Production schedule & Inventory control supporting system

Subject : Business Intelligence and Decision Support System

Lecture: MSc Nguyen Van Ho

Nguyen Van Tuyen

Tutors: Nguyen Anh Nhat

Team Members

Nguyen Thu Van

K194060880

Nguyen Do Thanh Thuy

K194060873

Nguyen Hoang Tuyet Nhi

K194060863

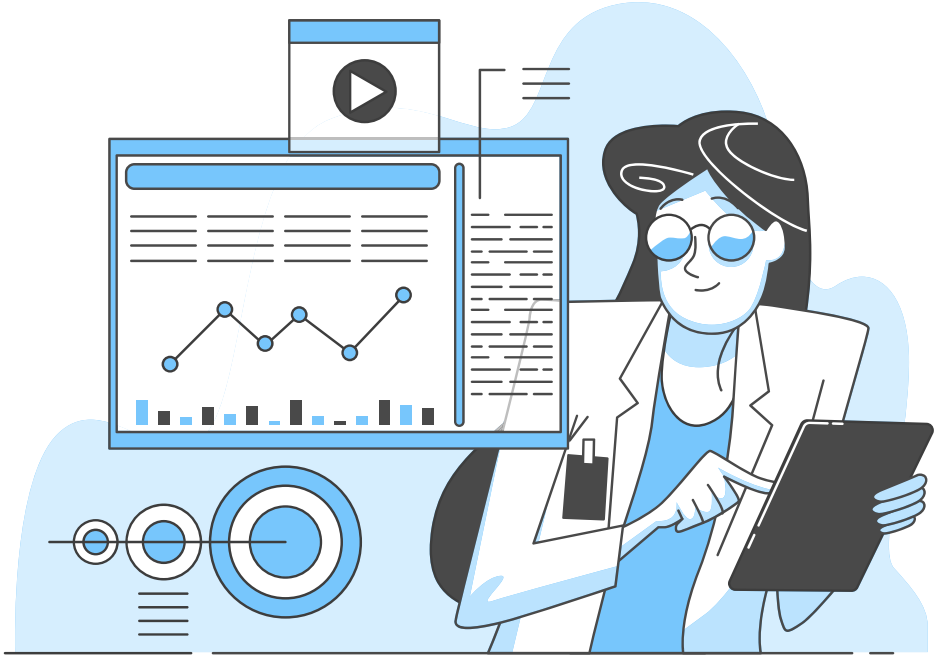
Bui Phuong Nga

K194060857

Le Thi Diem Quynh

K194060869

Table of Contents



01
Introduction

1.1 About Adventure Works

- Adventure Works is a **fictional bicycle wholesaler**. The company has 97 different brands of bikes
- Adventure Works serves the **customer global**.

1.2 About the project

The main objective of this project is to build a BI solution to boost operation of the production department with **a production schedule & inventory control supporting system**.

1.2.1 Define business requirement

1.2.2 Scope of the project

1.2.2.1 In scope

1.2.2.2 Out of scope

Research Questions

Production

-What is the current **production status** of the company?

+ How many items are **ordered, stocked, completed, and scrapped**? Is the quantity of these items increasing or decreasing over time?

+ Is there any correlation between **completed quantity and scrapped quantity**, or between the **ordered and stocked quantity**?

+ What is the total or the rate of **scrapped products** by quarter, year? How much waste or cost caused by scraping?

+ What is the difference between the **actual & planned production time** as well as the **actual & planned cost**?

Inventory

- What is the current **inventory status** of the company?

+ What is the total of **inventory value** by location and by product category?

+ How many items are in **stock, running-low or out of stock**?

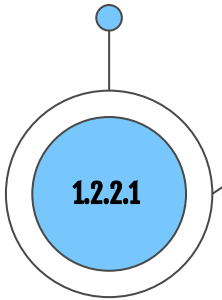
+ How long does each item usually stay in stock?

+ Which products are often below the **safety level**?

+ Which **location** in the warehouse was used the most and when?

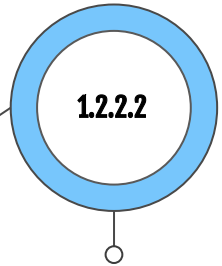
1.2 About the project

- Result includes a data warehouse, analytical model, and intuitive dashboard
- The data warehouse is built with **Kimball's approach and galaxy**
- Useful information is presented with **Power BI dashboards**.



In scope

Out of scope



- The proposed system supports other departments than production.
- The studied process involves external movement of inventory, usage of products and release of new products.
- The data on raw materials are scrutinized.

02

Building data warehouse and integrating data

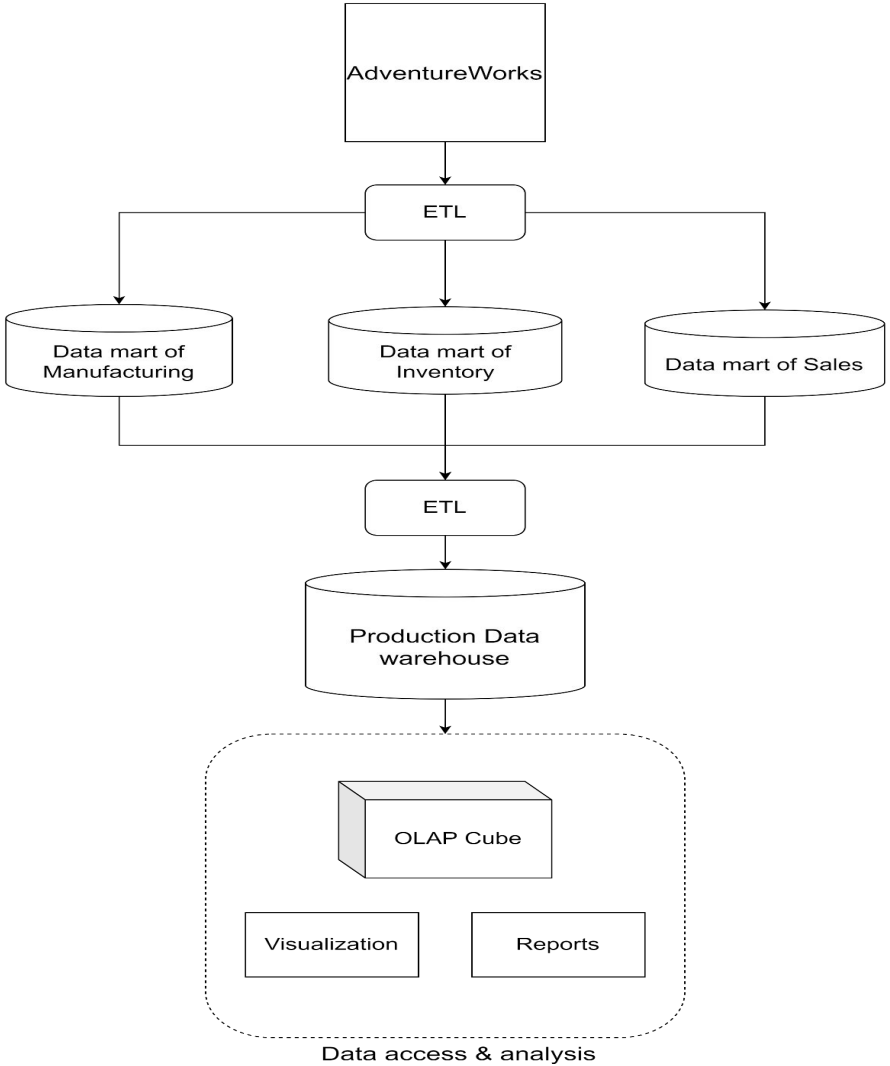
2.1
Data source

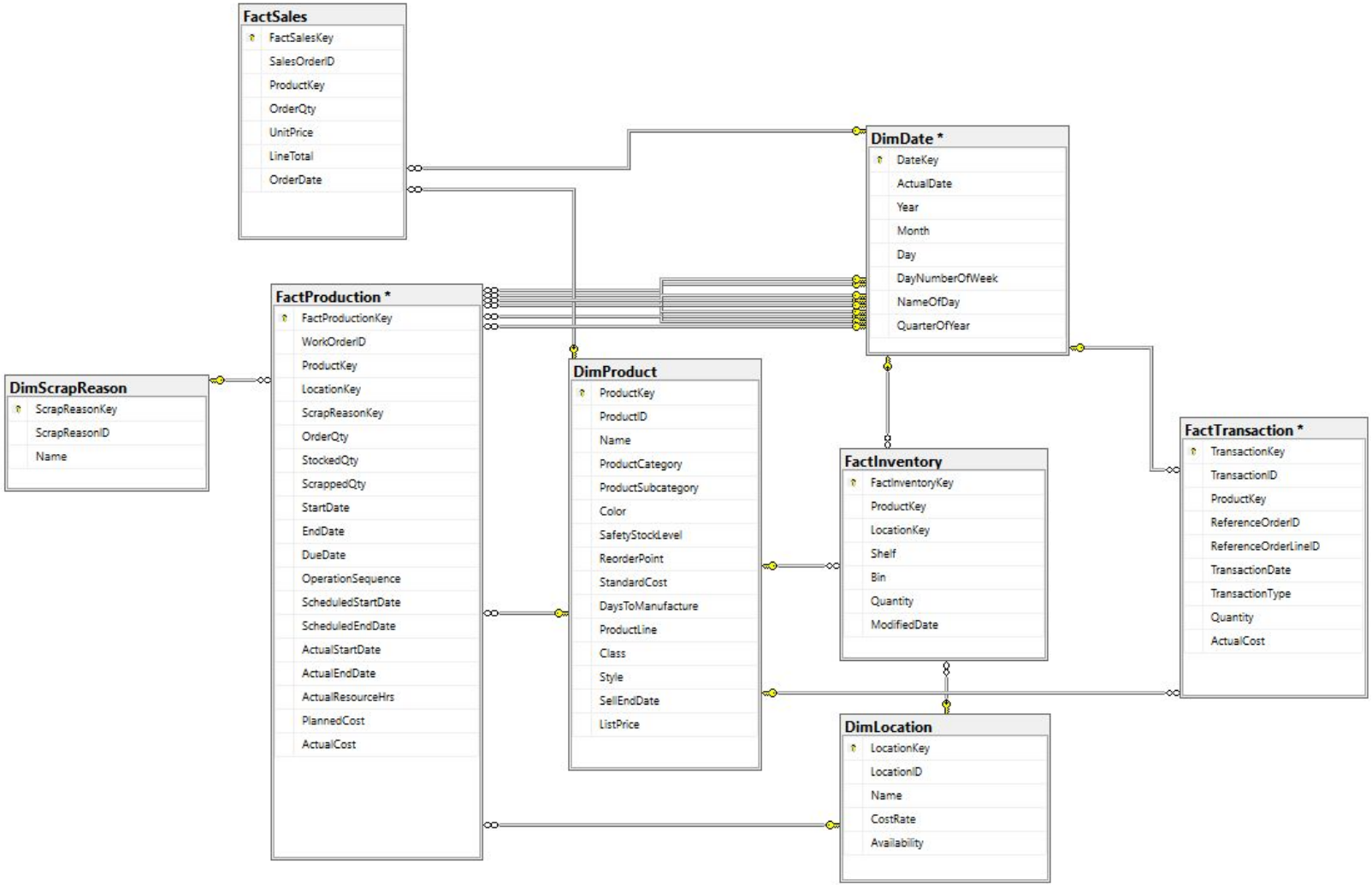
AdventureWorks database whose version is **OLTP 2019**

2.2

Data warehouse

Research process of the project

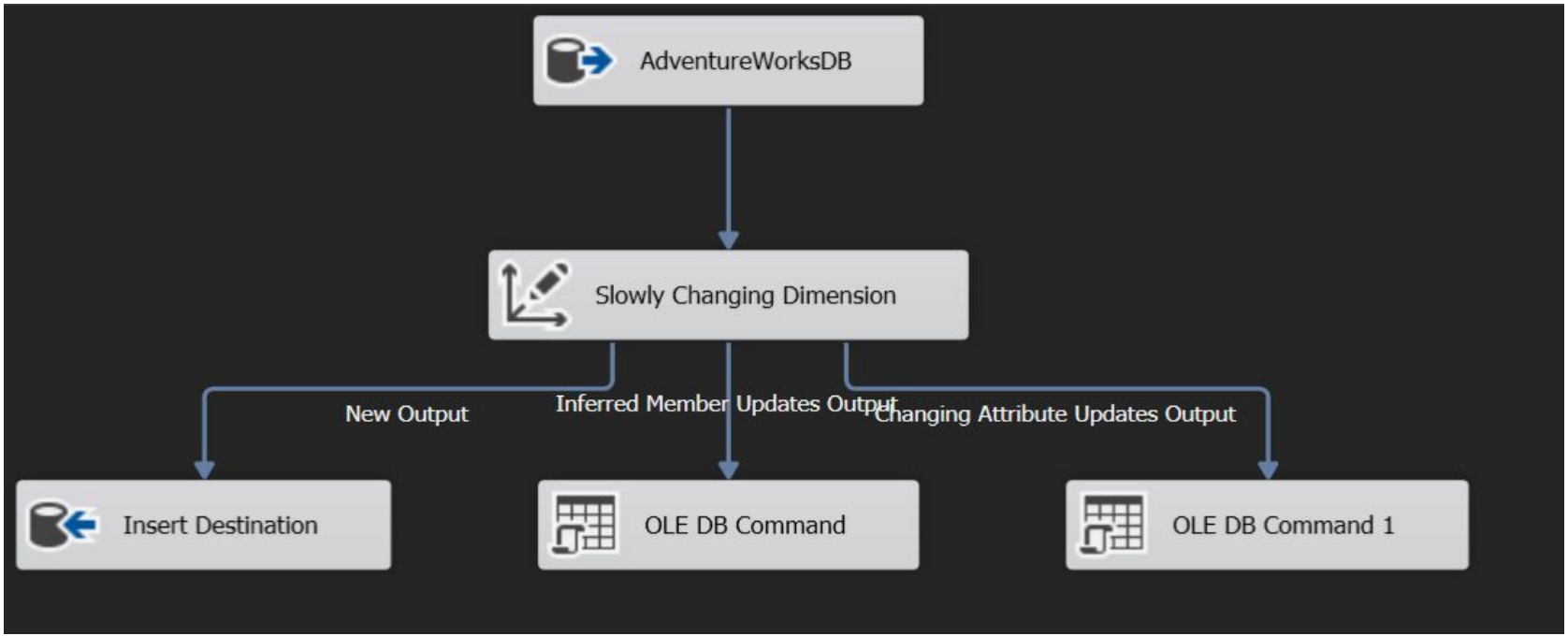



FactSales
FactSalesKey
SalesOrderID
ProductKey
OrderQty
UnitPrice
LineTotal
OrderDate
DimDate *
DateKey
ActualDate
Year
Month
Day
DayNumberOfWeek
NameOfDay
QuarterOfYear
FactProduction *
FactProductionKey
WorkOrderID
ProductKey
LocationKey
ScrapReasonKey
OrderQty
StockedQty
ScrappedQty
StartDate
EndDate
DueDate
OperationSequence
ScheduledStartDate
ScheduledEndDate
ActualStartDate
ActualEndDate
ActualResourceHrs
PlannedCost
ActualCost
DimScrapReason
ScrapReasonKey
ScrapReasonID
Name
DimProduct
ProductKey
ProductID
Name
ProductCategory
ProductSubcategory
Color
SafetyStockLevel
ReorderPoint
StandardCost
DaysToManufacture
ProductLine
Class
Style
SellEndDate
ListPrice
FactInventory
FactInventoryKey
ProductKey
LocationKey
Shelf
Bin
Quantity
ModifiedDate
FactTransaction *
TransactionKey
TransactionID
ProductKey
ReferenceOrderID
ReferenceOrderLineID
TransactionDate
TransactionType
Quantity
ActualCost
DimLocation
LocationKey
LocationID
Name
CostRate
Availability

Research Questions	Metrics
What is the current production status of the company?	FactProduction.OrderQty, FactProductionStockedQty, DimLocation.Name, DimProduction.Name
What is the total or the rate of scrapped products by quarter, year? How much waste or cost caused by scraping?	FactProduction.ScrappedQty, DimScrapReason.Name, ∑ScrappedCost=ScrappedQty*AtualCost
What is the difference between the actual & planned production time as well as the actual & planned cost?	FactProduction.ScheduleStartDay, FactProduction.ScheduleEndDay, FactProduction.ActualStartDay, FactProduction.ActualEndDay, FactProduction.PlannedCost, FactProduction.ActualCost
What is the current inventory status of the company? How to utilize the capacity of the warehouse efficiently?	FactInventory.Quantity, DimProduct.Name, DimProduct.ProductLine, DimProduction.Category

2.3

ETL process

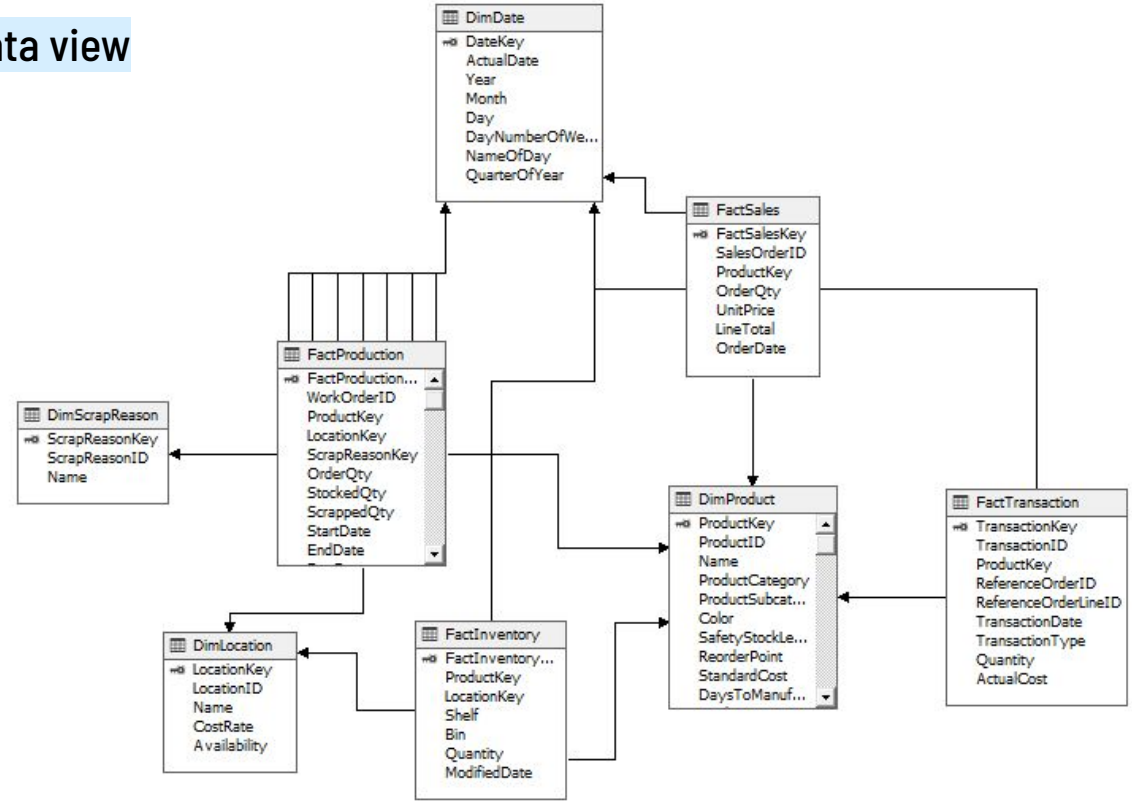

AdventureWorksDB
Slowly Changing Dimension
New Output
Inferred Member Updates Output
Changing Attribute Updates Output
Insert Destination
OLE DB Command
OLE DB Command 1

03

Building KPIs with SSAS

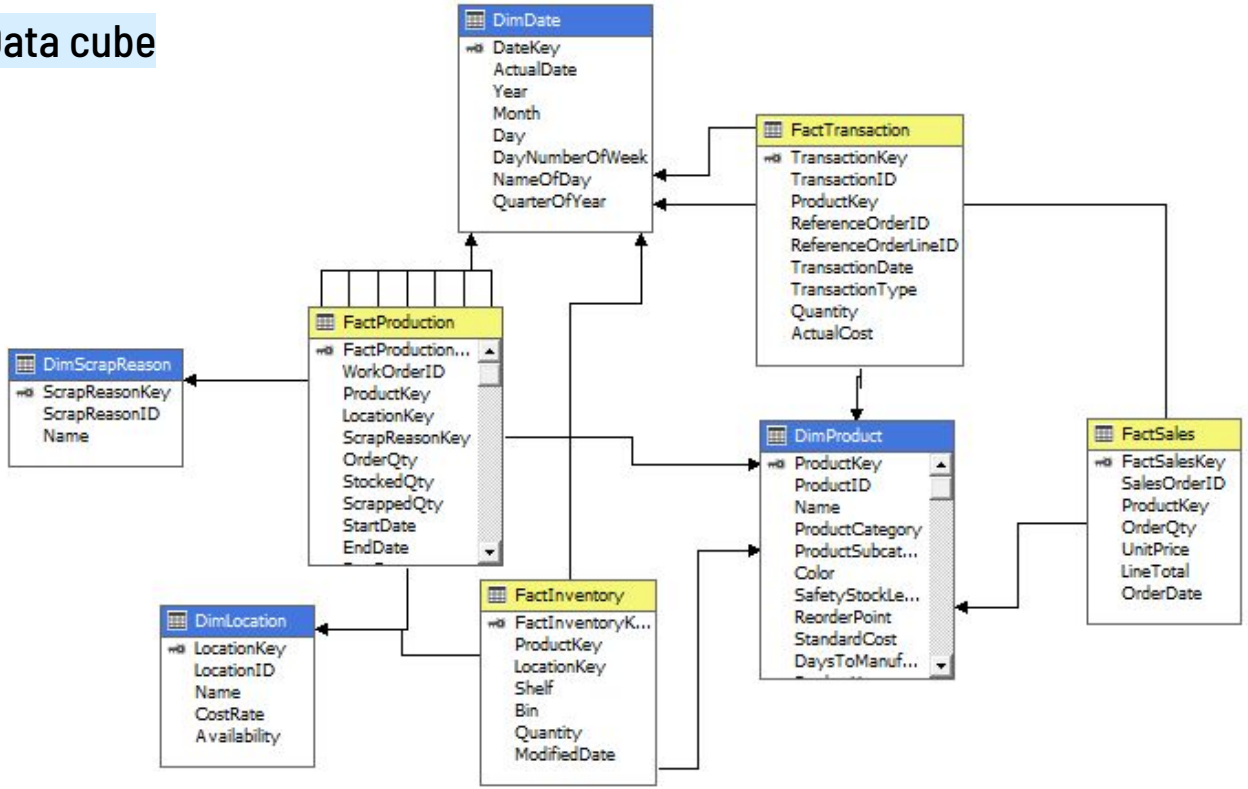
3.1 SSAS

Data view



3.1 SSAS

Data cube



3.2 KPIs

Production volume

Quantity produced

Manufacturing cost

Standard Cost * Quantity

Scrap rate

Number of Scrap Units / Total Units

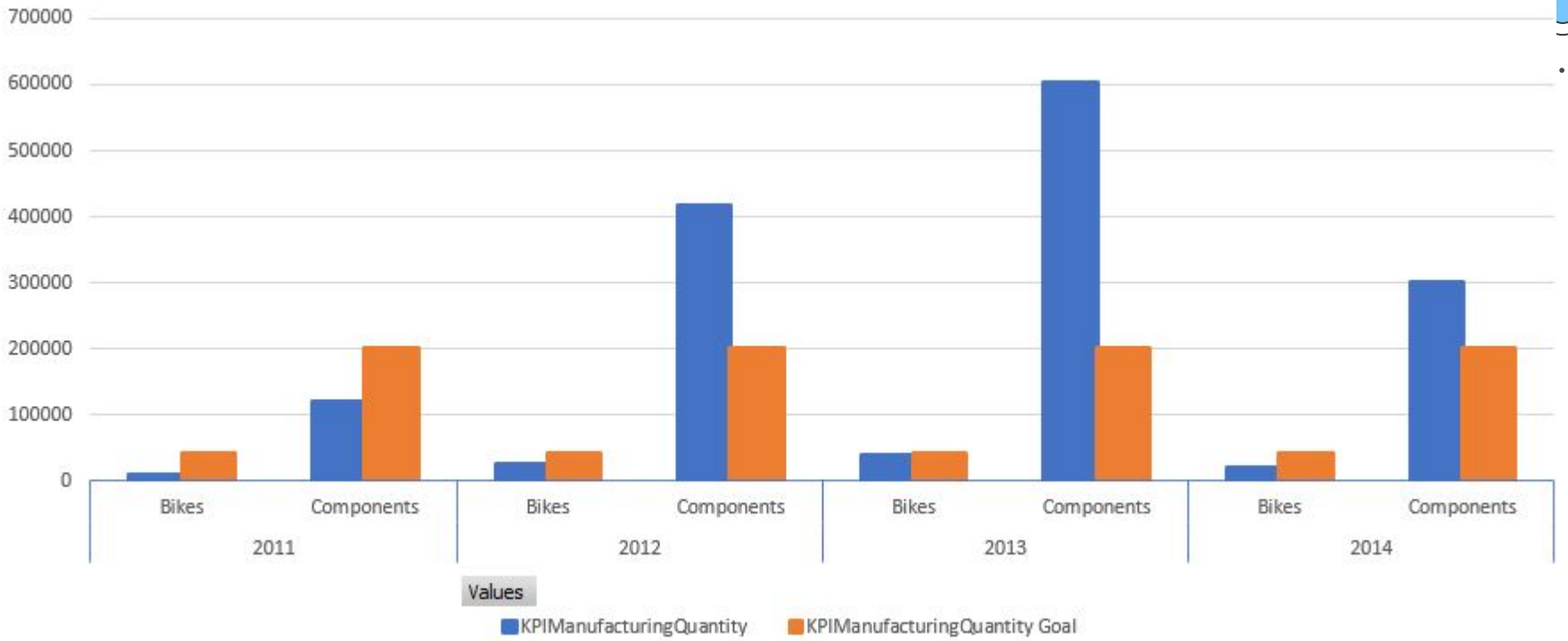
Production Volume

Row Labels	KPIManufacturingQuantity	KPIManufacturingQuantity Goal	KPIManufacturing Quantity Status	KPIManufacturing Quantity Trend
2011				
Bikes	7831	40000	◆	↑
Components	118854	200000	◆	↑
2012				
Bikes	25758	40000	◆	↑
Components	415445	200000	●	↑
2013				
Bikes	37348	40000	●	↑
Components	602703	200000	●	↑
2014				
Bikes	19183	40000	◆	↓
Components	298697	200000	●	↓
Grand Total	**1525819**		●	↑

Bikes: **$40,000** and Components: **$200,000**

Bikes are often **below the goal** (except for 2013)

Production Volume



Manufacturing cost

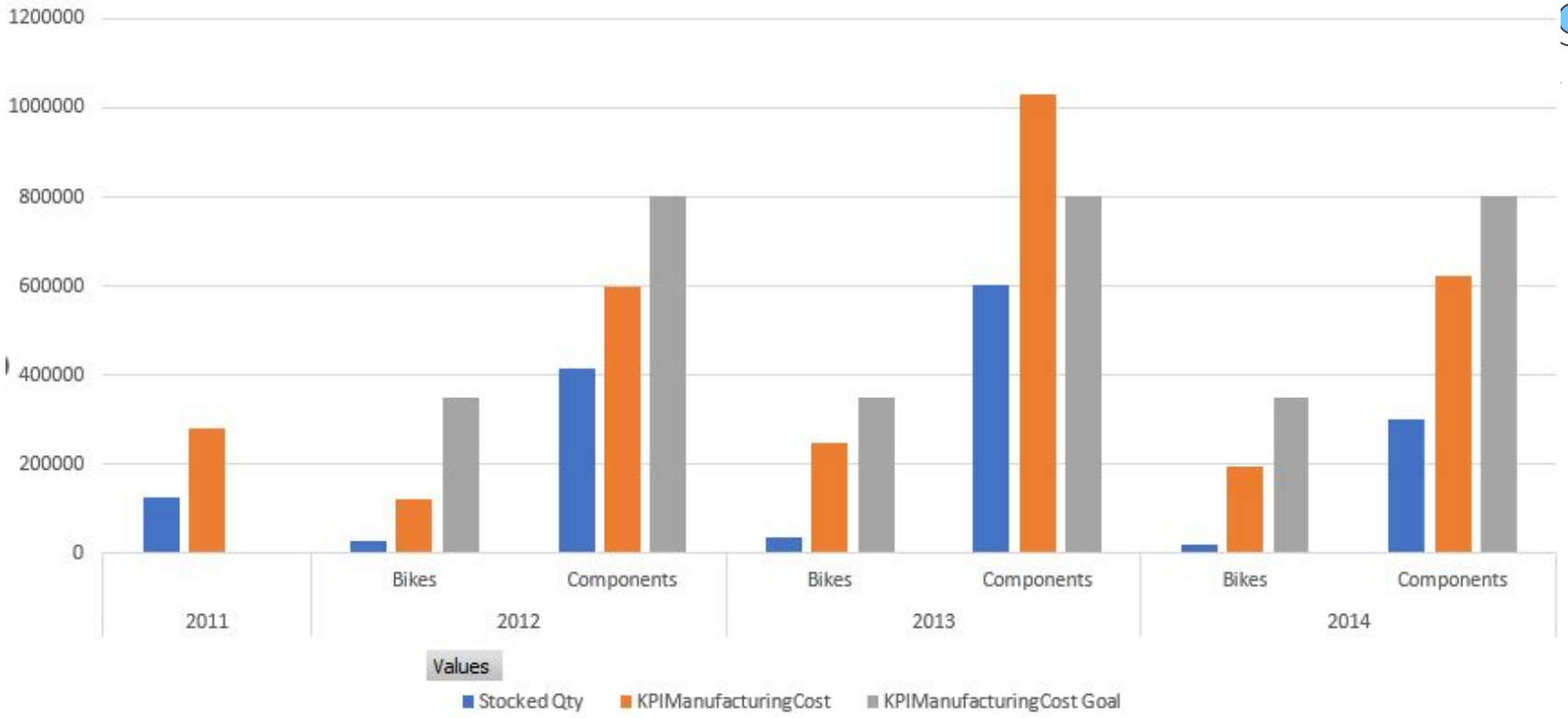
Row Labels	Stocked Qty	KPIManufacturingC	KPIManufacturingCo	ManufacturingCost St	KPIManufacturingCost Trend
2011					
Bikes	7831	46795	350000		
Components	118854	234050.25	800000		
2012					
Bikes	25758	122010	350000		
Components	415445	596854.25	800000		
2013					
Bikes	37348	248332	350000		
Components	602703	1030700.25	800000		
2014					
Bikes	19183	196245	350000		
Components	298697	623163.25	800000		
Grand Total	**1525819**	**3098150**	**0**		

Goals:

Bikes: **$350000**

Components: **$800000**

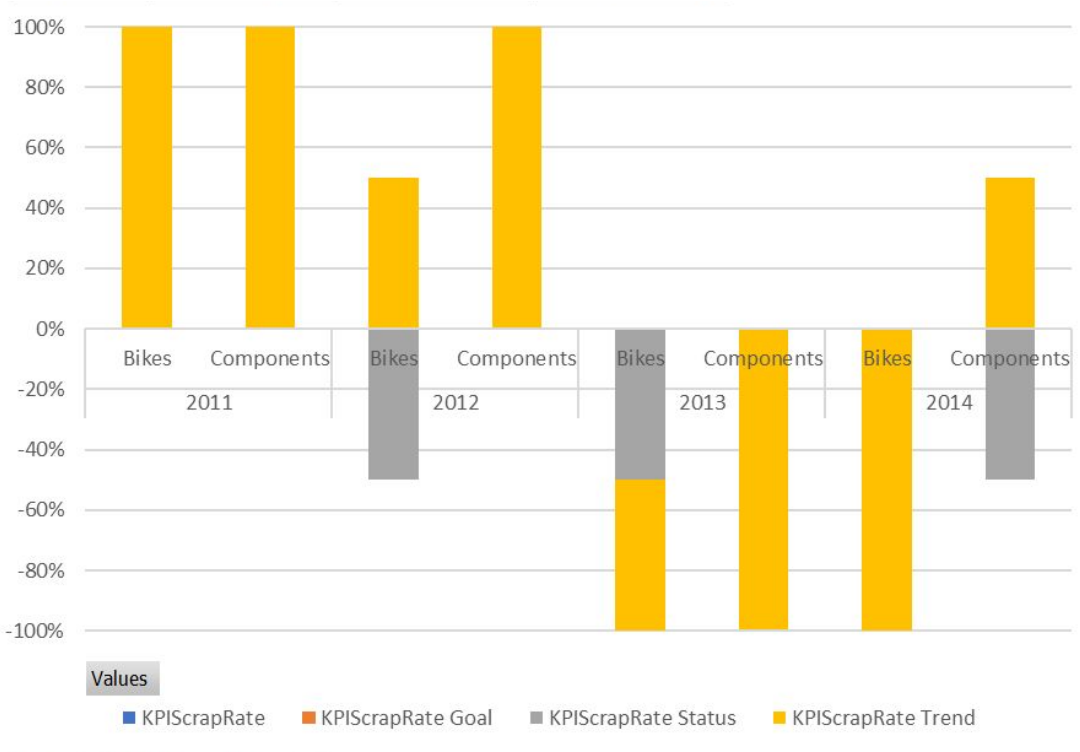
Manufacturing cost



Scrap Rate

Row Labels	KPIScrapRate	KPIScrapRate Goal	KPIScrapRate Status	KPIScrapRate Trend
2011				
Bikes	0.001276976	0.0015	▲	↑
Components	0.001901493	0.002	▲	↑
2012				
Bikes	0.002251728	0.0015	◆	↑
Components	0.001923239	0.002	▲	↑
2013				
Bikes	0.001552961	0.0015	◆	↓
Components	0.001788609	0.002	▲	↓
2014				
Bikes	0.001146849	0.0015	▲	↓
Components	0.002373643	0.002	◆	↑
Grand Total	**0.001939942**	**0.001**	◆	↑

Scrap Rate


100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
-100%
Bikes
Components
Bikes
Components
Bikes
Components
Bikes
Components
2011
2012
2013
2014
Values
KPIScrapRate
KPIScrapRate Goal
KPIScrapRate Status
KPIScrapRate Trend

04

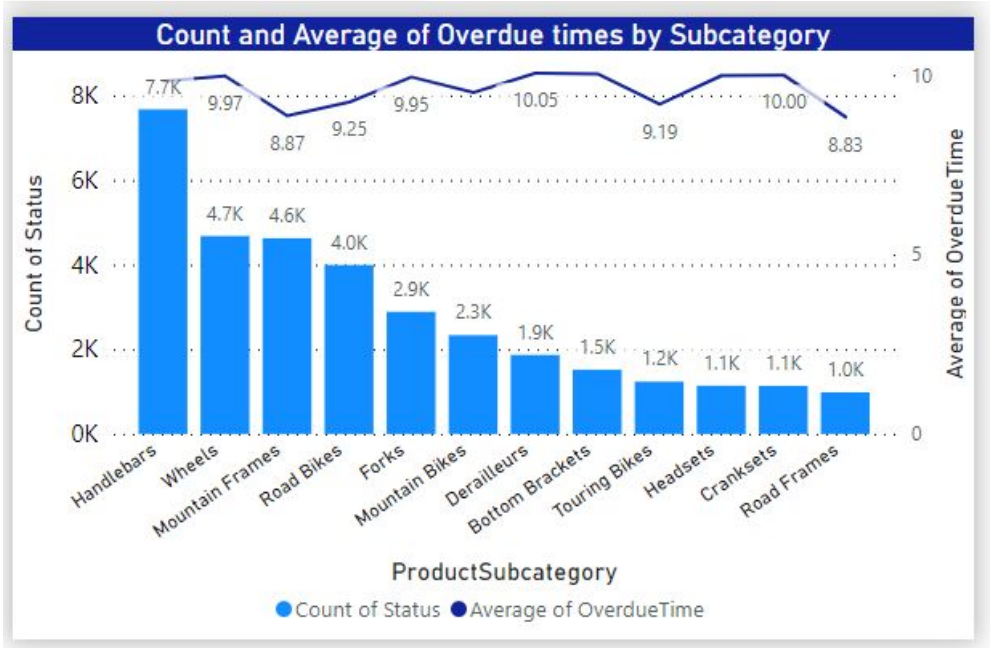
VISUALIZATION

4.1 Dashboard Structure

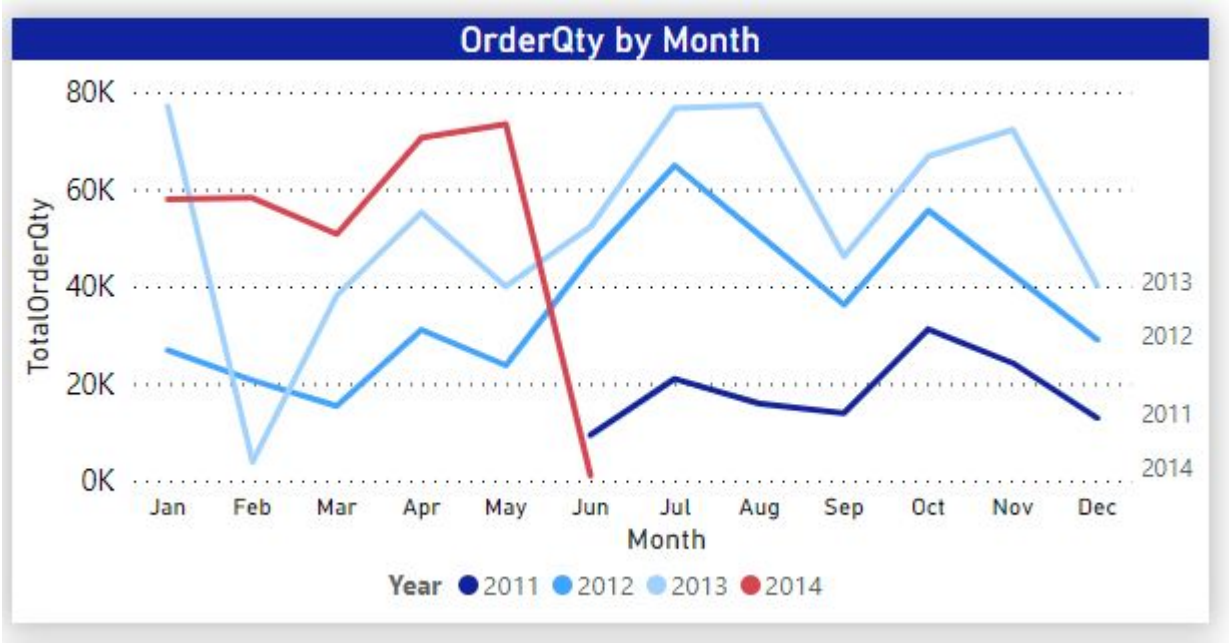
4.2 Production Analysis

4.3 Inventory Analysis

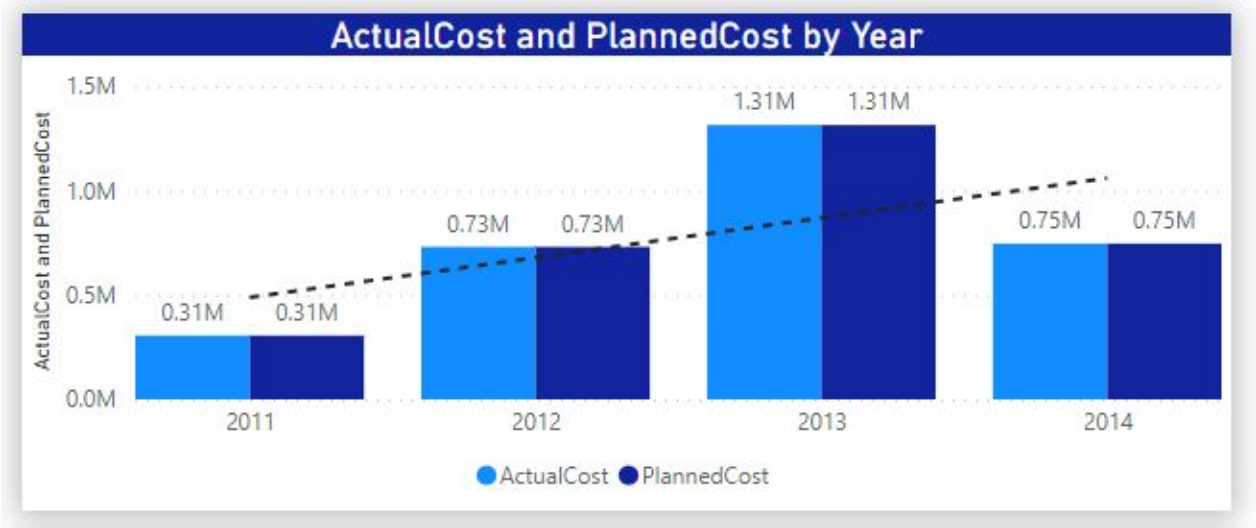
4.2 Production



The percent of time when production goals were met is quite **low** => Company should consider some ways to increase productivity at manufacturing such as: **Update processes** and technology, commit to scheduled maintenance, **train and educate employees** or organize the workspace,....

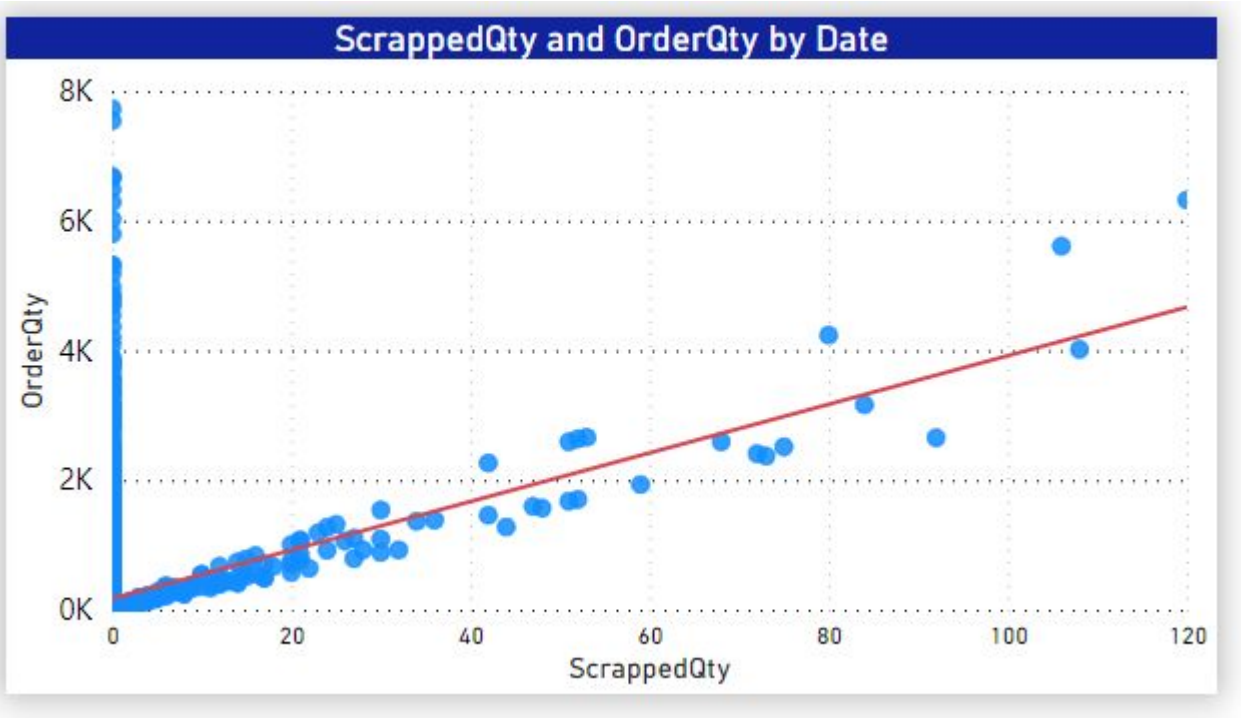


The order quantity often **increases** rapidly in the **first month of quarter** and **decrease** in the **next month**, but after that it will increase slightly in the last month. => Build production planning that maintain amount of product in stock at safety line and can **meet the demand**



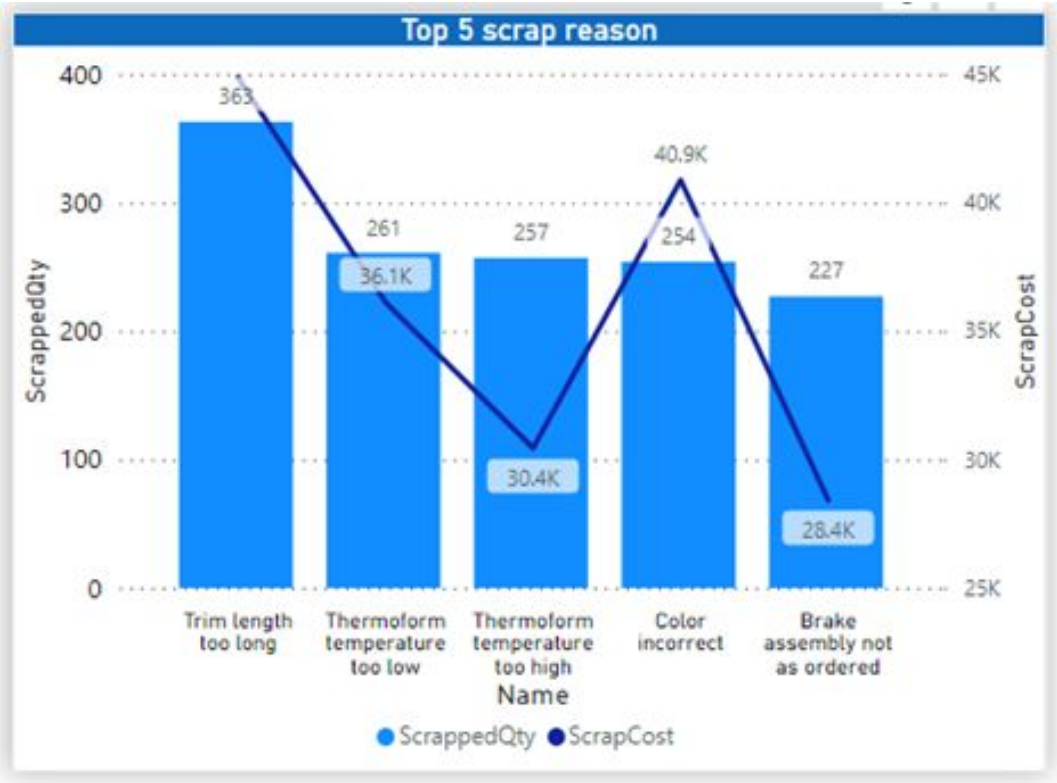
Cost **increases about $500,000/year.** Based on that, we can predict that cost in **the next 6 months** of 2014 will **increase about 1,000,000** if company does not have a solution to optimize their production process and reduce scrap quantity.

Scrap analysis



The scatter plot shows the positive correlation between the two variables **Scrap quantity** and **Order quantity**. This means that when the Order quantity increases, the Scrapped quantity also increases.

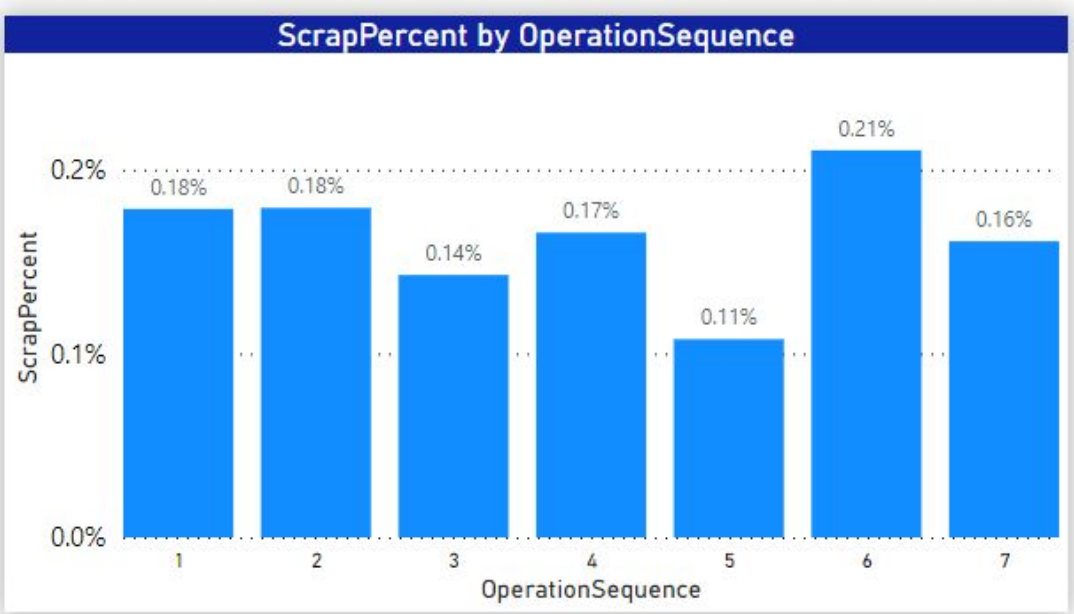
Scrap analysis



The scatter plot shows the positive correlation between the two variables **Scrap quantity** and **Order quantity**. This means that when the Order quantity increases, the Scrapped quantity also increases.

We suggest that the production department should pay attention to the production process of many items to **overcome or limit the scrap reasons.**

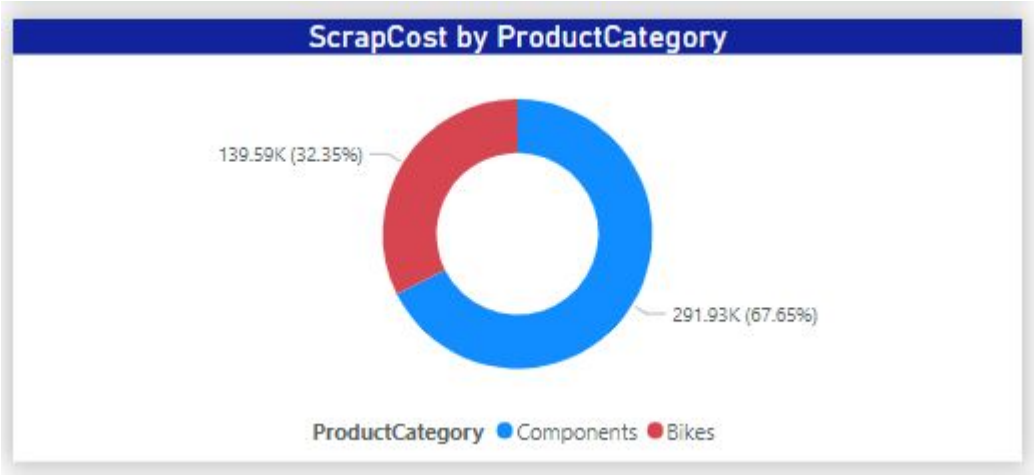
Scrap analysis



Sequence 6 is the key sequence and it has to work continuously, this is also the place where the **production of "Components" is concentrated**. Besides, the number of reasons is also quite diverse and accounts for nearly 80% of the number of the top 5 reasons.

Recommend: Focus on overcoming (or limiting) the causes of waste products (top 5 causes).
The product that reduces the amount of scrap quantity, will also decrease the waste cost.

Scrap analysis



Scrap cost of **Component** accounted for nearly **$139.59K**, and **Bike** accounted for **$291.93K**.

If a planned production process (both in time and cost) causes production defects and even exceeds the planned quantity, the company will spend more time and money to be able to produce enough quantity

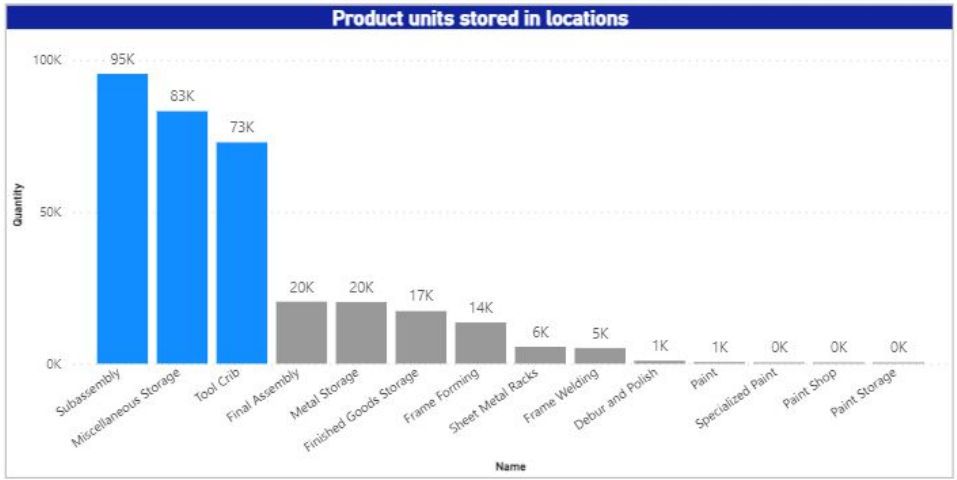
4.2
Inventory

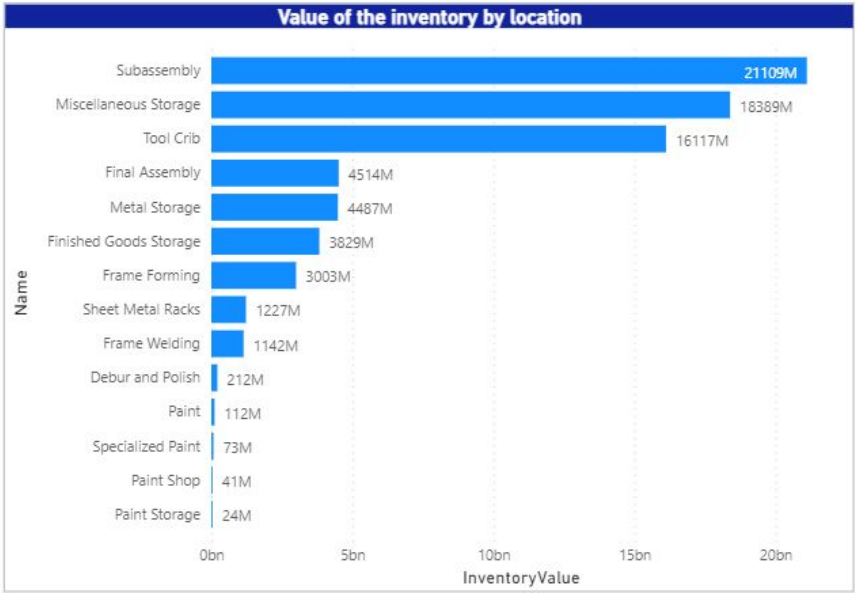
336K	432	14	74.28bn
Quantity	Products	Locations	InventoryValue

Year: All

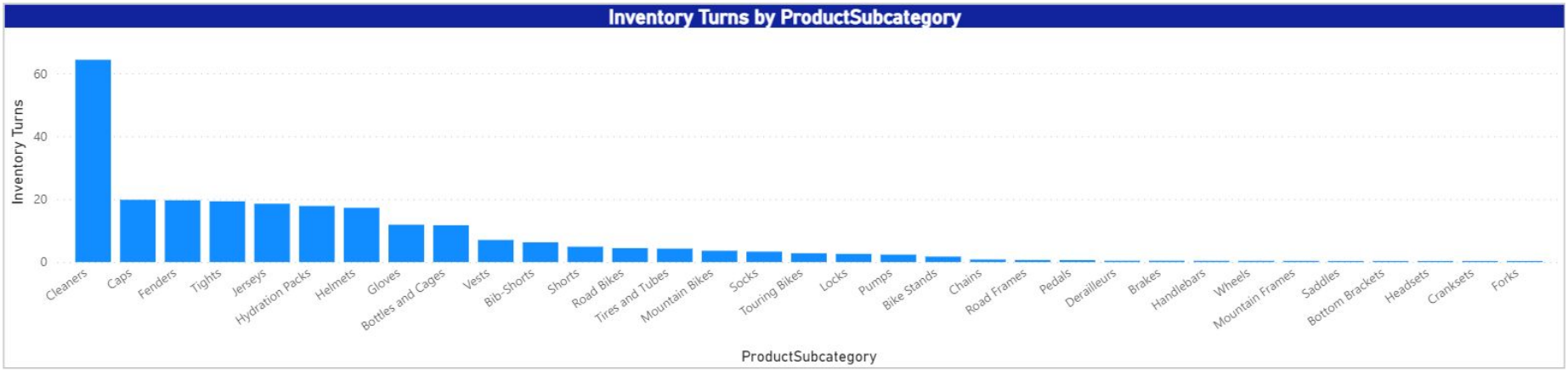
Product Category: All

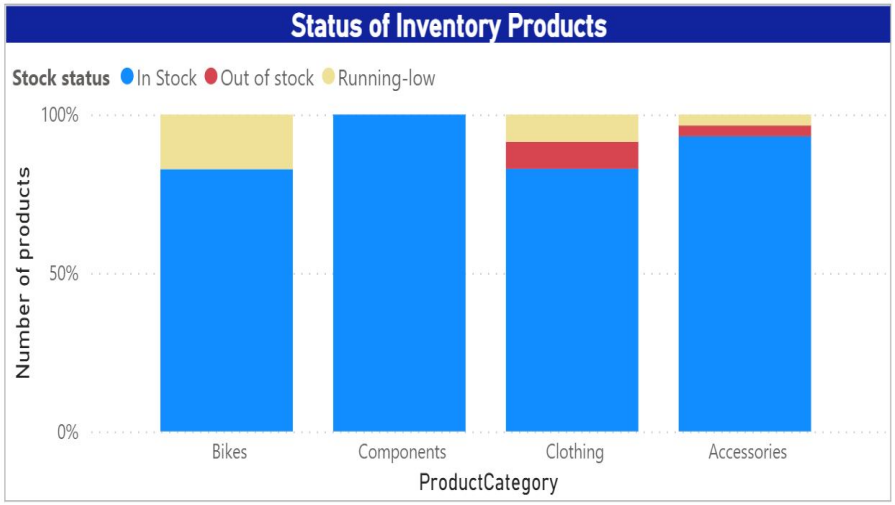
Product Subcategory: All





Inventory turns: The frequency of product sales of the store and can assess whether a product is selling quickly or slowly.



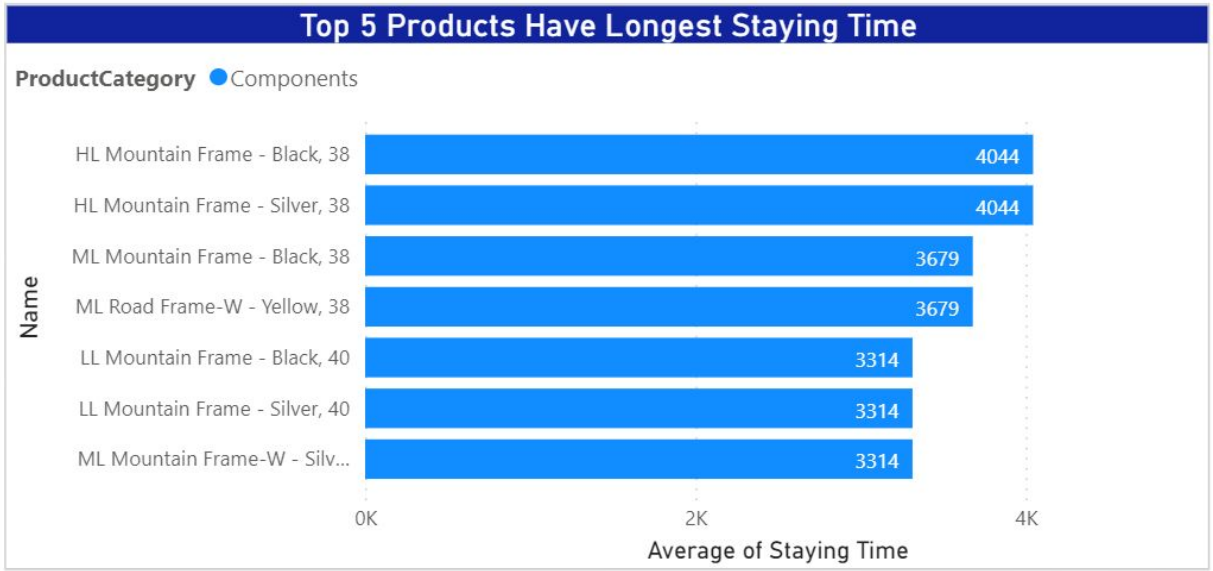


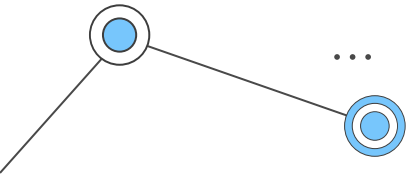
Components whose products are completely available.

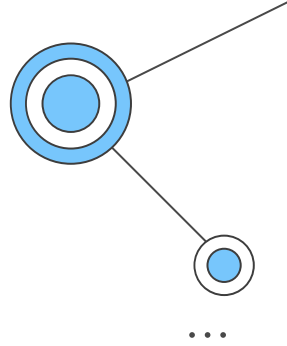
(?) Component stocks are managed well?

(?) Or they have not been sold and have stayed in inventory for a long time?

There is a case that products have high inventory days. In other words, these products were not turned into sales quickly.

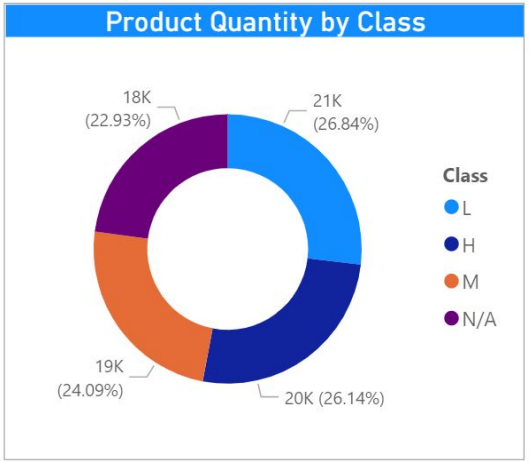


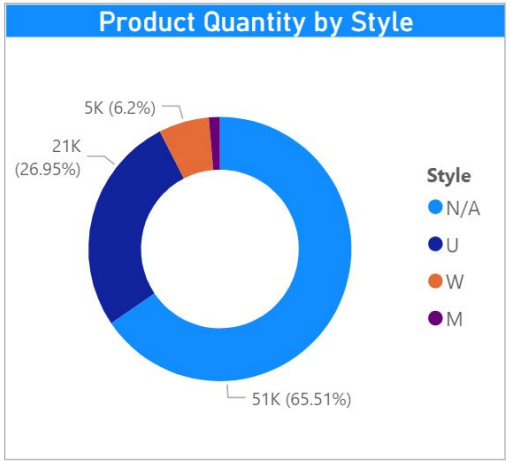




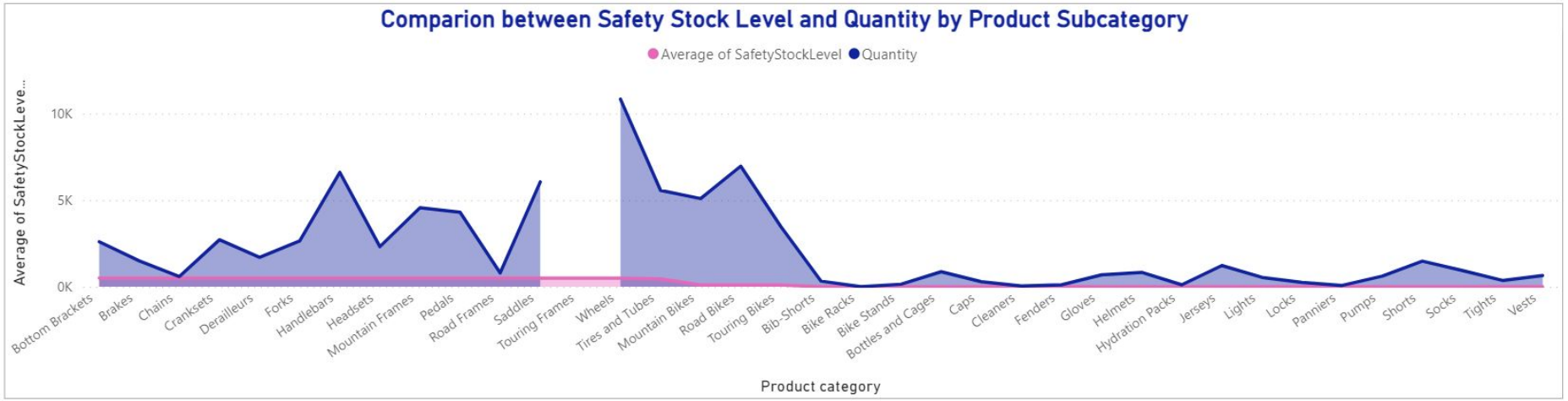
List of low stock products

ProductCategory	Name	Sales Quantity by Year	Quantity	Stock_status
Accessories	Bike Wash - Dissolver	829.75	36	Running-low
Clothing	Half-Finger Gloves, L	319.00	36	Running-low
Clothing	Half-Finger Gloves, M	866.00	0	Out of stock
Accessories	Hitch Rack - 4-Bike	791.50	0	Out of stock
Bikes	Mountain-100 Black, 44	169.50	49	Running-low
Bikes	Mountain-100 Silver, 38	160.50	49	Running-low
Bikes	Mountain-200 Silver, 46	554.00	32	Running-low
Bikes	Mountain-300 Black, 44	186.75	32	Running-low
Bikes	Mountain-500 Black, 52	68.00	30	Running-low
Bikes	Mountain-500 Silver, 44	95.25	30	Running-low
Bikes	Road-150 Red, 48	123.25	32	Running-low
Bikes	Road-250 Black, 48	374.50	49	Running-low
Bikes	Road-450 Red, 44	86.50	30	Running-low
Bikes	Road-450 Red, 52	177.50	49	Running-low
Bikes	Road-550-W Yellow, 44	231.75	30	Running-low
Bikes	Road-650 Black, 60	275.00	49	Running-low
Bikes	Road-650 Red, 52	278.00	32	Running-low
Bikes	Road-750 Black, 44	164.00	30	Running-low
Clothing	Short-Sleeve Classic Jersey, L	712.00	36	Running-low
Total		**8,315.25**	**922**	

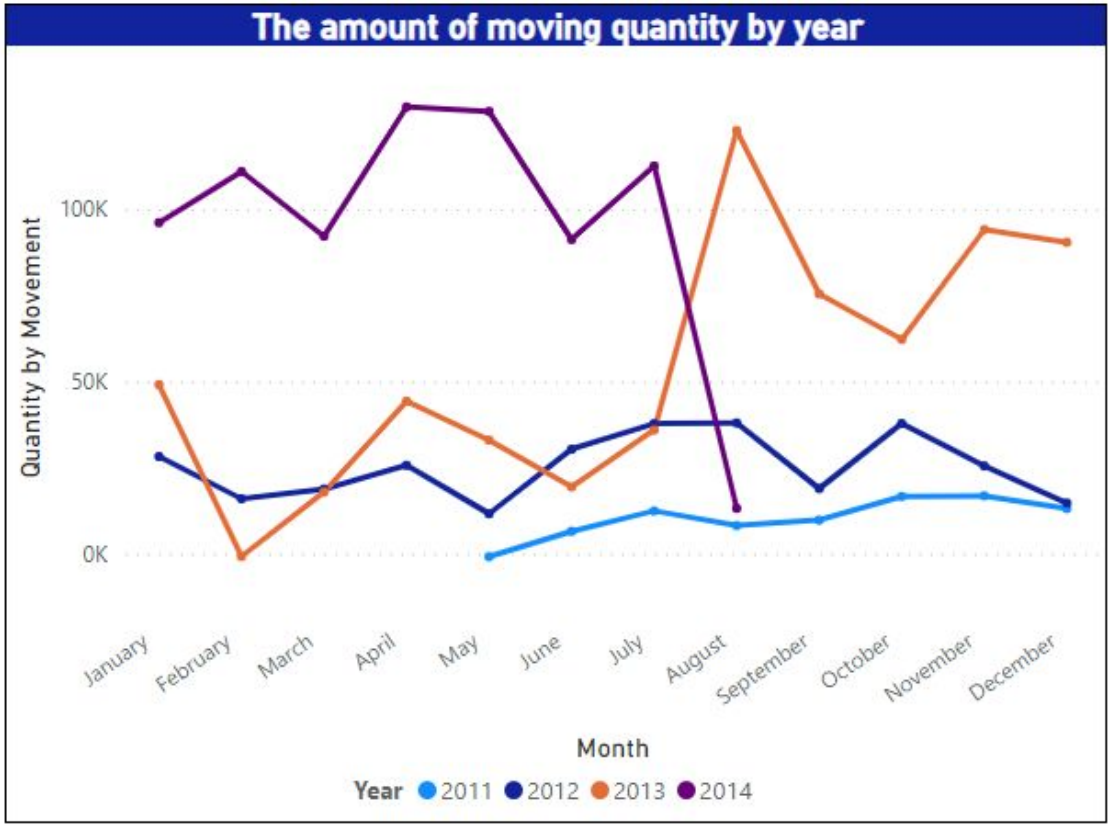




The charts would deliver information of how much class and style account for in inventory.



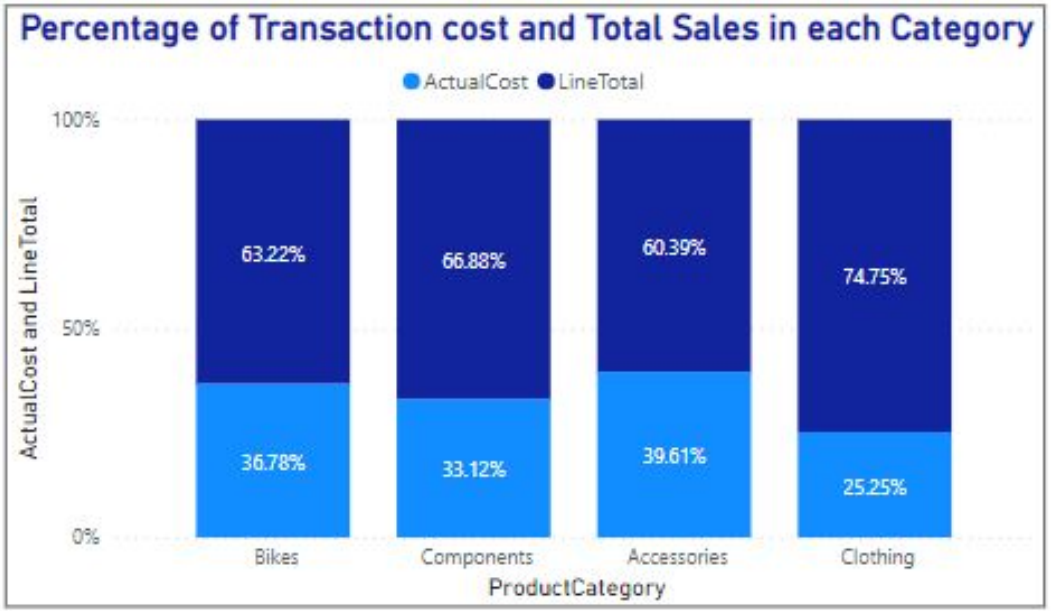
Safety stock level illustrates the minimum inventory quantity
→ inventory quantity should be higher than safety stock level.



Quantity by movement is the sum of goods in and outs in a period.

Q1 and Q3 of 2013 and months of 2011 and 2012 experienced negative values. It is can say that it is a:

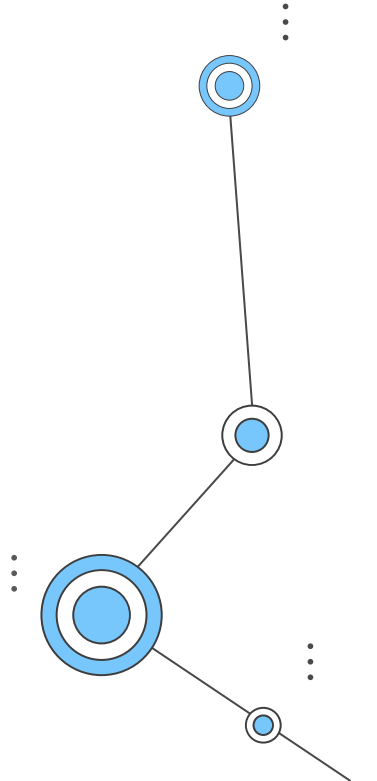
- Positive impact
- Negative impact



It shows how much the product cost (inventory) accounts for compared to the sales amount, which shows the effect of inventory and transactions inventory on total sales.

05

Conclusion



Thank you!