The Journal of Development Studies, 2023
Vol. 59, No. 9, 1337–1353, https://doi.org/10.1080/00220388.2023.2204178

Beyond the Formal-Informal Dichotomy: Towards Accommodating Diverse Milk-Collection Practices in the Economic Middle of Kenya's Dairy Sector

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(Original version submitted August 2022; final version accepted April 2023)

ABSTRACT *The triangle of dairy intensification, commercialisation and market formalisation is promoted to address the challenges of food and nutrition security (FNS) and climate change. This article questions the need for formalisation to reach intensification and commercialisation objectives in Kenya. Moving beyond the binary perception of milk markets as either 'formal' or 'informal', we investigate a repertoire of milk-collection practices and address the following question: 'What enables diverse intermediary practices to ensure a consistent flow of milk from grass to glass?' Sampling, data collection and analysis were guided by a qualitative research design for an empirical exploration of the practices of owner-operated (N = 13) and corporate (N = 4) milk collectors. Iterative analysis of observations revealed three main themes constituting milk-collection practices: (1) buying milk, (2) managing milk (quantity and quality measurement) and (3) selling milk to the next buyer. These practices were enabled and sustained by the diverse options available for each aspect of milk collection, and by the capacity of collectors to accommodate variety in their practices. We invite scholars and practitioners to conduct deeper explorations of how to accommodate events in practice to enhance the success of ambitions relating to FNS and climate change through pathways of intensification and commercialisation.*

KEYWORDS: Food provisioning; supply chain; low emission development; climate policies; East Africa

1. Introduction

The entangled challenges of food and nutrition security (FNS) and climate change are increasingly directing policy and interventions towards a combination of intensification, commercialisation and market formalisation, with particular attention to reducing greenhouse gas (GHG) emissions from livestock (Clay, Garnett, & Lorimer, 2020; Clay & Yurco, 2020;

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Khatri-Chhetri, Wilkes, & Odhong, 2020). This development pathway is evident in Kenya, where market dynamics, governments and international NGOs are promoting a transformation through 'Low Emission Development Strategies' or LEDS (Khatri-Chhetri et al., 2020; Wilkes, Wassie, Vorlaufer, Odhong, & Dijk, 2020). Kenya is not unique in this regard: similar developments are taking place throughout the East-African region (see e.g. Kihoro, Schoneveld, & Crane, 2021; Minten, Habte, Tamru, & Tesfaye, 2020).

The triangle of intensification, commercialisation and formalisation is gaining ground in national development policies specific to the dairy sector in Kenya (Blackmore, Guarin, Vorley, Alonso, & Grace, 2022). Policies and interventions aimed at reducing GHG emissions centre on intensification via promoting practices that increase milk yields per cow, which then reduces the emission intensities per liter of produced milk (Ericksen & Crane, 2018; Khatri-Chhetri et al., 2020). Commercialisation is the production of dairy for commercial rather than subsistence purposes. The formalisation of commercial transactions between milk producers, collectors and processors is presented as the most effective way of incentivising and enabling intensification. The underlying assumptions are that intensification practices can be promoted via the agricultural extension support of cooperatives and companies, and that formalisation creates a reliable market demand which incentivises producers to intensify. Formalisation implies a drastic transformation of current milk trade, which is largely operated by small enterprises (MALF, 2013). It is nevertheless important to consider whether formalisation is needed in order to achieve objectives relating to intensification and commercialisation in Kenya.

Strategies of formalisation are accompanied by risks. In 2015, an estimated 12% of all milk produced in Kenya, about 30% of all marketed milk, was processed in formal supply channels (Rademaker, Bebe, Lee, Kilelu, & Tonui, 2016), meaning that 70% of all marketed milk finds its ways via 'informal' channels. An emphasis on formalisation tends to ignore that informal markets often constitute a great share of markets, particularly in developing economies (Cerutti et al., 2018), where informal markets function as important links between small-scale farmers and low-income consumers (Leksmono, Young, Hooton, Muriuki, & Romney, 2006; Vorley, del Pozo-Vergnes, & Barnett, 2012). In many dairy sectors, the majority of both business actors and consumers are able to cope with, rely on and/or prefer to engage with informal institutional features of milk markets, as indicated by the perseverance of these features. This suggests that formalisation efforts might not reach the majority of people, and that they thus fail to achieve their initial objectives of enhancing FNS and realising reductions in GHG emissions. It would therefore seem more effective to explore contextualised solutions, rather than striving to realise ideal-type market organisations (Mangnus & Schoonhoven-Speijer, 2020).

To this end, the current study aims to offer a perspective that avoids the promotion of an exclusive sustainable-development pathway of formalisation. Our basic principle is understanding before intervening to transform. Addressing the issue from this perspective highlights the need for an institutional diagnostic question (Rodrik, Subramanian, & Trebbi, 2004; Schouten, Vink, & Vellema, 2018). Prior to proposing a transformative model, we consider why current trading practices and institutional arrangements in the economic middle are durable (Nicolini, 2011; Schoonhoven-Speijer & Vellema, 2020). Taking practices as the unit of analysis helps to depart from the binary view of markets as either 'formal' or 'informal'. We take an empirical route to answering the research question: 'What enables diverse intermediary practices to ensure a consistent flow of milk from grass to glass (farmer to consumer)?'

For a nuanced understanding of the contribution of real markets to FNS, the binary between 'formal' and 'informal' seems particularly problematic. Conceptually, there is general consensus about the meaning of 'formal' as legally registered, regulated and included in official statistics (Habib-Mintz, 2009). Formalisation is diverse and can be categorised into various forms at various levels (see e.g. Berkel & Tarp, 2022). The concept of 'informal' remains troublesome, however, as 'Describing people and their enterprises by what they are not has a built in assumption of their insignificance and that the other that they are not – formal – is superior'

(Wegerif, 2020, p. 3). Moreover, thinking in binary terms reduces the options to extremes (Duncan & Bailey, 2017). Rather than opting for any specific type of market infrastructure, this article responds to calls for investigating real markets as configurations of various types of market channels along and within a continuum from formal to informal (Blackmore, Guarín, Alonso, Grace, & Vorley, 2020; White & Aylward, 2016).

Various scholars have studied informal food sectors (Wegerif, 2020; Wegerif & Hebinck, 2016; Wegerif & Martucci, 2019), including in the Kenyan dairy sector (Alonso, Muunda, Ahlberg, Blackmore, & Grace, 2018; Blackmore, Alonso, & Grace, 2015, Blackmore et al., 2020; Galiè, Njiru, Heckert, Myers, & Alonso, 2022; Tavenner, Crane, & Saxena, 2021). Formal and informal markets continue to receive attention, as do the linkages between them (Berkel & Tarp, 2022; Fafchamps, 2018; Meagher, 2013; Mishra, 2022; Putzel, Kelly, Cerutti, & Artati, 2015). According to existing literature, strict formalisation policies entail the risk of adverse outcomes (Almeida, Paz, & Poole, 2022; Sen, Danquah, & Schotte, 2022), while actors operating within the informal middle are indispensable in food provisioning (Liverpool-Tasie et al., 2020; Mangnus & Vellema, 2019; Roba, Lelea, & Kaufmann, 2017; Schoonhoven-Speijer & Vellema, 2020; Soundararajan, Khan, & Tarba, 2018; Wegerif, 2020; Wegerif & Hebinck, 2016; Wegerif & Martucci, 2019).

Our study proceeds from the everyday practices of milk collectors in the economic middle of Kenya's dairy sector. Studies of FNS focus primarily on producers and consumers (Reardon, 2015; Veldhuizen et al., 2020). A stronger discussion engaged with the economic middle is becoming increasingly relevant, given the significant contributions of this segment to food provisioning (Legun & Bell, 2016). Activities in the economic middle include processing, storage and logistics, and they are estimated to account for 30–40% of all economic value added within food value chains in developing regions (Reardon, 2015). The diverse functions of intermediary actors have been categorised for the agri-food industry in innovation studies based on actor-network approaches (see e.g. Batterink, Wubben, Klerkx, & Omta, 2010; Kilelu, Klerkx, Leeuwis, & Hall, 2011; Winch & Courtney, 2007). Our study re-emphasizes the importance of intermediaries and complements actor approaches with a practice approach.

2. Methodology and methods

Our analytical approach is anchored within a methodological shift towards the examination of practices. A practice perspective is sensitive to everyday realities and an appropriate remedy for the tendency to describe the world in terms of irreducible dualisms (Nicolini, 2012), such as the formal-informal dichotomy. It can facilitate the exploration of how market institutions are ordered and reinforced (Mangnus & Vellema, 2019; Schoonhoven-Speijer & Vellema, 2020). As routinized and improvised social actions that reproduce economic space, practices are order-producing activities at the macro level (Jones & Murphy, 2011).

Following the methodological guidance proposed by Jones and Murphy (2011), we demarcate the boundaries for our analysis around the practices through which milk is transferred from the producer to the collector (A to B), and then transferred from the collector to another buyer/the consumer (B to C). Central in the practices are the flow of milk from producer towards consumers and the associated cash flow in the other direction (Figure 1). After zooming in on milk collection practices the analysis broadens to consider the various supply channels within a catchment area. A catchment area is typically a road network along which milk is collected. We conceptualize supply channels as various bundles of practices that together constitute a diversity of channels that in combination form the milk market within a catchment area.

The terminology used to distinguish between supply channels – owner-operated and corporate (Wegerif, 2020) – are more nuanced than formal and informal. We also depart from the use of terminology that is often pejorative (e.g. middlemen, hawkers) to describe the actors operating in the economic middle. Owner-operated supply channels are typically characterised as

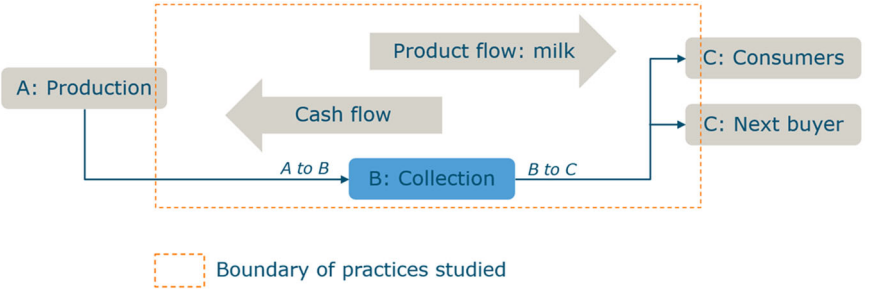

Figure 1. Visualisation of the boundaries for investigating practices of milk collection. This figure does not represent all supply chains and the variety of practices that exist (authors).

being small-scale, embedded within their local communities and with low barriers to entry (Wegerif, 2020; Wegerif & Hebinck, 2016; Wegerif & Martucci, 2019). Corporate market channels generally handle larger volumes of milk, which – in Kenya – typically reaches consumers in processed form. Milk that flows through owner-operated market channels is often consumed raw. For owner-operated collectors (hereafter owner-operators), building on the categorisation of Alonso et al. (2018) we also use terminology that distinguishes between those collecting at small shops (shop collectors), from one point along a road (street collectors), and those collecting milk in different locations, typically moving about by motorbike (mobile collectors). Table 1 presents and overview of the data collection activities.

2.1. *Research area*

The selection of the research area was informed by semi-structured interviews with 12 key informants in the dairy sector in Murang'a County in 2018. A catchment area around a middle-sized town was selected (Figure 2), characterised by the presence of three diverse, formally governed corporate marketing channels and a thriving raw-milk market operating partly outside the scope of state regulations. The town is about 30 km from the Murang'a County capital and about 110 km from the national capital, Nairobi, both of which are important milk markets.

Murang'a County has a diversified physical environment comprising three agro-ecological zones. In recent years, dairy production has been an emerging business across all altitudes (Asayehegn, Iglesias, Triomphe, Pédelahore, & Temple, 2017). The area is characterised by relatively intensive dairy systems, with the majority of smallholder producers operating in zero-grazing systems (TIAPD, 2021). Therefore, in contrast to other production systems in Kenya, milk is not as scarce in the dry seasons because the predominantly zero-grazing systems are less dependent on available grazing lands, although fluctuations in the production and availability of milk are experienced due to dry and wet seasons. Murang'a County has been subject to government interventions aimed at formalising the dairy sector (County Government of Murang'a, 2018).

2.2. *Sampling milk collectors*

We sampled 15 milk collectors for in-depth observations of their everyday business practices via a private and parastatal dairy company. These two companies are the most visible entry points to other dairy sector actors in the area. Proceeding from these companies, we used snowball sampling, purposefully requesting to observe as many diverse practices of milk collection as possible. Employees of the two companies who had been assigned to assist with the research also joined during the milk-collection observations, serving as drivers and interpreters where necessary. The data-collection activities were finalised when we had exhausted the network of

Table 1. Overview of the data collection activities

Objective	Month – Year	Activities
Mapping of the dairy network and exploration of the political economy of dairy-development initiatives in Murang'a County. This informed the sampling of the research area and helped place further findings in its context.	Nov–Dec 2018	*Key informant interviews* with the main actors in the dairy sector in Murang'a County ($N = 12$).
Scoping trip to the research area to discuss research plans with relevant actors and to explore options for a practice-oriented research design.	Aug 2019	Meetings with managers of the private and parastatal companies to discuss research plans; *joining a collector* ($N = 1$) in his milk collection activities.
Data collection at the level of milk collectors (Round 1).	Early Sept 2019	Meetings with managers of the private and parastatal companies and their extension-services staff to discuss the research approach. *Start joining milk collectors* ($N = 4$) in the network of the companies, with an extension staff member from one of the companies serving as a motorbike driver and interpreter, where necessary.
Data collection at level of milk collectors (Round 2) and filling in gaps.	Late Sept 2019	Meetings with managers of the private and parastatal companies and their extension-services staff to discuss progress and diversity in the types of milk collectors observed. In these meetings, the managers also elaborated on their own *milk-collection activities* ($N = 2$), which we had observed along the way while joining other collectors. *Join milk collectors* ($N = 10$). *Develop overview of key aspects of milk-collection practices and revisit most of the milk collectors* to clarify and confirm the data about these key aspects (see complementary material for the overview).

the companies. We do not claim that our sample is representative of all milk-collection practices within the catchment area. A description of the sample is provided in Table 2.

2.3. Data collection and analysis

All collectors included in this study provided oral consent for the first author and an interpreter to join their milk-collection activities. We informed them about the objective of our study – to investigate how milk collection is organised – and made it explicit that we were working independently of the companies and from the regulatory authority. The research design allowed for

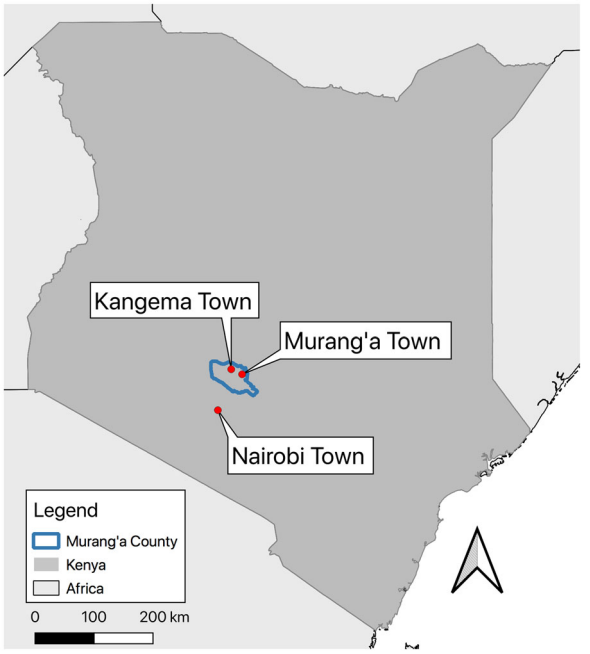

Figure 2. Research location: a milk catchment area around Kangema Town in Murang'a County, Kenya (authors).

various informal conversations by the first author with collectors, buyers and consumers where language allowed or with help of the interpreter. The collectors were already in the network of the companies and sometimes supplied there, making them both clients and competitors. A limitation of this study is that we can therefore not claim to have captured the variety of milk collection practices that exist. The first author was also regularly allowed to take pictures with verbal consent of the people in the pictures. All field notes and pictures were taken on a smartphone and transferred and processed on a computer the same day.

We identified three main aspects of the practice of milk collection within the catchment area through iterative data analysis of the observations, pictures, semi-structured interviews and informal conversations. These main aspects follow the flow of milk: (1) buying milk, (2) managing milk, and (3) selling milk. Specific aspects that constitute these practices that will be elaborated in the results section are establishing milk quality and quantity, organising buyers to sell milk to, establishing milk payments and prices, and competition.

The presentation of data in the following section it is intended to highlight our analytical process. The results section begins and ends with a detailed narration of the interactions between a milk collector named John and a milk supplier. In between, the three aspects of the practice of milk collection are elaborated by moving back and forth between the narrative descriptions and the analysis of the practices observed. The results section will continue to refer to John and other milk collectors to illustrate their practices.

3. Results: diverse milk-collection practices in the economic middle of Kenya's dairy sector

On a chilly morning in September 2019, John got up around 5:30 a.m. to start his daily milk-collection activities in Central Kenya's highlands. On his motorbike, he drove 3 km away from Kangema Town on an unpaved road to meet his first milk producer. She was waiting along the road in the dark at 6:05 a.m. with a few liters of milk in an aluminium can. John stopped and exchanged greetings, while he unpacked a funnel, sieve and plastic measuring cup from a bag

Table 2. Description of the sample

	Corporate			Owner-operated				
Collectors	Private company ($N=1$)	Parastatal company ($N=1$)	Suppliers' cooperative collectors ($N=2$)	Mobile collectors ($N=2$)	Both mobile and street collectors ($N=3$)	Mobile collectors for others ($N=2$)	Street collectors ($N=3$)	Shop collectors ($N=3$)
Name			James, Robert	John, Patricia	William, David, Richard	Michael, Thomas	Jennifer, Elizabeth, Linda	Barbara, Jessica, Charles
Liters of milk collected per day	22,000 L/day	>2,500 L/day	>1,500 L/day	150–200 L/day	210–850 L/day	Included in number of owners	120–400 L/day	50–600 L/day
Daily distances covered	70 km	70 km	25 km	5–6 km	0–10 km	19–60 km	0 km	0 km
Activities	Collecting (along routes and fixed points) Transporting Cooling/bulking Processing Selling	Collecting (along routes and fixed points) Transporting Cooling/bulking Transporting Processing (somewhere else) Selling	Collecting (along routes and fixed points) Transporting Cooling/bulking Selling	Collecting (along routes and fixed points) Transporting Selling	Collecting (along routes and fixed points) Transporting Selling	Collecting (along routes and fixed points) Transporting Selling	Collecting (fixed points) Selling	Collecting (at a shop) Selling

Names have been changed to protect respondents' identities.

hanging on the handlebars of his motorbike. He removed the small lid of a jerrycan on the back of his motorbike, put the funnel in the jerrycan and then inserted the sieve into the funnel. The supplier poured the milk into the plastic measuring cup held by John. After looking at the measuring cup, he poured the milk through the sieve and the funnel into the jerrycan. The supplier put down her aluminium can and handed him a piece of paper. After writing on it and handing it back to the supplier, John then wrote in a small notebook from inside his jacket. He put the funnel, sieve and measuring cup back into the bag on the handle bars, replaced the lid on the jerrycan, and left. He followed the road back towards Kangema Town to meet his next two suppliers and repeat the procedure four minutes later.

This narration of the interactions between a milk collector and his supplier illustrates key aspects of the practice of collecting milk from producers. These practices include the exchange of milk from the producer to the collector and measuring the quantity using the measuring cup. The amount of milk collected was registered on the collection card that the supplier kept in a small plastic bag and in John's notebook. Not everything was described, however, such as if the supplier was paid or if John performed any quality tests. These and other points are elaborated below.

3.1. Milk quantity measurements

Establishing the quantity of milk from the supplier is a central aspect of milk collection, as it determines the supplier's final payment. There were variations in how the quantity of milk was measured by the collectors. The companies and the suppliers' cooperative took measurements to one decimal place using scales that were located along their routes. Practices of measuring milk quantity using scales require a common trust in the correctness and objectivity of the scales, thus rendering the process of establishing the quantity of milk delivered a non-negotiable exercise. Owner-operators were less precise in how they established the amount of milk collected: they recorded only half or whole liters instead of recording amounts to one decimal place, as with the scales. In some cases, collectors asked producers how much milk they had delivered, roughly estimating whether these quantities were correct according to what they saw, but not using a measuring cup to confirm. Establishing the quantity of milk in this way requires some form of negotiation and agreement between the supplier and the collector, based on trust, previous interactions and knowing that there would be future interactions.

All moving and fixed-point collectors included in the sample recorded the volumes of milk they exchanged with suppliers. This consisted of noting the volumes of milk exchanged in liters on a so-called collection card for the supplier and in their own notebooks. The supplier's collecting card usually had a supplier number corresponding to a number in the collectors' records. The cards had space for recording volumes of milk for one month, and were distributed free of charge. All owner-operators indicated that their supplier numbers were relatively stable, although supplied milk volumes were varying depending on season and production cycle of the cows. There was more variety in the quantity-measurement practices within the owner-operated channels than there was within the corporate channels.

3.2. Milk quality measurements

Although payments were not based on quality with the collectors included in the sample, establishing the quality of milk remains an important aspect of the milk-collection practices for reasons of food safety. Focusing on quality-measurements practices, although John did not seem to perform any quality tests, he actually did. When the supplier poured milk from the aluminium can into John's measuring cup, he not only established the quantity of milk, but also looked at the milk and smelled it as a way of establishing the quality. Similarly for Richard, he explained after the suppliers left that he smelled the milk 'secretly, in order not to offend the supplier'. Some collectors who looked closely at the milk and smelled it to establish quality

before pouring it into the other milk used the term 'organoleptic testing' to describe what they were doing. This means to establish milk (product) quality using senses of sight, smell and taste (Draaiyer et al., 2009). The collectors who performed this test were confident about their ability to distinguish good milk from bad milk, drawing on their years of experience as milk collectors, which varied from 3 to 20 years and on average was 10 years.

The companies did not regard organoleptic testing as very credible. As expressed by the manager of the parastatal company, 'You can't see antibiotics and aflatoxins or smell whether people have added water'. Despite their dissatisfaction with the organoleptic test as the only quality test performed, the companies independently reported that they rarely had milk-quality issues with collectors and noted that this is usually an issue with individual suppliers. The corporate collectors performed a variety of quality tests, including lactometer tests to measure milk density and the alcohol test to establish whether the milk is sour. These tests can be performed in a matter of seconds. The collectors of the suppliers' cooperative did not perform these tests during milk collection but at the chilling centre. The same was largely true for the private company, although the milk in some of the aluminium cans was randomly tested by the quality officers on each of the 24 trucks during milk collection. Additional tests that take more time (e.g. establishing levels of aflatoxins) were also performed by the labs of the companies.

These observations illustrate that the corporate supply channels performed more stringent quality tests. The various quality tests were valued differently between owner-operated – and corporate supply channels. Because the corporate collectors are the back-up markets for the owner-operators it is in the interest of all collectors to be able to guarantee the quality of their milk.

3.3. Selling the collected milk

John was registered with both companies and was allowed to sell his milk there, which he did. At the time of data collection he had sold milk to the private company that same month, and to the parastatal the month before. The parastatal company did not set any entry-level requirements for suppliers, but the milk price without registration is lower than the price after registration. The private company required collectors to register and to supply at least three days per month. Corporate collectors required suppliers to have a bank account, as payments were processed exclusively through the bank. There were no minimum milk-volume requirements for any of the collectors included in this study.

Focusing on the practices, we observed that all of the milk collected by owner-operators was sold the same day for example to schools, restaurants and other milk traders. The corporate collectors had cooling tanks and could store the milk for longer than a day. They also first processed the milk in their processing facilities (either in Kangema or one of their other locations) before selling it. The owner-operators included in the sample did not add value to the milk except on rare occasions that they had unsold milk left. This illustrates that the business models of owner-operated collectors consisted primarily of buying and selling milk, and not adding value. In contrast, the corporate collectors targeted a different consumer market: urban markets in which people consumed processed products such as yoghurt and packaged milk.

The owner-operators could get better prices (more on milk prices below) from other buyers than selling to the companies, including (1) direct sales to consumers, (2) schools, (3) food establishments, (4) Nairobi traders[1] and (5) other small dairy businesses within or close to Murang'a County. Milk prices that they received for their collected milk from these market outlets at the time of data collection varied between 33 and 50 KES (0.32-0.48 USD) per liter. Except for one cornershop collector, the owner-operators had at least two outlet markets, which could (but not always did) include the companies, excluding sales to consumers. For example, David had nine buyers of milk (excluding the companies and consumers): four food establishments and schools, and a Nairobi trader. One major drawback of some market outlets

was however that they were closed during parts of the week (e.g. Sundays) or year (e.g. schools are closed during holidays).

The market for afternoon milk was not as large as the market for morning milk. Of the owner-operators in this study, half collected in the afternoon and the others did not. In general, those who did collect milk in the afternoon/evening collected considerably less milk from less people. For example, William collected daily from 60 morning suppliers and 11 afternoon suppliers. The corporate collectors accepted milk at their coolers all day, albeit also from fewer suppliers in the afternoon than in the morning.

Broadening the focus to the various milk-supply channels, the practices of selling milk were strongly linked to the various business models that were in existence. Typically, the business models of the corporate channel centred on adding value through processing (thereby eliminating the necessity of selling the milk that has been collected each day) and generating income through the sale of processed dairy products to typically higher-end and urban consumers. Owner-operated channels typically did not have access to (cooled) storage facilities, which induced them to sell the collected milk each day. Thereby their business models revolved around collecting and selling raw milk as quickly as possible, with limited time of product ownership.

3.4. Establishing milk payments

John did not pay his suppliers for the milk that was exchanged on the morning of 12 September 2019. He also did not receive any payments for the milk that he sold to Nairobi traders later that morning, but he did receive cash payments from the three other milk buyers that he sold milk to (two food places and a shop). During the milk-collection activities, limited exchanges of cash were observed. The collectors included in the sample paid their suppliers according to the suppliers' preference. They mostly preferred to be paid monthly, none were paid daily in cash, and few were paid weekly and bi-weekly. The corporate collectors paid their suppliers monthly through bank accounts, without exception. Advance payments before the end of the month were not possible with the corporate collectors. Some fixed-point milk collectors with shops engaged in barter trade where suppliers delivered milk and took something from the shop (e.g. flour or sugar) in return without paying money for it.

Zooming in on the payment practices of collectors to suppliers, the few cash exchanges that were observed were primarily early payments (known locally as 'soft loans'). This service, which was offered only by owner-operators, allowed suppliers to request an advance of the final payment (in most cases, monthly). In general the amount that could be requested as an early payment should not exceed the value of the milk that had already been supplied for that month. Collectors who had working capital sometimes allowed suppliers to repay in two to four months. The amounts requested through early payments varied from 20 to 10,000 KES (0.18–96 USD). This system showed similarities to what is known as 'check-off' – a service offered by the corporate collectors, in which suppliers have access to inputs (e.g. feed and veterinary care), the costs of which were deducted from payments at the end of the month. The main difference is that owner-operators could provide cash while corporate collectors do not provide early cash payments, but only (early) access to inputs.

In addition to collector's payment practices to suppliers, there are payments between the collectors and their next buyers of the milk. Another exchange of cash was observed between Jennifer and Elizabeth and a new Nairobi trader to whom they sold half their collected milk. Since this trader was new, the collectors requested him to pay direct cash, as they feared that he would otherwise not show up again and take their milk for free. The other Nairobi traders who came to the area on a daily basis paid the owner-operators every two or four weeks. This suggests that cash payments indicated a lack of trust and relatively new relationships, with monthly payments thus indicating the durability of relationships and practices.

Table 3. Number of buyers and frequency of payments from these buyers, per owner-operated milk collector

Type of owner-operated collector	Buyers (no.)	Timing of payments*
Mobile collectors ($N = 2$)	1	Biweekly
	2–4	Daily
	1	Daily
	2	Biweekly or monthly
Both mobile and street collectors ($N = 3$)	1	Weekly
	2	Biweekly
	3–6	Monthly
	≥1**	Weekly
	≥1**	Daily
	≥1**	Monthly
	1–2	Weekly
	3–4	Monthly
Street collectors ($N = 3$)	1	Biweekly or monthly
	2	Daily
	≥1**	Biweekly
	≥1**	Monthly
	1	Biweekly
	2	Monthly
Shop collectors ($N = 3$)	1–2	Monthly
	3–4	Every 2–3 days
	5	Less than monthly
	1	Monthly
	2–4	Daily
	1	Monthly

*Payments from milk sales to individual consumers are not included.
**Exact number unknown, but at least 1 buyer.

Broadening the focus to owner-operated supply channels, the variations in modes of payment for the different buyers to whom owner-operators sold their milk enabled these collectors to meet the daily costs of running their operations, while also saving enough to pay all their suppliers at the end of the month. With the exception of one corner-shop collector for whom the shop and not milk collection was the main source of income, all owner-operators received payments over different time periods (Table 3). Except for the direct sales to consumers which are not included in Table 3, most owner-operators in this study sold their milk to 1 to a maximum of 11 'bulk' buyers such as schools, the companies, or food places, with varying timing of payments.

3.5. Milk prices and competition

With regard to establishing milk prices to suppliers, owner-operators paid similar prices as the corporate collectors. This is because the companies were their back-up markets and they could not risk their other markets falling through and losing money. Prices for the parastatal company were set nationally each month. Price-setting by the private company was also done monthly, based on supply and demand. The owner-operators' prices to suppliers were based on oral agreements for the duration of a month. An overview of the prices paid to suppliers per liter of milk is provided in Table 4, along with the consumer prices per liter of raw milk.

Interestingly, broadening the focus to the various supply channels, the milk prices paid to producers hardly varied between channels. Some owner-operated collectors even paid slightly less than the companies did, contrary to other accounts of prices in raw-milk markets in Kenya in which owner-operated enterprises usually pay more than the companies (Blackmore et al., 2020). Jennifer indicated that producers were aware that they were offering 2 cents less than the

Table 4. Raw milk prices at the time of data collection

Kenya Shillings (KES)	Price paid to producers for 1L raw milk in KES [USD)	Price for 1L raw milk for consumers in KES [USD]
Private company ($N = 1$)	32 [0.31]	Not applicable. no raw milk sales
Parastatal ($N = 1$)	30* [0.29]	Not applicable. no raw milk sales
Suppliers' cooperative ($N = 1$)	32 [0.31]	Not applicable. no raw milk sales
Mobile collectors ($N = 2$)	32 [0.31]	40 [0.39]
	30 [0.29]	50 [0.48]
Both mobile and street collectors ($N = 3$)	27–32** [0.26–0.31]	40 [0.39]
	32 [0.31]	50 [0.48]
	30 [0.29]	50 [0.48]
Street collectors ($N = 3$)	30 [0.29]	50 [0.48]
	30 [0.29]	50 [0.48]
	30 [0.29]	40 [0.39]
Shop collectors ($N = 3$)	32 [0.31]	50 [0.48]
	32 [0.31]	40 [0.39]
	32 [0.31]	45 [0.43]

*Final price depended on amounts supplied per agreement; if the amount supplied was more or less than agreed, the price was slightly lower. Although the costs of transportation and extension services are usually deducted as well, the majority of producers delivering to the parastatal in September 2019 received KES 30 (0.29 USD) per liter.
**William paid his morning suppliers KES 30 (0.29 USD) and his afternoon suppliers KES 27 (0.26 USD), due to differences between the morning and afternoon markets, with his primary afternoon market being the parastatal company.

private company, but people continued to sell milk to them, primarily because of the service of early payments, which was not available with the corporate collectors.

With regard to competition for milk in the area, an employee of the parastatal company shared a proverb in the local language, Kikuyu: *'Ngombe itiri cianinanira nyeki'* which is roughly translated to 'Cows can't finish each other's grass'. He used this proverb to describe that all actors will always get their share. He further noted that the main function of the parastatal is to ensure that a milk market is always available to producers. This seemingly productive co-existence despite competition for the same milk was further expressed by the private company who noted that they were in business to make a profit and grow, but that they mostly needed to meet a target amount of milk in order to supply their current markets, and the target amount was less than all the milk that was produced in the area. A related example of productive co-existence amongst owner-operated collectors was illustrated by Jennifer and Elizabeth sitting next to each other every morning, collecting milk. They paid the producers the same price, and they both had a business involving milk. They, along with other collectors on their route, also sought to make sure that new buyers would get their share of 'grass' when deciding to sell part of their milk to these new buyers to increase competition and negotiation power. Through these practices, they enabled other practices and, together, they constituted the milk markets around the Kangema area.

At 7:35 a.m. on the same day with which this section opened, John arrived at a junction south of Kangema Town to meet the Nairobi traders, to whom he sold 105 liters of milk. At the same junction, John also met Patricia and Linda, who sold some of their milk to the Nairobi traders, and on his way, John drove past one of William's collectors and the cooling plant of the parastatal company. After leaving the junction, John sold the remaining 30 and 15 liters to two roadside restaurants in town. He had already sold another 10 liters to a shop along the road to the junction. He estimated that he had sold 20 liters of milk directly to consumers, although he did not maintain records of this. He had now sold all the milk that he had collected

that morning and, because he did not collect milk in the afternoon, his milk-collection activities for that day were finalised, leaving him with a profit of 980 KES (9.45 USD).

4. Discussion

The combined interests in FNS and the reduction of GHG emissions have been a driving force in policy and intervention in East African dairy sectors. This interest commonly translates into a pathway approach that combines the intensification of dairy farming with the commercialisation and formalisation of market infrastructures. We use an empirical study of the practices of milk collection to examine whether formalisation is productive in achieving ambitions pertaining to FNS and GHG emission reductions. We adopted an empirical approach to answer our diagnostic research question: 'What enables diverse intermediary practices to ensure a consistent flow of milk from grass to glass (supplier to consumer)?'

Iterative analysis of observations revealed three main themes constituting milk-collection practices: (1) buying milk from the producer, (2) managing milk (quantity and quality measurement) and (3) selling milk to the next buyer. These practices were enabled and sustained by the diverse options available regarding the aspects of milk collection and the capacity of collectors (particularly owner-operators) to accommodate such variety in their practices. Moreover, the collectors' practices enable and constitute different supply channels that serve and provide benefits to a variety of producers and consumers. At the catchment level, we conclude that the diversity of practices by actors operating along a continuum from 'formal' to 'informal' are productive in the sense that they successfully arrange the flow of milk from farms to consumers on a very frequent (daily or more) basis. This is highly valuable in terms of supporting rural livelihoods and availing nutritious food, and therefore for contributing to FNS.

Proceeding from practices of conduction in order to detect the institutional dimensions of daily transaction processes (Mangnus & Vellema, 2019; Schoonhoven-Speijer & Vellema, 2020), we demonstrate how suppliers know what to expect from milk collectors, given that sourcing milk is not a random, unorganized practice, but reflects institutional features that are recognized within rural communities. As a specialised task, the manner in which milk collection is organized relates to a set of unwritten rules linked to the timing and frequency of supply, the mode and timing of payments and acceptable quantities and quality controls. These aspects are enacted and reinforced in the everyday practices of buying and selling milk, in which collectors play a central role.

In the situated practices of milk collection, the collectors demonstrate skills in managing milk and associated cash flows in a flexible yet predictable manner. This sustains the flow of milk sourced from rural communities, as small-scale suppliers and remote buyers depend for their access to transaction on the performance of the skilled collectors in managing the middle of the milk chain. In addition, milk collectors are able to accommodate a variety of interests and supply practices. Given the diverse needs of producers and consumers, milk collectors need a variety of skills relating to various forms of interaction and transaction. At the level of milk collection in rural communities, therefore, there is no single way of governing the transactions, and the resulting degree of institutional variety within the catchment area is again reinforced and enacted in milk-collection practices. Institutional variety can support sustainability and inclusivity of the system.

Although formal and informal markets may exist theoretically, in practice, they are not as distinct as the concepts suggest. This is illustrated by the included owner-operators in this study who's milk partly ends up with companies ('formal') and individual consumers ('informal'), among others. Strategically, thinking in binary terms rather than looking at markets along a continuum from formal to informal reduces the options to extremes (Duncan & Bailey, 2017) – such as formalisation – thereby excluding options that may appear in between the extremes. It would therefore be much more effective to explore contextualised solutions, rather than striving to realise ideal-type market organisations (Mangnus & Schoonhoven-Speijer, 2020).

Approaching the concepts as a continuum (Blackmore et al., 2020; White & Aylward, 2016) could enhance the likelihood of reducing what Blackmore et al. (2022) refer to as the 'regulation-reality' gap for Kenya's dairy sector. Instead of applying a 'state' perspective to economic activity in dichotomous terms of 'formal' and 'informal' terminology, we recommend adopting an actor and practice perspective when discussing economic activity. One way to do this could involve adopting a more precisely nuanced view of the types of actors observed (Alonso et al., 2018; Wegerif, 2020; Wegerif & Martucci, 2019) and examining the diverse functions that they perform and the productivity of these functions (Kilelu et al., 2011).

The formalisation of commercial transactions between milk producers, collectors and processors is often presented as the most effective way in which to incentivise and enable intensification. The underlying assumptions that we partly challenged are that intensification practices can be best promoted via the extension support of cooperatives and companies, that formalisation of transactions create reliable markets and foster commercialisation: all considered incentives for producers to intensify dairy. The results of this study suggest that the owner-operators, as much as the corporate collectors, do provide the reliable market demand and create incentives to intensify. Moreover, it appears having both 'informal' and 'formal' alongside each other creates a more diverse and sustainable system that gives more options and therefore better incentives for a wider range of producers.

It is important to note, however, that the intensification of production is not only a function of having access to markets. A subsequent step towards the realisation of intensification efforts could be to complement this practice-oriented study of milk-collection practices with an actor-oriented typology of intermediary functions in innovation, such as those focused on providing access to inputs and those distributing technology (Kilelu et al., 2011). Future studies could explore which functions are already being performed and could be supported in order to fit within the business models of collectors, and which functions would likely fit better with types of actors and institutions other than corporate and owner-operated milk collectors.

In this article, we avoid promoting an exclusive sustainable-development pathway (of formalisation) in favour of engaging with 'messier' (but often organised) realities of the provisioning and marketing of food. We invite scholars and practitioners to engage in deeper exploration of how what occurs in practice could be accommodated and improved for ambitions relating to FNS and the reduction of GHG emissions through pathways of intensification and commercialisation.

Note

1. Traders that purchase milk from collectors to sell in Nairobi. All included collectors in this study collect milk (at least partly) directly from milk producers. The collectors' buyers who do not collect milk directly from producers but are in the business of trading milk are labelled as traders.

Acknowledgements

We acknowledge the participants of this study and the anonymous referees for valuable comments. Upon (reasonable) request the data will be shared.

Ethical approval

This research was approved by the Institutional Research Ethics Committee (IREC) of the International Livestock Research Institute (ILRI) in 2017.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research was financially supported by the International Fund for Agricultural Development (IFAD) within the "Greening Livestock: Incentive-based Interventions for Reducing the Climate Impact of Livestock in East Africa" project [grant number 2000000994, 2016] and by the project "Multiple pathways and inclusive low emission development: navigating towards leverage points in the East-African dairy sector" (grant number W 08.260.306) financially supported by the Food & Business Global Challenges Programme (GCP) of the Netherlands Organisation for Scientific Research (NWO) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in East Africa. CGIAR receives generous financial support from the CGIAR Trust Fund and CGIAR Donors through bilateral funding agreements. For details, please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

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