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Innovation Opportunities in Milk Production in Rwanda

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Abstract

The importance of dairy subsector in Rwanda's economic development cannot be gainsaid given that it is lined up to provide pathways out of poverty for large numbers of players along its value chain development. In Rwanda, 68.2% of all households raise some type of livestock, cattle being the most commonly raised by many households (47%). Although the Rwanda's national milk production has remained well below levels that can sustainably enhance its contribution to economic development, it is nevertheless recognized to have potential for enormous contribution to food security, nutrition and employment. The overall objective of this research was to undertake a rapid milk value chain analysis toward identifying innovation opportunities to boost the milk production in Rwanda. It is noted that milk and dairy products play important roles in human nutrition in diversifying diets. They provide energy dense and high quality proteins and micronutrients. While Rwanda produces an average of 188 million litres of milk annually, it is observed (from 2000-2013) that its production is very low as compared with other EAC countries. Milk production in Rwanda is faced with many constraints among which prevalence of poor quality indigenous cattle breeds, limited land sizes and good quality pastures, low milk demand and limited markets are key. Milk production VCA conducted at the Mudende Milk IP indicate that the chain starts with input supply to small-holder IP farmers as the main players in producing and partially marketing the milk to processors in local and urban markets. All other factors considered, innovation opportunities exist that can boost milk VC in Rwanda for enhanced socio-economic benefits of the VC actors. The identified opportunities include boosting milk production through improved cattle breeds and animal nutrition, introduction of small and medium scale processors, development of business hub models around MCCs, and consumer sensitization and school programs to boost milk demand.

Key words: Milk, Innovation Platform, Rwanda, VCA, Innovation opportunities

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Introduction

The dairy subsector is important to the economic development of Rwanda. Dairy is expected to offer a pathway out of poverty for large numbers of households keeping livestock and for those who provide services and value addition throughout the supply chain (MINAGRI, 2013). In Rwanda, 68.2% of all households raise some type of livestock, and cattle are among the most commonly raised by 47% of households (NISR, 2012).

Livestock keeping and milk production trends

All over the world, two cattle species have traditionally been recognized, *Bos Taurus* (humpless cattle) and *Bos indicus* (Zebu cattle). However 35% of dairy cows belong to the Holstein-Friesian breed, a popular breed largely because of its high average milk production and superior ability to convert feed in to protein (FAO, 2013). In Rwanda, 68.2% of all households raise some type of livestock, and cattle are among the most commonly raised by 47% of households (NISR, 2012). Cattle are raised mainly in the districts of Muhanga, Kamonyi, Karongi, Gakenke and Gachumbi, where at least over 50% of households in these areas have cattle (NISR, 2012) (Fig. 1). There are three types of dairy farmers, as defined by the way in which cows are fed; open grazing, semi-grazing, and zero-grazing. Semi-grazing farmers are those that are transitioning between open and zero grazing and do not intend to remain in this stage for long. The reliance on naturally growing or cultivated grasses as the sole source of nutrition (i.e., open grazing and some semi-grazing farmers) creates a production system dependent on weather (Technoserve, 2008).



Figure 1. Map of Rwanda showing the main cattle producing districts

About 188 million litres of milk are produced annually in Rwanda (FAOSTAT, 2013). This translates into on average about 3.2 litres per day per cow. This yield is still very low, due to the fact that improved breeds constitute only 10% of the 157,000 milking cows in the country (TechnoServe, 2008). Rwanda's milk production from 2000-2013 when compared with other EAC countries is shown to be very low (Table 1). The trends of milk production by the EAC countries during the same period are also shown in Figure 2.

Table 1. Milk production (tons) from 2000-2013 in the EAC countries

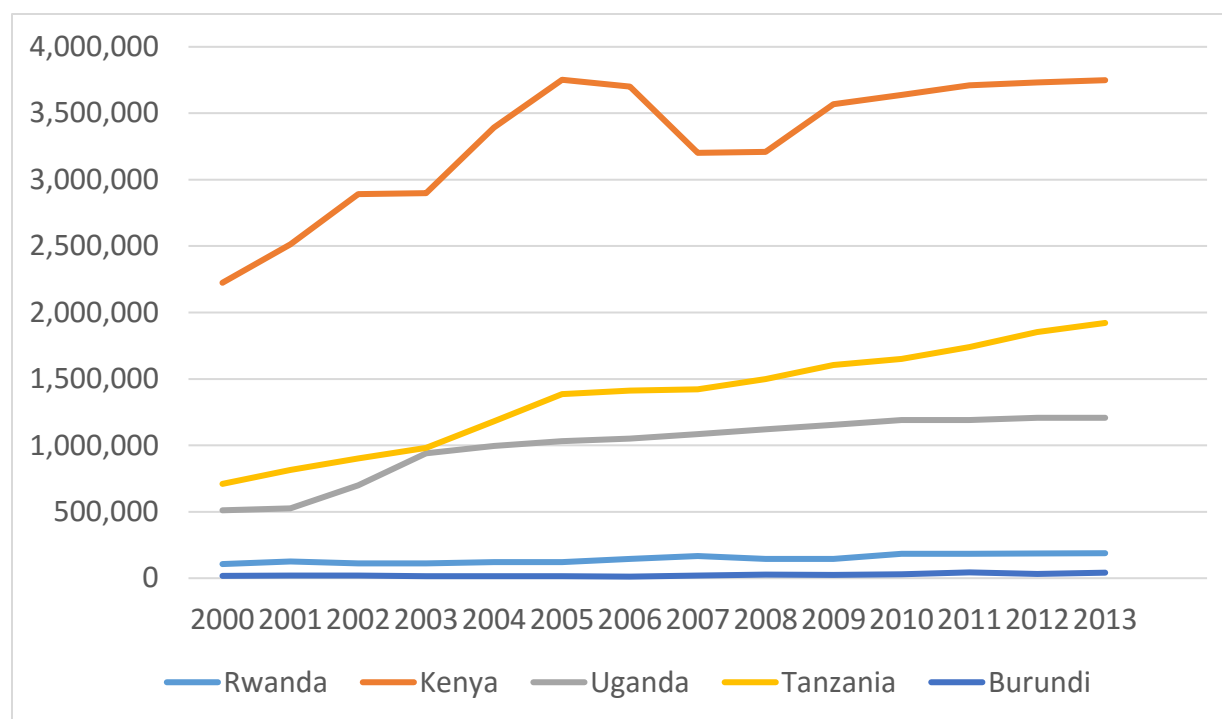
Year	Rwanda	Kenya	Uganda	Tanzania	Burundi
2000	106,458	2,224,000	511,000	710,000	18,550
2001	125,900	2,512,586	525,000	814,000	19,250
2002	112,000	2,890,685	700,000	900,500	19,250
2003	112,463	2,898,446	940,450	980,500	14,794
2004	121,417	3,392,400	995,750	1,180,000	14,344
2005	120,000	3,752,200	1,032,500	1,386,400	16,150
2006	144,888	3,700,080	1,050,000	1,412,786	11,869
2007	166,733	3,202,387	1,085,000	1,422,205	19,642
2008	145,000	3,208,946	1,120,000	1,500,000	26,167
2009	145,000	3,567,247	1,155,000	1,604,126	24,715
2010	183,700	3,638,592	1,190,000	1,649,857	30,418
2011	184,000	3,711,364	1,190,000	1,738,683	43,836
2012	186,000	3,732,960	1,207,500	1,853,099	31,800
2013	188,000	3,750,000	1,207,500	1,921,640	41,086

Source: FAOSTAT (2016)

In spite of the apparent poor milk production performance regionally, the vision of the Rwanda dairy subsector is to contribute effectively to the growth of the national economy and improve the standard of living for the largest number of Rwandan households in a sustainable and environmentally sound manner. The goal of the sub-sector is to achieve a competitive dairy sector providing quality dairy products, which are available, accessible and affordable to all Rwandans and other consumers in the region (MINAGRI, 2013). Dairy supports each of the six pillars of the Vision 2020 directly and indirectly through its contribution to GDP, household income, food security and nutrition, among others. The Government of Rwanda (GoR) through the Ministry of Agriculture and Animal Resources has set the mission of the dairy subsector to create conditions for the provision of wholesome and affordable milk products to benefit the largest numbers of consumers for both the local and regional markets on a sustainable basis (MINAGRI, 2013).

As a result, a number of government programs have been put in place to enhance the growth of the sub-sector. These include the introduction of new cattle breeds, a robust insemination

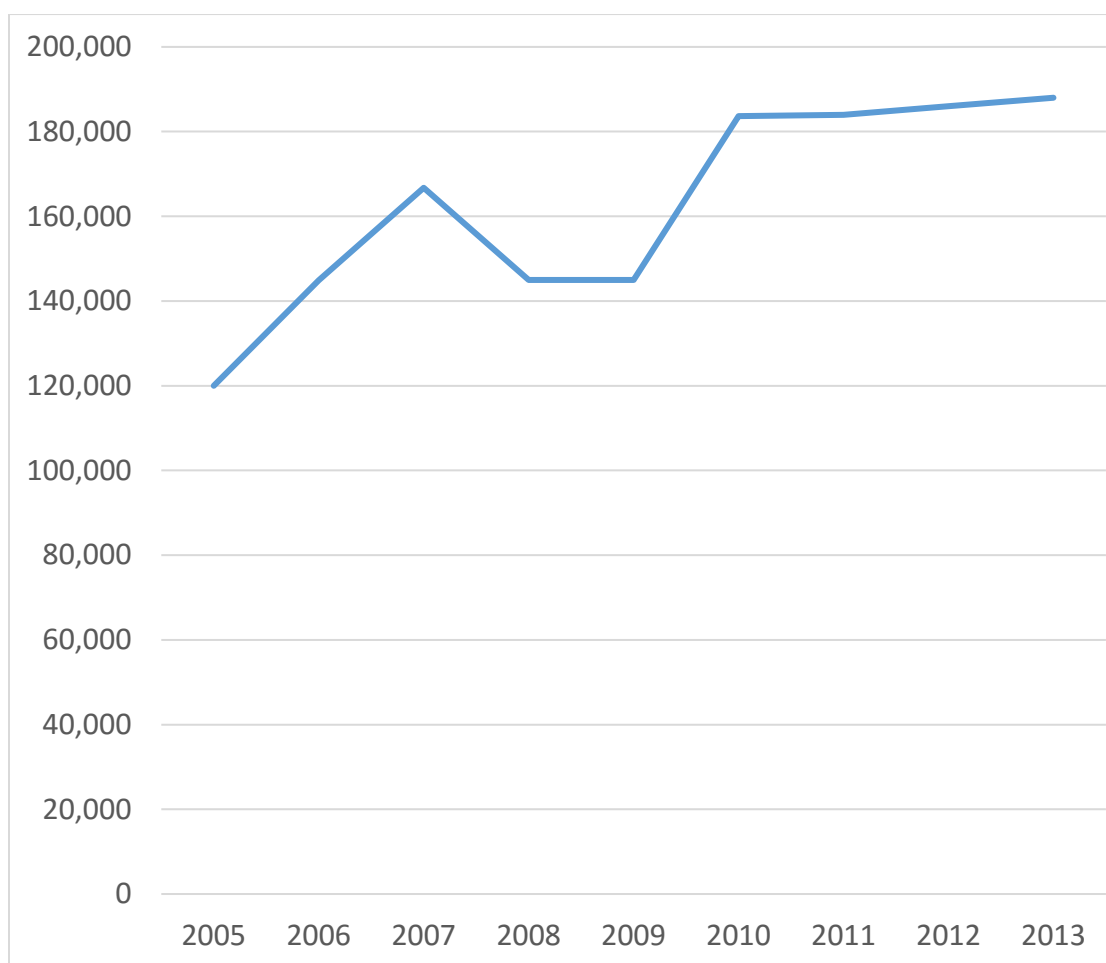
program, an effective disease control program, and the ‘one cow per poor family’ program. The latter, also known as *Girinka*, is GoR’s cornerstone for the development of the dairy sector (MINAGRI, 2013).



Source: FAOSTAT, 2016

Figure 2. Trends of milk production (tonnes) in the EAC countries from 2000-2013

The efforts of the government programs in the dairy sub-sector have resulted in a dramatic transformation of the sector with an annual growth rate of milk production of about 8% in the recent years. This is mainly attributed to the *Girinka* program. In 2008, the program distributed more than 10,000 heads of cattle increasing the total number of cattle to 157,000 as well as milk production, and the growth rate is further projected to increase to 13% by 2020. Figure 3 shows Rwanda’s milk production from 2005 to 2013.



Source: FAOSTAT, 2016

Figure 3. Rwanda's milk production (tons) per year from 2005-2013

Role of dairy products in the food chain

Globally there is a rapid rise in aggregate consumption of milk, which is propelled by millions of people with rising incomes diversifying from primarily starch-based diets into diets containing growing amounts of dairy and meat (Muehlhoff *et al.*, 2013). In the developing countries, milk and dairy products can play a particularly important role in human nutrition. This is due to the fact that diets of poor people frequently lack diversity and consumption of animal-source foods may be limited.

A vast number of dairy products can be processed from milk. Butter and skimmed milk can be processed from whole fresh milk during first level processing. Skimmed milk can then be converted into a range of products in second level processing, including skimmed milk cheese, fresh whey, evaporated skimmed milk, condensed skimmed milk, and dry skimmed milk. Some

of these products can be processed further to give other products during third level processing such as processed cheese from skimmed milk cheese (Wijesinha-Bettoni and Burlingame, 2013). Dairy therefore offers compelling opportunities, such as the prospect of simultaneously improving nutrition and reducing poverty where there is a generally positive public perception of milk (Muehlhoff *et al.*, 2013).

Nutrition

Dairy products are important in diversifying the diets. They are energy dense and provide high quality protein and micronutrients in an easily absorbed form (McLeod, 2013). Milk and dairy products are important sources of calcium, magnesium, selenium, riboflavin, vitamins B12 and B5. Although there is evidence to suggest that adding dairy products to the diets of undernourished pregnant women and children above the age of 12 months is beneficial for child development, milk does not contain sufficient iron to meet the needs of growing infants (McLeod, 2013).

Production Constraints and Identified Hindrances to Productivity and Profitability

The prevalence of local cattle breeds results in low milk productivity (Technoserve, 2008). At Mudende IP, although member households were found to achieve significantly more milk per day than the non IP counterparts, milk yield was much lower than it could be. The government has put effort in introducing better yielding animal breeds, and introducing the 'Girinka Program' where on average a household was found to own at least two improved animals. While continued improvement of the animals is expected to improve milk yield, limited availability of land constrains fodder production. On average households were found to own between 0.6-0.9ha of land. IP members on average accessed four parcels and non IP members accessed three parcels. Livestock keepers sometimes have to rely on purchased feed, optimal quantities of which may not be affordable to a good number of them.

Profitability is mainly hindered by lack of access to markets. For the farmers that are able to transport their milk to the milk collection centres (MCCs), a fair price is achieved. For those who fail to get to the MCCs, especially women farmers, low and unreliable prices are obtained by selling the milk in informal markets near homes. Besides, the consumption of milk and milk production has been low, and hence low demand for milk even in the informal markets. Sensitization of the communities is critical to boost consumption, and demand for milk.

Innovation Opportunities

Innovation opportunities exist around the identified intervention points; improving milk yield, support to processors to invest in milk processing, community awareness campaigns and school feeding programs, and support to the MCCs to develop into a business hub (Fig.4).

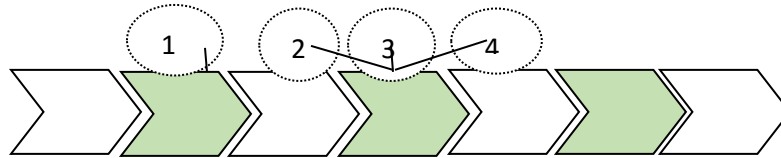


Figure 4. Milk value chain intervention points

1. Improving milk yield; 2: Support to small and medium scale processors; 3: Awareness campaigns and school feeding programs; 4: Support to the MCCs to become a business hubs.

While the GoR is already working on improving cattle breeds in the country, and to develop MCCs into business hubs, private and public investors in processing of milk are still required. A number of products can be processed from milk by local investors, such as cheese, butter, ice-cream, skimmed and powdered milk. Such investors would need support in establishing the necessary infrastructure, and training to obtain the processing and handling skills. Community sensitization and school feeding programs would then enable the public to access the locally available products. This would raise the demand for milk from the communities and provide more reliable prices to the producers.

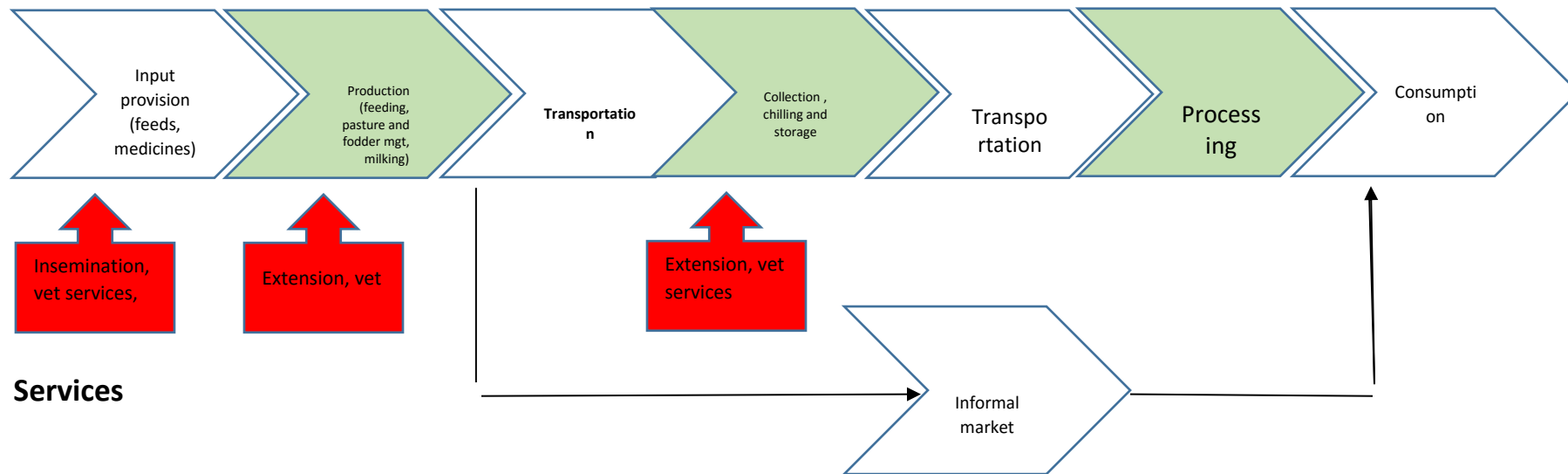
Value Chain Analysis

The value chain begins with input provision (Figure 6). The major inputs include salts and feeds, which are provided by local agro-input shops. Feeds constitute the largest proportion of the total cost of production. Artificial Insemination (AI) is provided by government services and a few farmers can access private service providers where they pay. However there is no AI services in Rubavu district and so majority do not use AI but pay to have their cows served naturally. Production is done by the farmers who feed the cattle either on purchased feed, open grazing, or a combination of open range and zero grazing. About 70% of the respondents were engaged in zero grazing, 21% in semi-grazing, while 9% were engaged in open range grazing. Farmers were able to access parcels of land for grazing but mainly for preparing fodder for zero grazing (Figure 5). However, the number of parcels accessed for grazing were significantly different between IP and non-IP members. IP members accessed on average 4 parcels compared with 3 accessed by non-IP members. This difference was significant at the 1% level. On average male-headed households accessed four parcels while female-headed households accessed three parcels, and this difference was also significant at the 5% level (Table 2).



Figure 5. Mr. Bwitinge Innocent in his fodder garden

Processes



Services

Actors

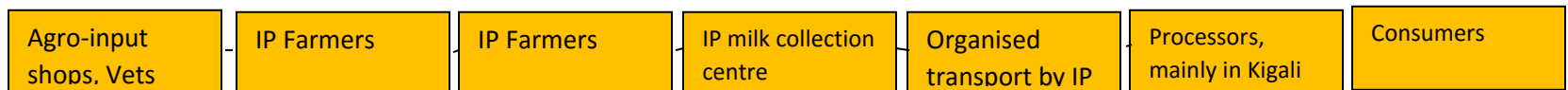


Figure 6. Mapping the actors, processes and services of the milk value chain at the Mudende IP

The quantity of milk produced per animal varied significantly between IP and non-IP members. On average IP member households produced 2.3lts, while non-IP households produced 1.47lts daily per animal. The difference was significant at 5% level, and this could be attributed to the services offered by stakeholders at the IP. In particular, the IP members credit Rwanda Agricultural Board (RAB) for providing good planting materials and offering training on good farming methods. Although this level of milk production lies between the estimated range of milk production in Rwanda of 0.7-3.2lts per cow per lactating day (TechnoServe, 2008), milk production by the respondents is low. This should be the first intervention point; to raise the yield of milk per animal. Low milk yield is believed to be caused by local breeds and poor animal feeding. Intervention at this point ought to focus on these factors, as well as engaging available financial service providers (such as Imbonera SACCO, Figure 7) to improve feed and other input purchases.



Figure 7. Imbonera SACCO located in Mudende Sector, and stakeholders of the Mudende IP

The farmers are urged to sell their milk at the MCCs and milk is transported there mainly using bicycles (8). A number of farmers however sell in the informal market where prices are highly volatile. While on average farmers sold at RwF140 at the MCC, in the informal market, they were offered as low as RwF80 per lt. The milk produced by the respondents was valued using the prices they were offered during high and low milking seasons. The value of the milk produced was found to vary significantly between IP and non-IP members, and between male- and female-headed households. IP households had a value significantly higher than the non-IP households, most likely as a result of selling at the MCCs. Male-headed households had a value of milk produced significantly higher than their female-headed counterparts. This implies that more female headed-households most likely sell their milk in the informal markets.



Figure 8. Transporting milk to Mudende Milk Collection Center

From the MCCs, the milk is loaded on to trucks for transportation mainly to Kigali where it is processed, packed and sold to consumers by supermarkets (Figure 9). Kigali city, located about 4 hours from Mudende is currently the main market of the processed milk and products.

The second intervention point could consist of support to small and medium scale processors to be based in the milk producing areas near the IP. This would help to increase the players in the milk market and make it relatively more competitive. More competition would help stabilize the prices. Although the consumption of milk and processed products is still low in the rural areas, these areas are urbanizing fast (Figure 10), and they are likely to demand the products in the near future.

Thirdly, awareness campaigns for the consumption of milk and processed products as well as the introduction of school feeding programs could increase the demand of milk in the formal markets, which would stabilize the prices. Lastly, the GoR has plans to develop a business hub model around the MCCs. Mudende MCC could be supported to establish the model so as to provide a number of other business services including business development, extension, as well as collection and chilling the milk.



Figure 9. Loading milk on to a truck at the Mudende MCC for transportation to Kigali



Figure 10. A middle class urbanized countryside in Western Rwanda

Summary and Conclusion

Although milk production in Rwanda is low compared with her neighboring countries, opportunity exists to boost production and develop new processed milk products. Milk production and productivity could be enhanced by further promoting government efforts to improve animal breeds and better animal nutrition, at farm level. The milk value chain is still faced with challenges of volatile prices in the informal market, where most of the milk is sold fresh, although government is making effort to harmonise at the MCCs. The major market of the processed milk and products is found in Kigali. Support to small and medium scale processors would increase market competition that would stabilize prices in the formal market while enabling the creation of new products from the processed milk. Awareness campaigns and school feeding programs would increase the demand for milk and processed products in the rural areas while support to develop a business hub at MCCs would enable more services to be provided by the MCCs towards increased production and marketing of milk.

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