Supply Chain Analysis

The dataset I have used here contains one CSV file which includes data about the supply chain of a Fashion and Beauty startup.

In [1]:
```
import pandas as pd
import plotly.express as px
import plotly.io as pio
import plotly.graph_objects as go
pio.templates.default = "plotly_white"
```

Data Extration

In [2]:
```
data = pd.read_csv("Supply_chain_data.csv")
print(data.head())
```

```
  Product type    SKU      Price  Availability  Number of products sold  \
0     haircare   SKU0  69.808006            55                      802
1     skincare   SKU1  14.843523            95                      736
2     haircare   SKU2  11.319683            34                        8
3     skincare   SKU3  61.163343            68                       83
4     skincare   SKU4   4.805496            26                      871

   Revenue generated Customer demographics  Stock levels  Lead times  \
0        8661.996792             Non-binary            58           7
1        7460.900065                 Female            53          30
2        9577.749626                Unknown             1          10
3        7766.836426             Non-binary            23          13
4        2686.505152             Non-binary             5           3

   Order quantities  ...  Location Lead time  Production volumes  \
0                96  ...     Mumbai        29                 215
1                37  ...     Mumbai        23                 517
2                88  ...     Mumbai        12                 971
3                59  ...    Kolkata        24                 937
4                56  ...      Delhi         5                 414

  Manufacturing lead time Manufacturing costs  Inspection results  \
0                      29           46.279879             Pending
1                      30           33.616769             Pending
2                      27           30.688019             Pending
3                      18           35.624741                Fail
4                       3           92.065161                Fail

   Defect rates  Transportation modes   Routes       Costs
0      0.226410                  Road  Route B  187.752075
1      4.854068                  Road  Route B  503.065579
2      4.580593                   Air  Route C  141.920282
3      4.746649                  Rail  Route A  254.776159
4      3.145580                   Air  Route A  923.440632

[5 rows x 24 columns]
```

In [3]:
```
print(data.describe())
```

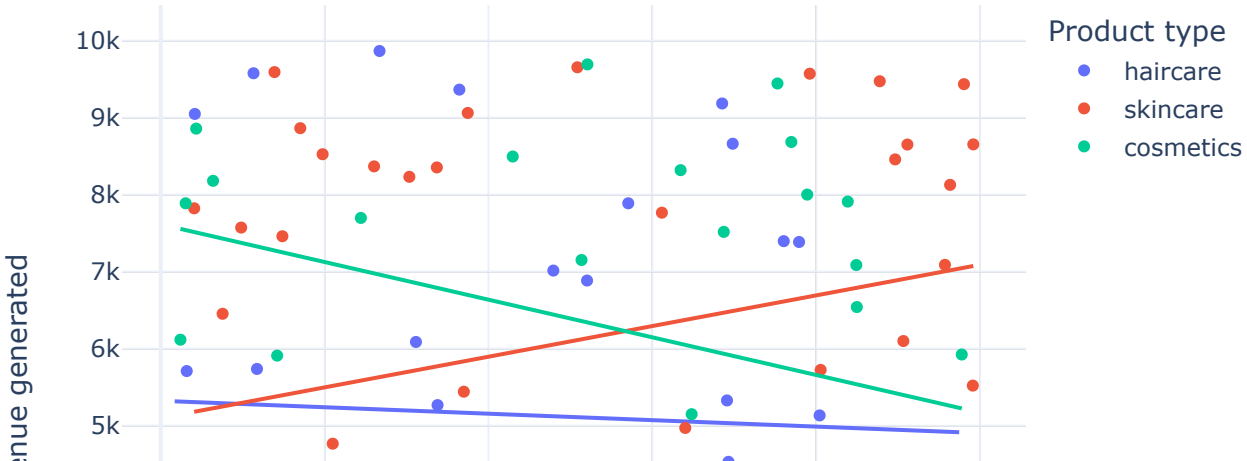
```
            Price  Availability  Number of products sold  Revenue generated  \
count  100.000000    100.000000               100.000000         100.000000
mean    49.462461     48.400000               460.990000        5776.048187
std     31.168193     30.743317               303.780074        2732.841744
min      1.699976      1.000000                 8.000000        1061.618523
```

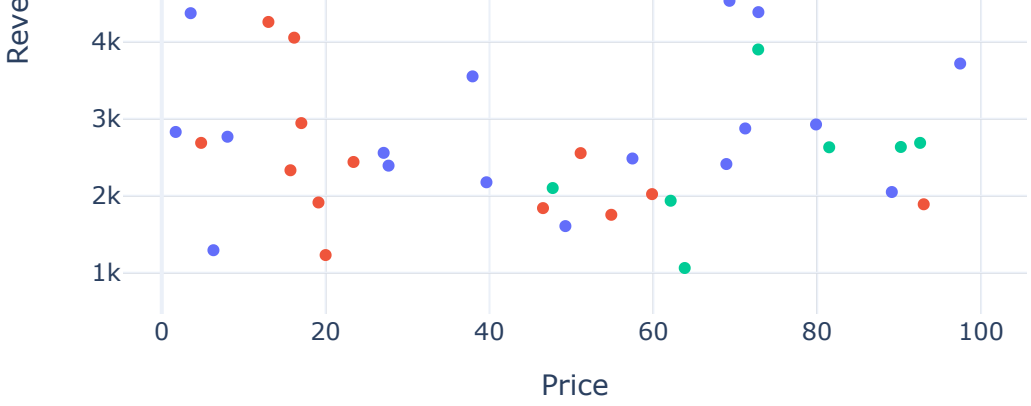
```
25%      19.597823     22.750000                184.250000        2812.847151
50%      51.239831     43.500000                392.500000        6006.352023
75%      77.198228     75.000000                704.250000        8253.976921
max      99.171329    100.000000                996.000000        9866.465458

       Stock levels  Lead times  Order quantities  Shipping times  \
count    100.000000  100.000000        100.000000      100.000000
mean      47.770000   15.960000         49.220000        5.750000
std       31.369372    8.785801         26.784429        2.724283
min        0.000000    1.000000          1.000000        1.000000
25%       16.750000    8.000000         26.000000        3.750000
50%       47.500000   17.000000         52.000000        6.000000
75%       73.000000   24.000000         71.250000        8.000000
max      100.000000   30.000000         96.000000       10.000000

       Shipping costs   Lead time  Production volumes  \
count      100.000000  100.000000          100.000000
mean         5.548149   17.080000          567.840000
std          2.651376    8.846251          263.046861
min          1.013487    1.000000          104.000000
25%          3.540248   10.000000          352.000000
50%          5.320534   18.000000          568.500000
75%          7.601695   25.000000          797.000000
max          9.929816   30.000000          985.000000

       Manufacturing lead time  Manufacturing costs  Defect rates       Costs
count                100.00000           100.000000    100.000000  100.000000
mean                  14.77000            47.266693      2.277158  529.245782
std                    8.91243            28.982841      1.461366  258.301696
min                    1.00000             1.085069      0.018608  103.916248
25%                    7.00000            22.983299      1.009650  318.778455
50%                   14.00000            45.905622      2.141863  520.430444
75%                   23.00000            68.621026      3.563995  763.078231
max                   30.00000            99.466109      4.939255  997.413450
```

Data Analysis

The relationship between the price of the products and the revenue generated by them.

In [4]:
```
fig = px.scatter(data, x='Price',
                 y='Revenue generated',
                 color='Product type',
                 hover_data=['Number of products sold'],
                 trendline="ols")
fig.show()
```

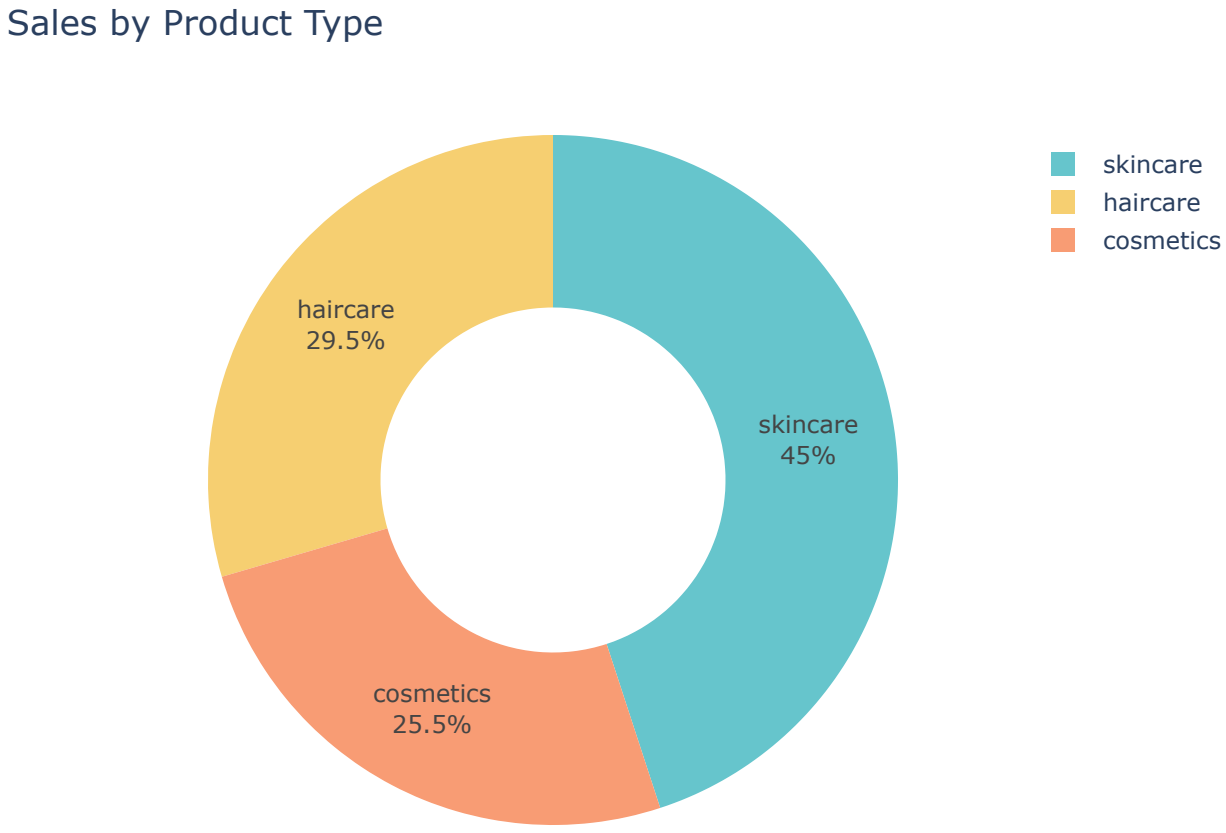




The company derives more revenue from skincare products, and the higher the price of skincare products, the more revenue they generate.

The sales by product type

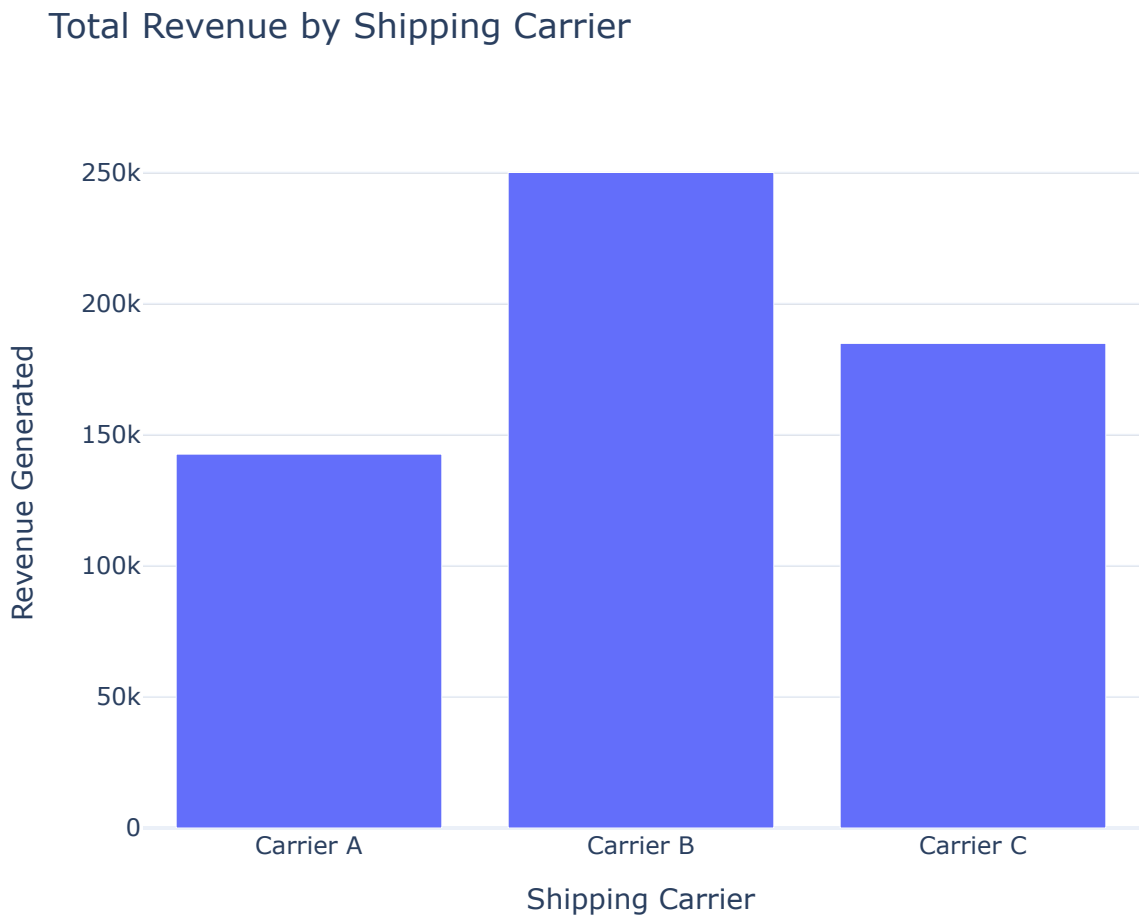
In [5]:
```
sales_data = data.groupby('Product type')['Number of products sold'].sum().reset_index()

pie_chart = px.pie(sales_data, values='Number of products sold', names='Product type',
                   title='Sales by Product Type',
                   hover_data=['Number of products sold'],
                   hole=0.5,
                   color_discrete_sequence=px.colors.qualitative.Pastel)

pie_chart.update_traces(textposition='inside', textinfo='percent+label')
pie_chart.show()
```



45% of the business comes from skincare products, 29.5% from haircare, and 25.5% from cosmetics.

Total revenue generated from shipping carriers

In [6]:
```
total_revenue = data.groupby('Shipping carriers')['Revenue generated'].sum().reset_index
fig = go.Figure()
fig.add_trace(go.Bar(x=total_revenue['Shipping carriers'],
                     y=total_revenue['Revenue generated']))
fig.update_layout(title='Total Revenue by Shipping Carrier',
                  xaxis_title='Shipping Carrier',
                  yaxis_title='Revenue Generated')
fig.show()
```



The company is using three carriers for transportation, and Carrier B helps the company in generating more revenue.

The Average lead time and Average Manufacturing Costs for all products of the company

In [7]:
```
avg_lead_time = data.groupby('Product type')['Lead time'].mean().reset_index()
avg_manufacturing_costs = data.groupby('Product type')['Manufacturing costs'].mean().res
result = pd.merge(avg_lead_time, avg_manufacturing_costs, on='Product type')
result.rename(columns={'Lead time': 'Average Lead Time', 'Manufacturing costs': 'Average
print(result)
```

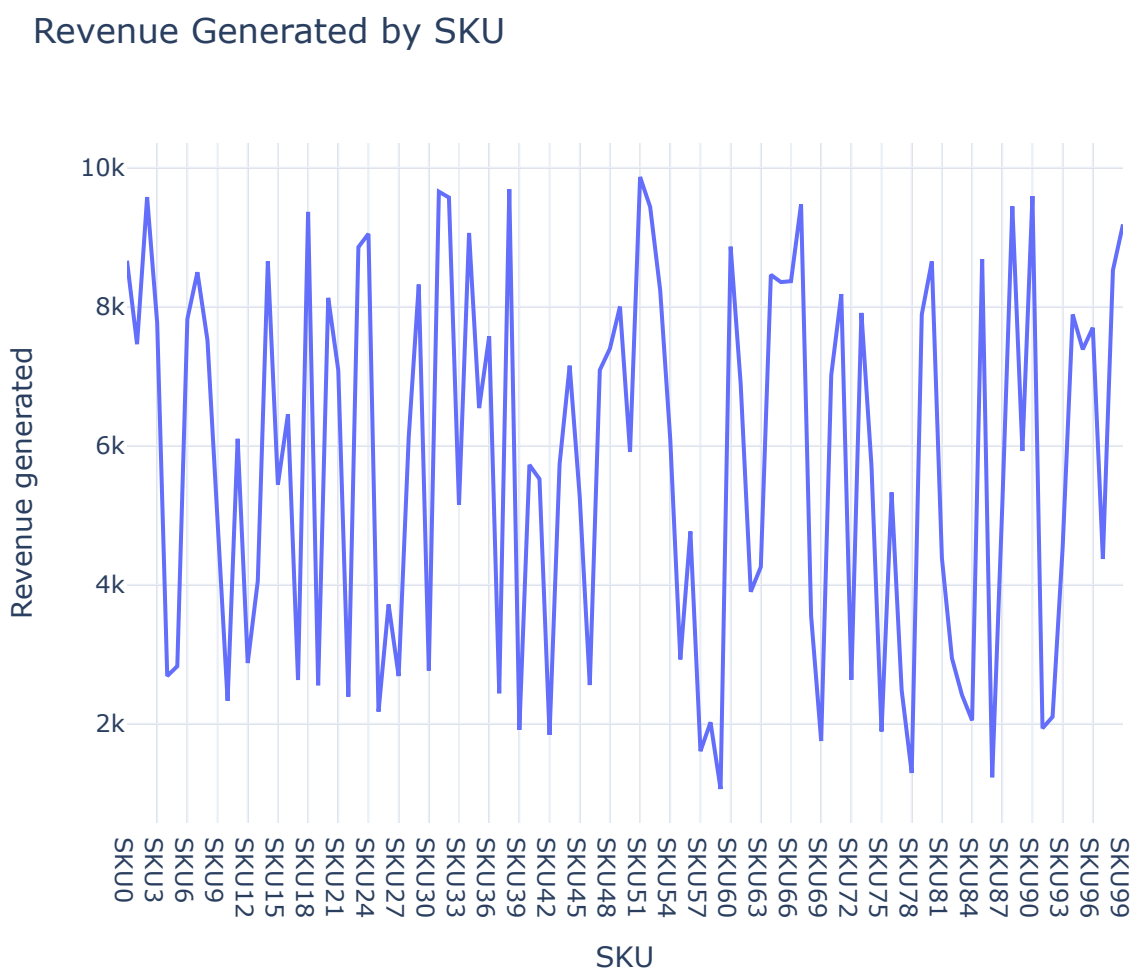
	Product type	Average Lead Time	Average Manufacturing Costs
0	cosmetics	13.538462	43.052740
1	haircare	18.705882	48.457993
2	skincare	18.000000	48.993157

Analyzing SKUs

There's a column in the dataset as SKUs. SKU stands for Stock Keeping Units. SKU is a special code that helps companies keep track of all the different things they have for sale. Imagine a large toy store with lots of toys. Each toy is different and has its name and price, but when a company wants to know how many pieces are left, the company needs a way to identify them. So SKU is a unique code for different toy types, like a secret number only the store knows. This secret number is called SKU.

The revenue generated by each SKU

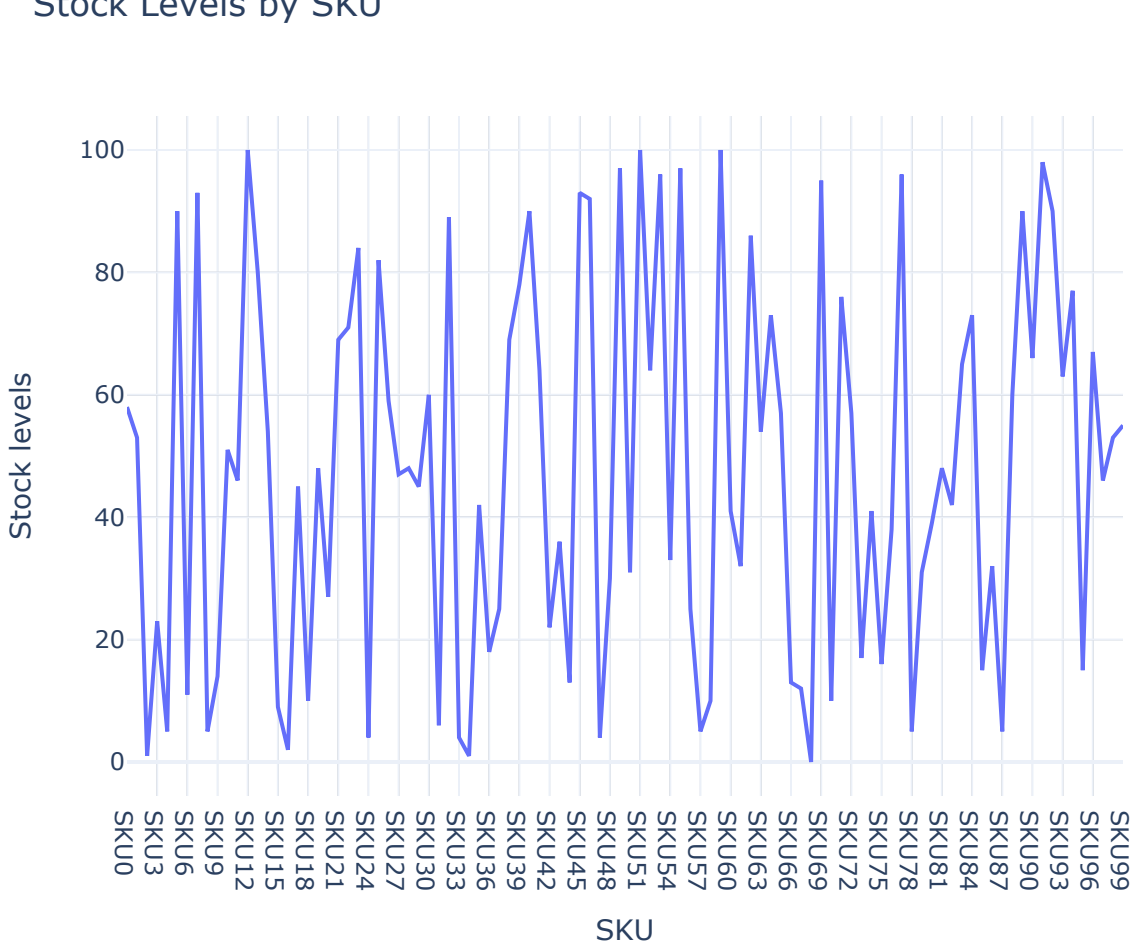
In [8]:
```
revenue_chart = px.line(data, x='SKU',
                        y='Revenue generated',
                        title='Revenue Generated by SKU')
revenue_chart.show()
```



There's another column in the dataset as Stock levels. Stock levels refer to the number of products a store or business has in its inventory.

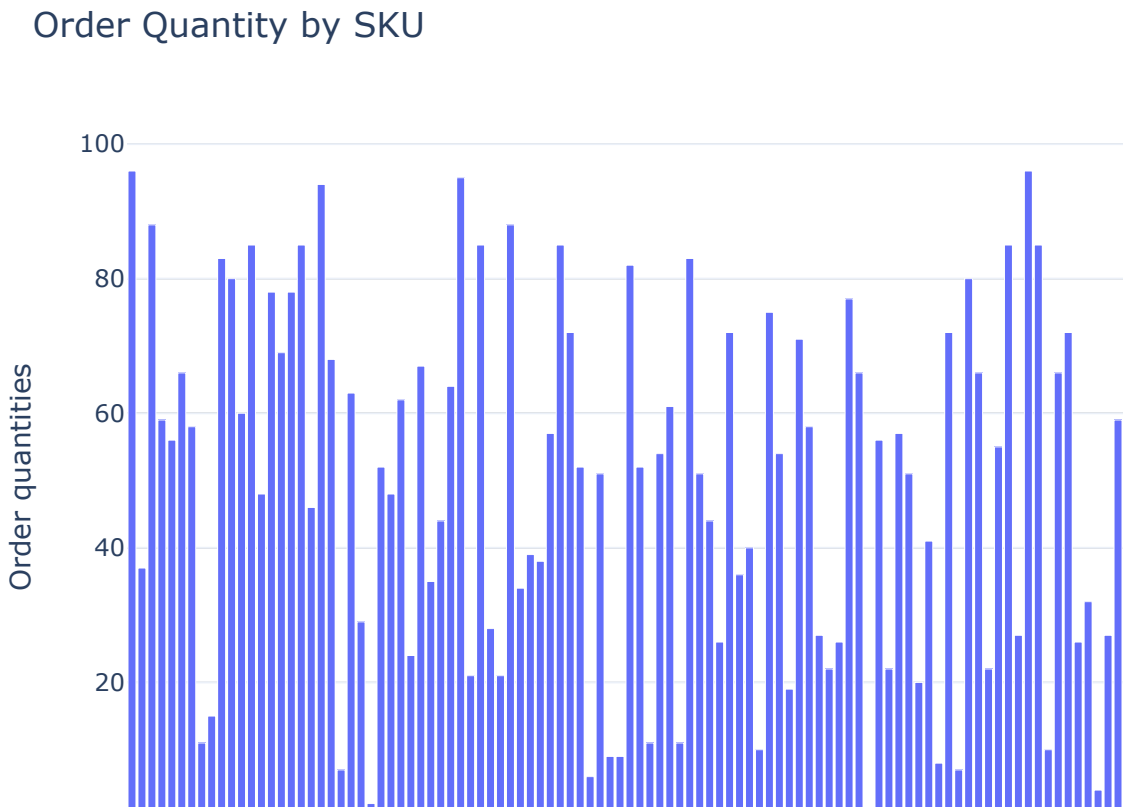
The stock levels of each SKU

In [9]:
```
stock_chart = px.line(data, x='SKU',
                      y='Stock levels',
                      title='Stock Levels by SKU')
stock_chart.show()
```



The order quantity of each SKU

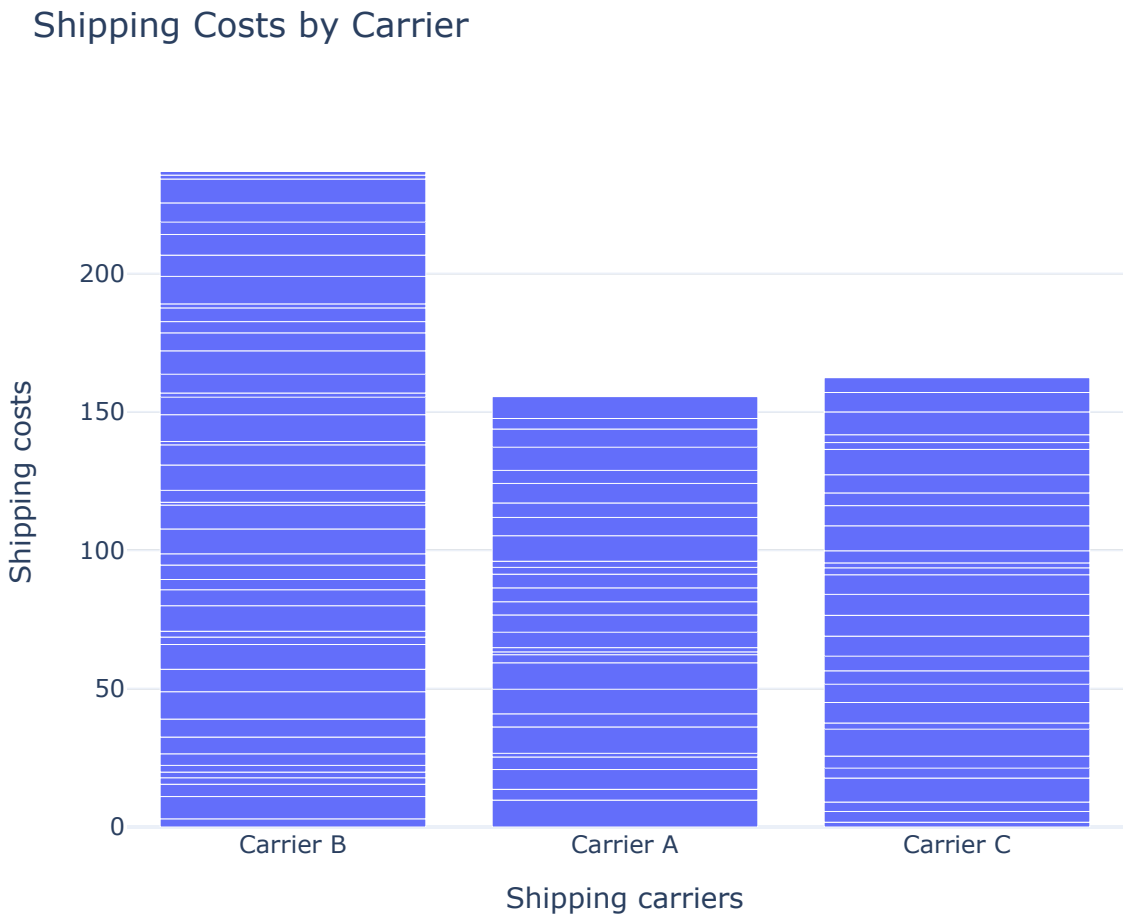
In [10]:
```
order_quantity_chart = px.bar(data, x='SKU',
                              y='Order quantities',
                              title='Order Quantity by SKU')
order_quantity_chart.show()
```



Cost Analysis

The shipping cost of Carriers

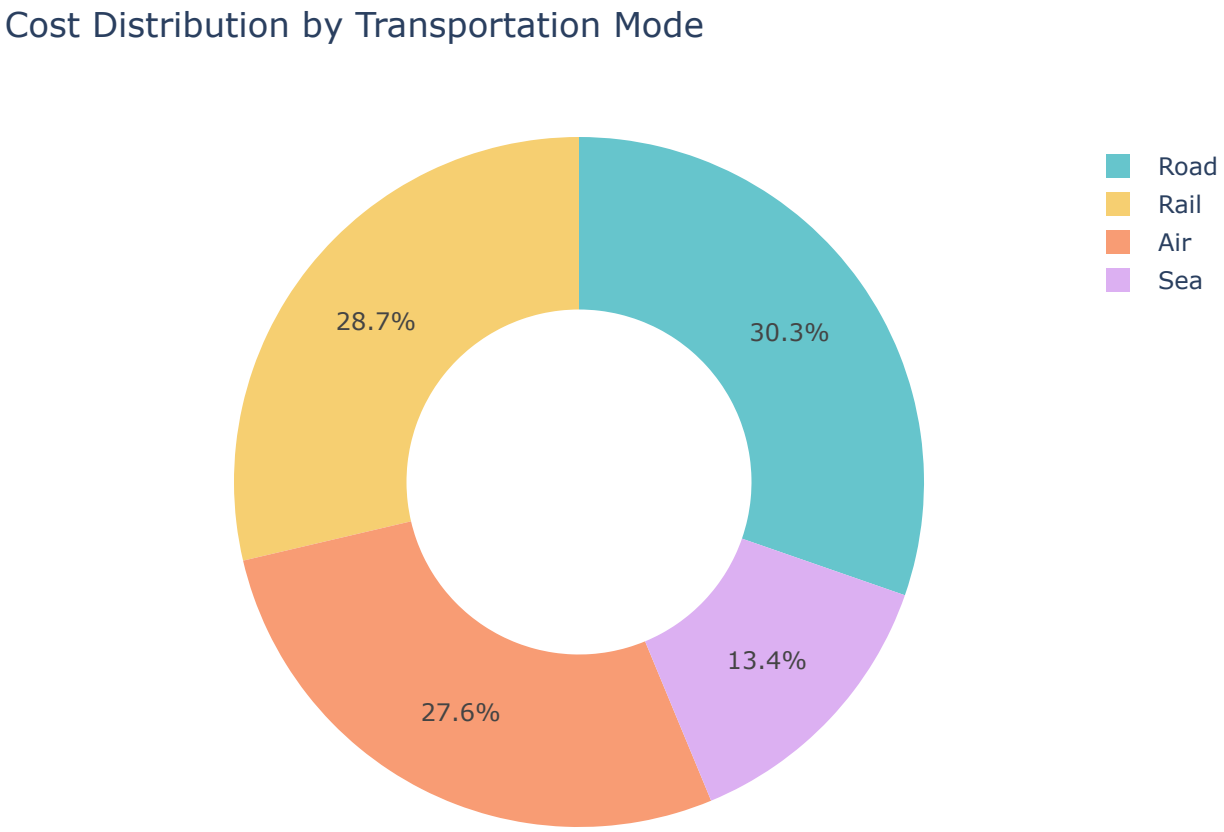
In [11]:
```
shipping_cost_chart = px.bar(data, x='Shipping carriers',
                             y='Shipping costs',
                             title='Shipping Costs by Carrier')
shipping_cost_chart.show()
```



The Carrier B helps the company in more revenue. It is also the most costly Carrier among the three.

The cost distribution by transportation mode

In [12]:
```
transportation_chart = px.pie(data,
                              values='Costs',
                              names='Transportation modes',
                              title='Cost Distribution by Transportation Mode',
                              hole=0.5,
                              color_discrete_sequence=px.colors.qualitative.Pastel)
transportation_chart.show()
```



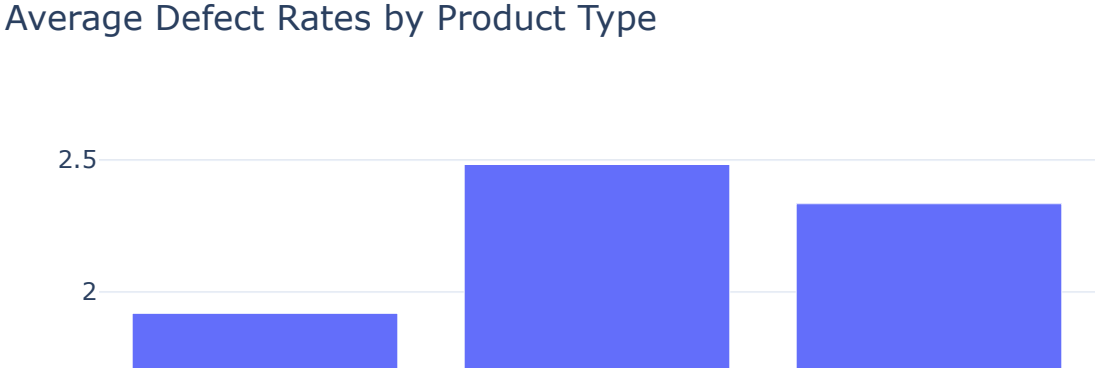
The company spends more on Road and Rail modes of transportation for the transportation of Goods.

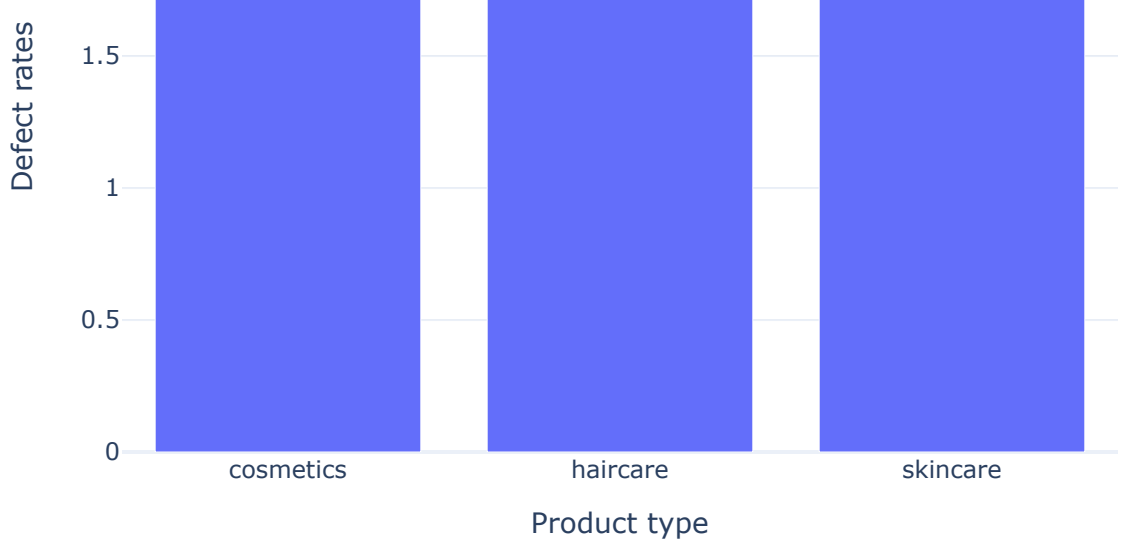
Analyzing Defect Rate

The defect rate in the supply chain refers to the percentage of products that have something wrong or are found broken after shipping.

The average defect rate of all product types

In [13]:
```
defect_rates_by_product = data.groupby('Product type')['Defect rates'].mean().reset_inde

fig = px.bar(defect_rates_by_product, x='Product type', y='Defect rates',
             title='Average Defect Rates by Product Type')
fig.show()
```

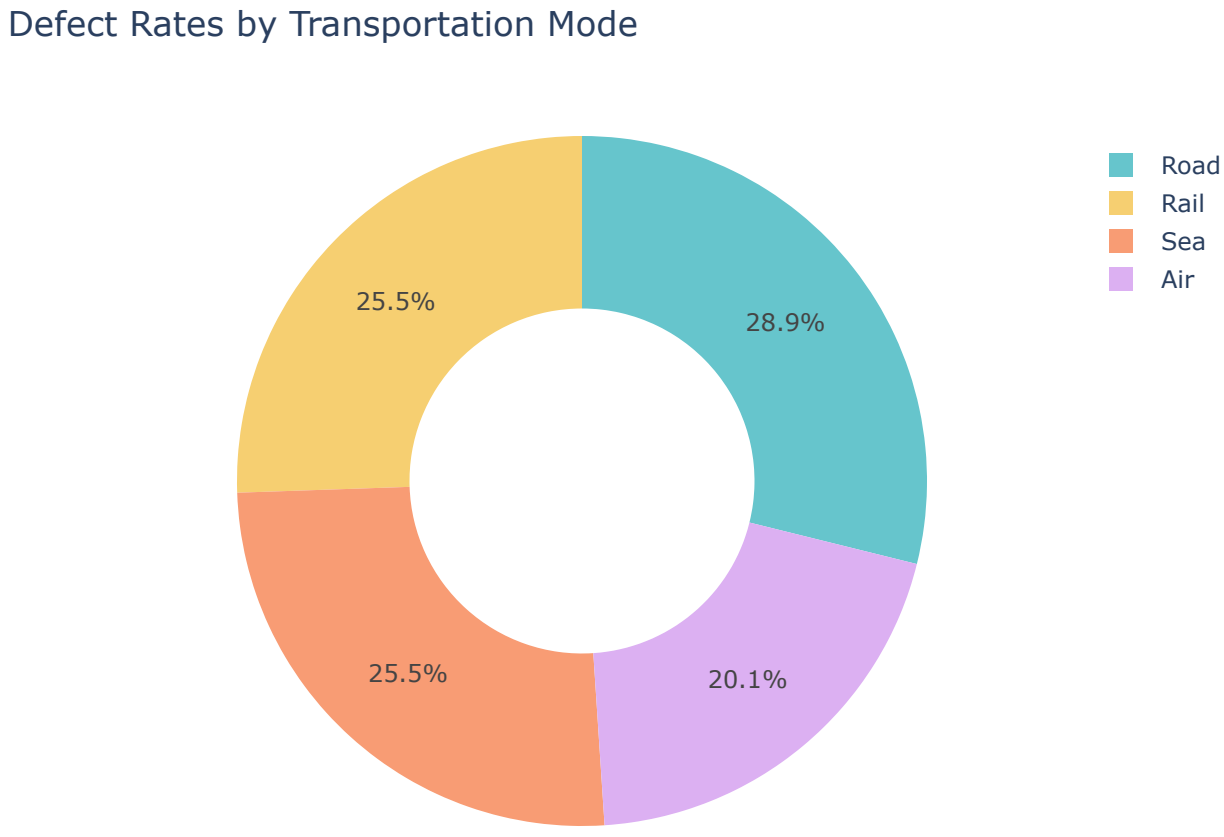




The defect rate of haircare products is higher.

The defect rates by mode of transportation

In [14]:
```
pivot_table = pd.pivot_table(data, values='Defect rates',
                             index=['Transportation modes'],
                             aggfunc='mean')

transportation_chart = px.pie(values=pivot_table["Defect rates"],
                              names=pivot_table.index,
                              title='Defect Rates by Transportation Mode',
                              hole=0.5,
                              color_discrete_sequence=px.colors.qualitative.Pastel)
transportation_chart.show()
```



Road transportation results in a higher defect rate, and Air transportation has the lowest defect rate.

Conclusion

In conclusion, the analysis of the Fashion and Beauty startup's supply chain provides valuable insights into various aspects of its operations. The company predominantly relies on skincare products for revenue, with higher-priced skincare items contributing significantly to overall earnings. Additionally, the examination of transportation modes reveals that while Carrier B generates more revenue, it is also the most costly carrier. Finally, the defect rate analysis indicates that the company faces higher defect rates in the haircare product category and that road transportation has a higher average defect rate compared to other modes. Overall, this comprehensive analysis offers a foundation for strategic decision-making and optimizations within the supply chain.