The Paper Research of Warehouse Management System for Restaurants

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Abstract. The quality, cost of the food and the eco-friendly of the restaurant is very important. Each restaurant needs to prepare their own vegetable, meat, oil, noodles etc. The purpose of the paper is to control the variations of quality, quantity and cost. While unnecessary storage space, time wasted for purchasing supplies should all be cut off. So then the warehouse is established and the warehouse management system is developed for the restaurant. In the new process, the food is gathered from the wholesalers to the warehouse. Then the food will be sorted into different categories so that each group has similar quality. After receiving orders from the restaurants, the food will be delivered to the restaurants daily or twice a day by milk run delivery, which means that the delivery goes through a certain sequence to satisfy the restaurants demand and drive back to the warehouse as a loop. With the warehouse management system, we can assure that the restaurant will maintain high service level with low cost while eco-friendly. With the application of this system, we hope that the aggregate forecast will be much more accurate and the supply will be stable with good quality. Not only will the customers satisfied by the good service level but in the future we plan to add the ID of the ingredient to make the food distribution more transparent.

Keywords. Risk Pooling, Milk Run Delivery, Food Logistic

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Introduction

It is very important to understand the restaurants since we need to eat every day. The quality, cost of the food and the eco-friendly of the restaurant is very important. Each restaurant needs to prepare their own vegetable, meat, oil, noodles etc. It requires a lot of time to buy all of the ingredients and take the risk of not being able to purchase them when supply is inefficient. Another issue is that small restaurant cannot make good forecast in demand. Most of the time they prepare more food than demand to assure high service level. More food means more storage space that meant no value-added. Not only quality and quantity, but also prices are unstable. With all the uncertainties the meals delivered to the customer has great variation, causing frustrated customers.
The purpose of the paper is to control the variations of quality, quantity and cost. While unnecessary storage space, time wasted for purchasing supplies should all be cut off.

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So then the warehouse is established and the warehouse management system is developed for the restaurant. The system starts with the restaurant. The restaurant updates the demand each day on the system and after calculating the whole amount of demand, the order is delivered to the wholesaler. While the truck will deliver the ingredients to the restaurants.

Figure 1. Warehouse Management System Process for Restaurants.

Literature review

This section introduces food logistic, milk run delivery, risk pooling.

Food logistic

We applied the research approach and modeling methodology in the food supply chain of a major fastfood restaurants chain in Greece. The supply chain of the form is comprised of a central producer and warehouse (CW) located in Thessaloniki, which then supplies directly sixty restaurants in northern Greece (NR). The firm also owns a distribution centre (DC) in Athens, which supplies sixty nine restaurants located in the southern and coastal Greece (SR). These organizations maintain a chain partnership (based on franchising contracts) to improve business performance via responsive operations combined with better utilization of resources. The franchising contracts cover various issues such as quality, customer service levels, etc. A major component of the replenishment contracts is related to food distribution (inventory replenishment policies, lead times, required storing space and conditions, delivery times, etc.). The specific characteristics of the system are the following:

- The desired fill rate of the restaurants is 100%. To maintain this goal the safety stocks at CW and the restaurants are considerable, even though the lead times are short. For the same reason both the inventory and the production capacity of CW in Thessaloniki is practically infinite.
- The demand for each restaurant is generally high and further fits to a normal distribution, the parameters of which are estimated applying standard statistical techniques on real data (fitting the sample mean and variance to the unknown parameters l and r2 of the distribution).
- The DC in Athens and each restaurant employ an (R,S, s) policy for inventory replenishment. Thus, inventory is inspected every R periods. If it is found to be at a level less than or equal to s then an order up to the desired inventory level, S is placed. This policy is formulated as an anchoring and adjustment process (described in Section 2.2). The review period R is set to 1 day. The optimal parameters S and s for each restaurant are determined using classical inventory management techniques (see Nahmias, 2001).

• The maximum acceptable lead time for an order is 24h. This implies that the central warehouse CW, or the distribution center DC, must adjust their delivery schedules to satisfy all orders within this time window. Deliveries may occur any time during day or night.

• Both the CW and DC maintain two independent fleets of trucks.

• When the number of the company-owned trucks is inadequate to satisfy demand, CW and DC currently lease third party trucks (usually trucks of a 3PL, third party logistics company) to accommodate increased demand. There is no additional delay in the acquisition of leased trucking capacity since the contractual agreements between the company and the 3PL guarantee immediate response for tracks and drivers. Naturally, there are constraints in leased capacity volume, but based on historical data these limits never became active in the past.

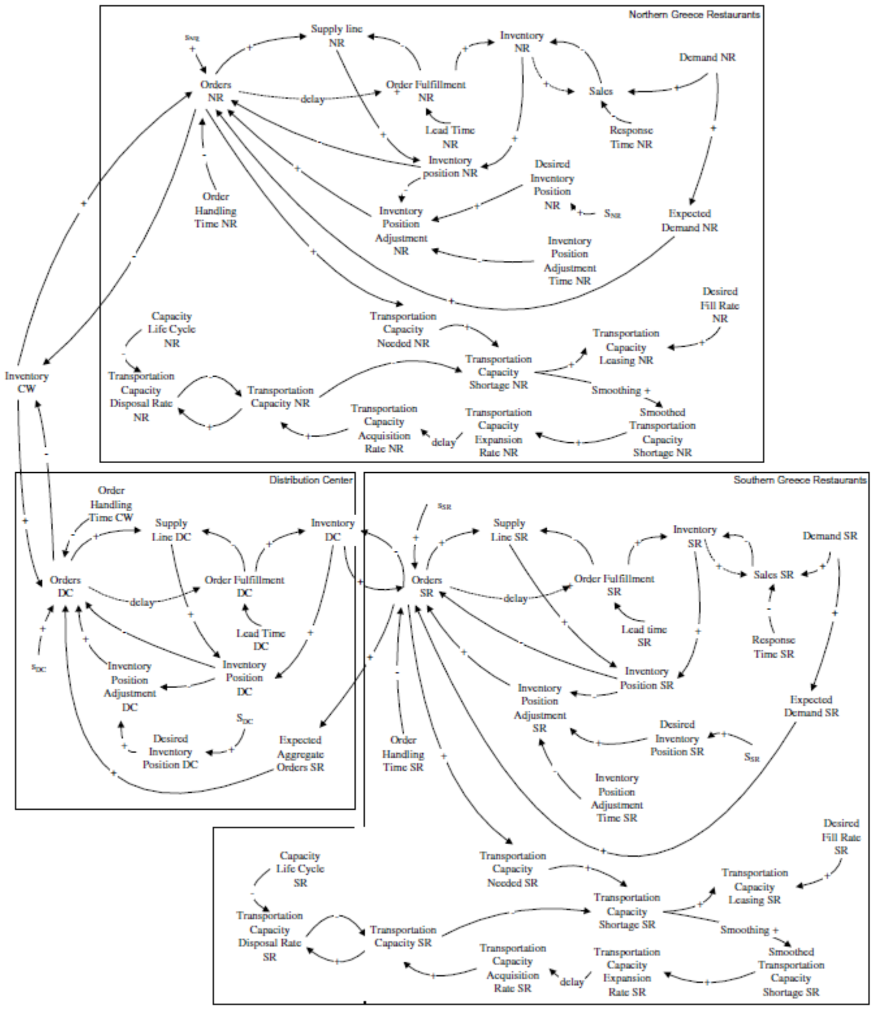

Figure 2. Fast food chain

Milk run delivery

Milk-Run logistics is a generic name of a logistics procurement method that uses routing to consolidate goods by the buyer. It is a method of goods collection in which the user (i.e. car assembly manufacturer) dispatches one truck at a specified time period to visit various suppliers (i.e. parts supplier) following a predefined route to collect parts or products, and deliver them to the factory. In general, the reasons why Milk-Run logistics has been widely employed are: 1. Reduction in transportation costs due to consolidated transportation offsetting even the use of small lot transport. 2. Improvement of the assembly manufacturer's production line and greater accuracy of JIT goods delivery due to synchronization. Milk-Run logistics can provide consolidated collection of goods necessary to improve logistics procurement systems. 3. Improvement of the vehicle loading rate, shorten the total distance traveled. It can achieve various suppliers and manufacturers of coordination, improve agility supplies and flexibility, but also improve the ability of the manufacturer's response and system efficiency. 4. It reduces the risk of product quality if problems. Manufacturers can quickly discover and inform the corresponding suppliers, to minimize the impact on sales. 5. It changes logistics strategies, using third-party logistics significantly reduce in-process inventory, increased capital flows, reduce investment risks.

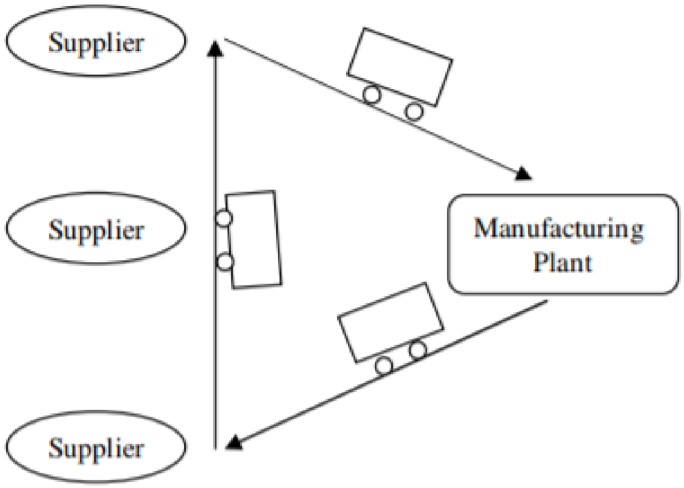

Figure 3. Milk Run Delivery

The milk run network can be solved by a classical vehicle routine problem (VRP) involving pickup and/or delivery requests, as it will be discussed later. On the other hand, a crossdocking transportation network can share vehicle sources and focuses more on the coordination of the service between suppliers and customers. It is implemented so that vehicles carry products from different suppliers, and products are then moved to other vehicles, which are dedicated to serving individual customers directly. However, if more products are shipped from suppliers than are needed by customers, a distribution centre is needed to maintain the inventory. A successful example of this type of distribution is Wal-Mart, which allows suppliers' (or retail stores') delivery vehicles to exchange goods directly with the vehicles of other retail stores in a distribution centre, and so maintains a very low inventory. A crossdocking network can cut the level of inventory greatly, but

requires a high degree of coordination among suppliers, retailers and vehicles. The third consolidation network, the tailored network, combines both full truckload and LTL by allowing high-volume orders to be shipped from suppliers to customers directly, and low-volume orders to be consolidated through the distribution centre (DC).
As it has been pointed out, when the orders are less than a truckload, the vehicle should be shared to save cost. This study will focus on developing a vehicle-dispatching system in a mixed milk run network, which consolidates services between suppliers and customers. In the network, a vehicle serves both suppliers and customers whenever orders are placed. Since current information technology allows rapid interaction (for instance, tracing the delivery path, tracing the status of an order, placing orders and changing orders), the environment is dynamic. In a work situation, as described in (Christopher, 1998), a company can benefit from the service by establishing a ’hot order’ channel between service engineers and field engineers to allow urgent shipment of parts for machines on repair. The service allows an order to be placed and picked today, dispatched tonight, and received and fixed tomorrow.

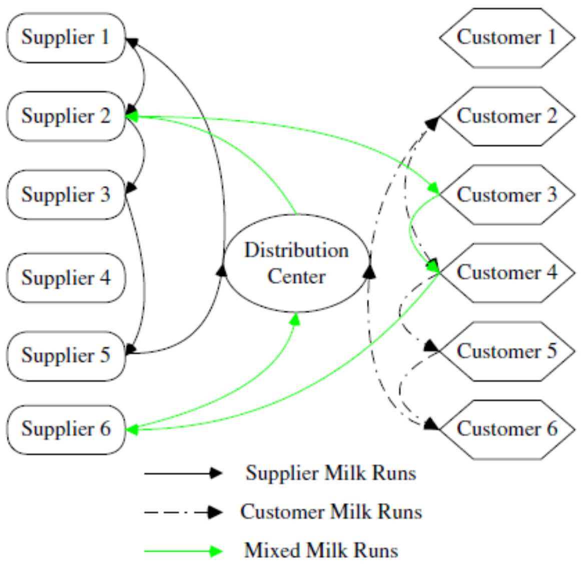

Figure 4. Supplier, Customer and Mixed Milk Runs

Risk pooling

This paper constructs and analyzes a multi-location inventory model to examine the value of warehouse risk-pooling in high service-level systems. Specifically, risk-pooling over the outside-supplier leadtime is examined. Two alternative systems of N identical retailers are formulated. In System 1, each retailer operates independently: retailers receive goods directly from an outside supplier after a fixed leadtime (Ls + Ltr), where Ls is the outside supplier's own (e.g., manufacturing) leadtime and Ltr is the transportation/receiving leadtime to the retailers. In System 2, the system order is shipped to a warehouse, arriving after a fixed leadtime (Ls + Ltw), where Ltw is the transportation/receiving leadtime to the warehouse. Upon receipt of the goods, the warehouse allocates and ships units to the retailers to equalize their inventory positions. The warehouse does not hold inventory. Allocation and reshipment in System 2 requires a fixed leadtime of (Lpw + Ltr) time periods, where Lpw is the allocation and (re)packaging leadtime at the warehouse. Hence, System 2 pools risk over the outside supplier leadtime, but at the cost of: (1) increased overall leadtime to the retailers; and (2) an 'internal' pipeline inventory holding cost. Our analysis asks the question: given equal required service-levels and equal safety stock holding cost (plus pipeline inventory cost for System 2), how large can System 2's extra leadtimes (Ltw, Lpw) be? Our analysis concludes that pipeline inventory-holding cost significantly influences the overall value of these breakeven leadtimes. Specifically, when pipeline inventory holding costs can (somehow) be ignored, the corresponding breakeven leadtimes can be quite large. However, if these costs cannot be avoided, then the corresponding breakeven leadtimes are significantly reduced. Managerial interpretations are provided.

Methodology

Step1: The vendors order on the warehouse management system
The vendors select the demanded items and the amount on the warehouse management system platform.

Step2: The orders then are passed to the warehouse and organized
The warehouse received the order from the vendor and start sorting items and amount. Prepare the data for routing.

Step3: The delivery routing is planned and delivered
The delivery will be planned by milk run delivery and delivered to vendors in an certain frequency.

Step4: The warehouse then sent the order to the wholesaler
The warehouse add up all the demand with scale of economics and can bargain price with the wholesaler. Then sent the order.

Expected Result and Future Work

(1) The restaurant can maintain high service level.
(2) The restaurant can order ingredients in a lower price.
(3) The restaurant can serve food fresh.
(4) The warehouse management system can have the power to bargain price.
(5) The warehouse management system can predict the total demand and reduce waste.
(6) The warehouse management system can also schedule the delivery route.
(7) The warehouse management system can storage the ID of the ingredient to make the distribution more transparemt.

In the new process, the food is gathered from the wholesalers to the warehouse. Then the food will be sorted into different categories so that each group has similar quality. After receiving orders from the restaurants, the food will be delivered to the restaurants daily or twice a day by milk run delivery, which means that the delivery goes through a certain sequence to satisfy the restaurants demand and drive back to the warehouse as a loop. With the “Warehouse Management System for restaurants”. The delivery frequency can be doubled, and after risk pooling means more accurate forecast. With economies of scale the quality and price will be more stable. What is best is that the food can be sent to the restaurant after a few clicks on the ordering webpage and the customers can enjoy the meal.

Conclusions

With the warehouse management system, we can assure that the restaurant will maintain high service level with low cost while eco-friendly. With the application of this system, we hope that the aggregate forecast will be much more accurate and the supply will be stable with good quality. Not only will the customers satisfied by the good service level but in the future we plan to add the ID of the ingredient to make the food distribution more transparent.

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