# Food Waste at FreshMart

## 1. Statistical Analysis

### 1.1 Hypotheses on Variable Relationships

**Food Type:**

Different foods have different characteristics, such as water activity, pH and composition, which significantly affect their shelf life and food waste. Seafood is more perishable than meat because of its high water activity, neutral pH, rich unsaturated fatty acids, and non-protein nitrogen compounds (Kontominas, 2021). According to Assessment 2a, the average meat waste percentage is 7.39%, while seafood is 16.06%. Based on this, the following hypothesis is proposed:

Hypothesis 1: Food type has a strong impact on food waste.

**Price:**

According to the previous study, about 40% of food is wasted before it reaches consumers (Kayikci et al., 2022), especially when food is mispriced. Li and Wang (2017) found that dynamic pricing strategies have a significant positive effect on reducing food waste. According to Assessment 2a, the average price of seafood is 7 dollars higher than meat, which is in line with the waste percentage. Although seafood is generally more expensive than meat, the impact of price on food waste cannot be ignored. Based on this, the following hypothesis is proposed:

Hypothesis 2: Price has a moderate negative impact on food waste.

**Shelf Time:**

Tsiros and Heilman (2005) argue that food with longer shelf time can lead to higher food waste because consumers are reluctant to buy them as they near expiration date, which results in food waste. Another view is that food would be more likely to be sold with longer shelf time. Data from Assessment 2a shows that the average shelf time of meat is 4 days longer than seafood, which seems to support the second view. Based on this, the following hypothesis is proposed:

Hypothesis 3: Shelf time has a strong negative impact on food waste.

**Weekend Time:**

Most consumers are inclined to store and over-buy food on weekends, which means food that arrives on shelves on weekends may be more likely to be sold and food waste would decrease. Based on this, the following hypothesis is proposed:

Hypothesis 4: Weekend time has a weak negative impact on food waste.

# 1.2 Correlation Analysis

（1）Shelf Time and Food Waste

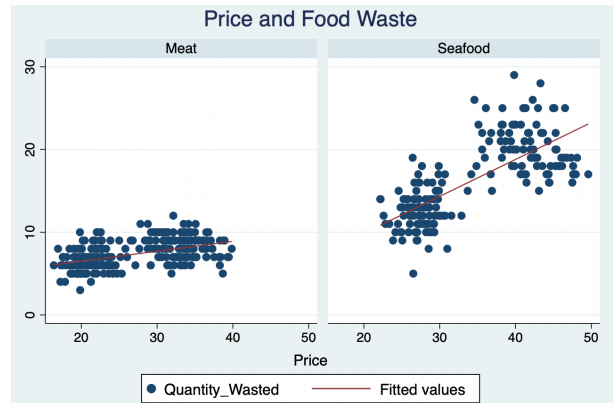| Correlation | Food Waste | Food Waste of seafod | Food Waste of meat |
|---|---|---|---|
| Shelf Time | -0.8233 | -0.6115 | -0.2595 |



There is a negative correlation between shelf time and food waste, which suggests that longer shelf time helps reduce food waste. The correlation coefficient of meat is small. This reflects different food waste situation between different food.

（2）Price and Food Waste

| Correlation | Food Waste | Food Waste of seafod | Food Waste of meat |
|---|---|---|---|
| Price | 0.6719 | 0.7337 | 0.5068 |



There is a positive correlation between price and food waste. The correlation coefficient between seafood waste and price is larger than that of meat, which means price may have bigger impact on seafood.

（3）Weekend Time and Food Waste

| Correlation | Food Waste | Food Waste of seafod | Food Waste of meat |
|---|---|---|---|
| WeekendTime | -0.0178 | 0.0088 | 0.0251 |



The correlation between weekend time and food waste is very weak, which means the impact of weekend time on food waste is extremely limited and almost negligible.

## 1.3 Regression Analysis

My initial variables are food type, shelf time, price, and weekend time. Correlation analysis have shown that the impact of food type, shelf time, and weekend time was the same with hypotheses. However, the impact of price showed a positive correlation, which was inverse to hypotheses, providing an opportunity for further research. This study will conduct a regression analysis using the three variables that are already available and build an econometric model to explore.

$$FoodWaste_{it} = \alpha_0 + \alpha_1 ShelfTime_{it} + \alpha_2 Price_{it} + \alpha_3 WeekendTime_{it} + \xi_{it}$$

|  | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Variables | Food Waste | Food Waste | Food Waste | Food Waste of Seafood | Food Waste of Meat |
| Days_On_Shelf | -1.670*** | -1.325*** | -1.326*** | -0.932*** | -0.103* |
|  | (-32.37) | (-23.07) | (-23.01) | (-5.57) | (-1.70) |
| Price |  | 0.201*** | 0.201*** | 0.347*** | 0.113*** |
|  |  | (10.38) | (10.34) | (10.40) | (9.01) |
| Weekend_Time |  |  | 0.037 | 0.226 | -0.028 |
|  |  |  | (0.14) | (0.48) | (-0.18) |
| Constant | 21.914*** | 13.622*** | 13.619*** | 7.935*** | 5.185*** |
|  | (58.83) | (15.71) | (15.68) | (4.94) | (7.29) |
| Observations | 500 | 500 | 500 | 190 | 310 |
| R-squared | 0.678 | 0.735 | 0.735 | 0.604 | 0.264 |

Regression analysis found that there was a significant negative correlation between shelf time and food waste, meaning that the longer shelf time, the less food wasted. This relationship is different between seafood and meat with -0.932 and -0.103 respectively. There is a positive correlation between price and food waste, supporting the correlation analysis. The impact of weekend orders on food waste was weak and insignificant, which was the same with hypothesis. These findings help FreshMart to develop more reasonable inventory management and pricing strategies to reduce food waste. However, these regression results are limited by model, sample size and uneven distribution, so they should be applied on real cases considerably.

## 1.4 Summary

In conclusion, the study has found that shelf time has significantly negative impact on food waste; The price of food has strong positive impact on food waste; Weekend orders have less of an impact on waste. These results help FreshMart to develop different management strategies for different food, especially when it comes to seafood. In addition, while weekend orders have a limited impact on waste, it still should be considered in strategy. These results provide FreshMart with directions to reduce food waste and improve economic efficiency.

# 2. Ethical Decision-making Framework

The outline below is the seven steps of ethical decision-making（Davis, 1999）, which will be used to deal with the first ethical dilemmas. The following steps influence decision-making in my final evaluation

1. Assess the Situation
In this case, FreshMart plans to switch to more durable but non-biodegradable packaging to reduce food waste. But it faces plastic pollution at the same time. This is an issue that involves how to balance business benefits and the environment. While plastic packaging can effectively protect food and extend its shelf life(Wohner et al., 2019, Verghese et al.,2015), Ncube et al. (2021) noted that most of these packages finally entered the environment, causing pollution of land, water, and food. There are three key stakeholders: FreshMart, consumers and the environmental department. FreshMart may reduce costs but damage brand if it takes this plan; consumers can benefit from longer shelf time but be concerned about pollution; the environmental department faces regulatory pressure. Therefore, this study aims to evaluate the advantages and disadvantages of this plan and help FreshMart change strategies.

2. Assumption & Worldviews
There are one assumption and one bias that needs to be careful. The assumption is that using more durable packaging is the only way to reduce food waste. In this case, FreshMart was faced with its own serious food waste problem, where the percentage of seafood waste was above the maximum limit. In order to solve this problem, more effective inventory management and more sustainable packaging are options FreshMart can choose. The bias is that overvalue the benefit that durable packaging gives to FreshMart. Plastic pollution can lead to long-term environmental damage and eventually damage FreshMart itself.

3. Principles, Duties and Care Needs
Everyone's rights should be respected. In this case, FreshMart has a responsibility to provide qualified food and earn profit. Consumers have the right to healthy and safe food while enjoying a green environment. The environmental department has the right to supervise the behavior of FreshMart and enforce environmental protection regulations. Although there is a conflict between business benefits and environmental protection, FreshMart should take others' right into consideration and ensure its choice in line with ethical and legal standards. In order to ensure fair processes and outcomes, FreshMart needs to transparently open its choice to the public and claim the environmental impact of its choice.

4. Option, Outcomes and Consequences
(1) Continuing to current packaging but taking other measures to reduce food waste. This way does not change the packaging material, therefore it does not cause plastic pollution worse than before. Other ways could be taken, such as improving inventory management (Ceballos et al., 2021), reducing food waste but increasing operational costs. If inventory management is widely used, FreshMart or even other retailers could deal with food waste problem and benefit from this in long term.

(2) Using sustainable materials packaging. It could be useful to extend the shelf life of food while reducing waste due to deterioration in quality (Licciardello, 2017). Using sustainable materials packaging may increase the costs of FreshMart in the short term. But in the long term, this way will be less harmful to the environment and reduce greenhouse gas emissions (Dilkes et al., 2018). People will also have a good impression of FreshMart because of its green packaging and then choose FreshMart and the environmental department will support this way at the same time.

5. Character Factors?

In this case, responsibility, honesty, and innovation are the main virtues that could be applied. FreshMart should protect environment because it is its responsibility. Honesty is also important and FreshMart should open its information and choice to the public. At the same time, Using sustainable materials packaging is an innovation that FreshMart considers business benefits and environmental protection. Through these virtues, FreshMart will be a benchmark for responsibility and environmental sustainability while achieving long-term development.

6.Comprehensive Assessment

FreshMart should prioritize environmental protection when making choices because environmental problems have a long-term impact on itself and society. Environmentally friendly behaviors are increasingly valued by the market. Therefore, FreshMart should use sustainable materials packaging. While this way may increase costs in the short term but would help FreshMart become competitive in the long term.

7. Justify your Decision

Based on the analysis of the first five steps, this study will choose to use sustainable materials packaging to balance environmental responsibility and business benefits. Finally, FreshMart leads to a win-win situation. An evaluation of my decisions above is based on what is ethically right. By analyzing the problem and looking for possible solutions, I choose a balanced approach of using sustainable materials packaging, which would contribute to social sustainable development.

# 3. Developing Solutions

## 3.1 Structuring the Argument

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### (1) Situation–observation–resolution story summary

RESOLUTION: FreshMart could use sustainable materials packaging to reduce food waste but be friendly to the environment. Though it is costly to FreshMart in the short term, FreshMart would benefit from this option and people would show their interest to the product of FreshMart because of its green packaging.

SITUATION: FreshMart can choose to switch to more durable but non-biodegradable packaging to reduce food waste. But this way can be harmful to the environment, which causes plastic pollution.

OBSERVATION: FreshMart was faced with a serious food waste problem, where the percentage of seafood waste was 16.06% which is over the capped number 12% and the percentage of meat waste was 7.39% which is near the capped number 8%.

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### (2) Argument structure
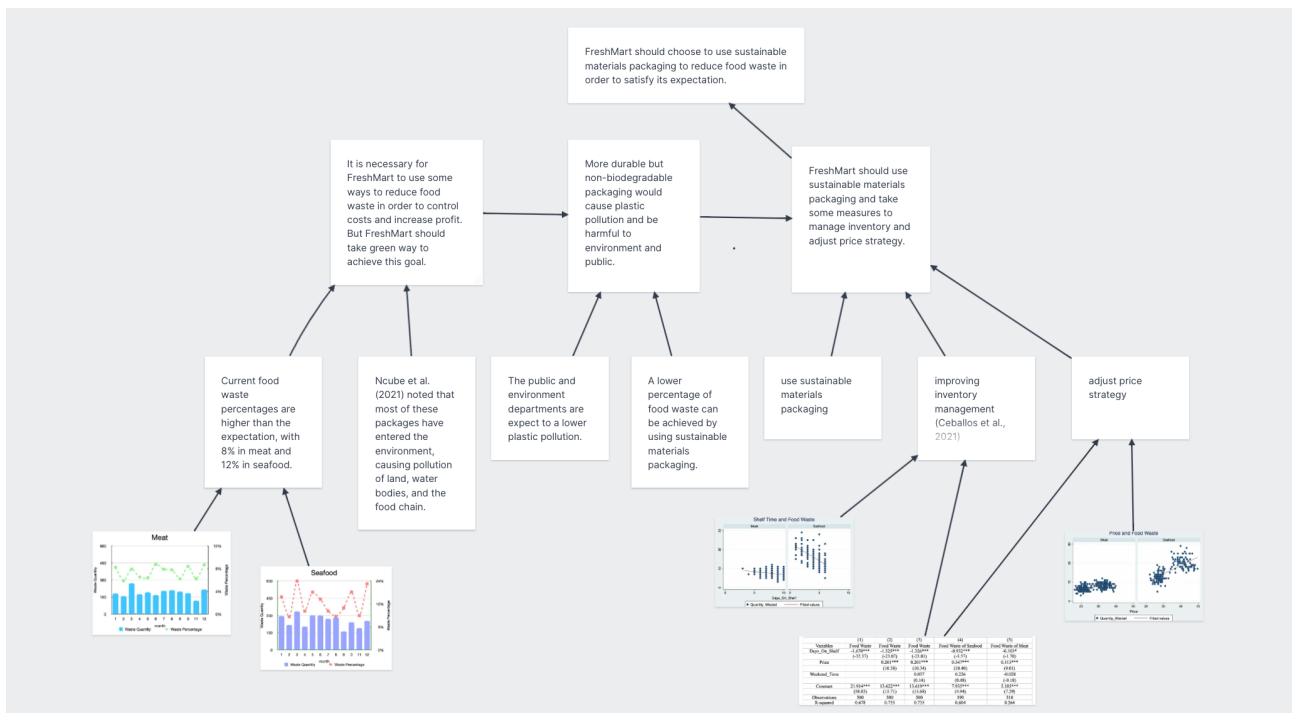


## 3.2 Solution Recommendations

According to the results of correlation analysis and regression analysis, it can be seen that shelf time and price have strong impact on food waste, so this study will make recommendations for these two points. Also, the impact of weekend time is very weak, but some suggestions could be given accordingly.

1. FreshMart can use sustainable materials packaging to increase shelf time and reduce food waste because shelf time has a strong impact on seafood (as can be seen from the results of regression). To consider costs, FreshMart can customize two different packaging for seafood and meat to control costs.

2. Optimize inventory management, it can be clearly seen from the statistical analysis that there are significant fluctuations in the amount of meat waste in March, October and December. So the purchase volume in these months can be appropriately reduced.

3. The implementation of the dynamic price, it can be found in the table that the average price of seafood and meat are increasing month by month and the regression results also show that price has a strong positive impact on food waste. In order to reduce food waste, different pricing strategies should be implemented in different months. Due to the percentage of seafood waste is large, the selling price of seafood can be appropriately reduced.

4. Weekend time, although it has a weak impact on food waste, FreshMart can still implement promotional strategies on weekends.

## 3.3 Assumptions and Limitations

Linearity assumptions of regression: This study assumes that the impact of variables on food waste is linear. However, this linear assumption may not be reasonable because there may be more complex relationships between variables, such as nonlinearities, threshold effects, or interactions. Linear models may not fully capture these complex relationships, resulting in limitations in analytical results.

Limitation of variables: this study only includes 3 available variables. But in reality, food waste may be affected by more factors, so the regression results in this study has limitations.

Sample size limitations: There were only 500 data samples in this study. While this sample size may be sufficient for a preliminary analysis, it may also lead to statistical bias. The small sample size may limit the reliability of the statistical analysis and may not provide a comprehensive picture for FreshMart, so the conclusions may be affected by the limitations of the data sample.

Data availability limitations: Lacking of detailed data such as cost information of FreshMart, internal employee opinions, and customer feedback is a problem, which can influence FreshMart to develop strategies addressing all aspects.

# Reference

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