Cost Optimisation for Unilever's Logistic Scheduling through Data Mining and Visualization

IE3100M Systems Design Project (Group 12)

Team Members: Chan Hua Han | Lim Cheng Kiat | Darren Pang | Liu Peng | Chow Jun Hao Jacky

Supervising Professors: Prof. Andrew Lim | Dr. Li Chongshou

Unilever Supervisors: Ms. Zoey Zhang | Mr. Daniel Cortez

Course Co-ordinator: Dr. Bok Shung Hwee

Unilever

NUS National University of Singapore

Department of Industrial Systems Engineering and Management (ISEM)

PROBLEM OVERVIEW

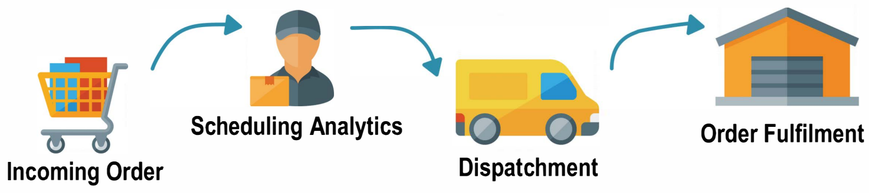
INTRODUCTION

With increasing demand for fast moving consumer goods, this incurs rising supply chain operation costs as a result of sub-optimal logistic shipment allocations. Unilever is furthering their analytics capabilities to increase efficiency.

SHIPMENTS **LOGISTICS COSTS** **ANALYTICS TOOLKIT**

This project aims to develop a data mining tool to enable deep dive and analytics for identifying potential areas of improvements in the logistics costs.

PROBLEM DESCRIPTION



- Unilever currently relies on SAP Enterprise Resource Planning
- Data Extraction is confined to reporting and ad-hoc usage only
- Increasing pressure to manage complexity and scale of logistic operations
- Need for digitalizing operations framework for continuous business insights

KEY OBJECTIVES

1. Utilize existing data to provide better analytical tools for business analytics
2. Provide cost savings methods to improve overall logistic excellence
3. Integrate above features into a single executable dashboard toolkit for ease of use
4. Ensure accessibility of usage through multiple platforms

DEVISE KPIs to empower stakeholders in everyday operations

ANALYZE Current system performance to maintain and improve quality

OPTIMIZE Propose strategies to augment current performance

PROJECT ROADMAP

Problem Formulation:
Understanding the planning and processes behind the data to identify the problem

Data Consolidation:
Consolidate the extracted data to derive information required for analytics

Descriptive Analytics:
Generate first layer of performace indicators to display trends and anomalies

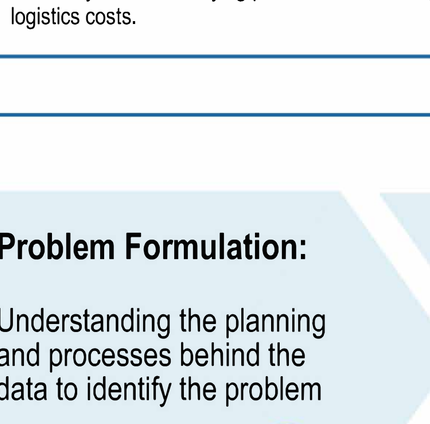
Criteria Formulation:
Formulate cost savings methods to evaluate and compare between different computation methods

Visualization:
Generate dashboard toolkit for visualization on the front end and backend formulation of program for automation

Results Analysis:
Validation of results to evaluate their effectiveness

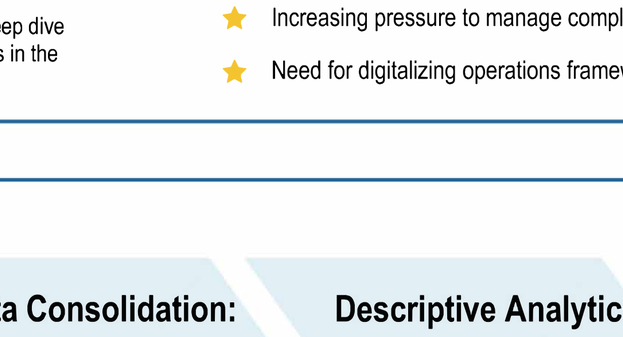
METHODOLOGY

STEP 1: CONCEPTUALIZATION



Based on the design values, the programming language and toolkit was then narrowed down.

STEP 2: PRELIMINARY DESIGN



Initial toolkit used Excel VBA to attain graphical trends but this was felt to be too slow in producing required results and further development would be hindered

Criteria Evaluation

(1) Parameters
1. Temperature Conditions
2. Transport Scope
3. Transport Mode
4. Sanitized Data

(2) Processing Time
Approximately 30 seconds per click per criterion

STEP 3: ALGORITHMS

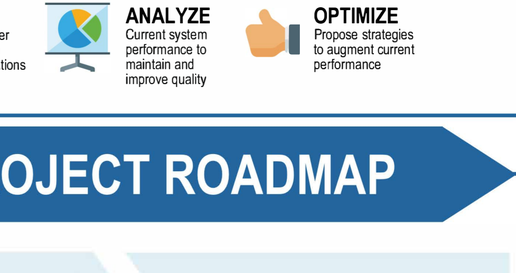
Method 1: Right Truck Sizing

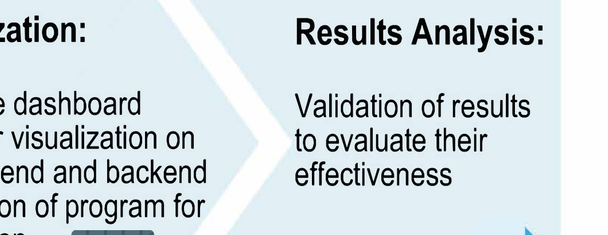
- Each shipment is checked for loadfill percentage
- If smaller vehicle available, consider weight and volume
- If found, highlight and calculate the percentage difference in cost

Method 2: Truck Consolidation

- Identify consecutive shipments of same description based on user input
- Check for suitable truck combination to hold total loadfill
- Compare new cost against originial sum. If lower, compute the cost saving

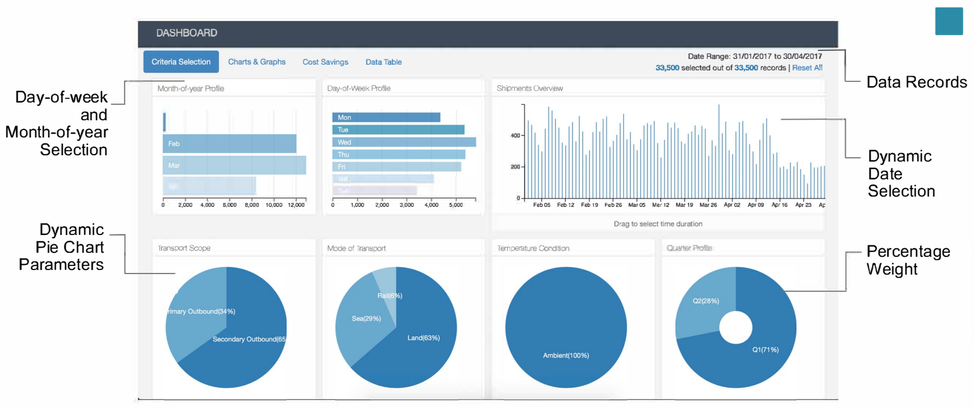
STEP 4: AUTOMATED TOOL





The toolkit works in a single pass format by passing all the input data computations from Python into Javascript for dashboard display

PRODUCT IMPLEMENTATION



Criteria Selection Interface

Final product design takes in data input from the user and enables dynamic criteria selection which computes the cost saving based on the the selection concurrently

IMPACT OF AUTOMATED TOOLKIT

- Report can now be generated completely within minutes compared to a few hours previously
- This increases productivity and allows the company to focus on mitigating cost savings in the shipment logistics rather

Programming Logic

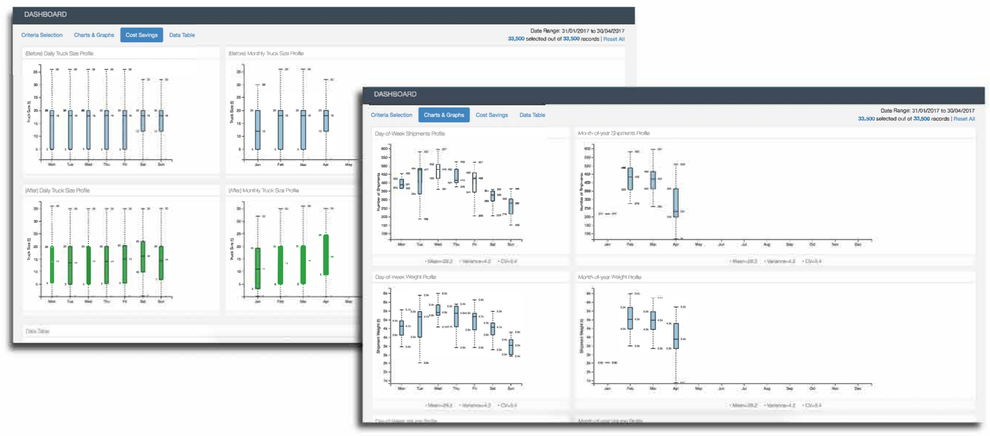
Based on the output charts and cost savings summary, identify trends and potential cost saving allocations from the cost saving methods

Month-of-year / Day-of-week Chart

1. Shipment Profile
2. Weight Profile
3. Loadfill Profile
4. Volume Profile
5. Truck Size Profile

Cost Savings - Before and After

1. Daily Truck Size
2. Monthly Truck Size
3. Percentage Savings



Cost Savings Graphs and Charts Interface

IMPROVEMENTS

KEY SKILLSETS

- Human Factors Engineering (HFE) principles were applied to improve the visualization of the model
- Statistics knowledge and data analytics skills were applied to interpret and evaluate the significance of the data
- Engineering communications and human resource management were adopted to facilitate the interaction with stakeholders and team
- Software engineering techniques used to enable automation of toolkit

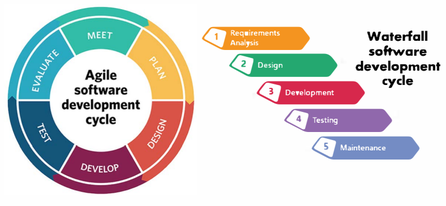
LIMITATIONS

- End-user has to learn python programming for effective use and future modifications of the new dashboard reporting tool
- Certain components of the dashboard tool require manual adjustments

RECOMMENDATIONS

- Standardization of input data to reduce need for manual adjustments
- Python and Javascript programming for end-user as well as documentation for code

Currrently adopting an agile methodology framework for this project. Future work can focus on using a waterfall programming methodology framework to scale up the dashboard



VALIDATION OF PRODUCT TOOLKIT

Criterion	Description	Remark
Practicality	Dashboard is deemed a practical visualization tool by the company, since visuals are easy to comprehend and computation of required information is quick and efficient	✓
Workability	Dashboard displays results in an ergonomic manner and allows user to easily modify the layout according to specific analysis needs	✓
Accessibility	Dashboard requires less time and cost to gain access than conventional methods since data extraction is separate from the analytics toolkit	✓
Flexibility	Dashboard allows for further development to incude additional features to be included	✓

***** Data shown on this poster are fabricated for demonstration purposes only.**