

milkX

A decentralised market for safer, verifiable breastmilk transactions

*Originally developed as a team project for a FinTech subject with a team of six students; since refined the concept and authored this whitepaper.
A concept and feasibility study, not a regulated product.*

The problem

Human breastmilk is A source of nutrition for infants, but families who cannot produce enough of it are left with two poor options. Hospital milk banks pasteurise and screen donated milk to a high standard, so it is safe, but they run mostly on goodwill donation, pay donors little or nothing, and prioritise the most vulnerable babies. Supply is scarce and rarely reaches families outside the hospital system.

The alternative is an informal market that runs over social media, usually for cash. It is easy to access but almost entirely unregulated. Buyers have no way to check how fresh the milk is, how it was stored, or whether it has been watered down or contaminated, and there is nothing to hold a dishonest seller to account. Prices swing wildly.

The idea

milkX sits in the gap between these two core issues in the problem; it aims to bring the trust and fair payment of a milk bank to a market that is currently neither safe nor accountable.

The concept rests on three pieces working together.

1. A tamper-evident record tracks a batch's quality and handling from expression to delivery.
2. An escrow contract holds the buyer's payment and only releases it once that delivery is verified.
3. A reward token gives donors a reason to take part honestly and consistently.

The goal is a market where a buyer can trust what they are getting and a donor finally gets paid for the effort of producing it.

What this does not solve

This is a study of how to make a market more trustworthy, not a medical or safety system, and it should not be read as one. Four things stand between the concept and anything that could actually launch.

- The biggest is safety. Milk banks pasteurise milk and screen donors for infections such as HIV and hepatitis, for medications, and for bacterial contamination. The sensors here cover freshness, handling and dilution, not disease. A timestamp and a temperature log do not make unscreened milk safe to drink, so any real version would need clinical screening built in from the start.
- Then there is regulation. Human milk is treated very differently from one place to the next, sometimes as a food, sometimes as human tissue, sometimes as nothing in particular, and selling it is restricted or banned in many of them. None of that compliance work is modelled here, and it would probably decide whether the idea is viable anywhere at all.
- There are ethical questions too. Paying for human milk sits inside an unsettled debate about putting a price on parts of the body. Payment can grow supply, but it can also push people to over-express, to sell milk their own baby needs, or to dilute it for profit, and a reward token makes those pressures sharper rather than softer. The system also leans on the sensors and oracle telling the truth: a tampered sensor, or a reading altered before it is signed, breaks every guarantee built on top of it. Sensor standards and oracle design remain open problems.
- milkX is a coherent answer to a problem nobody has solved well, and it is worth presenting as a study precisely because refining it surfaced the hard parts; the safety, legal and ethical questions any serious attempt would have to face first.

How it works

The system is built in four layers, shown in Figure 1 below. Users only ever see the top one, a phone app that handles sign-up, wallet connection, matching donors and buyers by location, and a dashboard of orders, rewards and quality history.

Below that sits an off-chain layer that connects the app to the physical world, since a blockchain cannot measure milk on its own. Off-the-shelf scanning hardware profiles a batch's quality at the point of expression, a tag logs temperature and tamper evidence in transit, and an oracle signs these readings and writes them to the chain, with random lab audits spot-checking listings to keep donors honest. This layer carries the most weight in the design, and it is also where the design is most fragile, as the next section explains.

The protocol layer runs on a public-permissioned Ethereum-compatible chain. It records each batch's provenance and runs the escrow contract that holds funds, releases them on verified delivery, and slashes a donor's staked deposit if a batch fails its checks. A milkX token handles rewards and an immutable ledger keeps the history for audit. Payment settles in a stablecoin such as USDT, so an everyday purchase is not exposed to crypto price swings, while rewards run separately as a loyalty mechanism.

milKX — System Architecture

A decentralised settlement and provenance layer for verifiable breastmilk transactions

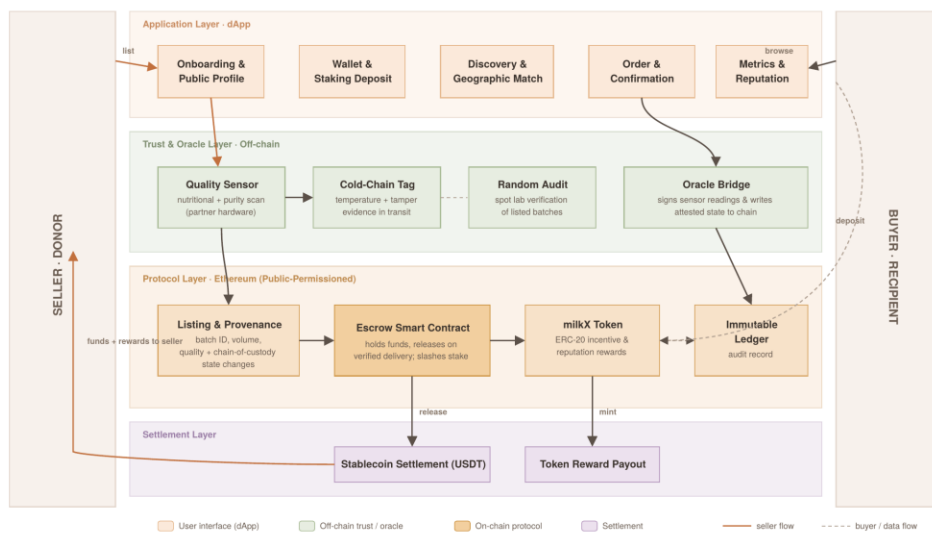


Figure 1. The four layers of the system.

How it stays honest

The economics are meant to make honesty the easy choice. A donor posts a refundable deposit; an honest sale returns it, a failed or faked one forfeits it, so cheating has a real and immediate cost. The buyer is covered because escrow only pays out once delivery checks out, which removes the pay-and-hope risk of the current market. And because every outcome feeds a public reputation score, a good track record becomes worth something over time.

Market

The concept was sized against the United States market, where the informal and milk-bank channels are best documented. The figures below come from the original project research and show scale rather than predict revenue.

Segment	Role	Indicative pricing
Donor, unpasteurised (informal)	Primary buyers; private market	~\$2.50 / oz
Donor, pasteurised (not-for-profit)	Milk banks to NICU and private	~\$4.00 / oz
Mixed / formula-supplemented	Large adjacent market	~\$0.50 to \$1.00 / oz

Indicative figures from original research, not verified.

The market is leaderless and easy to segment, with clear demand that current supply does not meet. The main headwinds are competition from infant formula and regulation that differs sharply between countries, forcing a market-by-market rollout. Revenue could come from transaction and subscription fees, sensor-hardware partnerships, and licensing provenance data to milk banks and researchers.