LOCAL FOOD WASTAGE ANALYSIS

Problem Statement

Food wastage is a significant issue, with many households and restaurants discarding surplus food while numerous people struggle with food insecurity. This project aims to develop a Local Food Wastage Management System, where:

- Restaurants and individuals can list surplus food.
- NGOs or individuals in need can claim the food.
- SQL stores available food details and locations.
- A Streamlit app enables interaction, filtering, CRUD operation and visualization.

Business Use Cases

- **Connecting surplus food providers** to those in need through a structured platform.
- **Reducing food waste** by redistributing excess food efficiently.
- **Enhancing accessibility** via geolocation features to locate food easily.
- **Data analysis** on food wastage trends for better decision-making.

Key Insights on type of food providers contributing the most food

1. Restaurants as Primary Contributors
    - Restaurants generate the largest share of surplus/claimed food.
    - This suggests high levels of daily leftovers (due to customer demand variability and menu variety).
2. Catering Services & Supermarkets Are Significant Sources

- Catering services contribute heavily, likely from bulk-prepared meals/events.
- Supermarkets contribute consistently through unsold but still consumable items.

3. Grocery Stores Contribute Least, but Still Substantial
    - Grocery stores' contribution is slightly lower but still significant.
    - Likely from perishable goods (fruits, vegetables, bread).
4. Close Quantities Across Providers
    - All provider types contribute within a relatively narrow range.
    - This indicates food wastage is a systemic issue across the supply chain, not just limited to one type.

Key Insights on Receiver Type claiming the most food

1. Charities as Primary Receivers
    - Charities are the **largest beneficiaries**, showing that they have strong networks and infrastructure to collect and redistribute food.
    - This indicates an effective channel for tackling food insecurity through organized groups.
2. NGOs as Key Secondary Receivers
    - NGOs are nearly on par with charities, highlighting their role in structured redistribution (food banks, welfare programs, feeding drives).
3. Individuals and Shelters Claim Less
    - **Individuals**: Lower claims may reflect limited access to app awareness, transportation issues, or food being prioritized for bulk receivers (charities/NGOs).
    - **Shelters**: Despite being direct beneficiaries, their claims are lower—possibly due to capacity limits (storage, cooking facilities, number of residents).
4. Balanced Food Distribution Network

- The fact that all receiver types claim substantial amounts (6000-7200) shows the system ensures fairly equitable distribution across sectors.

Key Insights on Top 5 Cities having the highest food listings

1. **East Heatherport is the Largest Contributor**
    - With the highest number of listings, East Heatherport emerges as a **key food surplus hub**.
    - This city should be the **first target for redistribution efficiency**, logistics optimization, and NGO partnerships.
2. **Mid-Level Contributors (Lake Andrewmouth & Jamesfurt)**
    - Both cities have substantial but lower listings compared to East Heatherport.
    - They represent **secondary hubs**, useful for regional redistribution networks.
3. **Smaller Contributors (South Kathryn & New Carol)**
    - Fewer listings suggest either **lower population density**, **smaller food industry presence**, or **less awareness/engagement with the app**.
    - Potential exists to **expand awareness and participation** in these areas.
4. **Urban Concentration of Surplus**
    - The top 5 cities alone account for a large share of listings, showing that **urban centres generate most surplus food**.
    - Rural or smaller towns might be underrepresented, indicating a gap in provider onboarding.

Key Insights on Commonly Available food Types

1. **Vegan Food is the Most Commonly Wasted/Available**
    - Vegan food has the **highest surplus**, more than double vegetarian and non-vegetarian combined.
    - Likely includes fruits, vegetables, grains, bread, and plant-based meals that have shorter shelf lives and higher spoilage rates.
2. **Moderate Surplus in Vegetarian Food**
    - Cooked vegetarian meals (like dairy-based, lentils, rice) contribute significantly but far less than vegan.
    - Indicates some balance in supply-demand.
3. **Least Contribution from Non-Vegetarian Food**
    - Non-vegetarian items (meat, poultry, fish) are much lower in surplus.
    - This may be due to **higher cost, stricter handling/storage requirements, and faster perishability**, leading providers to prepare/store them more carefully.
4. **Consumer Behavior Impact**
    - Surplus patterns suggest **plant-based food is overproduced** more often (possibly bulk catering, grocery overstocking).
    - Animal-based foods are managed more cautiously due to cost and regulation.

Key Insights from Claim Status Distribution

1. **Balanced Distribution**
    - The number of claims across **Cancelled, Completed, and Pending** statuses are fairly close (all around ~300–350).
    - This suggests the claim management process is active, but efficiency can be improved.

2. **High Cancellation Rate**
    - A large portion of claims are **Cancelled**.
    - Possible causes: poor food quality, delays in delivery, mismatch in receiver needs, or manual errors.
    - This is a red flag since high cancellations directly translate to food wastage.
3. **Pending Claims**
    - A significant percentage of claims remain **Pending**.
    - Pending claims may indicate bottlenecks in logistics, insufficient volunteers, or poor real-time coordination.
    - Pending claims risk eventual cancellation, which again contributes to wastage.
4. **Completed Claims**
    - While completions are almost equal to cancellations, the goal should be to maximize **Completed claims**.
    - This shows that when logistics align properly, the system is capable of successful food distribution.

Key Insights from Food Claims made for each item

1. **High Claim Categories**
    - **Rice, Dairy, Fish, Soup, and Salad** are the **most frequently claimed items** (above 100 claims each).
    - This suggests these food items are either produced in large quantities or are highly perishable, leading to more wastage and subsequent claims.
2. **Moderate Claim Categories**
    - **Bread, Chicken, Pasta, Vegetables** show **moderate claims** (80–100 claims).

- These foods are still wasted but not at the same rate as Rice or Dairy.

3. **Lowest Claim Category**
    - **Fruits** show the **least claims** (~70), which could mean:
        - Better consumption rates (less wastage).
        - Smaller storage/supply chain issues compared to other foods.
        - Or possibly, less reporting of wastage compared to staple items like Rice.
4. **Staple Foods Drive Wastage**
    - Staple foods like **Rice and Bread** appear in the top wastage list, highlighting inefficiencies in cooking/portion planning.
5. **Perishable vs Non-Perishable**
    - Perishables (**Dairy, Fish, Salad, Soup**) dominate the high-claim list.
    - Non-perishables (like **Pasta**) show fewer claims, which indicates storage life plays a key role in reducing wastage.

Key Insights from Most Claimed Meal Type

1. **Breakfast Dominates Food Claims**
    - More food is claimed for breakfast than any other meal.
    - Possible reasons: breakfast items are prepared in bulk (e.g., bread, milk, cereals) and have shorter shelf life, leading to higher wastage.
2. **Lunch & Snacks Are Close in Claims**
    - Lunch and snacks claims are almost at the same level, suggesting midday and between-meal food waste is significant.

- Indicates that portion sizes or demand prediction during these times may not be optimal.

3. **Dinner Has the Least Claims**
    - Dinner meals are relatively better managed with fewer claims.
    - This may indicate improved demand forecasting in the evening or smaller portion servings compared to other meals.
4. **Optimization Opportunity**
    - Focus should be on breakfast planning—better portion control, improved demand forecasting, and redistribution strategies to reduce waste.
    - Since snacks and lunch together make up a big chunk of claims, re-evaluating snack variety or portion size can also reduce overall wastage.

Key Insights from Providers who shipped expired but are pending

1. **High Volume of Expired Pending Deliveries**
    - Multiple providers have shipped **expired food** that is still in **pending status** (not delivered).
    - The top contributors (e.g., **Long-Alexander, Munoz-Stone and Wallace, Ferguson-Henderson and Wallace**) each have **40+ units of expired food pending**, making them the biggest sources of potential wastage.
2. **Pattern of Repeated Offenders**
    - Some providers appear to contribute significantly higher quantities of expired pending food compared to others.
    - This indicates possible **poor inventory management** or **lack of proper expiry checks** before shipment.

3. **Operational Inefficiency**

- Since these items are already expired **before delivery**, the system is failing at the **verification stage** (expiry check before shipping).
- Pending deliveries of expired food **waste logistics resources** and increase the risk of **customer dissatisfaction** or **health hazards** if mistakenly delivered.

4.Food Wastage Hotspots

- Providers at the top of the chart represent **critical wastage hotspots**.
- For example, **Long-Alexander** and **Carlson-Mathis** alone account for a substantial portion of expired shipments.

Implications:

- **Food Safety Risk** → If delivered by mistake, expired food can cause serious health issues.
- **Cost of Wastage** → Extra logistics effort on expired items increases operational cost.
- **Reputation Impact** → Providers consistently appearing in the list could harm overall trust in the food distribution system.

Final Strategic Recommendation & Conclusion

The analysis highlights that **food wastage is a systemic issue across multiple providers, cities, food types, and distribution stages**, requiring a **multi-pronged strategy** to reduce inefficiencies and maximize redistribution.

1. Provider-Side Optimization

- **Restaurants and Catering Services**, being the largest contributors, should be the primary focus for **portion planning, AI-driven demand forecasting, and rapid redistribution networks**.
- **Supermarkets and Grocery Stores** must implement **near-expiry discounting, FIFO inventory rotation, and structured donation programs**.
- Strict enforcement of **expiry verification before dispatch** is critical to eliminate the high volume of **expired pending deliveries**, ensuring food safety and operational efficiency.

2. Receiver-Side Strengthening

- **Charities and NGOs** should be leveraged as the **core distribution hubs** since they already claim the most food and have structured networks.
- **Shelters and individuals** require greater access via **awareness campaigns, app-based incentives, and last-mile delivery support** to ensure more inclusive distribution.

3. Geographical Focus

- **East Heatherport** should serve as the **primary redistribution hub**, with **Lake Andrewmouth and Jamesfurt** as regional secondary hubs.
- **South Kathryn and New Carol** need awareness and onboarding campaigns to expand participation.
- Adopt a **hub-and-spoke logistics model** to extend food access from urban centers into underrepresented rural areas.

4. Food Type & Meal Optimization

- Since **vegan foods (fruits, vegetables, bread, grains)** dominate surplus, providers must enhance **perishable management, storage, and redistribution speed**.
- **Breakfast items** have the highest claims—bulk preparation needs better portion control and predictive cooking.
- **Rice, Dairy, and Fish** are high-claim categories that require **priority redistribution channels** to avoid wastage.

5. Operational & Policy Improvements

- Reduce **cancellations and pending claims** through:
    - Real-time matching of donors with nearby receivers.
    - Priority assignment for near-expiry food.
    - Backup logistics volunteers to prevent delays.
- Introduce a **Provider Compliance Score** to hold repeated offenders accountable for expired shipments.
- Governments and local authorities should incentivize donations (tax rebates, CSR credits) and penalize avoidable wastage.

Conclusion

The Local Food Wastage Management System demonstrates immense potential to **bridge the gap between surplus and need**. By focusing on **restaurants/catering waste reduction, strengthening NGO/charity redistribution networks, optimizing hub cities, and addressing perishable vegan food surplus**, the system can significantly cut wastage while fighting food insecurity.

Strategically, success will depend on:

- **Technology integration** (AI demand forecasting, IoT tracking, expiry validation).

- **Logistics efficiency** (hub-and-spoke redistribution, last-mile delivery).
- **Provider accountability and receiver empowerment** (compliance scoring, awareness campaigns).

If implemented, this strategy will **maximize completed claims, minimize cancellations, and ensure safer, faster, and fairer food distribution**—making the app a scalable model for sustainable food security.