Procurement Analytics and Data-Driven Insights for Velocipede Cycles

Big Data Management (INF20016)
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Prepared for

Senior Executives

Velocipede Cycles

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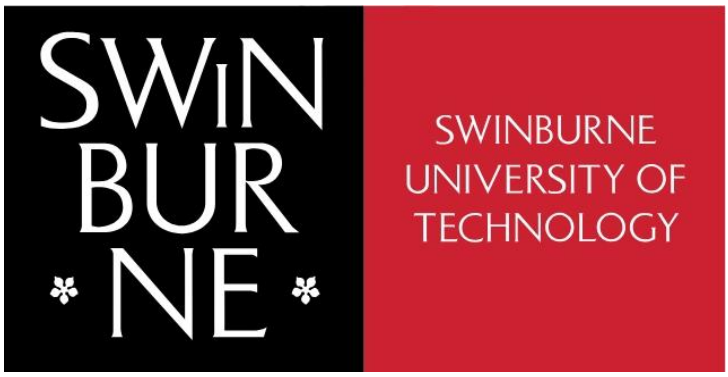

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EXECUTIVE SUMMARY

In 2024, Velocipede Cycles experienced around $11.5M purchasing spending increase which is around an additional 10% from the financial year of 2023. However, despite the increase in spending, the number of suppliers remains at 10. Moreover, a few items, such as frames, batteries, and displays, contribute to the majority of the spending. This shows the room for negotiation for high-value items.

The total potential savings have been declining from $2.3M in 2023, down by 26% in 2024 to just $1.7M. We also observed that there are differences in the same items provided by different suppliers. This shows that profit margin can be expanded by choosing the right supplier through re-negotiation without any cost-cutting involved.

Some risks that we notice throughout the supplier performance are that there is a monopoly on the supply of some critical parts, especially frames and e-bike systems, by one main supplier. This lack of variation in suppliers might pose a risk of price increase, or if the supplier fails to deliver, Velocipede Cycles' sales and production might be disturbed.

Based on this analysis, we provided some recommendations that Velocipede Cycles can follow, such as setting a target price, negotiating during quieter periods and allowing price locking, reducing single supplier risk, and introducing a supplier performance score

These steps will help to reduce purchasing spending, protect the company’s profitability, allow room for negotiation, and strengthen Velocipede Cycles' relationship with supplier companies by filtering out quality suppliers.

Introduction

This report has been prepared for the senior management team of Velocipede Cycles to provide insights into the company's procurement. The company's sales have been growing across 15 stores. However, there are concerns raised about the procurement inefficiencies during the recent internal reviews, which caused a loss in profit margins. This report has been commissioned to allow better decision-making by identifying the areas of risk and showing improvement opportunities.

The scope of this analysis is based on 2023-2024 purchasing data. The report applies data quality assessment techniques to ensure the reliability of the dataset, followed by procurement performance monitoring through key performance indicators (KPIs). The analysis will also highlight cost-saving opportunities, evaluate supplier dependencies and risks, and benchmark supplier performance in order to support decision-making.

Overview of The Industry

Velocipede Cycles competes in a fast-moving cycling market that has evolved from traditional road and mountain bikes to e-bikes. A lot of the company's demand comes from health and commuting trends and promotional events. Margins are sensitive to exchange rates for imported components and fluctuations in component pricing

Procurement analytics matters because Executives need a clear view of where money is spent, if the company has many single suppliers, and which suppliers are underperforming.

Scope of data and analysis

Data window: Purchasing transaction of 2023-2024
Entities covered: Purchase orders/lines, items, suppliers, buyer agents.
Analytical focus:

- Data quality assurance to ensure the dataset is accurate, consistent, and fit for purpose.
- Executive KPI baseline (total spend, average order value, on-time delivery rate, supplier spend mix).
- Three deep-dive lenses selected from: Cost Savings Analysis, Supplier Dependency & Risk, Supplier Performance Evaluation, Opportunity Identification & Supplier Consolidation.

Intended users: Senior management and the procurement leadership team, to allow the best decision for near-term actions and medium-term strategy.

Assumptions and limitations

- The analysis focuses on procurement drivers of margin.
- Consistency in delivery time cannot be measured due to limited data availability
- Geolocation fields were not provided in the source data; therefore, location-based analysis was not possible.

Data Quality Assessment

Data quality assessment was done on the *Velocipede Cycles* procurement dataset. According to Wang and Strong (1996), data quality is best understood as "fitness for use", emphasising that evaluation must be done from the perspective of the consumer to meet the needs of the company. Similarly, Mahanti (2019) mentioned that high-quality data must be accurate, complete, consistent, and timely in order to support effective business decision-making. Guided by these principles, several key data issues were identified and addressed.

Our data source is *Velocipede Cycles 23–24 Dataset.xlsx*, given in the case study. We used a reproducible Tableau Prep flow to input, Remove Duplicates, Data Processing, date quality, Handle Typos, and produce output, which is stored in the *Cleaned_Data_Velocipede_Cycles.xlsx file*, to implement the following checks/fixes

1. Duplicate Records

We defined a transaction business key as {PO_ID, Product_ID, Supplier_ID, Order_Date, Unit_Price, Quantity} to identify and remove duplicate transactions. There are 3 duplicate rows, which we removed. This reduces the dataset from 4,995 to 4,992 lines (0.06% of records).

Some near-duplicates were also found in {PO_ID, Product_ID} with a tiny price difference in Unit_Price. The differences in pricing show supplier pricing variation. This allows the price-dispersion signal required for downstream cost savings and supplier comparison analysis.

2. Referential integrity (foreign keys)

After standardising key fields, we make sure that every foreign key in the Procurement table is consistent with the master data. For example: Supplier_ID -> Suppliers, Product_ID -> Products, and Buyer_Agent_ID -> Buyer Agents using *left-anti joins* (fact minus dimension) to detect orphans. The results came out as: 0 orphan suppliers, 0 orphan products, and 0 orphan agents.

Other than that, we also confirmed many-to-one cardinality and validated semantic attributes via joins (each Product_ID maps to a single UoM/Category, each Supplier_ID maps to one Supplier_Name). These ensure reliable roll-ups, prevent row loss or duplication during joins, and underpin accurate concentration, performance, and savings metrics . All integrity tests are embedded in the Tableau Prep flow for repeatable governance.

3. Inconsistent Naming

Column headers across multiple sheets displayed inconsistent naming conventions. To improve consistency and interpretability, we standardised column headers, for example: Supplier Name -> Supplier_Name, Product Name -> Product_Name, Agent Code -> Agent_ID

And by trimming whitespace, removing stray characters, and enforcing a canonical format (upper-case prefixes + fixed numeric codes), we normalise key identifiers following Wang and Strong's (1996) intrinsic data quality category, which stresses the importance of accuracy and believability.

4. Validity, ranges & units

AUD is used throughout the document. This was adjusted in Tableau Desktop. To prevent missed pack sizes or unit inflation, product units of measure (UoM) are being standardised to the product master, so no mixed pack size is found. Values that were implausible and unsubstantiated by notes were corrected or removed, while legitimate cross-supplier price differences were retained for downstream price variance and savings analysis (Batini & Scannapieco, 2016, 18).

We also validated commercial fields and units to ensure numerical integrity and comparability, such as enforcing non-negativity on all transactional amounts (Quantity ≥ 0, Unit_Price ≥ 0) and reconciling line totals via the identity. Amount = Quantity × Unit_Price mismatches were corrected, or the row was excluded if unverifiable. Lines with zero values, Quantity = 0 or

Unit_Price = 0, were removed from spend-based KPIs unless supporting notes confirmed intent. All these checks allow consistency, accuracy, and interpretability.

Limitations

1. The scope is limited to approved purchases recorded in source systems. Any off-record transactions are not represented
2. Product master and UoM consistency were validated against the provided master tables; any upstream master-data errors would propagate, though no material issues were found.
3. Currency is treated as AUD throughout; multi-currency effects are out of scope.

Summary of Data Cleaning

Cleaning operation	Action	Why does it matter
Remove exact duplicate lines	Defined a line “business key” and removed 3 exact duplicates (4,995 to 4,992 rows).	Prevents artificial inflation of spend/volume, improves accuracy/uniqueness.
Standardise column headers	Harmonised headers and casing across sheets.	Improves interpretability/consistency and reduces join errors.
Correct ID typos & enforce formats	Fixed malformed IDs and typos. Some fields are renamed eg: [Po_Number], [PO_Date], [PO_Year]	Ensures validity/consistency/traceability; enables accurate roll-ups by supplier/agent.
Drop redundant field	Removed an unused procurement column present only in the raw file (col count - 1).	Reduces clutter; supports conciseness.
Referential integrity checks	Confirmed every Supplier_ID, Product_ID, Buyer_Agent_ID in Procurement exists in master tables (no orphans post-fix).	Protects the integrity of joins and dashboards.
Calculated fields dictionary	Documented formulas used later (e.g., *Avg Order Value*, *Avg Unit Buying Price*, *On-Time Rate*, *Potential Savings*, *Top-5 Concentration*).	Ensures consistent meaning from prep to dashboards (interpretability).
Prep flow & lineage artifacts	Saved the Tableau Prep flow (Input -> Remove Duplicates -> Date Processing -> Handle Typos -> Output) and the ID-correction map.	Makes the process reproducible/auditable.
Round up fractional PO quantities (discrete items)	[PO_Quantity] was removed, and [PO_Quantity_Rounded] was added instead.	Fractional values in `[PO_Quantity]` were rounded up to the nearest whole number and stored in `0 [.PO_Quantity_Rounded]`. This adjustment reflects the fact that items are discrete and cannot be partially sold (e.g., 1.5 units)

Insight

1. KPI Monitoring & Executive Overview

This dashboard shows procurement health for 2023-2024 includes three different themes such as growth, concentration, and seasonality,

and links each KPI to an action standard. This part of the report shows the baseline for procurement performance so that senior executives can monitor procurement health at a glance. This dashboard highlights the trends and exceptions that require action.

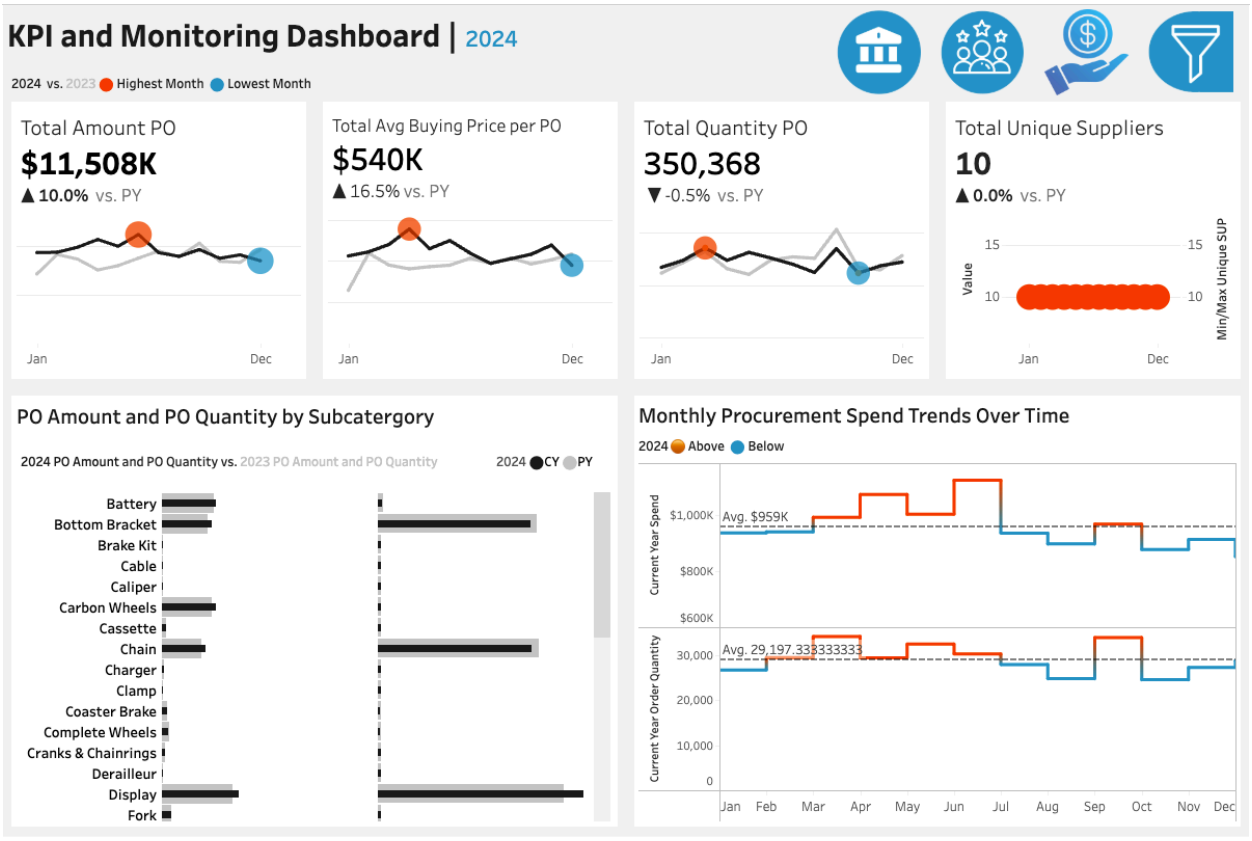


Figure 1 - KPI and Monitoring Dashboard

As per the graph below, in 2024, total spending rose by 10% reaching $11.508M. However, the number of suppliers stays at 10, indicating growth on a narrow base.

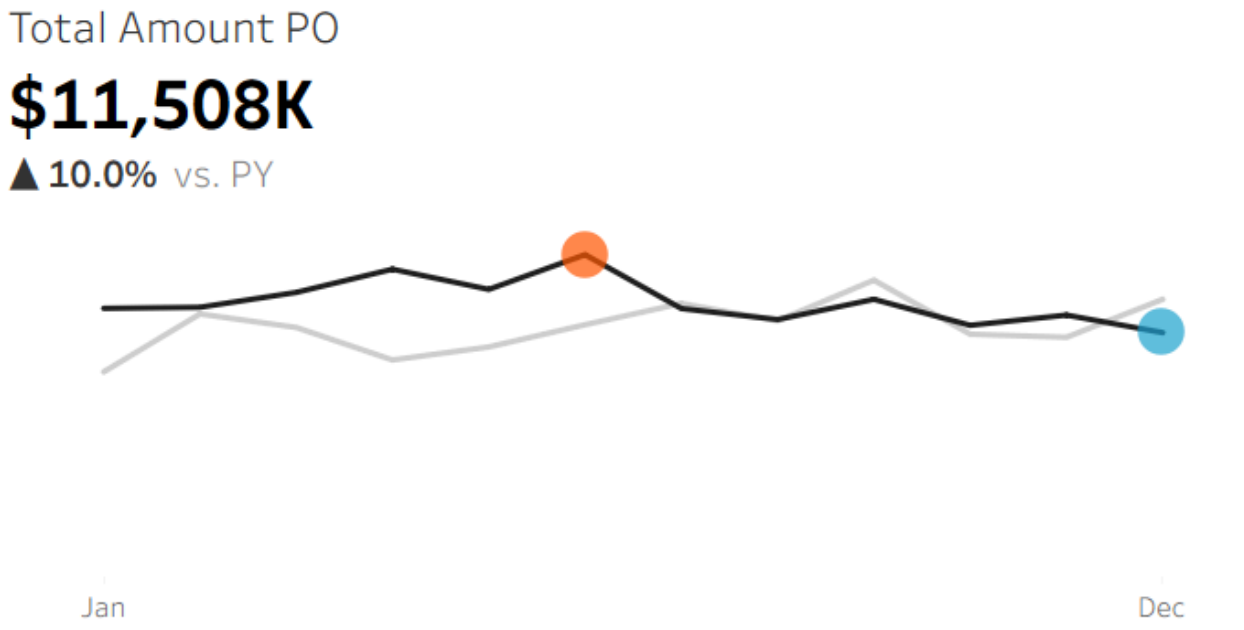


Figure 2 -Total Amount PO

Figure 3 - Total Unique Supplier

We can also notice that there is an increase in average order value by 16.5%, which is consistent with larger transactions.

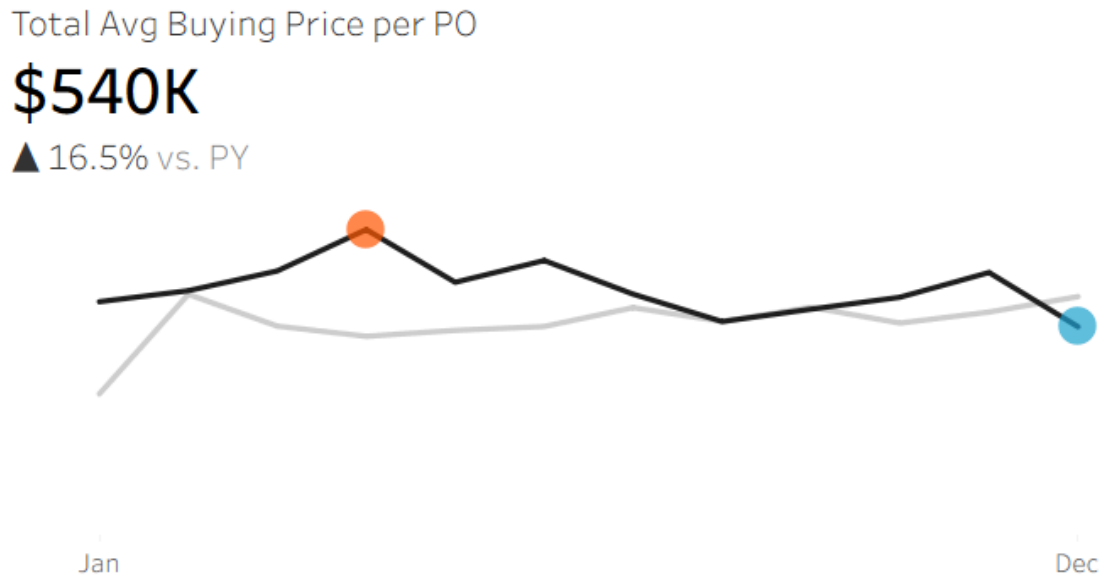


Figure 3 - Total Average Buying Price per PO

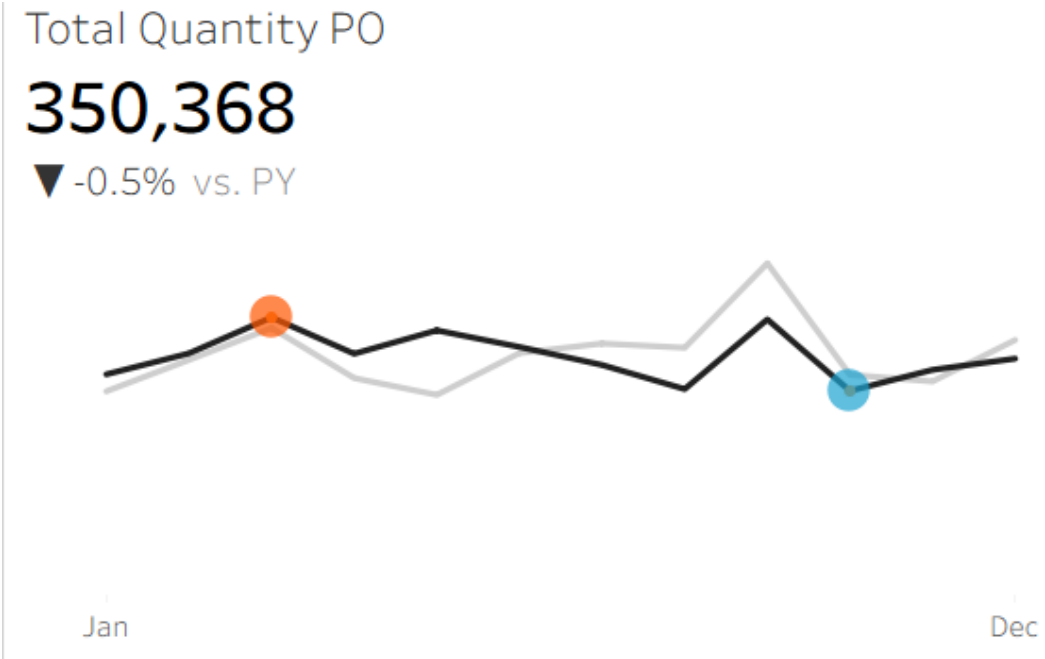


Figure 4 - Total Quantity PO

Sub Category comparison shows that items with the biggest purchase quantity are Bottom Bracket, Chain, Display, Plug, sensor, and Tubes, whilst high-value item spending is concentrated into 4 different items (Frames, Display, carbon wheels, and batteries).

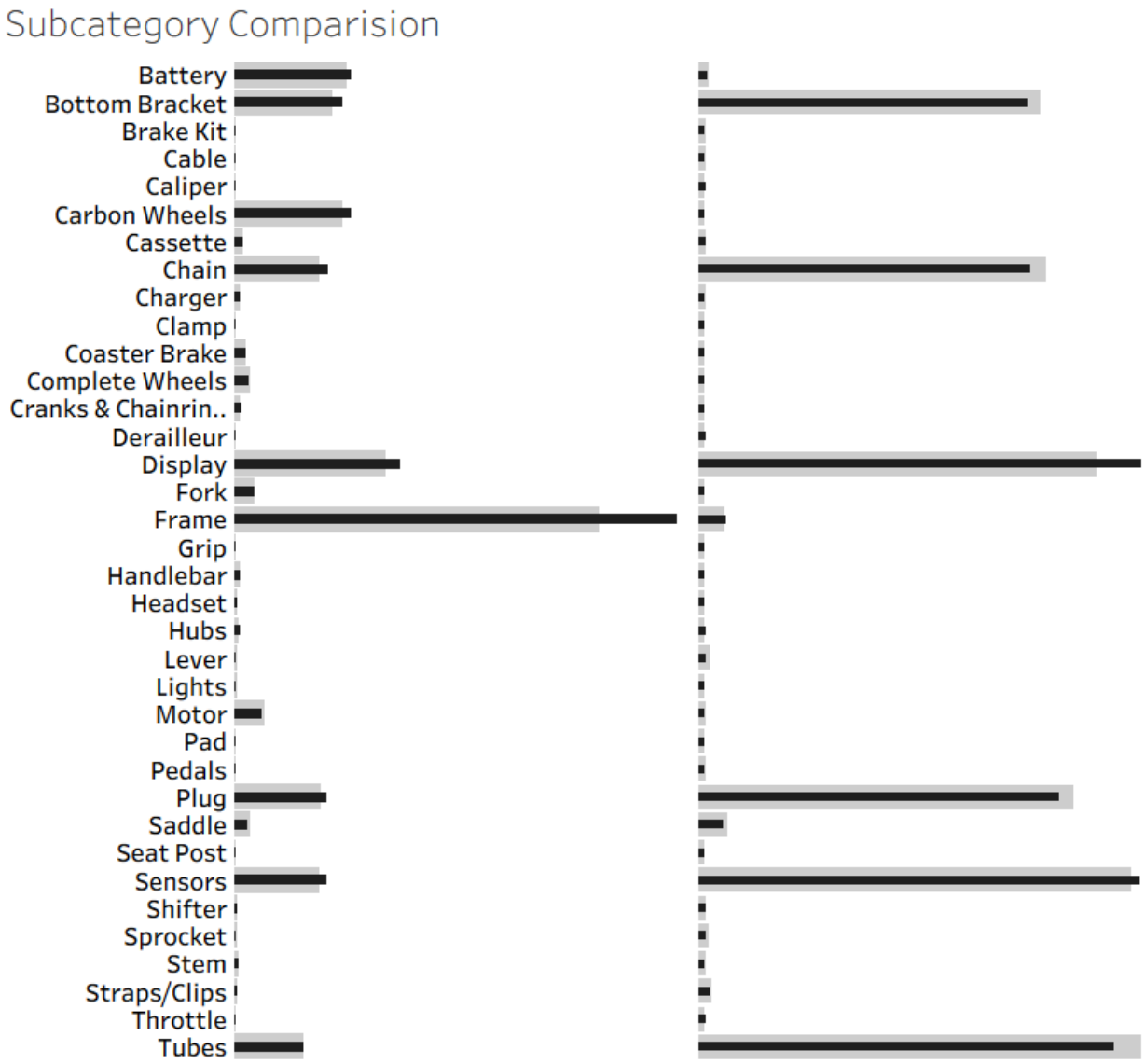


Figure 5 - Subcategory Comparison

The monthly procurement spend trends show a pattern of peaks appearing in March to April and June - October. This could help the management to make an informed decision based on the patterns available to suit the procurement and boost profitability (Borucka, 2023.

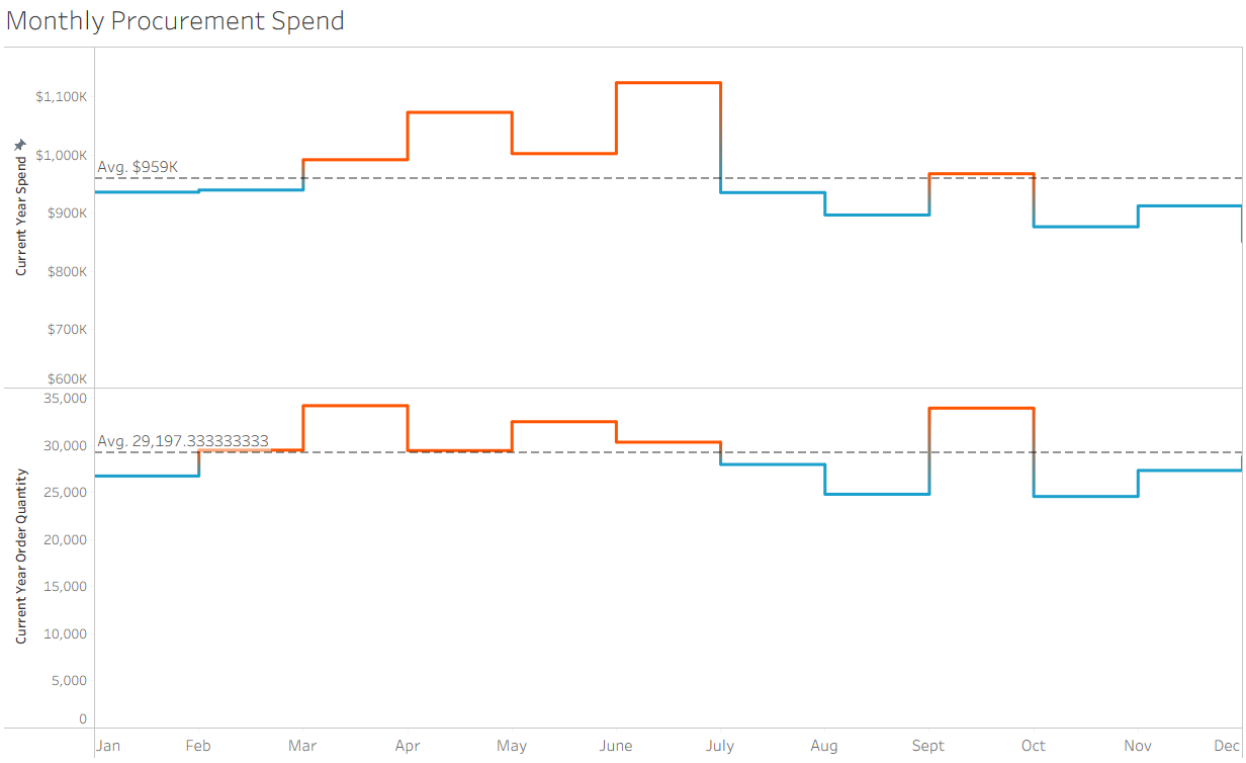


Figure 6 - Monthly Procurement Spend

2. Cost Savings Analysis

This part of the report shows the Cost Saving Analysis Dashboard, which measures the procurement effectiveness at the per-item (SKU) level. Through this process, it helps the company identify potential savings and leakage by comparing unit prices to best-available benchmarks. It shows which products are delivering savings and which are costing more than they should, guiding management on where to set target prices, renegotiate, or shift volume to capture value. ("The Impact of Applying the Target Cost and Continuous Improvement (Kaizen) on Achieving the Sustainable Competitive Advantage of Palestinian Industrial Companies," 2023)

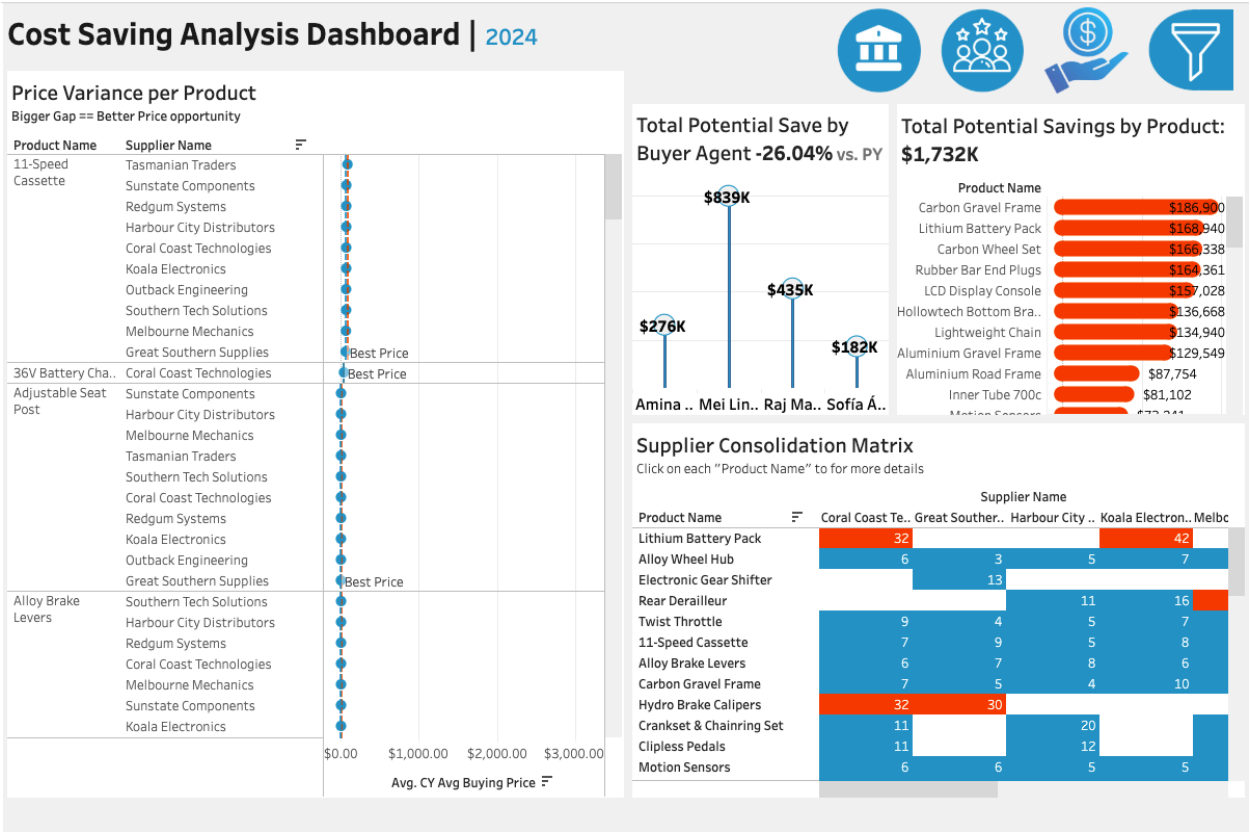


Figure 7 - Cost Saving Analysis Dashboard

The potential savings total $1,732,425, which is a 26% decline in 2024 compared to 2023, which was $2,342,464. This shows that if the company acts quickly on getting the insight, it could remove "easy" gaps by negotiating the best pricing. Future strategies should target supplier negotiation, component standardisation, and design optimisation in these emerging pressure areas ("Total Cost of Ownership Factors in Procurement and Technology Economic Assessment: A Systematic Literature Review," 2024).

Savings can be done in the top five Items that contribute to 48.6% of the total pool. Key example from Total Potential Savings by Product chart:

- Carbon Gravel Frame: $186.9k
- Lithium Battery Pack: $168.9k
- Carbon Wheel Set: $166.3k
- Rubber Bar End Plugs: $164.4k
- LCD Display Console: $157.0k

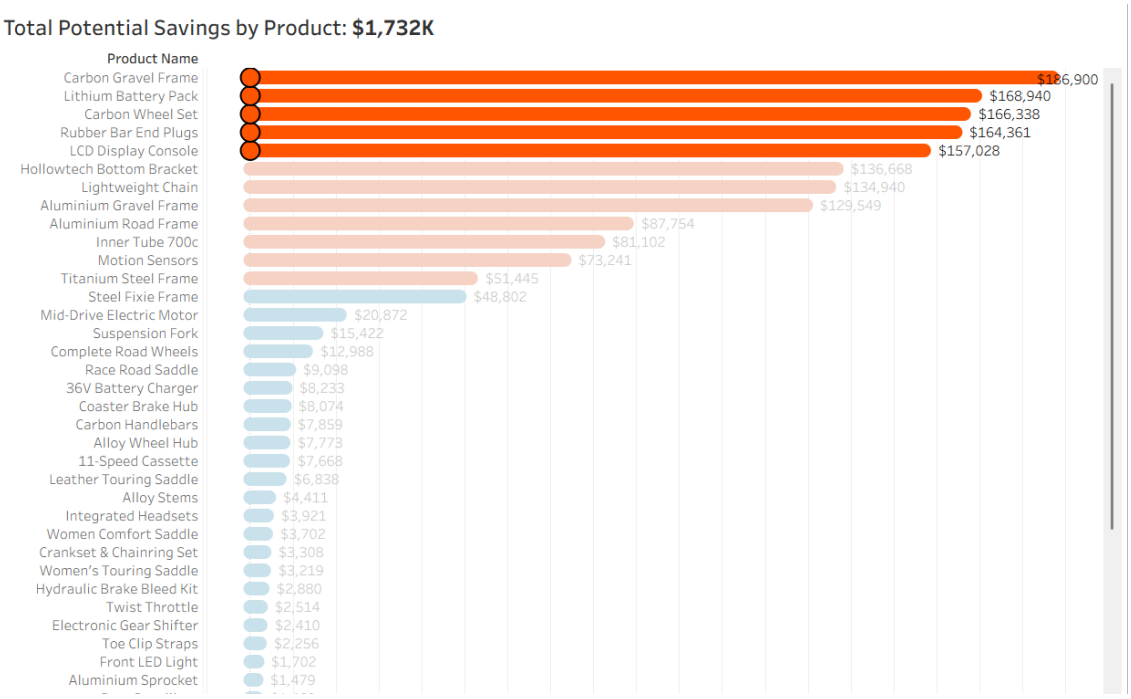


Figure 8 - Total Potential Saving Chart

The chart below shows the variation of pricing given by the suppliers for the same item, for example, frames like Carbon Gravel Frame priced by Outback Engineering are $2,883, while Sunstate Components is $3,143, showing a $260 gap. So, the Aluminium Gravel Frame price by Outback Engineering is $1,142 vs the Sunstate Components $1,310, showing a $168 gap. Even if it is just a $300 gap, with multiple frame volumes, the company could have six-figure savings potential ("Total Cost of Ownership Factors in Procurement and Technology Economic Assessment: A Systematic Literature Review," 2024).

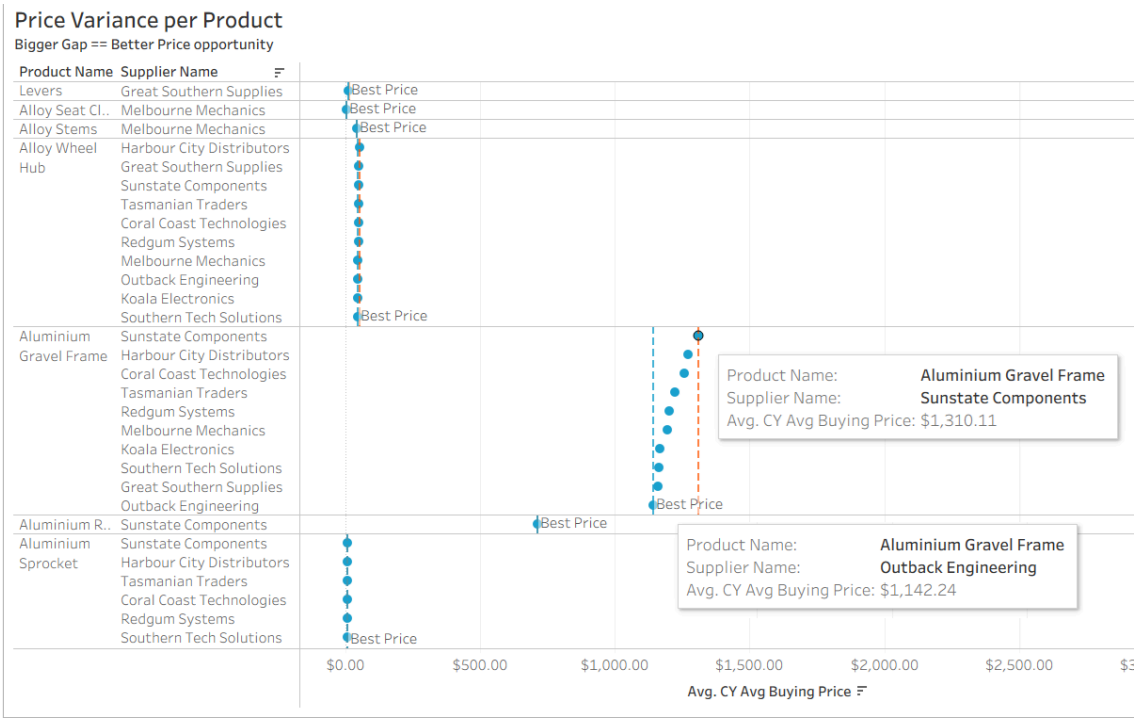


Figure 9- Price variance per product (Aluminium Gravel Frame)

To get the best price on the market, category specialisation should be based on the buyer agent

- Mei Ling Chen: $839k (core systems: brakes, drivetrain, frames)
- Raj Malhotra-Bergman: $435k (e-bike systems)
- Amina El-Sayed: $276k (wheels)
- Sofía Álvarez: $182k (handlebar/accessories)

From the chart below, it can be seen that Mei Ling Chen has the highest spending on the components, indicating that there could be further saving potential.

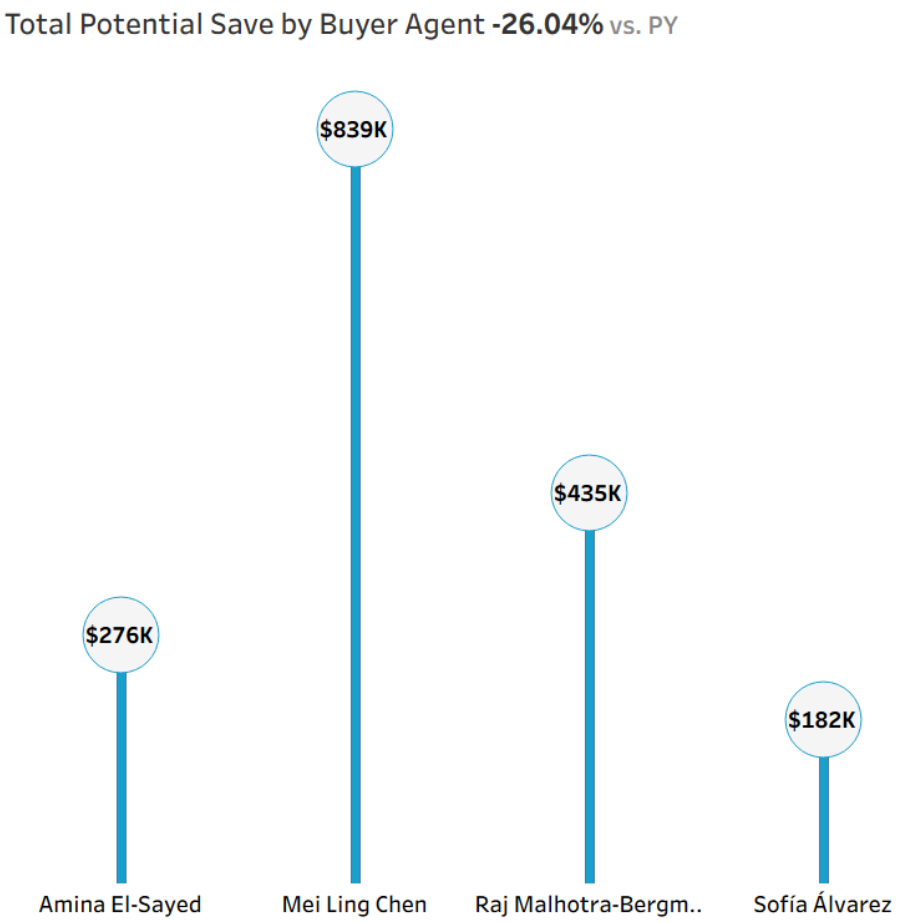


Figure 10 - Total Potential saved by the buyer agent

3. Risk Assessment & Supplier Dependency

This section of the report identifies potential vulnerabilities in the supply chain that could disrupt the operations. We assess supplier concentration, single-sourced SKUs (especially for critical and high-value components), and dependency risks so management can prevent stockouts, protect production, and maintain sales through targeted dual-sourcing, share caps, and SLA controls (Chauhan et al., 2023).

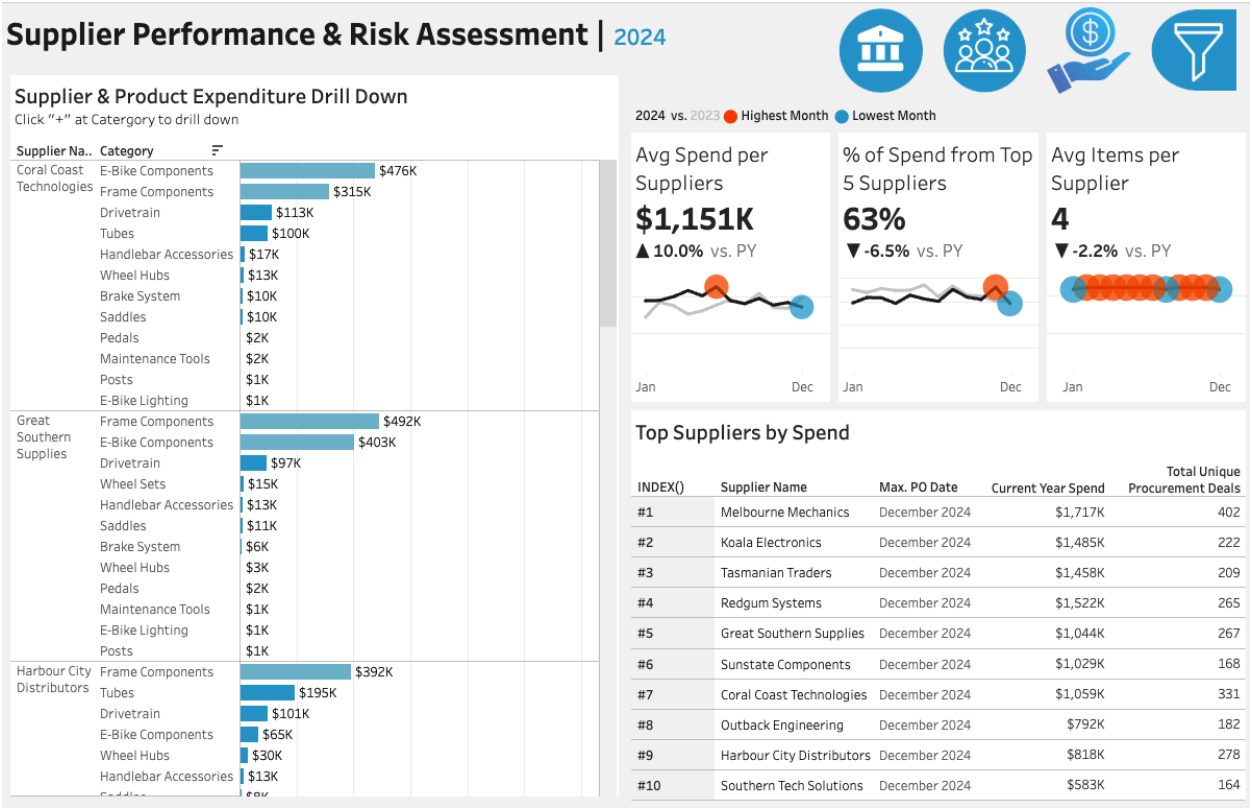


Figure 11 - Supplier Performance & Risk Assessment dashboard

In 2024, 63% of purchasing was concentrated in the top five suppliers, although there are only 10 active suppliers. Average spend per supplier increased by 10% which is $1.151M, showing that growth continues to be built on a relatively narrow base.

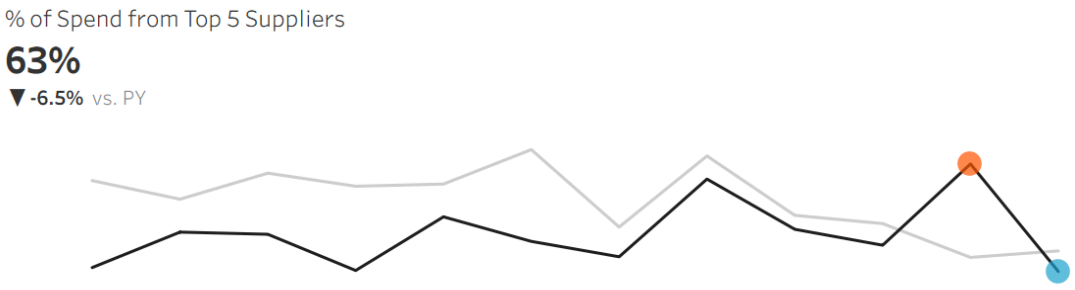


Figure 12 - % of Spend from the top 5 Suppliers

On average, Suppliers provide 4 items. This is down from 5 in 2023, showing the limited portfolio from the supplier. For our company, this makes it difficult to negotiate and could raise continuity risk when disruptions occur.

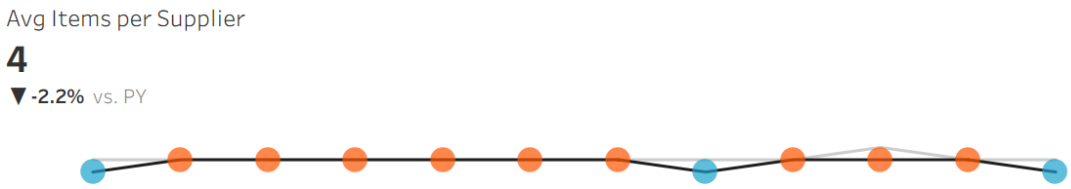


Figure 13 - Average Items per Supplier

Product-level exposure. Drill-downs show heavy dependency in Frames, E-bike electronics (Displays/Batteries), and Drivetrain. Several SKUs appear single-sourced, which magnifies the risk if a vendor misses a shipment or adjusts pricing.

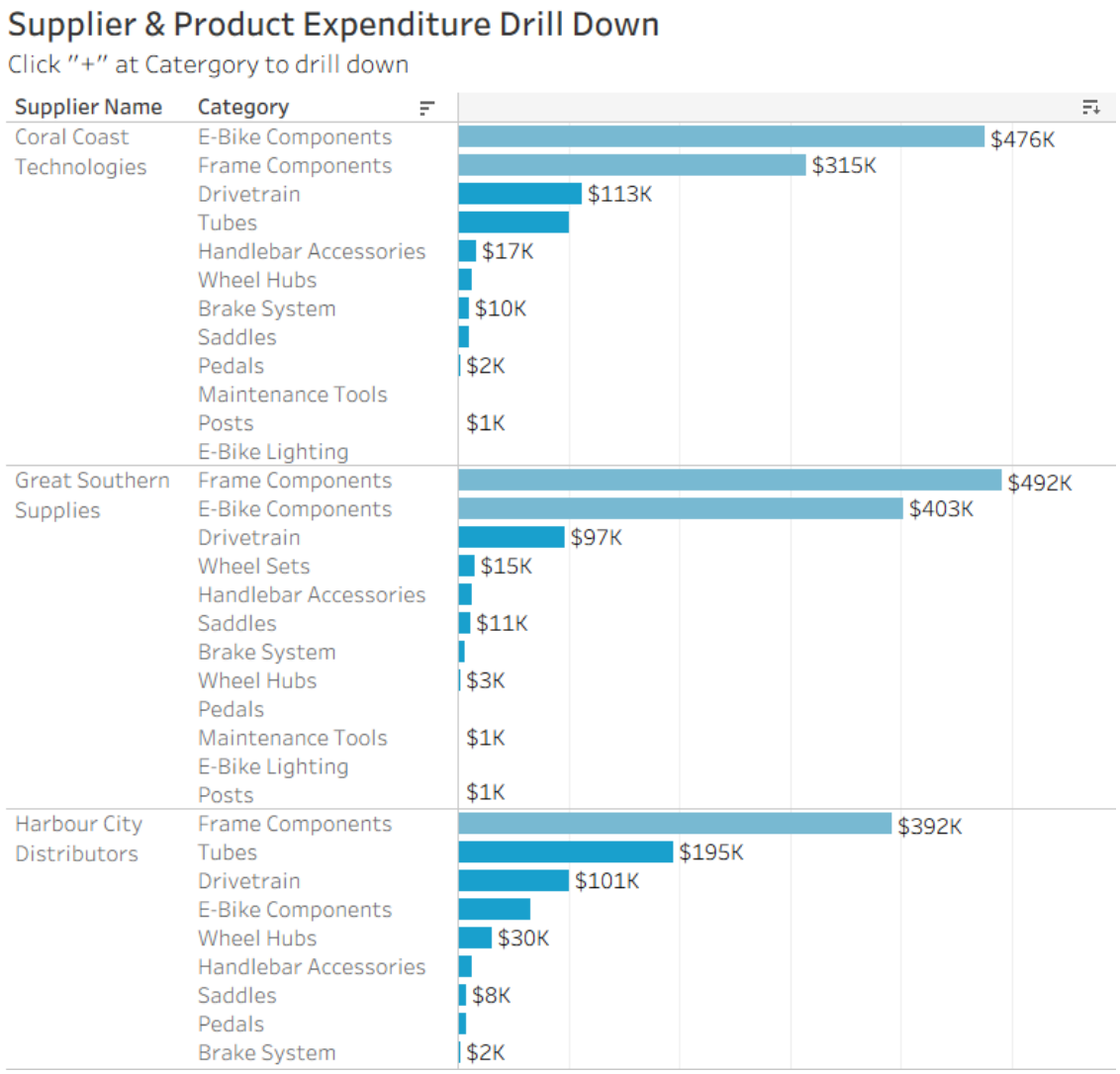


Figure 14 - Supplier product expenditure drill down

The HHI score shows that we are focusing on 10 suppliers. We could just make sure that we have fewer suppliers to allow better administration and simplify the negotiation and purchasing process.

Top Suppliers by Spend

INDEX()	Supplier Name	Max. PO Date	Current Year Spend	Total Unique Procurement Deals
#1	Melbourne Mechan..	December 2024	$1,717K	402
#2	Koala Electronics	December 2024	$1,485K	222
#3	Tasmanian Traders	December 2024	$1,458K	209
#4	Redgum Systems	December 2024	$1,522K	265
#5	Great Southern Su..	December 2024	$1,044K	267
#6	Sunstate Compone..	December 2024	$1,029K	168
#7	Coral Coast Techno..	December 2024	$1,059K	331
#8	Outback Engineeri..	December 2024	$792K	182
#9	Harbour City Distri..	December 2024	$818K	278
#10	Southern Tech Solu..	December 2024	$583K	164

Figure 15 - Top 10 Active Suppliers

4. Opportunity Identification & Supplier Consolidation

The Supplier Consolidation Matrix shows which items are supplied by too many vendors and has the opportunity for consolidation that could push down the pricing. And which items have only one single supplier, which increases the continuity risk if the item is unavailable or there is a price increase. This chart enables senior management to make an informed decision where to consolidate and where to diversify supplier coverage (Deligiannis et al., 2023).

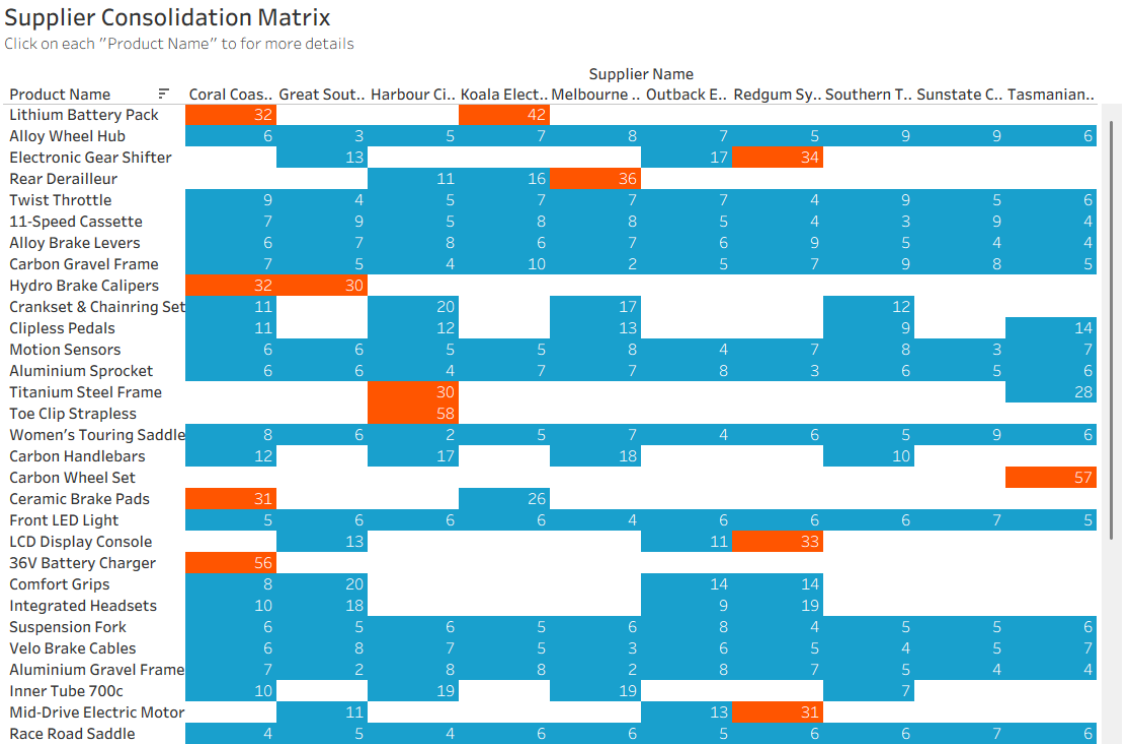


Figure 16 - Supplier Consolidation Matrix

Supplier Consolidation Matrix (2)

Category	Coral Coa..	Great So..	Harbour ..	Koala Ele..	Melbourn..	Outback ..	Redgum ..	Southern ..	Sunstate ..	Tasmania..
					Supplier Name					
Brake System		45	15	37	10	12	14	9	9	11
Clamps					54					
Drivetrain	40	21	56			18	14	34	18	28
E-Bike Components		47	10	54	15	52		17	8	13
E-Bike Lighting	5	6	6	6	4	6	6	6	7	5
Frame Components	20		48	23	10	21	18	19		43
Handlebar Accessori..	30	38	17			23	33	10		
Maintenance Tools	6	5	7	5	1	3	7	6	5	8
Pedals	6	5		3	7	6	4	5	5	4
Posts	6	4	3	6	7	2	4	4	6	5
Saddles	19	24	14	18	18	15	27	25	30	29
Tubes	10		19		19			7		
Wheel Hubs	11	3	21	7	24	7	5	22	9	6
Wheel Sets		7				17	24			57

Figure 17 - Supplier Consolidation Matrix (2)

To improve purchasing efficiency and look for savings opportunities, we recommend combining spending with suppliers who offer cheaper prices across multiple products for an item that is sourced from more than 2 or 3 suppliers, such as Brake System, Saddles, Maintenance tools, etc, which are sourced from more than 3 suppliers. This will help to reduce operational overhead from managing too many suppliers and open a better negotiation without sacrificing supply, and simplify contract management (Deligiannis et al., 2023; Chauhan et al., 2023).

Items with only one supplier, like Titanium Steel Frame and Toe Clip Strapless, must be sourced from a variety of 2 or 3 suppliers to reduce the risk of supply failure in case the single supplier is unable to distribute the product and to maintain price discipline.

Recommended consolidation steps

1. Nominate Preferred Suppliers by category.
2. For each strategic category and based on the best price and how many SKUs they can supply in that category, select 1-2 preferred suppliers.
3. Use the lowest price per unit as the “target price” to guide purchasing approval rules. The company must not issue a PO above the target unless:

- documented quality/spec difference, or
- urgent continuity risk.

4. In the quieter period from January to March, stage major negotiations to lock pricing ahead of peak months to stabilise unit costs and cash flow.

Expected benefits

1. Direct cost reduction: The Company could save $1.732M in 2024.
2. Less administration overhead with fewer yet stronger suppliers who can deliver 5+ items in a category.
3. A diversified supplier allows more options for the best pricing and reduces the disruption risk.

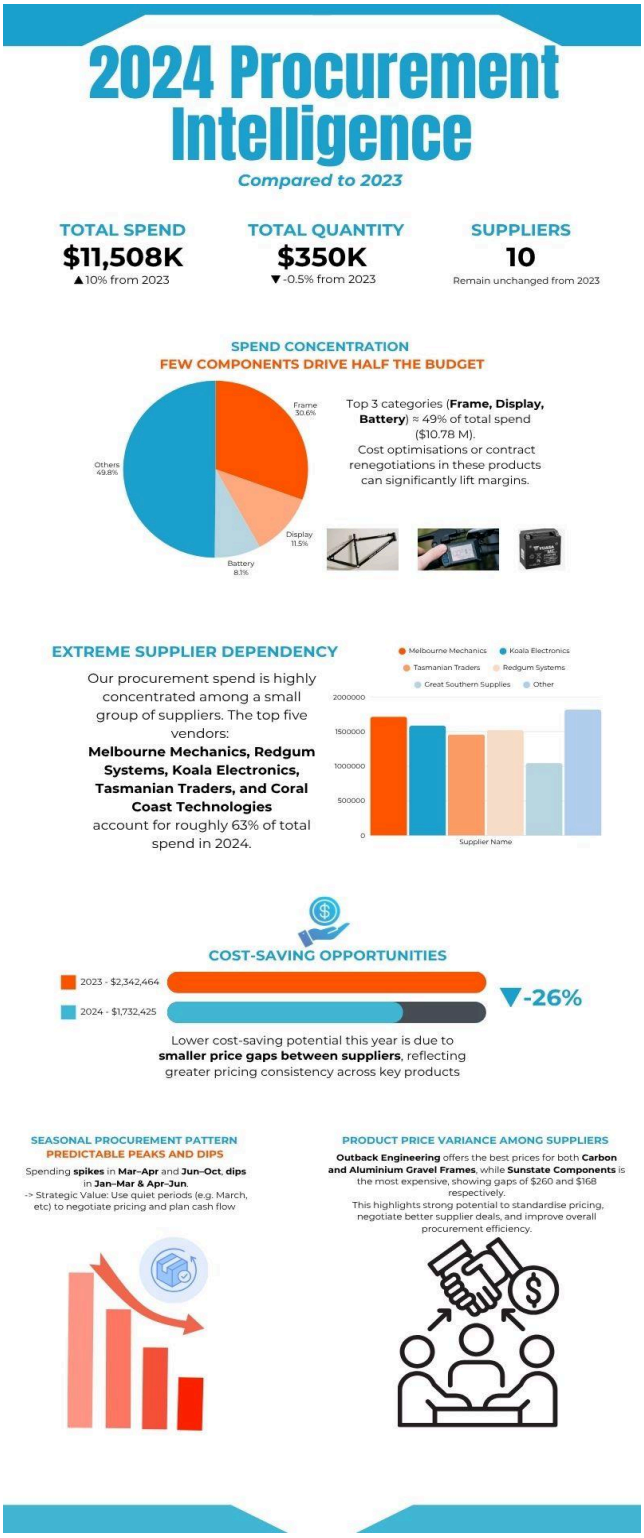
5. Supplier Performance Evaluation

The best supplier in terms of pricing and the number of SKUs that they can provide is Outback Engineering.

Other than that, as we don't have the data to determine the supplier's shipping speed from ordering to shipment, we are unable to give recommendations based on the service and quality of the items each supplier provided.

Infographic

[Link to the infographic]



Conclusion

In conclusion, through this report, it appears that procurement is now a key driver of profit and risk for Velocipede Cycles.

Highly concentrated supplier creates both leverage and vulnerability, whilst the cost savings analysis shows that savings could be increased.

Going forward, we gave a recommendation to set a target price from the lowest price available on the market. Negotiate and lock pricing during the predicted quieter period, and maximise profit during the peak time. Concentrate spending with a reliable supplier to lower overhead cost and simplify administration, and introduce a supplier performance score to better assess suppliers' performance.

References

Batini, C., & Scannapieco, M. (2016). Data and Information Quality: Dimensions, Principles and Techniques. Springer International Publishing.

Borucka, A. (2023). Seasonal Methods of Demand Forecasting in the Supply Chain as Support for the Company's Sustainable Growth. Sustainability, 15(9). https://doi.org/10.3390/su15097399

Chauhan, V. K., Alomari, M., Arney, J., Parlikad, A. K., & Brintrup, A. (2023). Exploitation of material consolidation trade-offs in multi-tier complex supply networks. Supply Chain Analytics, 4. https://doi.org/10.1016/j.sca.2023.100050

Deligiannis, M., Pandelis, D. G., & Liberopoulos, G. (2023). Managing supply chain risks with dual sourcing: Bayesian learning of censored supply capacity. International Journal of Production Economics, 265. https://doi.org/10.1016/j.ijpe.2023.109002

The impact of applying the target cost and continuous improvement (Kaizen) on achieving the sustainable competitive advantage of Palestinian industrial companies. (2023). Journal of Business and Socio-Economic Development, 3(4), 372 – 387. https://doi.org/10.1108/jbsed-11-2022-0121

Mahanti, R. (2019). Data Quality and Data Quality Dimensions. Software Quality Professional, 22(1), 4-8. https://www.proquest.com/docview/2345532565?_oafollow=false&accountid=14205&pq-origsite=primo&sourcetype=Scholarly%20Journals

Total cost of ownership factors in procurement and technology economic assessment: A systematic literature review. (2024). E3S Web of Conferences, 484, 1022. https://doi.org/10.1051/e3sconf/202448401022

Wang, R., & Strong, D. (1996). Beyond Accuracy: What Data Quality Means to Data Consumers. ournal of Management Information Systems, 12(4), 5-33. 10.1080/07421222.1996.11518099

Appendix A: Dashboard Navigation and Interactivity

Navigation Buttons

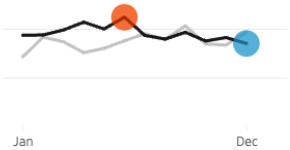
- **Dashboard 1–3 Buttons:**
  Each of the first three buttons provides direct navigation to one of the three dashboards in the system. These dashboards present different analytical views of the procurement data, such as supplier concentration, product category trends, and yearly procurement summaries.

- **Filter Button:**
  The fourth button opens the **filter panel**, where users can refine the displayed data by **Year**, **Category**, and **Sub-category**. This enables users to tailor the dashboards to specific analysis needs (e.g., viewing procurement patterns in 2023 within electronic components).

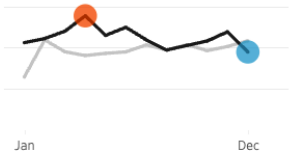
KPI and Monitoring Dashboard | 2024

2024 vs. 2023 Highest Month Lowest Month

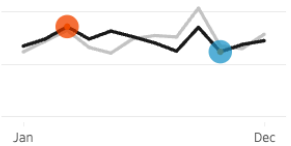
Total Amount PO
$11,508K
▲ 10.0% vs. PY



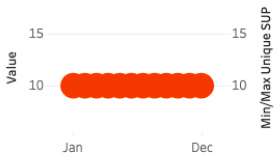
Total Avg Buying Price per PO
$540K
▲ 16.5% vs. PY



Total Quantity PO
350,368
▼ -0.5% vs. PY

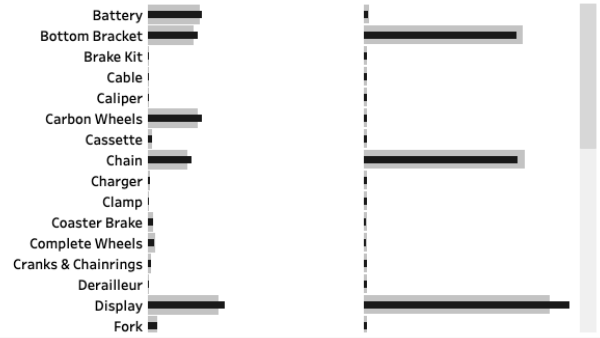


Total Unique Suppliers
10
▲ 0.0% vs. PY



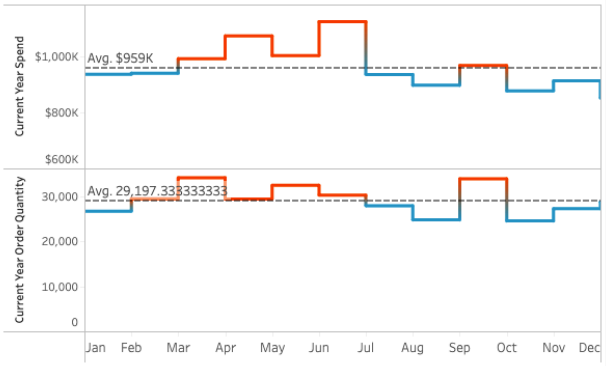
PO Amount and PO Quantity by Subcatergory

2024 PO Amount and PO Quantity vs. 2023 PO Amount and PO Quantity 2024 CY PY



Monthly Procurement Spend Trends Over Time

2024 Above Below



Supplier Performance & Risk Assessment | 2024

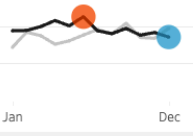
Supplier & Product Expenditure Drill Down

Click "+" at Catergory to drill down

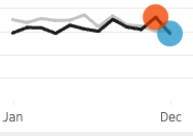
Supplier Na..	Category	
Coral Coast Technologies	E-Bike Components	$476K
	Frame Components	$315K
	Drivetrain	$113K
	Tubes	$100K
	Handlebar Accessories	$17K
	Wheel Hubs	$13K
	Brake System	$10K
	Saddles	$10K
	Pedals	$2K
	Maintenance Tools	$2K
	Posts	$1K
	E-Bike Lighting	$1K
Great Southern Supplies	Frame Components	$492K
	E-Bike Components	$403K
	Drivetrain	$97K
	Wheel Sets	$15K
	Handlebar Accessories	$13K
	Saddles	$11K
	Brake System	$6K
	Wheel Hubs	$3K
	Pedals	$2K
	Maintenance Tools	$1K
	E-Bike Lighting	$1K
	Posts	$1K
Harbour City Distributors	Frame Components	$392K
	Tubes	$195K
	Drivetrain	$101K
	E-Bike Components	$65K
	Wheel Hubs	$30K
	Handlebar Accessories	$13K

2024 vs. 2023 Highest Month Lowest Month

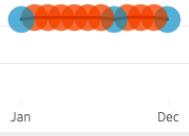
Avg Spend per Suppliers
$1,151K
▲ 10.0% vs. PY



% of Spend from Top 5 Suppliers
63%
▼ -6.5% vs. PY

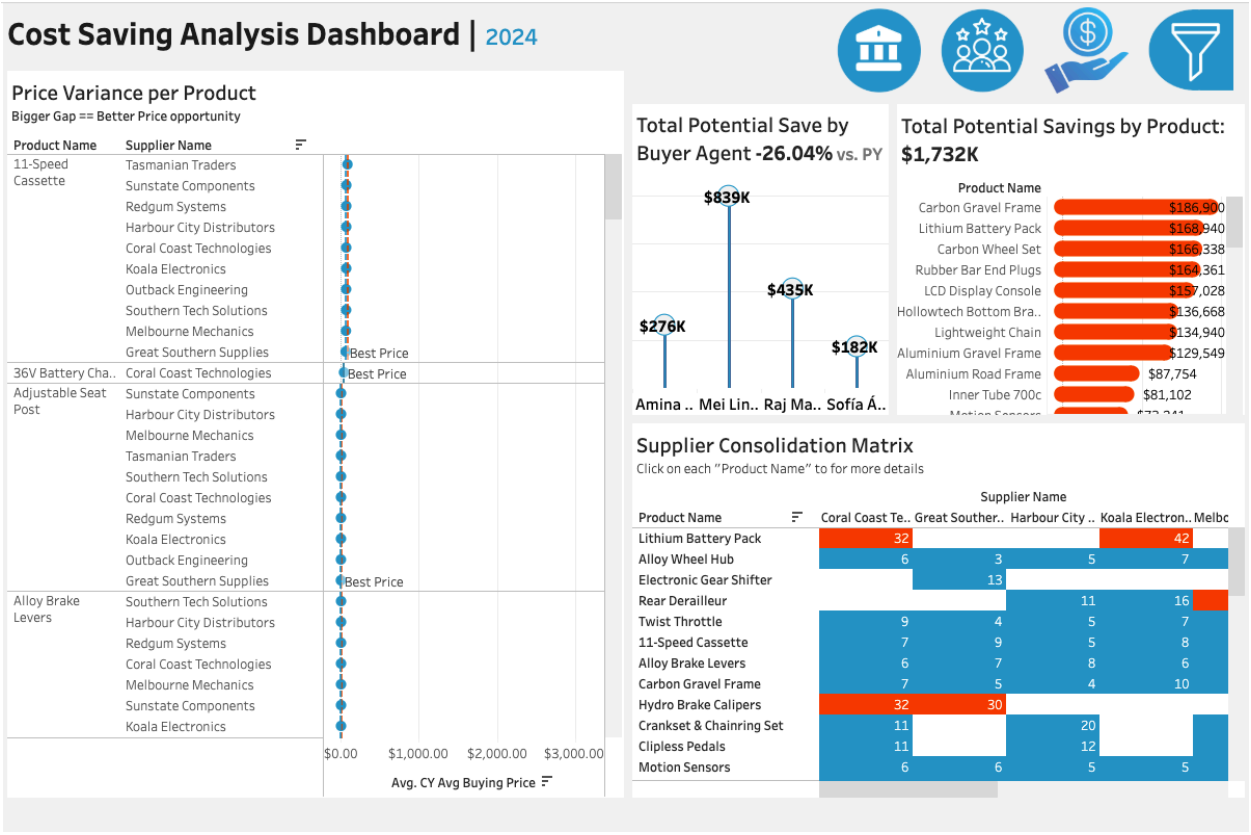


Avg Items per Supplier
4
▼ -2.2% vs. PY



Top Suppliers by Spend

INDEX()	Supplier Name	Max. PO Date	Current Year Spend	Total Unique Procurement Deals
#1	Melbourne Mechanics	December 2024	$1,717K	402
#2	Koala Electronics	December 2024	$1,485K	222
#3	Tasmanian Traders	December 2024	$1,458K	209
#4	Redgum Systems	December 2024	$1,522K	265
#5	Great Southern Supplies	December 2024	$1,044K	267
#6	Sunstate Components	December 2024	$1,029K	168
#7	Coral Coast Technologies	December 2024	$1,059K	331
#8	Outback Engineering	December 2024	$792K	182
#9	Harbour City Distributors	December 2024	$818K	278
#10	Southern Tech Solutions	December 2024	$583K	164



The third dashboard, which is the Cost Saving Analysis Dashboard, is fully interactive. Selecting elements on one visualization dynamically updates others across the interface. For Instance, if a user wants to know which products are being supplied by too many suppliers, they can click on a specific product name in the **Product Name** chart. Instantly, all other charts will update to show relevant supplier distribution, price variance, and potential savings insights for that selected product.