EYouth X DEPI Tech Challenge

Supplier Quality Analysis Report

Presented to: EYouth

Date of Submission: 28/2/2025

Submitted by: Mohammed Yasir Abduljawad

Contents

Introduction

In modern supply chain management, maintaining supplier quality is vital to ensure product reliability and customer satisfaction. The purpose of this report is to showcase the analysis made on supplier quality dataset. The dataset originates from supplier quality monitoring systems and contains multiple tables with essential supplier quality details.

Methodology

- Clean and prepare the data for the analysis by dealing with duplicates, missing values, and inconsistencies.
- Data modelling and structuring the dataset into relational model for accurate analysis.
- EDA (Exploratory Data Analysis) to derive informative insights.
- Recommendations to improve supplier quality management.

Expected Outcomes

Decision makers will gain actionable insights into supplier quality issues. These insights will assist in refining supplier quality criteria, improving material source strategies, and implementing initiative-taking prevention measures to optimize the overall supply chain.

Business Questions

These questions pave the way for better analysis.

- Which suppliers have the highest defect quantity?
- Which suppliers contribute most to downtime due to defects?
- Are there specific materials that have higher defect rates?
- Which plants experience the most defects, and are certain suppliers responsible?
- What are the most common types of defects, and which vendors are associated with them?
- Is there a trend in defect occurrences over time?
- What is the average downtime caused by defects for each vendor?

- What percentage of total defects are caused by the top three worst-performing vendors?
- Are there specific plants that frequently report defects from certain vendors?
- Which months experience the highest defect rates?
- Is there a correlation between defect quantity and downtime per supplier?
- How frequent are downtimes?

Data Cleaning

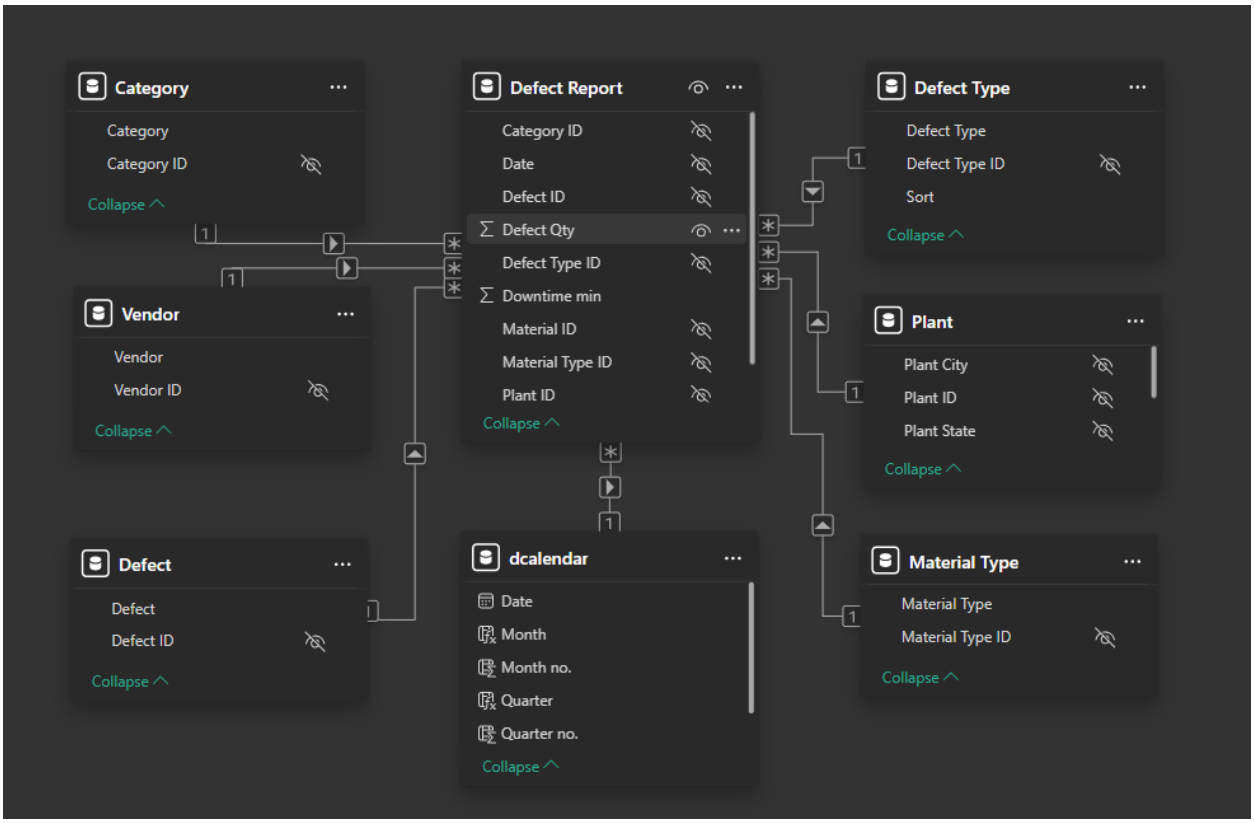
The data cleaning process was to ensure accuracy, consistency, and reliability in the dataset. There were not any missing values or errors in the dataset. Duplicate records were identified and removed to prevent redundancy and misinterpretation of results. Some columns where split or removed to maintain data relevance.

Table	Key Issues Found	Action Taken
Category	Duplicate columns (Category, Sub-Category)	Removed Sub-Category, Renamed ID Column Changed ID type to text
Defect	No issues	Changed Defect ID type to text
Defect Type	No issues, but ID format inconsistent	Converted Defect Type ID to Text
Material	No issues	Converted Material Type ID to Text
Plant	City & State in one column, inconsistent abbreviations	Split columns, corrected state abbreviations Changed Plant ID type to text
Vendor	No issues	Changed Vendor ID type to text
Defect Report	193 duplicate records	Removed duplicates. Renamed Subcategory ID Changed IDs type to text

Data Modeling

After cleaning, the dataset was structured into a relational model to ensure efficient analysis. The Defect Report Table serves as the fact table, containing defect records linked to multiple dimension tables, including Category, Vendor, Material, Plant, and Defect.

ID columns were standardized to text format across all tables, ensuring consistency. A hierarchy was created for plant locations by separating City and State, enabling better geographical analysis. A calendar table was created to ensure date consistency.



Dax Measures

```
Total Defect Qty. = SUM('Defect Report'[Defect Qty])
```

Total Defect Qty

```
Total Downtime (min) = SUM('Defect Report'[Downtime min])
```

Total Downtime (min)

```
Defect Qty. SPLY = CALCULATE([Total Defect Qty.], SAMEPERIODLASTYEAR(dcalendar[Date]))
```

Defect Qty. SPLY

```
Downtime (min) SPLY = CALCULATE([Total Downtime (min)], SAMEPERIODLASTYEAR(dcalendar[Date]))
```
Downtime (min) SPLY

```
Average Defect Qty. = AVERAGE('Defect Report'[Defect Qty])
```
Average Defect Qty.

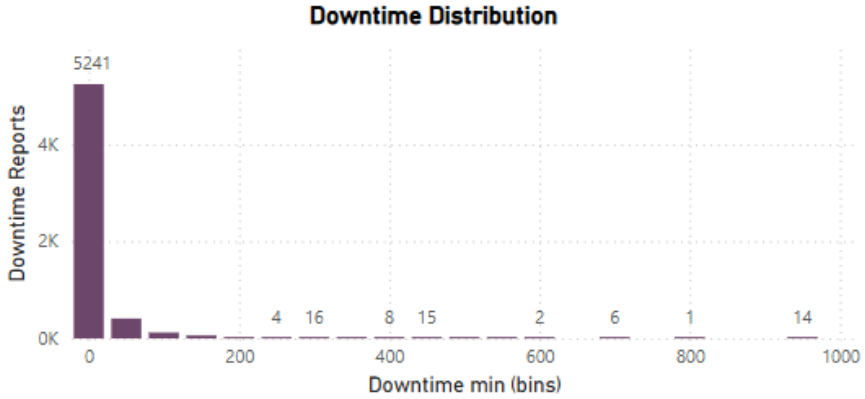
```
Average Downtime = AVERAGE('Defect Report'[Downtime min])
```
Average Downtime

```
Downtime Reports = COUNT('Defect Report'[Downtime min]
```
Downtime Reports

Analysis and Insights

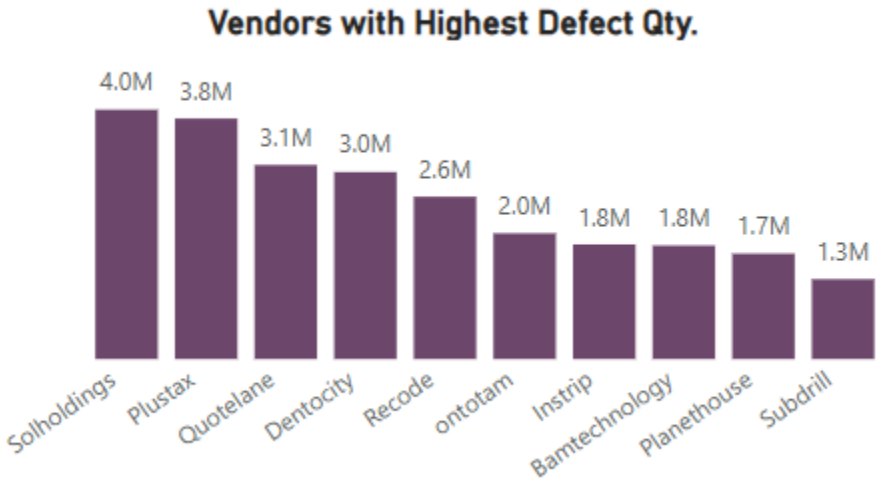
Analysis will be presented by answering the business questions.

How frequent are downtimes?



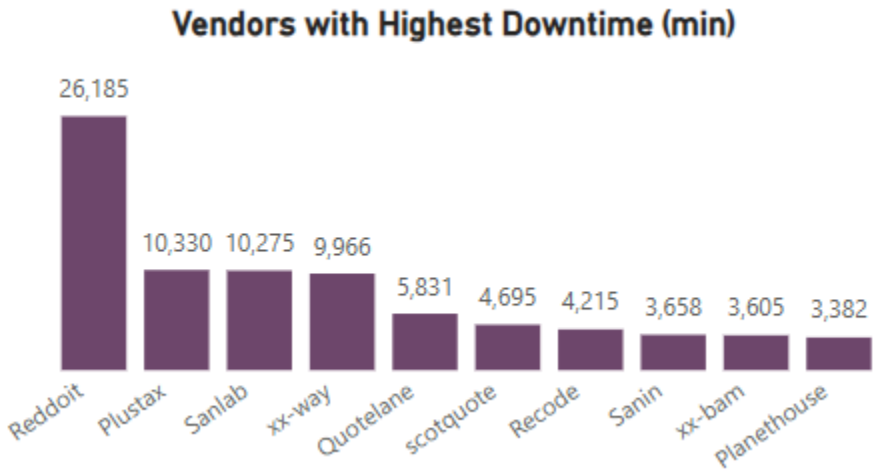
The distribution of downtimes shows that they are **highly frequent but mostly short in duration**. The majority of downtime reports (5,241 out of 5,952) are concentrated in the lowest time bin, indicating that most downtime events are brief. However, the distribution exhibits positive skewness, meaning that while most downtime instances are short, there are a few extreme cases with significantly higher durations. These outliers, seen in the higher downtime bins (e.g., 600–1000 minutes), suggest that although rare, some downtimes are exceptionally long and may cause significant operational disruptions.

Which suppliers have the highest defect quantity?



The vendors with the highest defect quantities are Solholdings (4.0M), Plustax (3.8M), and Quotelane (3.1M), followed closely by Dentocity (3.0M) and Recode (2.6M). These vendors are the primary contributors to overall defects, with Solholdings and Plustax standing out as the worst performers. The high defect rates indicate potential quality control failures, inconsistencies in manufacturing processes, or poor material handling from these vendors.

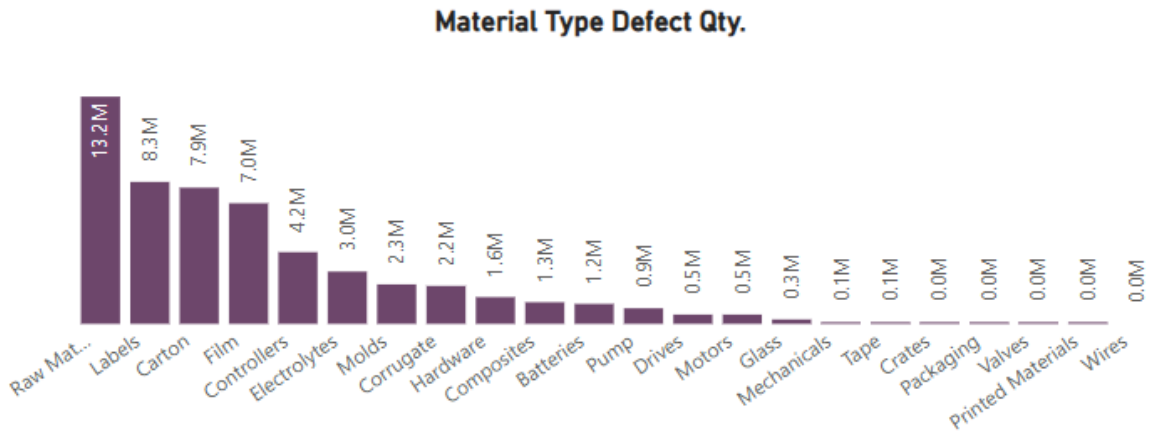
Which suppliers contribute most to downtime due to defects?



The vendors with the most downtime are Reddoit, Plustax, Sanlab not only produce large numbers of defects but also cause extended production

stoppages. This indicates a direct link between defect rates and operational inefficiencies.

Are there specific materials that have higher defect rates?



Certain material types consistently show high defect rates, particularly those related to Raw materials, Labels, Carton, and Film. These types contribute disproportionately to overall defect counts and require improved supplier quality control.

Which plants experience the most defects, and are certain vendors responsible?

Plant State	Bamtechnology	Dentocity	Instrip	ontotam	Planethouse	Plustax	Quotelane	Recode	Solholdings	Subdrill	Total
IA						4,268			37,061		**41,329**
IL	3,560	737,206	1,828,614	872,919	1,681,683	3,176,376	1,156,905	1,060,459	1,443,717	80,282	**12,041,721**
IN		1,641,415		466,675			103,310	137,012	1,006,101	1,193,550	**4,548,063**
MI	1,806,844	427,203		665,780		256,923	224,345	1,029,260	1,362,146		**5,772,501**
OH		176,524				267,676	127,189	217,561	87,666		**876,616**
WI						131,060	1,483,449	145,027	41,271		**1,800,807**
Total	**1,810,404**	**2,982,348**	**1,828,614**	**2,005,374**	**1,681,683**	**3,836,303**	**3,095,198**	**2,589,319**	**3,977,962**	**1,273,832**	**25,081,037**

The state that experiences the most defects is Illinois (IL) with a total of 12,041,721 defects, followed by Michigan (MI) with 5,772,501 defects, and Indiana (IN) with **4,548,063 defects**. These three states account for most defects in the dataset.

Several vendors contribute significantly to these defects. In Illinois, Planethouse (1,681,683), Plustax (3,176,376), and Quotetlane (1,156,905) are

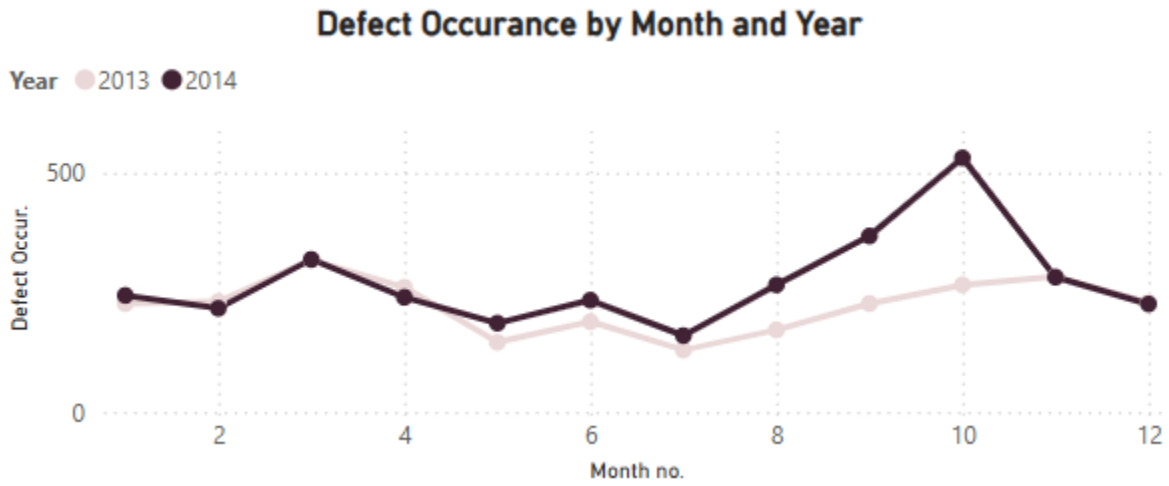
major contributors to the defect count. In Michigan, Bamtechnology (1,806,844) and Instirp (665,780) are responsible for a sizable portion of defects.

What are the most common types of defects, and which vendors are associated with them?

The top five most common defect types in the dataset are Misc, Not Certified, Printing Defects, Warped, and Wrong Shade of Color. These defects are associated with multiple vendors.

The Misc defect is the most widespread, linked to vendors such as Acequote, Anmedia, Bamity, Bluecorporation, Donware, Fin-cone, Plustaxon, Tamcan, Ventocore, and Zunice, among many others. The Not Certified defect is also prevalent, appearing in vendor records like Anzammedia, Bamity, Blue-Tech, Canemedkix, Dongbase, Jaylane, Planetware, Ronplanet, Scotfase, and Zummatax. Printing Defects are linked to a smaller group of vendors, including Blueit, Instrip, Ontotam, Recode, Scotquote, and Silverfase. The Warped defect is associated with D-zohex, Geofind, Plustax, Reddoit, Sanin, and Subdrill. Lastly, the Wrong Shade of Color defect is recorded under vendors such as Bamtechnology, Conelane, Goldenbam, Keyzunbase, Planethouse, Recode, Scotfase, Solholdings, Strongdax, Ventocore, and Zoodrill.

Is there a trend in defect occurrences over time?



The trend in defect occurrences over time reveals an increase in 2014 compared to 2013. Throughout both years, defect occurrences fluctuated, but a notable peak is observed in October, followed by a sharp decline in November and December. This suggests that certain factors, such as increased production demands, vendor constraints, or environmental influences, may contribute to higher defect rates during this period. Additionally, the overall increase in defects from 2013 to 2014 indicates a decline in vendor quality or inefficiencies in quality control processes.

What is the average downtime caused by defects for each vendor?

The top 20 vendors by average defect quantity are Hotity (204,781), Plextechi (161,535), O-ace (131,008), Scotlex (128,160), Whitefan (109,559), Icedox (80,990), Conzumzap (66,847), Saozoomtex (66,643), Goldentechi (61,361), Zunice (55,635), Vaiazozice (53,311), Zentrax (47,282), Labdox (45,455), Technoline (45,390), Coneranron (44,589), Streetlam (43,163), Gravemedia (41,999), Inchholdings (41,795), Faseelectronics (40,958), and Strongtechnology (40,444).

What percentage of total defects are caused by the top three worst-performing vendors?

Vendor	Total Defect Qty.
Solholdings	3,977,962
Plustax	3,836,303
Quotelane	3,095,198
Total	**10,909,463**

The top three vendors contribute 20% of total defects, equating to 10,909,463 defects.

Are there specific plants that frequently report defects from certain vendors?

Plant State	Dentocity	ontotam	Plustax	Quotelane	Reddoit	Sanlab	scotquote	Subdrill	Trio-dax	xx-way	Total
IA			21		28						**49**
IL	109	49	123	161	340		87	15	239	229	**1352**
IN	70	21		139		110		236			**576**
MI	3	82	29	27	67	60				173	**441**
OH	5		61	3	178		4				**251**
WI			74	50	93		57				**274**
Total	**187**	**152**	**308**	**380**	**706**	**170**	**148**	**251**	**239**	**402**	**2943**

5952
Downtime Reports

The data reveals that specific plants frequently report defects from certain vendors, with Illinois (IL) experiencing the highest number of defect reports (1,352), followed by Indiana (576) and Michigan (441). Among the vendors, Reddoit is the largest contributor to defect reports, with 706 defects, affecting Illinois. Quotelane (380 defects), Plustax (308 defects), and Subdrill (251 defects) also show significant defect contributions across multiple plant states. The concentration of defects in Illinois suggests that supplier quality issues are more severe in this region, potentially due to higher production volumes or weaker supplier quality control.

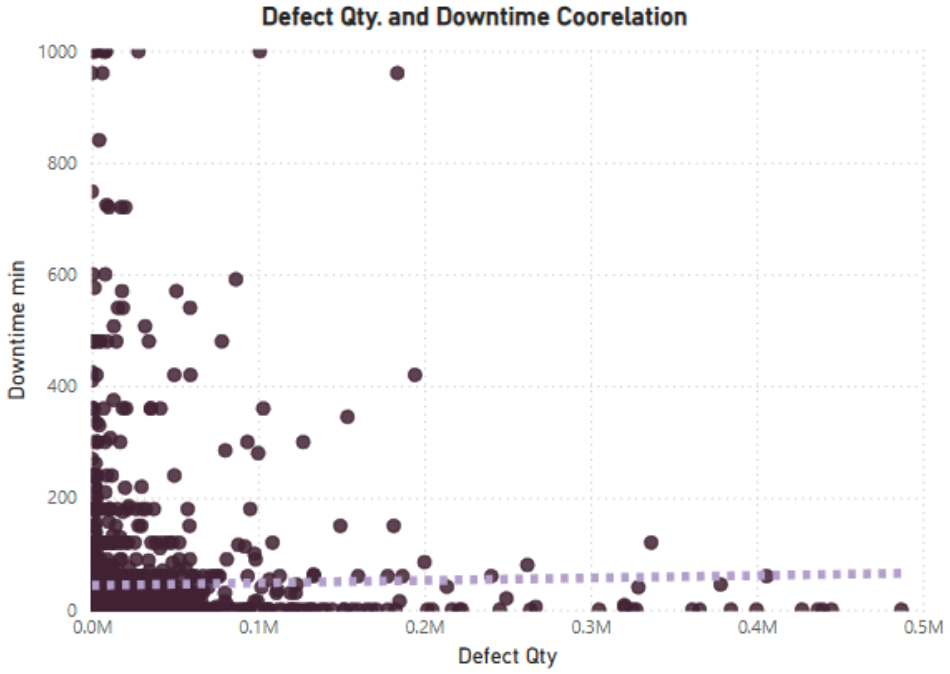
Which months experience the highest defect rates?

Month	Total Defect Qty.
Oct	6,616,667
Jun	6,560,886
Apr	5,369,136
Sep	5,264,634
Jan	4,792,256
Total	**28,603,579**

54,558,796
Total Defect Qty.

Oct, Jun, Apr, Sep, and Jan were the months that experienced the highest defect rates with total of 28,603,579 which is about 52% of the total defects between 2013 and 2014.

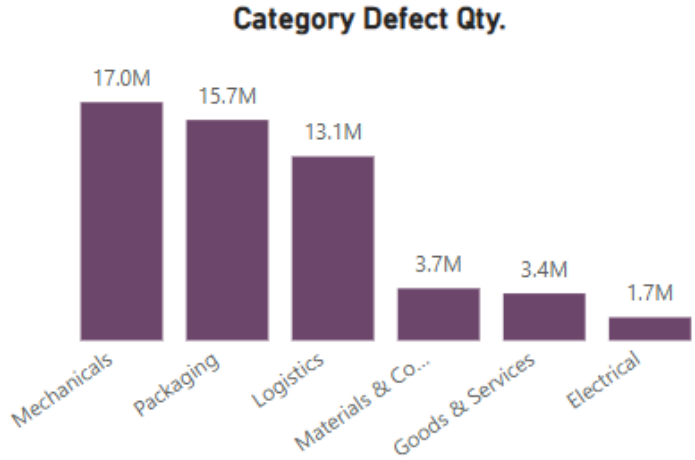
Is there a correlation between defect quantity and downtime?



Coorelation cooficient	R-squared
0.07268803	0.00528355
CORREL(I:I,J:J)	RSQ(J:J,I:I)

The correlation between defect quantity and downtime is very weak. The correlation coefficient is 0.0727, indicating almost no linear relationship between the number of defects and the amount of downtime. Additionally, the R-squared value is 0.0053, meaning that only 0.53% of the variation in downtime can be explained by defect quantity.

Which Categories have the highest defect quantity?



The categories with the highest defect quantities are Mechanicals (17.0M defects), Packaging (15.7M defects), and Logistics (13.1M defects), making them the most significant contributors to overall quality issues. Materials & Components (3.7M), Goods & Services (3.4M), and Electrical (1.7M) have lower defects.

Recommendations

- Implement mandatory quality audits and corrective action plans for Solholdings, Plustax, and Quotelane, which collectively contribute 20% of total defects.
- Conduct root cause analyses (RCAs) with Reddoit, Plustax, and Sanlab, which cause extended downtime despite moderate defect volumes.
- Enforce stricter inspection protocols for Raw Materials, Labels, Carton, and Film, which account for the highest defect rates. These materials are critical to production.
- Deploy dedicated teams to plants in Illinois, Michigan, and Indiana to address localized issues. Local audits and supplier collaboration can mitigate recurring issues.
- Suspend vendors like Anzammedia and Bamity linked to "Not Certified" defects until compliance is verified. Certification gaps indicate systemic quality failures.
- Ramp up inspections and supplier capacity checks before October, which saw the highest defect rates. Trends show defects spike in October; proactive measures can prevent seasonal quality declines.
- Redesign processes for Mechanicals, Packaging, and Logistics through cross-functional teams. These categories drive 70% of total defects; process improvements here will yield significant quality gains.