuable asset owned by the rural poor, many of whom do not own agricultural land. Women and children are responsible for grazing, collecting fodder, and cleaning the animals which are generally kept within the homestead, and livestock work is seen as an extension of household chores rather than an economic activity (Balagamwala et al. 2015; Mazhar et al. 2017).

Many of the rural communities did not, traditionally, market milk. Households kept buffalos, cows and goats for their own family's milk consumption requirements. Surplus milk would be converted into purified butter which has a long shelf life and is used as cooking fat. Other than that, fresh milk and other perishable products such as buttermilk were distributed free of cost among relatives and neighbours, or the poor who did not own any livestock (Balagamwala and Gazdar 2014; Balagamwala et al. 2015). This was particularly the case with surplus milk from the evening milking. Morning milk was usually consumed within the family or churned into butter. It might be argued that many of these customs were connected with the absence of storage and transportation facilities. Although rural livestock holders do sell milk, some free or reciprocal circulation of milk and buttermilk from the evening milking is still practised (Gazdar and Mysorewala 2016).

The rural loose milk supply chain, therefore, is perhaps the oldest and simplest arrangement for marketing milk in a society where it used to be produced for self-consumption. The key actors are the small-scale producers who hold anywhere from one to five animals (Zia et al. 2011). They supply fresh, unprocessed milk to a middleman (known in many areas as doodhi), who in turn delivers the

milk to loose milk retailers in small towns or directly to the consumers. The doodhi has arguably played an important role in the commodification of milk. His ability to deliver and supply highly perishable fresh milk over long distances, quickly and safely, converted milk into a tradable good. There is a growing rural market for milk too, particularly catering to roadside tea cabins and restaurants, and these too rely on the doodhi (**Figure 1**).

**Figure 1: Rural/ small town loose milk supply**
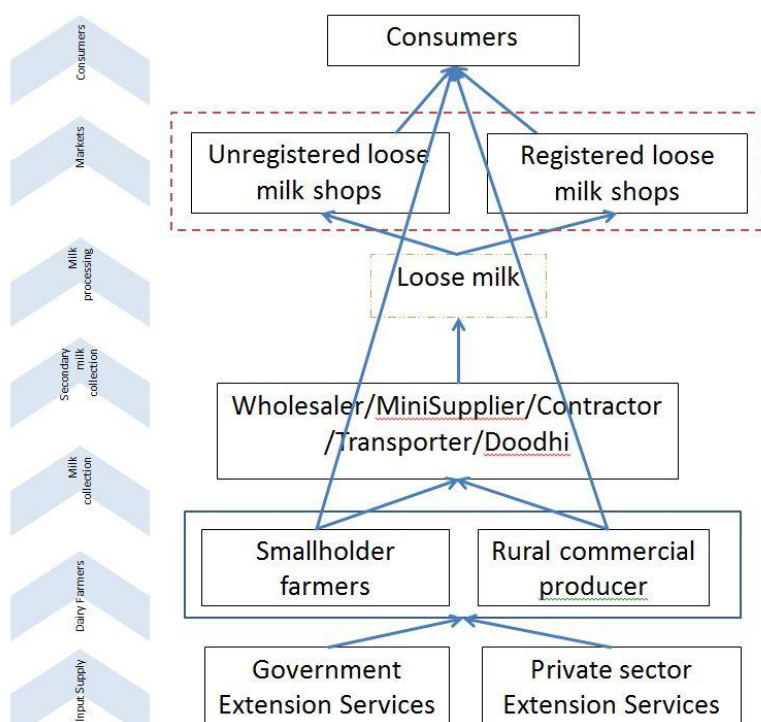
Various sector reviews (Anjum et al. 1989; Burki et al. 2004; Fakhar and Walker 2006; Staal et al. 2008; Zia et al. 2011; Younas 2013; Burki and Khan 2016) have identified a number of constraints in traditional rural value chains. It is thought that the absence of an established cold chain leads to a high rate of spoilage — estimates range to around a fifth of the produce.[vii] There is also seasonal fluctuation in the availability of milk — herds produce around twice as much milk in the winter 'flush' season than in the lean months in the summer (Anjum et al. 1989).[viii] Seasonal variation is attributed to the availability of free or cheap green fodder in the winter months. It is widely reported, but with little more than anecdotal evidence, that doodhi-supplied milk is adulterated with contaminated water as well as other unsafe additives. Adulteration is seen as being linked to the risk of spoilage and seasonal variations. It is suspected that doodhis use ice (made from unsafe water) to chill the milk in the summer, and then use various chemical agents to make the milk appear to be thick and creamy.

2.2 Large city (Karachi) loose milk

Karachi is the largest city in Pakistan, and, unlike other major urban centres of the country, it does not have access to a significant agricultural hinterland in its immediate environs. The main source for the supply of fresh milk to the city is a designated dairy-producing zone located in the industrial suburb of Landhi on the outskirts of the city (**Figure 2**). Bhains Colony (literally cattle colony) consists of around a thousand individually-owned cattle pens which hold between 50 and 3,000 animals. The colony is thought to house a total of over 200,000 animals (buffalos and cows) and has a daily output of around 1.4 million litres of milk. Bhains Colony owes its origins to municipal regulation in the 1960s which restricted the holding of livestock within city limits. The government formally designated land on the outskirts of Karachi for the purpose of supplying fresh milk to the city.

In addition to the farmer, the middleman and the retailer are the main actors along the supply chain. Due to the short shelf life of fresh unpasteurised milk, the loose milk supply chain needs to be fast paced and robust, whereby milk is transported within the city at least twice daily from the cattle colony by wholesalers to retailers. The robustness of the supply chain is demonstrated by the fact that even when there have been political disturbances in the city and other businesses have closed down, the delivery of milk to retail outlets is seen to continue (key-informants).

Figure 2: Large city (Karachi) loose milk supply
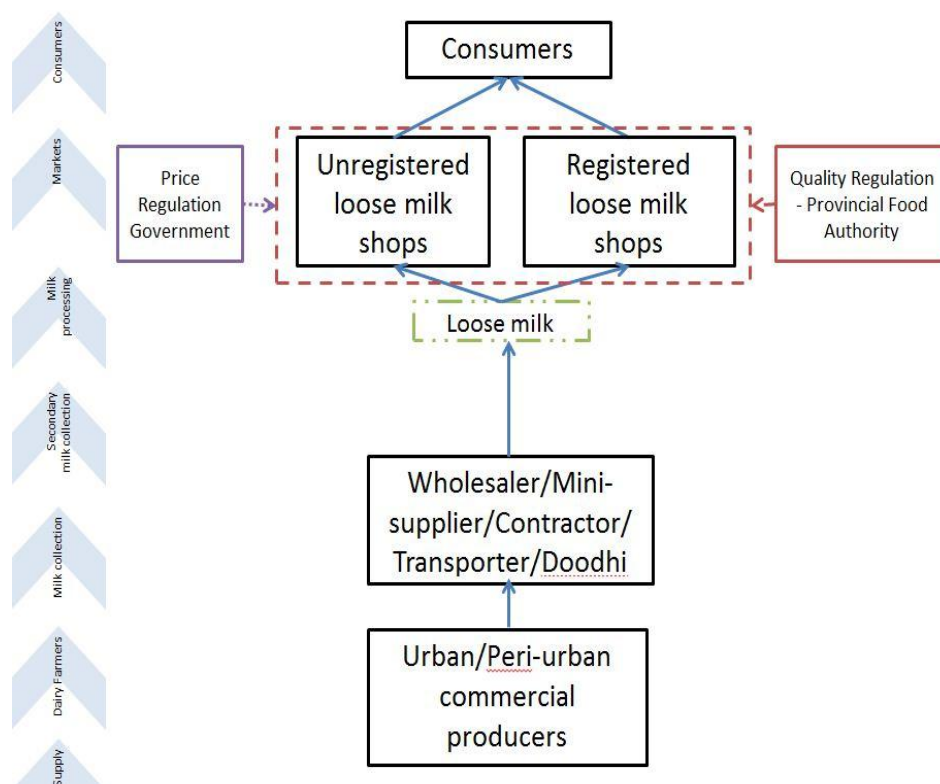
Stage 1: Farming

There are two milkings in a day. The first one takes place around 4 a.m. and the next one twelve hours later. Milk is transported into the city in metal containers, each with a capacity of 40 litres. Containers are owned by the farmer and reused for delivery, and thus need to be cleaned twice for each shift to ensure that the quality of the newer milk is not affected by stale milk that has been accidently retained (key informants). Milk yields are generally thought to be low compared to international standards. Animal feed is sourced from agricultural regions located away from the city (in Sindh and southern Punjab). Because of the high costs of maintaining animals in Karachi, farmers tend to dispatch the buffalo or cow for slaughter once its wet period ends. There are reports of harmful steroids being used to increase milk yield.

Farmers enter into advanced annual agreements with middlemen which require a fixed daily supply of milk through the year. The agreement with the middlemen specifies the fat content of the milk that is supplied. There is strong consumer preference for buffalo milk which is thicker and creamier than cow milk. Buffalo milk is mixed with cow milk on a 70-30 or 80-20 basis, depending on the cream content criterion agreed upon with the retailers and middlemen. Buffalo milk normally has around 7 per cent fat whereas the retailers have a 3.5-4 per cent requirement, so the farmers can dilute the milk substantially and still be within the prescribed range.

Stage 2: Middleman

The middleman has a similar role to that of the doodhi's in the rural market, but operates on a larger scale. He is in charge of transportation and also serves as a small wholesaler between the farmers and the retailers. Yearly contracts known as the "*bandi*" system are signed between the three actors, whereby price, quantity and estimated fat content for the milk are specified (key informants). The middleman is responsible for the credit cycle. At the time of the contract, he provides the farmer an advance equivalent to three months' revenue in return for the guaranteed supply for a whole year. The farmer needs to ensure that he supplies the contracted amount regardless of fluctuations in the output of milk due to seasonal or other variations. Because the credit cycle can roll over from one year to the next, many farmers find themselves locked into multi-year contracts with their middlemen.

Stage 3: Retail

Loose milk is sold at numerous retail outlets or milk shops throughout the city. Besides fresh milk, these shops also sell dairy products such as fresh yoghurt, as well as non-dairy foods such as bread and eggs. There are hundreds of milk shops in Karachi and most of them pre-dominantly source their fresh milk supplies from the Bhains Colony.

The price of fresh milk in Karachi is regulated by the government and is enforced mostly at the retail stage. At the time of the fieldwork in December 2015, the retail price set by the government was PKR 70 per litre (USD 0.70). Retailers claimed they bought the milk from the middlemen at PKR 75 and needed a 10 rupee margin per litre in order to sustain their enterprises. They, therefore, sold milk at PKR 85 per litre and found it expedient to pay a penalty imposed on them every month as

opposed to complying with the mandated price. It is also likely that retailers paid off price inspectors.

The primary technical challenge of the loose milk supply chain in Karachi, much like that of its rural counterpart, is to ensure the delivery of a highly perishable product from the farmer to the consumer. The supply chain is relatively effective in meeting this challenge. The other aspect of quality which is achieved through the specification of supply contracts is the fat content of the milk. Supply agreements usually specify a much lower fat content than the natural fat content of buffalo milk. This creates room for dilution at various stages of the supply chain. Other processes such as the removal of surplus cream and the addition of thickening adulterants are also thought to affect the quality of the final product. Government regulation, however, is mostly focused on retail price and not on the various dimensions of safety and quality.

2.3 Modern value chain

The UHT processed milk value chain was first established in Pakistan in the late 1980s. The main catalyst in the introduction of this modern agri-food value chain was a multinational food packaging company (Tetrapak), which set up its plant in the country and began to promote the adoption of UHT technology in order to market its own product. By the mid-2000s, there were several local companies in a market which had initially been led by the multinational Nestlé. Although they compete with one another, the UHT milk processors have a number of features in common. First, the main dairy product — UHT milk — is comparable across manufacturers, and represents a significant departure from the commonly-used fresh loose milk. Second, most manufacturers have adopted a comparable value-chain model for sourcing milk for their product. The rest of this section describes the supply chain from the milk producer to retail. Consumer preferences with respect to different types of milk are discussed in the next section.

Stage 1: Village Milk Collection/Area Milk Collection

Milk collection is largely a generic process across milk-processing companies. According to industry informants, the main sources of milk for all companies are village milk collection centres (VMCs) spread across rural areas of the two high-productivity agricultural provinces — Punjab and Sindh. The locations and numbers of VMCs have tended to shift over time, and there have been cases where a company abandoned operations in a region and handed over its collection infrastructure to another firm. A dairy company, which reportedly has around a 50 per cent share of the UHT milk market, claims to operate over 1,600 such collection centres, each with milk storage and processing capacity of up to 500 litres.[ix]

It makes sense to procure milk from rural areas rather than from the urban cattle colony, where the cost of milk, despite economies of scale, can be up to a fifth more than the village. The urban cattle colony can put up with the higher cost associated with its setting close to the city, because this location allows it to supply highly perishable fresh milk to its consumers. UHT milk processors can source their supplies from regions far away from their retail markets due to the longer shelf life of their product. Some companies maintain their own dairy farms, but these represent a relatively small and specialised segment of the market. Some companies also own dairy farms consisting of imported cows for producing a specialised brand of low-fat, high-protein milk.

Companies base their decision to site a VMC after surveying a village for its capacity to produce 'surplus' milk.ˣ The catchment area of a VMC is spread over a 6-7 km radius (key informants). Staff at VMC is locally hired from within the community (key informants). Once a VMC starts functioning, it enrols local vendors and maintains a relationship with them. Typically, a VMC can have between 50 and 80 active milk vendors on its register, who are paid on a weekly basis. The qualitative fieldwork found that the VMC had difficulty maintaining a regular group of suppliers due to competition from the doodhi who offered higher prices for the produce.

Vendors can be classified into three categories. First, there are the farmers themselves who bring the milk directly to the VMC. Companies claim that these are their preferred suppliers as they do not involve intermediaries who might compromise quality. A direct vendor generally brings only around 2-4 litres daily. Then there are local agents who collect milk from several farmers in their localities and bring it to the VMC. These "farmers' agents" bring 30-40 litres daily. Finally, there are contractors or doodhis who can manage 100-200 litres daily. Some companies say that they rely exclusively on direct vendors, while others accept the use of intermediaries, particularly during the summer months when the supply of fresh milk is constrained. Rather than displacing doodhis, in many instances the VMCs end up relying on them.

Cattle are milked twice over the daily cycle — once in the morning and then again in the evening. Farmers prefer to keep most of the evening produce for their own consumption and sell most of the morning produce in the market. The VMC requires the vendor to deliver the milk within two hours of the milking. The milk that is brought to the VMC is first tested in the laboratory for hygiene as well as for its contents. If milk is rejected, it is returned immediately to the vendor who then uses it for other purposes such as making *khoya* (condensed milk used as a dessert base) or paneer (cottage cheese) (key informants). Rejection rates vary seasonally, going up in the summer months.

The main quality control function takes place at the VMC. This is critical because once a farmer's milk is accepted at the VMC and mixed with that supplied by other vendors, it is no longer possible to assign responsibility for its quality and hygiene to the individual supplier. There is no involvement of a government quality or health regulator at this stage. Since there is no independent monitoring, quality assurance depends entirely on the robustness of a company's internal monitoring systems. There are unverified claims that there might be collusion between local staff and vendors (not condoned by the companies), to help vendors in passing off low quality milk.

Communities where the VMC operates the milk output have diverse possible avenues of distribution. For a start, most farmers keep some milk for their own consumption, and only sell what is regarded as surplus. In the market too, there are many competitors, and according to key informants in the UHT industry and in the community, the VMC is not always the most attractive option. Fieldwork findings confirmed the view that doodhis generally offer a higher price — sometimes up to 50 per cent higher — than the VMC.ˣⁱ Local tea shops are also in the market for fresh milk. At the time of the fieldwork in May 2016, the VMC at the rural village regularly procured approximately 30 litres in the summer months and between 200 to 300 litres of milk during winter months, while the chiller installed there had a capacity of 500 litres. In contrast to the expectation that an active VMC should have at least 50 regular suppliers on its books, the fieldwork site had only around ten suppliers.

In the villages where the qualitative fieldwork was conducted, the VMC was not a dominant actor in the milk supply chain. In some places it was active only in the winter months when the output of milk was higher. Other uses of milk, such as selling it to local tea shops, were more attractive options for farmers. Dairy companies did offer services such as the provision of high quality fodder to milk suppliers, but such services were only available to those who met the target of providing 10 litres of milk on a daily basis. This was not possible for most small rural producers. At least in these villages, therefore, the VMC had not played any significant role in the commodification of milk or in the dairy economy generally.

A cluster of 25-50 VMCs comes under a central office called the area milk collection centre/area office. The area milk centre (AMC) is responsible for accounts and reporting, and also acts as a logistical transit point. Trucks transfer milk from the VMCs to area offices which have bigger chillers, and where the temperature of the milk is reduced further. Milk is collected from VMCs in tankers once or twice a day. Each route collects milk from 5 VMCs with a 40-minute travel time between each chiller. The route starts from the furthest VMC and moves closer to the area centre or processing plant. A dairy company, which is among the top five UHT milk producers, has 8 AMCs in total and, according to the Manager, Operations, one AMC has a catchment area comprising 25-45 VMCs within an 80 km radius. From the Area Collection Centres chilled milk is transported to processing plants. This company's 8 AMCs finally deliver all of their milk to two plants. The furthest distance between an AMC and its corresponding processing plant is 280 km.

Stage 2: Processing

Quality testing and chilling are the only technical processes that the milk is subjected to from the point of procurement till it arrives at the manufacturing plant. Further quality testing is done at the plant and rejected milk is either sold to khoya makers or drained. The plant encompasses three important further processes leading to the manufacture of UHT milk: altering content, treatment, and packaging.

Much of the fat content is removed from the milk and used as raw material for other high-value products such as butter, clarified butter and yoghurt. Besides the removal of fat, it is thought that milk content is altered through the addition of preservatives. In a petition filed in the High Court in 2009, concerns were raised that some manufacturers used preservatives such as melamine which are considered to pose health risks.[xii] Although these questions were addressed when tests showed packaged milk to be fit for human consumption, some consumers continue to believe that there might be harmful additives in this product.

Packaged milk manufacturers claim that public perceptions about the alteration of the content of the milk are based on a misunderstanding of the manufacturing process. They argue that milk from diverse sources needs to be standardised at the pasteurisation stage. Because the content of the milk varies greatly by source and across seasons, the manufacturing process must first remove many constituents before adding others such as protein, calcium and iron in order to ensure a standardised product. It is important to note, nevertheless, that the different viewpoints about the alteration of milk content all refer to the inability to ensure the supply of standardised fresh milk in the first instance.

UHT milk is sold in packaging of two sizes — 250 ml and 1,000 ml — with each size accounting for around half the total volume sold. Nearly all UHT milk products in Pakistan are packaged by one company, which not only supplies the packaging but also the packaging machines used by all dairy companies.[xiii]

Stage 3: Distribution/Retail

Different companies have advantages in various cities. A company which is thought to have the highest market share nationally is known to be particularly successful in the Karachi region. Another is thought to be the leading brand in Lahore, while a third is popular in Multan (key informants). Urban areas are the main markets for UHT milk. Because of its long shelf life, packaged UHT milk does not require any special conditions for transportation and storage, and is widely available at retailers of various sizes in urban areas. UHT products are sold in all kinds of retail outlets, unlike fresh unprocessed milk which is sold either directly to consumers or through specialised dairy shops. But, also unlike fresh milk, UHT products are marketed intensively.

Interviews with industry informants revealed that the companies have made concerted attempts at understanding consumer behaviour. They classified milk consumption not only by region and socio-economic status of households, but also according to the use of milk. Insights such as the differential demand within the household for milk as a drink (mostly for children) and for 'tea-creaming' formed the basis of strategies which aim to address various market segments. UHT milk, which the companies like to call 'premium UHT', is mainly targeted at higher income groups in urban areas. Furthermore, due to the significantly higher prices of UHT milk and low demand, they are not sold in rural areas.

The sales concentration of 20 per cent of liquid dairy products (UHT plain milk, dairy beverages, tea creamers, high-calcium low-fat (HCLF) milk, and flavoured milk) are in three major urban cities: Karachi, Lahore and Islamabad/Rawalpindi. Overall rural share of sales of liquid dairy products is 25 per cent. Tea creamers and UHT milk have 57 per cent and 35 per cent market share, respectively, in packaged dairy products (Burki and Khan 2016).

Figure 3: Processed milk supply
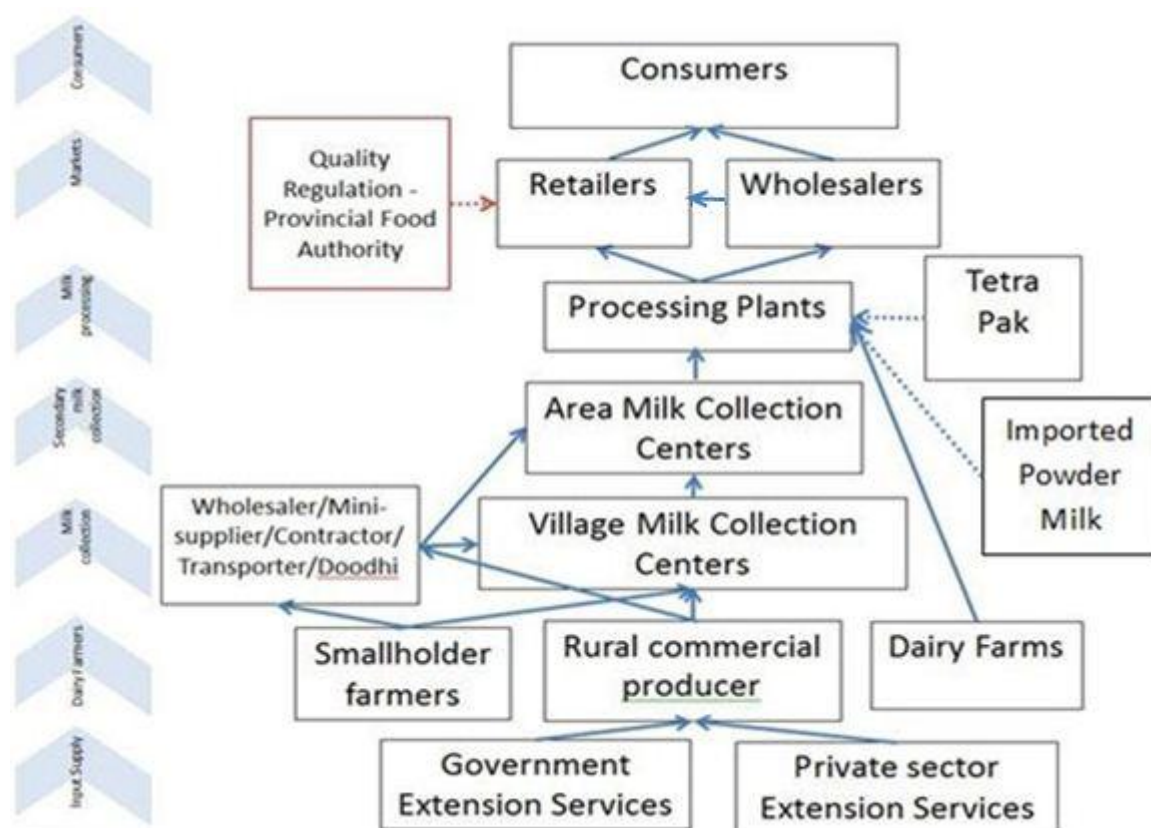
2.4 Historical context of the dairy value chain innovation in Pakistan

A series of sector analyses cited above characterised the situation of dairy in Pakistan as that of low productivity and high potential. Small herds of low-yielding breeds, wide fluctuations in output due to the seasonal variation in availability of green fodder, and high levels of spoilage because of the absence of effective cold chains were identified as the supply side issues limiting growth. Weak regulatory enforcement meant that the milk that reached consumers was vulnerable to adulteration and poor hygiene.[xiv]

The introduction of a modern value chain for processed milk was seen as a significant innovation which could raise farmer incomes and improve the safety and availability of a widely-consumed nutrient-dense food.[xv] A positive narrative was constructed around the developmental, income-generating, poverty-alleviating and empowering roles of this innovation.[xvi] The innovation which was spearheaded by the Pakistan-based partner of a transnational packaging company (Tetra Pak) was taken up by a number of other private businesses.[xvii]

The core element of the innovation was the sourcing of fresh milk from local suppliers, its treatment and processing, and the aseptic packaging of ultra-heat treated (UHT) milk for distribution and sale. Two brands (Milkpak and Haleeb) were introduced in the early 1980s — the former being a joint venture led by Tetra Pak's local partner.[xviii] UHT milk was promoted as a safe and nutritious

alternative to unprocessed raw milk which was widely available and consumed in rural and urban areas alike. The market attracted new entrants and by the late 2000s several brands of UHT milk became available — nearly all of them using Tetra Pak packaging. Other entrants were mostly local firms such as Engro Foods (UHT milk brand Olpers) looking for a share in what promised to be an expanding market. It has been argued that a 2007 livestock sector policy — spurred on, in part, by the optimism surrounding the modern dairy value chain — was an important turning point (Burki and Khan 2016).[xix]

At around the same time, a number of supportive interventions were made at the supply end of the value chain.[xx] The main stated aim of these interventions was to increase farmer incomes by addressing some of the weak links on the supply side of the dairy value chain. These interventions provided infrastructure and organisational inputs at the community level to connect farmers with the modern value chain. They installed cold chain facilities, trained and hired local staff, and offered veterinary and trainings to farmers. The private sector played an important part in all of these projects. The Dairy Hub project, for example, was led by Tetra Pak Pakistan to help a number of milk processing companies — all customers of Tetra Pak's packaging — to set up or improve their milk sourcing systems. For at least two projects, private businesses received funding from development agencies (Zuberi et al. 2016). It has not been possible to find independent evaluations of these interventions (ibid.).

The modern value chain innovation in Pakistan's dairy sector was premised on realising the untapped potential of this sector by providing a critical missing link between producers and consumers. Consumers would be offered a safe and hygienic naturally nutrient-dense food in the place of unprocessed fresh milk which was thought to be susceptible to spoilage and adulteration. This new product — namely, UHT milk in aseptic packages (supplied by Tetra Pak) — was highly portable and had a long shelf life. It was expected that, because of efficiency gains, UHT milk would eventually become cheaper than unprocessed milk due to economies of scale and would capture market share (Burki et al. 2004). An affordable, acceptable nutritious food was to be made widely available to consumers in greater quantities. At the same time, the interventions at the supply end implied that all actors along the value chain would benefit and be able to capture some part of the value thus created. Most importantly, the fact that the innovation was driven by private business meant that producer incentives were well-aligned for profitability and sustainability.

2.5 Beyond milk and dairy

From around 2007[xxi] onwards (refer to **Table 1**), UHT milk manufacturers began to introduce new, mostly non-dairy, products, which have little or no nutritional value. The so-called 'tea creamers' are vegetable fat-based liquids that are designed to taste and look like milk when added to tea. These were joined by 'dairy liquids' in 2011, which have some added milk fat but cannot be marketed as milk or as a substitute for milk.[xxii]

The introduction of these products was based on two premises. First, a realisation on the part of the UHT milk producers that their product was unable to compete with loose milk at both the retail and the supply ends of the value chain. At the time of this fieldwork, for example, a litre of fresh loose milk was available for PKR 85 in Karachi compared to the UHT milk which was sold for PKR 110. This is despite the fact that, as shown above, the doodhis offer more competitive prices to milk

producers compared to the local VMCs. Companies, therefore, focused their marketing on upper income groups (SEC A and B, according to industry key informants) and promoted UHT milk as a safe and hygienic alternative to untreated fresh loose milk.

Second, the UHT milk companies applied modern analytical methods to better understand consumer preferences and discovered that they could supply a product, albeit more nutritionally compromised, which fulfilled some of these preferences, at a lower cost. It was found that around 70 per cent of milk consumption in Pakistan was to prepare tea. Consumers liked a product which was creamy, a little sweet, and which gave a 'rich colour' to the tea when brewed.[xxiii] These insights resulted in the introduction into the market of tea creamers which did not overtly claim to be dairy products but which could be offered to consumers at prices equal to or below the price of fresh loose milk, and which capitalised on the fact, or rather the ambiguity, that the product matched in appearance with packaged milk. Like packaged milk, the tea creamer is more convenient than fresh loose milk in terms of its packaging and durability.

While the market share of companies selling UHT milk increased slowly from the 1980s to the 2000s to around 10 per cent (90 per cent of the milk consumed was fresh loose milk), non-dairy tea creamers quickly began to overtake UHT milk as the main retail product of these dairy companies These, along with 'dairy liquids', are priced to compete with the fresh loose market and cater to lower income groups. Together, the volumes of tea creamers and 'dairy liquids' are more than doubling every year, accounting for over two-thirds of the sales amount of UHT milk manufacturers.[xxiv]

These products, particularly tea creamers, are the main sources of growth in the industry. They, like UHT milk, use aseptic packaging supplied by Tetra Pak, and are marketed along similar supply chains that are utilised for UHT milk. The liquid tea-creamers innovation is viewed as a breakthrough in the industry, and was framed as an achievement by industry key informants in the interviews with them, even though the powdered variant has been in the market since an earlier time. The companies are now able to actively divert market share from loose milk and access a newer, wider consumer base in the form of low-income consumers. The supply chain of tea creamers and 'dairy liquids' has already diverged from that of UHT milk even at the distribution stage: the former two products are sold through wholesalers while UHT milk is distributed directly to retailers.

The companies have successfully created a product, which has overcome cost constraints[xxv] (Andrew 2012) associated with the UHT chain, and which simultaneously has the attributes of traditional fresh milk — such as richness of colour in tea-making and sweetness in taste. Some of these attributes are associated by consumers with good nutrition as they invoke the high fat and nutrient content of buffalo milk. Industry key informants indicated they were aware of instances where the product was being utilised as a drink by children in low-income households, even though it is categorically harmful for consumption by children under 5 years of age. It might be argued that the rapid growth in the sales of creamers is premised on subtly prodding consumers into believing they are using a nutritionally sound product.[xxvi]

Table1: Product types and description

Period	Product	Comment
Up to 1980s	Fresh loose milk	Insufficient supply – imported milk powder Concerns about hygiene, dilution Available in rural and urban areas
Late 1980s onwards	UHT milk	Increasing market share and seen as addressing problems with fresh loose milk, but reaching plateau Driven by packaging technology Higher price Concerns about preservatives/non-dairy inputs Unavailable in rural areas of Sindh
2007 onwards	Non-dairy teacreamers	Non-nutritional product to compete directly with fresh loose milk for tea-creaming Concerns that also being used for drinking, particularly in low-income market segment Widely available in rural and urban areas
2011 onwards	'Dairy liquids'	Introduced to compete with fresh loose milk for drinking Concerns about nutritional value, dairy content; regulatory ambiguity Pre-dominantly available in urban areas

Recently, there have been two types of developments that seem to improve regulation and implementation of safety and hygiene standards in the manufacturing and marketing processes of packaged milk.

First, on a federal level, the Pakistan Standards and Quality Control Authority (PSQCA) has taken initiatives to bring the packaged milk industry under the legal discipline. PSQCA is responsible for monitoring of the quality of 103 items under the Compulsory Certification Mark Scheme; it also includes 37 food items, except packaged liquid milk which is not a regulated item. PSQCA under the Ministry of Science and Technology has drafted the Statutory Regulation Order (SRO) and forwarded it to the relevant ministries and provincial departments for comments. The passing of SRO will enable the Authority to monitor the quality of products and implementation of hygiene standards (Shahid 2016; Bokhari 2016).

Second, warnings have been issued by the Punjab Food Authority regarding the accurate labelling of tea whiteners. Punjab Food Authority Act, 2011 mandates the Punjab Food Authority (PFA) to check the food standards and safety in Punjab province. PFA has recently issued requirements for companies to print a disclaimer 'This is not milk' on 15 per cent of the product's packaging surface area.[xxvii]

Moreover, the Supreme Court of Pakistan recently took regulatory action regarding concerns that companies were misrepresenting whiteners as milk. In 2017, it issued a warning to the companies regarding adequate labelling of whiteners (Sheikh 2017) and in 2018 issued a mandatory order for clear labelling of whiteners as not milk (Baloch 2018).

3. Consumption Patterns and Preferences

3.1 Qualitative fieldwork and quantitative survey

In order to gain a better understanding of the consumer end of dairy value chains, two complementary sources of data have been used.

The dairy value chain case study was one of two value-chain case studies, the other being on fortified wheat flour. Qualitative research needed to cover sites which allowed the opportunity of observing salient features of both value chains. For dairy, this implied selecting sites which had VMCs as well as some rural sites which did not have VMCs. The Naushehro Feroze district of Sindh has a high concentration of VMCs belonging to one of the leading UHT milk manufacturers. The district also had villages which did not have a VMC. Muzaffarabad was selected because it was reported in key informant interviews that there was an active wheat flour fortification project in the area. Two rural sites were selected in Naushehro Feroze — one with a VMC and one without. The urban sample included one locality in the city of Muzaffarabad and one in Karachi.

A total of 22 in-depth interviews were carried out across five fieldwork sites. All in-depth interviews were conducted with mothers of children aged between 6 to 24 months. This selection criterion was driven by primary focus on infant and young child feeding (IYCF) or complementary feeding of children in that age category. A total of 9 focus group discussions (FGDs) were also conducted separately with married women and men in each fieldwork site, as were key informant interviews with local retailers and doodhis.

In addition to the qualitative research, questions were included, related to the consumer end of the dairy, wheat flour and manufactured complementary food value chains in a representative survey of over 1,000 mother-child dyads in rural Sindh. The Women's Work and Nutrition (WWN) survey is part of a wider study under LANSA. Value chain specific questions relating to IYCF practices, consumer preferences, and other aspects of consumption behaviour were included in the WWN survey to gain a better understanding of the impact/potential of agriculture-nutrition value chain interventions for IYCF in communities that are particularly vulnerable to child undernutrition.

3.2 Sample Description: Urban and Rural

An obvious distinction between rural and urban fieldwork sites was the self-production of milk in the former. Another distinction was the presence in the same site of households with very different socio-economic conditions. The urban sites were known to be relatively low-income areas and there was also relatively less variation in the income levels of their residents. In the rural sites, those who owned agricultural land also tended to own dairy animals. They were likely to own electrical appliances such as refrigerators (essential for storing dairy products), and were able to afford better health services. Those who did not own agricultural land worked as sharecropping tenants and daily wage workers, some of whom kept goats and other livestock on an "*adhiari*" basis. This involves a person rearing livestock belonging to someone else in return for the use of milk and a share in the profit once the animal is sold. Some urban residents were recent migrants from rural areas and this was significant with respect to their consumption preferences and habits.

In general, there was a strong preference for fresh buffalo milk across fieldwork sites and income levels. This preference was found to be most strongly articulated in rural areas where there appeared to be a premium on freshness, as well as a high level of confidence in the quality of locally-produced milk. Processed products are often suspected in these areas of containing unknown additives. Even the poor in the rural fieldwork sites who did not have milk-producing animals preferred to buy fresh milk from their neighbours in small quantities. While local retailers in the urban fieldwork sites (which happened to be relatively lower-income areas) did stock UHT milk packets, their rural counterparts only kept non-dairy products such as tea creamers. In fact, there were some brands of tea creamers that were marketed only in the rural areas.

The high level of reliance on own-produced milk in rural areas can be seen from the WWN Survey (**Table 2**). While nearly all sample households reported consuming milk, only two-fifths said that they bought milk; the rest relied on animals that they owned or reared on a share-owning basis. This confirms the resilience of the idea that for much of the rural population, milk production is primarily a domestic rather than a market-oriented activity.

Table 2: Milk consumption and purchasing – Rural Sindh WWN sample

		Does the household consume milk?		Total
		Yes	**No**	
Does the household buy milk?	Yes	40.1	0.0	40.1
	No	58.7	1.2	59.9
Total		98.8	1.2	100.0

Tea-making is the most commonly-cited use of milk in households across fieldwork sites. Tea is consumed by adults and children alike, and among the poor and the food insecure, it is often used as an accompaniment to the main staple food (wheat flour bread or roti). If milk is available, the poor add it to the tea and if not they use sweetened black tea.[xxviii] This is confirmed by the quantitative survey in rural Sindh which found that only 2.7 per cent of the sample households did not use any milk for tea, while over a sixth reported that mothers or children did not drink any milk (**Table 3**).

Fresh milk was by far the most popular form of milk in the rural survey, with very few households reporting the use of UHT milk, creamers or other similar manufactured products. These findings suggest that the modern dairy value chain has not made any significant impact on the nutrition of the rural poor. The rest of this section further examines consumer preferences with respect to feeding infants and young children as well as other uses of milk.

Table 3: Milk used for children's drinking and for making tea (N = 1,157)

	Children's drinking		Making tea	
	N	**per cent**	**N**	**per cent**
Fresh	929	80.3	1,086	93.9
Nido	14	1.2	6	0.5
UHT milk (Milkpak, Haleeb, Olpers)	14	1.2	26	2.2
Creamer	7	0.6	29	2.5
'Dairy' liquid	0	0.0	9	0.8
Did not use	202	17.5	31	2.7

Table 3 also highlights a number of other features at the consumer end of the dairy value chain. Survey findings in rural areas confirm the views of key informants (Section 1) that, even within the small segment of the market occupied by the modern value chain, non-dairy products such as creamers and so-called dairy liquids have overtaken UHT milk. Further, the use of modern value-chain products was even more limited for children's use than it was for tea-making. But alarmingly, there were some families which reported giving non-dairy creamers to children as milk. Some of these issues are examined below in greater detail with reference to consumer knowledge and perceptions of quality.

3.3 Feeding the newly-born

Mothers generally reported that their infant-feeding decisions are guided by older women in the household and are based on feeding practices that are traditionally perceived to be healthy in the family and the community. But advice from medical professionals was also widely cited as being important. Exclusive breastfeeding is the prescribed best practice up to the age of six months. Although all mothers interviewed were aware of the benefits of breastfeeding young infants, they were ambivalent about exclusive breastfeeding. Most of them thought that giving water was important, particularly if the child was ill and dehydrated. Women believed that giving water and feeding honey or butter in small amounts were acceptable exceptions to the advice that young infants should be exclusively breastfed.

"The doctors told me to only give my milk for the first 5 months, but I gave water at 4 months" (Rani, age 27, Naushero Feroze district)

"I gave water at 4 months. The child was sick with fever…otherwise I would have given at 5, because my sister-in-law told me to do so at 5 months." (Raheela, age 27, Naushero Feroze district)

"I gave water at 2 days after birth because my infant had fever. I also did the same with other children. The infant is small – they need water. In summers we give more water, because the weather is hot and dry." (Shamim, age 25, Naushero Feroze district)

"…after four months I started giving water although doctor told me give water after six months. Doctor also disallowed me to give butter to [my child] but it is our tradition. Children's health is very important for us so we gave butter to him – in the next visit the doctor told me that if you wish to give him butter then don't give water after it because it will cause chest infection." (Mehreen, age 25, Naushero Feroze district)

For many mothers, breastfeeding is the preferred option to costly alternatives such as fresh animal milk or infant formula — the latter being the most expensive. Many respondents reported having difficulty in producing a consistent supply of breast milk. In situations where mothers were unable to feed their infants, there were harsh dilemmas.

"The doctor told me to buy infant formula for my child but it is very expensive. I did not want to create a habit of giving powdered milk because it is very expensive. Actually I believe cow's milk is better for children. It is healthier." (Haleema, age 37, Naushero Feroze district)

"Even if I had the money I won't feed my child infant formula. I know nothing about it. I don't know how to prepare it. It is not available nearby. I might be able to pay for it by my sewing work (making patchwork quilts). But our men are daily wage labourers. After work, will they rest or travel far to get things for us? And also, even if I could buy it today, how will I make sure I can afford it tomorrow? I would rather give buffalo milk and buy Nice[xxix] biscuits. At the moment my infant is not getting milk regularly. If my relatives have milk left over, I get it from them and give it to the baby." (Rani, age 27, Naushero Feroze district)

Lack of awareness about the precise nature of manufactured products is evident in the following quote from a respondent in one of the rural fieldwork sites:

"When my daughter was 21 days old, I started giving her cow's milk because I could not produce enough breast milk and my daughter was weak. I used to boil cow's milk and fill it in my daughter's feeder but she rejected it. Then I tried to give her Tarang in her feeder but she rejected that as well. My husband buys it for tea, so I added sugar in it and tried to feed to my baby. The women here give animal milk. They don't give Tarang as milk because of its smell or perhaps because their children also don't like it. I was told to try boxed milk [probably infant formula] by my sister-in-law from Karachi. She gives it to her children, so I tried Tarang. I cannot read so I don't know what it says on the label. The shopkeeper tells me the name of the product." (Saleema, age 32, Naushero Feroze district)

This case echoes a concern raised by a brand manager of a packaged milk company:

"Price is the main driver [of demand], *followed by health awareness. Low Income mothers know that* [fresh] *milk is diluted with water. What they don't know is that there is a difference between milk and tea creamer. So they have started supplementing tea creamer as milk. They don't know that that's not the healthiest option for their kids. It's not a natural product. We have very stringent laws regarding labelling, and we do label our products. But some mothers still give creamers to their children."* (Brand Manager, UHT milk company)

Urban mothers had greater awareness about different products, including powdered milk and infant formula, though here too there were issues of affordability.

"We don't use fresh milk for the baby because it is expensive and it cannot be kept outside. That's why we use powdered milk." (Saima, age 36, Azam Basti, Karachi)

Even those few mothers in the fieldwork sites (mostly lower-income communities) who used infant formula regarded it as a less desirable alternative to breast milk. The situation might, of course, be different among higher-income women who might find breastfeeding less convenient.

"When I had twins then I gave them Lactogen. I started giving them Lactogen when they were 3 months old. I used to add 2 spoons of Lactogen in water. Doctor advised me to give Lactogen because I did not have enough breast milk. I fed them for 9 months. People started saying that my babies looked well but I did not believe they were truly healthy inside, so I stopped giving them Lactogen." (Huma, age 25, Bhittaiabad, Karachi)

"I haven't given my baby fresh milk because I already had my breast milk. I once tried giving her Lactogen but she did not like it. I did not try giving her anything else. We brought Lactogen for my niece also but she too did not like it." (Aliya, age 30, Muzaffarabad)

3.4 Complementary feeding of infants and young children

Nutritionists recommend that infants and young children are given mother's milk for up to the age of two years, and for complementary feeding (weaning) to begin after the first six months of exclusive breastfeeding. Animal milk and dairy products are important complementary foods in Pakistan (PDHS 2013). Large surveys such as the Pakistan Demographic and Health Survey (PDHS) do not distinguish adequately between different types of milk products that are used for IYCF. In the qualitative fieldwork as well as the WWN survey detailed questions were asked not only about the type of milk product provided to young children, but also parental- and community-level norms and perceptions about what was good, appropriate, or desirable. These aspects of consumer behaviour are critical for a better understanding of how value-chain interventions in the dairy sector might have an impact on nutrition.

While the choice of complementary food (for weaning) is an important behavioural concern in nutrition policy, for many families in Pakistan, the main constraint is affordability. As shown in **Table 2** above, 17. 5 per cent of the households in the WWN survey were not able to provide any milk to their children. The extremely fragile economic conditions of some families were illustrated by the following case:

"My infant is not getting milk at the moment. My neighbours can sell me 1/8th of litre of buffalo milk for 7 rupees (USD 0.07). Sometimes I buy it on credit and then repay them when I have been paid for my sewing work (making patchwork quilts). If I am able to buy milk it is used to make porridge for the infants. So the children only drink milk once in a while when we have the money; otherwise we don't even have enough to make tea." (Rani, age 27, Naushero Feroze district)

Availability was also an issue in some rural areas. This was particularly the case in the rural fieldwork site which was selected because it did not have a VMC. The absence of a VMC did not mean that there was more milk for local consumption — quite the contrary. UHT manufacturers who had conducted a survey in the area already knew that this village did not have the capacity to produce surplus milk for marketing and hence did not site a VMC here. This finding underlines the fact that the UHT value chain is not only relatively marginal in terms of poor people's consumption of milk, it is also an unimportant factor with respect to the supply side. In the non-VMC village, the poor, but not only the poor, noted that there was very little available for purchasing.

"We don't get milk easily. Those who have cattle use the milk to make butter and lassi. People in this area do not sell milk. Buying milk was easier before but population is increasing so usage of milk is increasing that's why it has become difficult to buy milk." (Arfa, age 20, Naushero Feroze district)

While fresh milk dominates supply as well as demand for all uses of milk, including for children's drinking and tea-making, there is a strong preference for buffalo's milk within fresh milk **(Table 4)**. But mothers perceive some difference between different types of fresh milk in terms of what is desirable for their infants. Buffalo milk is liked for being thick and sweet (and having higher fat content) but is also thought to be less easy to digest by infants. Many rural and urban informants prefer 'lighter' milks such as goat or cow milk for younger children.

"Most of the women here give buffalo milk to their children. Some children gain health while some children's health is affected in a negative way." (Rasheeda, age 17, Naushero Feroze district)

"Buffalo milk is heavy on young children's stomach. For children who are unable to digest buffalo milk, the doctor recommends giving boxed milk." (Saba, age 30, Naushero Feroze district)

Table 4: Type of fresh milk used: children's drinking and tea-making (N = 1157)

	Child		Tea	
	N	per cent	N	per cent
Buffalo	619	53.5	936	80.9
Cow	187	16.2	115	9.9
Goat	204	17.6	105	9.1

The rural WWN survey also asked mothers what type of milk was better for their children — as distinct from what they actually fed them. This question about preference as distinct from actual behaviour was asked to probe if there might be a different response if mothers were free to choose, unconstrained by resources or other people's preferences. It was found that buffalo milk was preferred by more mothers than other types of milk (**Table 5**). This was in line with actual behaviour. The reasons they gave for liking buffalo milk for their children were taste (meaning thickness, creaminess and sweetness) and health (greater fat content). The quantitative findings, therefore, are consistent with the view expressed in in-depth interviews that compounded taste with goodness. The WWN survey also found that those who reported a preference for cow and goat milk overwhelmingly cited that young children found it easier to digest these types of milk.

Table 5: Type of milk for children's drinking: preferred reasons

Type	Taste	Health	Digestible	Availability	Total
Buffalo	373	257	6	21	657
Cow	20	15	205	1	241
Goat	32	21	140	6	199
Manufactured	0	9	1	0	10
Total	425	302	352	28	1,107

In addition to drinking, milk is also a staple ingredient in other foods that are commonly fed to infants. A porridge-type dish known as "*bhatt*" was commonly fed to infants in rural parts of Sindh, usually introduced after the third month or so, especially in cases where breast milk was not consistently being produced and manufactured baby cereal was unaffordable. This was made with butter, wheat, sugar and milk. Another common weaning food is rice pudding prepared with milk. Biscuits dipped in tea are also fed to infants. The milk usually preferred to prepare these items is fresh milk, but in areas where fresh milk is scarce, expensive or not of adequate quality, tea creamers are often used as substitutes, and thus enter the infant's dietary intake even if they are not used for its drinking.

"I have given this (bhatt) to all my children because my feed doesn't come in a good quantity and is not enough for their appetite. I also give a biscuit dipped in tea made from creamer." (Saleema, age 32, Naushero Feroze district)

"I started feeding biscuits and rusks after 8 months. I dip them in tea and then feed the baby. I also give tea by itself, though I know it is not as good for health compared to other items." (Haleema, age 37, Naushero Feroze district)

"We use Tarang for tea. I cannot read what is written on the packet. Packet milk is not good for the baby because it doesn't give her strength so I don't feed it to her as a drinking substitute but I do sometimes use in preparation of kheer." (Rafia, age 23, Muzaffarabad)

3.5 General household consumption of milk

Tea forms an important part of the diet of poor households. The quantity and quality of sugar and milk can be, and is, altered in response to economic conditions. On a day when the family may not have enough money, perhaps because the main earner was unable to get wage labour, they might do with very little milk. On days when they have more money they would prepare milky tea. For the poor in urban and rural areas getting milk for tea is a higher priority, and children's diets are usually not that different from those of adults.

"We always drink tea, and generally with milk. Sometimes we are able to give milk to children to drink. It really depends on what is available and the money in hand. If there is no money and no milk, we drink black tea." (Shamim, age 25, Naushero Feroze district)

"We can't afford tea and sugar - tea is not made in any of our family's four households. We like to consume tea but we can't afford it. All the different kinds of fresh milk are good but we would prefer buffalo milk. If we could afford it we would use it for tea." (Rani, age 27, Naushero Feroze district)

The poor often end up feeding the children whatever is used in the household for general consumption with few modifications. This is significant for understanding the impact of the modern value chain in dairy products as commodities marketed for adults will often be used for IYCF. The contrast between fresh milk and creamers and other non-dairy products becomes salient in these cases because fresh milk, with all its possible problems of hygiene and dilution, is still an accepted part of a healthy IYCF diet, while non-dairy products such as creamers are of virtually no nutritional value.

The modern value chain has made inroads in urban areas with a high density of retail outlets. There are various factors besides price that appear to contribute to the success of these products:

"We use Tarang for tea. We sometimes use fresh milk for drinking but usually we avoid it. We use Tarang as it costs 10 rupees per packet. We make tea twice from one packet. We can't buy 10 rupees of fresh milk at a go, and can't store larger quantities. You have to keep it in the fridge [and we don't have one]. We use one packet for the whole day. Powdered milk is expensive that is why we use Tarang. We sometimes use UHT milk. I was inspired to first try Tarang after watching the glamorous commercial on TV." (Saima, age 36, Azam Basti, Karachi)

"We don't like the boxed milk and don't use it in the village. When we work in Karachi we buy Tarang. It is extensively used by the labouring classes in the city as on some sites fresh milk is not readily available at all, so everyone uses Tarang for tea" (Hamid, age 40, Naushero Feroze district)

"We once used Tarang for tea. My father-in-law brought it but we did not like its taste. We came to know about Tarang through advertisement. We liked the colour of the tea it made so we bought it once for tea but we did not like its taste." (Kausar, age 20, Bhittaiabad, Karachi)

In Muzaffarabad city, the fresh milk supply chain is weak because its hinterland consists mainly of low productivity hilly areas. Fresh milk is relatively expensive — even more so than Karachi — and is often highly diluted. There is a high level of consumer demand here for UHT milk as well as non-dairy tea creamers.

"Sometimes we use Olpers. Don't use Tarang because we have heard it is not good. I only bring Olpers or Milkpak when there is need. I can distinguish between UHT milk and the cheaper creamers, but I don't know the exact difference." (Rozina, age 28, Muzaffarabad)

"My in-laws told me that they use Tarang at home because its taste is good and they have seen many advertisements of it on TV." (Rafia, age 23, Muzaffarabad)

Retailers at the rural fieldwork sites did not stock UHT milk as it was considered to be expensive and beyond the reach of local consumers. Tea creamers, however, were readily available at shops in these villages. These were sometimes consumed by households for tea in the event that fresh milk was in short supply, or if there was an unforeseen need, such as serving tea to unexpected guests. Respondents had mixed opinions, however, about the quality of creamers compared to fresh milk.

"We have heard that people get stomach aches because of creamers. Fresh milk is good and it tastes good too. People use it for tea but we don't. We don't know if the packet milk is fresh or expired that's why we avoid using it." (Arfa, age 20, Naushero Feroze district)

"Yes, we use Tarang for tea when we have guests at home or at times of headaches and we need tea. We have Tarang's packet at the shop. We all use Tarang for tea as it costs us PKR 20 rupees. All tetra packs are same the only difference is of the cover. I cannot read what is written on the packet. The packet is of mud colour. Tetra packs are not good, as we don't know for how long the pack has been in the shop. Fresh milk is better as it is tastier for tea as well as for drinking milk." (Haleema, age 37, Naushero Feroze district)

"We don't buy Tarang – we used it once or twice but don't buy it anymore because it is shelved for a long time at the store and is expired. Shopkeepers don't tell you this. I can't read the expiry but my husband can read it" (Shamim, age 25, Naushero Feroze district)

"We own a cow and use fresh milk for tea and drinking. Our cow is pregnant at the moment so we buy milk from our neighbour. I generally don't sell the cow's milk because my husband likes tea made from it. But sometimes, if a needy person comes, I would sell 15 rupees worth of milk. If at times when we don't have milk for tea and guests come over we use packet milk. We only have Tarang in our village. We can easily get it from the shop. I cannot read. I just bring it from the shop and make tea for the guests. Fresh milk is healthier than packet milk." (Saleema, age 32, Naushero Feroze district)

"We have a goat that produces milk, and buy buffalo milk from our neighbours. When we are out of goat milk and can't buy buffalo milk we buy the packet milk [actually creamer]. The packet milk [creamer] is more expensive than buffalo milk at 20 rupees versus 15 rupees for 250g, and we also prefer buffalo milk because for its taste. We use packet milk [creamer] for tea and for drinking. We give it to older kids for drinking, but not babies because it has a strange smell, doesn't seem healthy." (Raheela, age 27, Naushero Feroze district)

4. Assessment of the Value-Chain Innovation

For the business-driven value-chain innovation to have lived up to its promise of acting as a bridge between producers and consumers, and for it to have a positive impact on nutrition, a number of trends and patterns should have become apparent. Numerous frameworks and ex-ante sector reviews (such as those cited in Sections 1 and 2) had helped to create a positive narrative around this innovation as a panacea to the problems of low productivity, seasonal fluctuations, and the supposedly poor quality of existing supply. According to the reviews, the modern value chain should have made a significant dent on the market shares of supposedly inefficient traditional value chains,

both at the supply and consumer ends (Burki et al. 2004). The price of UHT milk should have decreased overtime and it should have become available and affordable to low-income consumers (ibid.). Consumers should have become willing to pay a quality (and nutrition) premium over available alternatives. With these changes in place, it should then have been able to observe some of the bottlenecks and constraints associated with the traditional value chains being addressed — such as high rates of spoilage, seasonal fluctuations, and low yields (Anjum et al. 1989; Burki et al. 2004; Fakhar and Walker 2006; Zia et al. 2011; Younas 2013).

Data on the total volume of milk that goes through the modern value chain, and changes within that over time, are patchy and based mostly on figures provided by the industry. Burki et al. (2004) reported that in 2003, UHT milk accounted for around 1 per cent of the total volume of milk produced in the country. With the rapid expansion of the sector in the mid-2000s and the establishment of dairy hubs across the country, Burki and Khan (2016) cited industry sources as claiming that 1.8 billion litres out of an annual output of around 40 billion litres of milk (or 4.5 per cent) was processed by the companies, out of which 1.18 billion litres (under 3 per cent) was used specifically for UHT products[xxx, xxxi] Younas (2013), citing Afzal (2006), reported that 4-5 per cent of the milk produced in the country was being processed by dairy companies, with around half of that in the form of boxed UHT milk. The rest of the milk channelled through the modern value chain was converted into other dairy products. It was reported by industry key informants that the market share of UHT products had gone up to around 10 per cent but that over half of the volume was accounted for by non-dairy milk replacements like tea creamers.[xxxii]

There were indications that milk procurement through VMCs had initially risen and then regressed. In a panel survey of dairy farmers, Burki and Khan (2016) found that the selling of milk to companies had declined since 2010. Qualitative research in a VMC community in rural Sindh revealed a reason: the dairy company paid far less to the farmers than the local doodhi, and the VMC was active only in the winter flush season. The ex-ante narrative expected an evening out of seasonal fluctuations as increased demand from UHT companies would have created incentives for farmers to use green fodder the year round. Instead, the companies themselves ended up leveraging seasonal differences in the availability of raw milk (Hasan 2017). In fact, sector reviews failed to account for structural factors behind the continued subsistence characteristics of the dairy economy. Seasonality in milk output is not necessarily an investment bottleneck. It is driven in large measure by the reliance on farming by-products which, in turn, is made possible by the existence of unpaid family labour of women and children. The scale of this subsistence-like activity can be gauged from the fact that while livestock accounts for over half of value added in agriculture, fodder cultivation takes up only around a tenth of the gross cropped area (Ministry of National Food Security and Research 2014-2015).

There are concerns, moreover, that dairy companies had started relying on imports of dried milk in order to produce pasteurised milk. The volume and value of milk product imports witnessed a five-fold increase between 2007 and 2015 — the period when a number of new UHT milk and non-dairy milk replacement products came on the scene.[xxxiii] These trends are clearly in the opposite trajectory of the expected benefits of the value-chain innovation to local milk output.

Despite the lower price paid to farmers compared to the doodhi, the retail price of UHT milk (or the so-called premium product) is higher than that of fresh unprocessed milk in most cities. In

Karachi at the time of the survey, fresh milk sold for PKR 85 per litre compared to PKR 110 per litre being charged for UHT milk. The gap was wider still in smaller towns and rural areas where UHT milk was not stocked by retailers due to its high price.

With the marketing insight that over two-thirds of milk consumption in the country is for preparing tea, companies came up with a product which was creamy, a little sweet, and which gave a 'rich colour' to the tea when brewed. Qualitative fieldwork findings about consumer preferences suggest that companies have been successful in deciphering some of the factors associated with the popularity of buffalo milk in Pakistan. In interviews with consumers in rural and urban sites alike, it was said that buffalo milk is considered to be a nutrient-dense product and its sweet taste and creamy consistency is read as a signal of its goodness. Dairy companies have been able to reproduce that signal without the original ingredients at a low price.

Some three decades down the line, hopes and expectations vested in the growth of modern value chains in the dairy sector in Pakistan appear to have been largely unmet. It was thought that processed milk will revolutionise demand as well as supply by expanding the market for a safer product than unpasteurised fresh milk which had a notorious reputation for adulteration and dilution. This case study of the modern value chain in the dairy sector —- the supply side as well as its consumer end — has shown that the main dairy product (packed UHT milk) struggles to compete with its traditional alternative.[xxxiv]

Where the modern value chain has innovated and competed profitably with unpasteurised fresh milk in terms of price and consumer preferences, it has engineered a product that is less nutritious and uses less raw milk than the already existing products. Creamers and the so-called 'dairy' liquids are mostly non-dairy products of little nutritional value, and with weak or non-existent linkages with local agriculture. Modern value chain dairy companies have done what they are good at doing — understanding the market and responding to it.

There is an interesting and unresolved debate about regulation in the dairy sector around price and quality. Modern value chain manufacturers claim that the lack of proper regulation of the fresh milk supply chain (for quality and hygiene) allows the latter to maintain its high market share. According to some industry stakeholders, mandatory pasteurisation will level the playing field between the mostly unregulated fresh milk suppliers and the modern value chain. The other side argues, however, that they have remained competitive despite adverse price regulation. While the price of fresh milk is regulated, there is no such regulation on the price of pasteurised milk. They argue for a lifting or relaxation of price regulation, and clearly believe that they will retain their market share even at higher prices.

In the meanwhile, there are other aspects of regulation that potentially affect the marketing of packed milk and non-dairy products. Milk companies focus the marketing of these products towards lower-income sectors where the main form of milk consumption is in tea-making. Consumers at this end of the spectrum have preferences (refer to **Table 6**) based on a traditional association between taste and goodness, and are often unable to tell if the product they are buying is milk or not. This ambiguity is clearly something which might be addressed by more careful regulation of the market.

Some regulatory authorities in the country have, indeed, taken the view that the so-called 'dairy liquids' cannot be marketed in their present form.

Table 6: Product types and consumer preferences

	Informal value chains	Dairy Value-Chain intervention		
Consumer Preferences	Loose Milk	UHT Premium Milk	Tea Creamer	'Dairy' Liquid
Affordability	X		X	X
Thickness (perceived nutrition)	X		X	
Freshness	X			
Hygiene		X	X	X
Consistency		X	X	X
Convenience		X	X	X

Source: Authors' fieldwork

Furthermore, this case study of Pakistan's dairy sector suggests that a simplistic traditional-modern dichotomy in value chains for nutrition is not only erroneous, it is also misleading. While frameworks such as Gomez and Ricketts (2013) offer a more nuanced understanding of the relationship between the supposedly traditional and modern sectors, ground realities are more complex. The resilience of the 'traditional' value chain in Pakistan is, in part, due to an optimal use of available resources, and the higher costs in the 'modern' value chain may be due to the uncompetitive pricing of the packaging. The 'upgrading' of value chains (Hawkes and Ruel 2012), which is usually taken to entail the introduction of modern segments, needs a more rigorous comparison with existing value chains than has been the case in Pakistan.

The modern dairy value chain in Pakistan was not designed at the outset for explicit nutrition outcomes (Zuberi et al. 2016). This case study has shown that it has not had an incidental impact either. These interventions have not led to major changes in milk production and marketing for the small rural producers. They have also not led to the introduction of affordable and nutritional alternatives to fresh milk for lower-income rural or urban consumers.

Evaluative frameworks such as Maestre et al. (2017) can play an important role in guiding policymakers in this regard. By focusing on specific requirements with respect to consumption and production conditions, such frameworks can obviate the need for a prior classification of value chains. The present case study has revealed that while the dairy value chain innovation in Pakistan met, ex-ante, the requirements posited by Maestre et al. (ibid.), it failed to live up to its promise. Instead of developing the local dairy sector, increasing the availability of milk and increasing farmer incomes, this innovation led to the marketing of mostly non-dairy products made with imported raw materials. Market-driven food companies moved quickly from the dairy value chain to non-dairy products in response to their analysis of where they could capture value. While the checklist of

requirements offered by Maestre et al. (ibid.) is very useful in evaluating the nutrition impact of a value-chain intervention at a given moment in time, it will be more useful to policymakers if it can also anticipate dynamic changes in value chains, given producer incentives and consumer behaviour.

5. Conclusions

Milk is a key ingredient in the diet of infants and young children in Pakistan, and is one of the few nutrient-dense foods consumed by the poor on a regular basis. The dairy sector is also a major sub-sector in agriculture and one which is more inclusive than crop farming. While land ownership is highly concentrated, a relatively high proportion of rural households own or hold cattle. Moreover, women play an active role in this sub-sector, sometimes as asset holders themselves. It is not surprising, therefore, that despite not having nutrition improvement as an explicit goal, the modern value chain in this sector was considered to hold much promise with respect to food consumption as well as poverty reduction. It is also not surprising that besides business-led investments, these innovations attracted considerable interest and investment from public (donor) resources.

This case study, based on a mapping of all of the main value chains in the dairy sector, has shown that the modern dairy intervention, consisting of processing, packaging and retailing UHT milk in the first instance, has remained a marginal player on the production as well as the consumption ends of the value chain. While the modern dairy value chain has continued to attract new corporate players and investment, and has somewhat expanded its market share, it lags considerably behind traditional value chains. Moreover, innovations in this sector have shifted their focus towards products that are not dairy-based and not particularly nutritious.

What can be learnt from the failure of what appeared to be a promising pro-nutrition business-led value-chain innovation in Pakistan's dairy sector? A cynical view might be that the positive narrative around the UHT innovation was promoted, at least in part, by corporate interests that benefited from the expansion of their markets, regardless of any benefits in terms of addressing constraints and bottlenecks in existing value chains. While this view cannot be discounted altogether, there are still lessons to be drawn for the sector or for wider debates on business-driven nutrition improvement, and for the emerging analytical frameworks. After all, the question of how agriculture can play a more positive role for nutrition improvement is still around, and livestock is the largest sub-sector within Pakistan's agriculture. Moreover, a traditional-modern dichotomy is widely used in the analysis of food value chains, often with the presumption of a productivity advantage attributed to modern innovations.

This does not necessarily mean that there is no scope for value-chain interventions which will leverage this major agricultural sub-sector in Pakistan for improved nutrition. In order to see how those interventions might be positioned, it is important to draw out the main insights from the present case study about dairy value chains, in general, and the modern value chain, in particular. Such understandings will also be of wider significance for the design of other agri-food value chain interventions.

First, for any business-driven value-chain intervention to have a pro-nutrition impact, it is important for such an objective to be an explicit element in the design. Business-driven changes in value chains will generally respond to existing cost/price structures and market conditions. They will be good at reading consumer preferences, and at times manipulating them. In the absence of a strong public policy focus on agri-nutrition linkages, such interventions should not be expected to deliver pro-nutrition outcomes.

Second, in a poor and unequal economy such as Pakistan, the prospect of improving nutrition through the consumption of more nutritious foods will require addressing income poverty and instability. The fact that a very large segment of the population simply cannot afford even the most basic nutritious foods implies that any value chain-based intervention will need to incorporate some element of public subsidy to the poorest.

Third, the identification of technical constraints to productivity improvement and market expansion needs to happen alongside institutional analysis. Sector reviews, embedded in a dichotomous traditional-modern framework, focused on supply chains as the locus for strategic intervention, without recognising the effectiveness of the doodhi-managed traditional supply chain in delivering a perishable product at low cost. While these analyses understood capacity issues in smallholder production, they have not been attentive to the actual organisation of the livestock economy at the household level that relies on unpaid work on the part of women and children, particularly in the collection and processing of fodder from local farm by-products. Despite increasing commodification, the livestock sector retains important elements of a subsistence household economy such as the concept of 'surplus' milk.

Fourth, there is sufficient market penetration and choice even in low-income communities to build up a clearer understanding of what works in terms of supply chains, and what might drive consumer behaviour. A proper analysis of these elements of existing value chains is essential for the effective design of pro-nutrition agri-food interventions.

There is merit in recovering some of the insights from earlier literature in the value-chain perspective which focused not so much on prescriptions about value-chain interventions, but on the policy implications of companies applying value-chain analysis in their business strategies. Companies focused squarely on actions that offered them the greatest opportunities for capturing value, and changed strategies in response to these opportunities. Rather than being wedded to particular value chains, they created new ones which offered them higher returns. The packaging company leveraged its near monopoly status as the supplier of aseptic packaging to create new markets for its product. Milk processing companies saw marketing as their niche and designed products and marketing campaigns to compete with the otherwise more efficient traditional value chain. A value-chain innovation that appeared, prospectively, to be pro-nutrition along with being pro-poor was overtime abandoned as businesses rapidly adapted to new marketing insights and homed in on a value chain devoid of the nutrition focus, but which has proved to be more robust in terms of overcoming business costs and constraints. Emerging conceptual frameworks such as those which identify necessary conditions for pro-nutrition value chains (e.g., Maestre et al. 2017) need to be extended to pay greater attention to the inherent dynamism of the private sector in creating a new value chain just as an existing one has been analysed.

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Notes

i The largest local manufacturer of such packaging became the main promoter of the dairy value-chain innovation, primarily to create demand for its own product.

ii By then, the business studies literature was already referring to the value-chain concept as belonging to 'that old industrial model' (Normann and Ramirez 1993).

iii A total of 30 key informant interviews were conducted by one of the authors of this study in 2015, over a time period of three months. These included several representatives from two local private large-scale dairy businesses.

iv The Naushehro Feroze district of Sindh has a high concentration of VMCs belonging to one of the leading UHT milk manufacturers. The district also had villages which did not have a VMC. We also carried out fieldwork in urban centres of Karachi and Muzaffarabad. We carried out five in-depth interviews at each of the sites. All in-depth interviews were carried out with mothers of children aged between 6 to 24 months. This selected criterion was driven by our primary focus on understanding infant and young child feeding or complementary feeding of children in that age category. Focus group discussions were also conducted separately with married women and men in each fieldwork site. We also conducted key informant interviews with local retailers.

v According to project material which was available, a donor-supported intervention had been implemented in this community.

vi Gomez and Ricketts (2013) classify the latter, i.e., modern sourcing and flexible marketing through existing markets and retailers, as a modern-traditional value chain which is regarded as a promising path to nutrition improvement.

vii It is difficult to find direct evidence of spoilage. Sector reviews base their estimate of the rate of spoilage on differences in aggregated national data on milk output and consumption reported officially.

viii The existence of seasonal variation is widely accepted and cited anecdotally. The basis for the claim that milk output varies by a factor of 100 per cent between seasons is based on a rare study of seasonality carried on in the 1980s study of herds in one region of the country (Anjum et al 1989).

ix If all of these VMCs operated to full capacity (two collections a day) throughout the year, they would dispatch 584 million litres of milk to processing plants annually, compared with an estimated total milk output of 40 billion litres.

x The modern value chain thus operates within a traditional context in which only 'surplus' milk is brought to the market.

xi At our VMC site, most villagers were disinclined to sell their milk to the VMC because of the lower price offering. Most people prefer to sell their milk to the doodhi instead. At our site, the VMC purchased milk for Rs36-38 per litre whereas the doodhi offered a rate of Rs45-48 per litre.

xii This issue was highlighted by one of our key informants from the milk retail association. For a report on the court case, see http://tribune.com.pk/story/9651/milk-companies-claim-their-products-melamine-free/.

xiii The only exception is innovative jug-shaped packaging used by one company for its 250 ml UHT milk carton.

xiv Similar issues have been identified in dairy sector reviews in countries: see, for example, Millogo et al (2008) for Burkina Faso, and Omore et al (2004) for Kenya, Ghana and Bangladesh.

xv The term 'modern' is used here in contrast with 'traditional food value chains' which source fresh produce locally and supply them through wet markets at relatively low price (Gomez and Ricketts 2013).

xvi Evocative phrases such as 'rivers of milk' conveyed the optimism associated with this approach (Fakhar and Walker 2006). Such slogans were widely used by the Pakistan Dairy Development Company which was set up as an autonomous entity with a grant from the government's Small and Medium Enterprise Development Agency (SMEDA) (Mumtaz et al 2011).

xvii Packages Ltd was a joint venture of a Pakistani industrial group, led by the entrepreneur Syed Babar Ali, and Tetra Pak of Sweden.

xviii Milkpak was launched in 1981 as a brand of Milkpak Ltd in which Packages Ltd was a major stakeholder. In 1982, Tetra Pak Pakistan was formed as a local subsidiary of the transnational Tetra Pak, and Packages Ltd were key shareholders of this company too. In 1988, the transnational Nestlé acquired stakes in Milkpak, and then took over the company and the brand in 1992.

xix In 2009 Tetra Pak Laval of Switzerland acquired Packages Ltd.'s shares in Tetra Pak Pakistan, thus creating some nominal distance between Tetra Pak and the Milkpak brand. This move, also, arguably facilitated the entry of rival brands in the UHT market. The connection between Tetra Pak and Nestlé Pakistan remained strong through Packages Ltd. The latter retained its stakes in Nestlé Pakistan, and also dominated the market for the raw material used for Tetra Pak packaging.

xx There have been seven value interventions in the dairy sector in the last decade. Four of these (Model Dairy and Village Project 2006, the Dairy Hub 2007, Haleeb Value Chain Project 2008, and Women's Empowerment and Livelihood Development or the WELD project 2011) were directly related to the UHT milk industry. See Zuberi et al (2016) for a detailed review of these interventions.

xxi Engro's flagship tea-creamer 'Tarang' entered the market in 2007.

xxii Engro was found to be in violation of the Competition Act, 2010 (Pervaiz and Quddus 2016) and fined by the Competition Commission of Pakistan for marketing and misrepresenting their dairy drink 'Omung' as an alternative and substitute for loose milk (Cornall 2017).

xxiii Companies probably first became aware of consumer preferences in their efforts to market UHT milk. This is usually advertised as 'thick and creamy', despite the fact that the fat content is probably lower than that of fresh loose milk.

xxiv Tea creamers now account for 55 per cent of the sales volume of UHT milk manufacturers while dairy liquids make up another 7 per cent (Burki and Khan 2016; industry key informants).

xxv Vegetable fat costs PKR 130 per kg, whereas the milk fat it replaces costs PKR 250 per kg according to Andrew (2012).

xxvi Some non-dairy products have names such as 'Nature' which evoke a natural produce. While industry key informants are careful to state that their marketing does not advertise these products as milk, they admit that most consumers are illiterate and unable to read the fine print on the packaging. Recently the Food Authority in the Punjab province of Pakistan has issued requirements for companies to indicate that this product is not milk on 15 per cent of the packaging (Dawn, March 27th,2017).

xxvii The Director General of the Authority has also publicly said that "tea whitener is prepared by using vegetable fat and it is being consumed by the public at large, especially children, as milk due to vague advertisement campaign by companies. It is also affecting public health." (Dawn, March 27th, 2017).

xxviii This was cited in in-depth interviews with poor households. See Balagamwala and Gazdar (2014), and Gazdar et al. (2015) for comparable findings.

xxix This is a brand that is marketed for infants. The packaging has an image of a healthy baby, and the product is generally known in the local language as "munna" or baby biscuit. It not clear, however, if these biscuits have any specific nutritional value for IYCF.

xxx Burki and Khan (2016) assume total processed output to include "UHT milk, milk powder, chilled and flavored milk."

xxxi Our own back-of-the-envelope calculations based on the processing capacity of VMCs suggest a far smaller ratio.

xxxii Industry informants speak of market share: that is, UHT milk as a proportion of all milk sales. They do not include milk that is self-consumed by farming households, which accounts for around half of all produce (Burki and Khan 2016).

xxxiii Although UHT companies claim that they source their milk locally, in a debate on rising imports of dried milk products the federal commerce minister revealed that these were being used by the dairy industry to make pasteurised milk (Senate Secretariat 2016).

xxxiv There have been similar experiences in other countries — see, for example, Leksmono et al. (2006) and Karanja (2003) on Kenya