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DECISION SCIENCE TECHNOLOGY

CASE STUDY

THE IMPORTANCE OF ADVANCED ANALYTICS COUPLED WITH ORGANIZATIONAL CHANGE MANAGEMENT IN RETAIL DISTRIBUTION

Keywords: Transport Planning and Scheduling – Cargo – Routing Optimization – Transportation Management System (TMS) – Deliveries and Transportation Planning – Math-Optimization – Grocery, Food, Beverage, Retail

Abstract

Advanced analytics such as math-optimization, advanced predictive modeling or dynamic simulation are key–success factors in a complex and competitive market. To maximize the benefit such type of projects must be combined with a change management and process re-engineering.

In this case we focus on the importance of the organizational "change management" adapting math-optimization techniques to support management decisions with a specific focus on transportation and goods distribution.

Topics:

1. How advanced analytics can be used to improve service level and cut costs of good distribution to a network of stores;

2. The importance of "change management" to solve and avoid natural and frequent organizational deadlocks to enhance profits.

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THE CONTEXT

A grocery retailer, “G-Retail Inc.”, serves food stores in a geographical area within a radius of about 200 miles.
The business organization follows the classical **cooperative model** where single entrepreneurs own of one or more stores and a central organization (cooperative) provides services including procurement, distribution, logistics, IT services.
Logistics operations are triggered by the **orders form the stores** that enable the **picking process** and the **distribution** by trucks to the stores.
Stores are **visited for deliveries based on a pre-defined weekly calendar.** A store is visited with higher or lower frequencies based on its overall sales volume: the higher the sales the higher the delivery frequency.
Different types of goods, fruits and vegetables, dairy products and meat, fish are delivered separately in different time windows of the day. The fleet is shared between the fruits & vegetables and grocery products. Fruits & vegetables are delivered during the night - and the groceries are delivered during the day.

THE PROBLEM AND THE CHALLENGES

Stores managers claim a **poor service level** from the distribution process, thus increasing the pressure on the local logistics manager. Their desire is to reduce the “goods-receiving” time windows, that is the time windows during which a truck can arrive at the store to deliver the goods.
The store managers were asking to reduce the delivery time-window to a maximum of **2 hours.** This request was based upon **a long history of late deliveries by the DC.** Clearly there was a **conflict between the single store managers,** requiring a higher service level and the need to **contain transportation costs at the central level**, in a period during which the transportation cost was slightly, but constantly, increasing for external reasons.
The distribution process was quite complex: several small stores in downtown areas, high level of traffic, tight time windows had to be respected for the delivery.
An additional problem to solve was related to the **frequent delays** of the delivery in specific days of the week due to **an intensive picking activity** in the warehouse which was causing a delay on the departure time of the trucks, from the warehouse.
The fleet management was based on the experience supported by standard software and managed directly by a 3PL logistic partner.

THE NUMBERS

- More than 200 stores served
- Each store is visited by trucks from3 up to 6 times per week based on a predefined calendar;
- Mileage of the fleet: 83,000 miles/month

THE SOLUTION

After a discovery meeting it was evident that before applying optimization, there was a tremendous need to understand the process and identify the correct sequence of actions. A data analysis permitted the team to identify how the different elements influence the costs and the specific reasons of frequent delays. The analysis permitted us to answers the key questions:

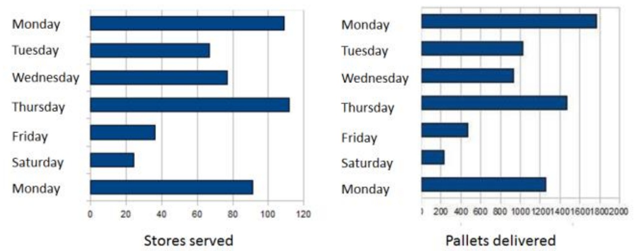
1. What do the stores managers really need for service level? How can we objectively measure it? What is the impact of a poor service level for the stores?

2. What is the sensitivity of the transportation costs respecting the service level, or in other words, increasing the service level of "x%" what is the incremental cost?

3. Why in certain days picking process generate more delays on transportation?

The fleet was composed by trucks of different dimensions. The as-is analysis showed that small trucks were over saturated in the early morning causing delays and impacting the activity of the day. The analysis showed that, maintaining the same organization of the distribution process, the request to serve a store within a 2 hour time window (service level 100%), would have dramatically increased the transportation by a cost of ~50%.
Once key-elements related to the as-is process were clear and measured, it was also clear the role of math-optimization to support the daily operations and improve the identified KPIs.

The next step in the project was analysis using the Ublique module of transportation scheduling and routing optimizer. By this analysis it was demonstrated that the optimizer would have reduced the cost increase to 30% vs. 50% without the adaption of optimization. In any case the goal of reaching a 100% service level (delivery time windows max of 2 hours) would have increased the transportation costs and this was something that the logistics manager wanted to avoid.
The analysis proceeded to figure out the saturation of the fleet per type of trucks during the day and during the week.
This analysis we permitted to demonstrate that part of the transportation cost was related to a significant variability of the workload during the week and within the day.
The following chart shows the variability in terms of stores served per day and number of pallets shipped.



This variability was generated by two elements:
1. **the weekly delivery calendar** which defines in which day of the week the stores receive the goods. It has to be highlighted that operatively, the calendar deliveries were also frequently subjected to exceptions. (Eg. a store requires an urgent delivery or to post-pone a delivery);

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2. the time-windows **constraints were concentrated in particular hours** of the day, with a consequent effect to oversaturate the smaller vehicles that typically serve the centers of the cities.

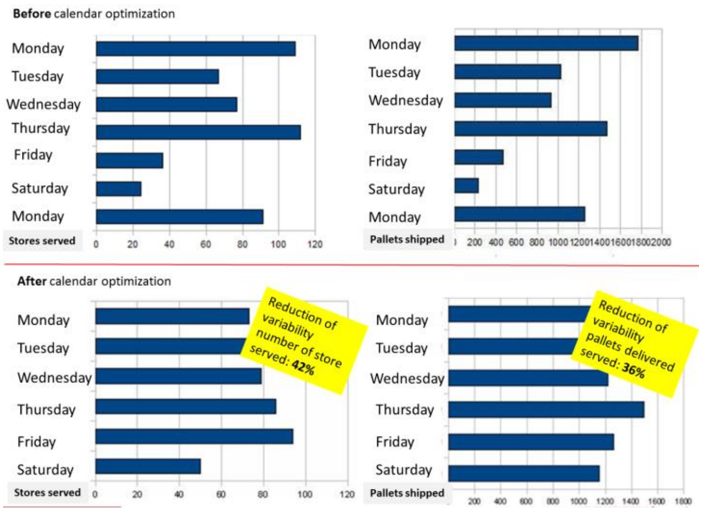
Based on this evidence, the team proceeded with an analysis optimizing the delivery calendars using another Ublique's optimizer in the transportation suite. The optimization considered multiple aspects:
1. the capacity of the distribution center to deliver a certain volume of pallets per shift;
2. the capacity of the fleet;
3. the demand of the single store;
4. commercial service level in terms visit frequency for the single store (number of visits per store per week);
5. specific constraints at store level – for example "store S1 cannot receive a truck the Monday morning".

The objective is to minimize the expected traveling distances and at the same time, maintain as much as possible a constant workload at the distribution center and utilization of the fleet.
By optimizing the delivery calendars, and simulating the distribution with these new calendars, it was demonstrated, as the following charts show, that it was **possible to contain the workload variability with a positive effect on the cost.** The variability reduction is 42% for the number of stores served per day and 36% in terms of pallets shipped.

The effects of such workload variability reduction are:

1. an improved capacity saturation in terms of fleet and resources for the picking process inside the warehouse;

2. the possibility to apply a standard delivery calendars



The transport simulation with the new calendars permitted to calculate in details all the KPI and including the impact on traveling distances of the new optimized calendar.

The simulation showed that using Ublique as a Deliveries and Transportation Planning for daily operation it was possible to reach the 100% of service level (2 hours of time-windows), limiting the extra cost due to the increased service level, to 17% against the original cost increment of 50% without any optimization (in other words 33% of cost reduction due to the optimizer).

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The team preceded with a sensitivity analysis on the delivery time windows changing them from 2, 3 and 4 hours. The results showed a significant impact: 17% of saving in the range from 2 to 4 hours' time windows.

This analysis pushes the team to evaluate if there was any possibility to keep the time windows wider with respect to the requested 2 hours without impacting on the stores operations. In other words, in order to further contain the distribution costs, is there any possibility to change the time windows, removing the 2-hours constraints at least under certain circumstances?

Interviewing some of the stores managers the reason why the stores managers were requiring a 2-hour max delivery time window: the stores managers need to schedule their personnel in the store. Due to the poor service of the distribution process (frequent delays), they were not able to schedule all the activities at the stores with a consequent increment of the personnel cost. Their unique internal lever for the store managers, to influence the distribution process was to force tight time windows. Thus they would know with a reasonable precision, the time of the trucks arrival permitting them to better organize store personnel for the receiving activities.

At this point the solution was evident:

1. optimize the calendar. Optimization should be reviewed every season due to customer seasonality buying habits, have special weeks during year with dedicated calendar days for deliveries, due to holidays;

2. introduce the optimizer Ublique as Deliveries and Transportation Planning to support the operation for the Fleet Scheduling and Routing;

3. organize the picking activity based on the transportation plan: the fleet plan is anticipated respect the picking and picking is organized based on the transport plan;

4. as the transportation plan is communicated several hours before the delivery to the stores it was also possible to send an automatic text and e-mail to the store providing the precise time of the next visit. Having such information the store managers were able to plan the activity and the personnel at the store and were open to accept wider time window (2 hours in certain case 3 or even 4 hours in others cases).

Each truck of the fleet had a GPS system, therefore made it possible to improve the service by alerting stores in case of any delay during the travel due to traffic or other unexpected conditions. Ublique receives every 5 minutes, the position of the truck and based on a specific algorithm estimate if there could be delays. In that case an alert is issued to the transportation manager and the system reschedules the route, providing the estimation of the new arrival times at the store.

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Summarizing:

1. By using Ublique deliveries were optimized weekly for store visits,

2. The time windows remain fixed at 2 hours only where there were specific logistic or commercial reasons and set at 3 hours as default for others.

3. Ublique used as a Deliveries and Transportation Planning permits the daily fleet schedule and routing.

4. The transport plan was used as the input to organize the warehouse picking activity

5. Stores received an early communication with the expected arrival time to the store;

6. A real-time module of Ublique permits the stores to be alerted in case of delay of the vehicle receiving the new expected time;

7. A fleet composition analysis addressed a review of the fleet in terms of number of trucks per type as the fleet was completely used to serve the stores network.

CONCLUSIONS

The numerical results related to the adaption of vertical Advanced Analytics were evident and summarized in the table below as it has also be evident for the stores managers the improvement of the service level.

KPI	As-is	Optimized	Saving
Number of routes/day	525	478	**9%**
Miles/week	20,588	17,265	**16%**

In addition to these results another important goal that was: a lesson learned by the whole organization: to measure facts, to perform “what-of analysis,” the re-engineering of the process and the openness to change the “consolidated” are fundamental to obtain concreate and stable results from these types of projects.

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