ANALYSIS OF THE TRUCK TRIP GENERATION CHARACTERISTICS OF SUPERMARKETS AND CONVENIENCE STORES

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INTRODUCTION

Significance and Rationale of the Study

WHAT IS TRUCK TRIP GENERATION (TTG)?

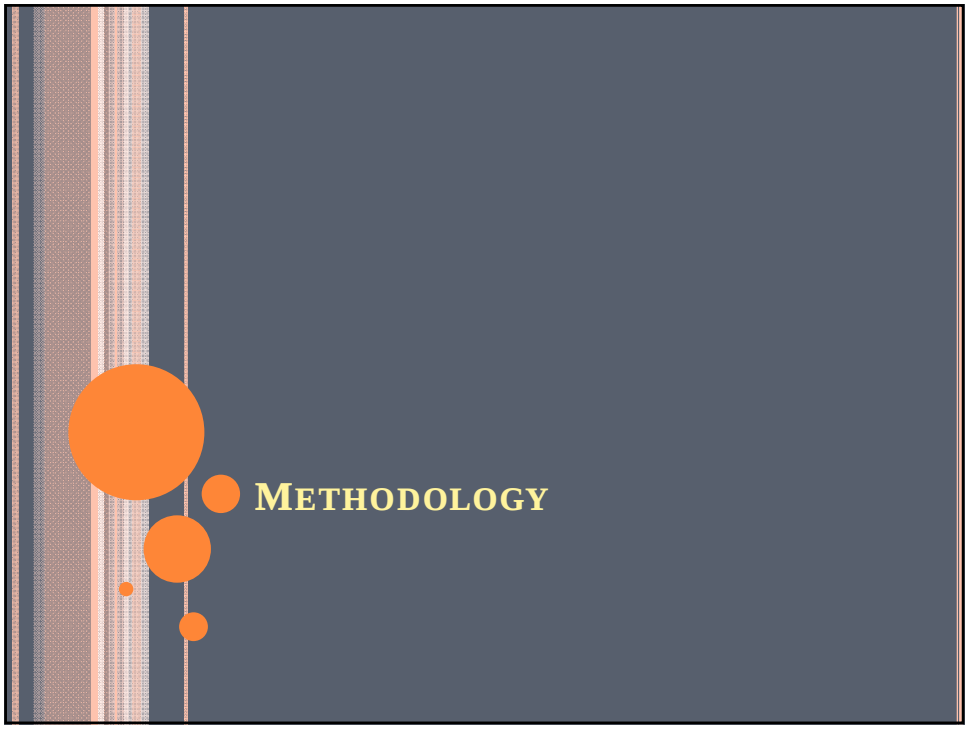
- Used to understand the impacts of truck traffic on congestion and the environment.
- TTG for firms
  - GOAL: reduce the total costs of transport and operations and maximise profits.

Why Supermarkets?

- Supermarkets (and convenience stores) are ubiquitous features of the urban and suburban landscape.
- High turnover of goods.
- Most residents living in the city don't like trucks!

Factors Used To Determine TTG For Stores (Previous Studies)

- Size of the store (gross floor area, retail area, etc.)
- Number of store employees
- Geographical location of the store
- Turnover of goods (proxy is used!)



PARTICIPANTS

- A survey and truck count study was conducted at 8 participating food retail markets in one town in New Zealand in May 2011.
- The participants are 4 supermarkets (S1,S2,S3,S4), 2 convenience stores (C1,C2), 1 bulk food store (BS) and 1 farmer's market (FM).




Data Collection

- Survey of store managers about the physical and operational characteristics of their store
- 2 days manual truck counts
- Interview with drivers about origin of loading

Parameters For Study

- Retail trading area
- Storage space
- Number of parking spaces
- Number of full-time equivalent employees
- Weekly operation hours
- Product variation score (*)

Measuring Product Variation

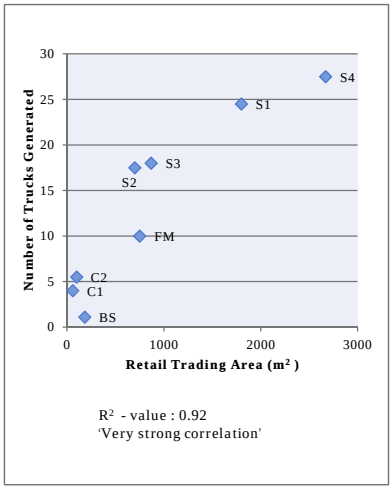
- 6 commodities chosen:
  - Bread, jam, honey, oil, eggs, yogurt
- For each product, count the number of brands the store carries

Supermarket: high product variation

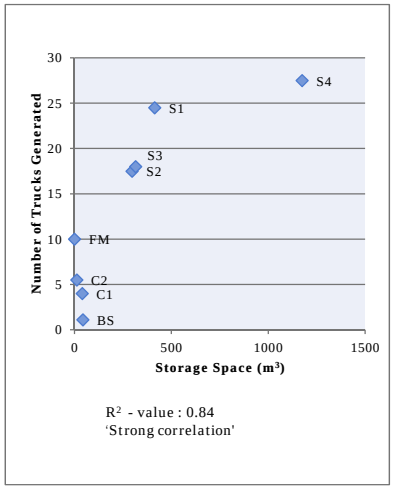
Convenience Store: low product variation

RESULTS

SIZE OF STORE STRONGLY AFFECTS TTG

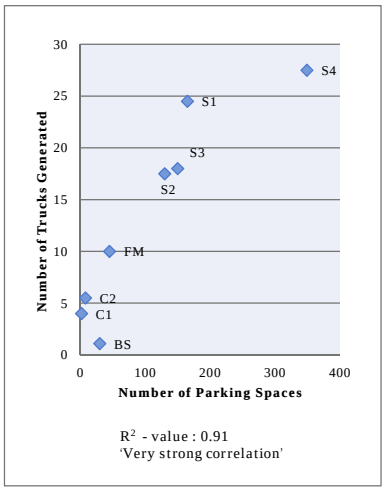


R^2 - value : 0.92
'Very strong correlation'

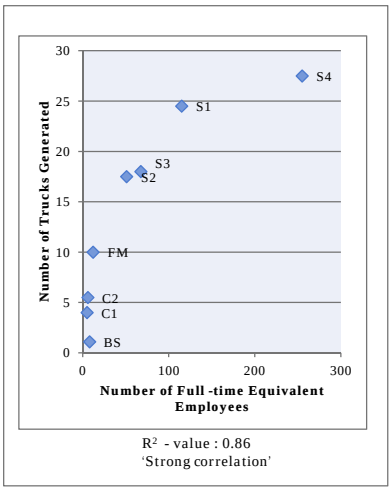


R^2 - value : 0.84
'Strong correlation'

Parking Space And Employee Counts Strongly Affects TTG

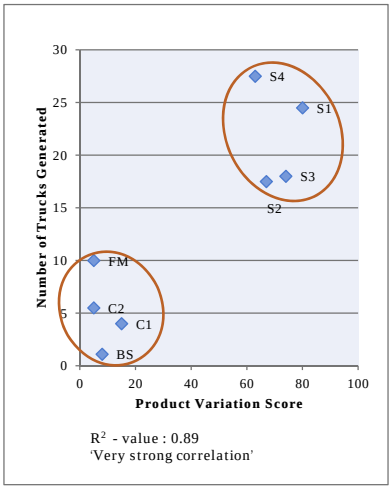


R^2 - value : 0.91
'Very strong correlation'

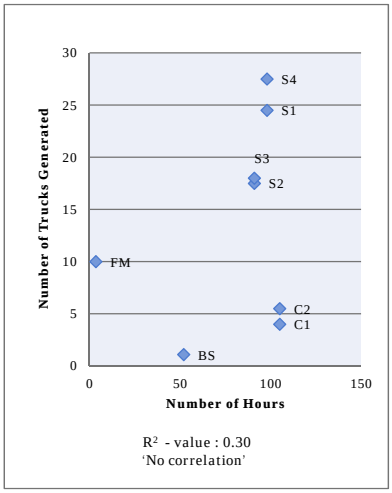


R^2 - value : 0.86
'Strong correlation'

Product Variation Strongly Affects TTG Operational Hours Does Not Affect TTG



R^2 - value : 0.89
'Very strong correlation'



R^2 - value : 0.30
'No correlation'

TRIP LENGTH CLASSIFICATION/BINS

Local	Origin of loading is <= 20 km from the store
Regional	Origin of loading is 20 – 200 km away from the store
Long Haul	Origin of loading is > 200 km away from the store.

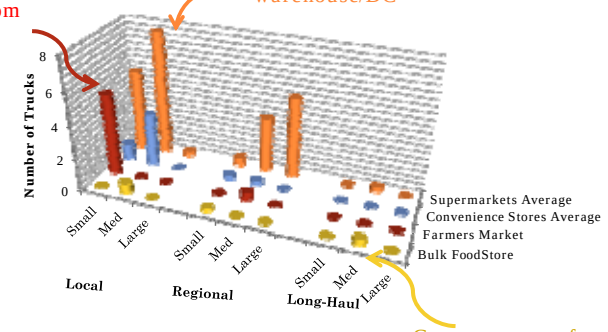
TRUCK TYPE CLASSIFICATION/BINS

Small	Small trucks ranged from private cars, cars with trailers, pick-ups, and vans	
Medium	Medium trucks ranged from 2, 3, 4-axle single units, 2-axle tractor 1-axle trailer, 2-axle tractor 2-axle trailer, and 3-axle tractor 1-axle trailer.	
Large	Large trucks all those with a total of 5 or more axles.	

Truck Type and Trip Length Distribution for the Stores

Most trucks/vehicles are coming from local farms

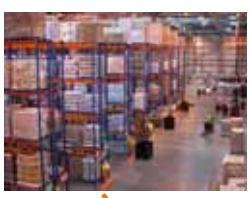
A lot of trucks are coming from local warehouse/DC



Generates very few trucks but half are long-haul.

Freight And Energy

Calculating Fuel Intensity



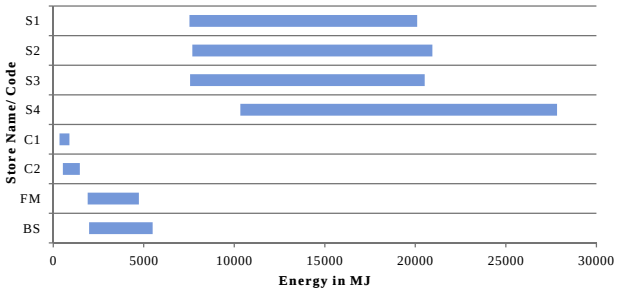

Note: Calculations are based on just one link of the complex supply chain

Assumptions

Estimated Mileage Range of Vehicles	
Small	8 – 11 L/100 km
Medium	14 - 25 L/100 km
Large	20 – 33 L /100 km

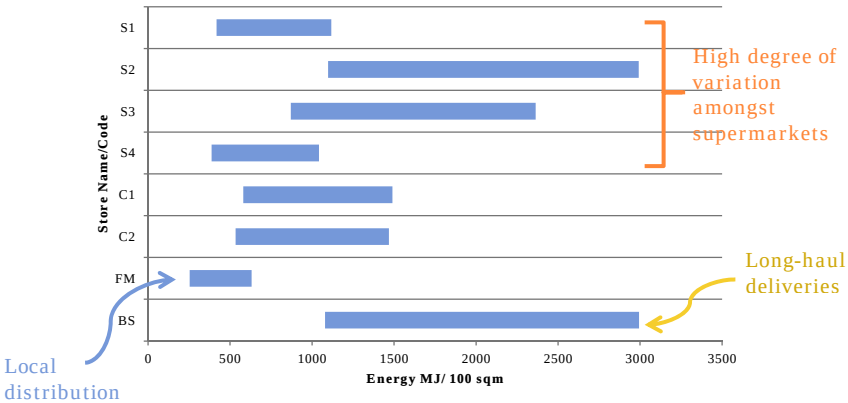
Liquid fuel conversion using Higher Heating Value	
Diesel	1 litre = 38.7 MJ
Gasoline	1 litre = 34.8 MJ

Estimated Energy Consumption For The Deliveries



Note that calculations did not factor in trip chaining of the trucks and based on the interviews only 19% of trucks delivered to only 1 store and returned to its origin of loading.

Fuel Intensity Of Stores



Note: Using size as the proxy for tonnage of food delivered which potentially skewed the results for the Farmer's Market.

Conclusions And Recommendations

Conclusions

- Strongest factors determining TTG are:
  - Retail trading area
  - Parking space
  - Product variation score (new parameter)
- A framework for analysing freight energy consumption using TTG.
- The Farmer's market model MAY have the lowest fuel intensity.

Future Work

- Consider trip chaining.
- Influence of the geographical location
  - Results may differ for towns of different size or geographical area
  - Current study is being undertaken on the influence socio-economic indicators of the market shed

Acknowledgement

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