Research Proposal

Measuring Food Waste in Prince George Restaurant: Volume, Model, and Effects

Akihiko Mori, MA NRES UNBC

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Akihiko Mori,
MA NRES
UNBC

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Introduction

- One-third of food is lost or wasted around the world[1].

- Around 1.3 billion tons of FWL is generated annually, and the rate is projected to grow by 44% per year by 2025[2].
- Canada creates about 35 million tons and the largest waste generator per capita in western countries in 2016[3].

- In BC, 40% of the waste to landfills is organic waste, the majority is produced from domestic waste[4].

- Limited number of studies have been conducted on the food supply side

Introduction

Research Questions

- What is the average volume of food that is wasted during processing and consumption in restaurants?
- What is the extent of food wastage in Japanese restaurants in Prince George?
- What are the main factors contributing to food loss and waste?
- To what extent is a social or environmental impact from food loss waste generated by a single restaurant?
- What approaches are Japanese restaurant operators taking to reduce food waste generation?

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Definition of FLW

- No universally accepted definitions of FLW

Organizations	Definition
Food Loss by FAO	harvest/slaughter/catch
Food Waste by FAO	retail/ consumption
Food Waste by EU	Food removed from FSC
Food Loss by US	unused product from agri
Food Waste by US	Subcomponent of FL

Literature Review

Definition of FLW

1	2	3	4	5
Production	Handling	Process	Distribution	Consumption
<−	FL	−>	<−	FW −>
<−	−	FLW	−	−>

Organizations	FL	FW	Subset
FAO	First 3 stages	Last 2 stages	X
EU	None	All	X
US	All	Last 2 stages	O

Literature Review

Five Measurements of FLW

Method	Note
1.Self-report	individuals report FLW
	low cost but high dropouts
2.Survey	collect FLW by interview or questionnaire
	cost-effective but not accurate
3.Composition	sample and analysis at lab
	need special knowledge and equipment
4.Mass balance	material flow analysis
	limitation in waste factor assumptions
5.Direct weight	directly measure FLW
	most accurate but high cost

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Statistic Model

- **Multiple Linear Regression**
- Ad: Simple and interpretable
- Disad: Not suitable to time series
- Disad: Stationary and Spurious
- **Bayesian Modelling**
- Ad: Flexible and adaptable to time series data
- Disad: No appropriate result in some cases

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Effects of Food Loss and Waste

- **Economic Loss**:
- labour, material resources, time, and energy
- **Environmental Impacts**:
- water scarcity, soil erosion, and GHG

Literature Review

Hypotheses

- Estimate average FLW
- Any patterns between FLW and business operations
- Any patterns between FLW and weather conditions
-

Methods

Study Area

- Japanese restaurant in Prince George
- lunch and dinner for three hours each, six days of a week

Methods

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Sample Collection

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Sample Size

- By Power analysis, 95% CI and 10% margin of error with most conservative estimate says 97 samples[]
- one in ten rule (rule-of-thumb) suggests 100 observations with 10 predictors[]
- Green's rule states 130 samples with 10 predictors[]

Methods

Variables

Variables	Note
1.Food Loss	Daily disposed food by kitchen
2.Liquid Food Waste	Daily disposed liquid food by customers
3.Solid Food Waste	Daily disposed solid food by customers
4.Number of Customers	Daily Number of dine-in customers
5.Sales	Daily sales
6.Liquor	Daily Number of liquors sold
7.Takeouts	Daily Number of takeout sold
8.Orders	Daily Number of orders sold
9.Temperature	Hourly mean temperature each day
10.Humidity	Hourly mean humidity each day
11.Precipitation	Precipitation each day

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Multiple Linear Regression Model (additive)

$$Y_i = \beta x_i + \epsilon_i$$
$$\epsilon_i \overset{\text{i.i.d.}}{\sim} N(\mu = 0, \sigma^2).$$

Baysian Modelling

$$Y_i = \beta_i x_i + \epsilon_i$$
$$\beta_i \sim N(\beta_{i-1}, \sigma_\beta^2)$$
$$\epsilon_i \sim N(0, \sigma_y^2).$$

Expected Results

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Expected Results

- Estimations of FLW in a restaurant
- Patterns of FLW
- Implications of FLW reduction

Expected Results

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Current Progress

- From Sept. 16, four months.
- Collected over 100 samples.
- Basic analysis (Histogram, Time series plots)

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TODO

- Develop potential causes of FLW (weather)
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[1] [2] [3] [4] [5]