

Strategic Insights into Supply Chain Management



INTRODUCTION

- This presentation provides an in-depth analysis of our sales data, focusing on crucial metrics such as Revenue trends, Defect rates, and other business-critical insights. By examining product performance, customer demographics, supplier efficiency, and shipping carriers, we aim to answer key questions that impact business growth and operational efficiency. This data-driven approach highlights opportunities for improvement and supports strategic decision-making.





Quick look into the Data

- Before exploring detailed insights and answering key business questions, let's first review some key metrics such as total sales, total revenue, top products, regional sales and customer demographics. This high-level overview will provide a snapshot of the current business performance.
- Following this summary, we will dive deeper into each visual representation to extract actionable insights that can support business growth and profit maximization.



Number of Products Sold

46,099

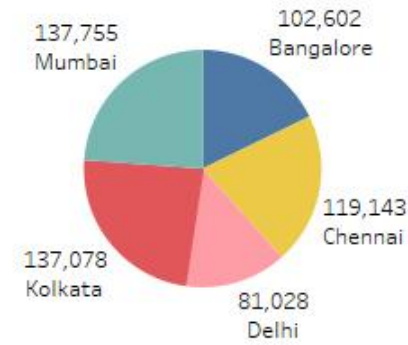
Top products

Location	SKU	Product type	
Bangalore	SKU51	haircare	9,866
	SKU90	skincare	9,593
	SKU24	haircare	9,049
Chennai	SKU31	skincare	9,655
	SKU99	haircare	9,185
	SKU34	skincare	9,062
Delhi	SKU64	skincare	8,459
	SKU53	skincare	8,232
	SKU49	cosmetics	8,002
Kolkata	SKU32	skincare	9,572
	SKU18	haircare	9,365
	SKU23	cosmetics	8,858
Mumbai	SKU38	cosmetics	9,692
	SKU2	haircare	9,578
	SKU67	skincare	9,474

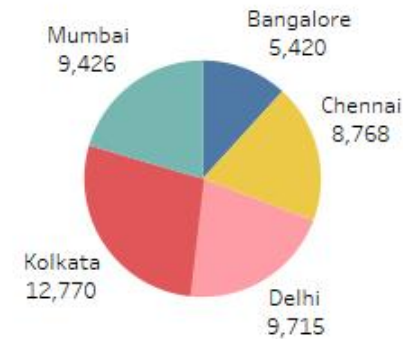
Total Revenue Generated

577,605

Revenue based on Location

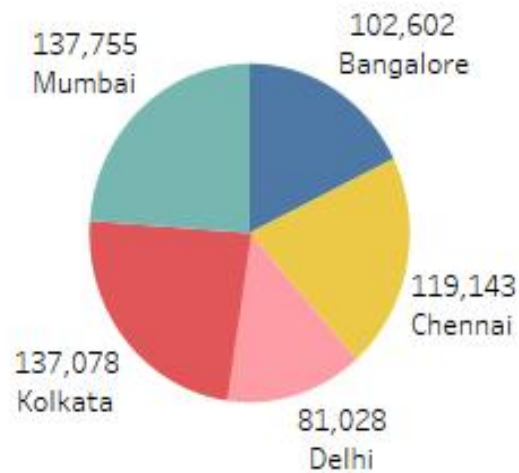


Number of Products sold based on Location



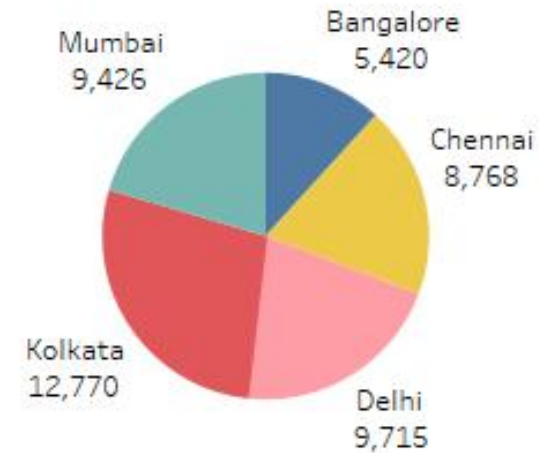
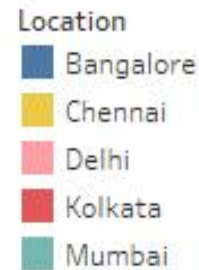
Sales Distribution by location

Revenue based on Location



Number of Products sold based on Location

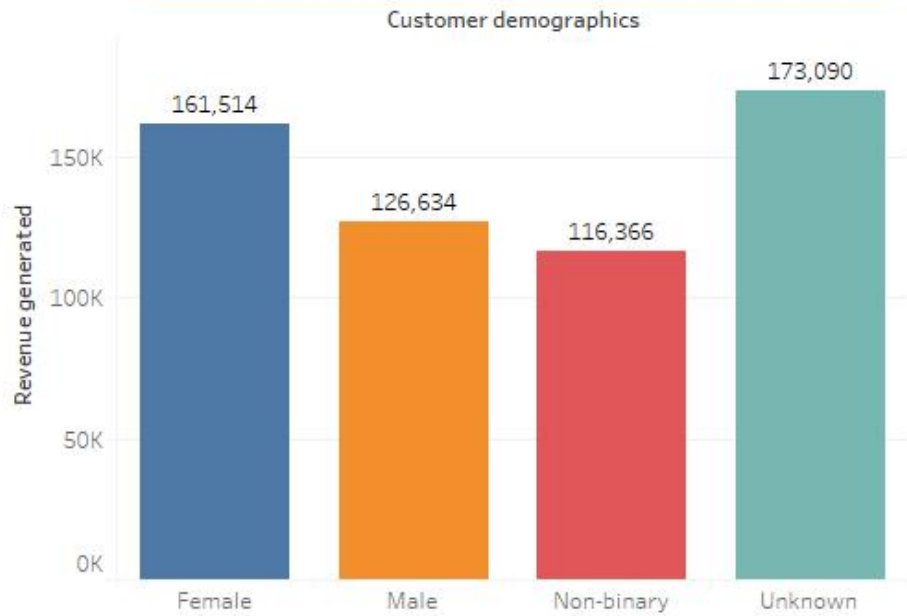
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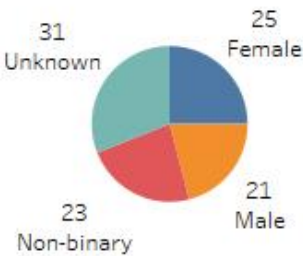
These pie charts provide a clear overview of the locations generating the highest sales and revenue. It is evident that Kolkata leads in both sales and revenue. Additionally, while Bangalore has comparatively lower product sales, it is generating nearly the same revenue as other cities.

Revenue by Demographics

Customer d..	
Female	161,514
Male	126,634
Non-binary	116,366
Unknown	173,090



Products Demographic Breakdown



Revenue Generation and Product Sales



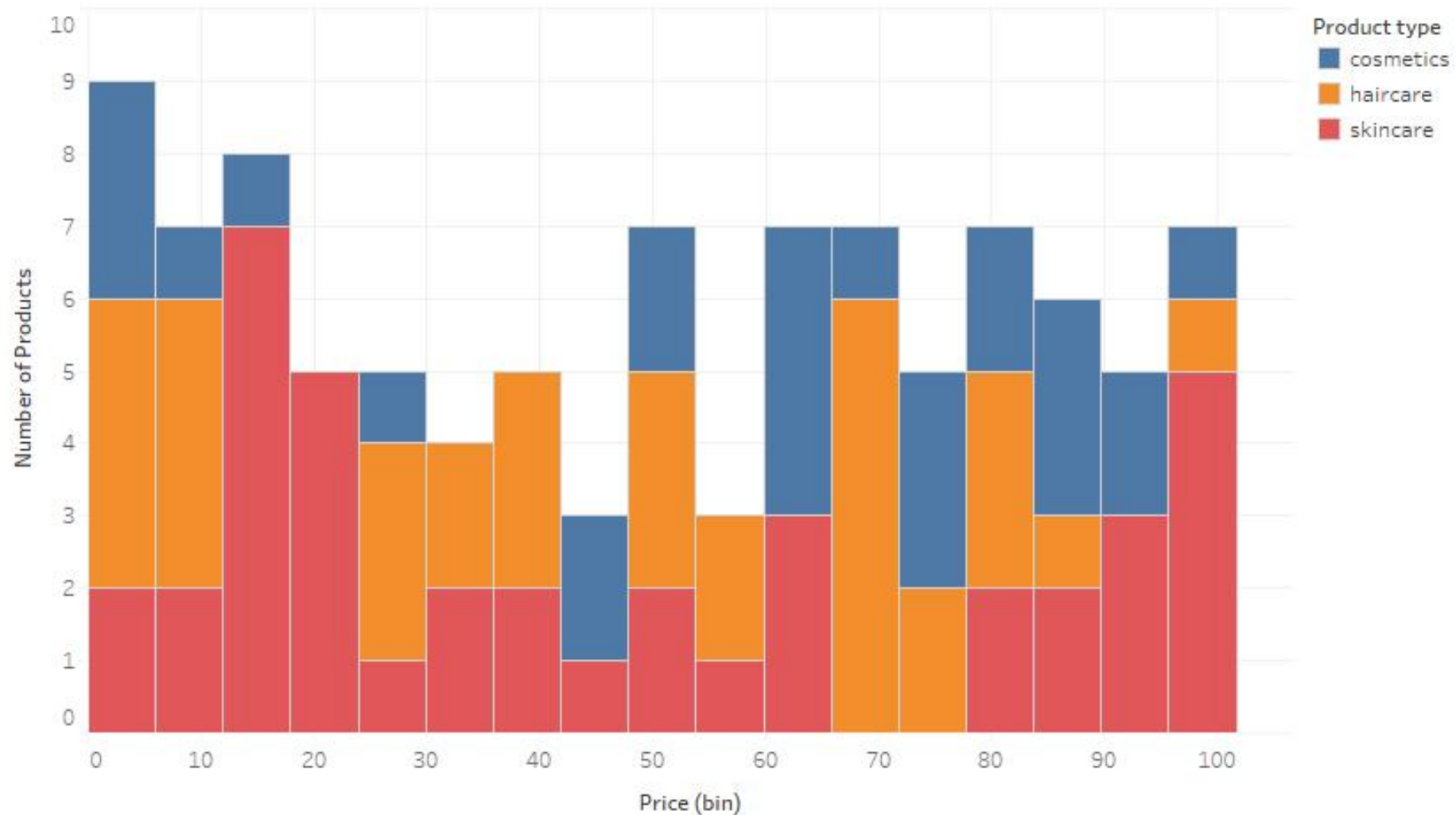
Price Distribution



Sold Products Distribution by Product type and Customer Demographics



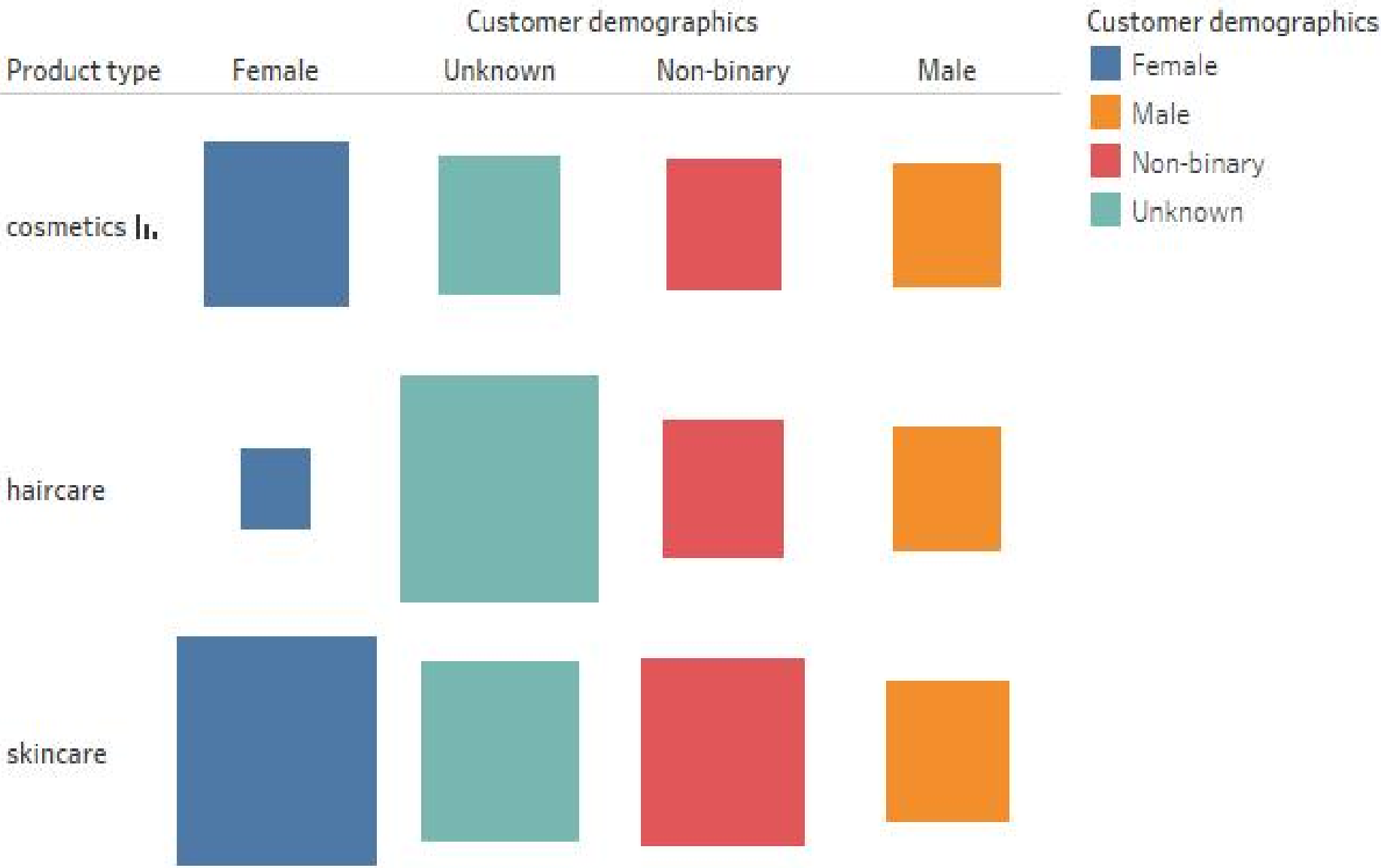
Price Distribution



This visual shows the price distribution of the products across different product type.

- Cosmetics products are mostly in the range of 45-100 with a few products in the 0-15 price range too.
- Haircare products are almost evenly distributed throughout. However there are fewer products costlier than 85
- Most of the skincare products are in the price range of 0-25 and 80-100. However there are a few products in the range of 25-65 too. This suggests that skincare products prices are more diverse than the other two.

Sold Products Distribution by Product type and Customer Demographics



This visual shows that what are the target groups for different products.

- The sales of cosmetic products are nearly uniform across all customer demographics, with a slight increase for female customers.
- The sales of haircare products is the most for gender neutral products.
- The sales of skincare products are nearly uniform across all customer demographics, with a slight increase for female customers.

Understanding Business Problems

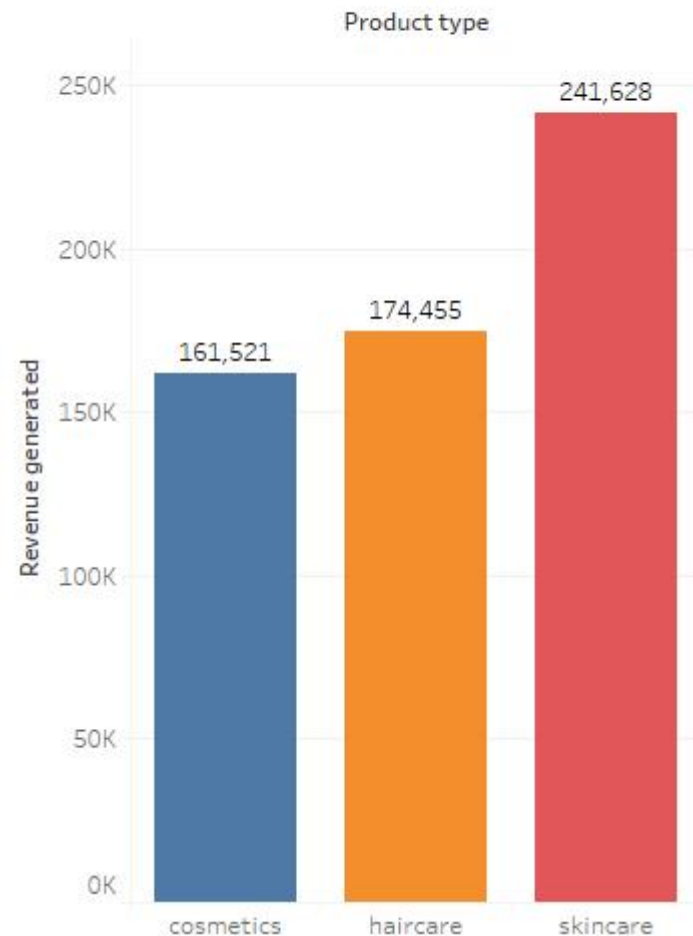
- Now that we've reviewed the data summary, it's time to dive deeper into the analysis and extract meaningful insights.
- Rather than searching for insights randomly, a more effective approach is to outline key questions first, then use the data to answer them.
- This method will help us stay focused, ensuring we understand what information we need from the data and where we are headed.



Critical Questions from the Sales Analysis

- Which Product type generates the highest revenue and what are the top products from each product type?

Revenue Generation and Product Sales



The following bar graph illustrates that skincare products generates the highest revenue with a total of 241,628 followed by haircare products with a total of 174,455, and lastly cosmetics products at 161,521

Top products

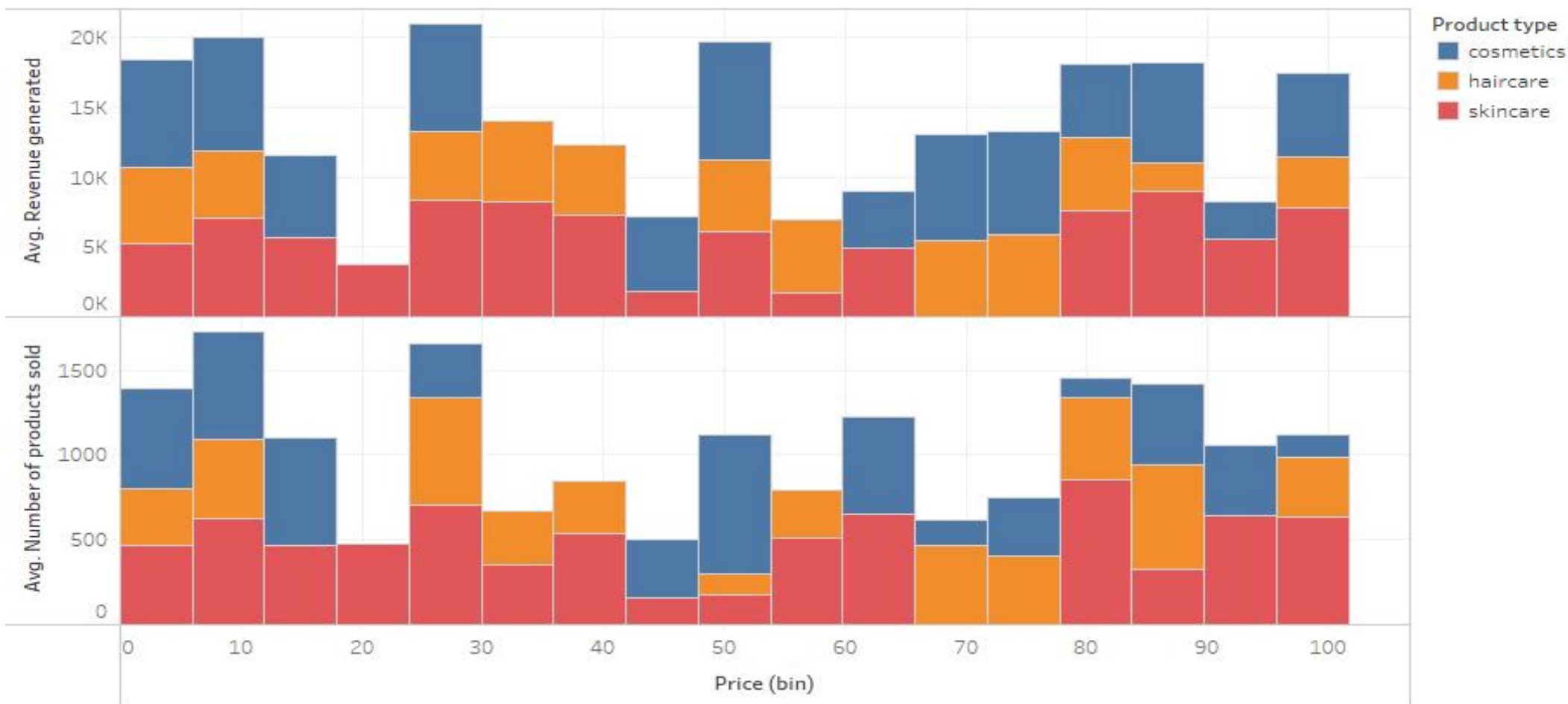
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The following table shows the top products from each type for every location giving us a comprehensive summary of which products are performing the best in the market.

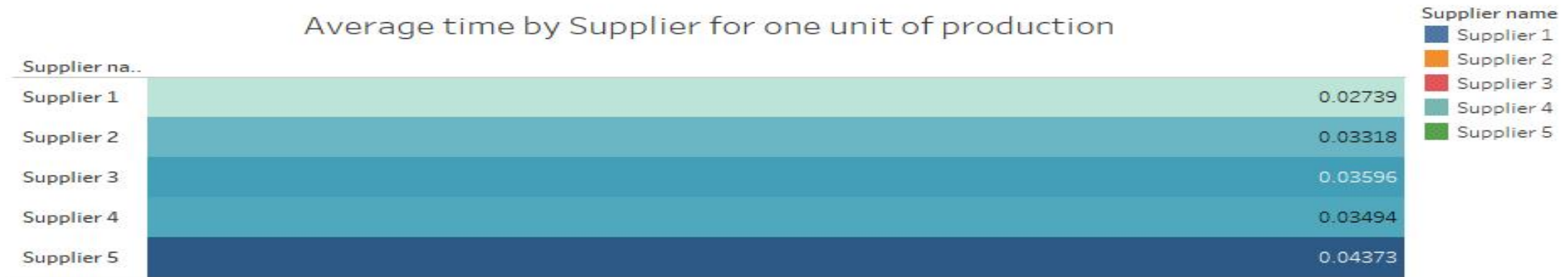
- Products of what price range is doing good in the market. Which price range performance is concerning and needs attention?

Revenue by Price range

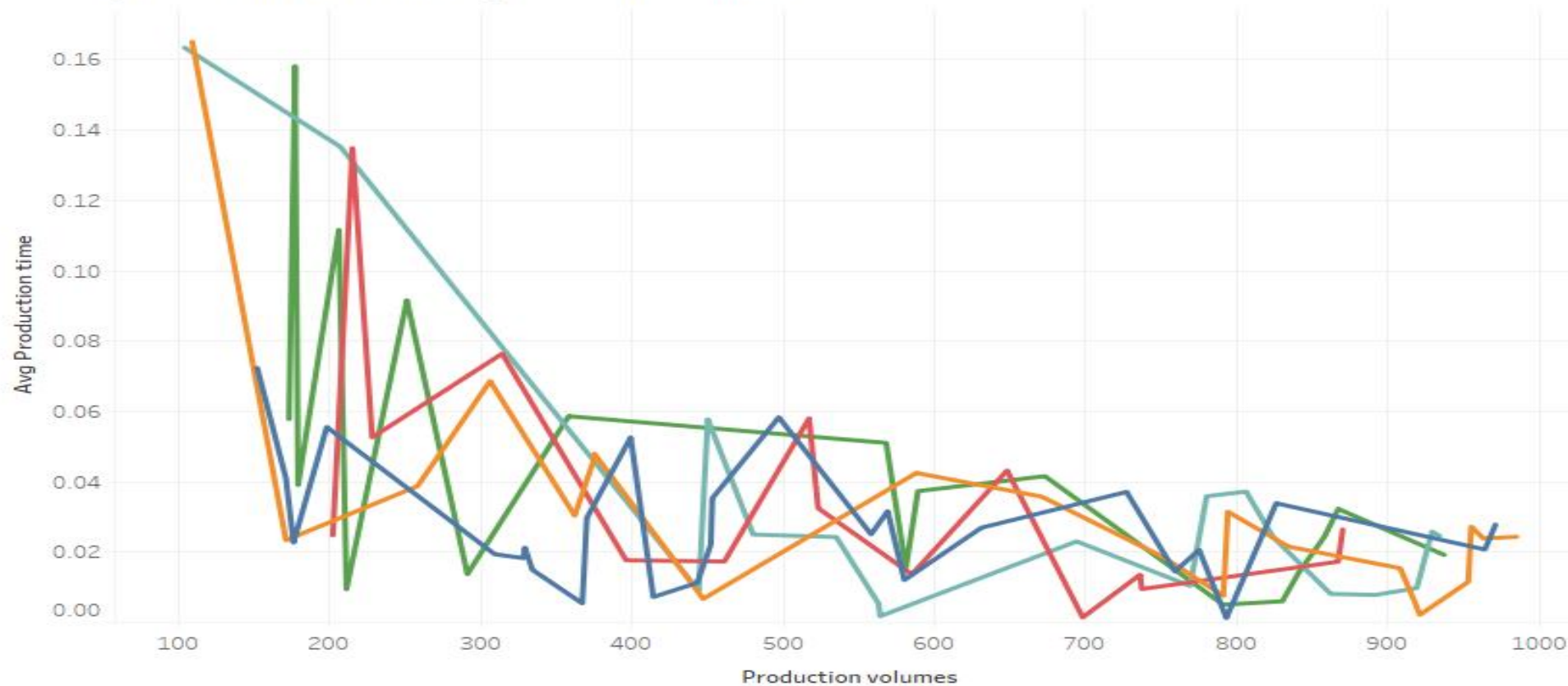


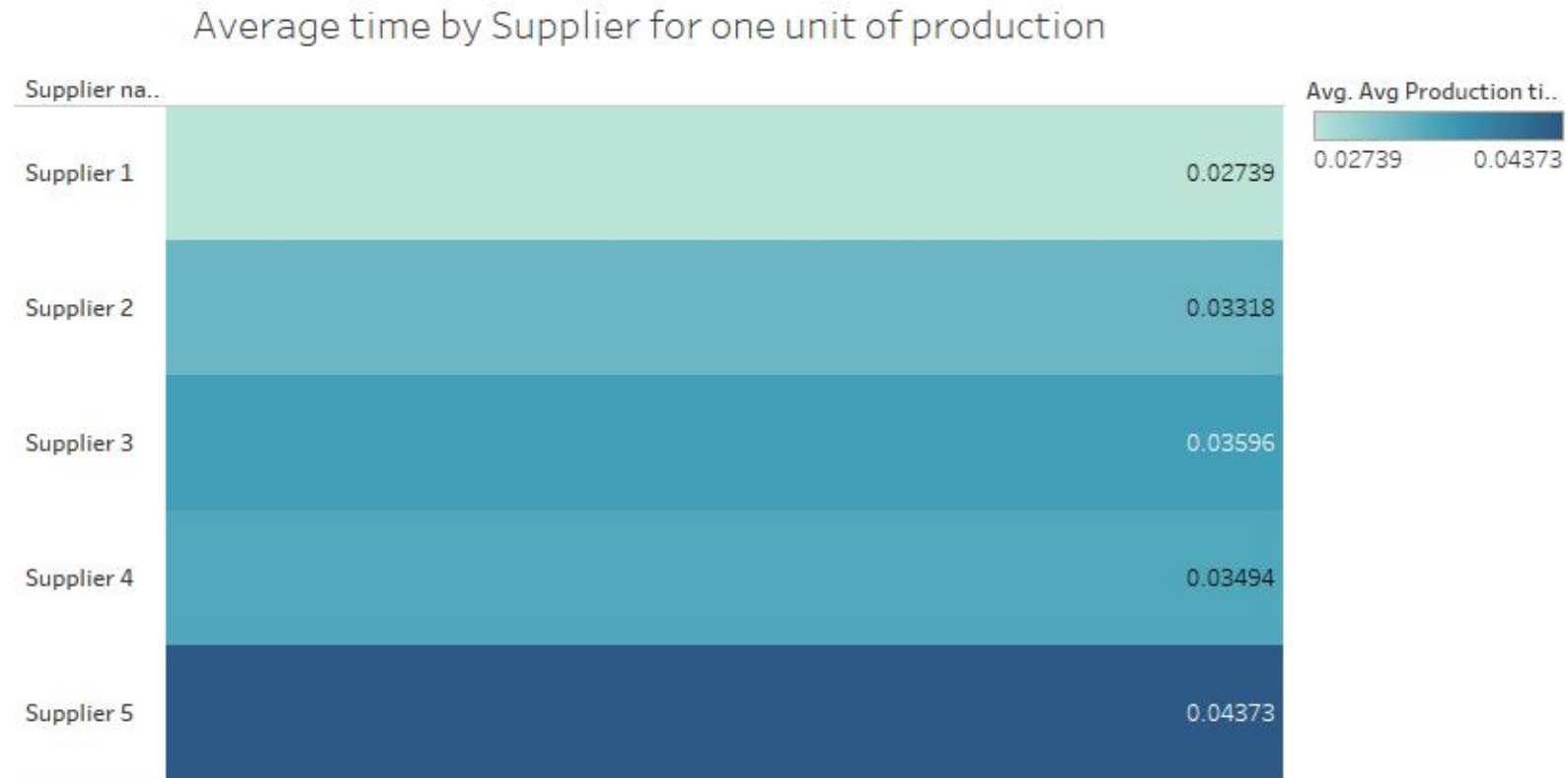
We can observe smaller bars in the middle of the visual for skincare products, indicating that they are struggling in the market. Cosmetic products in the price range of 65-85 also show comparatively lower sales, while haircare products maintain consistent sales across all price ranges.

- Which suppliers have the most efficient manufacturing process?



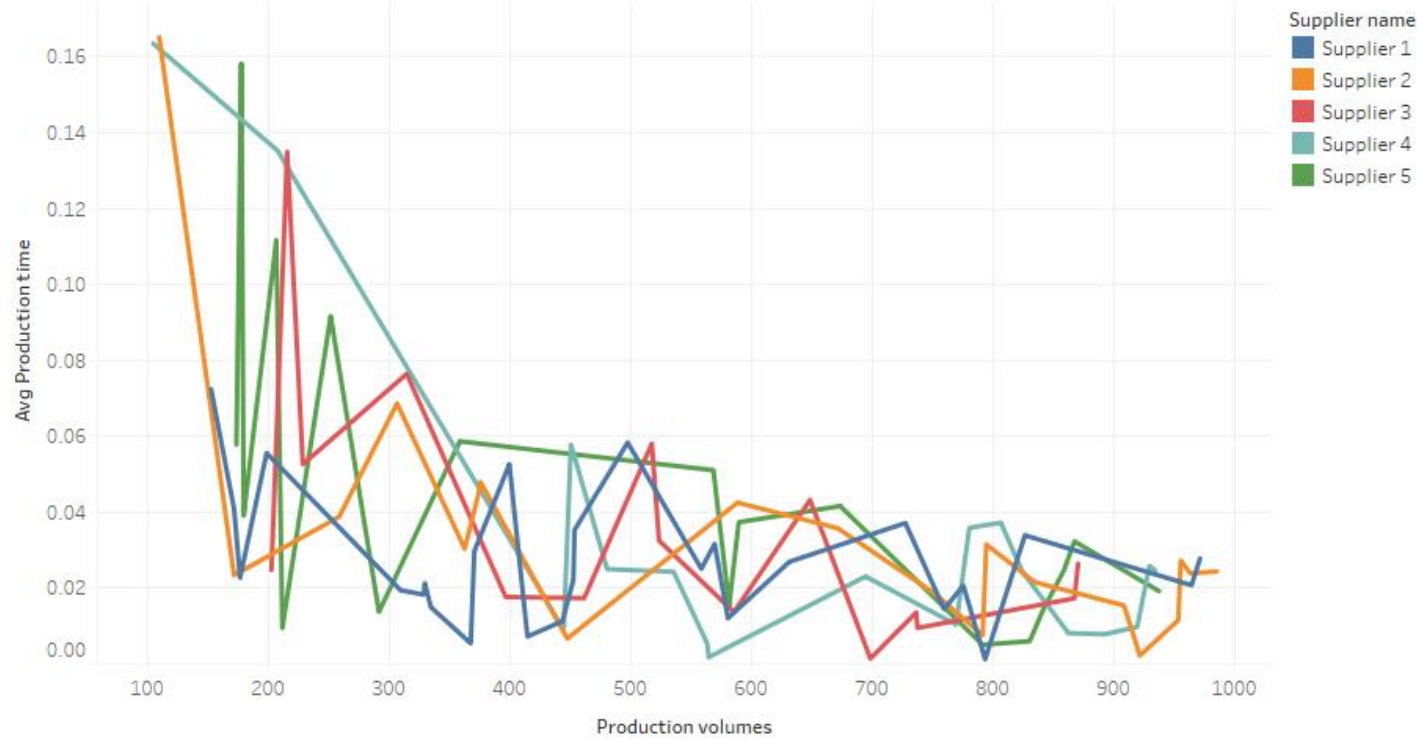
Average Production Time by Product volume



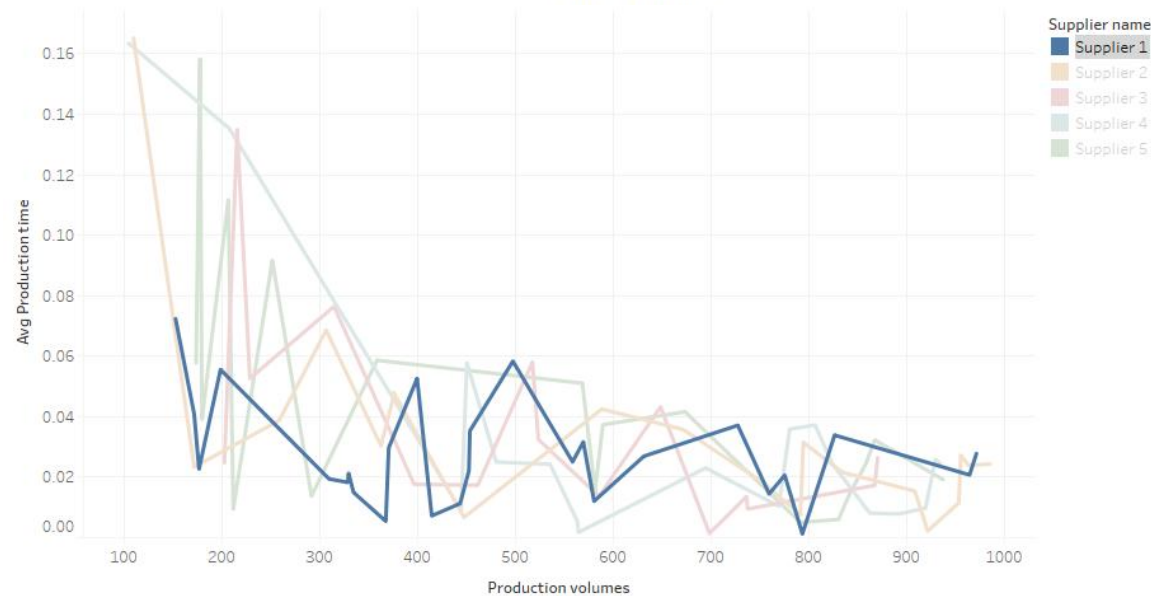


This visual illustrates that supplier 1 takes the least amount of time for one unit of production.

Average Production Time by Product volume



From the visual, we can observe that for all suppliers except Supplier 1, lower production volumes result in higher average times. However, as production volume increases, the average time decreases, and all suppliers tend to converge around a similar average. This suggests that manufacturers follow a uniform production approach, causing the average time to rise when the volume is lower (since Average time = Total time taken / Production volume).



In contrast, Supplier 1 maintains a consistent average across all production levels, resulting in a more efficient overall production time.

- How do shipping costs vary by Shipping carriers and location?

Average Shipping cost



From the following visual we can observe the average shipping cost of all the shipping carriers for different locations.

For carrier A the average shipping cost for Delhi and Kolkata is a little lower than the rest of the cities by carrier A.

For carrier B the average shipping costs for Kolkata and Mumbai is higher than the rest.

For carrier C the average cost for Bangalore is super high but consistent for the rest of the cities with the average cost between 4-6.

- What are the significant factors affecting the Defect rates?

To answer this, we will use the statistical methods for the test of significance. We will use ANOVA test on the categorical features and regression analysis test for the continuous features.

Lets now look at the test results and its summary

```
ANOVA results for Product type:
              sum_sq    df      F    PR(>F)
C(Q("Product type"))  4.904933    2.0  1.151903  0.320319
Residual              206.518405   97.0      NaN      NaN

ANOVA results for Customer demographics:
              sum_sq    df      F    PR(>F)
C(Q("Customer demographics"))  2.286528    3.0  0.349861  0.789326
Residual              209.136809   96.0      NaN      NaN

ANOVA results for Shipping carriers:
              sum_sq    df      F    PR(>F)
C(Q("Shipping carriers"))  20.421162    2.0  5.185419  0.007252
Residual              191.002175   97.0      NaN      NaN

ANOVA results for Supplier name:
              sum_sq    df      F    PR(>F)
C(Q("Supplier name"))    9.527672    4.0  1.120788  0.351379
Residual              201.895665   95.0      NaN      NaN

ANOVA results for Location:
              sum_sq    df      F    PR(>F)
C(Q("Location"))        3.778532    4.0  0.432181  0.785062
Residual              207.644806   95.0      NaN      NaN

ANOVA results for Transportation modes:
              sum_sq    df      F    PR(>F)
C(Q("Transportation modes"))  8.841617    3.0  1.39663  0.248565
Residual              202.581720   96.0      NaN      NaN

ANOVA results for Routes:
              sum_sq    df      F    PR(>F)
C(Q("Routes"))          1.242355    2.0  0.286678  0.751387
Residual              210.180982   97.0      NaN      NaN
```

ANOVA test Summary

The ANOVA test determines if two features are correlated. If the p-value is less than 0.05, we can conclude, with 95% confidence, that a correlation exists. In the output, the column "PR(>F)" represents the p-value for each feature. We observe that only "Shipping Carriers" (p-value = 0.007252) has a p-value below 0.05, indicating a significant correlation with product defect rates.

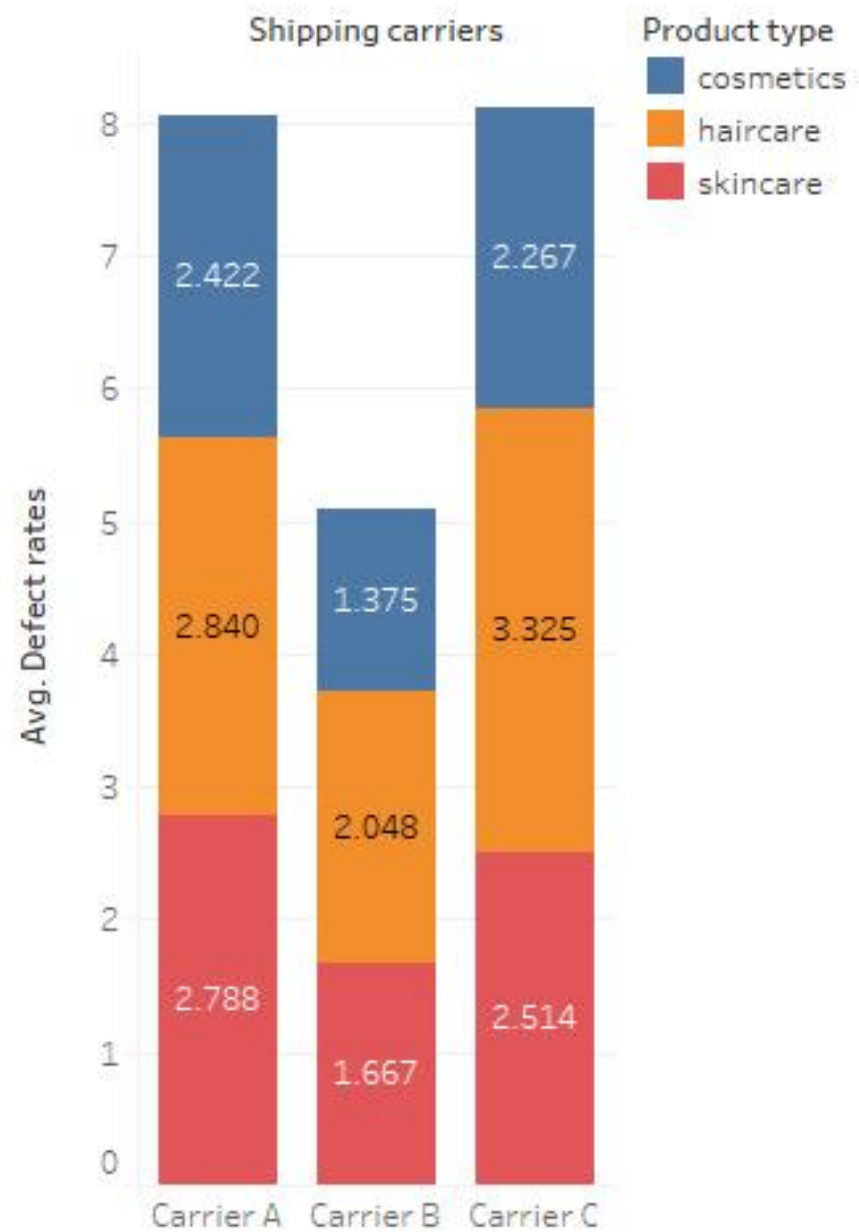
With this information, we can now create a targeted visual to explore this relationship further, without the need to generate visuals for every feature that lacks a significant correlation.

	coef	std err	t	P> t	[0.025	0.975]

const	2.1902	1.100	1.991	0.050	0.002	4.378
Price	-0.0080	0.005	-1.563	0.122	-0.018	0.002
Availability	0.0041	0.005	0.824	0.412	-0.006	0.014
Number of products sold	-0.0005	0.000	-1.014	0.313	-0.001	0.000
Revenue generated	-7.354e-05	5.46e-05	-1.346	0.182	-0.000	3.51e-05
Stock levels	-0.0080	0.005	-1.672	0.098	-0.018	0.002
Lead times	0.0040	0.018	0.225	0.822	-0.031	0.039
Order quantities	0.0017	0.006	0.295	0.768	-0.009	0.013
Shipping times	-0.0187	0.054	-0.348	0.729	-0.125	0.088
Shipping costs	0.0539	0.055	0.974	0.333	-0.056	0.164
Lead time	0.0548	0.017	3.191	0.002	0.021	0.089
Production volumes	-9.217e-05	0.001	-0.103	0.918	-0.002	0.002
Manufacturing lead time	0.0186	0.026	0.706	0.482	-0.034	0.071
Manufacturing costs	-0.0013	0.005	-0.249	0.804	-0.012	0.009
Costs	8.42e-05	0.001	0.144	0.886	-0.001	0.001
Avg production time	-4.5531	7.883	-0.578	0.565	-20.230	11.123
=====						
Omnibus:	5.149	Durbin-Watson:		2.360		
Prob(Omnibus):	0.076	Jarque-Bera (JB):		2.708		
Skew:	0.138	Prob(JB):		0.258		
Kurtosis:	2.243	Cond. No.		3.60e+05		

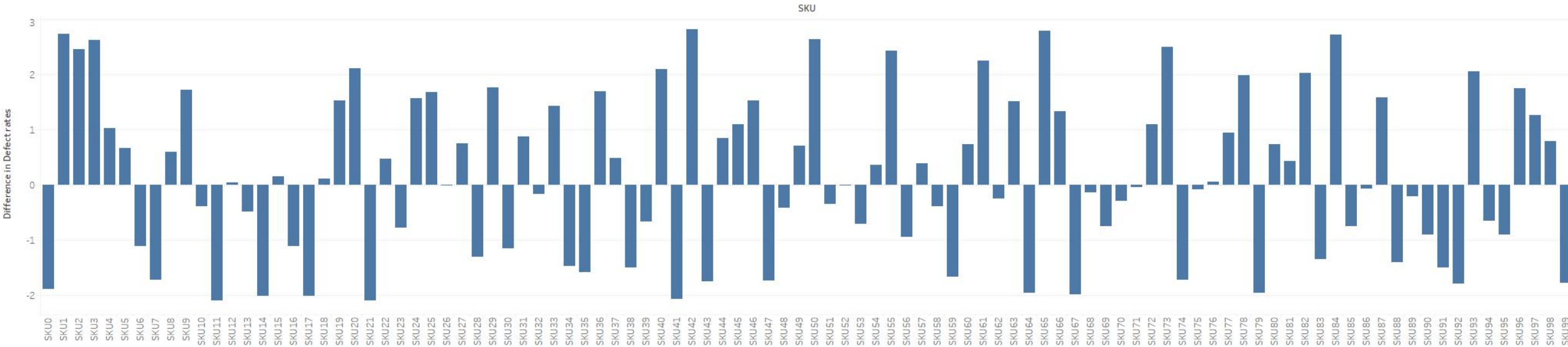
Similar to the ANOVA test, the p value determines if two features are correlated. Here the column $P>|t|$ shows the p value. We can see that only the feature Lead time(p value = 0.002) is significantly correlated to Defect rates.

Defect rate by Shipping carriers



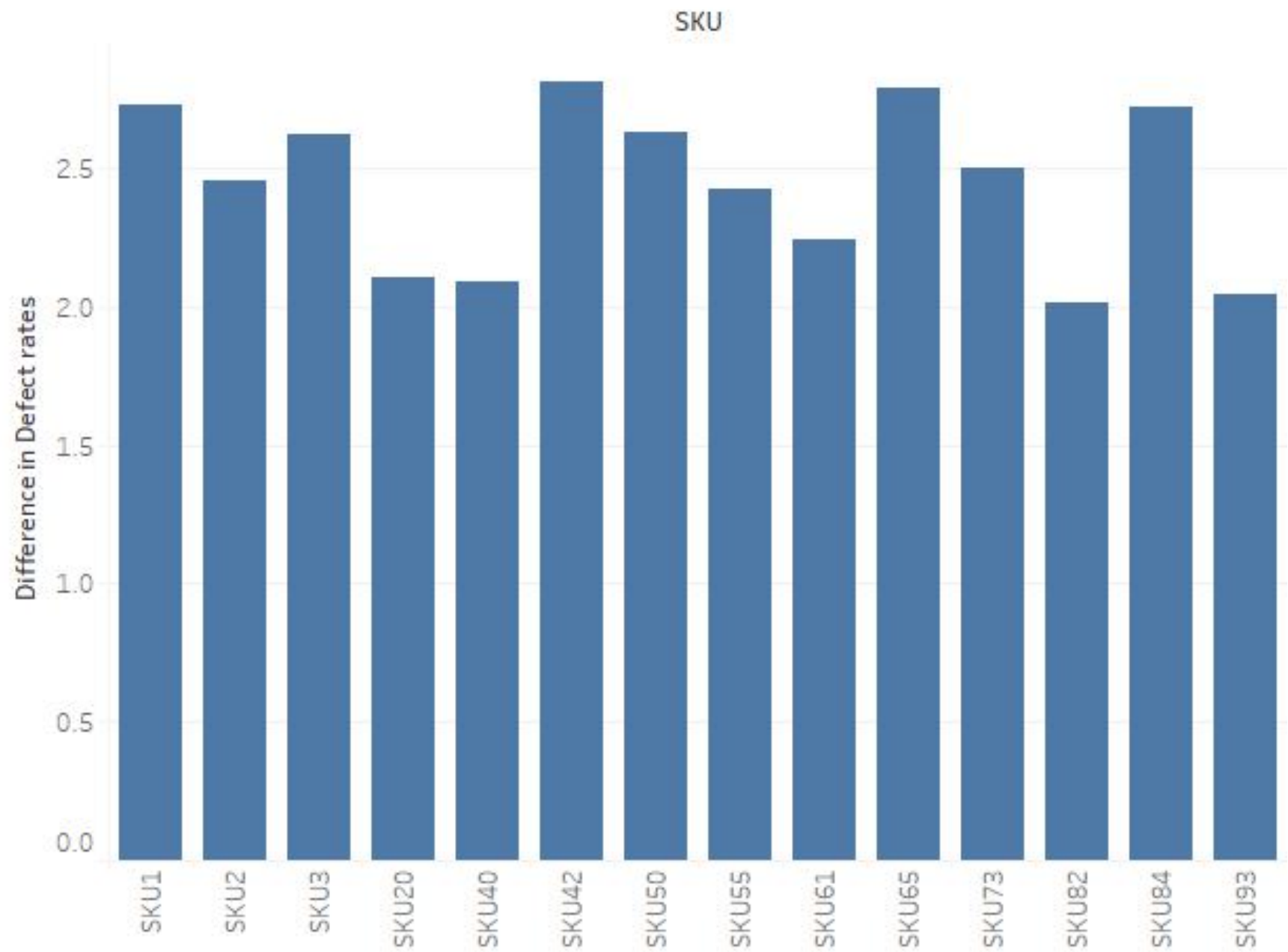
The bar graph clearly shows that the average defect rate is significantly higher for Carrier A and Carrier C compared to Carrier B, indicating that Carrier B handles products more effectively during shipping.

Defect rate by SKU



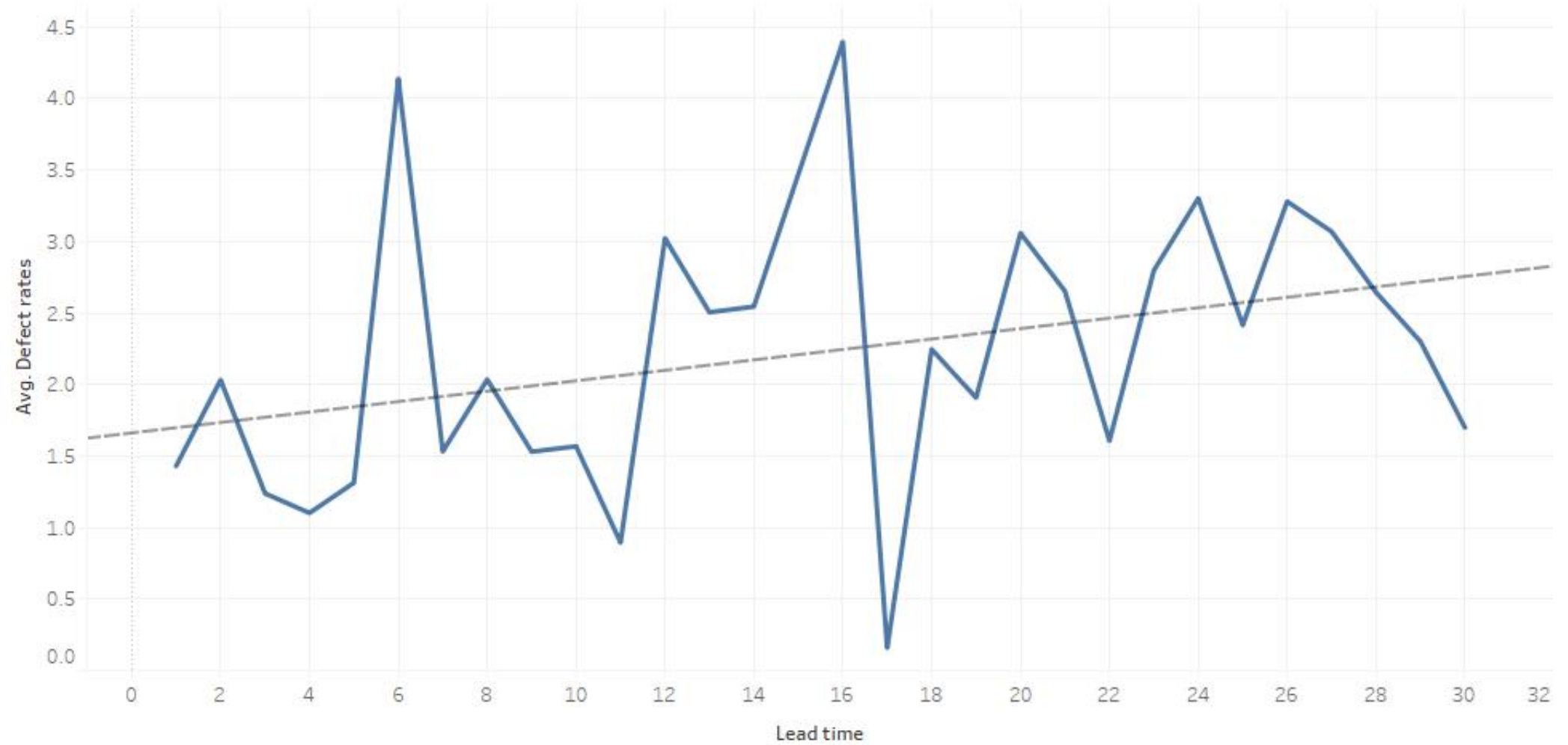
The following graph displays the deviation of defect rates for various SKUs from the median value, represented by the zero line. Bars extending above the zero line indicate SKUs with defect rates higher than the median, while bars below the zero line represent SKUs with lower defect rates.

Defect rate by SKU



These products have defect rates more than 2 units above the median value, indicating significantly higher defect rates. With this information, we should closely examine these products to determine the underlying causes of the elevated defect rates. It's important to assess whether the higher defect rates are due solely to the carrier or if other factors are contributing.

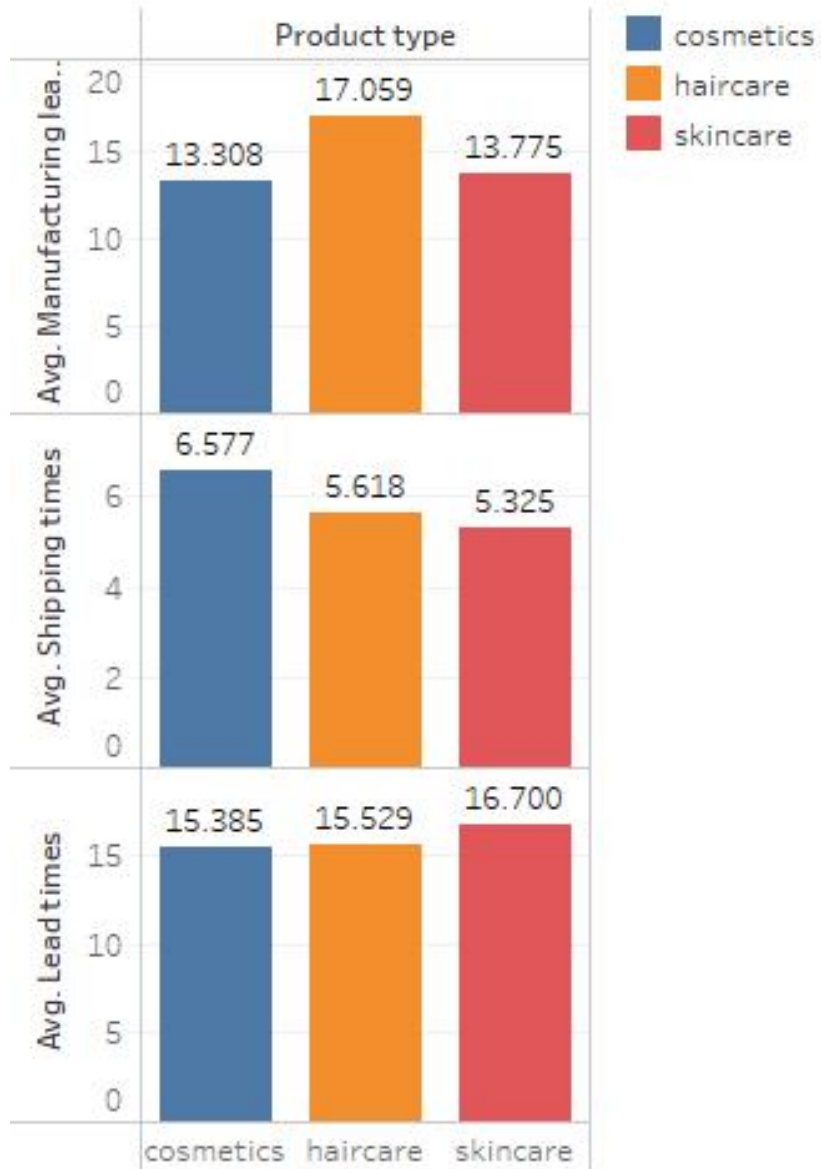
Average Defect rate by Lead time



The following graph and the trend line shows that the Defect rate tends to increase when the Lead time increases. This suggests a positive correlation between Defect rates and Lead time.

- How does Product type affects the manufacturing, shipment and lead times?

Time relations



For average manufacturing time, we observe that haircare products take longer to produce compared to the other product types. However, shipment and lead times are relatively consistent across all product types.

© Conclusive Summary

After a thorough analysis, we now have a clear understanding of our business challenges and can focus on developing solutions to drive growth. To further increase profitability, we can implement the following strategies:

- Reduce Defect Rates: Achieve this by selecting the most reliable shipping carriers.
- Lower Shipping Costs: Optimize carrier selection based on location, while considering defect rate data to maintain quality.
- Cut Manufacturing Costs: Decrease average production time by increasing batch sizes, ensuring we avoid overstocking.



Thank You

- Presented by: Sanket Anand

