Background

Urbanization, increasing population, rising income levels and changing dietary patterns are expected to increase demand for milk and dairy products in Kenya. The per capita milk consumption of 110 litres is projected to double by the year 2030 (Rademaker et al. 2016; KDB 2016). Linked to this growth, is the demand for safe affordable milk, which is stimulating technological and market innovations in the dairy industry. One such innovation is milk retailing through milk dispensing machines in major urban centres, popularly known in Kenya as “milk ATM” (Bebe et al. 2018; Kosgey et al. 2018). The spread of milk ATMs, which are required to sell pasteurized milk, indicates a potential to grow the formal (pasteurized) market segment and address quality and safety concerns in sector that is dominated by informal marketing. This ties with the vision articulated in the Kenyan Dairy Masterplan and KDB’s strategic plan to expand formal market share, which is estimated at 30% of total amount of milk that is sold, and to also improve quality (KDB, 2016; ROK 2010; KDB 2018). However, information on current growth patterns and on drivers and factors that inform the development of the ATM market segment is scanty. Furthermore, the growth in milk ATM businesses amidst regulatory gaps has resulted in various compliance issues that have raised quality and safety concerns.

This brief presents summary findings of a study that analysed development of ATM milk retailing in Kenya, focusing on growth in businesses and related support services, consumer perceptions and demand, and milk quality and safety issues in this market segment. Building on the trends analysis, the second part of this brief presents scenarios linked to policy interventions that are likely to affect further growth in milk ATMs. The evidence is intended to inform the necessary policy and regulatory frameworks that can be supportive of quality-driven investments in this growing milk retail market segment.

Study methodology

The study was conducted in six counties with high ATM density according to Kenya Dairy Board data: Nairobi, Kiambu, Nakuru, Kajiado, Uasin Gishu and Machakos Counties. Data were collected by surveying 162 milk ATM operators and 352 consumers and interviewing seventeen milk suppliers, nine ATM machine suppliers and six public service officers.

Key messages

- The milk ATM market segment has potential to be a game changer in expanding the formal milk market in Kenya.
- While the exponential growth of the ATM milk market is concentrated in a few towns; under right conditions this can expand to other towns.
- Affordability of ATM milk offers the potential of upgrading the formal milk market share, especially if quality concerns are addressed. The raw milk market is the biggest competitor for ATM milk.
- ATM milk is purchased by consumers of all income categories, but mostly by low- and middle-income earners.
- Some consumers’ perceptions of quality and safety of ATM milk impedes growth of the segment.
- The ATM milk market has stimulated a diverse business ecosystem with enormous business and employment opportunities, also for youth and women. Development can further be boosted by policy and regulations and business development support.

Policy recommendations

- Fast-track dairy regulations and enhance KDB capacity to support ATM business operators through training and guiding operations to deliver quality and safe milk to the market.
- Introduce traceability systems to ensure accountability of all milk ATM supply chain actors.
- Offer policy support such as tax-breaks, financing and development of standards to enhance food-grade quality of locally manufactured ATMs.
1. Trends and development of milk ATMs

**Growth of milk ATM businesses**
The number of ATMs in Kenya has grown over time with a peak in 2018, as shown in Figure 1. According to KDB supplied data, there were 1550 registered milk ATMs in 2018. The decline in 2019 can be linked to a suspension in ATM licensing by KDB to introduce new regulatory measures. Based on a projection that includes what was found as unregistered businesses we estimate that there are about 2030 milk ATMs in Kenya in 2019.

![Figure 1: Trends in growth of milk ATMs across Kenya](image)

**Source:** KDB

**Milk ATM distribution**
The development of geographical distribution over time shows that ATM businesses are concentrated in Nairobi and neighbouring Kiambu County (Figure 2). This could be attributed to their dense populations, resulting in a higher demand for milk.

![Figure 2: Geographical distribution of milk ATMs](image)

**Source:** ATMs Survey data (n = 162)

**Types of ATM Business models**
We identified various milk ATM business models. In terms of location, 21% of ATMs are located in supermarkets, and 79% in other business premises or as standalone shops. On business ownership, the majority (79%) were sole proprietorship, while some were owned by companies (17%), partnerships (3%) or cooperatives (1%). Some businesses operated several machines in different locations, but most (82%) ran a single machine.

**Pricing and milk volumes sold through ATMs**
On average, each ATM sold 140 litres of milk per day. This represents about 16% of the formal processed milk (i.e. 102 million litres of 634 million litres marketed formally in 2018). ATM milk retail prices range from KES 50 - 80 per litre, reflecting differences across counties, and with a mean of KES 63 per litre. ATM milk is more affordable than other processed milk products. The average price of pasteurized packed milk (KES 93 per litre) that of ultra-heated (UHT) milk (KES 110 per litre is 48% and 73% more expensive than ATM milk. On the other hand, raw milk sold informally by traders averaged KES 54 per litre, being 18% cheaper than ATM milk. This confirms what was noted by some ATM operators, that raw milk remains the major competitor and impediment for growth of their business.

![Photo 2: Customers buying ATM milk](image)

**Table 1: Types of milk consumed by different consumers**

<table>
<thead>
<tr>
<th>Product</th>
<th>Low income (n=139)</th>
<th>Middle income (n=110)</th>
<th>High income (n=15)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw milk</td>
<td>18.71</td>
<td>18.18</td>
<td>0.00</td>
<td>17.42</td>
</tr>
<tr>
<td>ATM milk</td>
<td>69.06</td>
<td>73.64</td>
<td>60.00</td>
<td>70.45</td>
</tr>
<tr>
<td>Packed processed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>milk</td>
<td>0.00</td>
<td>0.00</td>
<td>60.00</td>
<td>61.36</td>
</tr>
</tbody>
</table>

2. Consumer preferences and perceptions and quality aspects of ATM milk

**Consumer characteristics and milk consumption patterns**
From the consumer survey of 352 household heads, of which 196 were women and 156 were men, the respondents were characterized according to monthly income levels. Households with monthly earnings below KES 20,000 were classified as low income (52%), KES 20000 to KES 50,000 as middle income (42%), and above KES 50,000 were classified as high income (6%). Table 1 shows differences in consumer milk purchasing patterns in...
the past year based on incomes. Overall, ATM milk was the most (70%) purchased type of milk by the respondents. There were some gender differences in milk purchasing and consumption patterns. More households with female decision makers (68%) consumed ATM milk in the past year compared to 59% of households with male decision makers.

**Consumer perceptions and quality issues of ATM milk**

About 85% of surveyed consumers had ever purchased ATM milk but in 2019 only 63% were buying ATM milk representing a retention rate of 73% (Figure 3).

![Figure 3: Consumer purchase patterns of ATM Milk (n=352)](image)

For consumers who purchase ATM milk, affordability was a key reason (43%), followed by availability (17%) and flexibility in quantity purchased (15%). Other reasons relate mainly to taste and sensory qualities. Most consumers who do not purchase ATM milk (56%), consider it to be adulterated and about 22% consider it not clean enough or spoiling easily (Figure 4). This implies that consumer perception about the quality issues deters purchase of ATM milk. Hence, improving quality practices and sensitizing and assuring consumers on quality and safety could grow the market segment.

![Figure 4 Reasons why some consumers do not buy ATM milk (n= 66)](image)

The study also reviewed secondary sources to understand the extent to which ATM milk complied with regulatory quality and safety standards. KDB 2018 surveillance data of 60 sampled milk ATMs across the country showed that some samples failed to comply with the set standards (Figure 5). About 19% of the milk samples failed the alcohol test, an indication of milk spoilage. Further, 15% of the samples had butter fat content below accepted levels, which could indicate milk adulteration, especially addition of water or skimming of cream. Aflatoxin and antibiotic residues were detected in some samples. Some of the results mirror those of recent studies on quality and safety standards of ATM milk (Bebe et al. 2018; Kosgey et al. 2018).

![Figure 5: Surveillance results of sampled milk ATMs (source: KDB data 2018)](image)

**Figure 5:** Surveillance results of sampled milk ATMs (source: KDB data 2018)

### 3. Milk ATM business ecosystem

The emergence of the ATM milk market segment has stirred development of a business ecosystem with opportunities for diverse supply chain actors. The businesses fall under three categories: ATM operations (milk retail), ATM milk suppliers, and ATM technology suppliers. These have expanded employment opportunities in the milk industry.

**Business along the ATM milk supply chain**

As noted in section 1, the ATM milk retail segment has grown exponentially. Linked to this, is the milk supply chain that starts with the farmers to various intermediary businesses that collect, transport, pasteurize and supply milk to the retailers. Figure 6 shows the value distribution and margins for the different supply or value chain actors involved in milk supply. This is an aggregate value for the different business actors involved at the various nodes of the milk supply chain.

![Figure 6: Value distribution along the ATM milk supply chain](image)

The vast majority (99%) of the milk ATM operators were selling pasteurized milk (95% supplied with already pasteurized milk, 2% self-pasteurization and 2% co-pasteurization), while 1% sold raw milk. Co-pasteurization is where a milk ATM retailer purchases raw milk and hires pasteurization services of an independent pasteurizer. It was evident that there is growing business of small pasteurization units, which may not be regulated by the KDB.
Milk ATM technology supply
The majority (98%) of milk ATMs are fabricated locally, while a few suppliers import fully assembled ATMs. Local fabrication involves assembly of various imported parts, but also conversion of standard refrigerators into ATMs. The imported parts included refrigeration units, calibration units, milk pumps and tamper-proof cans. Local fabrication has brought down the price of ATMs from about KES 1.2 million, to KES 120,000 - 700,000, depending on the specifications.

Compliance issues and best and poor practices of milk ATMs
KDB requires that milk ATMs sell pasteurized milk. Based on responses from milk ATM operators, 99% of businesses sell pasteurized milk and only 1% sells unpasteurized milk. For milk transportation to ATMs, only 1% of suppliers had adopted the recommended tamperproof cans, while 83% use sealed aluminium cans to assure quality of milk. Sealing cans is seen as a cheaper substitute for use of tamperproof cans. About 15% of suppliers used unsealed aluminium cans, which could compromise quality of the milk supplied. Around 94% of ATM retailers had a valid business license, 75% had ever acquired a KDB permit, and 79% had a public health medical certificate. Most of the KDB licenses had expired, as new requirements by KDB had not been met and because its issuance had been suspended at the time of this study as KDB was developing regulations for the same.

At the ATM operation level, the best and poor practices are centred on milk-handling practices, certification of milk handlers, servicing of ATM technologies, waste disposal and calibration of equipment. The best practices in terms of quality of ATM technology including the use of the recommended quality milk cans and sale of pasteurized milk, while poor practices were in the adulteration of milk, sale of raw milk, poor cleaning of ATMs and not having the required permits and licences.

Employment creation by milk ATMs
We estimate that milk ATM businesses are currently employing 3,350 operators nationally, with about 41% female operators and 59% male. The average age of the operators was 28 years, indicating that most workers employed in these businesses were youth. The majority of the employees (54%) had secondary education, 6% had primary education and 40% tertiary education as the highest level. While the study did not delve deeply in other nodes of the supply chain, it was found that the ATM technology suppliers are mostly small enterprises with 6-20 employees (not all full time). They are also generating job opportunities. In addition, new opportunities arise in pasteurizing, ATM machine maintenance (technicians), and spare parts sales and in milk transportation, among others.

4. Future development of milk ATM retailing – Scenario analysis
The study looked at possible scenarios linked to policy interventions in the development of the milk ATM supply chain and their implications for the sector (expressed as demand and supply of milk, and employment over the next 10 years).

Three scenarios were developed and discussed at a roundtable meeting with stakeholders from the milk ATM supply chain. Key assumptions were made on the scenarios, where a logistic growth function was applied related to the number of consumers demanding ATM milk, number of milk ATMs and the utilized capacity. The relative growth rate of the ATM sector was projected from historical data.

Scenario 1: Business as usual
This scenario assumed all conditions remaining constant without any policy intervention. The results show positive growth of the milk ATM market segment. In this case, demand for ATM milk would increase by a growth factor of 3.36 and the quantity supplied by 3.2 in 10 years (Table 2). The change in quantity demanded exceeds change in quantity supplied because the ATM market segment exhibits demand-led growth. Thus, suppliers of ATM milk will lag their supply decisions, such that the market stabilizes, before committing more resources.

The scenario reveals that there is a likelihood of expansion of local ATM machine fabrication which will increase the levels of employments. Supply changes in ATM milk implies increased pasteurization and thus more business. This trend may trigger further growth in co-pasteurization and more investment in capacity to ensure compliance with KDB standards.

Table 2: Future projections in demand and supply of ATM milk in a business-as-usual scenario

<table>
<thead>
<tr>
<th>Variable</th>
<th>Status quo</th>
<th>In 10 years</th>
<th>Normal case</th>
<th>Best case</th>
<th>Worst case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity demanded (1000 liters)</td>
<td>202,205</td>
<td>343,307</td>
<td>447,233</td>
<td>217,297</td>
<td></td>
</tr>
<tr>
<td>(336%)</td>
<td>(438%)</td>
<td>(213%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity supplied (1000 liters)</td>
<td>107,385</td>
<td>343,445</td>
<td>443,230</td>
<td>220,005</td>
<td></td>
</tr>
<tr>
<td>(320%)</td>
<td>(413%)</td>
<td>(205%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ATMs</td>
<td>2,030</td>
<td>3,710</td>
<td>3,971</td>
<td>2,904</td>
<td></td>
</tr>
<tr>
<td>(183%)</td>
<td>(196%)</td>
<td>(143%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scenario 2: Stronger KDB regulatory framework and increased compliance
Currently, the KDB is developing new dairy regulations that will also govern the milk ATM market segment. Once passed, the likely scenario is that KDB will have a stronger basis for enforcement. Currently, KDB has an estimated compliance rate of 28% in the milk ATM segment. However, it aims to attain 80% compliance (benchmarked from processed milk segment). To comply, operators incur additional costs to make necessary investments, which are likely to be passed on to the consumers. On the other hand, increased compliance would assure consumers of the quality of ATM milk, which would build consumer trust in the product, which in turn would increase the quantity demanded. However, competition from cheap imported milk from neighbouring countries can have an effect on the price competitiveness of ATM milk.
To achieve a higher level of compliance, KDB would require additional human resources and investments in laboratory and equipment to monitor the milk ATM machine and ATM milk supply chains. By the tenth year, compliance would have grown to 79%. This will attract more consumers who are concerned about quality and price of milk, providing a mechanism for the ATM segment to encroach on the processed packaged milk market. On the other hand, where enhanced compliance takes longer (worst case), quantities demanded and supplied reduce compared to the normal-case scenario (Table 3). Consumers will tend to shift to raw milk consumption because of the price and quality effect in the market, as laxity in ensuring compliance by KDB would lead to mushrooming of non-compliant milk ATMs.

Table 3: Scenario with compliance rate changes through a stronger regulatory framework

<table>
<thead>
<tr>
<th>Variable</th>
<th>In 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal case</td>
</tr>
<tr>
<td>Quantity demanded (000 litres)</td>
<td>343,307</td>
</tr>
<tr>
<td>(336%)</td>
<td>(471%)</td>
</tr>
<tr>
<td>Quantity supplied (000 litres)</td>
<td>343,446</td>
</tr>
<tr>
<td>(320%)</td>
<td>(448%)</td>
</tr>
<tr>
<td>Number of ATMs</td>
<td>3,710</td>
</tr>
<tr>
<td>(183%)</td>
<td>(191%)</td>
</tr>
<tr>
<td>Compliance level (%)</td>
<td>70%</td>
</tr>
</tbody>
</table>

Scenario 3: Public ban on sale of raw milk in urban areas

A scenario of enforcing a (partial) ban on sale of raw milk in urban areas – to increase food safety – will result in the ATM market segment eating into the dominant informal market segment quoted to be 70% of total marketed milk. In this scenario, the ATM milk segment can contribute to growth of the formal pasteurized market.

Table 4: Scenarios with public ban of raw milk in urban areas

<table>
<thead>
<tr>
<th>Variable</th>
<th>In 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal case</td>
</tr>
<tr>
<td>Quantity demanded (000 litres)</td>
<td>343,307</td>
</tr>
<tr>
<td>(336%)</td>
<td>(580%)</td>
</tr>
<tr>
<td>Quantity supplied (000 litres)</td>
<td>343,446</td>
</tr>
<tr>
<td>(320%)</td>
<td>(536%)</td>
</tr>
<tr>
<td>Number of ATMs</td>
<td>3,710</td>
</tr>
<tr>
<td>(183%)</td>
<td>(234%)</td>
</tr>
</tbody>
</table>

The demand for ATM milk grows by a factor of 5.8 in the best-case scenario where additional growth (difference between the best and normal cases; 5.80-3.36) can be as a result of more consumers switching from raw milk to ATM milk (Table 4). The growth in supply is projected to be less than that of demand because suppliers speculate that not all consumers will switch to ATM milk which is more expensive than raw milk.

In the worst-case scenario, the ATM milk market segment does not grow fully because a black market to trade raw milk that is cheaper than ATM milk might develop. Future growth of the ATM milk sector is anchored on encroachment into the informal market segment rather than competing with packaged processed milk.

5. Conclusions

- While the ATM growth is concentrated in a few towns, mainly in Nairobi and neighbouring counties, there is opportunity to expand to other urban areas with growing populations.
- ATM milk is affordable and provides flexibility in volumes purchased thus enhancing access, especially for low income consumers, thus contributing to nutrition security.
- More consumers are purchasing ATM milk, but there are perceptions and concerns with quality and safety issues that is affecting consumer confidence.
- The ATM milk segment is expanding business opportunities and employment in milk pasteurization, supply & retail, local fabrication of the technology and related services. However, policy and regulatory gaps leading to food safety and quality concerns that may affect growth need to be addressed.
- The scenarios presented show that the ATM milk segment has the potential to encroach on the informal milk market segment, offering an alternative source of milk to consumers, resulting in a maximum growth in ATM milk supply volume by a factor of 5.8 over the next decade.

6. Recommendations

The growth of the milk ATMs is potentially a game-changer in expanding the formal market of the Kenya dairy industry. Based on gaps identified that can affect the growth, we recommend the following:

- Fast-track passing of revised dairy regulations and increase regulatory investment and capacity to enhance compliance. GoK should support strengthening of KDB capacity in terms of enforcement officers, laboratory and testing, data management systems, including traceability in registering and monitoring of ATMs.
- KDB should enhance compliance by promoting responsible behaviour of business operators along the supply chain, including through labelling and integrating traceability systems.
- Enhance capacity of the operators through training and integrating operating procedures. KDB can involve public health department, training institutes and consumer organizations to assist in the process.
- The Kenya Revenue Authority should provide tax-incentives to access affordable food-grade materials, and KEBS should develop and enforce fabrication standards of milk ATM.
- Encourage investment along the ATM milk market. The upcoming regulations should facilitate improvements to the supply chain, through a phased approach to safeguard the interest of the investments already made and offer incentives to promote a quality-driven market.
References


3R Kenya Project

The 3R Kenya (Resilient, Robust, and Reliable— From Aid to Trade) project is a learning initiative supported under the Agriculture and Food and Nutrition Security (FNS) program of the Embassy of the Kingdom of the Netherlands. 3R Kenya seeks to generate evidence and lessons from FNS and other related programmes that support competitive, market-led models in spurring agricultural development. It focuses on the aquaculture, dairy and horticulture sectors. 3R Kenya is executed at a time when Dutch government’s bilateral relations in Kenya are transitioning from a focus on Aid to Trade to enhance the development of agri-food sectors. Through evidence generation and stakeholder dialogue, 3R seeks to contribute to an understanding of effective conditions for sustainable inclusive trade for transforming resilient, robust and reliable agri-food sectors.

Acknowledgements

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The brief is a summary of a more comprehensive research report available at https://www.3r-kenya.org/ || https://www.wur.nl/

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