Muesli Project Presentation

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Stakeholder: A Muesli distribution company

Goal: help a client to understand their delivery process and develop key performance indicators (KPIs) to track the state of the business and improve customer service.

What we need to do: analyze the order fulfilment time, identify bottlenecks and develop metrics that will allow the company evaluate and improve the efficiency of the delivery process

Received dataset

Table "Orders": 9 994 rows

Name	Description
Index	Index
Order ID	Identifier of the order
Order Date	Date of the order
Ship Mode	Shipping class
Customer ID	Identifier of the customer
Customer Name	Name of the customer
Origin Channel	Distribution channel
Country/Region	Country/Region of sales
City	City of sales
State	State of sales
Postal Code	Postal Code
Region	Region of sales
Category	Category of product
Sub_Category	Sub_Category of product
Product ID	Identifier of the product
Sales	Product's price
Quantity	Quantity in the order
Discount	Order's discount
Profit	Order's profit

Table "InternData Study": 290 rows

Name	Description
Order ID	Identifier of the order
Ready to Ship Date	Date of shipment from the warehouse
Pickup Date	Date of loading into the car

Table "Order Process Data": 5 899 rows

Name	Description
Row ID	Identifier of the row
Order ID	Identifier of the order
Customer Name	Name of the customer
Order Date	Date of the order
On Truck Scan Date	Date of loading into the car
Ship Mode	Standart or Express

Table "Campaign Data": 333 rows

Name	Description
Order ID	Identifier of the order
Arrival Scan Date	Date of the arrival of the order
Customer Name	Name of the customer

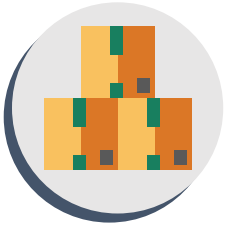
Order delivery process by Muesli distribution company

(described by warehouse manager)

Day 1 | **Day 3** | **Day 4** | **Day 7** | **delivered**

Order received (1 day)

The customer places an order online. The order is received and confirmed.



Order processed (normally 2 days)

The warehouse team processes the order, picks the items from the inventory, packs them, and makes them ready for shipping.

Order leaves warehouse (following day)

The packed order is handed over to the logistics team, loaded onto a truck.

Delivering to a customer (an average 3 days)

The logistics company handles the transportation and delivery of the order.

The order has been delivered

The package is delivered to the customer at their specified address.

Working Flowchart

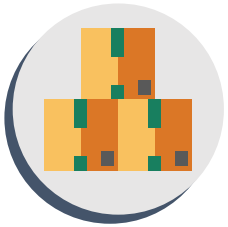
days of fulfilment

Day 1 → Day 3-5 → Day 3-7 → Day 8-11

duration

1 day	2-4 days	0-2 days	3-5 days	delivered
Order received	Order processed	Order leaves warehouse	Delivering to a customer	


order_date


ready_to_ship_date


on_truck_date


arrival_date

MVP =


Muesli Company

Express

Standart

+


Outer Logistic Company

Hypothesis

STANDARD DELIVERY																	
Week 1							Week 2							Week 3			
Mo 1	Tu 1	We 1	Th 1	Fr 1	Sat 1	Sun 1	Mo 2	Tu 2	We 2	Th 2	Fr 2	Sat 2	Sun 2	Mo 3	Days of fulfillment	Musli company	Logistic company
Order	Process	Process		Delivery	Delivery	Delivery	Arrive								8	5	3
	Order	Process	Process	Delivery	Delivery	Delivery	Arrive								7	4	3
		Order	Process	Process			Delivery	Delivery	Delivery	Arrive					9	6	3
			Order	Process			Process		Delivery	Delivery	Delivery			Arrive	10	7	3
				Order			Process	Process	Delivery	Delivery	Delivery			Arrive	9	6	3
					Order		Process	Process	Delivery	Delivery	Delivery			Arrive	8	5	3
						Order	Process	Process	Delivery	Delivery	Delivery			Arrive	7	4	3

EXPRESS DELIVERY																	
Week 1							Week 2							Week 3			
Mo 1	Tu 1	We 1	Th 1	Fr 1	Sat 1	Sun 1	Mo 2	Tu 2	We 2	Th 2	Fr 2	Sat 2	Sun 2	Mo 3	Days of fulfillment	Musli company	Logistic company
Order	Process	Process*	Delivery	Delivery			Arrive								8	3	5
	Order	Process	Process	Delivery	Delivery	Delivery	Arrive								7	3	4
		Order	Process	Process*	Delivery	Delivery	Arrive								6	3	3
			Order	Process			Process*	Delivery	Delivery	Arrive					8	5	3
				Order			Process	Process	Delivery	Delivery	Delivery			Arrive	11	6	5
					Order		Process	Process	Delivery	Delivery	Delivery			Arrive	10	5	5
						Order	Process	Process	Delivery	Delivery	Delivery			Arrive	9	4	5

Process* ready_to_ship_date = on_truck_date

Data after cleaning and merging

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3003 entries, 0 to 3002
Data columns (total 8 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   order_id            3003 non-null   object
 1   order_date          3003 non-null   datetime64[ns]
 2   customer_id         3003 non-null   object
 3   customer_name       3003 non-null   object
 4   ship_mode           3003 non-null   object
 5   ready_to_ship_date  204 non-null    datetime64[ns]
 6   on_truck_date       3003 non-null   datetime64[ns]
 7   arrival_date        333 non-null    datetime64[ns]
dtypes: datetime64[ns](4), object(4)
memory usage: 187.8+ KB
```

Percentage of zero values

```
order_id              0.000000
order_date            0.000000
customer_id           0.000000
customer_name         0.000000
ship_mode             0.000000
ready_to_ship_date    93.206793
on_truck_date         0.000000
arrival_date          88.911089
dtype: float64
```

We calculated

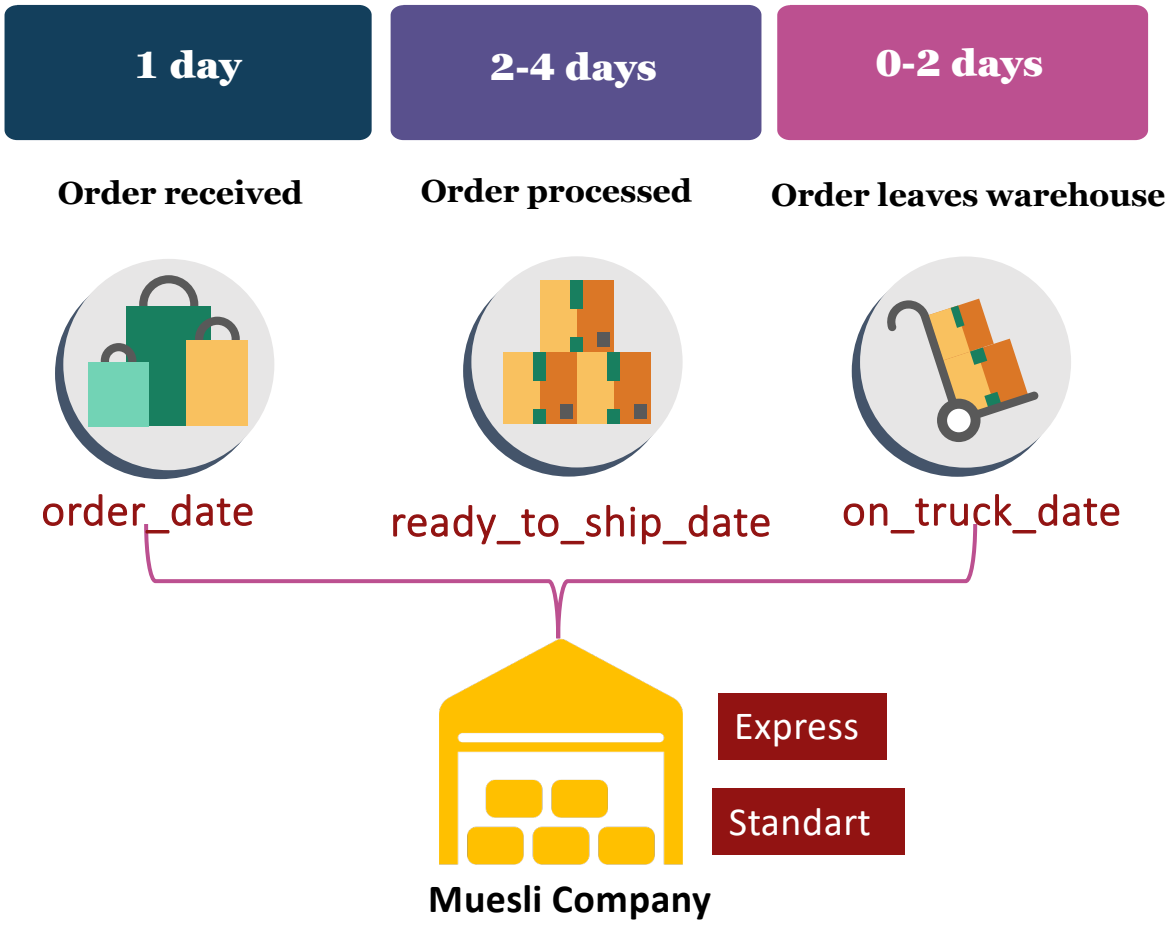
Days of delay compared to the days planned by the company

	order_id	ship_mode	order_to_ready	ready_to_truck	order_to_truck	truck_to_arrival	delay_ready_to_ship	delay_arrival	delay_on_truck_express	delay_on_truck_standard
2988	CA-2019-123540	Standard Processing	NaN	NaN	8	NaN	NaN	NaN	NaN	4.0
2989	CA-2019-113341	Standard Processing	NaN	NaN	7	5.0	NaN	2.0	NaN	2.0
2990	CA-2019-162159	Express	NaN	NaN	2	3.0	NaN	0.0	-1.0	NaN
2991	CA-2020-111717	Standard Processing	NaN	NaN	4	NaN	NaN	NaN	NaN	-1.0
2992	CA-2020-122308	Standard Processing	NaN	NaN	8	NaN	NaN	NaN	NaN	4.0
2993	CA-2020-137785	Standard Processing	NaN	NaN	7	NaN	NaN	NaN	NaN	1.0
2994	CA-2020-105823	Standard Processing	NaN	NaN	7	NaN	NaN	NaN	NaN	2.0
2995	CA-2020-111388	Express	NaN	NaN	0	NaN	NaN	NaN	-3.0	NaN
2996	US-2020-165456	Express	3.0	1.0	4	NaN	1.0	NaN	1.0	NaN
2997	CA-2020-113460	Standard Processing	NaN	NaN	6	NaN	NaN	NaN	NaN	1.0
2998	US-2020-109610	Standard Processing	3.0	2.0	7	NaN	1.0	NaN	NaN	1.0
2999	CA-2019-146913	Standard Processing	NaN	NaN	6	3.0	NaN	0.0	NaN	-1.0
3000	CA-2020-107209	Standard Processing	NaN	NaN	9	NaN	NaN	NaN	NaN	4.0
3001	US-2020-152842	Standard Processing	NaN	NaN	8	NaN	NaN	NaN	NaN	1.0
3002	CA-2019-122581	Standard Processing	NaN	NaN	7	NaN	NaN	NaN	NaN	1.0

Difference between two dates

Analysing the first part of the process

(on the side of Muesli company)



Calculating the days of delay

We calculated the expected time from when an order is received to when it is picked up by the logistics company by days of the week and types of delivery (for Express and Standard delivery). The result is a plan of how an order should be processed based on the words of a company.


```python
def get_norm_on_truck(day_of_week):
    norms = {
        0: (3, 5),  # Monday
        1: (4, 4),  # Tuesday
        2: (3, 6),  # Wednesday
        3: (5, 7),  # Thursday
        4: (6, 6),  # Friday
        5: (5, 5),  # Saturday
        6: (4, 4)   # Sunday
    }
    return norms[day_of_week]
```

0.0s

Then, we compared this target time with the actual time spent processing the order and calculated the number of days of delay in order processing separately for express and standard delivery.

delay_on_truck_express

The number of days of delay in order processing from the order receipt date to the truck loading date for express delivery

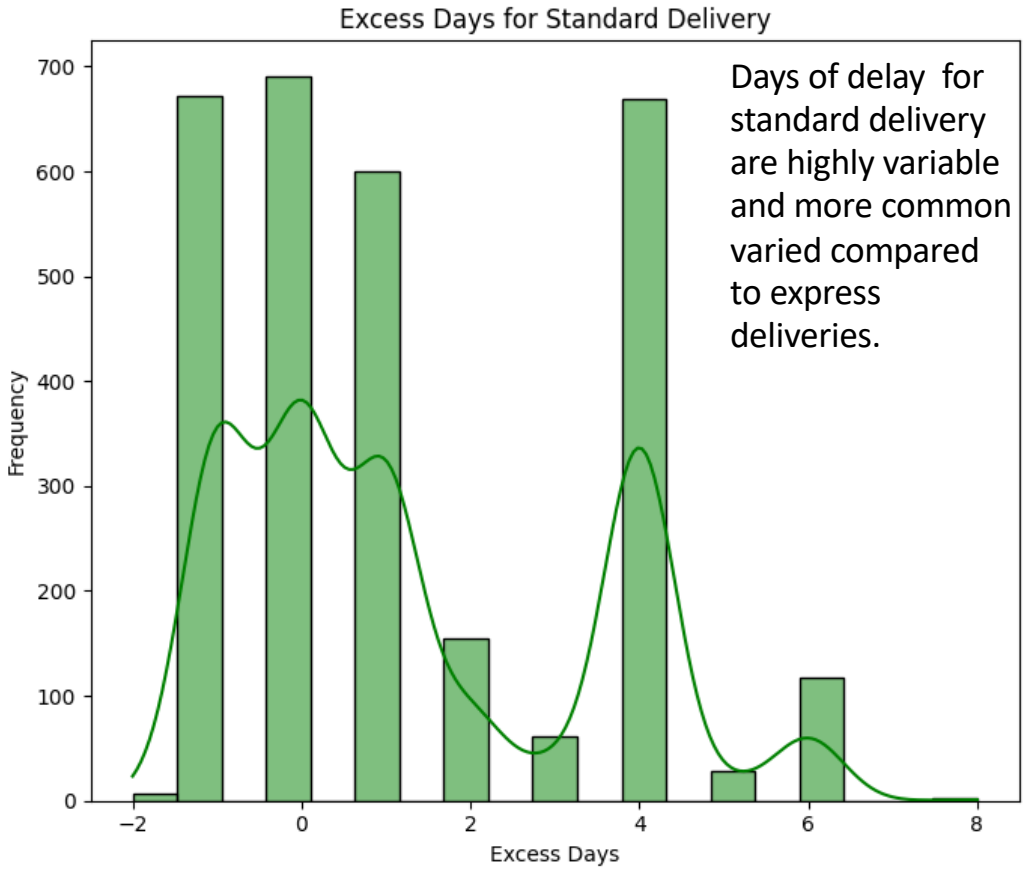
delay_on_truck_standard

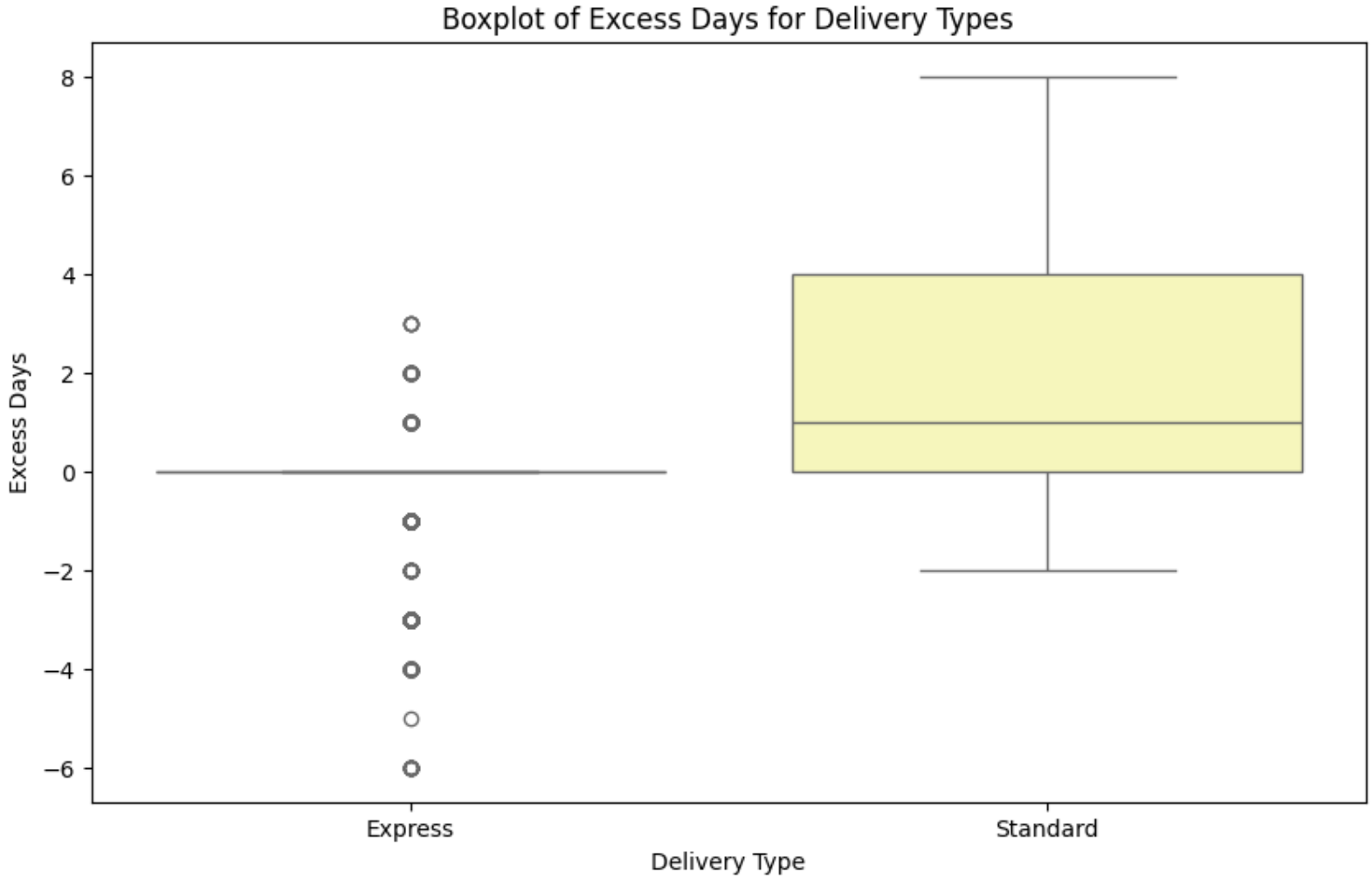
The number of days of delay in order processing from the order receipt date to the truck loading date for standart delivery

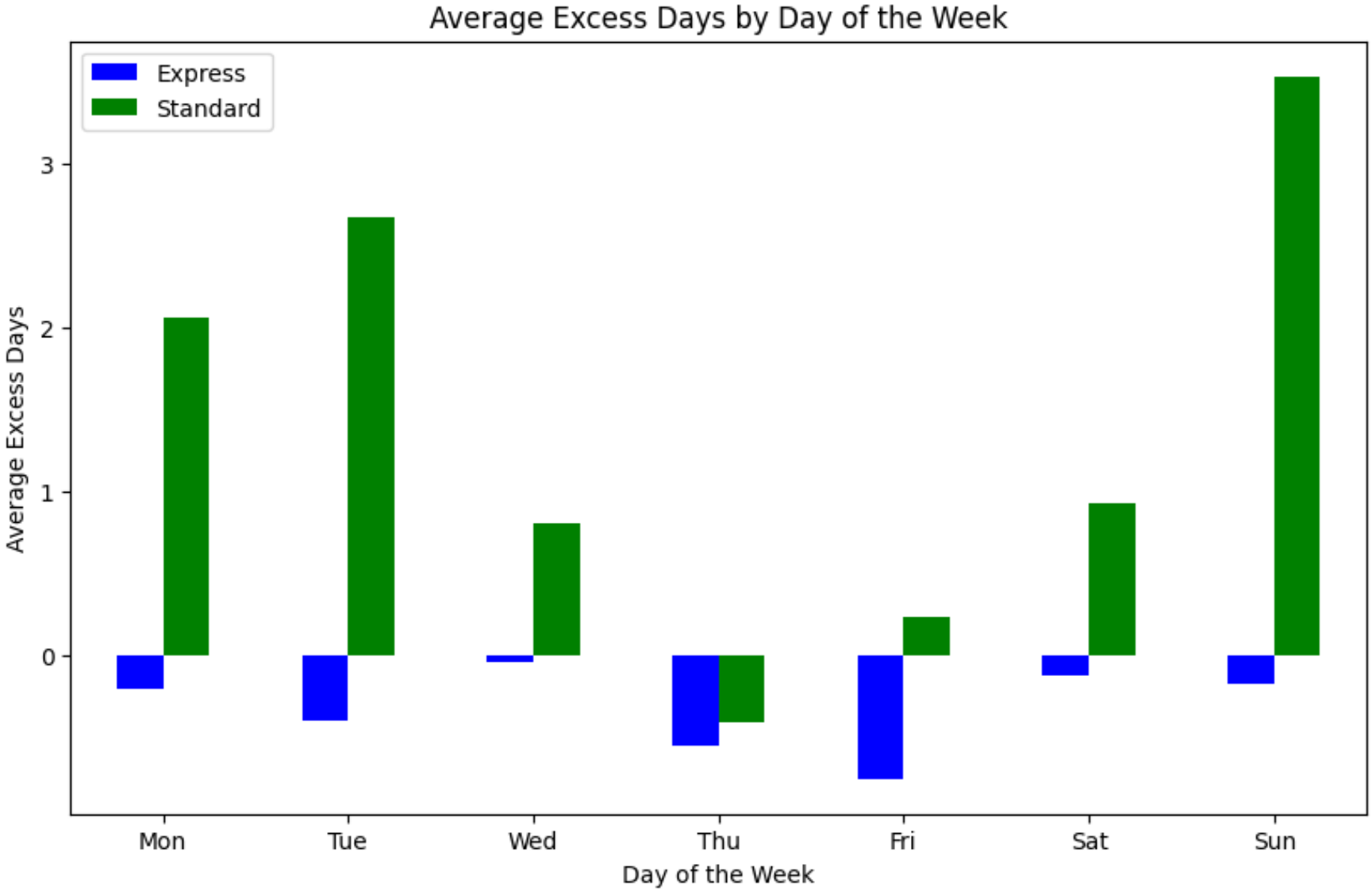
Descriptive statistic

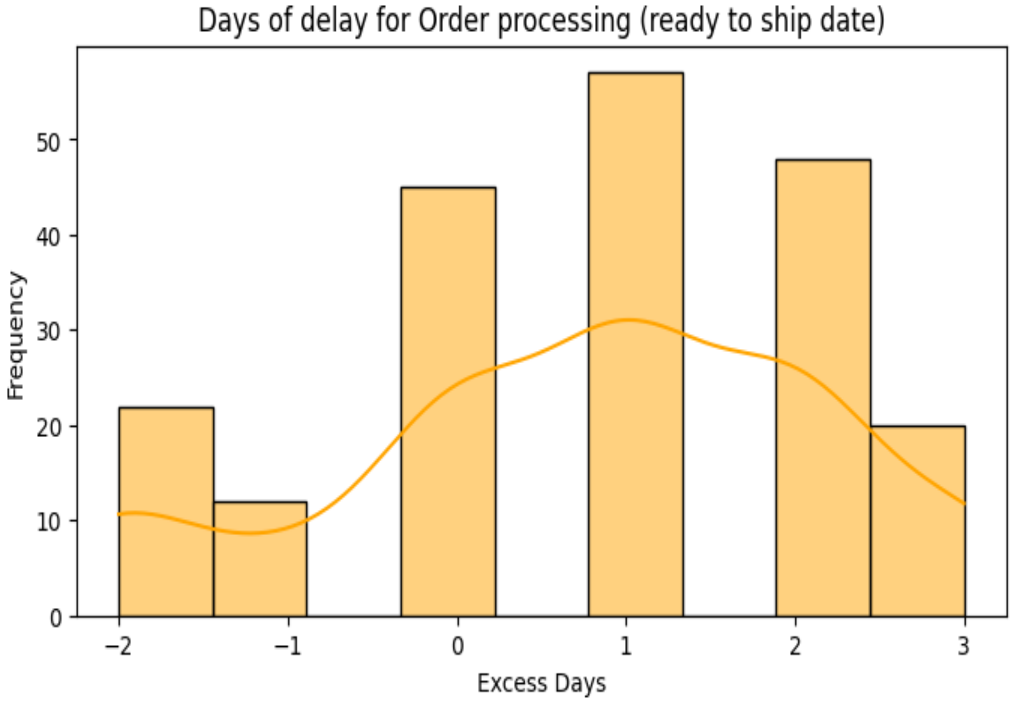
	delay_on_truck_express	delay_on_truck_standard
count	3003.0	3003.0
mean	-0.0	1.0
std	1.0	2.0
min	-6.0	-2.0
25%	0.0	0.0
50%	0.0	1.0
75%	0.0	4.0
max	3.0	8.0

Days of delay for express and standard delivery

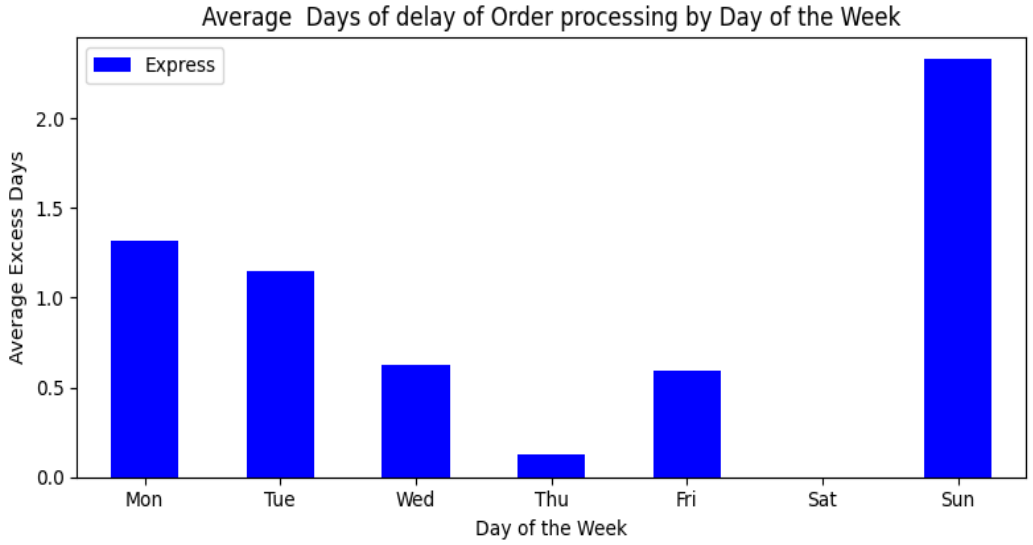



Boxplot of Excess Days for Delivery Types
Excess Days
8
6
4
2
0
−2
−4
−6
Express
Standard
Delivery Type


Average Excess Days by Day of the Week
Express
Standard
Average Excess Days
3
2
1
0
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Day of the Week

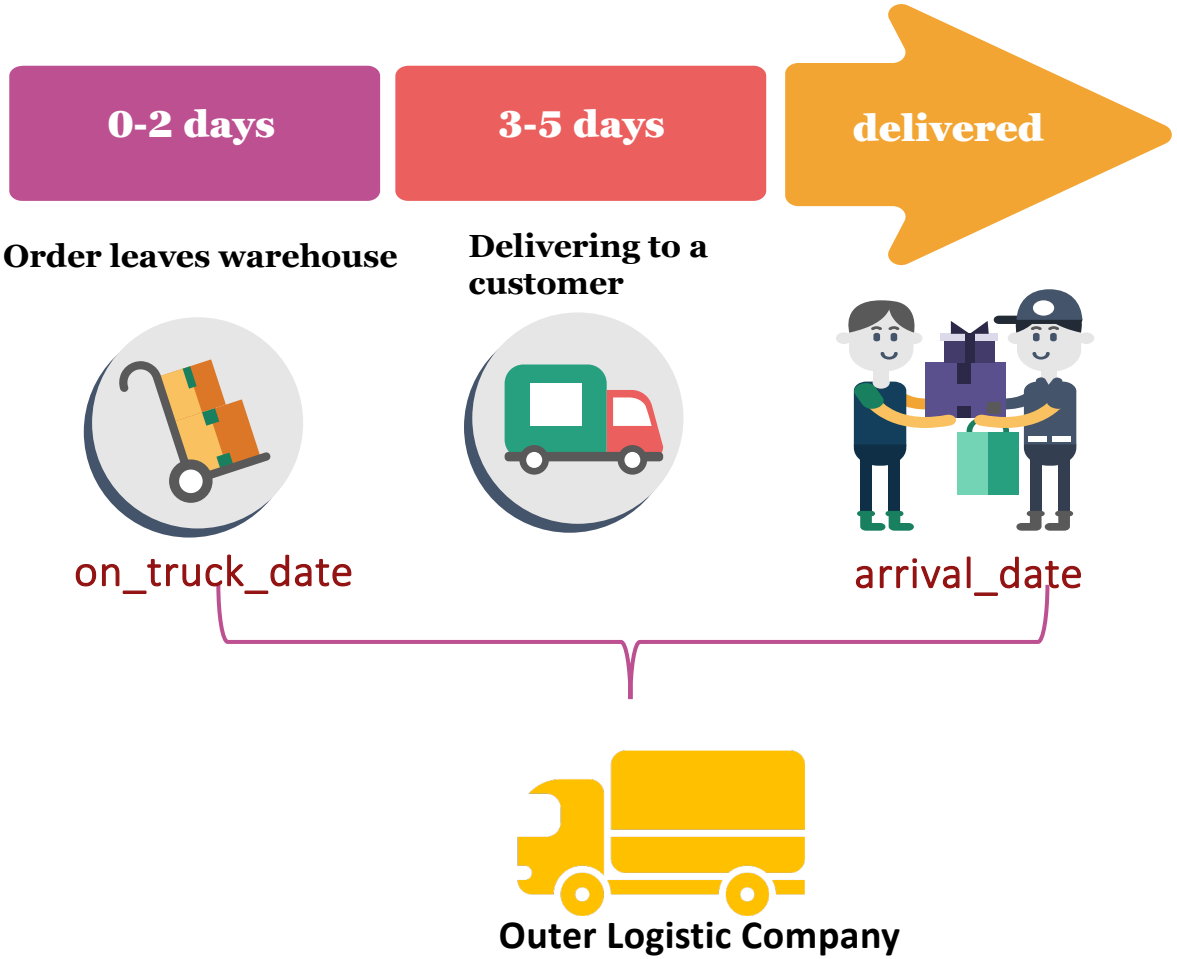

Days of delay for Order processing (ready to ship date)
Frequency
Excess Days
0
10
20
30
40
50
−2
−1
0
1
2
3

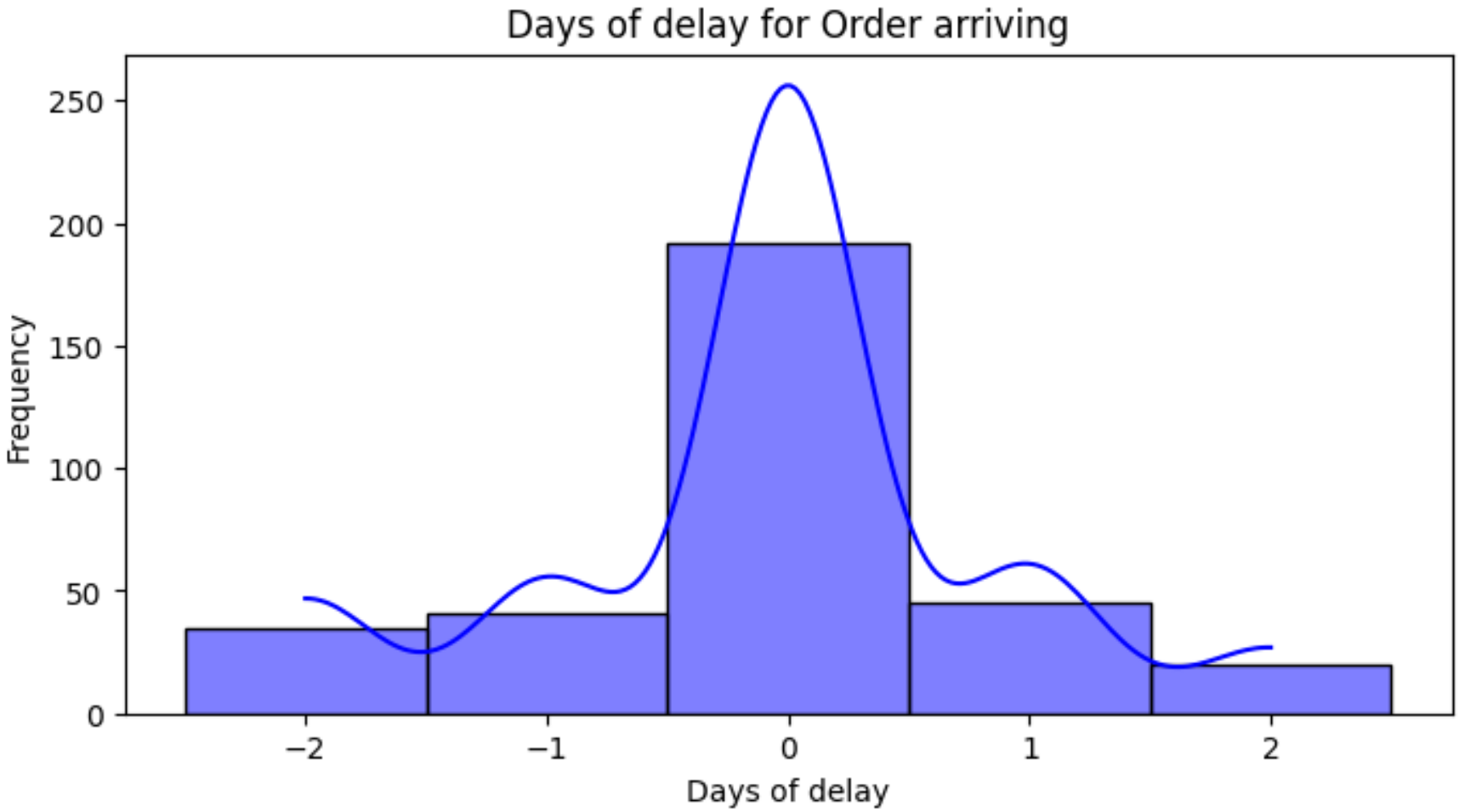

order_date
ready_to_ship_date


Average Days of delay of Order processing by Day of the Week
Express
Average Excess Days
0.0
0.5
1.0
1.5
2.0
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Day of the Week

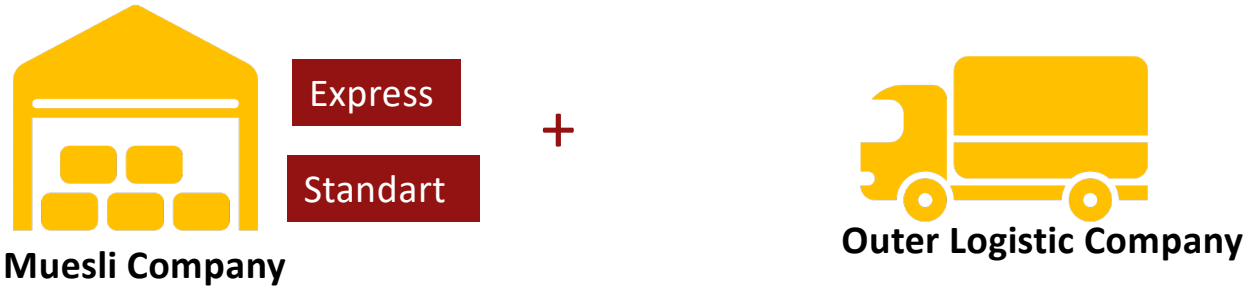
Analysing the second part of the process

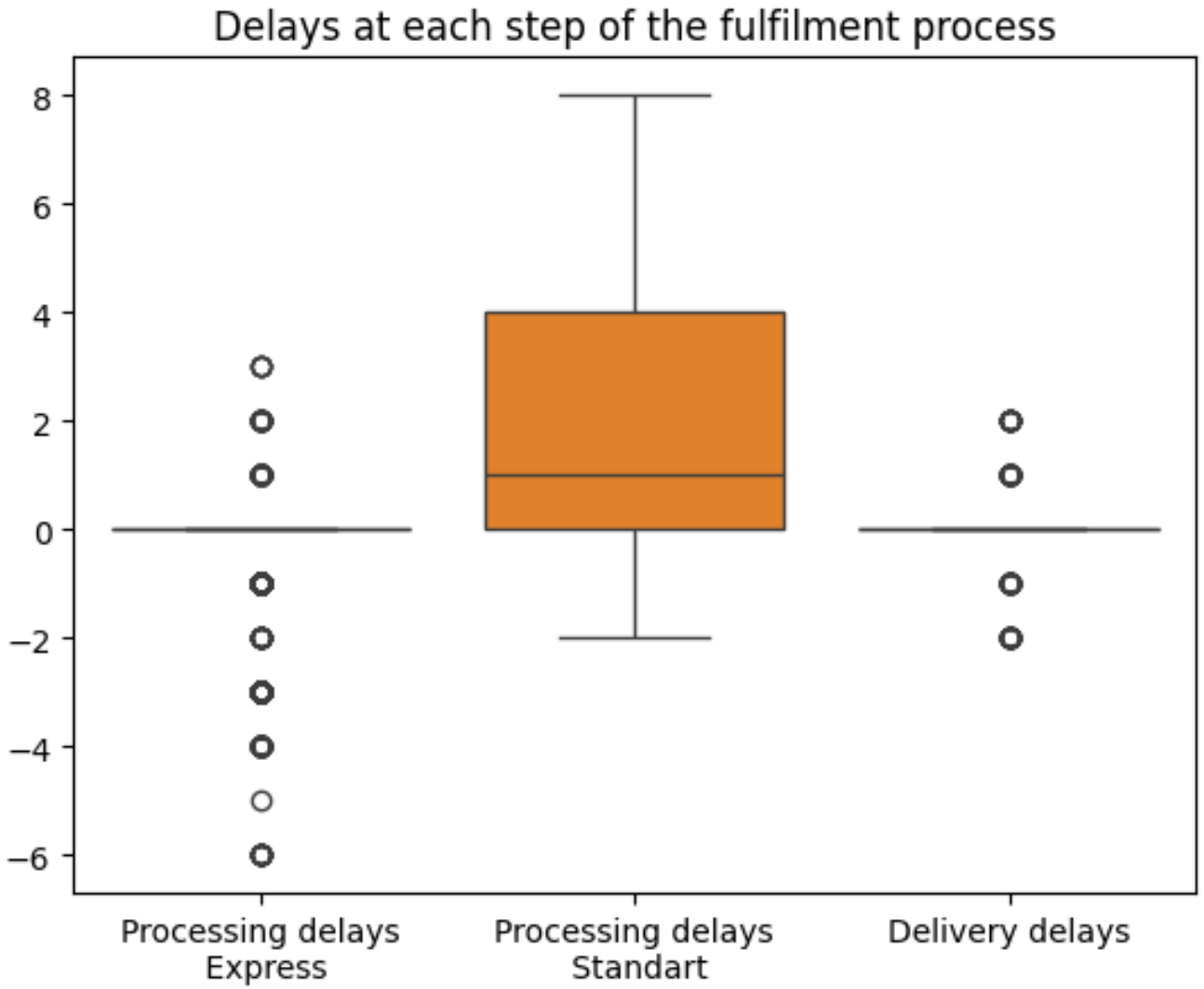
(on the side of outer Logistic company)



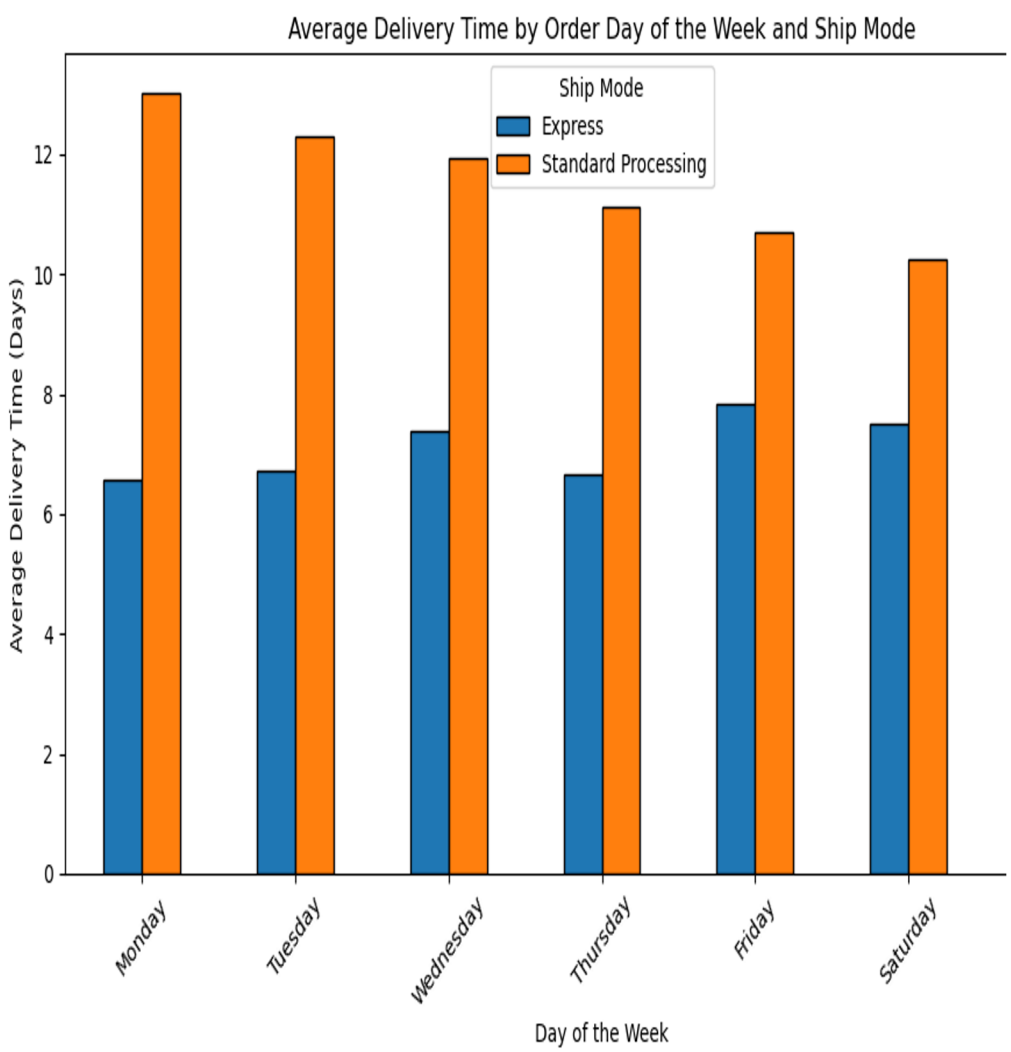

Days of delay for Order arriving
Frequency
250
200
150
100
50
0
−2
−1
0
1
2
Days of delay

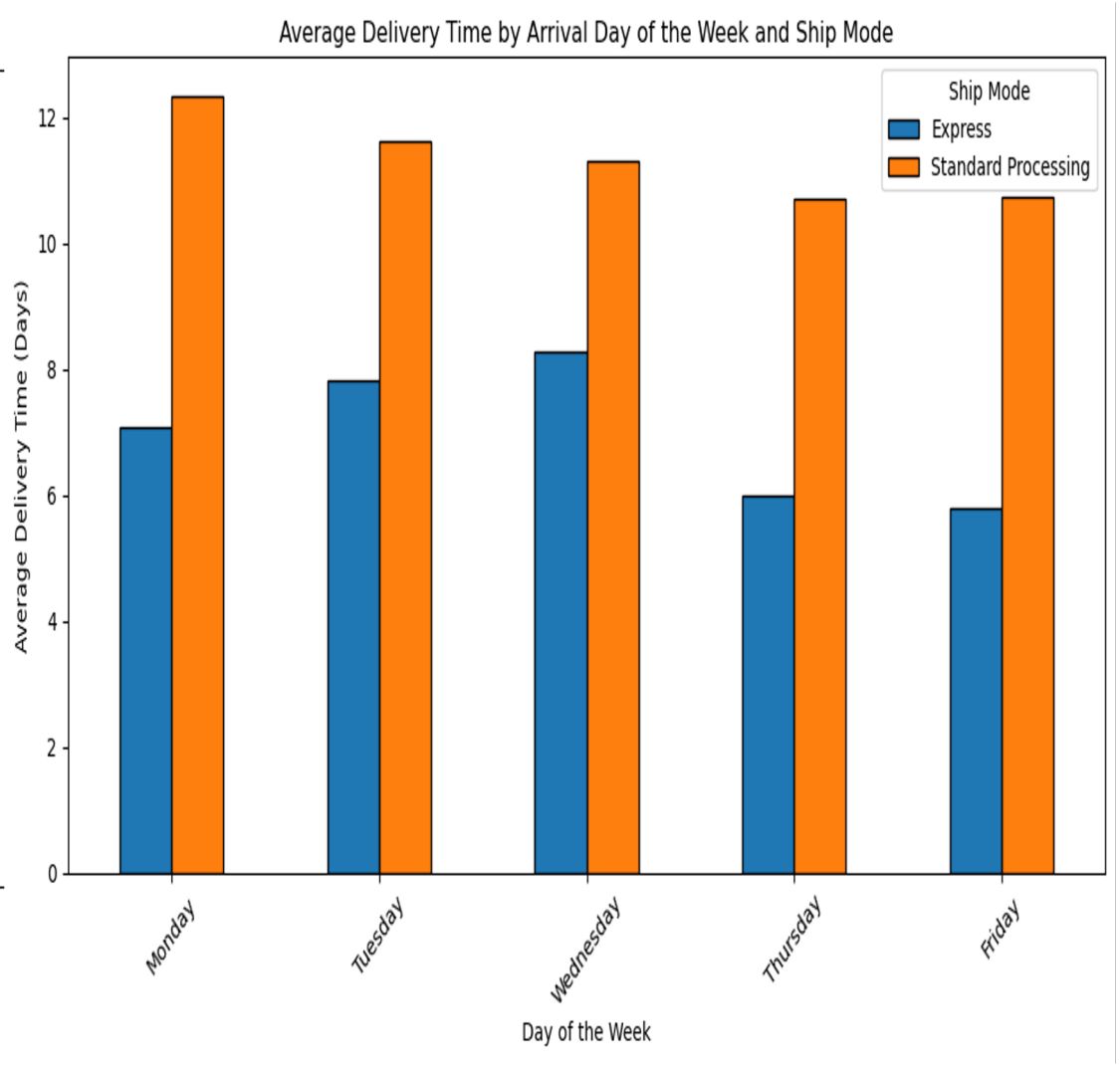
Analysing the whole process




Delays at each step of the fulfilment process
8
6
4
2
0
−2
−4
−6
Processing delays Express
Processing delays Standart
Delivery delays

Average Delivery Time by Order/Arrival Day of week and Ship Mode





Suggested Key Performance Indicators (KPIs)

1. `Order Processing Time:` Time from order received to order ready to ship.

- Calculation: Ready to Ship Date - Order Date
- Target: 2 days (considering business days)

2. `Warehouse Efficiency:` Percentage of orders processed within the target time.

- Calculation: (Number of orders processed within 2 days / Total number of orders) * 100
- Target: High percentage, e.g., 95%

3. `Truck Departure Time:` Time from order ready to ship to order leaves warehouse.

- Calculation: On Truck Scan Date - Ready to Ship Date
- Target: Next available truck day (Monday, Wednesday, Friday), or same day for Express Processing

4. `On-Time Shipment Percentage:` Percentage of orders shipped on the expected truck day.

- Calculation: (Number of orders shipped on the expected day / Total number of orders) * 100
- Target: High percentage, e.g., 95%

5. `Delivery Time:` Time from order leaves warehouse to order delivered to customer.

- Calculation: Delivery Date - On Truck Scan Date
- Target: 3 days (considering business days for final delivery)

Metrics: Target vs. Actual

Metrics	Measurement	Target (mean)	Actual (mean)
Order Processing time	working days	2	3
** Processing delays Express*		*0*	*0*
** Processing delays Standart*		*0*	*1*
Warehouse Efficiency	%	95	38.73
Truck Departure time	days	N/A (insufficient data: 93% null)	
On-Time Shipment Percentage	%	95	36.94
Delivery time	days	3	3

Recomendations

1. To effectively track performance indicators, the client needs to implement a system for recording dates for each step in the logistics process.
2. It is necessary to provide a more detailed analysis of the department responsible for standard delivery, as the number of processing days varies significantly, with an average days of delay - 1 day.
3. It is also necessary to analyse whether the delay in order processing is related to a lack of staff, because orders placed on weekends and at the beginning of the week are not processed on time.
4. The average delivery time of orders by the logistics company matches the target time. However, there are many instances of orders being delivered much earlier or significantly later. This indicates that the delivery time is not consistent. Client needs to discuss with the partner what can be done to ensure that their order delivery times are as close to 3 days as possible.