

SmartShelf



◆◆ Problem & Market Need

- About 30% of the wasted food goes straight to the landfill (ReFED, 2024)
- Static discounts (e.g., “-50% stickers”) are inefficient — they’re applied too late and not data-driven.
- Customers want fresh, affordable, sustainable options.



SmartShelf: Dynamic Discounts for Near-Expiration Products

- AI-driven pricing system for supermarkets.
- Adjusts prices in real time based on product shelf life and demand.
- Reduces food waste and increases revenue.



Target Customers & Price Sensitivity

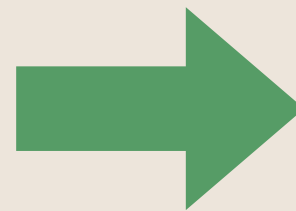
Primary: Budget-conscious shoppers (students, families)

“As a university student with a tight budget, I want to find fresh products at lower prices, so I can eat healthy without overspending.”

Secondary: Eco-conscious consumers (value sustainability).

“As an eco-conscious shopper, I want to buy items that are close to expiration to help reduce food waste and make more responsible choices.”

High price elasticity

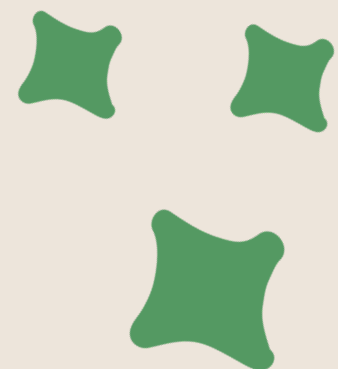


Very responsive to discounts

Dynamic Pricing Concept



Dynamic Pricing Factors

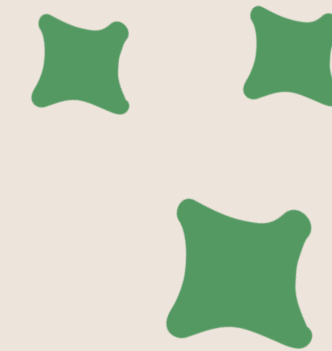


Factor	Description
Expiration Date	Days left → main price driver
Demand	Real-time sales data and customer flow
Time of Day	Rush hours → smaller discounts
Stock Levels	Surplus inventory → stronger discounts
External Events	Weekends, holidays, weather patterns





Data





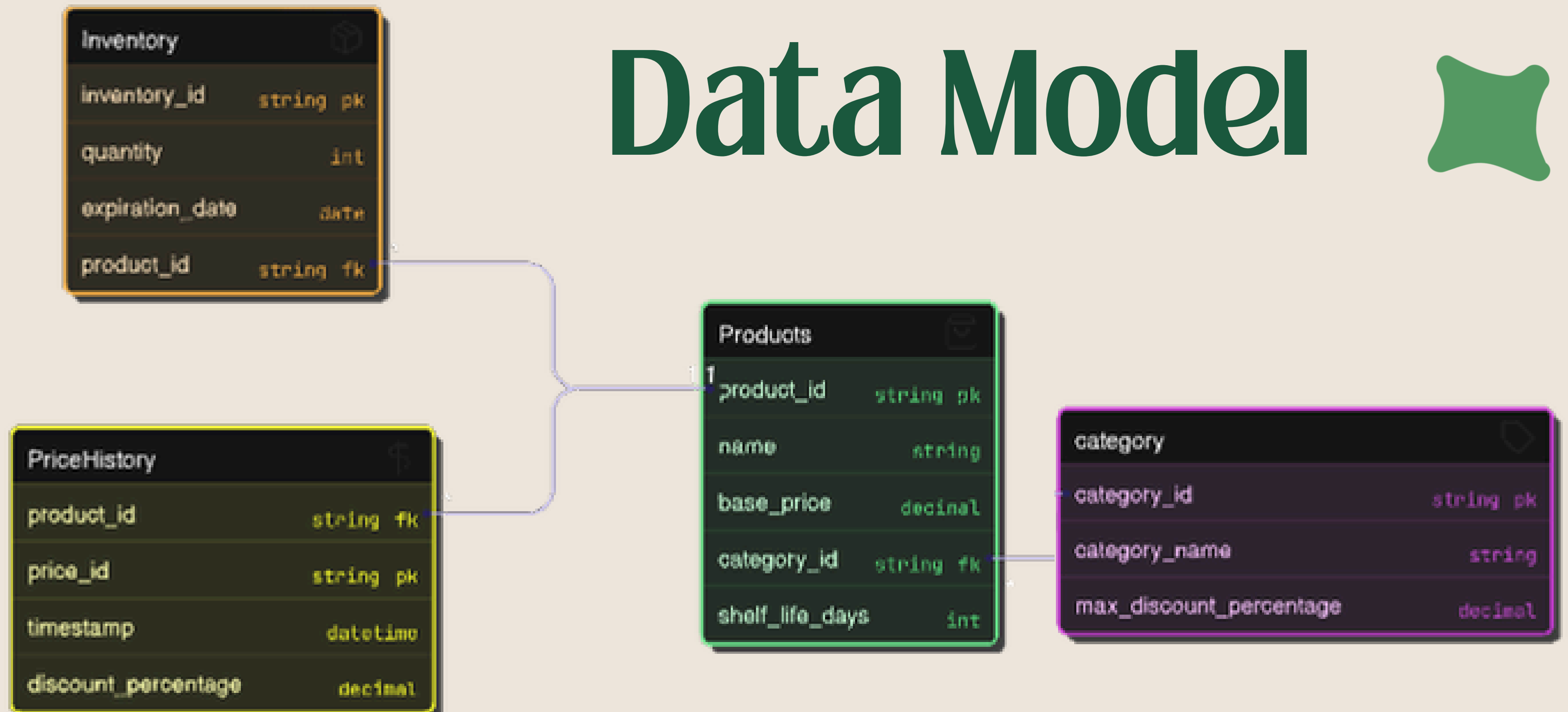
Required Data



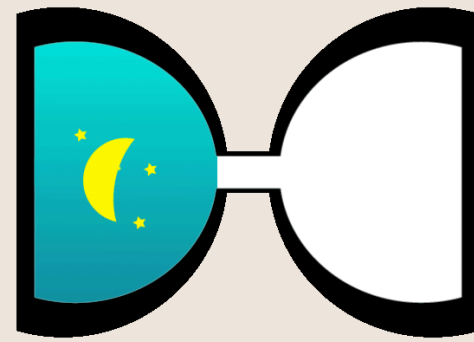
-Datasets:

- **Product information:** base price, shelf-life days, category
- **Inventory data:** quantity per batch, expiration date
- **Price history:** previous discounts, timestamps
- **Category rules:** max discount allowed per category (business rules)
- **Demand signals:** sales velocity, time-of-day patterns (peak hours)
- **External factors:** weekends, holidays, weather (cold-soups)

Data Model



How Data Feeds Pricing



- Calculates **days to expiration** from Inventory
- Measures **stock pressure** from quantity
- Uses past discount performance (**PriceHistory**)
- Adjusts using **demand signals** (sales velocity, time of day)
- External factors refine the pricing even further...



prototype



Price Adjustment Logic

◆◆ Prices adjust automatically every day ◆◆

$$P(i) = P_0 \left(1 - d_{\max} \frac{i}{D - 1} \right)$$

$P(i)$ = Price at day index(i),

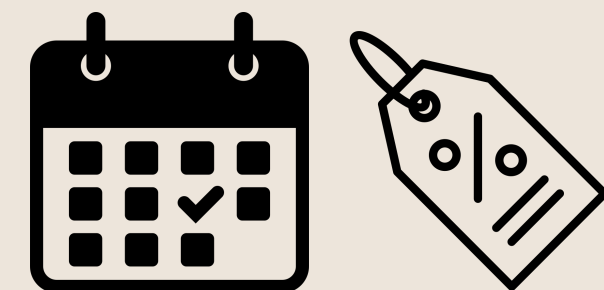
P_0 = Base price,

$d_{\max}$ = Maximum discount fraction,

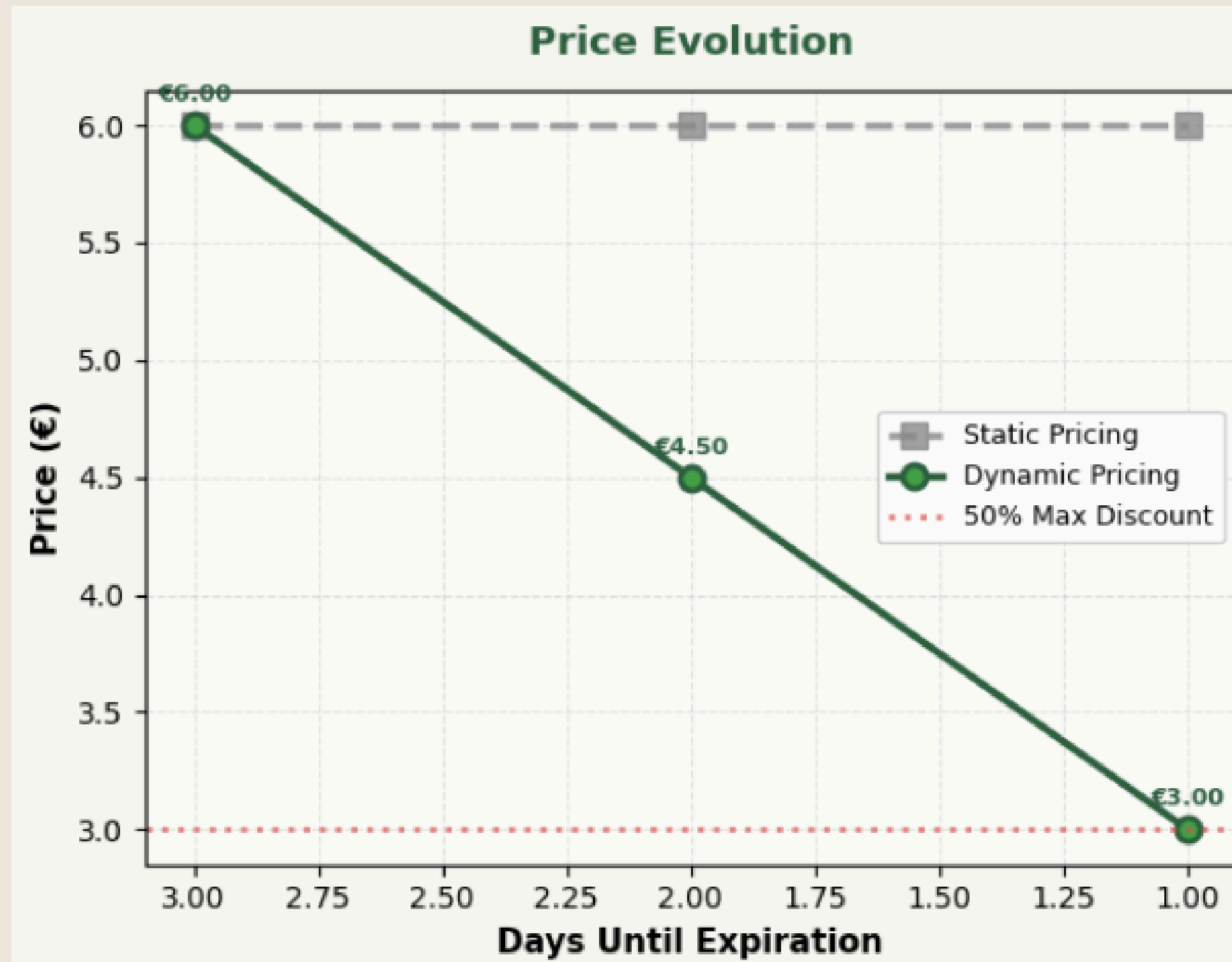
i = Current day index(0 to $D - 1$),

D = Total days to expiration.

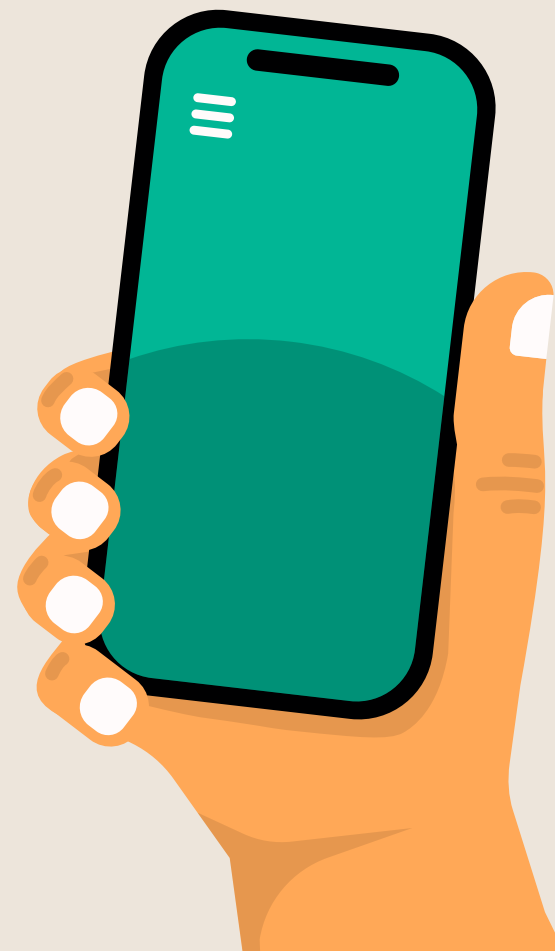
**The closer the product is to expiration,
the bigger the discount**



Price Evolution Visualization



Prototype / Demonstration



Google Colab
[google.com](https://colab.google.com)

Opportunities, Risks & Limitations



Opportunities

Economic

- Higher margin recovery on unsold goods.
- Optimized inventory by selling the products faster and reducing operation costs.



Customer Loyalty

- Customers are part of an environmental action while they save money
- Better customer experience showing real time price logic.



Environmental

- Reduce food waste by ~60%.
- Supports sustainability goals
- Better inventory lifecycle management reduces unnecessary overstocking.



Risks

Operation & integration

Data errors could lead to wrong prices or missed discounts.



Customer Distrust

Customer distrust in dynamic pricing could hurt supermarket sales and profits.



Compliance

Price changes must comply with consumer protection laws (BMLEH).



Limitations

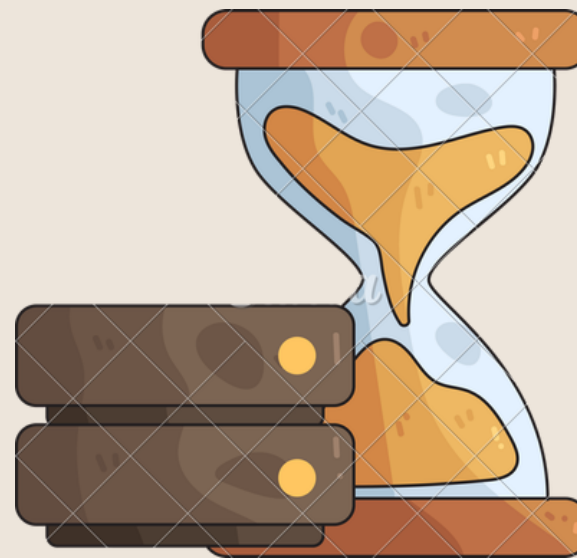
Dependency on Store Size

Limited benefit for small stores or low-volume items.



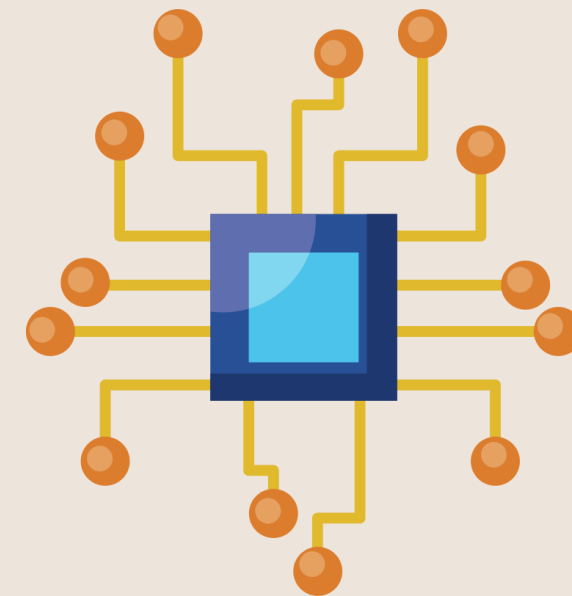
Real-Time Data Quality

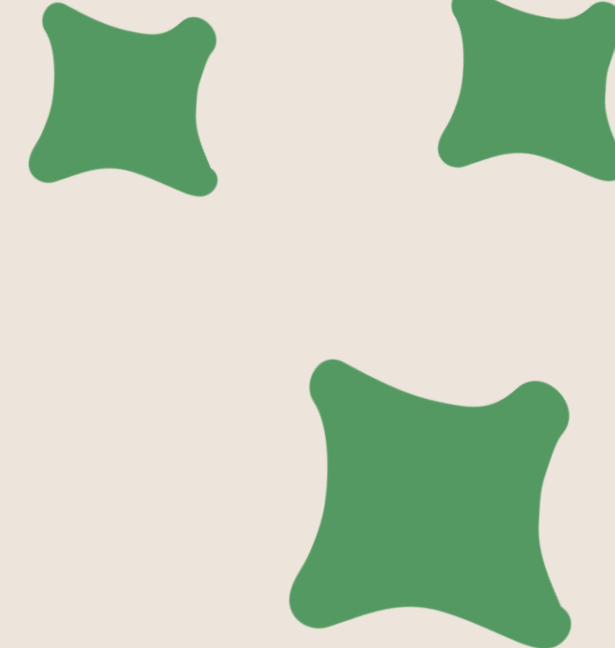
The system is only as good as the accuracy of data



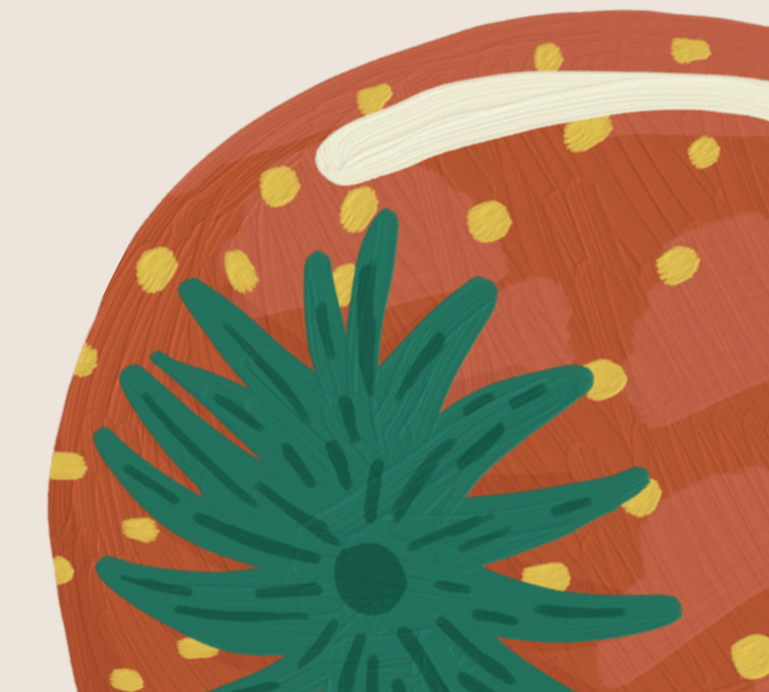
Hardware & Infrastructure

Network reliability and “smart tags” are critical





Thank you!



References

Morawski, B. R. (2024, August 23). How supermarkets and grocery stores contribute to food waste. One5c. <https://one5c.com/food-waste-supermarkets-136944209/>

BMLEH - Food hygiene and safety. https://www.bmleh.de/EN/topics/consumer-protection/food-hygiene-safety/food-hygiene-safety_node.html