Rudi's Route Optimization

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Team 3

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Business Understanding

Rudi's Rocky Mountain Bakery is a manufacturer of organic and gluten-free grain-based breads established in 1976 in Boulder. In 2014, Hain Celestial Group, which had listed a series of distribution gains at Kroger, Publix, Sprouts, Target, Walmart, and Whole Foods, paid $61.3 million to acquire Rudi's from Charterhouse Equity Partners. At the time, Rudi's generated nearly $85 million in annual retail sales. Unfortunately, by May 2020, revenue was down to $35 million.

In Colorado, Rudi's Bakery efficiently manages direct store delivery routes within the Denver/Boulder area. The company faces ongoing challenges in enhancing delivery efficiency, focusing on key areas to optimize costs and operations. These areas include managing fuel costs, optimizing driver labor, reducing product unloading time, and improving route management. By addressing these aspects, Rudi's Bakery aims to maintain a balance between operational efficiency and cost-effectiveness. We are addressing the route management problem via this project.

Problem Statement

We are seeking to optimize Rudi's delivery operations to 50+ retail locations through the development of two efficient delivery routes. We aim to deliver to Costco locations every working day, excluding Wednesdays and Sundays, and to the other retail stores three times a week within a 9-hour delivery window. Given the constraints of no deliveries on Wednesdays and Sundays, the truck's one-time departure per day, and the consideration that certain stores will need to be visited more frequently than others, the challenge is to design routes that minimize travel time and distance, ensuring timely deliveries to all stores. This optimization will not only increase the frequency of deliveries to enhance sales but also reduce the risk of stale bread, aligning with Rudi's vision of efficiency and quality in service.

Overarching Objectives

Efficiency Improvement: Enhance the efficiency of delivery operations by designing two optimal routes that minimize total travel time and distance, ensuring all 50 destinations are serviced within the constraints of the 9-hour daily delivery window and the 15-minute service time per stop.

Increased Delivery Frequency: Increase the delivery frequency to all serviced stores, with a specific focus on daily deliveries to Costco (except Wednesdays and Sundays) and three times a week to other retail stores, to meet customer demand more effectively and ensure product freshness.

Sales Growth: Drive sales growth by increasing the availability of fresh bread at retail locations, thereby enhancing customer satisfaction and loyalty.

Waste Reduction: Reduce the amount of stale bread through more frequent deliveries, aligning with sustainability goals and reducing losses.

KPIs

Route Efficiency Improvement:

KPI: Percentage reduction in total route distance per week.

Target: Achieve a certain percentage of reduction in total miles traveled.

Data Points: Distance traveled per route before and after optimization.

Service Frequency Enhancement:

KPI: Increase in the number of delivery days per store.

Target: Increase service from 3 days per week upto 5 for the stores.

Data Points: Number of delivery days per store per week.

Time Management Efficiency:

KPI: Average time spent per delivery stop.

Target: Maintain the average time (15 minutes) per store for loading and unloading.

Data Points: Time logged per store visit.

Sales Improvement Per Store:

KPI: Percentage increase in sales per store.

Target: Set a specific sales growth target for stores based on increased delivery frequency.

Data Points: Sales figures per store before and after the change in delivery frequency.

Agile/Planning Elements

Team members

Akshaj Khirwadkar – Product Owner

Did my undergrad in Business Administration in 2022. I worked as a Data Analyst in an Ad Tech company for a year before coming here to pursue MSBA. I have some experience in Python but not much with optimization modeling, which is why I am really looking forward to this project as a learning opportunity. I will be facilitating this project as a Product Owner.

Product owner is responsible for maximizing the value of the project delivered by the development team. They would work closely with Rudi's Bakery to understand their operational and financial goals, prioritize the work to be done, and ensure that the project's objectives align with the company's strategic needs, such as optimizing delivery routes to balance store count, delivery times, and minimize costs.

Will Peltier – Scrum Master

Graduated with my undergraduate degree in Information Science from the University of Colorado Boulder in 2023. I have no significant professional experience, but my skill set includes Python, R, scikit-learn, pandas, Numpy, Tableau and the Microsoft suite. I'm excited to solve this problem! I'll be on the Development Team for this project.

The Scrum Master would act as a facilitator and coach for the development team, ensuring that Agile practices are followed and that the team has an optimal environment to complete their tasks. This role involves removing any impediments that the team might face, facilitating Agile ceremonies (like daily stand-ups, sprint planning, reviews, and retrospectives), and working with the product owner to manage the backlog and guide the project smoothly.

Development Team

This team would be composed of individuals with diverse tech skills necessary to complete the project, others who might contribute to the development of the optimal routing model. The team would collaboratively work on the tasks in the backlog, self-organize to best achieve the sprint goals, and adapt their plans as necessary based on feedback and the results of iterative development.
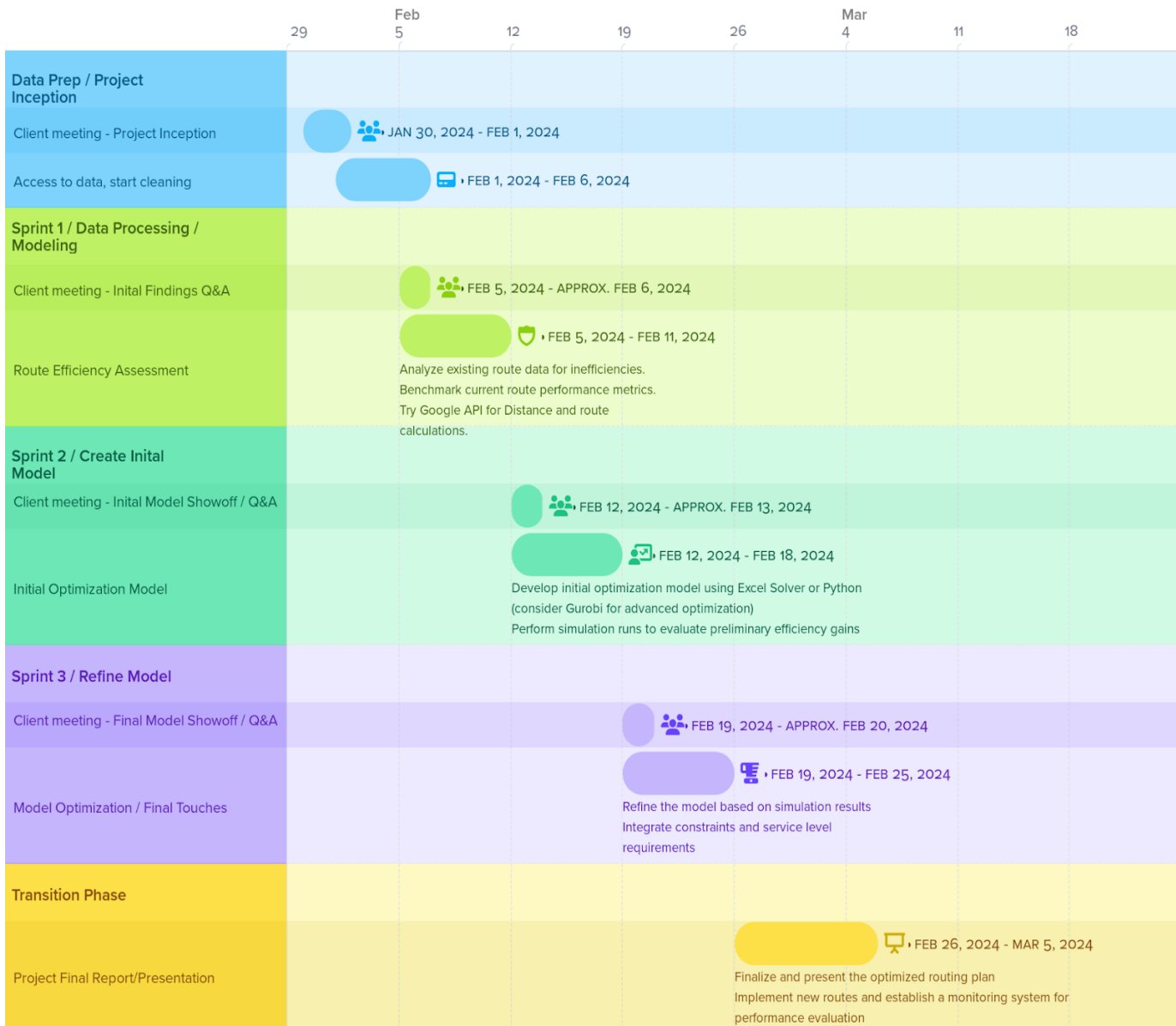
Members of the Development Team

Raghav Pariti: I graduated in 2022, with a bachelor's in Information Technology. I have a fair amount of experience in programming languages, and web development. I'm looking forward to this project as it poses as a great opportunity for me to use my coding skills! I will be the product owner for this project.

Vincent Carter: In 2023, I completed my undergraduate studies at CU Boulder, earning a degree in Accounting and Information Management and Analytics. My academic journey has equipped me with a solid foundation in Python, SQL, Alteryx, and Excel, enhancing my coding and data analysis capabilities. Engaging in this project presents a valuable opportunity to advance my programming expertise, deepen my understanding of business concepts, and gain practical experience in a real-world setting. I'll be on the Development Team.

Annan He: In 2023, I earned my degree in Aviation Management from Utah Valley University. Prior to my time at Leeds School, my experience with coding was limited. This project represents a significant opportunity for me to not only learn how to tackle complex problems collaboratively with my teammates but also to refine and enhance my analytical skills.I will be on the development team for this project.

Project Timeline

	Feb 5	12	19	Mar 4	11	18

Data Prep / Project Inception

Client meeting - Project Inception — JAN 30, 2024 - FEB 1, 2024

Access to data, start cleaning — FEB 1, 2024 - FEB 6, 2024

Sprint 1 / Data Processing / Modeling

Client meeting - Inital Findings Q&A — FEB 5, 2024 - APPROX. FEB 6, 2024

Route Efficiency Assessment — FEB 5, 2024 - FEB 11, 2024
Analyze existing route data for inefficiencies.
Benchmark current route performance metrics.
Try Google API for Distance and route calculations.

Sprint 2 / Create Inital Model

Client meeting - Inital Model Showoff / Q&A — FEB 12, 2024 - APPROX. FEB 13, 2024

Initial Optimization Model — FEB 12, 2024 - FEB 18, 2024
Develop initial optimization model using Excel Solver or Python (consider Gurobi for advanced optimization)
Perform simulation runs to evaluate preliminary efficiency gains

Sprint 3 / Refine Model

Client meeting - Final Model Showoff / Q&A — FEB 19, 2024 - APPROX. FEB 20, 2024

Model Optimization / Final Touches — FEB 19, 2024 - FEB 25, 2024
Refine the model based on simulation results
Integrate constraints and service level requirements

Transition Phase

Project Final Report/Presentation — FEB 26, 2024 - MAR 5, 2024
Finalize and present the optimized routing plan
Implement new routes and establish a monitoring system for performance evaluation

Project Outcomes

- **Week 1 (Sprint 1): Route Efficiency Assessment**
    - Analyze existing route data for inefficiencies.
    - Benchmark current route performance metrics.
    - Try Google API for Distance and route calculations.

- **Week 2 (Sprint 2): Initial Optimization Model**
    - Develop initial optimization model using Excel Solver or Python (consider Gurobi for advanced optimization)
    - Perform simulation runs to evaluate preliminary efficiency gains

- **Week 3 (Sprint 3): Optimization Model Refinement**
    - Refine the model based on simulation results
    - Integrate constraints and service level requirements

- **Final Outcome: Implementation and Monitoring**
    - Finalize and present the optimized routing plan
    - Implement new routes and establish a monitoring system for performance evaluation

Risks and Challenges

Data Accuracy and Availability: Ensuring that the data used for optimizing the routes, such as store and depot locations and delivery windows, is accurate and up-to-date. Inaccurate data can lead to suboptimal routing solutions.

Technology Integration: Integrating new optimization tools and algorithms (e.g., Google API, Excel Solver, Python libraries) with Rudi's existing logistics systems may pose technical and compatibility challenges.

Scalability and Adaptability: The model's ability to adapt to changes, such as adding new retail locations or changing delivery frequency requirements, without requiring significant rework.

Complexity of Constraints: The complexity of constraints, including specific delivery windows, varied frequency of deliveries to different stores, and no-delivery days, can make the optimization problem quite complex, potentially limiting the effectiveness of standard optimization models.

Project Strategy

To achieve our project goals, we've committed to adopting Agile Methodologies, ensuring a flexible and iterative approach to development. Our team's diversity, with members from various backgrounds, will be crucial for enriching our project with a wide range of perspectives and skills. This collective approach is fundamental to realizing our objectives with the highest quality outcomes

Getting Everyone on the same page

To start our project effectively, our team emphasizes fully understanding the problem statement, its constraints, and our vision for solving it. Recognizing the significant learning opportunities throughout the project's implementation, we prioritize acquiring and applying lessons learned to enhance our collective efficiency

Finalizing Data

Ensuring processing and cleansing of data is crucial for our Team's Objectives. This refined data will be helpful for route planning

Algorithm/ Model Selection

Selecting the optimal algorithm for route optimization is pivotal to the success of this project. Our team is dedicated to constructing a sophisticated optimization model utilizing tools like Microsoft Excel's Solver, Python programming, or graph-based algorithms. We will iteratively refine our model by rigorously testing it with various algorithms throughout the sprints to enhance performance and efficiency

Documenting and Presenting our Work

Upon completion of the third sprint, we will document our work, findings, and present. Our presentation will focus on the project's achievements, lessons learned throughout the process, both individual and collective growth, key discoveries, and the degree to which we have met our Key Performance Indicators (KPIs). This presentation is designed to showcase our concerted efforts and our dedication to achieving excellence in the project.

Key Takeaways

Leverage Advanced Analytics: Utilizing advanced optimization algorithms and tools like Gurobi and Python libraries can significantly enhance route efficiency and service frequency, leading to improved operational performance.

Focus on Incremental Improvements: Given the complexity of the optimization problem, focusing on achieving incremental improvements in route efficiency and delivery frequency can be a practical approach to realizing tangible benefits.

Emphasize Data-Driven Decisions: Making data-driven decisions based on accurate and comprehensive data analysis is crucial for optimizing delivery operations and achieving the desired outcomes.

Prioritize Flexibility and Scalability: Developing a routing model that is flexible and scalable will allow Rudi's to adapt to future changes in business operations, such as expanding to new retail locations or adjusting delivery frequencies.

Assumptions

Stable Retail Locations: It is assumed that the 50+ retail locations, including Costco and other stores, will remain constant throughout the optimization process, with no significant additions or closures that could alter the routing requirements.

Consistent Delivery Windows: The 9-hour daily delivery window and the 15-minute service time per stop are assumed to be consistent across all retail locations and throughout the optimization period.

Vehicle Capacity and Availability: It is assumed that the delivery vehicles have sufficient capacity to handle the deliveries for each route without overloading, and that there are enough vehicles and drivers available to meet the delivery schedule requirements.

Delivery Frequency Requirements: The requirement to deliver to Costco locations every working day except Wednesdays and Sundays, and to other retail stores at least three times a week, is assumed to be a fixed constraint that will not change during the optimization process.