Questions to answer

Part 1: Product Performance Analysis

1. **Which sub category products have the highest profit?**
2. **Which product categories are performing best?**
3. **What are the average sales per product per month?**

Part 2: Inventory and Production Efficiency

1. **Which products are at risk of stockouts?**
2. **How have the costs changed over time for each category?**
3. **How long does it take to complete a work order on average for each Category?**
4. **What is the scrap rate for each product Sub category?**

Part 3: Market Demand and Trends

1. **Which geographical locations have the highest product storage?**
2. **What is the percentage of discontinued products in each category?**
3. **How do costs compare against revenue for sub categories with high cost?**

Tables needed

All these tables are taken from production scheme

1. Product
2. Product Category
3. Product Subcategory
4. Transaction History
5. Bill Of materials
6. Product location
7. Product Inventory
8. Product Cost History
9. List Price History
10. Work Order

Along with these Tables I needed to construct some views, to be able to answer some hard questions, or make the analysis easier.

Views

1. Below Needed Products

To answer the question what are the product, which run out of stock or about to.

I Made a view containing each category and its average price

```
create view CategoryPriceChange as
SELECT
    FORMAT(pc.StartDate, 'yyyy-MM') AS date,
    c.name,
    c.ProductCategoryID,
    AVG(pc.StandardCost) AS AverageCost
FROM
    Production.ProductCostHistory pc
join Production.Product p
on p.ProductID = pc.ProductID
join Production.ProductSubcategory ps
on ps.ProductSubcategoryID = p.ProductSubcategoryID
join Production.ProductCategory c
on c.ProductCategoryID = ps.ProductCategoryID
GROUP BY
    FORMAT(pc.StartDate, 'yyyy-MM'), c.Name, c.ProductCategoryID;
```

Results Messages

	date	name	ProductCategoryID	AverageCost
1	2011-05	Accessories	4	12.0278
2	2012-05	Accessories	4	16.0826
3	2013-05	Accessories	4	12.0219
4	2011-05	Bikes	1	1182.6254
5	2012-05	Bikes	1	831.2355
6	2013-05	Bikes	1	813.0205
7	2011-05	Clothing	3	19.9136
8	2012-05	Clothing	3	23.8501
9	2013-05	Clothing	3	25.5579
10	2011-05	Components	2	443.1582
11	2012-05	Components	2	270.1572
12	2013-05	Components	2	275.679

Data Cleaning and Exploration

Python code used to check which columns have nulls

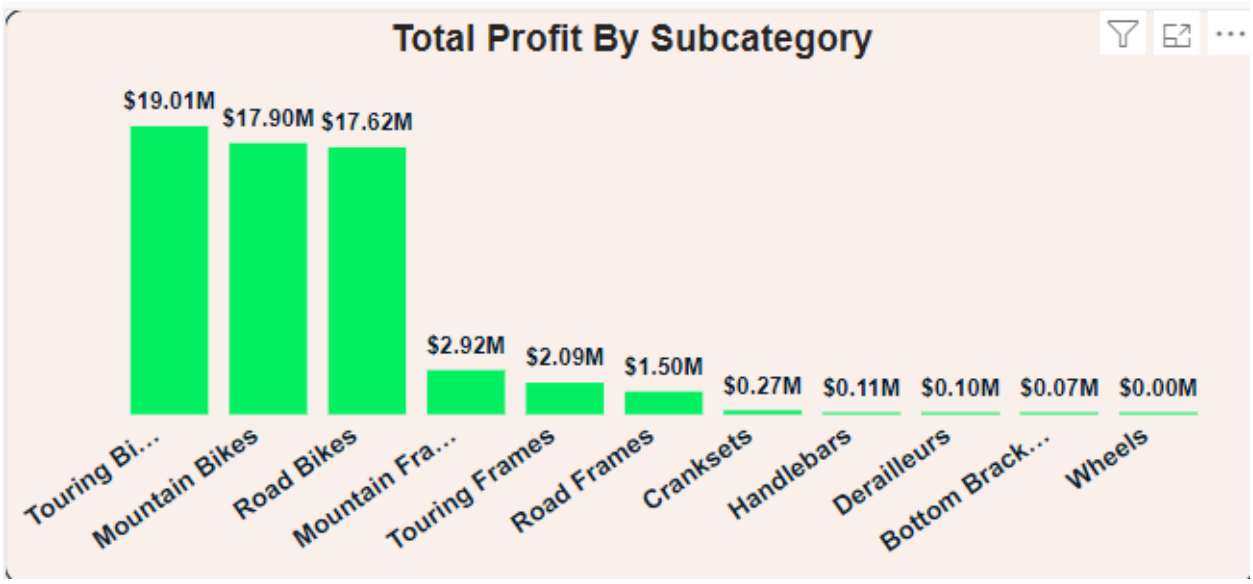
```
# taking conncetion information
connection_string = (
    "DRIVER={ODBC Driver 17 for SQL Server};"
    "SERVER=DESKTOP-P5UVUF4;"
    "DATABASE=AdventureWorks2022;"
    "UID=البوزر بتاعك;"
    "PWD=الباسورد بتاعك;"
)

def finding_null(table_name, primary_key):
    try:

    # Establish the connection
        connection = pyodbc.connect(connection_string)

        # Create a cursor from the connection
        cursor = connection.cursor()
    except Exception as e:
        return f"An error occurred: {e}"

    # extract columns of the table
    columns = cursor.execute(f"select column_name from INFORMATION_SCHEMA.COLUMNS where TABLE_NAME = '{table_name}';")

    # the output will be a list containing sum of tuples each tuble contains a column name we need to put all the column names
    # into one list
    table_columns = []
    for i in columns:
        for j in i:
            table_columns.append(j)
    # now we have a list containing all the column names

    for column in table_columns:
        # counting the null included in each column
        nulls_number = cursor.execute(
                f"select count({primary_key}) from Production.{table_name} where {column} is null")
        nulls_number = nulls_number.fetchall()

        # printing each column and its null counts
        print(f"column {column} has {nulls_number[0][0]} null values ")
        print("\n")
        print("="*50)
```

- Changed column Names to be easier to grasp while making Analysis.
- Dropped some unneeded columns.
- Changed values included in some columns to be easier to make analysis on

Data Modeling

Answering Questions

1. **Which sub category products have the highest profit?**

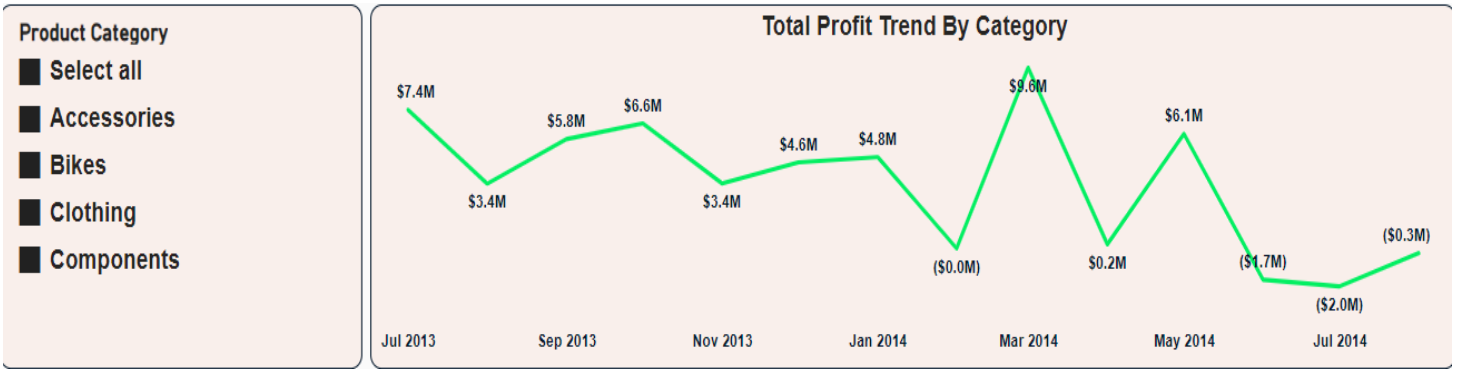


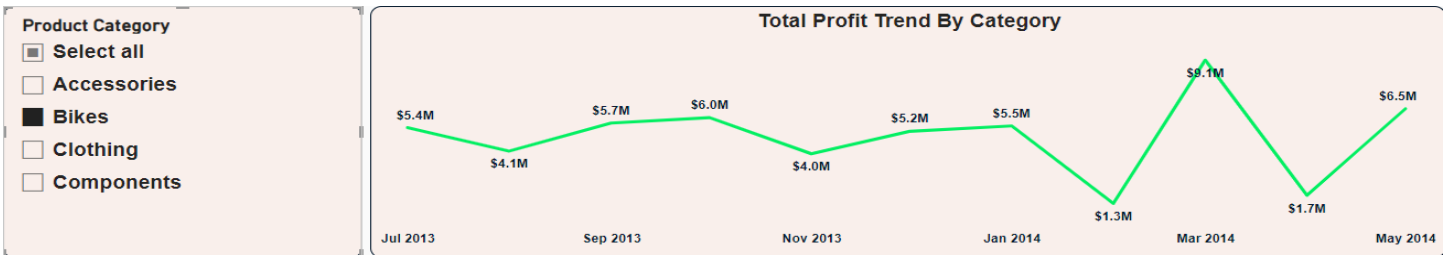
- Obviously touring, mountain and road bikes has the best effect.
- We don't get that much from selling bikes components.

2. **Which product categories are performing best?**

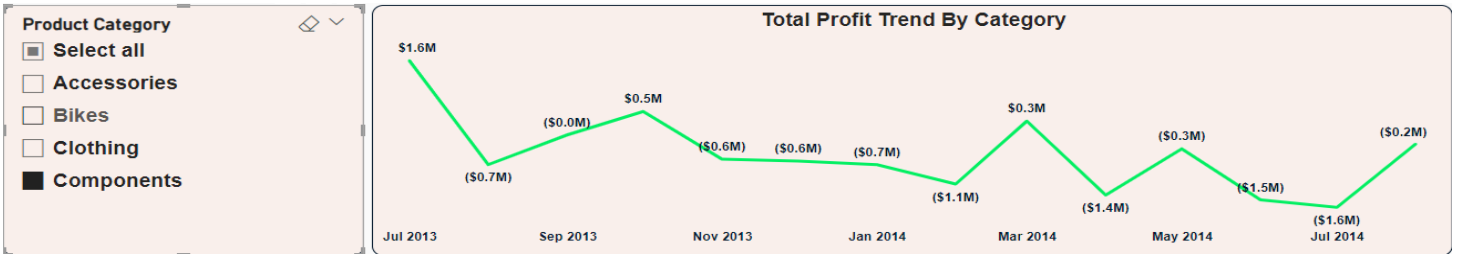
- This question supports the result of the first.
- We cannot say that there is a problem with components and accessories as they are used to manufacture Bikes.
- But we need to increase these products sales.

3. **What are the average sales per product per month?**



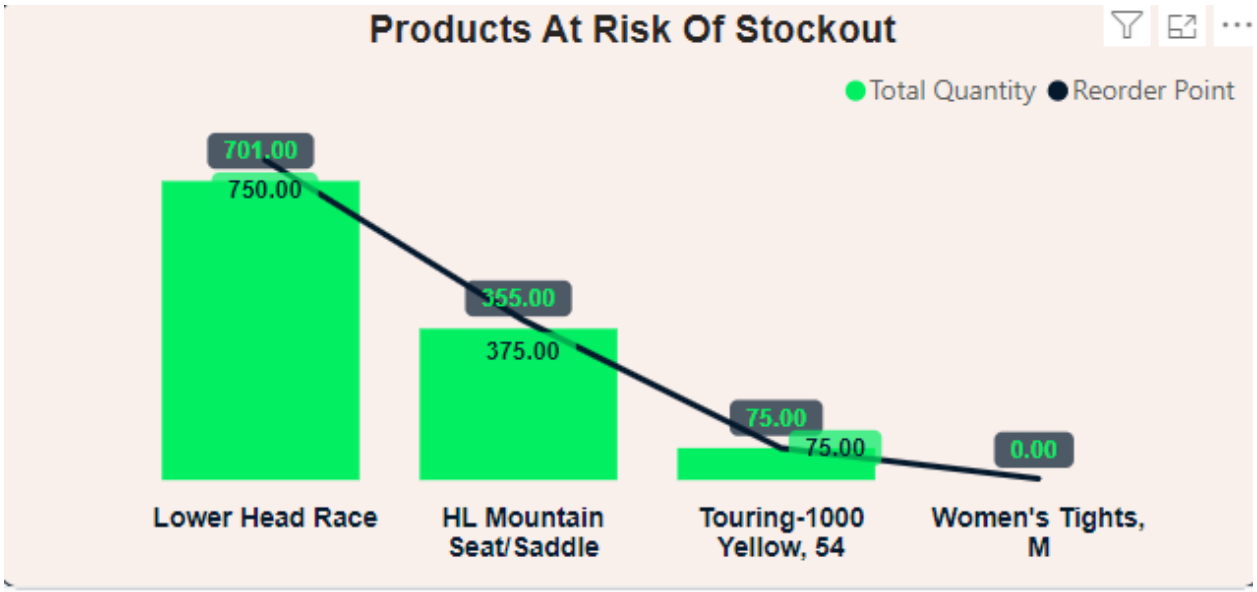


- Sales numbers are not consistent so we need to focus on the reasons for this inconsistency



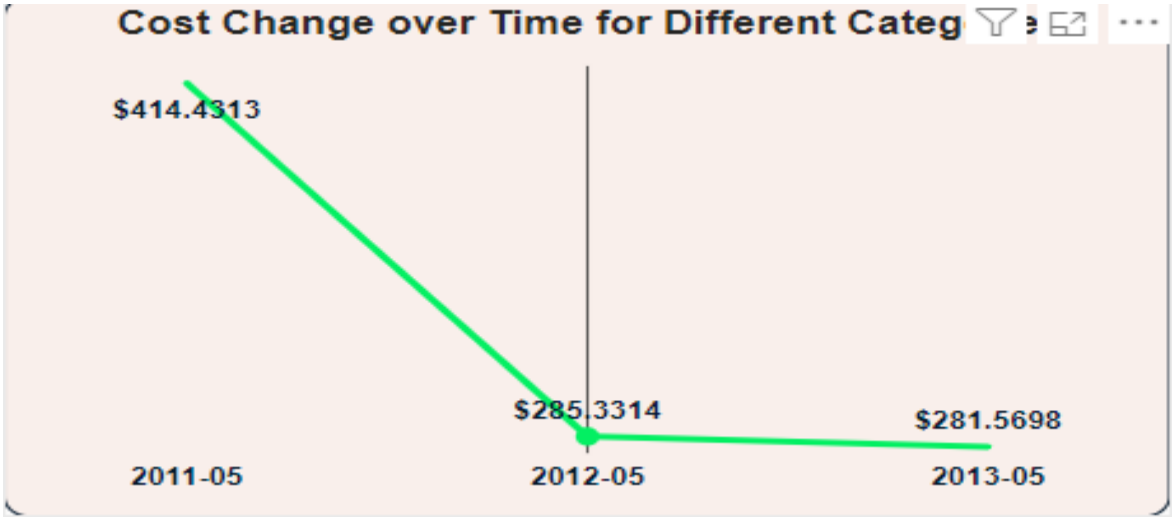
- There is a serious continuous problem with component sales.

4. **Which products are at risk of stockouts?**



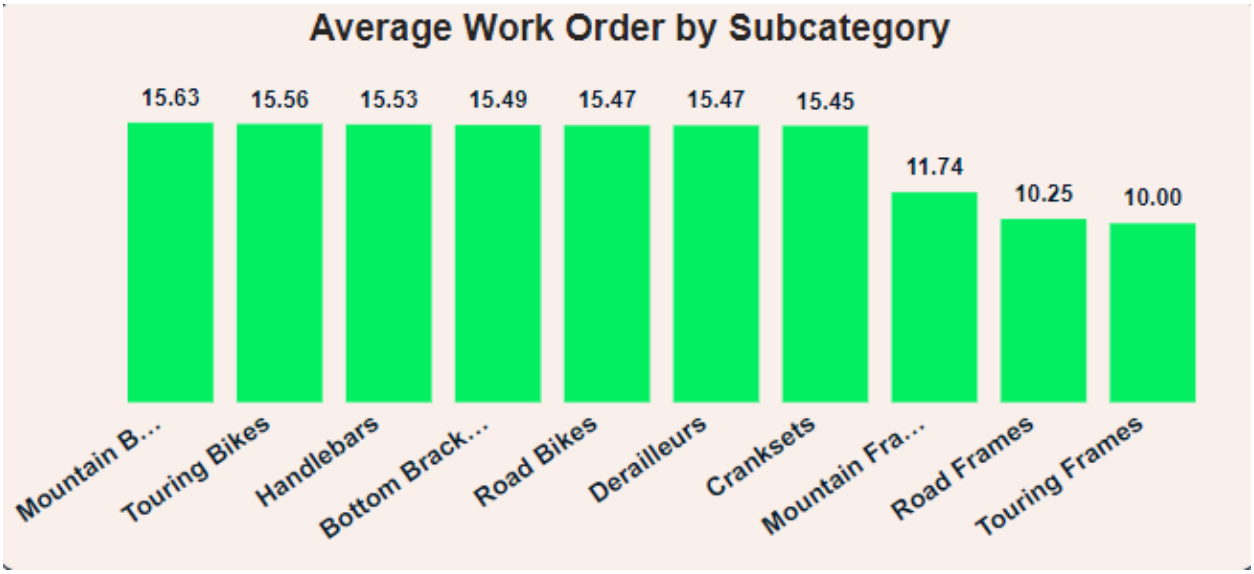
- We need to supply these components as fast as we can.

5. **How have the costs changed over time for each category?**



- We have done a great job decreasing the production cost of our product by starting producing the main components.

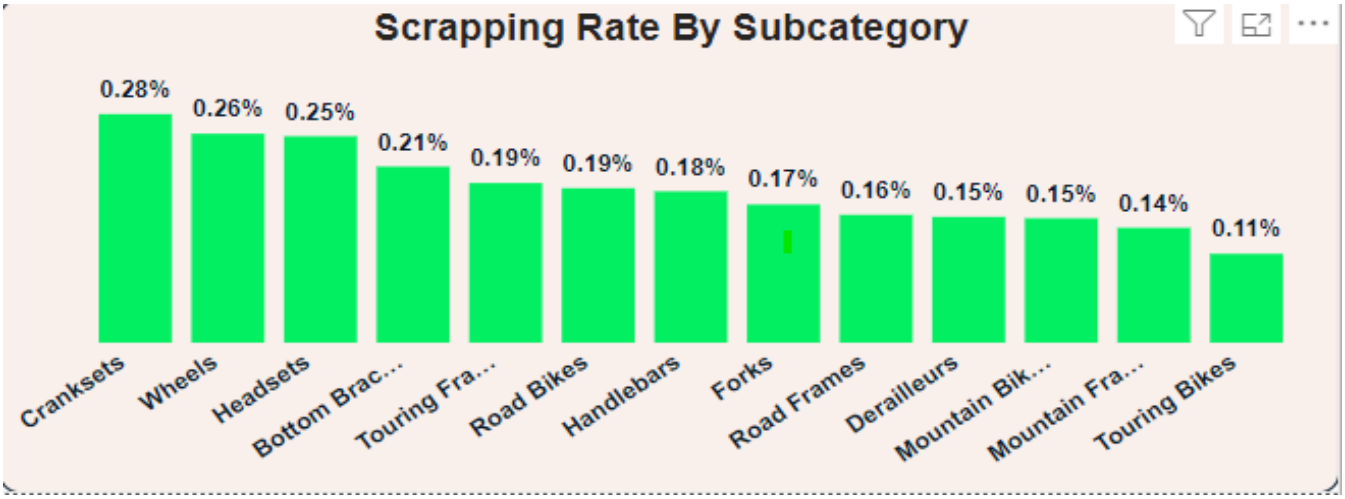
6. **How long does it take to complete a work order on average for each Category?**



Potential for improvement: The last three categories (Mountain Fre..., Road Frames, Touring Frames) have significantly lower work order periods. This discrepancy might indicate:

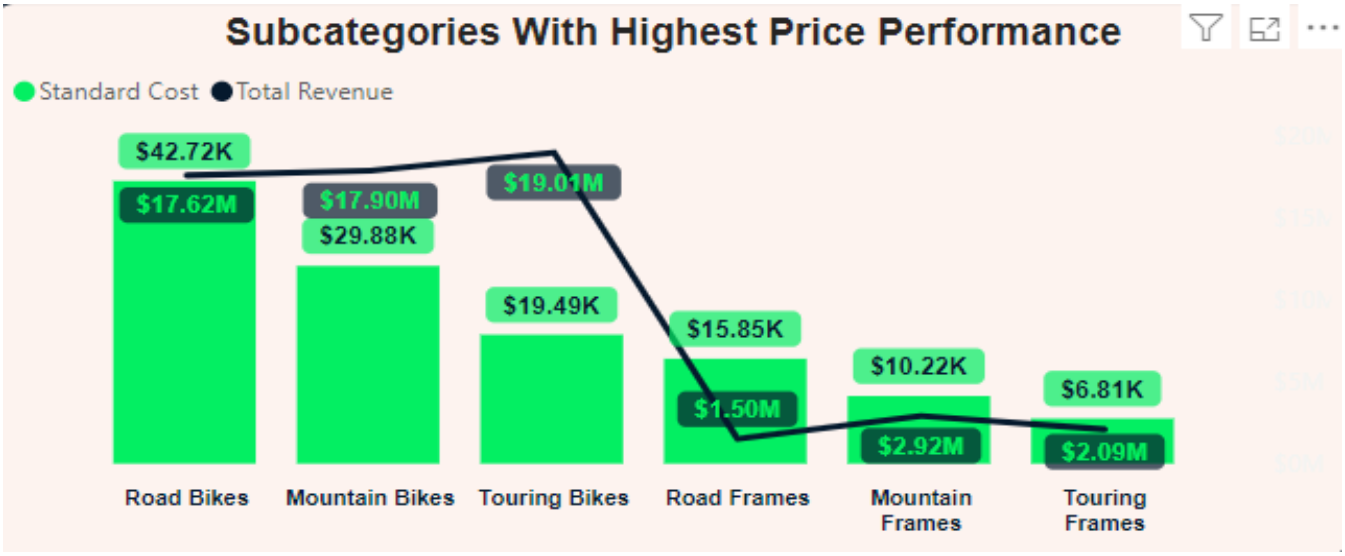
- More efficient processes for these items, which could be studied and potentially applied to other categories.
- Or, these categories might be underserved and could potentially benefit from more attention or resources.

7. **What is the scrap rate for each product Sub category?**



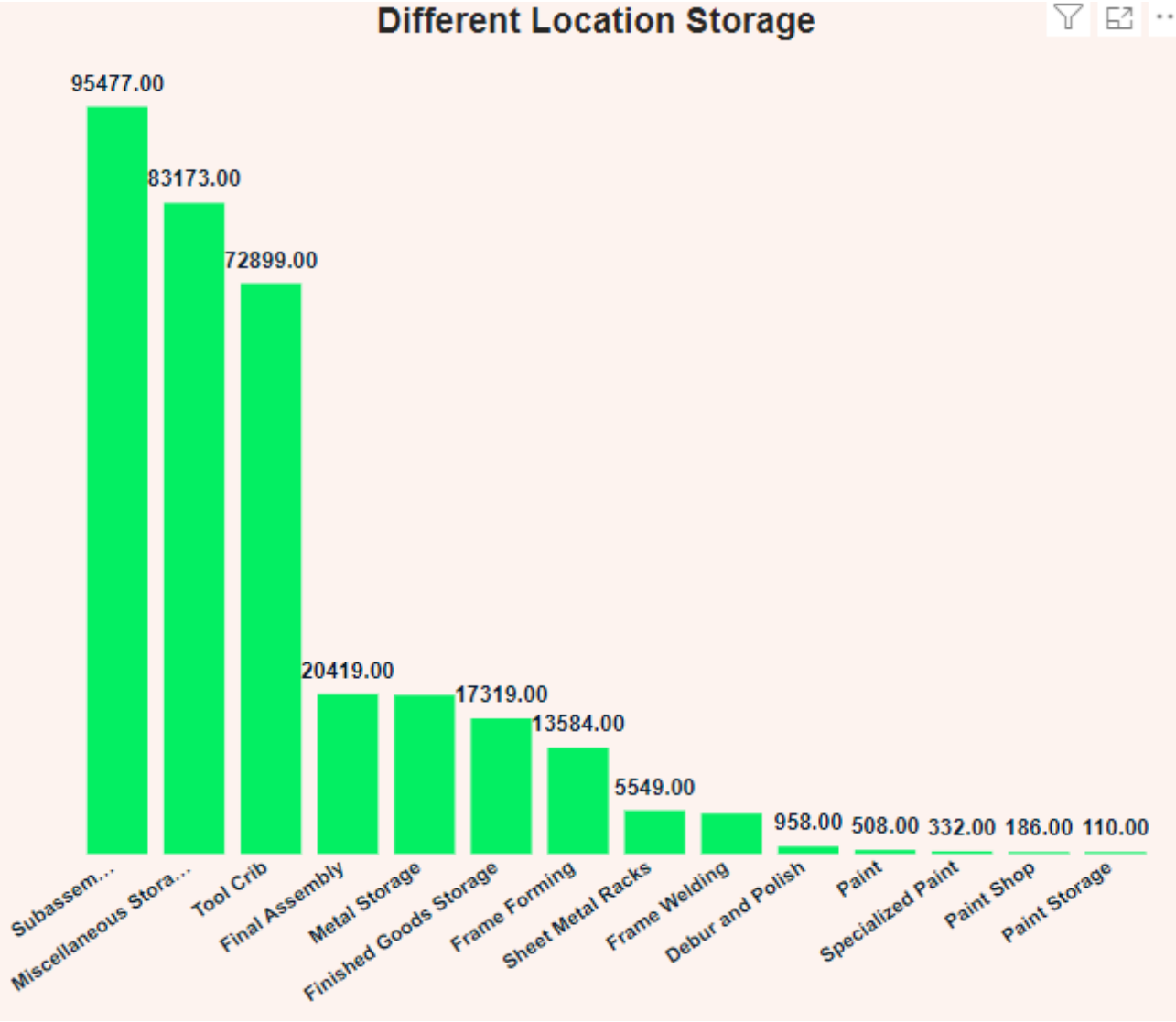
- Scrapping rate is productively applicable.

8. **How do costs compare against revenue for sub categories with high cost?**



- Compared to revenue the costs are really good.

9. **Which geographical locations have the highest product storage?**



- Wide range: There's a significant range in inventory levels across locations, from 110.00 (Paint Storage) to 95477.00 (Subassembly).

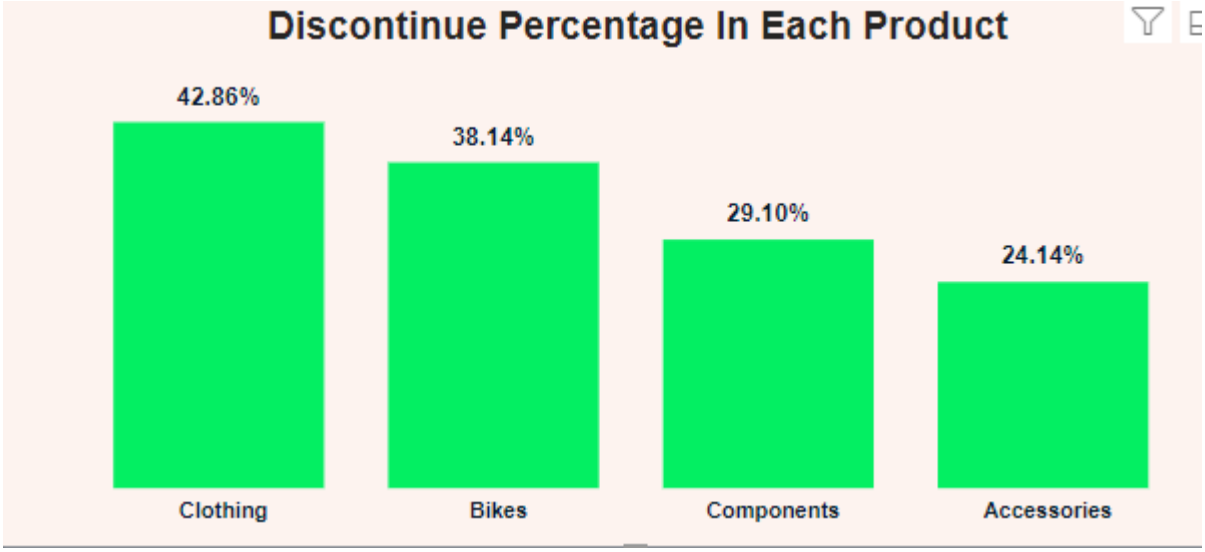
- Top storage areas: The three locations with the highest inventory levels are:

  Subassembly (95477.00)

  Miscellaneous Storage (83173.00)

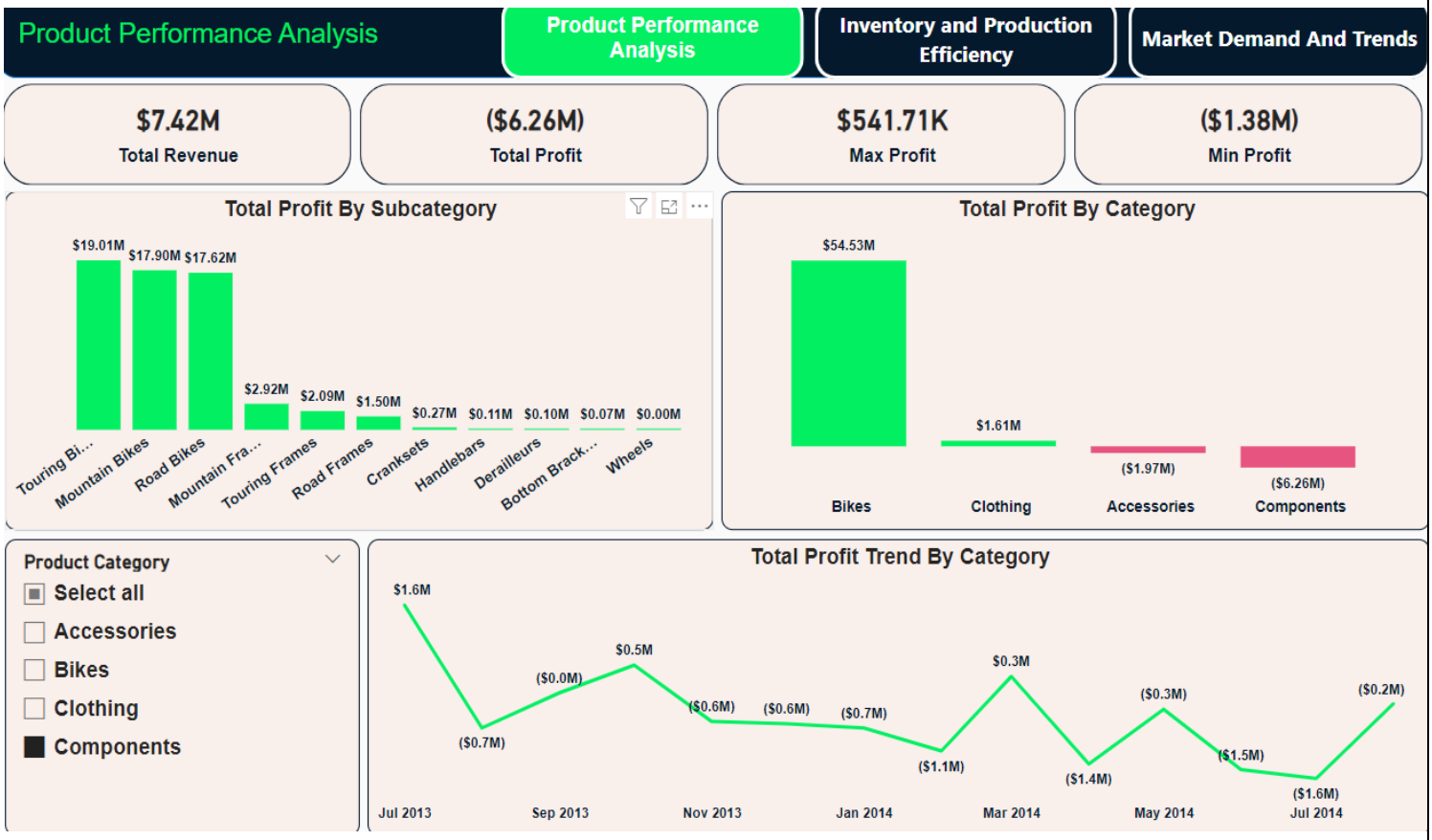
  Tool Crib (72899.00)

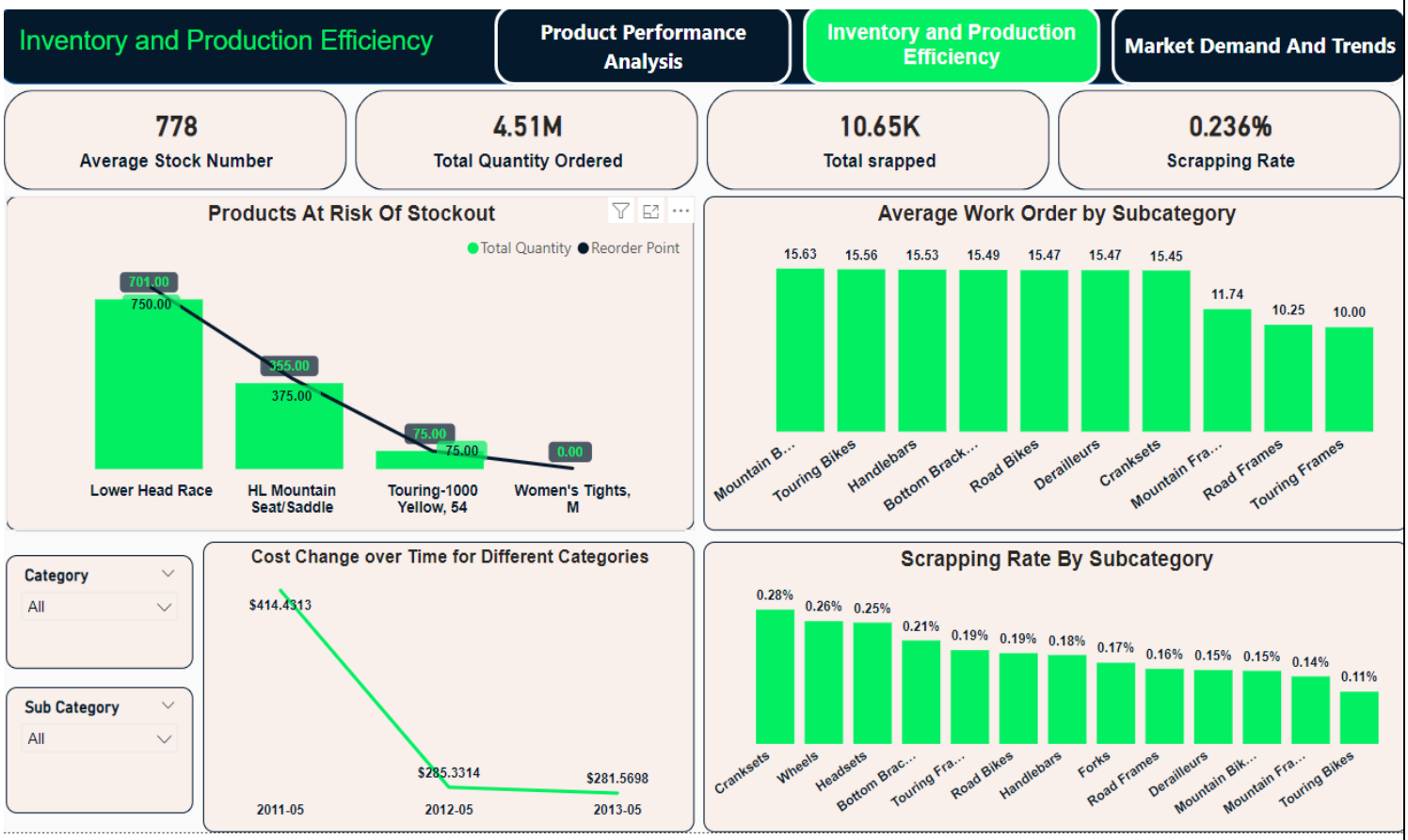
10. **What is the percentage of discontinued products in each category?**

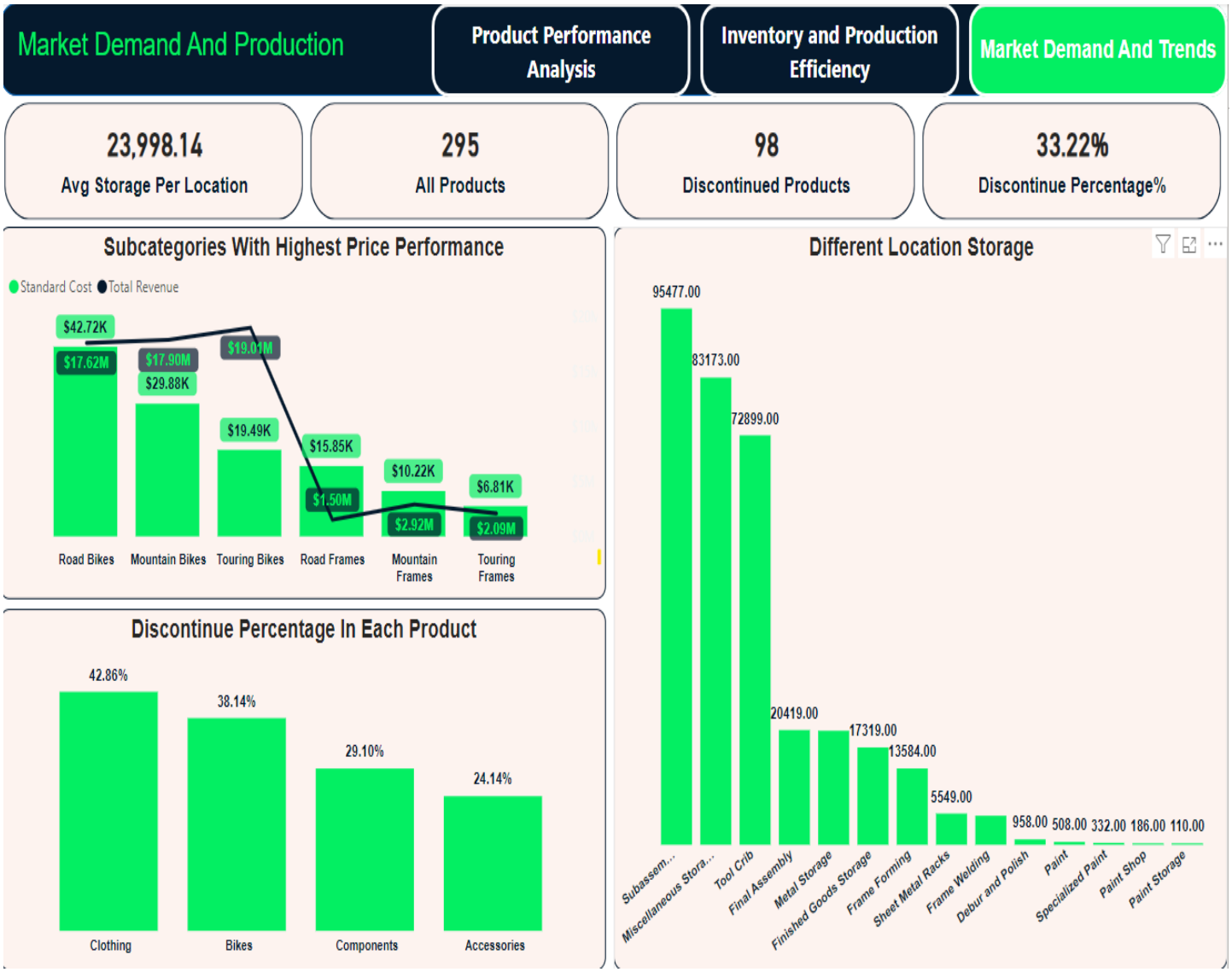


- The rates are very high, before we decide to produce new products we need to study the market very well.

Dashboards


Product Performance Analysis
Product Performance Analysis
Inventory and Production Efficiency
Market Demand And Trends
$7.42M
Total Revenue
($6.26M)
Total Profit
$541.71K
Max Profit
($1.38M)
Min Profit
Total Profit By Subcategory
$19.01M
$17.90M
$17.62M
$2.92M
$2.09M
$1.50M
$0.27M
$0.11M
$0.10M
$0.07M
$0.00M
Touring Bi...
Mountain Bikes
Road Bikes
Mountain Fra...
Touring Frames
Road Frames
Cranksets
Handlebars
Derailleurs
Bottom Brack...
Wheels
Total Profit By Category
$54.53M
$1.61M
($1.97M)
($6.26M)
Bikes
Clothing
Accessories
Components
Product Category
Select all
Accessories
Bikes
Clothing
Components
Total Profit Trend By Category
$1.6M
($0.7M)
($0.0M)
$0.5M
($0.6M)
($0.6M)
($0.7M)
($1.1M)
$0.3M
($1.4M)
($0.3M)
($1.5M)
($1.6M)
($0.2M)
Jul 2013
Sep 2013
Nov 2013
Jan 2014
Mar 2014
May 2014
Jul 2014


Inventory and Production Efficiency
Product Performance Analysis
Inventory and Production Efficiency
Market Demand And Trends
778
Average Stock Number
4.51M
Total Quantity Ordered
10.65K
Total srapped
0.236%
Scrapping Rate
Products At Risk Of Stockout
Total Quantity
Reorder Point
701.00
750.00
355.00
375.00
75.00
75.00
0.00
Lower Head Race
HL Mountain Seat/Saddle
Touring-1000 Yellow, 54
Women's Tights, M
Average Work Order by Subcategory
15.63
15.56
15.53
15.49
15.47
15.47
15.45
11.74
10.25
10.00
Mountain B...
Touring Bikes
Handlebars
Bottom Brack...
Road Bikes
Derailleurs
Cranksets
Mountain Fra...
Road Frames
Touring Frames
Category
All
Sub Category
All
Cost Change over Time for Different Categories
$414.4313
$285.3314
$281.5698
2011-05
2012-05
2013-05
Scrapping Rate By Subcategory
0.28%
0.26%
0.25%
0.21%
0.19%
0.19%
0.18%
0.17%
0.16%
0.15%
0.15%
0.14%
0.11%
Cranksets
Wheels
Headsets
Bottom Brac...
Touring Fra...
Road Bikes
Handlebars
Forks
Road Frames
Derailleurs
Mountain Bik...
Mountain Fra...
Touring Bikes


Market Demand And Production
Product Performance Analysis
Inventory and Production Efficiency
Market Demand And Trends
23,998.14
Avg Storage Per Location
295
All Products
98
Discontinued Products
33.22%
Discontinue Percentage%
Subcategories With Highest Price Performance
Standard Cost
Total Revenue
$42.72K
$17.62M
$17.90M
$29.88K
$19.01M
$19.49K
$15.85K
$1.50M
$10.22K
$2.92M
$6.81K
$2.09M
Road Bikes
Mountain Bikes
Touring Bikes
Road Frames
Mountain Frames
Touring Frames
Different Location Storage
95477.00
83173.00
72899.00
20419.00
17319.00
13584.00
5549.00
958.00
508.00
332.00
186.00
110.00
Subassem...
Miscellaneous Stora...
Tool Crib
Final Assembly
Metal Storage
Finished Goods Storage
Frame Forming
Sheet Metal Racks
Frame Welding
Debur and Polish
Paint
Specialized Paint
Paint Shop
Paint Storage
Discontinue Percentage In Each Product
42.86%
38.14%
29.10%
24.14%
Clothing
Bikes
Components
Accessories