

ORACLE

Art of Possible with AI & Data Science

Leveraging Procurement Vendor Segmentation, Anomaly Detection and Forecasting

August 2023

EMEA Data Science Specialists

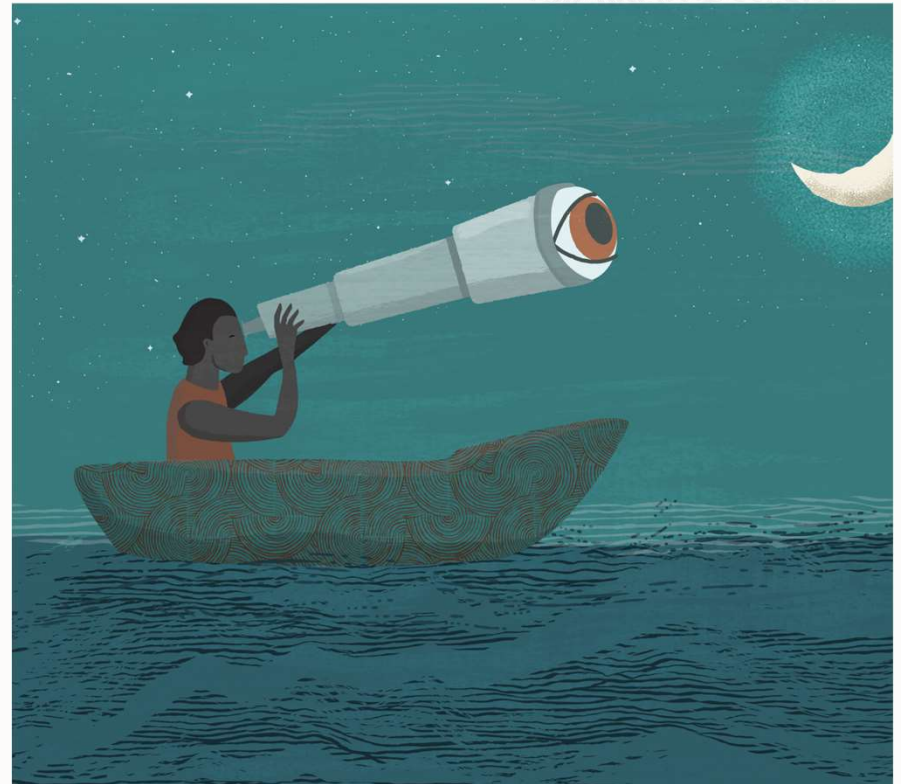


Demo Inspiration

This demonstration will showcase the capabilities of Oracle Data Science/Machine Learning Platform in aiding procurement teams with data-driven decision-making.

Objective is:

- **Classifying vendors** or suppliers into different categories based on various criteria to streamline procurement processes
- Identifying unusual or **abnormal patterns** in spending data
- **Forecasting** total daily/weekly/monthly procurement spending for each vendor.



Demo Flow

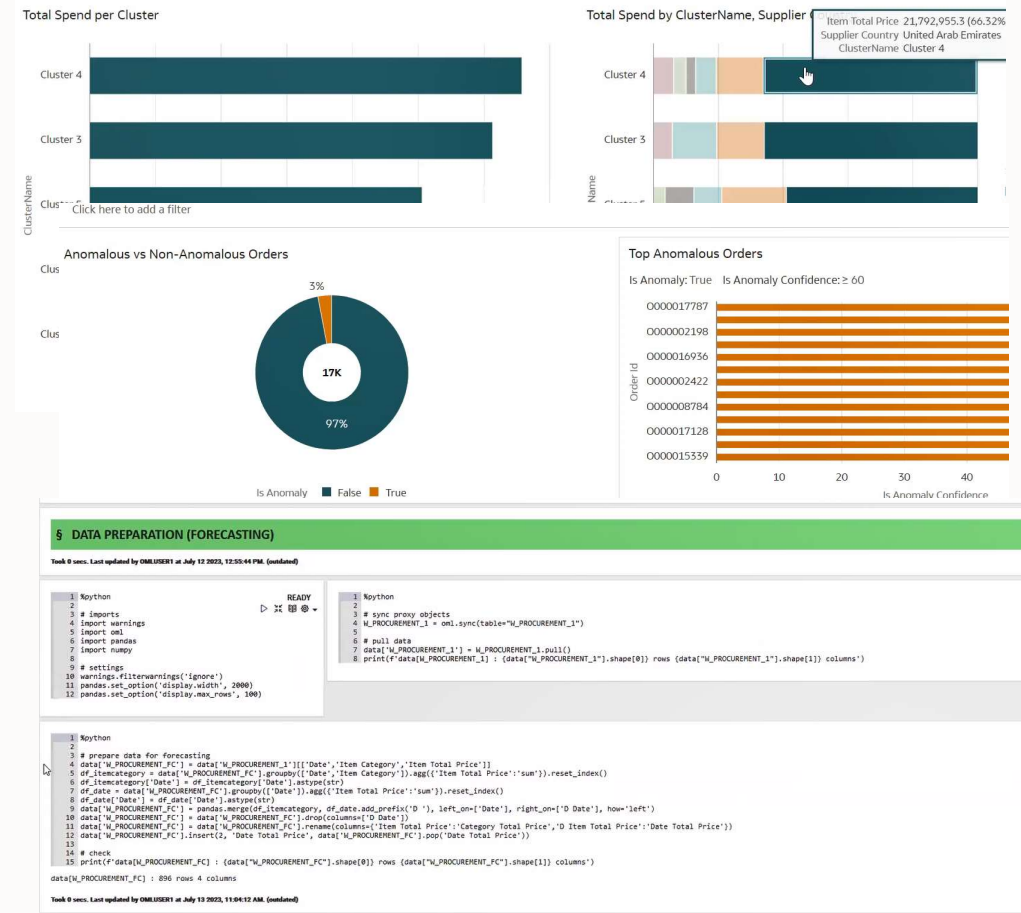
1. Summary

2. How did we achieve this?

- Data Discovery & Preparation
- Modeling
- Actionable Insights for Business

3. Behind the Scenes

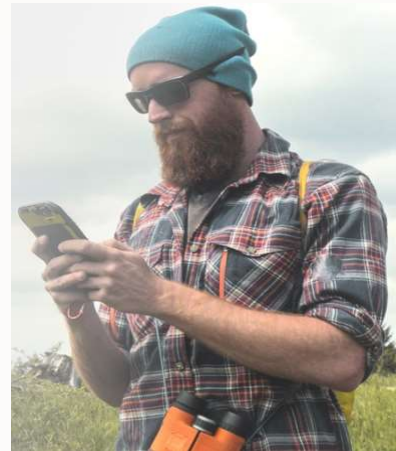
- Oracle Data Science/ML Platform



Target Personas



Procurement manager wants to understand future procurement spendings, any anomalies in spendings and different vendor categories to manage relationships with suppliers effectively



Data scientists wants an end-to-end platform to address data science lifecycle and help procurement decision making process with ML

Summary

At the end of this demo, the questions that procurement manager will be able to answer are:

Vendor Segmentation

How can we categorize and segment our vendors based on their characteristics, performance, or strategic importance?

Which vendors are most suitable for specific procurement needs or categories?

Understanding Anomalies in Procurement Spendings

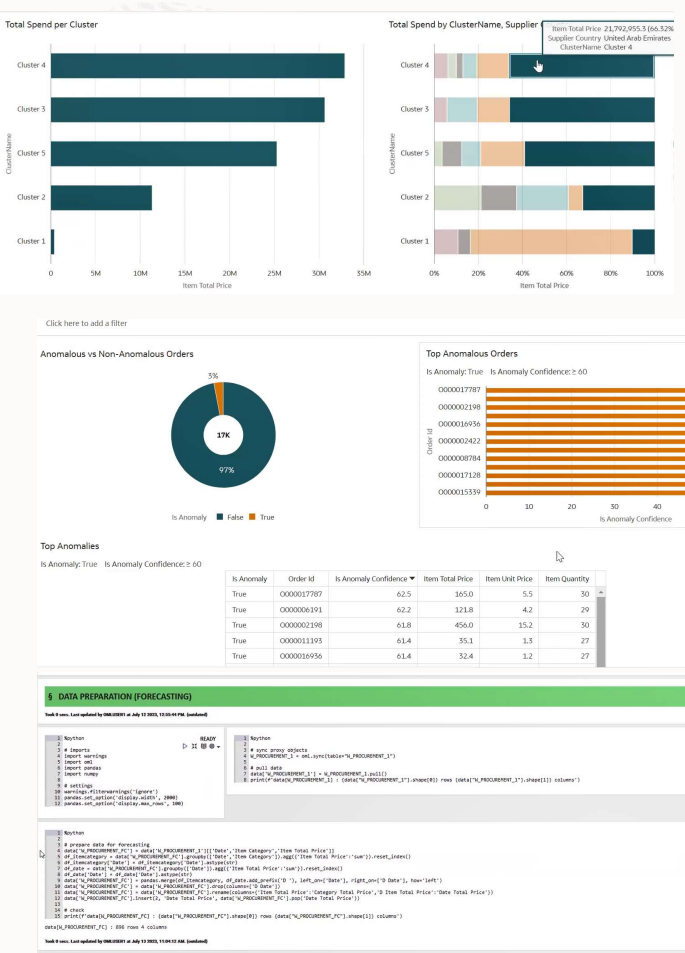
Are there any unusual or suspicious spending patterns that might indicate abnormal spending?

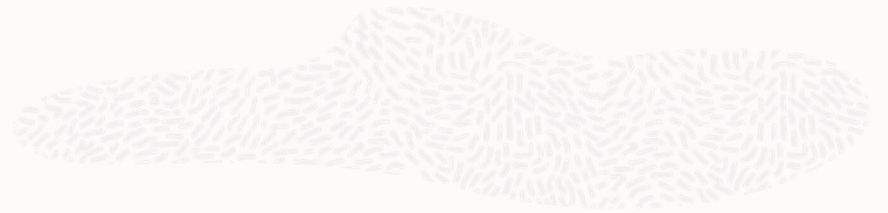
Which procurement transactions exhibit spending patterns that deviate significantly from the norm?

Procurement Spending Forecasting

What will be the expected spending levels for specific procurement categories in the future?

Can we identify potential cost-saving opportunities by analyzing historical spending patterns?





How have we achieved this?

Initial Data Discovery & Preprocessing



Procurement manager imports data to OAC. Discovers data that can provide an initial insight about procurement spendings and improves data with her business expertise



Data Preprocessing Cont'd



Procurement manager wants to have a high-quality time series data to predict future spendings as a citizen data scientist



Data scientist assesses data quality issues, fix them and shares final time series procurement data with procurement manager

Data Preprocessing Cont'd

ORACLE Machine Learning

OMLUSER1 Project
OMLUSER1 Workspace

OMLUSER1

Connected

Procurement-Demo-WIP

DATA QUALITY

Took 1 sec. Last updated by OMLUSER1 at July 11 2023, 3:17:04 PM. (undated)

```
1 Npython
2
3 # check NULL values
4 for col in data['M_PROCUREMENT_1'].columns:
5     nulls = data['M_PROCUREMENT_1'][col].isna().sum()
6     ratio = round(100*nulls/data['M_PROCUREMENT_1'].shape[0])
7     print(f'data[M_PROCUREMENT_1]["{col}"] : {ratio} % nulls')
```

data[M_PROCUREMENT_1]["Date"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Day Of Week"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Is Weekend"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Is Event"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Supplier Id"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Supplier Country"] : 870 (5%) nulls
data[M_PROCUREMENT_1]["Supplier Years"] : 1244 (78%) nulls
data[M_PROCUREMENT_1]["Supplier Price Index"] : 2314 (13%) nulls
data[M_PROCUREMENT_1]["Supplier Discount"] : 2359 (13%) nulls
data[M_PROCUREMENT_1]["Item Category"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Item Quantity"] : 929 (5%) nulls
data[M_PROCUREMENT_1]["Item Unit Price"] : 1248 (7%) nulls
data[M_PROCUREMENT_1]["Item Total Price"] : 2385 (13%) nulls
data[M_PROCUREMENT_1]["Order Category"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Order Urgency"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Order Delivery Status"] : 0 (0%) nulls
data[M_PROCUREMENT_1]["Order Id"] : 0 (0%) nulls

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```
1 Npython
2
3 # check aggregation consistency
4 def checkConsistency(row):
5     return True if row['Min']==row['Max'] else False
6 for col in ['Day Of Week', 'Is Weekend', 'Is Event']:
7     df = data['M_PROCUREMENT_1'][data['M_PROCUREMENT_1'][col].isna()==False]
8     df = df.groupby(['Date']).agg({'col':['min','max']})
9     df.columns = ['Min','Max']
10    df['Check'] = df.apply(checkConsistency, axis=1)
11    inconsistencies = df[df['Check']==False].shape[0]
12    ratio = round(100*inconsistencies/df.shape[0])
13    print(f'data[M_PROCUREMENT_1]["{col}"] : {ratio} % inconsistencies')
```

data[M_PROCUREMENT_1]["Supplier Country", "Supplier Years", "Supplier Price Index", "Supplier Discount"] :
df = data[M_PROCUREMENT_1][data['M_PROCUREMENT_1'][col].isna()==False][['Supplier Id',col]]
df = df.groupby(['Supplier Id']).agg({'col':['min','max']})
df.columns = ['Min','Max']
df['Check'] = df.apply(checkConsistency, axis=1)
inconsistencies = df[df['Check']==False].shape[0]





Anomaly Detection in Procurement Spendings

Anomaly Detection in Procurement Spendings



Procurement manager wants to understand anomalies in procurement spendings



Data scientist creates an Anomaly Detection Model and shares spending anomalies data with procurement manager



Procurement manager analyses anomalies to take immediate action.



Anomaly Detection in Procurement Spendings - Modeling

The screenshot displays the Oracle Machine Learning (OML) interface with three notebooks open, all showing a 'FINISHED' status. The top notebook is titled 'Procurement-Demo-WIP'. The middle notebook is titled '§ DATA PREPARATION (ANOMALY DETECTION)' and contains the following Python code:

```
1 Npython
2
3 # imports
4 import warnings
5 import oml
6 import pandas
7 import numpy
8
9 # settings
10 warnings.filterwarnings('ignore')
11 pandas.set_option('display.width', 2000)
12 pandas.set_option('display.max_rows', 100)
```

The bottom notebook contains the following Python code:

```
1 Npython
2
3 # create anomaly detection model
4 H_PROCUREMENT_AD = H_PROCUREMENT_1[['Order Id', 'Item Quantity', 'Item Unit Price', 'Item Total Price']]
5 try:
6     oml.drop(model='H_PROCUREMENT_AD')
7 except:
8     pass
9 oml_settings = {'SVIS_OUTLIER_RATE': '0.03',
10                'SVIS_REGULARIZER': 'SVIS_REGULARIZER_L1',
11                'SVIS_CONV_TOLERANCE': '0.001'}
12 H_PROCUREMENT_AD = oml.svm('anomaly_detection', **oml_settings)
13 H_PROCUREMENT_AD.fit(H_PROCUREMENT_AD, None, model_name='H_PROCUREMENT_AD', case_id='Order Id')
14
15 # process results
16 def createIsAnomaly(val):
17     return True if val==0 else 'False'
18 def createIsAnomalyConfidence(val):
19     return round(100*val,1)
20 H_PROCUREMENT_AD = H_PROCUREMENT_AD.predict(H_PROCUREMENT_AD, supplemental_cols=H_PROCUREMENT_AD, proba=True)
21 data['H_PROCUREMENT_AD'] = H_PROCUREMENT_AD.pull()
22 data['H_PROCUREMENT_AD']['Is Anomaly'] = data['H_PROCUREMENT_AD']['PREDICTION'].apply(createIsAnomaly)
23 data['H_PROCUREMENT_AD']['Is Anomaly Confidence'] = data['H_PROCUREMENT_AD']['PROBABILITY'].apply(createIsAnomalyConfidence)
24 data['H_PROCUREMENT_AD'] = data['H_PROCUREMENT_AD'].drop(columns=['PREDICTION', 'PROBABILITY'])
25
26 # check
27 print(f'data[H_PROCUREMENT_AD] : {data[H_PROCUREMENT_AD].shape[0]} rows {data[H_PROCUREMENT_AD].shape[1]} columns')
28 data[H_PROCUREMENT_AD] : 17300 rows 6 columns
```





Supplier Segmentation

Supplier Segmentation



Procurement manager wants to segment suppliers based on their characteristics. She talks to data scientist to create an aggregated data at supplier level.



Data scientist aggregates data at supplier level and shares this final data with procurement manager



Procurement manager builds supplier segments and discovers different suppliers and optimize procurement strategies





Forecasting Procurement Spendings

Forecasting Procurement Spendings



Procurement manager wants to predict procurement spendings for each category and day to take proactive actions about spendings. She asks data scientist to prepare a final data to be used in her citizen data scientist environment



Data scientist prepares final data for category-based procurement spending forecasting and shares with procurement manager.



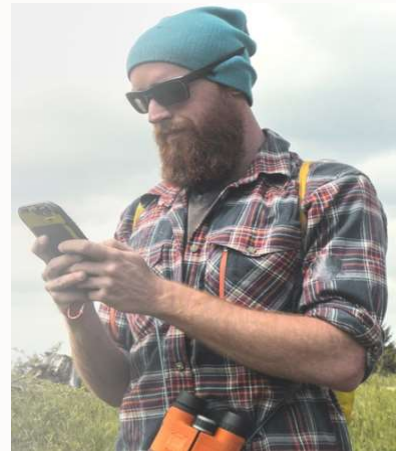
Procurement manager builds spending forecasting models and discover expected spending patterns for the future



Summary

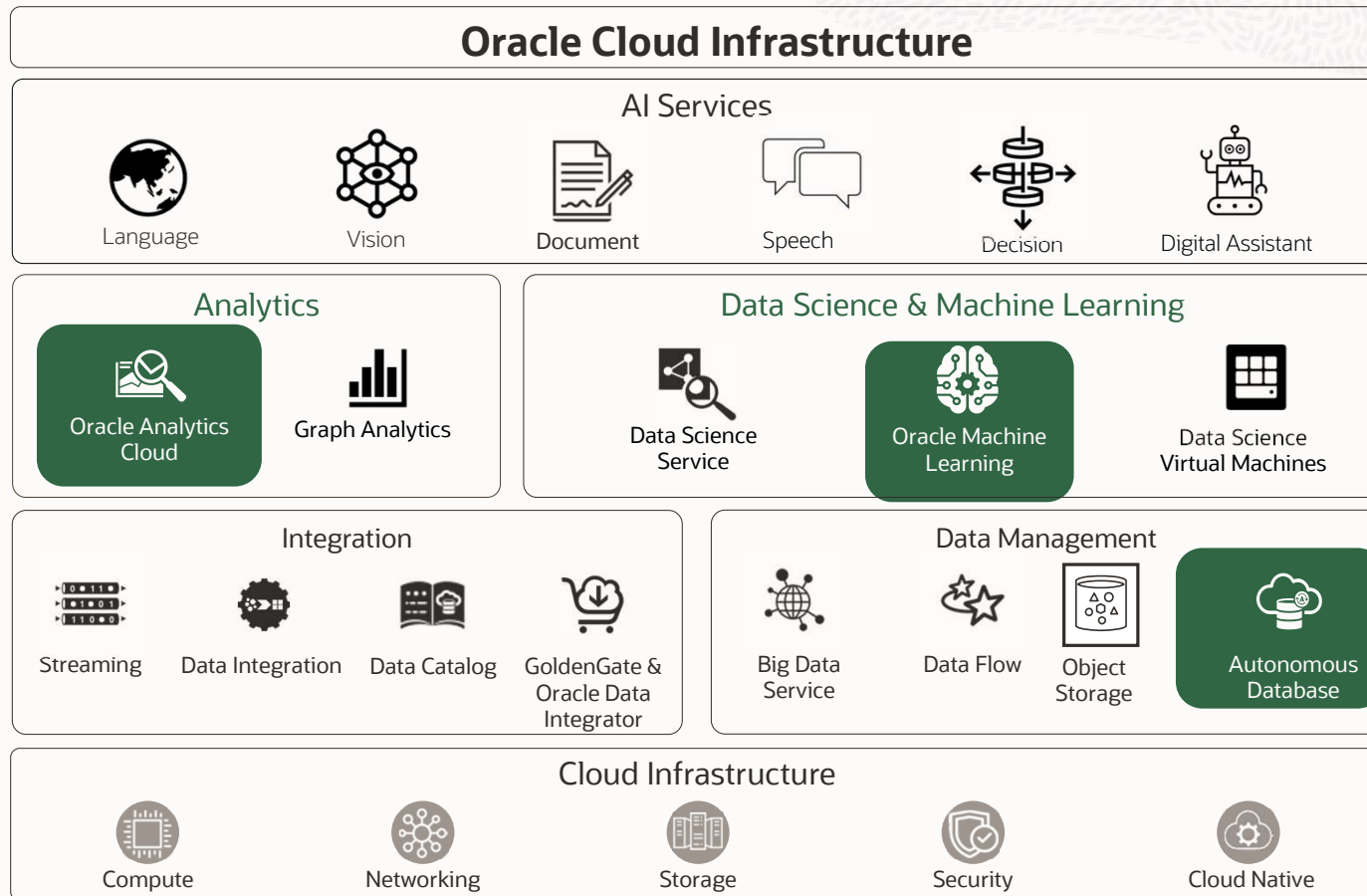


Procurement manager is happy to understand supplier behavior, spending anomalies and forecasting future procurement spendings



Data scientists is happy to have an end-to-end platform for advanced data science requirements

Behind the Scenes: Oracle Data Science Platform



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