Research Article

Tackling Food Insecurity Through Food Surplus Redistribution

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ABSTRACT

Food insecurity remains a global problem despite sufficient food production, posing substantial human, economic, and environmental consequences. In the United States, an estimated 83% of edible food is lost at the retail, food service, and consumer sectors. This review examines U.S. surplus food redistribution initiatives across national networks, technology platforms, and community-based efforts. Through a qualitative review of academic literature, organizational websites and government reports, the analysis identifies key challenges such as liability protection, confusing date labeling, and limited efforts in the household sector along with opportunities in AI-based logistics, crowdsourced volunteers and standardized federal policies across the nation. Combining technological innovations with strong policy frameworks and community-based initiatives offer a clear path toward reducing waste and improving food access.

Keywords: Food insecurity; food surplus redistribution; food wastage reduction; United States; Consumer food waste; retail sector; food donation liability; food donation nutrition

INTRODUCTION

Food insecurity remains an important global challenge despite the world producing enough food to feed everyone. According to the 1996 World Food Summit, Food Security is said to exist when "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (1). This definition highlights the multi-dimensional nature of food security, which typically encompasses the four dimensions of availability, access, utilization, and stability. All must be fulfilled simultaneously for a community to possess food security (1). Globally, food insecurity affects millions with severe and wide-ranging human and economic consequences. Poor or insufficient food intake weakens immune systems and increases the risk of chronic diseases. Severe acute malnutrition accounts for an estimated 20% of the deaths amongst children under five globally, impacting around 13.6 million children every year (2). Economically, food insecurity perpetuates the poverty trap, where malnutrition reduces the economic potential of populations causing poverty, and poverty increases the risk of food insecurity (3). In African nations, the economic cost of malnutrition has been estimated at 3-16% of their GDP annually (4).

On the environmental front, food wastage leads to emissions of greenhouse gases and consumption

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of valuable natural resources. Food and Agriculture Organization of the United Nations (FAO) estimates that close to one-third of food produced for human consumption is lost or wasted, equivalent to 1.3 billion tons annually, with a value of USD $936 billion, enough to prevent undernourishment in one-eighth of the world's population (5, 6). This represents a tremendous lost opportunity to mitigate hunger, to reduce pressure on the food sector which is already using 30% of the world's total energy consumption (7), and to mitigate the environmental impact. Key drivers for food insecurity such as rising food demand, climate change, natural resource depletion, and volatile markets, add further stress on global agricultural production (7).

In the United States alone, 70 million metric tons of edible food is lost annually (8) with less than 2% recovered. With 15.8 million households experiencing food insecurity, reducing the food waste by just 15% would be enough to feed all food insecure US households (6). Redirecting this surplus is also in alignment with the US Environmental Protection Agency's (EPA) proposed hierarchy (9) which prioritizes redirection of surplus food to feed hungry people over other waste management strategies.

This review paper will undertake a qualitative, descriptive analysis based on a review of academic literature, organizational websites, publicly available data, government reports, and case studies from U.S. based food wastage reduction and food surplus redistribution programs. The primary objective is to identify best practices, gaps and challenges, and opportunities for innovation as well as policy opportunities in the food recovery chain while addressing food insecurity (Figure 1). The scope will be US-based initiatives with a focus on retail, food service, and household levels that align with the EPA's Food Recovery Hierarchy.

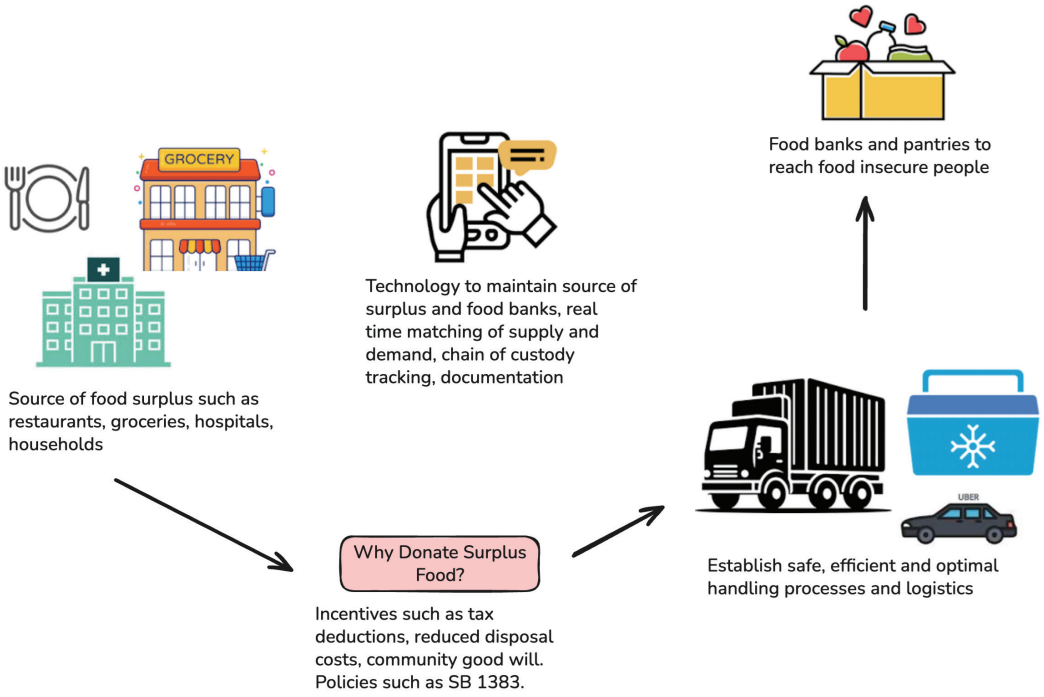

Figure 1. The Food Recovery Chain demonstrates the flow of food surplus from retail, food service and household sectors to food insecure populations. Incentivized food donation flows through safe and optimal transport that follow established guidelines, and reaches food banks, pantries, community fridges and other locations in need that tackle food insecurity. Technology can play a vital part in this food recovery chain by maintaining databases of sources of food surplus and food banks, real-time matching of supply and demand, chain of custody tracking for liability protection, and documentation systems for potential tax benefits. Emerging innovations, particularly in technology and logistics, can significantly support these efforts. For instance, artificial intelligence (AI) and crowdsourcing frameworks can track patterns in food surplus and demand, automate donor reports and tax documentation as well as support local volunteers for pickups and deliveries.

U.S. FOOD SURPLUS REDISTRIBUTION INITIATIVES

Programs and organizations were selected based on scale of operating as a national network. Only US based efforts with a clear redistribution component at the retail, food service, and household sectors were included. The review was structured around scope, key strengths, and challenges or gaps in implementation. In addition to academic literature, organizational websites and authoritative sources such as EPA, FAO, and ReFED were used. The search was restricted to materials published from 2005 to 2025.

Food Waste Reduction Alliance (FWRA)

Food Waste Reduction Alliance (FWRA) is a joint effort across multiple organizations such as the Consumer Brands Association, The Food Industry Association, and the National Restaurant Association (10). FWRA outlines three core goals: reduce the amount of food waste generated, donate more safe and nutritious food to people in need, and recycle unavoidable food waste and divert it from landfills.

In line with EPA guidelines, FWRA develops best practices and promotes them. For example, the ConServe program from National Restaurants Association establishes good practices in waste audit implementation, good inventory management and waste reduction (11). FWRA has also supported the Harvest Program, one of the largest prepared food donation programs in the United States (12), by partnering with Food Donation Connection to simplify collection and distribution to local agencies.

Despite these successes, FWRA surveys highlight ongoing barriers. In 2015, 67% of respondents indicate liability concerns including "proper chain of custody and generally having confidence that donations are handled safely to reduce risk to the donor" (11). This is despite the Bill Emerson Good Samaritan Act that provides federal liability protection for good-faith food donations, yet awareness of this law remains limited. The FWRA report also mentions the use by and sell by dates and labeling practices. Also, notably, FWRA does not currently address in-home consumer food waste — an area that, according to Dou et al (8), contributes a larger share of waste than retail.

Feeding America

Feeding America tackles food surplus redistribution at scale, operating a nationwide network of nearly 200 food banks and 60,000 meal programs (13). Their operations include working with the food industry to rescue food that would otherwise go to waste, storing food safely in food banks, and redistributing to local pantries and meal programs, while also advocating for policies that improve food access. In 2024 alone, the network distributed 5.9 billion meals, and in 2022, it recovered 4 billion pounds of food (13).

Feeding America integrates technology through its MealConnect application and partnership with Divert, a company that works with 13 of the largest food retailers in 38 states to increase donations (14). MealConnect and Divert enable redirection of unsold food to Feeding America's network of food banks.

One of the challenges faced by the organization is nutritional concerns around donations to food banks, with approximately one-quarter of distributed foods high in added sugars, sodium, and saturated fat in a 2017 survey of food banks (15). Feeding America also does not currently accept donations from individuals or households, though food banks might individually coordinate such efforts.

Food Donation Connection (FDC)

Food Donation Connection handles surplus prepared food recovery, linking restaurants and other food service providers to local food banks. The donors benefit from federal tax incentives and earn corporate goodwill while engaging with the community for hunger relief (12). Through its "Harvest Program" model, FDC has coordinated the donation of over 1 billion pounds of prepared surplus food from thousands of U.S. restaurant locations (12). FDC's Harvest programs connect restaurant locations (over 14,000 as of 2021) with local hunger-relief agencies, with 65 million pounds donated in 2021 alone.

FDC states that they don't compete with other local food wastage reduction programs for funding, instead funding operations through a small percentage of tax savings generated for donors. Some of their functions include "linking donor locations with food rescue groups, assisting in the development of product quality and handling standards, tax valuation, donation reporting and ongoing monitoring and follow-up to ensure program implementation and growth" (12). They also help to establish proper guidelines for storing surplus food and handling with proper chain of custody. All their staff are ServSafe certified in food safety with experience in operations and logistics. They have worked together with partners to establish rigorous

protocols to handle food safety.

The organization relies heavily on government policies, tax savings and high-volume corporate partnerships for its funding. While FDC maintains a website for client services and tax documentation, and a database of food banks, it does not appear to operate a dedicated mobile application like Feeding America's MealConnect, or AI integration for logistics, or volunteer crowd-sourcing support. Incorporating these innovations, along with same-day drop-off and pickup options, could enhance scalability and increase recovery rates, especially for prepared food donations that must meet stringent safety requirements.

Scope, Strengths and Challenges with National Networks (Table 1)

One of the most significant efforts in food recovery has come from the nationwide food wastage reduction networks such as Feeding America and FDC that achieve scale and influence policies but face barriers around food nutrition, penetration into household sector, and liability protection awareness.

TECHNOLOGY PLATFORMS RELATED TO FOOD SURPLUS REDISTRIBUTION

Programs and organizations were selected based on the use of technology platforms as well as scale of operation. Again, only US based efforts with a food surplus redistribution at the retail, food service, and household sectors were included. The review was similarly structured around scope, key strengths, and challenges or gaps in implementation.

Copia

Copia is a for-profit technology platform based in San Francisco that tackles the food surplus redistribution. They provide a technology platform through a consumer app, as well as an end-to-end solution for food surplus redistribution (16). Copia claims to provide a 99% match-rate to match surplus food to a local foodbank, with a live support team availability. By 2022, Copia had recovered more than 4 million pounds of food, delivering over 3.5 million meals (17).

In addition to the actual process of donating surplus

Table 1. This table summarizes the scope, key strengths, and challenges faced by U.S. based food redistribution initiatives that have national networks

Organization	Scope	Key strengths	Challenges
Food Waste Reduction Alliance (FWRA)	National coalition of Consumer Brands Association, The Food Industry Association, and the National Restaurant Association.	- Aligns with EPA guidelines in food surplus to people in need - Development of best practices. - Partnership programs for large-scale prepared food donation - Surveys, metrics to track barriers for donors	- Liability concerns amongst donors. - Supply chain concerns such as transportation, storage, and refrigeration. - Effect of use by and sell by date practices.
Feeding America	National hunger-relief network with 200 food banks and 60,000 meal programs nationwide	- Large scale redistribution capability - Significant recovery volumes - Technological innovation via MealConnect	- Nutritional quality of donated food - Lack of coverage of household sector
Food Donation Connection	National focus on prepared food recovery from restaurants and food service providers.	- Specialization in prepared food logistics - ServSafe certified staff with food safety expertise - Streamlined donation process - Funding through shared donor tax benefits	- Heavy reliance on government policy and high-volume corporate partnerships - No dedicated app or technological innovations - Stringent safety requirements for prepared food

food, Copia also provides the platform for tracking and reporting, including tax records as well as compliance records, to make the process as simple and measurable as possible. In addition, Copia also handles pick-up and drop off of surplus food and maintains chain-of-custody records, which is usually the biggest liability concern. The application also provides a subscription model for waste tracking and surplus prediction.

Goodr

The motto of Goodr, as stated by its Founder and CEO is, "Hunger is not an issue of scarcity; it's a matter of logistics" (18). Goodr uses logistics and technology to rescue surplus food from landfills and to redirect them to people in need in local communities. In 2023 alone, Goodr and its partners diverted nearly 7 million pounds of food and organic material from landfills, by recovering edible food for donation and recycling into compost or energy (18). In its impact report, Goodr states they have delivered more than two million meals and served more than 44,000 households (18).

As a tech-driven company, Goodr offers a SaaS solution to monitor and evaluate a client's contributions toward the community as well as their environmental impact. In return, the client pays Goodr a small portion of their tax savings from tracked food donations.

Goodr has invested in full transparency in the chain of custody using real-time logging of food data (including temperature etc.) and blockchain technology to create tamper-proof logging systems. This provides the donor increased engagement with who their donated food is reaching. In addition, Goodr also has an ongoing effort with pop-up grocery markets where food insecure families can pick up staple food such as fresh produce, meat and milk at no cost. They also have a mobile grocery truck for greater outreach.

MealConnect

MealConnect is Feeding America's food donation online platform that has rescued 6 billion pounds of food since its launch in 2014 (19). It connects sources of food surplus such as groceries, famers, and food distribution companies to food banks across the country. Through a simple interface, the MealConnect app is able to provide nearest food bank partners based on location and collect product details. The application also helps Feeding America extend its coverage to restaurants and other institutions with prepared food surplus.

Scope, Strengths, and Challenges with Food Sharing Apps (Table 2)

Some of the drawbacks with newly emerging food

Table 2. This table summarizes the scope, key strengths, and challenges faced by technology platforms that deal with food surplus redistribution

Organization	Scope	Key strengths	Challenges
Copia	For-profit technology platform that tackles the food surplus redistribution. Expanding nationally.	- Efficient technology platform with ease of access and tracking including impact, documentation and tax savings. - Good mix of paid drivers and crowdsourcing for logistics - Collects volume-based fee for funding operations	- distrust towards the safety of redistributed food (including expiry dates, food contaminations or allergens) - regulatory barriers including proven compliance with regulations for newer efforts - demographic factors such as age in using apps - operational complexity in scaling to nationwide effort for consistent service quality, as well as state laws and policies awareness. - Lack of presence in household sector
Goodr	Tech-driven company for food surplus redistribution expanding nationally with focus on logistics and technology.	- Full transparency in the chain of custody using real-time logging of data - Blockchain technology to create tamper-proof logging systems - Community outreach using pop-up markets and mobile food trucks	

sharing apps include distrust towards the safety of redistributed food (including expiry dates, possible food contaminations or allergens), a "reluctance to engage in a sharing community," and regulatory barriers including liability concerns, chain of custody, compliance with regulations (20). Meenakshi et al point out demographic factors such as age and socio-cultural barriers in the adoption of food sharing apps (20). Additionally, scaling to nationwide effort needs logistics investment in transportation and storage and operational complexity for consistent service quality, as well as state laws and policies awareness. The new wave of tech-enabled startups and platforms is boosting food recovery efficiency but is facing trust, scaling, and regulatory barriers.

LOCAL & COMMUNITY BASED INITIATIVES

Programs and organizations were selected based on community engagement in food surplus redistribution to tackle the problem of food insecurity.

Rethink Food

Rethink Food collects excess food from restaurants, partners, and other sources; partner with chefs to prepare nutritious meals and distribute them to food insecure communities (21). The restaurants also get marketing and publicity through their actions. Since its inception in 2017, Rethink Food has distributed more than 30 million meals to food insecure families in local communities and rescued more than 2.9 million pounds of food (21).

While Rethink's model can generate nutritious and balanced meals to communities, and partner with restaurants to earn revenue by making meals with their surplus food and idle kitchen time, it also uses up sizable resources in needing kitchens and chefs, as well as handling cooked food and distributing them while staying in compliance with liability laws and food codes. It might be difficult to scale this model of surplus food redistribution since it would need infrastructure, kitchens, chefs, transportation and networking with local food banks to expand into a new area.

Food Rescue US

Food Rescue US (FRUS) is a community-driven food surplus redistribution program with heavy reliance on technology. It follows the crowd-sourcing model, relying on a group of more than 20,000 volunteers, also known as "food rescuers," who use a web-based app to transfer small batches of food surplus to food banks and other recipients. They have provided more than 166 million meals and kept more than 199 million pounds from landfills (22).

Since their inception in 2011, FRUS has expanded to multiple states. This could be because of its low-overhead model of local sources, local recipients as well as local volunteers from the community based on crowdsourcing. Because of time-bound pickup and drop-off by the local community, this also saves overheads in terms of large, refrigerated trucks or food storage warehouses. This model is not well-equipped to handle large scale food surplus from large grocery chains or hospitals for example, which might need refrigerated trucks for transportation, but could potentially scale well into household food wastage reduction because of their access to local volunteers.

Scope, Strengths and Challenges for Community Based Efforts (Table 3)

Community based models offer flexibility, customization, possible penetration into the household sector, but so far lack scalability.

CLOSING THE GAP IN EDIBLE FOOD RESCUE

Despite meaningful progress, current efforts are still only scratching the surface of America's food waste problem. The data reveal an unfortunate reality: most of the surplus food is not being rescued, indicating tremendous room for improvement in scaling up recovery and preventing waste at the source. In 2023, out of 73.9 tons of surplus food, which is 31% of US food supply with a value of $382 billion, only 2% was donated to feed hungry people and 85% went to waste destinations (23). This suggests that while our food recovery programs have expanded, they are still capturing only a tiny fraction of the potential edible food that could be saved. This capture rate has huge potential for improvement, which will require addressing the barriers that keep more surplus food from being donated.

Gaps in liability protection and awareness

Better implementation, awareness, and standardization of liability protection across the U.S. can aid food recovery efforts. As noted in an earlier section, liability concerns including chain of custody and food safety were identified as a barrier to food donation by 67%

of FWRA respondents in 2015 (11). The Bill Emerson Good Samaritan Food Donation Act protects donors and non-profit organizations from liability when food is donated in good faith to charitable organizations, but low awareness of this protection amongst donors limits their participation. Hudak et al noted that no federal executive agency provides support for increasing awareness, implementing the act, or interpreting it (24), which leaves many potential donors uncertain about risks.

Harvard Law School Food Law and Policy Clinic similarly advocates for better implementation of the Emerson Act and recommends extending protection to food sold at reduced price (covered in eighteen states) and covering direct donation to individuals (implemented in eight states) (25, 26). Extending these liability protections could enable household sector food surplus redistribution, which is a major untapped source of food wastage.

The preemptive effect of the Emerson Act ensures minimal liability coverage in states that provide less protection, while allowing states with stronger laws to maintain them (24). Increasing awareness of standardized minimum coverage across the nation can further drive food recovery. Aitken et al found correlation between states with stronger liability protection and higher food donation (27), emphasizing the importance of policy and legal protection in driving food donation efforts.

Consumer Understanding of Food Date Labels

Misinterpretation of date labels is a major source of household food waste in the United States. A new Harris Poll survey of US adults in January 2025 reveals that 43% discard food near or past the food date label, while 44% incorrectly believe these labels are federally regulated, contributing to nearly 1.5 million tons of food being discarded by consumers for this reason according to ReFED (23). Consumers frequently misunderstand "sell by" labels used for retail inventory management as a safety deadline. A study by Kavaunaugh et al confirms this knowledge gap in a survey of 1042 US adults, with 81.6% using food date labels, but only 57.4% correctly identifying what "best by, use by" mean (28). Misunderstanding food labels leads to premature disposal of good edible food.

To address this, initiatives to standardize food date labels aim to differentiate quality and safety. California's AB 660, which goes into effect in July 2026, requires "use by" for safety, "best if used by" for quality, and for all grocery stores to no longer carry products with "Sell by" date labels (23). Dou et al highlight the need to reform the labeling system along with consumer education (8), while Harvard Law School Food Law

Table 3. This table summarizes the scope, key strengths, and challenges faced by community based food surplus redistribution initiatives

Organization	Scope	Key strengths	Challenges
Rethink Food	Community based effort; collects excess food from restaurants, partners, and other sources, partner with chefs to prepare nutritious meals for distribution to local communities	- Balanced, nutritional meals - Restaurants can earn revenue and goodwill by using surplus ingredients and idle kitchen time - community based effort that can customize dietary needs and cuisines	- Sizable resources in needing kitchens and chefs, - Operational complexity in handling cooked food staying in compliance with liability laws, food codes - Scaling complexity because of infrastructure, kitchens, chefs, integration with local communities.
Food Rescue US	Community-driven food surplus redistribution program with heavy reliance on technology and crowdsourcing.	- Volunteer-driven community model that tackles food waste at local level - Low overhead model with local source and recipient, and same day pickup and drop-off - Can scale well into household food wastage because of access to local volunteers	- Reliability on availability of volunteers with food safety training - Not well-equipped to handle large scale food surplus

and Policy Clinic advocates for federal legislature to standardize label language and to allow for sale or donation of items after the quality date, imposing restrictions only based on the safety date (25). Such measures could reduce confusion, reduce food wastage, and also allow more food surplus redistribution.

Household Sector Expansion

As aforementioned, several U.S. food surplus redistribution organizations have potential to expand their efforts into the household sector. In the United States, households generate approximately 43% of total food waste, followed by the retail sector (40%), farms (16%) and 2% from manufacturers (29). ReFED estimates that consumers waste nearly 35 million tons of food annually, worth $261 billion through discarded groceries and restaurant plate waste (23).

While public education campaigns on food storage, portion sizes, and meal planning are important, most national food wastage prevention campaigns focus mainly on education (23), and not actively solving the issue at hand with infrastructure and support. Household food wastage is mostly driven by individual habits – overbuying, cooking too much, not using leftovers, confusion over expiration dates, etc. Dou et al note how tackling this at scale is a challenging issue, also because of health and food safety concerns (8). Expanding the Emerson Act to cover direction donation to individuals and relaxing compliance for food labeling (as discussed in the section on liability protection) can strengthen liability protection and encourage household surplus donation. Standard food labels (as discussed in the section on food labels) can reduce unnecessary throwing away of food that's still safe to consume. Technological innovation (covered in the next section) can help to accelerate food surplus redistribution in the household sector.

Zhang et al highlight two modes of household food sharing: direct sharing with friends, neighbors, or through peer-to-peer sharing platforms such as Olio; or indirect sharing through organizations such as food banks, mobile pantries or community fridges (30). Their research shows consistent increase in food sharing with behavioral interventions such as food stickers with messages.

Community fridges, for example, provide public refrigerators or pantry shelves where individuals, retailers, and institutions can donate excess food, and anyone in need can take it without any process involved. These can be run by local volunteers or non-profits and are setup in public spaces and stocked with donations. San Jose Community Fridge (SJCF) is one such example (31), but there are many more such efforts coming up in neighborhoods.

Community-level initiatives offer the best opportunity to tackle household food waste and can provide good scaling if there's enough visibility and acceptance. Villa et al use data from Phoenix Rescue Mission (PRM) which serves food-insecure communities with mobile pantries to establish these can be effective in bring food to susceptible populations such as seniors and immigrant populations, especially those living in food deserts with limited access to fresh food (32). Scaling such localized community-based interventions could play a key role in reducing household food waste and improving food security.

Technological Innovations for Food security

Food security efforts are increasingly benefitting from technological innovations such as food sharing apps, crowd sourcing, social media awareness campaigns, and AI integration. Companies like Copia, Goodr and Food Rescue US have developed logistics and tracking systems that help businesses donate surplus food while receiving real-time data on their waste reduction. Copia emphasizes the business case for donation as well, noting that "for every $1 a company invests in food waste reduction, they can expect about a $14 return", due to savings on disposal, improved efficiency, and tax benefits (17). Better use of modeling systems that can predict as well as match supply and demand based on AI can help in faster movement of food to people who need it, as well as better anticipation of food demand to reduce wastage.

Crowd-sourced volunteer networks can also be particularly effective to serve food-insecure communities. Innovative crowd-sourced solutions such as Olio are the right step in this direction (33). Zhang et al note that Olio has more than 6 million users worldwide, and that peer-to-peer sharing platforms can "improve resource efficiency and reduce food wastage" (30).

There are ongoing research efforts to optimize crowd-sourced volunteers in the field of food redistribution. Lo et al have studied the effect of volunteer adoption on finding new matches (34), while Manshadi et al explore efficient volunteer crowdsourcing (35) which have been used to partner with Food Rescue US and to grow their user base. Efforts such as this also build the idea of community but need more exposure and normalization.

Awareness of food donation programs can be raised through innovative social media campaigns. Albertsons demonstrated this in their collaboration with famous YouTuber and philanthropist Mr. Beast, with his "Stranded in a Store" challenge (36). The message reached over 225 million YouTube viewers and has been translated into 14 languages (36). Social media is a key collaboration target for more awareness and impact in this area.

The growth of these tech-enabled services is vital for scaling recovery efforts, improving match rates between donors and recipients, and engaging communities through accessible platforms. As discussed earlier, integration of such technologies with improved liability protection and household-sector outreach could significantly enhance national food waste reduction efforts.

CONCLUSION

Significant progress has been made in food surplus redistribution through a combination of policy incentives, logistics coordination, and innovative technologies. Partnerships between retailers, nonprofits, and tech companies have led to meaningful reductions in food waste and increased support for food-insecure populations. The integration of technology platforms such as MealConnect, Copia, and Goodr has enabled easy scheduling and logistics for donors, automated tracking and reporting for tax compliance, real-time chain-of-custody monitoring, data-driven forecasting to prevent waste at the source.

However, the household sector remains the most significant untapped opportunity, accounting for 43% of food waste. New approaches, including app-based platforms for donation pickup, AI-powered matching algorithms, and crowdsourced logistics, can extend redistribution into homes and smaller communities. Donors could receive real-time feedback and engagement data, encouraging continued participation and generating community goodwill.

As global organizations and national governments, as well as private businesses commit to reducing food waste by 2025 or 2030, the U.S. must scale existing models and expand into new frontiers. Technological innovations, strengthened policy frameworks, and community-based initiatives offer a viable path toward reducing waste and improving food access. With sustained effort, collaboration, and strategic investment, there's a clear path toward achieving the goals of reducing food waste and redistributing surplus effectively to end hunger.

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CONFLICT OF INTERESTS

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