Data Analysis Report

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Project Goal:

The goal of this project is to analyze defect trends, vendor performance, and material quality issues within the company's supply chain. By examining defect data across various categories, materials, and vendors, the project aims to identify key areas contributing to defects, determine seasonal patterns, and assess vendor reliability. This analysis will provide actionable insights to enhance process efficiency, reduce defects, and optimize vendor management strategies.

Specific Objective:

1. **Identify the most common types of defects** and their frequency to prioritize quality improvement efforts.
2. **Assess the impact of defects on production**, particularly in terms of downtime and defect quantity.
3. **Evaluate vendor performance** by analyzing defect rates associated with different vendors.
4. **Investigate the influence of material types** on defect occurrences to improve material selection and usage.
5. **Compare performance across different plants** to identify best practices and areas needing support.
6. **Provide actionable insights and recommendations** to reduce defects and improve production efficiency.

Summary:

>>The Total Defect Qty is 54,539,246

>>The Total Downtime minutes is 138,311

>>There are 6 Subcategory (Machanicals is the highest in Defect Qty, Electrical is The Lowest in Defect Qty)

>>There are 3 Defect Type (Rejected is the highest in Defect Qty, No Impact is The Lowest in Defect Qty)

>> There are 328 Vendors (Solholdings is the highest in Defect Qty)

>> There are 22 Material Type (RawMaterials is the highest in Defect Qty,Wires is The Lowest in Defect Qty)

>> There are 305 Defects (Misc is the highest in Defect Qty)

>> There are 24 Plants (Detriot MI is the highest in Defect Qty)

Introduction:

This project focuses on a comprehensive defect analysis within the company's supply chain to address critical issues affecting product quality and operational efficiency. The primary objective is to identify the root causes of defects, evaluate the impact of these defects on the overall supply chain, and understand how different vendors and material types contribute to these issues. By examining data from multiple sources, the analysis aims to provide a clear picture of defect trends, downtime occurrences, and outlier patterns. This study also explores seasonal variations in defect rates to help the company better plan for and mitigate these issues. The ultimate goal is to deliver actionable recommendations that will drive improvements in quality control, vendor management, and overall supply chain performance.

Data Exploration:

Screen Of DataSet:

```
Sheet Name: Vendor
      Vendor   Vendor ID
0    Reddoit           1
1    Plustax           2
2     bamity           3
3  Quotelane           4
4     Viatom           5


Sheet Name: Plant
             Plant   Plant ID
0  Grand Rapids, MI         1
1     Milwaukee, Wi         2
2    Springfield, IL        3
3        Chicago, IL        4
4  Indianapolis, IN         5


Sheet Name: Defected Items
         Date  Sub Category ID  Plant ID  Vendor ID  Material ID  \
0  2014-12-31                2        16          2         2126
1  2014-12-31                2        16          2         2126
2  2014-12-31                2        16          2         2137
3  2014-12-31                2        20         59         1439
4  2014-12-31                2         2         46          607

   Defect Type ID  Material Type ID  Defect ID  Defect Qty  Downtime min
0               3                 4         27           0          60.0
1               3                 4         27           0          60.0
2               3                 6        281           1          60.0
3               3                 8        295           9          10.0
4               3                 8        299          47          30.0


Sheet Name: Material Type
  Material Type  Material Type ID
0     Corrugate                 1
1          Film                 2
2        Carton                 3
3     Batteries                 4
4    Composites                 5
```

>>Correlations Between defect Qty and downtime is 0.07

Data Cleaning:
ONLY in fact sheet

>>Delete 193 Duplicate rows

>>In Defect Type ID col, replace number 8 with the mode Id 1,because Defect Type ID not have id 8

>> In Vendor ID col, replace number 328 with the mode Id 1,because Vendor ID not have id 328

>> In Material Type ID col, replace number 69 with the mode Id 9,because Material Type ID not have id 69

Defect Analysis By SubCategory:
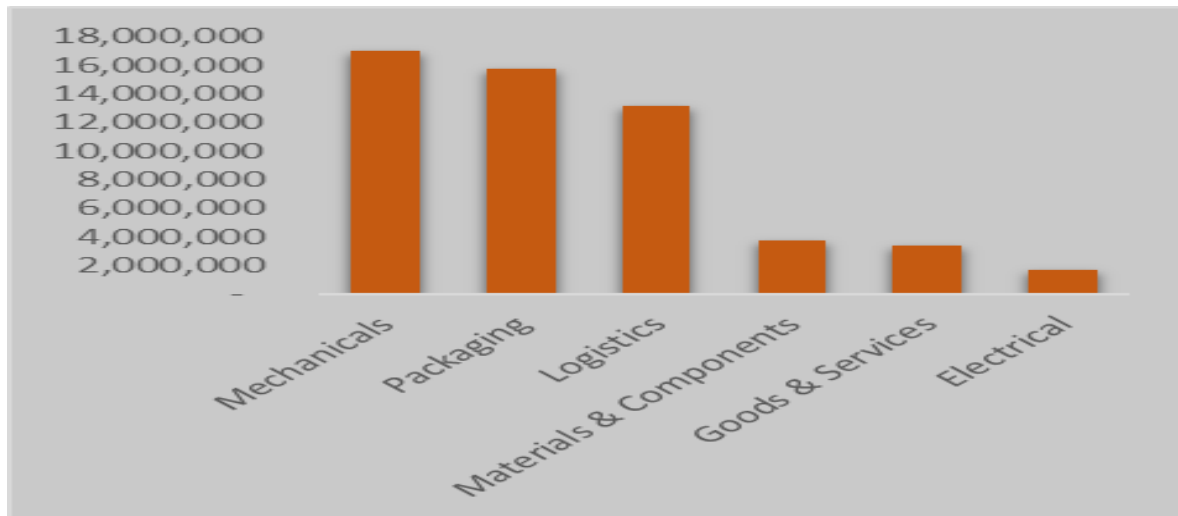
Mechanicals (16,989,072 defects) account for the highest number of reported defects

Electrical (1,650,080 defects) represents the least number of defects among the major subcategories

Recommendation:

1. **Enhance Quality Control**: Improve inspections and training for mechanical products.
2. **Check Materials Regularly**: Audit suppliers to ensure quality components.
3. **Set Up Feedback Channels**: Create a system for teams to report defects and share suggestion

Defect Analysis by Vendors:
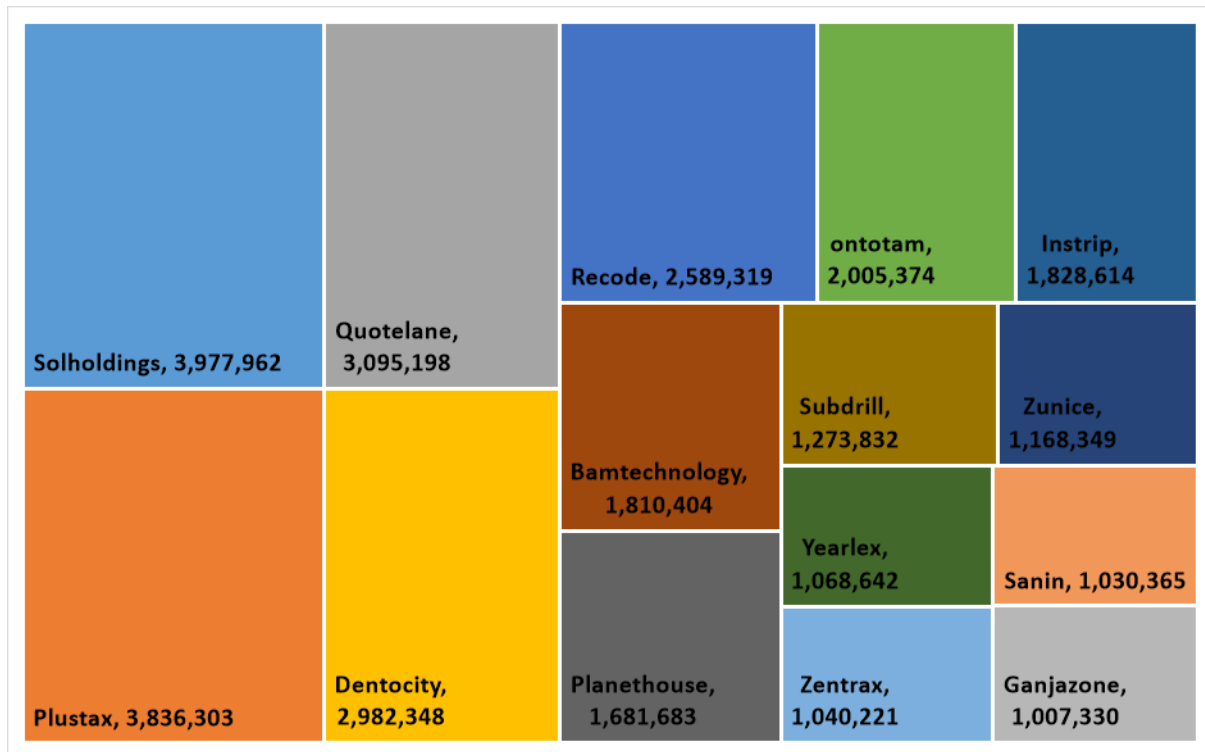
The total defects amount to **54,539,246**, while the top 15 vendors account for **30,395,944** defects. This means that the top 15 vendors from 328 vendors represent approximately **55.6%** of the total defects.

Recommendations:

1. **Provide Training**: Offer training to vendor staff on quality assurance and defect prevention.
2. **Encourage Communication**: Maintain open communication with vendors to quickly resolve issues.
3. **Monitor Performance**: Track defect rates for each vendor to measure improvements over time.
4. **Promote Continuous Improvement**: Encourage vendors to keep improving their processes to reduce defects.

Defect Type Analysis:
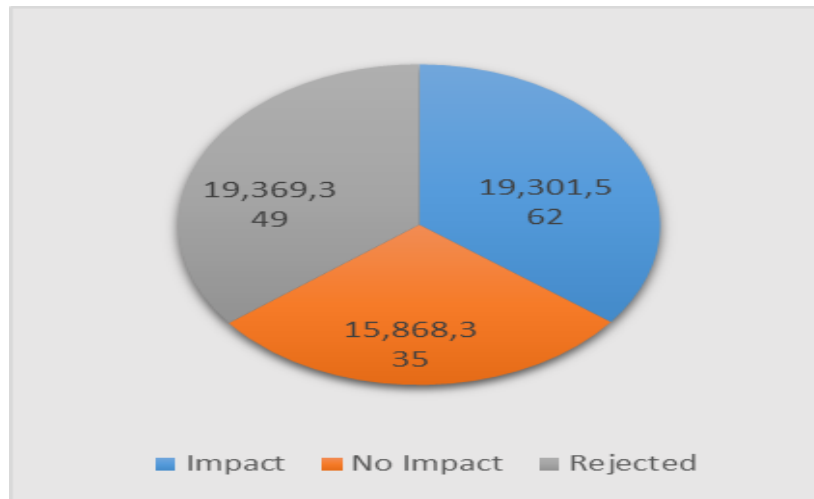
The Rejected and Impact categories are almost equal in defect quantity, suggesting that many defects are serious enough to either fail quality checks or significantly degrade product functionality.

The No Impact defects, while lower in quantity, still represent a significant number that should not be ignored, as reducing these can improve product appearance and reduce minor customer complaints.

Recommendations:

1. **Focus on improving quality control processes** during production to reduce the number of rejected items.
2. **Implement strict inspections** and standards to catch issues early.
3. **Invest in staff training** and enhance quality checks for critical components to lower the defects that directly affect product performance.

Defect Analysis:
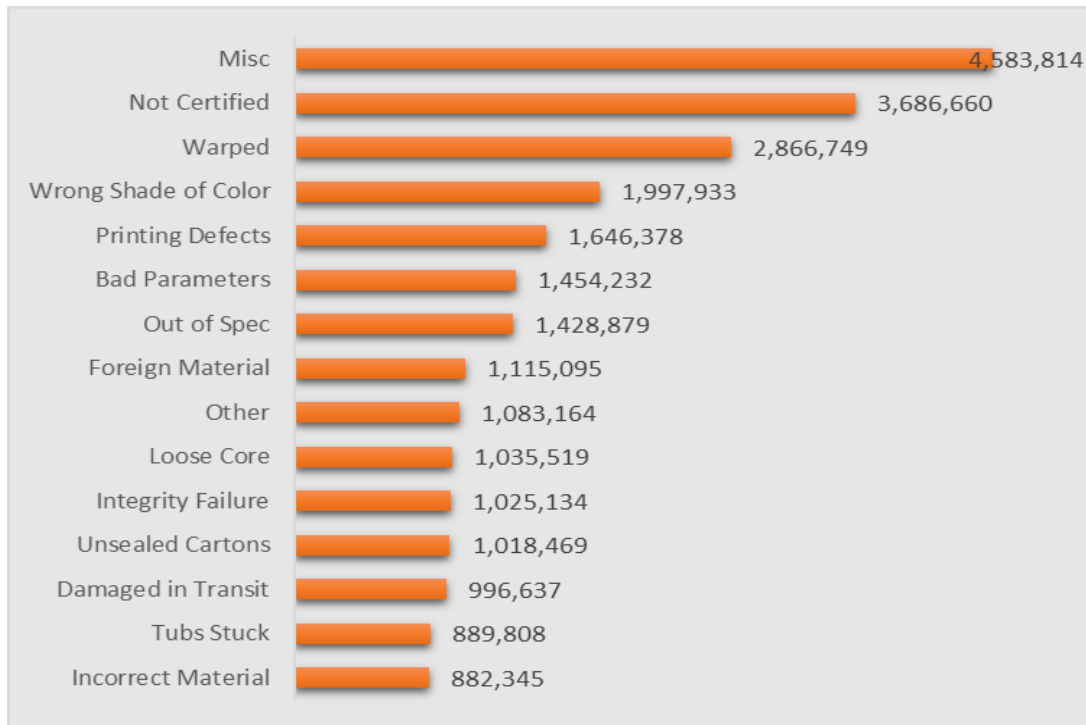
The top 15 defect contribute to **25,710,816 defects** out of the total **54,539,246 defects**, showing a significant concentration of issues among these categories.

Given that there are 305 defect types in total, these top 15 defects alone account for a significant proportion, indicating that addressing these key issues could lead to substantial improvements in overall product quality.

Defects By Material Type:
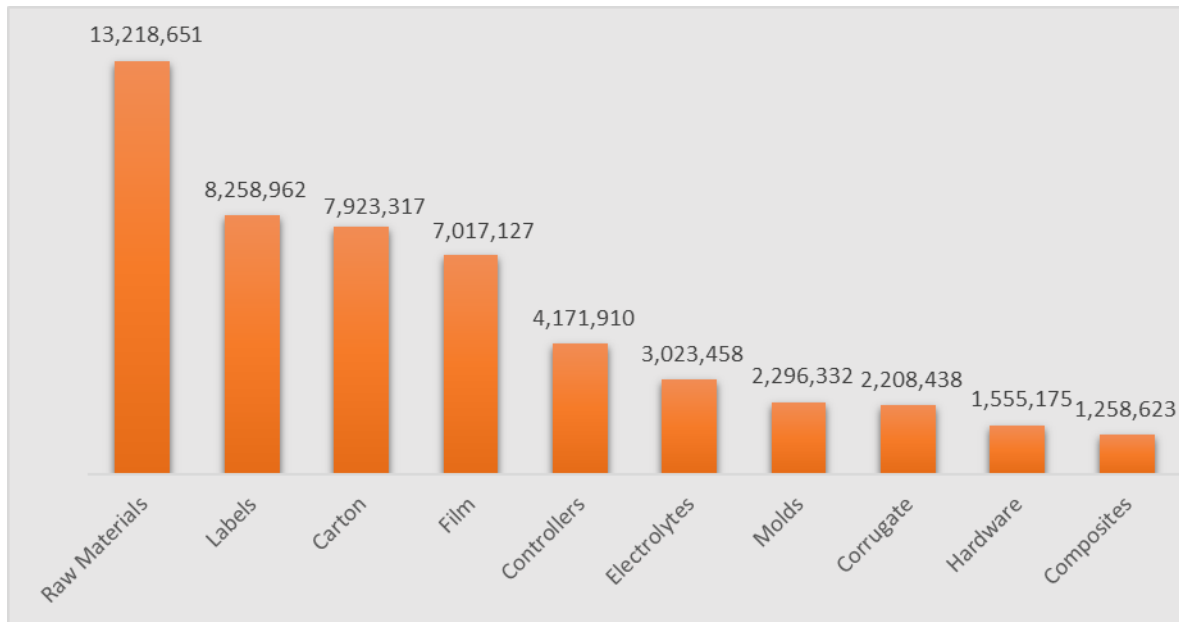
The top 10 material types account for **50,931,993 defects** out of the **total 54,539,246 defects**, representing **93.4%** of the total defects.

Recommendations:

1. Addressing defects in these key material types **(Raw Material , Labels, Carton, Film)** could significantly reduce the overall defect rate and lead to better product quality control.
2. **Enhance the quality control** process for raw materials by implementing stricter inspections and audits.
3. **Optimizing storage and handling conditions** will Address issues with labels, cartons, and film.
4. **Focus on quality awareness programs** to reduce human error in the production line.

Seasonal Patterns In Defects:

The line chart displays defects per quarter for 2013 and 2014:

Period	Quarter	Defects
2013	Qtr1	5,209,823
2013	Qtr2	8,063,954
2013	Qtr3	4,229,110
2013	Qtr4	5,414,458
2014	Qtr1	5,522,064
2014	Qtr2	7,021,642
2014	Qtr3	9,347,015
2014	Qtr4	9,731,180

The Total Defects in 2013 : 22,917,345.

The Total Defects in 2014 : 31,621,901.

There is a growth in the number of defects from 2013 to 2014, **especially in the third and fourth quarters of 2014** compared to the same periods in 2013.

Recommendation:
It is essential to investigate the causes behind this growth, particularly in Q3 and Q4 of 2014, to implement effective quality control measures and address any issues contributing to the increased defects.

Vendors With DefectQty & DownTime:

The Top 15 Vendors&Plant in DownTime

Row Labels	Sum of Downtime min	Sum of Defect Qty
Reddoit	26,185	518,984
Plustax	10,330	3,836,303
Sanlab	10,275	513,653
xx-way	9,966	734,948
Quotelane	5,831	3,095,198
scotquote	4,695	349,481
Recode	4,215	2,589,319
Sanin	3,658	1,030,365
xx-bam	3,605	155,032
Planethouse	3,382	1,681,683
ontotam	3,327	2,005,374
J-lax	3,318	937,620
Dentocity	3,088	2,982,348
Instrip	3,088	1,828,614
Solholdings	2,275	3,977,962
Grand Total	97,238	26,236,884

Row Labels	Sum of Downtime min	Sum of Defect Qty
Springfield, IL	17,296	3,784,005
Cincinnati OH	14,805	1,209,796
Monon, IN	11,964	3,356,864
Detriot, MI	11,428	6,610,107
Indianapolis, IN	11,305	3,431,509
Bangor, MI	9,531	1,773,241
Skokie, IL	9,052	1,968,165
Northbrook, IL	8,175	3,740,202
Madison, WI	6,633	1,904,438
Rockford, IL	5,799	3,697,133
Chicago, IL	4,946	3,714,589
Naperville, IL	4,601	2,211,497
Joliet, IL	3,924	660,243
Toledo, OH	3,893	1,938,406
Green Bay, WI	3,580	1,629,397
Grand Total	126,932	41,629,592

Vendor Performance:
Reddoit has the highest downtime (26,185 minutes) but a relatively moderate number of **defects (518,984).**

Plustax shows significant **defects (3,836,303)** with **lower downtime (10,330 minutes).**

Plant:

Springfield, IL has the highest downtime at 17,296 minutes, corresponding to **3,784,005 defects**.

>> There is No relationship between downtime and defects across vendors Or plants.
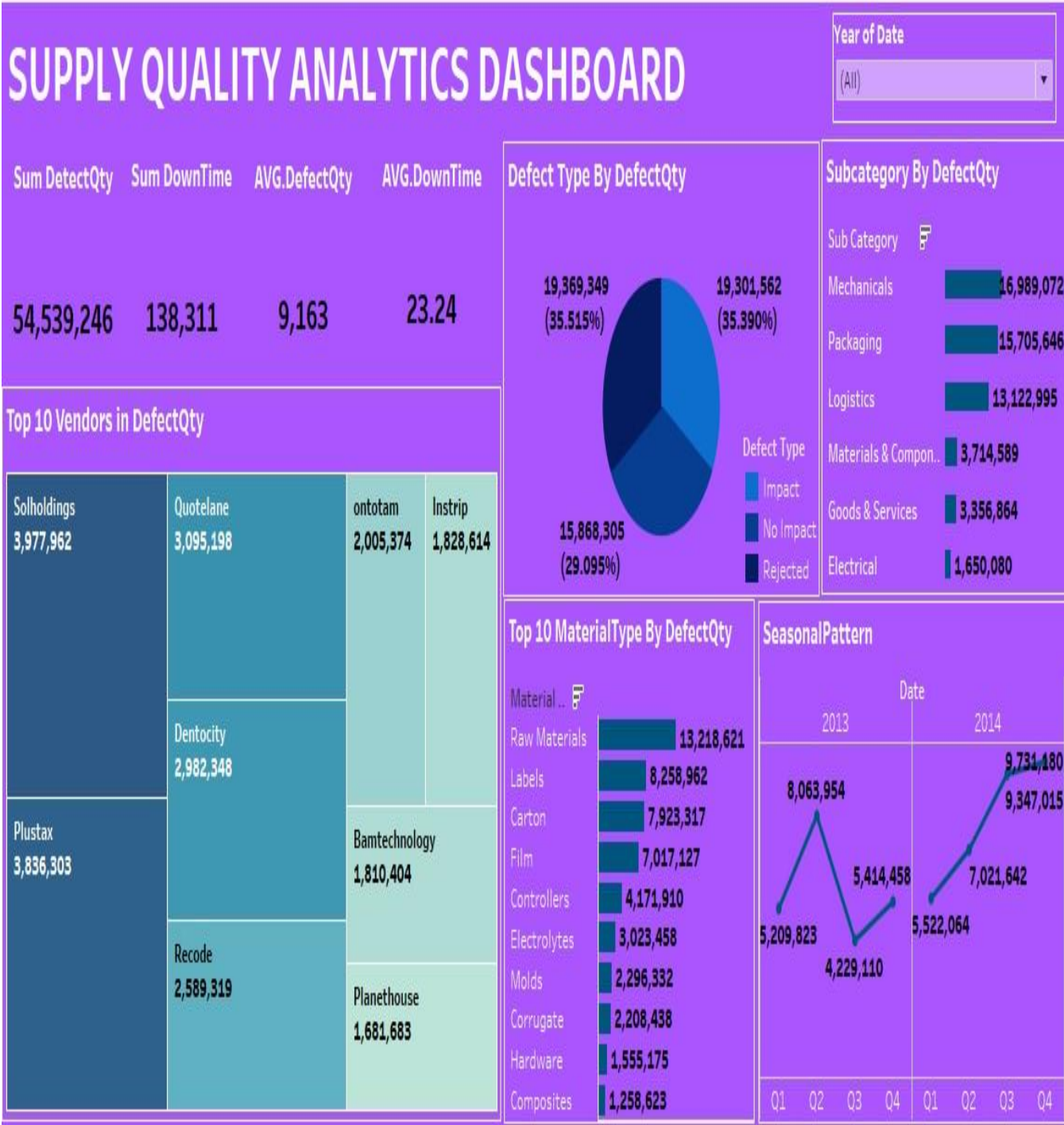
Limitation and Future Work:

Limitations

- **Data Gaps**: Some data points were missing or incomplete, which may affect the accuracy of the analysis.

- **Narrow Focus**: The analysis mainly looked at the top vendors, plants, and materials, so smaller contributors might have been overlooked.

- **Short Time Frame**: The study's focus on a limited period may not reflect long-term trends or unusual events.

- **Correlation, Not Causation**: The analysis highlights connections between defects and factors like materials or vendors but doesn't prove direct cause-and-effect relationships.

Future Work

- **Better Data**: Future analysis should include more detailed data like production volumes and environmental factors.

- **Predictive Tools**: Use predictive models to anticipate defects and take action before they happen.

- **Vendor Review**: Assess vendors in detail, considering factors like quality and response time.

- **Long-Term Analysis**: Expand the study to cover more years to see long-term trends and seasonal changes.

- **Find Root Causes**: Investigate high-priority defects to understand and fix the core issues.

DashBoard:

SUPPLY QUALITY ANALYTICS DASHBOARD

Year of Date

(All)

Sum DetectQty	Sum DownTime	AVG.DefectQty	AVG.DownTime
54,539,246	138,311	9,163	23.24

Defect Type By DefectQty

19,369,349 (35.515%)

19,301,562 (35.390%)

15,868,305 (29.095%)

Defect Type
- Impact
- No Impact
- Rejected

Subcategory By DefectQty

Sub Category

Mechanicals	16,989,072
Packaging	15,705,646
Logistics	13,122,995
Materials & Compon..	3,714,589
Goods & Services	3,356,864
Electrical	1,650,080

Top 10 Vendors in DefectQty

Solholdings 3,977,962	Quotelane 3,095,198	ontotam 2,005,374	Instrip 1,828,614
	Dentocity 2,982,348		
Plustax 3,836,303		Bamtechnology 1,810,404	
	Recode 2,589,319	Planethouse 1,681,683	

Top 10 MaterialType By DefectQty

Material ..

Raw Materials	13,218,621
Labels	8,258,962
Carton	7,923,317
Film	7,017,127
Controllers	4,171,910
Electrolytes	3,023,458
Molds	2,296,332
Corrugate	2,208,438
Hardware	1,555,175
Composites	1,258,623

SeasonalPattern

Date

2013 — 8,063,954, 5,209,823, 4,229,110, 5,414,458

2014 — 9,731,480, 9,347,015, 7,021,642, 5,522,064

Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

Recommendations:

The recommendations derived from this study, such as enhancing quality control, optimizing material selection, and refining vendor management, have the potential to significantly reduce defects, improve production efficiency, and ultimately strengthen the company's market position. By addressing these issues, the company can achieve higher product quality, reduce operational costs, and increase customer satisfaction, leading to a more robust and reliable supply chain.

Conclusion:

This project successfully identified key areas contributing to defects within the company's supply chain, including specific subcategories, defect types, vendors, and material types that require immediate attention. The analysis highlighted seasonal variations and significant differences in performance among plants, providing a roadmap for strategic improvements.