**MIDDLE EAST TECHNICAL UNIVERSITY**

**INDUSTRIAL ENGINEERING DEPARTMENT**

ENGINEERING MANAGEMENT PROGRAM

**EM 599 - TERM PROJECT**

***FINAL REPORT***

# MONTE CARLO SIMULATION IN LOGISTICS PRICING

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09.07.2021

# Table of Contents

## 1. INTRODUCTION

The aim of this project is to investigate and improve the present logistics operations of Constantia ASAŞ, Ankara. In this study; distribution strategy, logistics pricing and facility expansion will be covered. Throughout the investigation, the main objective is to provide a detailed and structured logistics analysis for the decision makers.

### 1.1. The Company – Constantia ASAŞ

ASAŞ was founded in 1978 by the Turkish entrepreneur Vural Baylan. Main product of ASAŞ was flexible packaging for consumer goods, such as snacks, chips, confectionery and so on (Figure 1). As ASAŞ had proven its superior quality and production capability; factory was purchased by the Constantia Flexibles Group in 2011. Now, the factory serves consumer goods producers in four continents.

Constantia Flexibles Group is one of the biggest flexible packaging producers for consumer goods and healthcare products. Although the group is based in Vienna, Austria; their products reach all over the world thanks to the 36 factories in 16 countries with more than 8000 employees.


Figure 1: Main product examples for ASAŞ

### 1.2. Problem Definition

In this study, customer and logistics firm names will be altered for the sake of corporate data protection.

As mentioned previously, ASAŞ has both domestic and foreign customers. ASAŞ has agreements with two different logistics firms to deliver finished goods, depending on whether the customer is domestic or foreign. For the domestic customers, the distribution is carried out by a firm named TransCo Logistics. The only exception for this is that several domestic customers prefer to use their own logistics firm. From now on, explanations and calculations will be for the domestic customers which ASAŞ uses TransCo Logistics for the deliveries.

By its nature, food manufacturers avoid having high inventory levels due to the spoilage. As a result of their just-in-time production mentality, they also avoid having a high level of raw material inventory in their stocks. To achieve this, they share the master production schedule with the suppliers and require bringing the production part by part in a large interval as needed. However, packaging film production is a continuous process. In other words, it requires high setup costs, time and work force. Therefore, ASAŞ prefers to produce the order in a single action, since it is much more cost saving. Yet, insufficient warehousing conditions are a downside for ASAŞ. The factory may not able to store all the finished products depending on the seasons.

According to the agreement between ASAŞ and TransCo Logistics; TransCo is responsible for both distribution and storage with its 6 warehouses in Turkey. ASAŞ pays 4500 TL for each delivery, regardless of how many pallets are loaded and whether TransCo warehouse is used or not. For example, below 4 scenarios will be charged the same price:

- From ASAŞ to Eskişehir: 30 pallets will be delivered directly to customer A
- From ASAŞ to Eskişehir: 10 pallets will be delivered directly to customer A and then 20 pallets will be delivered to customer B. Both customers are in Eskişehir.
- From ASAŞ to İstanbul: 10 pallets will be delivered directly to the customer, but 20 pallets will be stored in TransCo warehouse in İstanbul until the final delivery.
- From ASAŞ to Gaziantep and Mersin: 10 pallets will be delivered directly to the customer in Gaziantep, but 10 pallets will be stored in the TransCo warehouse in Gaziantep. The remaining 10 pallets will be delivered directly to the customer in Mersin.

ASAŞ may use trucks to visit different cities and firms. However, if the number of visit points exceeds 3, ASAŞ pays an extra of 300 TL for each.

Since the pricing policy is quite uncertain, one may not claim whether ASAŞ overpaid or underpaid for these logistics services. Moreover, a company in Eskişehir(235 km to Ankara) and a company in Tekirdağ(715 km to Ankara) are equally job costed in this pricing policy which is not fair and smart.

Why does ASAŞ need this study?

In the last few years, customer demand statistics have changed significantly. Customers tend to order smaller lots sizes to be able to minimize their inventory levels. In this case, ASAŞ should also adapt its logistics behavior accordingly to overcome the situation. The current pricing policy could be a reasonable agreement by the time; however, it needs to be investigated once again if it is still reasonable or no longer feasible. For this purpose, investigation should be fed by the current statistics and forecasts.

The aim of this project is to clarify logistics behavior and dynamics of ASAŞ, so that the decision makers will be able to negotiate with TransCo for a better deal. In the current situation, TransCo charges ASAŞ based on the number of trucks used and number of visit points above 3 of a single truck. However, how many times did ASAŞ exceed 3 visit points in a single truck? For example, if 90% of the deliveries have 4 or more visit points, in this case ASAŞ pays lots of extra money to the TransCo, which is not reasonable. Or maybe ASAŞ uses 90% of the trucks to deliver all the goods to a single visit point. In this case, why should ASAŞ negotiate for 3 visit points? In other words, ASAŞ's new agreement with TransCo should be based on the needs and behaviors of ASAŞ.

Of course, the decision making should rely on past statistics of ASAŞ in order to be realistic and reasonable. However, an important question is which statistics will be taken as the source. By the aid of the ERP system of the company; past sales data, past logistics data and past delivery data can be obtained. One may think that, since the aim is to improve logistics pricing, past logistics data can be a good guide. However, this will mislead the interpretation. Logistics executives in ASAŞ, arrange deliveries in a way that cost is minimized for the current model. Therefore, the shipments can be said to be biased. In other words, if ASAŞ wants to change logistics mentality, then delivery gathering policy should be also changed accordingly. For example, since big and small trucks are charged the same price, ASAŞ tries to deliver the goods with big trucks as much as possible. For this purpose, ASAŞ tries to gather as much as order it can to maximize truck fullness. However, if small trucks were cheaper, then it could be considered for different models. On the other hand, when past logistics data is investigated, one may think that ASAŞ always uses big trucks, so it was not needed to take small trucks into account for the new model. Would it be meaningful and helpful for the next agreement?

It would be wiser to set sales data as the source to generate forecasts. By doing this bias will be eliminated from the solution.

This study is not only important to prove that there is a more profitable pricing policy, but also to improve ASAŞ's job costing.

### 1.3. Roadmap

To be able to understand the current situation deeply, deliveries should be simulated. By using previous years' sales records, future orders can be forecasted. By using Monte Carlo Simulation technique, imaginary order times, amounts and sizes will be generated, from the past data.

Depending on their location, cities have grouped into regions; Aegean, Marmara, South. Since the trucks may contain different firms' and cities' deliveries; the generated orders will be aggregated depending on the city and the region by using computer software Python.

Obtained statistics will be used to decide optimal logistics strategy for ASAŞ. For the decision makers there will be 3 options with profit studies; go ahead with current agreement, renting a warehouse near ASAŞ and building a new warehouse in the facility.

## 2. OVERVIEW

### 2.1. Customers

Nowadays, ASAŞ has more than 50 active Turkish customers in 12 different cities. Most of the customers produce food products and there are also several hygiene product manufacturers.

Some of the customers have a strong business cooperation with ASAŞ for over 30 years. But also, there are customers with inconsistent order behavior over the years. Approach throughout the project for each of them will be different.

### 2.2. Demand

Although there is not a significant fluctuation in the demand for hygiene products, food products show extreme seasonality.

As mentioned above, food producers stick to a just-in-time mentality. In other words, food producers want to have the packages just before they start production. Therefore, demand for hot beverages in the food producer would not be different from the demand for its package in ASAŞ. In the wintertime, people are more likely to consume hot beverages, such as coffee (Figure 2). In Figure 2, it can be seen that there is an increase in the wintertime. Similarly, one may expect to see an increase in ice-cream demand in the summer. Seasonality must be the main concern while generating the demand forecasts.

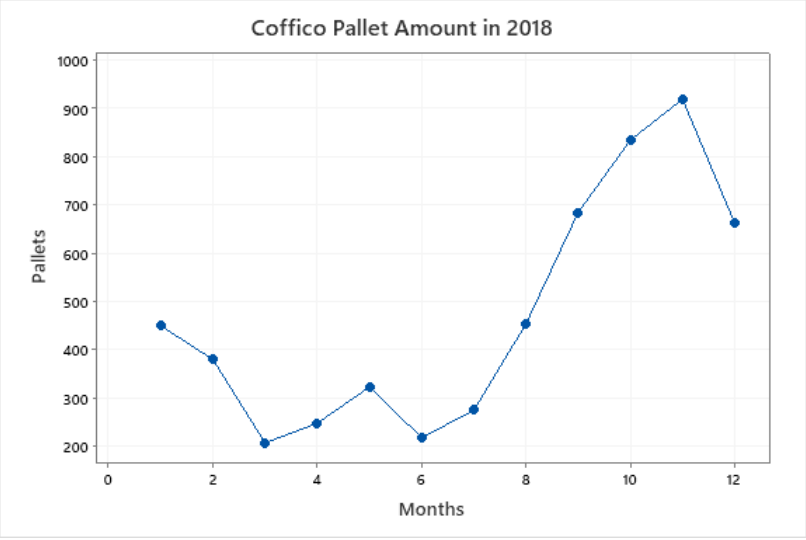



Figure 2: CoffiCo Turkey Coffee Demand in 2018

On the other hand, demand cannot be defined solely by seasonality. There are also yearly increases and decreases for the firms and the product groups (Figure 3). Firms may increase or decrease their orders year by year as ASAŞ gains/losses their trust by its performance. Those factors should also be included.

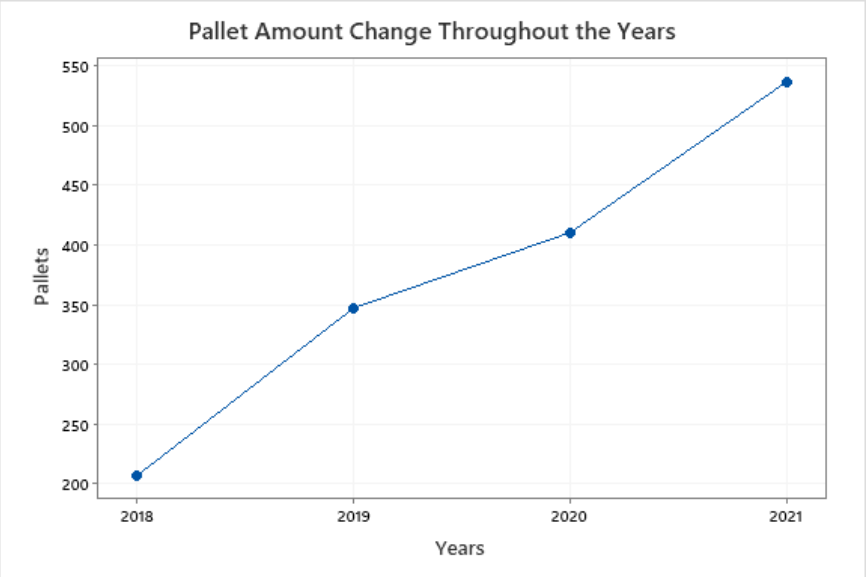



Figure 3: Pallet Amount Change for CoffiCo Turkey Throughout the Years

There are also sudden changes. In the Euro 2020 football tournament, Cristiano Ronaldo replaced Coca-Cola with a water bottle in press conference. This gesture may cause a change in Coca-Cola sales. Although the Coca-Cola sales will be higher again in the summertime than the winter, next year's summer sales can be expected to lower than the previous summer sales. Similarly, yeast products had a rapid increase after the pandemics because people tended to bake pastry in their home to avoid going out. This type of changes will be taken into account by manipulating the forecasts.

Interpreting the demand trend for big customers is easier. For example, ASAŞ has built a strong partnership with CoffiCo Turkey for years. ASAŞ is responsible for specific product groups for more than 20 years, so that the demand can be forecasted in terms of years and also seasons. There are two main CoffiCo products for ASAŞ: coffee and cereals. By looking at the total demand for them, meaningful data cannot be extracted. In the total graph, there is an increase starting in winter which lasts up to spring. Although it may look like a big bump; actually, there are two different peaks, winter for coffee and spring for cereals. In other words, each product group has their own seasonality. So, the remedy is to split product groups under the customer. To exactly know the behavior, the graphic should be evaluated separately.

In contrast, there are also small firms that come up with orders, after years with no appearance on the sales records. However, those small firms should also be included in the study because although their orders are inconsistent and small compared to big ones, the total of small firms should not be neglected. They are usually in Gaziantep or İstanbul, therefore they can be grouped and considered as a single firm. This manipulation will eliminate the fluctuation in the trend.

Although they do not have a meaningful trend as single firms, aggregation of small firms can be a good indicator.

To be able to extract meaningful data from previous sales records, separation and aggregation will be used in the next chapters.

## 3. PROCEDURE

### 3.1. Tools

The study was started with extracting the sales record from the ERP system to the Microsoft Excel. However raw data was not ready to be processed because there were noise entries. By using Excel, raw data was cleansed.

Then, by putting raw data to Minitab, data visualization and distribution fitting was applied for the sales record.

In order to perform Monte Carlo Simulation, Python software is used. By using Minitab results and Python's Random module, random data has been generated. Generated data has been processed and extracted to the Excel for the final evaluation.

### 3.2. Generating Random Orders

At this point, it is needed to clarify the definition of order. Sometimes when ASAŞ receives an order, the order amount is the monthly total amount needed by the customer. However, most of the time customers want to receive the goods in several lots. For ASAŞ, producing the total amount in a single action is much more cost saving. As a result, when ERP system data is examined, it is observed that for each order number there are several delivery entries (Table 1). Therefore, it is hard to track and interpret by looking at orders data. Instead, it would be wiser to work on deliveries data. From now on, each delivery will be considered and identified as an order, for the ease of understanding.

Table 1. Delivery Schedule for a CoffiCo order

| Order Number | Order Date | Customer | Total Amount Produced(kg) | Delivery Date | Delivery Amount(kg) |
|---|---|---|---|---|---|
| 623363 | 10.07.2020 | CoffiCo | 9948.96 | 22.08.2020 | 948.6 |
| | | | | 24.08.2020 | 4561.8 |
| | | | | 25.08.2020 | 562.6 |
| | | | | 28.08.2020 | 3185.52 |
| | | | | 31.08.2020 | 258.56 |
| | | | | 10.09.2020 | 431.88 |
| | | | | Total | 9948.96 |

As mentioned previously, for the food products seasonality is an important concern. Therefore, the intention is to investigate each customer while taking the month into account. To achieve this,

Minitab's Decomposition of Time Series is used. This tool is fed by monthly order amounts(counts) of previous years (Table 2) to predict next year's amounts by months (Figure 4). What is good about this tool is that it can both include yearly trends and seasonality at the same time. Minitab fits an approximation to the distribution and gives error values for each previous month (Table 3). When those error values are put into Minitab's distribution fit tool, it was seen that error values follow normal distribution (Figure 5). In the end, by the aid of Minitab, order amounts can be randomly generated depending on the forecast and the error value which is coming from normal distribution (Table 4).

Table 2. Previous Order Amounts of Coffico

| 2018 | Order Amount | 2019 | Order Amount | 2020 | Order Amount |
|---|---|---|---|---|---|
| Month 1 | 114 | Month 1 | 108 | Month 1 | 117 |
| Month 2 | 77 | Month 2 | 98 | Month 2 | 83 |
| Month 3 | 100 | Month 3 | 83 | Month 3 | 77 |
| Month 4 | 78 | Month 4 | 93 | Month 4 | 102 |
| Month 5 | 71 | Month 5 | 81 | Month 5 | 59 |
| Month 6 | 69 | Month 6 | 39 | Month 6 | 66 |
| Month 7 | 61 | Month 7 | 76 | Month 7 | 89 |
| Month 8 | 102 | Month 8 | 47 | Month 8 | 118 |
| Month 9 | 126 | Month 9 | 79 | Month 9 | 103 |
| Month 10 | 143 | Month 10 | 98 | Month 10 | 111 |
| Month 11 | 127 | Month 11 | 59 | Month 11 | 89 |
| Month 12 | 96 | Month 12 | 97 | Month 12 | 95 |

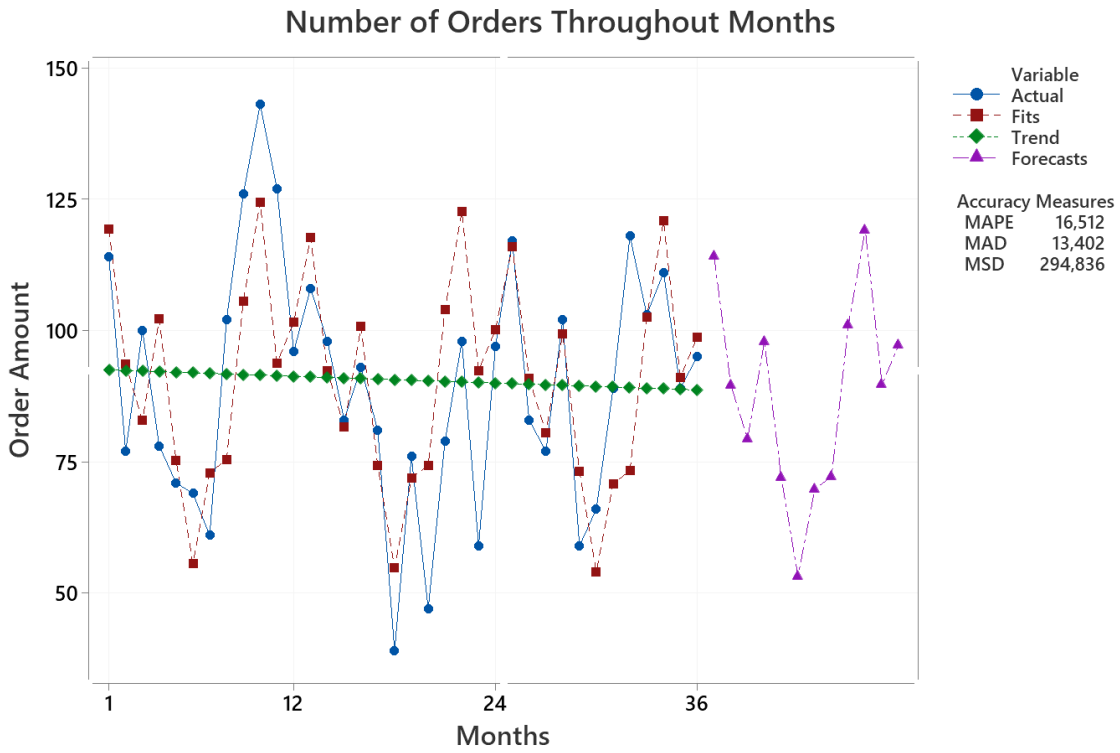



Figure 4: Next Year Forecast for Coffico in Minitab Decomposition

Table 3. Error Values for the Previous Months

| | Error Value for 2018 | Error Value for 2019 | Error Value for 2020 |
|---|---|---|---|
| Month 1 | -5.333 | -9.654 | 1.024 |
| Month 2 | -16.620 | 5.698 | -7.982 |
| Month 3 | 17.129 | 1.298 | -3.532 |
| Month 4 | -24.178 | -7.736 | 2.706 |
| Month 5 | -4.313 | 6.751 | -14.184 |
| Month 6 | 13.405 | -15.807 | 11.979 |
| Month 7 | -11.882 | 4.150 | 18.182 |
| Month 8 | 26.561 | -27.368 | 44.701 |
| Month 9 | 20.451 | -25. 049 | 0.449 |
| Month 10 | 18.530 | -24.699 | -9.929 |
| Month 11 | 33.255 | -33.409 | -2.075 |
| Month 12 | -5.593 | -3.145 | 3.697 |

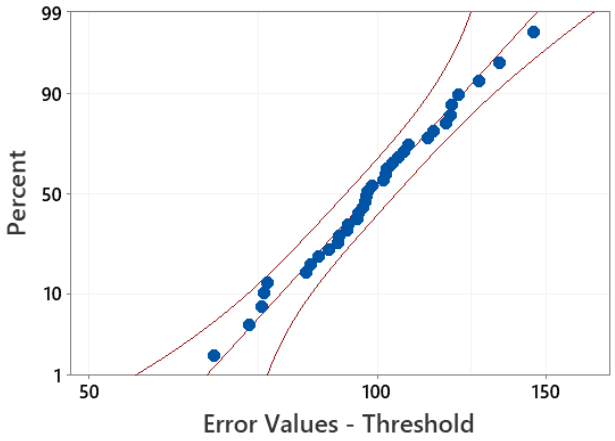
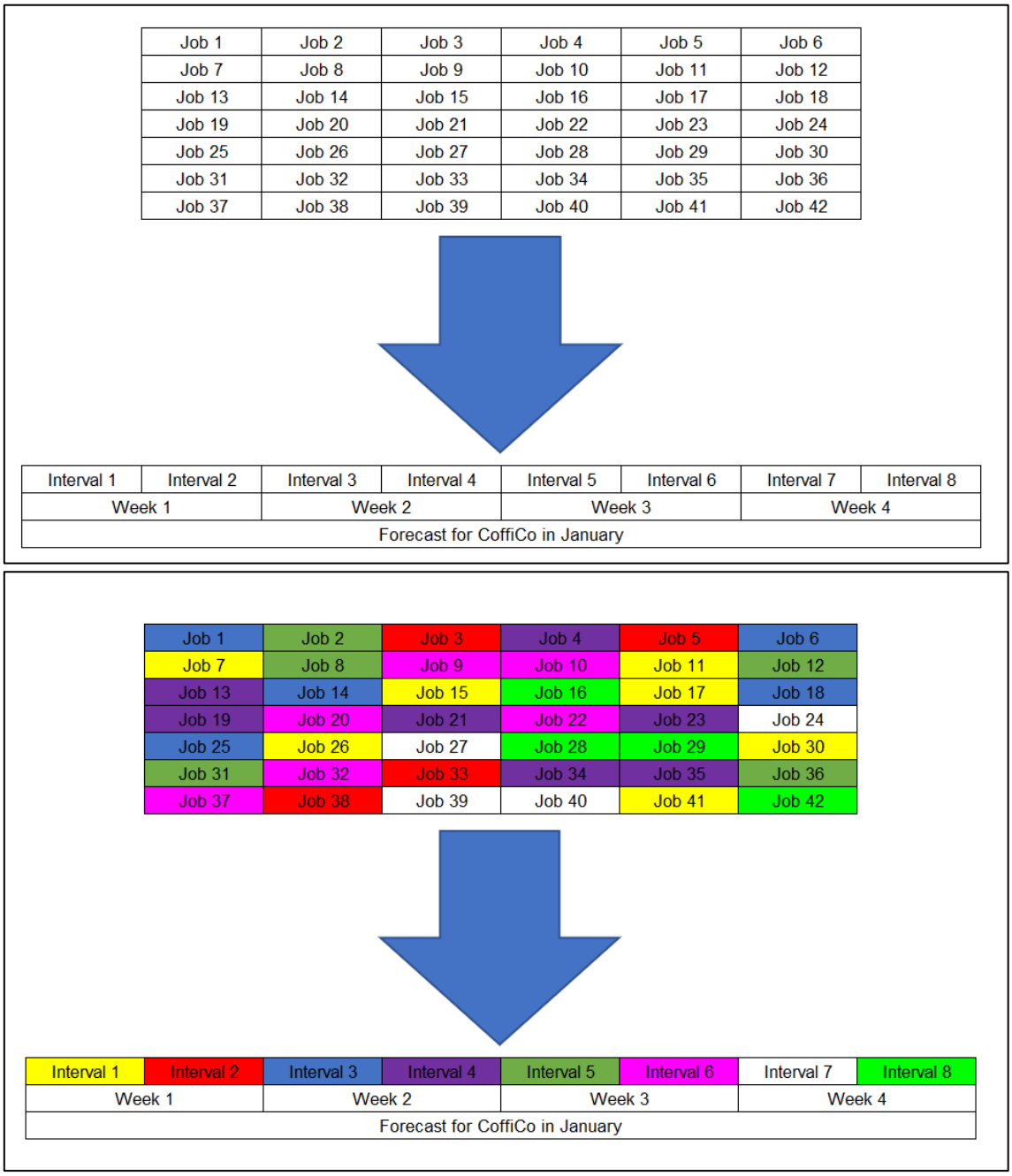



Figure 5: Probability Plot for Error Values

Table 4. Forecasted Order Amounts and Error Values for the Next Year

| | Forecasted Order Amount | Error Value(μ;σ) |
|---|---|---|
| Month 1 | 114.2 | (-0.831;17.393) |
| Month 2 | 89.66 | (-0.831;17.393) |
| Month 3 | 79.36 | (-0.831;17.393) |
| Month 4 | 97.85 | (-0.831;17.393) |
| Month 5 | 72,11 | (-0.831;17.393) |
| Month 6 | 53.23 | (-0.831;17.393) |
| Month 7 | 69.78 | (-0.831;17.393) |
| Month 8 | 72.22 | (-0.831;17.393) |
| Month 9 | 101.05 | (-0.831;17.393) |
| Month 10 | 119.15 | (-0.831;17.393) |
| Month 11 | 89.74 | (-0.831;17.393) |
| Month 12 | 97.24 | (-0.831;17.393) |

This action is repeated for all product groups and firms. After forecasting how many orders will be received, each order should be assigned the following dimensions: time and pallet amount. Although time is known in terms of month, it needs to be specified narrower. Narrower time assignment is crucial because deliveries in the same time interval and city will be gathered and loaded to the same truck. ASAŞ is able to strain production units to finish the goods several days earlier than planned. Similarly, the customers also allow ASAŞ to delay a delivery several days. So, orders in several days range can be gathered. For this project, a week is divided into two time intervals. Once the total number of orders is calculated for the customer and month, each order will be randomly assigned to one of eight intervals in the month (Figure 6).



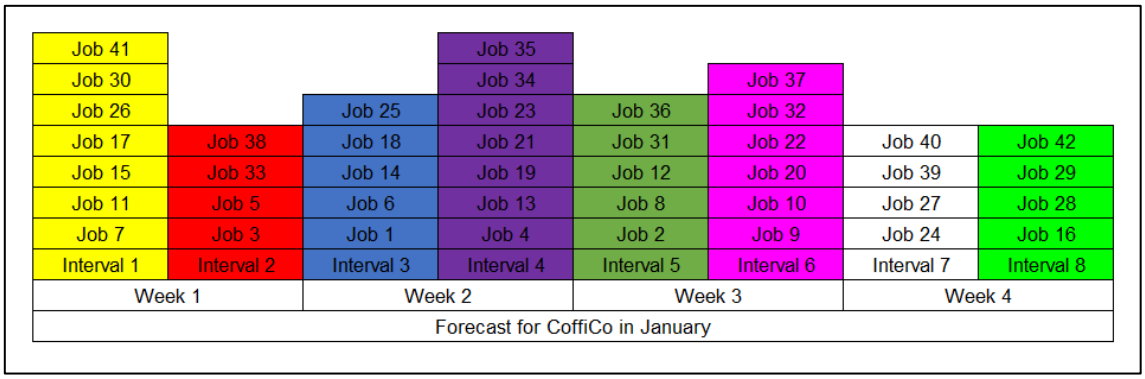



Figure 6: Random Distribution to the Intervals

In the next step, orders will be assigned pallet amount data. Approximate pallet amount in an order is 3, but it highly depends on firm characteristics and seasonality. Thus, pallet amount data should be generated from the respective firm and month. For example, the algorithm collects past January orders for CoffiCo Turkey, then creates probabilities of pallet amounts occurrence.

What percentage of orders were 1 pallet in January for CoffiCo Turkey?
What percentage of orders were 2 pallets in January for CoffiCo Turkey?
…

Those percentages will be decisive while generating an order in next year's January for CoffiCo Turkey.

### 3.3. Gathering the Orders

Trucks may carry different orders if the delivery dates and locations are close to each other. As described earlier; to be able to define "close date", time intervals were created and a time interval is one half of a week.

Algorithm starts with the city which has the highest total amount of pallets to be able to minimize the total city visit amount. If there is an empty space for more pallets, then other cities' orders are added to the trucks.

Big trucks are able to carry 33 pallets, and small ones 18. However, in the current pricing, big or small trucks do not change the price. Therefore, in the ASAŞ logistics department, the intention is to maximize the pallet amount and use big trucks instead of small ones.

While gathering the suitable orders in the joint trucks, also theoretical distances are added.

### 3.4. Summarizing a Year Simulation

Up to now, all the calculations have been made to simulate a year. However, the process involves lots of randomness in the parameters. Therefore, it is needed to re-run the simulation many times. In this project, simulation has been repeated 5,000 times and recorded.

## 4.RESULTS

### 4.1. Rendered Parameters

During the simulation, parameters have been rendered to understand dynamics of the phenomena. As mentioned above, each line involves summarized data of a year simulation. Since the table is quite long and large, it could not be added to the report. However summarized parameters for 5000 replications are as follow (Table 5):

- Total Number Of Vehicles
- Percentage of Big Trucks Used
- Percentage of Small Trucks Used
- Total Pallet Amount
- Average Travel Distance of a Vehicle
- Percentage of Vehicles That Visit Only 1 City
- Percentage of Vehicles That Visit 2 Cities
- Percentage of Vehicles That Visit 3 Cities
- Percentage of Vehicles That Visit 4 Cities
- Percentage of Vehicles That Visit Only 1 Firm
- Percentage of Vehicles That Visit 2 Firms
- Percentage of Vehicles That Visit 3 Firms
- Percentage of Vehicles That Visit 4 Firms
- Percentage of Vehicles That Visit 5 Firms
- Percentage of Vehicles That Visit 6 Firms
- Percentage of Vehicles That Visit 7 or Higher Firms

Table 5. Summarized Parameters for 5000 Replications

| Parameter | Mean and Std. Dev. |
|---|---|
| Total Number of Vehicles | 628,7±16,4 |
| %Big Truck | 75,9±1,3 |
| %Small Truck | 24,1±1,3 |
| Pallet Amount | 19561,7±601,6 |
| Total Distance | 12,307,118±679,188 km |
| Average Distance of a Truck | 580±4,8 km |
| 1 City% | 62,6±1,8 |
| 2 Cities% | 32,9±1,7 |
| 3 Cities% | 2,9±0,9 |
| 1 Firm% | 25,6±1,6 |
| 2 Firms% | 26,8±1,7 |
| 3 Firms% | 20,4±1,6 |
| 4 Firms% | 10,3±1,4 |
| 5 Firms% | 5,3±0,9 |
| 6 Firms% | 4,2±0,7 |
| 7 or Higher Firms% | 3,9±0,9 |

## 5. SCENARIOS

### 5.1. Decision Making for Warehouse

As stated earlier, the current agreement with the logistics firm also involves warehousing price. Since ASAŞ's warehouse is not sufficient to store all the finished goods, TransCo warehouses are utilized for the goods that await delivery to the customer. In Table 6, TransCo's fee for different cities information is shown. This price information is valid solely for the transportation operations. Average of the ratios will be used in the final calculations. Simulations suggest that if ASAŞ pays per km price, it would be much more cost saving. However, one should also keep in mind that ASAŞ will face warehousing fees for each pallet/delivery. To eliminate this downside, ASAŞ must consider two options; building a new warehouse in the facility or renting a depot near the facility to warehouse the goods.

Table 6. TransCo Fee Table

| | Distance(km) | Fee(TL) | Price per Distance(TL/km) |
|---|---|---|---|
| İstanbul | 543 | 2700 | 4.972 |
| Tekirdağ | 618 | 2975 | 4.814 |
| İzmir | 614 | 2750 | 4.479 |
| Bursa | 495 | 2175 | 4.394 |
| Gaziantep | 751 | 3400 | 4.527 |
| Mersin | 555 | 2375 | 4.279 |
| Adana | 548 | 2375 | 4.334 |
| | | Avr. | 4.543 |

Warehouse planning is not only important for the goods stored in TransCo's depot, but also important for all finished products, raw material and equipment. ASAŞ already rented a warehouse to keep its equipment. Similarly, raw material storage is a real struggle. Therefore, warehouse planning may also include these three important components. However, this is out of scope of this study.

ASAŞ can already store 600 pallets in the current facility. However, there are also other customers which are not included in this study. Therefore, ASAŞ can only spare 300 pallets capacity for this study. In Table 7, pallet information for the last 3 years can be seen. On average, ASAŞ must store 681 pallets daily. In the extreme case, ASAŞ stored 1150 pallets on the same day. Therefore, ASAŞ needs more places to store more pallets.

Table 7. Pallet Storage Data

| Type | Amount |
|---|---|
| Average Pallet Amount Stored in a Day | 681 |
| Maximum Pallet Amount Stored in a Day | 1150 |
| Minimum Pallet Amount Stored in a Day | 172 |
| Maximum Daily Amount Palletized | 142 |
| Average Amount Palletized in a Day | 42 |
| Average Amount Departed in a Day | 43 |

### 5.2. Renting a Warehouse Near to the Facility

According to market research for warehouse renting. ASAŞ will pay 5 TL for each entry/exit of a pallet. Also, to transfer those pallets from facility to warehouse, ASAŞ will pay 400 TL.

ASAŞ will use this warehouse to store 15,000 pallets annually. For entry and departure ASAŞ will pay 10x15,000=150,000 TL. Also, for the transfer, 470 trucks will be used which will cause 188,000 TL. Also, the building renting price will be 20,000TL per month.

All in all, ASAŞ will pay 582,000 TL for renting a warehouse near to the facility.

### 5.3. Building a New Warehouse

ASAŞ may also consider building a new warehouse in the existing facility. On average, ASAŞ needs more space to store the remaining 381 pallets. However, satisfying average needs may not be sufficient because in the peak time, there may be 800 more pallets to be stored. In fact, new building calculations can be made for 800 pallets because it can also help for raw material storage needs. Market research suggests that building a warehouse with 800 pallets capacity is 3,000,000 TL. However, in this option, transportation cost and entry/exit price will be eliminated, so that it is also reasonable.

## 6. DISCUSSION

### 6.1. Decision Making for Renting a Warehouse Near to the Facility

- Average total distance covered in a year is 364,645 ± 9,647 and average price per distance is 4,543 TL/km. So, total price paid will be 1,656,582 ± 43,826 TL.
- In section 5.2, it is calculated that ASAŞ will pay 582,000 TL for renting the warehouse.
- By looking at the parameters in Table 5, in the current pricing policy, ASAŞ would have to pay 2,921,598 ± 73,265 TL.

2,921,598 - 1,656,582 - 582,000 = 683,016

The %95 Confidence Interval for the Profit: (682,058 ; 683,965)

All in all, ASAŞ will save 683,016 TL per year if it changes it's logistics policy according to section 5.2.

### 6.2. Decision Making for Building a New Warehouse

ASAŞ will have to pay 3,000,000 TL for the new warehouse construction. However, ASAŞ will also get rid of other warehouse expenses by this option. Therefore, ASAŞ will save 1,265,016 TL each year.

2,921,598 - 1,656,582 = 1,265,016

The %95 Confidence Interval for the Profit: (1,264,058 ; 1,265,965)

ASAŞ will be able to recoup the new warehouse price within the fourth year.

## 7. CONCLUSION

In the study, the goal was to deeply understand the logistics parameters and structures of ASAŞ. In the current agreement, ASAŞ uses both TransCo's transportation service and TransCo's warehouses. In the new agreement, ASAŞ wants to use TransCo logistics solely for transportation. However, to make smart offers, ASAŞ needs to understand its logistics dynamics deeply.
Statistics in the project can enlighten ASAŞ, while negotiating for the price with TransCo Logistics. It can be said that, by the aid of the results obtained, ASAŞ will be able to make wiser decisions. In addition to transportation pricing, ASAŞ needs to investigate warehousing problems with two options. ASAŞ needs to create more space for warehousing other than TransCo's warehouses. ASAŞ may rent a new warehouse near the facility or construct a new warehouse building in the facility. In this report, both transportation pricing and warehousing feasibility studies for options were investigated. Then, the findings are combined to have meaningful insights.

For the renting option, ASAŞ will use a rental warehouse near the facility to store the goods that will be shipped by TransCo. The downside for the rental option is that ASAŞ needs to pay entry/exit costs, rental fee and transfer cost from the facility to the rental warehouse. All in all, it is still much more cost saving than the current model and does not require any capital investment. However, although it is reasonable financially, it will be a recurring expense for ASAŞ by its rental fee and operating costs. On the other hand, what is good about this option is that ASAŞ will start to save money immediately which is 683,016 TL per year.

In contrast to the rental option, ASAŞ needs to pay 3,000,000 TL for capital investment for building a new warehouse. However, ASAŞ will get rid of important operating expenses such as; entry/exit and transfer costs. By this option, ASAŞ will save 1,265,016 TL per year. If ASAŞ follows a financial plan that 3,000,000 credit to be repaid each year with the saving, within the fourth year ASAŞ will recoup its investment.

Both options will be presented to the company EVP.