



Addressing Food Insecurity and Waste in the United States Through a Market-Driven Model

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Foreword from AgriNovus Indiana

Over the last 24 months, the AgriNovus Indiana team alongside partners like Elevance Health, Shipt and many others, have embarked on a journey to leverage a community of innovators doing good by doing well through our HungerTech Innovation Challenge. Based on original research from Ernst & Young and Purdue University, a brief but salient point highlighted how technology will be an integral cog to increase accessibility to food and nutrition.

“Food access in the future may be less dependent on transportation or proximity to a full-scale retail outlet and more dependent on reliable, accessible internet.”

In its first two years, the HungerTech Innovation Challenge enabled 36 teams of innovators – from student entrepreneurs to venture-backed startups – to leverage technology to increase food access. From innovating around the Supplemental Nutrition Assistance Program (SNAP) to connecting farmers directly with consumers and modernizing food pantry systems, these teams have offered solutions that increase efficiencies and maximize impact to our most vulnerable populations.

HungerTech Innovation Challenge winners, Civic Champs and GreenBasket, have used their success as springboard, post-program. Civic Champs was selected by Hackernoon as a “Startup of the Year 2023,” while GreenBasket was one of five companies selected to participate in the gener8tor gBETA Agbioscience pre-accelerator.

Their success serves as a celebration and simultaneously, a stark reminder: we have just begun to scratch the surface of solutions needed to fully fix the problem of food insecurity. To kick off this year’s HungerTech Innovation Challenge, the AgriNovus team saw a new opportunity for innovators to research and influence the scope of this year’s program through the first-ever HungerTech Research Sprint.

Sixteen teams submitted two-page executive summaries backed by secondary research that highlight the opportunities for technology to impact food insecurity. An independent panel of judges evaluated and selected this year’s winner. Tushar Sonvani, a student at Purdue University, authored *Addressing Food Insecurity and Waste in the United States Through a Market-Driven Model*. Sonvani’s research shows the challenges faced the food insecure and where technology has a unique opportunity – and responsibility – to have its greatest impact.



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Addressing Food Insecurity and Waste in the United States Through a Market-Driven Model

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Background

A significant paradox exists in the United States where millions face hunger while the nation discards more food than any other country. Data from 2017 shows 11.8% of U.S. households unable to access sufficient, nutritious food while nearly 40 million tons - or 30 to 40 percent - of its annual food supply was thrown out. This stark contrast highlights a systemic issue exacerbated by logistical inefficiencies, inaccurate demand planning, and unequal access to information about food availability.

Challenges

We face a set of challenges to tackle food insecurity in the United States, after talking to farmers, restaurant owners, food service workers, including:

Food Insecurity and Waste: Dual challenges persist as many households struggle to secure enough food, and an immense volume of food is wasted, impacting environmental sustainability and economic resources.

Logistical Gaps in the Food Supply Chain: The current infrastructure exhibits critical inefficiencies in capturing, managing, and redirecting surplus food from points of excess, such as producers and retailers, to communities grappling with food insecurity. This challenge is exacerbated for perishable goods, which require rapid logistical responses to prevent spoilage.

Preservation: There exists a shortfall in current food preservation technologies' ability to prolong the shelf life of perishables without detracting from their nutritional value or safety. This necessitates the development of innovative and scalable solutions to enhance the durability and safety of perishable foods, particularly in areas lacking sophisticated infrastructure.

Inadequate Demand Planning and Forecasting: There exists a deficiency in the deployment of tools and for accurately forecasting the production of surplus food and quantifying the demand from food-insecure populations. This gap leads to significant mismatches between the availability of surplus food and the localized needs of various communities. Lack of planning also disregards a prevalent secondary market for food purchases after the primary demands of the market are met.

Economic Disincentives for Food Redistribution: The prevailing economic structures and business models within the food value chain offer limited incentives for stakeholders to actively engage in the redistribution of surplus food. This absence of motivation frequently results in the discarding of perfectly edible food, rather than its redirection to those in dire need.

Information Broadcasting Gaps: Discrepancies in internet access hinder the effective dissemination of information about food availability, exacerbating food insecurity for those without digital access.

Objective

- To innovate and implement a market-driven model that effectively addresses the intertwined issues of food insecurity and waste across the United States.
- This model will capitalize on technology for optimizing logistics, preservation, enhancing demand forecasting, and broadening information broadcasting to ensure equitable food distribution that is both environmentally sustainable and economically viable.

Implementation Strategy

The implementation strategy needs to be well-rounded for this multi-faceted problem; it needs to be an ecosystem of solutions that compliment each other to solve the food system paradox.

Viable Business Model: Develop a transaction-based platform that connects food producers with surplus directly to consumers and food assistance organizations, fostering a market that values surplus food as a resource.

Technological Integration for Logistics and Demand Planning: Employ artificial intelligence (AI) for accurate demand forecasting and Internet of Things (IoT) for real-time logistics management to streamline the food distribution network, reducing waste and improving access.

Inclusive Information Broadcasting: Deploy a multi-channel strategy for information access, utilizing internet platforms for digitally connected populations and alternative methods (e.g., SMS, community radio) for those without internet access, ensuring comprehensive reach.

Stakeholder Engagement: Collaborate across sectors with food producers, retailers, technology firms, and community organizations to create an incentive driven approach that maximizes the benefits of the model.

Expected Outcomes

- A marked decrease in food insecurity rates nationwide through improved access to affordable, nutritious food for all populations.
- A reduction in food waste across the supply chain, contributing to environmental sustainability and economic savings.
- The creation of a scalable, replicable model demonstrating how a market-driven approach can revolutionize food distribution systems without reliance on philanthropy or government intervention.

Leveraging Data-Driven Solutions and Technological Innovation to Forge a Path Forward

The model exemplified by “[Too Good To Go](#)”, a private company that operates in EU and North America illuminates a viable path forward, demonstrating how technological innovation can align the incentives of all stakeholders in the food value chain—from producers to consumers—thereby creating a dynamic secondary market for surplus food. This approach not only mitigates food waste but also enhances access to affordable, nutritious food for food-insecure populations, showcasing the potential of technology-driven platforms to efficiently bridge the gap between food surplus and need.

Moreover, the distressing statistics surrounding food waste, with over 80 percent of Americans discarding food due to misconceptions about expiration labels, coupled with the projected rise in food insecurity from 35 million individuals pre-COVID-19 to an estimated 50 million, underscore the urgency of adopting strategic interventions.

Hypothesis for Systemic Change:

A Holistic, Technology, and Logistics-Driven Framework

By integrating enhanced logistical operations and supply chain management with cutting-edge demand planning and predictive analytics and the right kind of preservation; a transformative solution emerges. This solution aims to effectively tackle the dual challenges of food insecurity and waste. Adopting technology-driven platforms for food sharing, inspired by successful initiatives such as “Too Good To Go,” alongside innovative demand forecasting mechanisms for both surplus food production and community needs, presents an opportunity to establish a scalable and sustainable secondary market. This strategic framework not only ensures the provision of affordable, nutritious food to those in need but also achieves an optimal match between the supply of and demand for food, significantly reducing waste and directing vital resources to the most critical areas of need.

Scale of Opportunity for Disruption

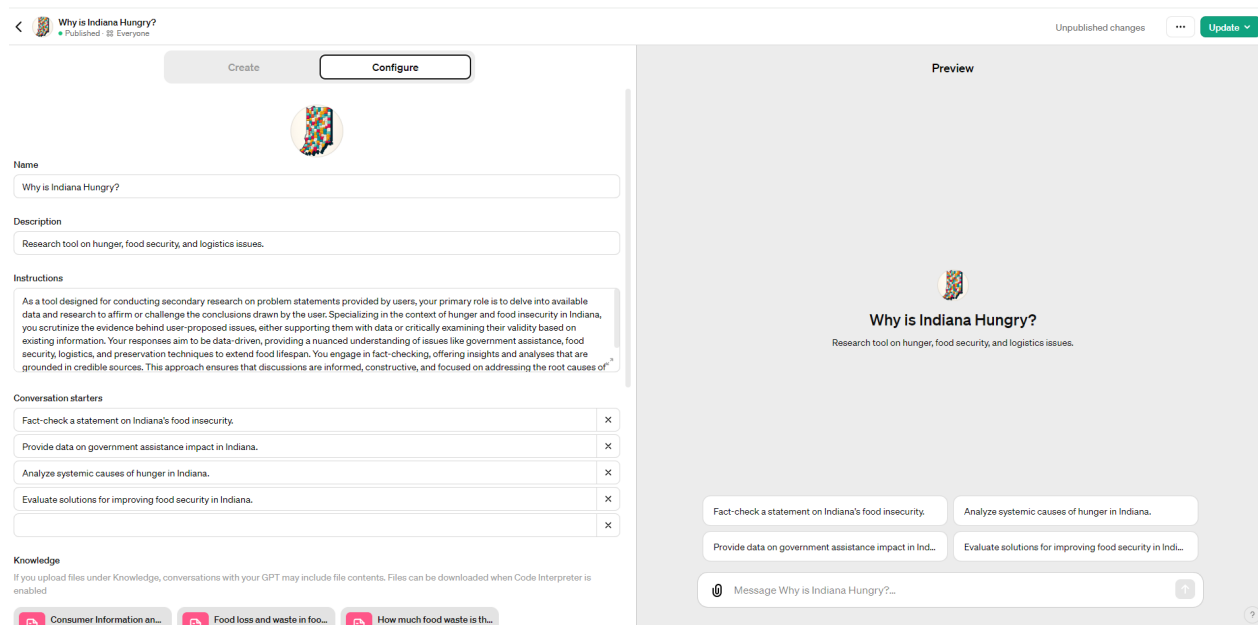
People Impact: By effectively addressing food insecurity and waste, the potential to positively impact millions of lives is substantial. In the United States alone, over 54 million people experienced food insecurity in 2020. Redirecting just a fraction of the estimated 30-40 percent of the food supply that is wasted each year could significantly reduce this number, ensuring access to nutritious food for those in need.

Economic Savings: The economic implications of food waste are profound, with an estimated \$161 billion worth of food wasted annually in the United States. Efficiently managing this surplus through a technology and logistics-driven framework could redirect substantial economic resources towards more productive uses, potentially saving billions of dollars annually.

Emissions Reduction: Food waste contributes significantly to greenhouse gas emissions, with disposed food in landfills emitting methane, a potent greenhouse gas. By reducing food waste, this model could dramatically lower emissions equivalent to removing millions of cars from the road or shutting down numerous coal-fired power plants.

Appendix and Research

Post the research for the hypothesis the author also built a GPT as an educational tool for stakeholders about the severity of the food security issues in Indiana and is also able to conduct analysis to answer complex questions about income levels, regions, and challenges that cause food insecurity specifically in Indiana. Here is the link to access the AI tool: (<https://chat.openai.com/g/g-UsG7bbkTg-why-is-indiana-hungry>) current limitations of the tool is the users will need a subscription to OpenAI's ChatGPT Plus service.



Glimpse of the AI tool

1. Food Insecurity in the United States

Prevalence: The United States Department of Agriculture (USDA) estimates that 13.5 million U.S. households, or 10.2 percent of all households, faced food insecurity in 2021, highlighting the widespread challenge of providing adequate food due to a lack of resources.

Impact of Economic Factors: Factors contributing to food insecurity include poverty, unemployment, low wages, limited access to healthy and affordable food, broadband connectivity, and the high cost of housing, transportation, and healthcare.

2. Food Waste in the United States

Magnitude of Waste: The United States discards more food than any other country, nearly 40 million tons annually, equating to 30-40 percent of the total food supply.

Economic and Environmental Costs: This waste not only represents a significant economic loss but also contributes to environmental degradation through the wastage of resources used in food production and the generation of greenhouse gases from decomposing food in landfills.

3. Technological Solutions for Food Distribution

Innovations in Food Access: Innovative food access solutions targeting specific populations, especially in rural, low-income, and minority communities, can improve food affordability, distribution, and access.

Technology for Healthy Choices: Technology solutions that educate consumers about healthy food choices and product labeling can empower individuals to make informed decisions regarding their nutrition.

4. Connectivity and Food Networks

Digital Divide: Rural communities, where nearly 30 percent of Indiana's residents live, face challenges related to food insecurity differently than urban households, partly due to connectivity issues that hinder access to information about food resources.

Enhancing Food Networks: Connecting consumers with food networks through food hubs, farmers markets, and community-supported agriculture (CSA) programs can increase the availability of healthy and affordable food options.

5. Data Analytics and Food Insecurity

Analytics for Understanding Food Insecurity: Using data and research insights to understand food business practices, product offerings, and the effectiveness of specific programs in promoting food security and health outcomes.

Readings

A collection of studies, surveys, and reports that provide a foundation for understanding the complexities of food insecurity and waste, and the role of private sector innovations in addressing these challenges. These include contributions from the United States Department of Agriculture (USDA), United States Census Bureau and Purdue University's Center for Food Demand Analysis & Sustainability, among others.

1. Feeding Low-Income Children When School Is Out: The Summer Food Service Program

Source: United States Department of Agriculture, Economic Research Service, July 2003.

Summary: This report evaluates the effectiveness of the Summer Food Service Program (SFSP) in serving children from low-income families outside of the school year. It reveals that in 2001, SFSP reached 2.1 million children, a fraction of the 15.5 million children served by the National School Lunch Program during the school year. It highlights the diversity of SFSP sponsors, the duration and frequency of the programs, and the nutritional quality of the meals provided. Additionally, it discusses barriers to participation and suggests improvements for increasing reach and effectiveness.

Keywords: Summer Food Service Program, SFSP, National School Lunch Program, NSLP, child nutrition, food security.

2. USDA Fiscal Year 2024-2026 Data Strategy

Source: United States Department of Agriculture, October 2023.

Summary: This strategy document outlines USDA's vision and objectives for leveraging data to enhance agricultural production, natural resource preservation, and rural economic opportunity. It addresses five primary goals: Data Governance & Leadership, Data & Analytics Workforce, Common Data & Analytics Toolset, Open Data, and Analytics for a Purpose. It emphasizes the importance of data in decision-making and policy development, aiming for a more data-driven USDA that supports farmers, ranchers, and consumers.

Keywords: USDA Data Strategy, data governance, analytics, open data, agricultural policy.

3. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States

Source: United States Department of Agriculture, Economic Research Service, February 2014.

Summary: This report offers an in-depth analysis of food loss in the United States, quantifying the amount, value, and caloric impact of food not consumed post-harvest. In 2010, 31% of the food supply (133 billion pounds) was lost, equating to \$161.6 billion and 141 trillion calories annually. It explores the economic implications of food loss and identifies meat, poultry, fish, vegetables, and dairy as the leading categories in terms of value lost. The document also discusses methodologies for estimating food loss and provides a foundation for policy development aimed at reducing waste.

Keywords: Food loss, food waste, USDA, economic impact, nutrition.

Supporting Studies for Hypothesis

Technological Limitations and Innovations: The Institute of Food Technologists highlights the importance of investing in R&D to develop new food preservation technologies that maintain food quality while extending shelf life without heavy reliance on refrigeration or chemical preservatives (IFT SPI White Paper on Processed Foods, 2023).

Economic Accessibility: A review in the “Journal of Food Science” discusses the economic challenges and cost-effectiveness of implementing advanced food preservation technologies at scale, emphasizing the need for affordable solutions for small-scale producers (Journal of Food Science, Vol. 88, Issue 4, 2023).

Education and Training: The Food and Agriculture Organization of the United Nations (FAO) underscores the role of education and capacity building in improving food preservation practices among smallholder farmers to reduce food loss (FAO report on food loss and waste reduction, 2023).

Regulatory Frameworks: A study in “Food Control” examines the regulatory challenges facing the introduction of novel food preservation methods, suggesting pathways for streamlining approval processes while ensuring safety (Food Control, Vol. 105, 2023).

Environmental Considerations: Research published in “Environmental Science & Technology” evaluates the environmental impacts of various food preservation methods, advocating for the development of more sustainable technologies that reduce energy consumption and greenhouse gas emissions (Environmental Science & Technology, Vol. 57, Issue 6, 2023).

2024 HungerTech Innovation Challenge Scope

The 2024 HungerTech Challenge tasks innovators with developing market-driven tech models that ensure increased and equitable food distribution that is both environmentally sustainable and economically viable.

Solutions could find, but are not limited to, opportunities for innovation in the following areas:

- **Infrastructure** – current critical inefficiencies exist in capturing, managing and redirecting surplus food from points of excess – such as producers and retailers – to communities grappling with food insecurity (this is exacerbated for perishable goods).
- **Forecasting** – deployment of tools for accurately forecasting the production of surplus food and quantifying demand from food-insecure populations have significant deficiencies.
- **Preservation** – there are shortfalls in current food preservation technologies to prolong shelf life of perishables without detracting nutritional value or safety.



Resources

Additional Research Submissions

Breaking the Paradox: Addressing Mobility Challenges in Food Distribution

Anamitra Jana, Radhika Bhoj, Mansi Kasar

Dynamic Pricing in Grocery Markets

Andrew Tanner

Addressing Systemic Barriers to Reduce Food Insecurity

Devrajsinh Raj, Kashvi Gandhi, Pravallika Navuluru, Rutika Banger