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The Fishmonger Future: Transforming Egypt's Informal Fish Trade

The market bustles with vendors setting up shop, retailers calling out prices, and customers haggling for better ones. On the outskirts of the market lies a group of women, shawls covering their faces, sitting around several buckets of fish known as tilapia. After a few hours of meager selling, a city official descends upon them like a vulture, demands a seller license, and disperses them when he discovers they do not have one. This is the reality for 90% of the female aquaculture workforce in Egypt (Kantor & Kruijssen, 2014). Egypt is a predominantly patriarchal country with women and men occupying different vocational spheres. In the aquaculture industry, there are virtually no women in farming and production. They are mainly concentrated in fish trading and retail making up 38% of the workforce, which accounts for 14,000 full-time jobs (WorldFish, 2017). For this reason, the solution proposed will be focusing on women fish retailers as they are the most vulnerable.

The fish saleswomen sell the primary source of protein for the working class with each retailer serving roughly 50-100 customers daily. Thus, improving their ability to sell safe, fresh fish will impact the nutrition of 1.5 million to 2 million urban and rural poor Egyptians (Murphy et al., 2020). A critical problem vendors grapple with is limited access to refrigeration for their tilapia stock. In response to these challenges, WorldFish developed and distributed solar-powered portable coolers to prolong the shelf life of their harvest. While these coolers are an important first step, women retailers still navigate difficult working conditions and limited access to opportunities. This paper details the challenges women retailers and their local communities face and proposes a solution: community solar-powered cold rooms to store live tilapia.

Background

The Nile River enables Egypt to be both the number one consumer and producer of farmed fish in Africa. With national production reaching an estimated 2.4 million metric tons, Egypt now meets 85% of its fish consumption demand internally (WorldFish, 2025). This minimal reliance on imports protects the local economy from trade disputes and ensures a stable protein supply regardless of international market shifts. Unfortunately, it is illegal for the Nile River to be used for purposes other than human consumption and watering crops. The majority of fish farms turn to irrigation and rain runoff from farm fields, also known as agricultural drainage water. This often carries high levels of pesticides, fertilizers, and heavy metals that can affect fish health and food safety. Fish farms are mainly concentrated in the Northern Delta area with governorates like Kafr El-Sheikh and Sharqia accounting for 70% of the total output (USDA, 2025). Due to a shortage of land in 2024 to 2026, these areas utilized integrated solar systems or brackish groundwater to set up fish farms in non-traditional areas. Integrated solar systems work "by converting sunlight into electrical energy to power water pumps without using fuel or electrical grids, making them perfect for remote and desert regions" (The Energy Pioneer 2025). This means that many rural Egyptians are taking strides towards renewable energy and will be more inclined towards renewable cold storage. In

an Egyptian household, men are the financial breadwinners while women are tasked with completing household duties. In rural areas, it is expected that the woman doesn't work unless supplemental household income is needed (Kantor, 2014). Egypt's minimum monthly wage for the public and private sector is 7000 EGP or 140 USD (Trading Econ. 2026). The recommended monthly minimum wage for families to afford a basic, but decent standard of living is 10,884 EGP or 217 USD according to Anker Living Wage, 2025. Unfortunately, rural informal workers, like women fish retailers, earn significantly less, meaning they are among the poorest of the poor in Egypt.

Challenge and Impact

The challenges begin at the break of dawn when fishmongers leave for work. These women often have limited transportation to major markets which are further from their homes. Usually they lack a secure, formal place to sell, and face harassment from the police because they don't have an official seller license. They face challenges in obtaining a license because they lack access to cold storage to ensure their fish meets food safety standards. As a result, they seek refuge on the outskirts of markets and negotiate with vendors for a stall. Once the day is done, they have nowhere to refrigerate the fish so they must discard it and lose significant profit. This creates a cycle where women are buying a batch of fish from sellers everyday instead of purchasing in bulk. Sellers also charge different retailers different prices because the seller will not be held accountable for a fixed price.

Even if retailers had access to cold storage, they would not have the financial means to buy tilapia in bulk from sellers. Where a man might be able to purchase 500 kg of tilapia and receive a bulk discount, a woman may only be able to purchase 10 kg and sell for the same price, thus making very little profit margin (Arora et al., 2020). This disparity occurs because women forward fund purchases of fish with credit while men use existing capital. They also cannot expand their businesses because low-cost credit is not readily available. If they want to take out loans, they have to complete formal paperwork and are charged high interest rates because they do not have a reliable credit history. Because of this, women will sometimes form cooperatives to pool their credit and make bulk purchases (Arora et al., 2020). While they may work together in this instance, women have a harder time than men recruiting friends and family into the business because of the deeply rooted patriarchal structure. One effect of this is time poverty where women are so busy keeping the business together, they don't have time to invest and improve their practice.

Exploring Solutions

To tackle this large problem, WorldFish implemented an ongoing program in 2023 to provide a portable solar-powered cooler model equipped with a photovoltaic solar panel, an inverter for efficient energy conversion and a battery for reliable operation for fish retailers (Mosbah, 2025). While portable solar-powered coolers have helped some retailers, many retailers are left behind. This is because on average, women retailers cannot afford the coolers. They would have to take out high-interest loans to afford them, and even after they buy them, there is a chance of them breaking down. In Kenya, fish retailers are facing a similar problem of selling fish at low rates because they have to throw out the remainder. They are currently selling their fish at USD 2.80 per kg, but with refrigeration could afford to increase their price to USD 5.00 per kg. Aditya Parmar, a Postharvest Scientist at WorldFish, reports that fish retailers are experiencing up to 45% in economic losses without access to reliable cold storage (Mukherjee 2025). In December 2024, Asia-Africa Bluetech Superhighway (AABS) installed four

pay-as-you-go (Pay-G) solar freezers with a mobile payment feature called M-Pesa. Instead of urging the communities to buy the solar freezers, they are instead rented out to groups of 2-3 fishermen. The fishermen pay a monthly cost of USD 35 for up to three years to gain ownership. This model was largely successful because it increased revenue for local fishermen and could be used for a long time. Even after purchase, affordable contracts and warranty periods are provided in the event of repairs (Mukherjee 25). This model of working together as a community to pay the upfront cost and then gaining ownership should be replicated in rural Egypt.

While Kenya used solar freezers, Egypt is currently using solar coolers. Giving the village authority the portable cooler, and loaning them out to fishmongers would ensure that the coolers remain a community investment rather than individual. After the cooler has been used for a long time, the community would purchase the cooler from the NGO and allow the cooler to circulate freely with a fine if it isn't returned. The standard for a long time has been freshly farmed tilapia that is not kept for longer than a day. Unfortunately, the CeREA coolers are causing many consumers to become skeptical of buying from fishmongers, as they associate refrigeration with old or spoiled fish (IMARC, "Egypt Aquaculture Market Size"). Egyptian people trust that the food from markets is fresh, and there will have to be a shift in consumer preferences for these coolers to be a success.

Instead of consistently relying on NGOs to provide repairs for renewable technology, Nigeria is placing the solution in the hands of the people. Because of high rates of youth unemployment coupled with a drive to pursue renewable energy, solar mechanic trainings are being provided in certain villages. In Ikeja, a solar empowerment program was launched by Oluwadamilare Sonayon Adebowale Bashir. The initiative aims to train one hundred individuals between the ages of 18 and 40 on solar mechanic training. At the end of the initiative, they will be provided toolboxes to jumpstart their contribution to the economy. Initiatives of smaller scale can work just as well too. In Minna, Niger state, a one week program provided solar technician certification to 23 individuals (Thoma, 2024). This program aims to combine training with an entrepreneurial spirit to encourage them to start their own businesses. Both programs are ensuring that solar energy will be long lasting and beneficial for generations to come.

Solution & Core Recommendation

Fishmongers are the backbone of the tilapia industry and improving their ability to sell safe, fresh fish impacts the nutrition of 1.5 million to 2.5 million urban and rural poor Egyptians. While the portable solar-powered cooler has made significant strides, they have proven difficult because they can break down, are costly, and hard to transport. A solution of solar-powered cold rooms storing live tilapia located at the entrance of a local market or near a fish landing site would be crucial in mitigating these problems. It would feature large oxygenated tanks and a bulk ice maker. Women retailers would dock their portable coolers at the station every morning. They would load their units with fresh water oxygenated by the station's high-capacity pumps, and select their live fish. Specifically, this would be a pilot program in Riyadh district, Kafr El-Sheikh governorate, which is a region in the Nile Delta. WorldFish has previously established village savings and loan associations (VSLA) in all 20 villages in Riyadh. The groups consist of 25 female and male members, half of which are women fish retailers. During weekly meetings, each member is expected to contribute 50 pounds (0.98 USD) in savings, the total of which is used to issue loans to group members. This creates an informal system where women without formal paperwork can still get help when needed (WorldFish, Tackling 2017). In this recommended solution, the money pooled

at the VSLA will be increasingly directed towards paying for the cold rooms. This is because women use the loans to buy more fish. The cold rooms will ensure all fish from each purchase is used thus reducing the frequency vendors have to replenish their stock. Each vendor will be expected to pay a daily fee or per kilogram fee to store leftover fish and after a maximum of 3 years, the cold room's ownership will be transferred to the VSLA.

While the VSLA will manage the finances, they cannot manage the maintenance and upkeep of the cold rooms. To ensure the project is long lasting, WorldFish will partner with Egyptian Energy Education Home (EEEH) to provide solar mechanic training. The target group will be unemployed individuals from the ages of 18-41 which will open up jobs in the renewable energy sector. Programs will take up to 9 months and upon completion, the group will receive solar mechanic certification and a toolbox so they can start working immediately. These workers will ensure the solar cold rooms can be maintained by the community and create a resilient relationship between traditional fish retailers and the younger generation. **Technology:** The cold rooms will be powered using Phase Change Material Technology. During the day, the solar panels power a refrigeration compressor that chills the PCM plates until they freeze solid. This stores solar energy as cold. When the sun sets or the power is cut, the PCM will start to melt. As it melts, it absorbs heat from the fish and the water keeping the internal environment stable from 18-22 degrees Celsius. Once it starts to melt, PCM can keep the temperature stable for up to 24 hours without electricity (Thermtest, 2020).

Creation of steering committees: To implement this solution, we would need executive management, government authority, and funding from the bank. The main organization in charge would be WorldFish because of their ongoing projects in the regions of Fayoum, El Mineya, Sharkia, Behera and Kafr El-Sheikh. WorldFish would partner with companies such as Caravanox or Cool Care Egypt, specializing in renewable cold storage, to tailor solar-powered cold rooms for villages. This project would be backed by government bodies Ministry of Agriculture & Land Reclamation and Lakes & Fish Resources Protection & Development Agency.

Feasibility & Funding

Transitioning from portable solar-powered coolers to solar-powered cold rooms is feasible and rapidly implementable. The same organization that was in charge of distributing coolers, WorldFish, can plan and establish the cold rooms with oxygenated tanks. Egypt recently secured 1 million dollars in the Montreal Protocol Multilateral fund in January of this year (Reindustry, 2026). The fund is targeted for energy-efficient cooling and can be used for the refrigeration unit itself. In addition, WorldFish can cite that the project fits under the Inverter Compressor and Sustainable Cooling mandates of the Protocol. The organization can also establish the solar mechanic training program using the local experts and infrastructure currently in the Upper Delta region. Egypt's Micro-Enterprise Agency would be in charge of funding the solar mechanic trading program. Because the cold rooms align with the Norwegian Government's action plan on foreign sustainable food systems, the Norwegian Embassy in Cairo would provide funding (CeREA, WorldFish 2023).

This would be a 12 month pilot program with an estimated cost of 110 to 160K USD for 2 solar-powered cold stations in Al Riyadh district. 2 villages would be selected based on locals' willingness for new technology and amount of need for cold storage. There would be five different components to these

rooms: Solar PV & battery system that costs 40-60K, cold storage room structure that costs 30-50K, bulk flake-ice maker that costs 16-28K, oxygenation and live tanks that costs 8-14K, site prep & docking setup that costs 5-10K. Finally, the logistics and implementation would cost 6-12K. In addition, the solar mechanic training program would train 10 people for both villages for an estimated cost of 30K. Once certified, the mechanics would enter a maintenance contract with the nominal fees from the women fish retailers. This would ensure the technical support is self-sustaining while receiving standard wages ($150-250 USD) per month.

Impact of Proposed Solution

Expected outcomes

The implementation of cold rooms would benefit fishmongers, consumers, and the environment. The cold rooms would potentially result in a reduction of post-harvest fish loss from 30% to less than 2% (Mosbah, 2025). This effectively increases the total food supply in the region without catching or farming more fish. Prices would also increase by 15-25% per kg as consumers are now paying for oxygenated, live fish rather than iced, dead fish. Egyptian culture places higher value over fresh, live fish from the Nile because they are believed to be the highest quality and safe. Within 12 months (the duration of the pilot program), women would shift from renters to owners of assets which include kits and toolboxes. They would also simultaneously build a digital credit history via mobile wallet as regular users of the community-shared cooler. For consumers, Project Baraka would result in a decrease in bacterial contamination in local markets. The oxygenated tanks would extend the shelf life of this vital protein. Because the cold rooms use solar panels, any greenhouse gas emissions associated with diesel-powered ice production would be eliminated. The use of PCM technology would mean cooling stability despite the increasing frequency of heatwaves in Egypt for future decades.

Stakeholder impacts

Women retailers stand to gain a lot from the cold rooms. Fishmongers will have more financial independence and be able to make decisions on equal footing as their husbands. Instead of having to do everything, women could become owners of their businesses and hire help. Because they don't have to sell their stock at low prices quickly, they will make a higher profit margin and have more time for essential household duties. Women will gain financial bargaining power as they now hold assets and can negotiate prices with wholesalers at fish markets. Fishmongers will finally be able to spend less time working in the business and more time working on the business. The local community will benefit as daily lease payments will stay within the VSLA fund, which can be re-loaned for other local businesses like vegetable farming or tailoring. Rural inland communities would gain widespread access to harbor-quality live fish that was previously only available in coastal cities or high-end urban markets. Project Baraka also aligns with sustainable development goals 5 (gender equality), 7 (affordable and clean energy), and 12 (responsible consumption and production).

Conclusion

Fishmongers are the hidden, but critical foundation of Egypt's agricultural economy, providing the staple protein for millions of households. Despite being a cornerstone of the industry, their job sector has never been formalized and their needs never realized. By establishing solar-powered cold rooms with oxygenated tanks, fishmongers will no longer have to sell on the outskirts of markets or sell out by 1 pm. Cold rooms present a socially-equitable and financially feasible solution targeting the last, most vital, link between producers and consumers for generations to come.

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