

Project Overview

This project examines the journey of food, particularly row crops and livestock, across various sectors in the U.S. during 2021. Our goal was to track the distribution of these agricultural products from farms to households and understand where and how much surplus (extra food) is generated at different stages.

Data Collection and Sources

Primary Data Sources:

To ensure a robust foundation for our study, we sourced our data from Refed's website and two renowned platforms:

FAOSTAT: An online database managed by the Food and Agriculture Organization, FAOSTAT provides comprehensive information about global food and agriculture trends. It's a trusted source widely used by professionals and scholars.

USDA (United States Department of Agriculture): A key U.S. government entity, the USDA oversees various aspects related to farming, forestry, and food in the U.S. Its databases are rich with specific details about U.S. agricultural production and distribution.

Methodology

Once we accessed the relevant datasets from these platforms, we filtered out the information directly pertaining to our sectors: farms, manufacturing, food service, retail, and households in the U.S. for 2021. This data was then compiled and structured to give us a clearer picture of how food is distributed and where surpluses emerge. We decided to work on a non-linear distribution of food consumption and surplus between the five sectors. The data from FAOSTAT, USDA gave the complete quantity (in CWT) of Farm sector. Using Refed's dataset and its calculations, we have approximated the percentage of food transfer between sectors.

Farm Stage:

To Manufacturing (50%): Typically, a significant portion of raw agricultural produce is sent for manufacturing to transform these raw goods into value-added products. This includes processes like milling grains into flour, converting raw milk into dairy products, and processing meats. The large allocation of 50% to this sector acknowledges the pivotal role manufacturing plays in food processing.

To Food Service (20%): The food service sector, including restaurants, cafes, and catering services, requires a substantial amount of fresh produce. The 20% allocation considers the

direct sourcing practices of many farm-to-table establishments and the general demand for fresh ingredients in the culinary world.

To Retail (15%): Retailers, such as supermarkets and grocery stores, offer a mix of raw and processed agricultural goods. While some of the produce sold in these outlets originates from the manufacturing sector, a sizable portion is sourced directly from farms for fresh produce aisles. Thus, a 15% allocation reflects this dynamic.

To Residential (10%): Some households and community-supported agricultural programs have direct relationships with farms, especially in rural and peri-urban areas. The 10% allocation accounts for direct farm sales and CSA (Community Supported Agriculture) programs.

Surplus (5%): Surpluses can emerge due to various reasons: overproduction, market demand fluctuations, or logistical challenges in distribution. Allocating 5% to surplus recognizes these unpredictable yet inevitable aspects of farming.

Manufacturing Stage:

To Food Service (40%): Food services not only rely on fresh produce but also on manufactured food items like sauces, ready-to-cook products, and other processed ingredients. The significant 40% allocation captures this dependency.

To Retail (30%): Retailers offer a wide array of processed foods. These products, ranging from packaged snacks to frozen meals, form a considerable portion of their inventory, justifying the 30% figure.

To Residential (20%): Many households prefer purchasing semi-processed or ready-to-eat products for convenience. The 20% allocation represents this direct purchase from manufacturing outlets, including factory sales and outlet stores.

Surplus (10%): Surpluses at the manufacturing stage can arise due to overproduction, changes in market trends, or shelf-life considerations. Thus, a 10% allowance is pragmatic.

Food Service Supply:

To Residential (80%): A notable portion of food services' produce and products eventually make their way to residential settings. This includes take-away, delivery services, and meal kits. The substantial 80% allocation accounts for these distribution avenues.

Surplus (20%): The food service industry can face significant unpredictability in demand, leading to surpluses. Events, changing consumer preferences, or seasonal variations can lead to an overstock, which is captured by the 20% surplus allocation.

Retail Supply:

To Residential (70%): The primary purpose of retail is to serve residential customers. As such, the vast majority of their stock is intended for household consumption, justifying the 70% allocation.

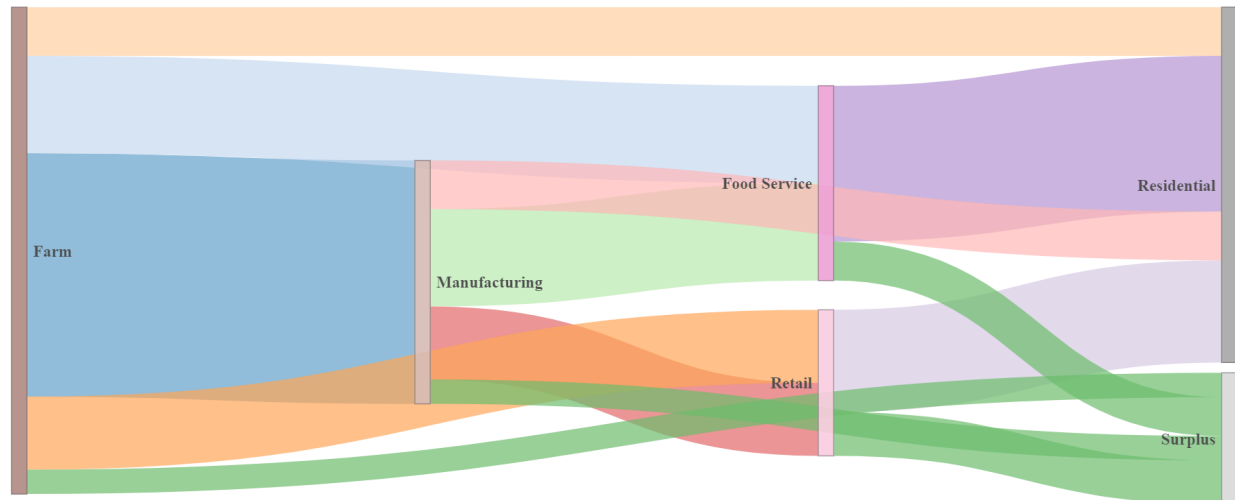
Surplus (30%): Retail surpluses can emerge from overstocking, nearing expiry dates, or not meeting visual standards for sale despite being perfectly consumable. Given these challenges, a 30% surplus allocation provides a realistic estimate.

Visualization

Using the above percentages, we have created a table as shown below which serves as an input for the visualization.

source	target	value	color
Farm	Manufacturing	550173678.47	#FF5733
Farm	Food Service	220069471.40	#33FF57
Farm	Retail	165052103.50	#5733FF
Farm	Residential	110034735.70	#FFD833
Farm	Surplus	55017367.85	#FF33A6
Manufacturing	Food Service	220069471.39	#33FFF5
Manufacturing	Retail	165052103.54	#F533FF
Manufacturing	Residential	110034735.69	#FF8F33
Manufacturing	Surplus	55017367.85	#FF33A6
Food Service	Residential	352111154.23	#FF3333
Food Service	Surplus	88027788.56	#FF33A6
Retail	Residential	231072944.93	#FF4D33
Retail	Surplus	99031262.10	#FF33A6

Created a Sankey Diagram which shows a non-linear flow of food usage and surplus between each sector.



Discussion

Our data illuminates the intricate pathways food takes before reaching its final destination. The farm-to-manufacturing route stands out with the highest volume, signifying the essential role of manufacturing in converting raw products into consumables. This heavy reliance suggests that the majority of our food undergoes some form of processing or transformation.

Simultaneously, the direct flow from farms to the food service sector, amounting to a significant 220 million CWT, underscores the value placed on fresh produce in culinary establishments. It indicates that many in the food service industry prioritize direct farm produce, possibly for its freshness or farm-to-table branding advantages.

Surplus generation at each stage is another crucial observation. It reminds us of the inherent inefficiencies in the food distribution system, where significant quantities are left unused, emphasizing the need for better demand forecasting and streamlined distribution mechanisms.

Conclusion

The journey of food from farms to residences is complex, with several stages in between, each having its unique distribution pattern. By understanding these flows, stakeholders can identify potential areas of intervention to reduce surplus, optimize distribution, and ensure food reaches where it's most needed. Our study provides a foundational understanding of these patterns, paving the way for future research and actionable insights in the realm of food distribution.

References

FAOSTAT - <https://www.fao.org/faostat/en/#data/QCL>

USDA - <https://www.nass.usda.gov/>

ReFed - <https://refed.org>