SalesHub Final Report: Dynamic Budget Adjuster

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1. Objective

We collaborated with SalesHub on our practicum which focuses on enhancing the **TracAnything** application within the Salesforce platform by implementing a "Dynamic Budget Adjuster." As organizations increasingly rely on real-time insights for strategic planning, this tool is designed to provide business leaders with advanced, data-driven decision-making capabilities for managing budgets across multiple projects and departments.

The primary objectives of this project are:

- **Develop a robust budget tracking tool** that operates across multiple projects.
- **Use advanced analytics to forecast** whether a project's budget is likely to be under-utilized or over-utilized.
- **Optimize budget allocation** by using these forecasts to proactively and dynamically adjust budgets, ensuring portfolio-level financial health.
- **Transform and integrate this solution** directly into the Salesforce platform for a seamless user experience.

Ultimately, this solution will enhance customer experience by predicting future project budget needs from real-time data and suggesting intelligent budget reallocations. Basically, our goal is to create an all-in-one tool that empowers TracAnything users with comprehensive project management and financial planning capabilities, streamlining their workflow and supporting strategic decision-making.

2. Our Solution & Methodology

Our process for developing the Dynamic Budget Adjuster followed a structured methodology, from data creation and modeling to platform integration.

2.1. Data Preparation and Analysis

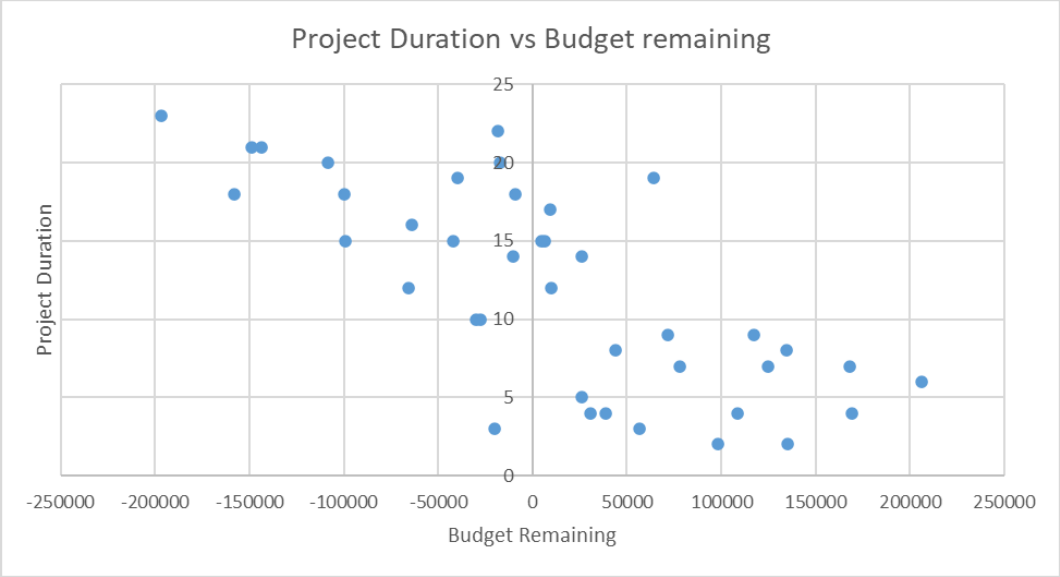
Since live data was not available for initial development, we began by creating a realistic mock dataset.

- **Mock Data Creation:** We generated a custom dataset (‘Budget staging records’) that is the duplicate of the original Budget dataset as it is easier to work with as opposed to the original dataset that has managed fields and limited permissions. All the records with 40 budget rows and 25+ fields were created in Python notebook as a mock dataset. This included existing managed fields from Salesforce (e.g., Approved Budget, Budget Period, Department, Currency Type) and new custom fields essential for modeling, *Project Duration* which is measured in months.
- **Data Transformation:** We cleaned the data by handling missing values and excluding non-predictive ID variables.

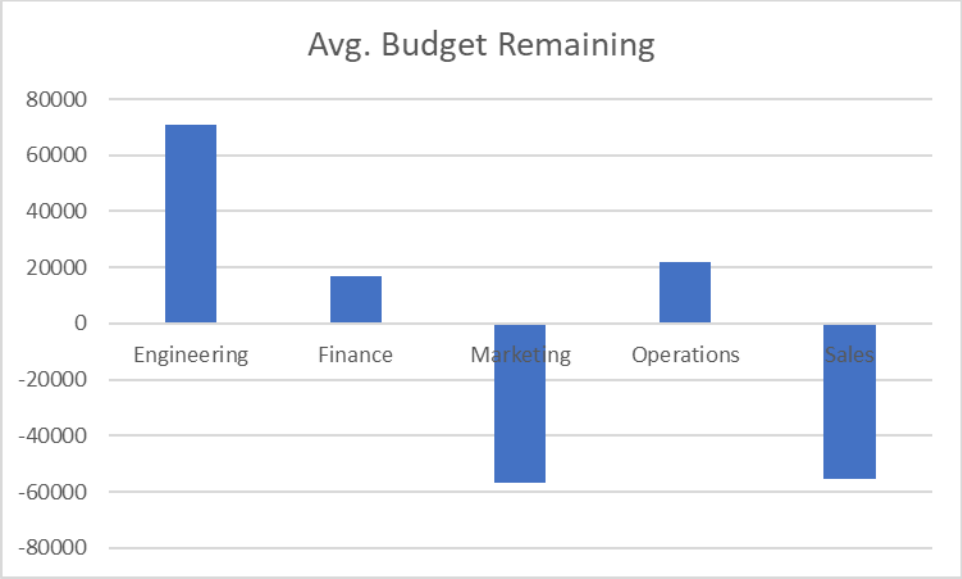
- **Feature Engineering:** A critical step was creating our target variable, **Budget Remaining**, which was engineered using the formula: Budget remaining = Approved Budget – Total Spend Amount. We also converted categorical variables (like Department) into a numeric format for the model.

Budget	Approval Date	Budget Period	Approved Amount	Budget Used	Budget Remaining	Budget Utilization	Currency Type	Department	Fiscal Year	GA Tech Team	Project Duration
a04gK0000015pZa	6/19/2024	Monthly	131958	161606.23	-29648.23	122%	USD	Sales	2025	Team1	10
a04gK0000015pZB	1/29/2024	Monthly	156867	220798.28	-63931.28	141%	USD	Sales	2025	Team1	16
a04gK0000015pZb	2/5/2024	Annually	141932	241147.71	-99215.71	170%	USD	Engineering	2024	Team1	15
a04gK0000015pZC	1/13/2024	Annually	375838	369584.88	6253.12	98%	EUR	Engineering	2024	Team1	15
a04gK0000015pZc	6/8/2024	Monthly	269178	309114.99	-39936.99	115%	USD	Marketing	2025	Team1	19
a04gK0000015pZD	11/22/2024	Monthly	129879	195702.33	-65823.33	151%	CAD	Marketing	2025	Team1	12
a04gK0000015pZd	7/5/2024	Annually	120268	317067.56	-196799.56	264%	CAD	Sales	2024	Team1	23
a04gK0000015pZE	8/30/2024	Annually	217892	326557.83	-108665.83	150%	USD	Operations	2023	Team1	20
a04gK0000015pZe	3/26/2024	Monthly	64886	85054.05	-20168.05	131%	USD	Sales	2023	Team1	3
a04gK0000015pZF	10/10/2024	Annually	147337	120979.92	26357.08	82%	CAD	Operations	2024	Team1	5
a04gK0000015pZf	3/6/2024	Monthly	485602	421158.54	64443.46	87%	CAD	Engineering	2023	Team1	19
a04gK0000015pZG	6/18/2024	Monthly	440410	272450.03	167959.97	62%	EUR	Engineering	2024	Team1	7
a04gK0000015pZg	2/14/2024	Annually	97498	240862.35	-143364.35	247%	CAD	Sales	2023	Team1	21
a04gK0000015pZH	3/2/2024	Annually	384871	267335.54	117535.46	69%	EUR	Engineering	2023	Team1	9
a04gK0000015pZh	5/13/2024	Monthly	398468	273377.32	125090.68	69%	EUR	Engineering	2025	Team1	7
a04gK0000015pZI	10/10/2024	Monthly	185203	285071.05	-99868.05	154%	EUR	Marketing	2025	Team1	18
a04gK0000015pZi	1/28/2024	Annually	201335	170830.57	30504.43	85%	EUR	Operations	2023	Team1	4
a04gK0000015pZJ	4/17/2024	Monthly	288167	262090.56	26076.44	91%	EUR	Operations	2023	Team1	14
a04gK0000015pZj	2/13/2024	Annually	51090	209099.64	-158009.64	409%	USD	Sales	2025	Team1	18

- **Exploratory Data Analysis (EDA):** We performed an EDA to study feature correlations. Analysis showed clear relationships between the Budget Remaining Forecast and key drivers like Project Duration and Approved Amount, confirming our data was suitable for modeling.
- The chart below shows projects committed with lower duration tend to go overboard than allocated budget



- The chart below shows that few departments like marketing and sales tend to go overboard (Budget remaining negative means actual spent budget was higher than the allocated budget). Using these signals, we will build the forecast.



2.2. Forecasting Model Development

Using the mock data, we tested multiple regression models to identify the most accurate predictor for our Budget remaining variable. The data was split into an 80% training sample and a 20% test sample.

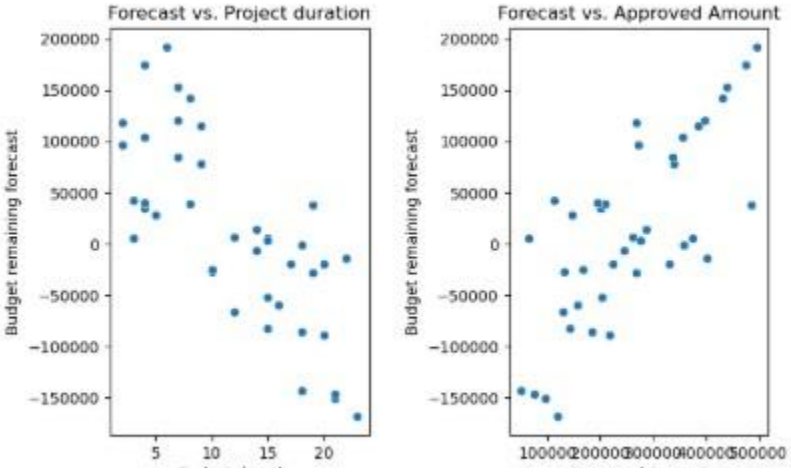
- Modeling sample:
    - Average approved budget :258K, Average budget remaining :11K
    - Test and Train sample: 80% Train sample, 20% Test sample

Technique	Mean Absolute Error (MAE)	R-squared (R-sq)
Linear Regression	20,786	88%
Random Forest	**19,346**	**87%**
XG Boost	31,574	68%

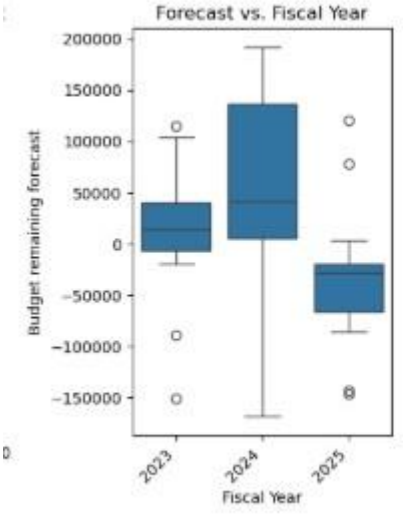
Based on its strong R-squared value and the lowest Mean Absolute Error, we selected the **Random Forest** model as our final prediction engine.

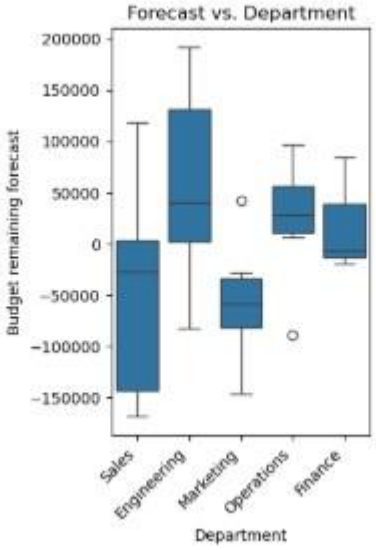
The top 5 variables contributing to the prediction were:

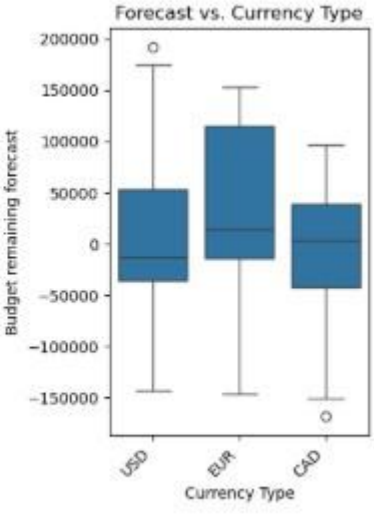
1. Project duration (0.567)
2. Approved Amount (0.391)
3. Fiscal Year_2025 (0.007)
4. Department_Sales (0.006)
5. Currency Type_EUR (0.005)


Forecast vs. Project duration
Budget remaining forecast
200000
150000
100000
50000
0
−50000
−100000
−150000
5
10
15
20

Forecast vs. Approved Amount
Budget remaining forecast
200000
150000
100000
50000
0
−50000
−100000
−150000
100000
200000
300000
400000
500000


Forecast vs. Fiscal Year
Budget remaining forecast
200000
150000
100000
50000
0
−50000
−100000
−150000
2023
2024
2025
Fiscal Year


Forecast vs. Department
Budget remaining forecast
200000
150000
100000
50000
0
−50000
−100000
−150000
Sales
Engineering
Marketing
Operations
Finance
Department


Forecast vs. Currency Type
Budget remaining forecast
200000
150000
100000
50000
0
−50000
−100000
−150000
USD
EUR
CAD
Currency Type

2.3. Model Integration & Architecture

We designed a flexible architecture to link our model with TracAnything, exploring multiple deployment strategies.

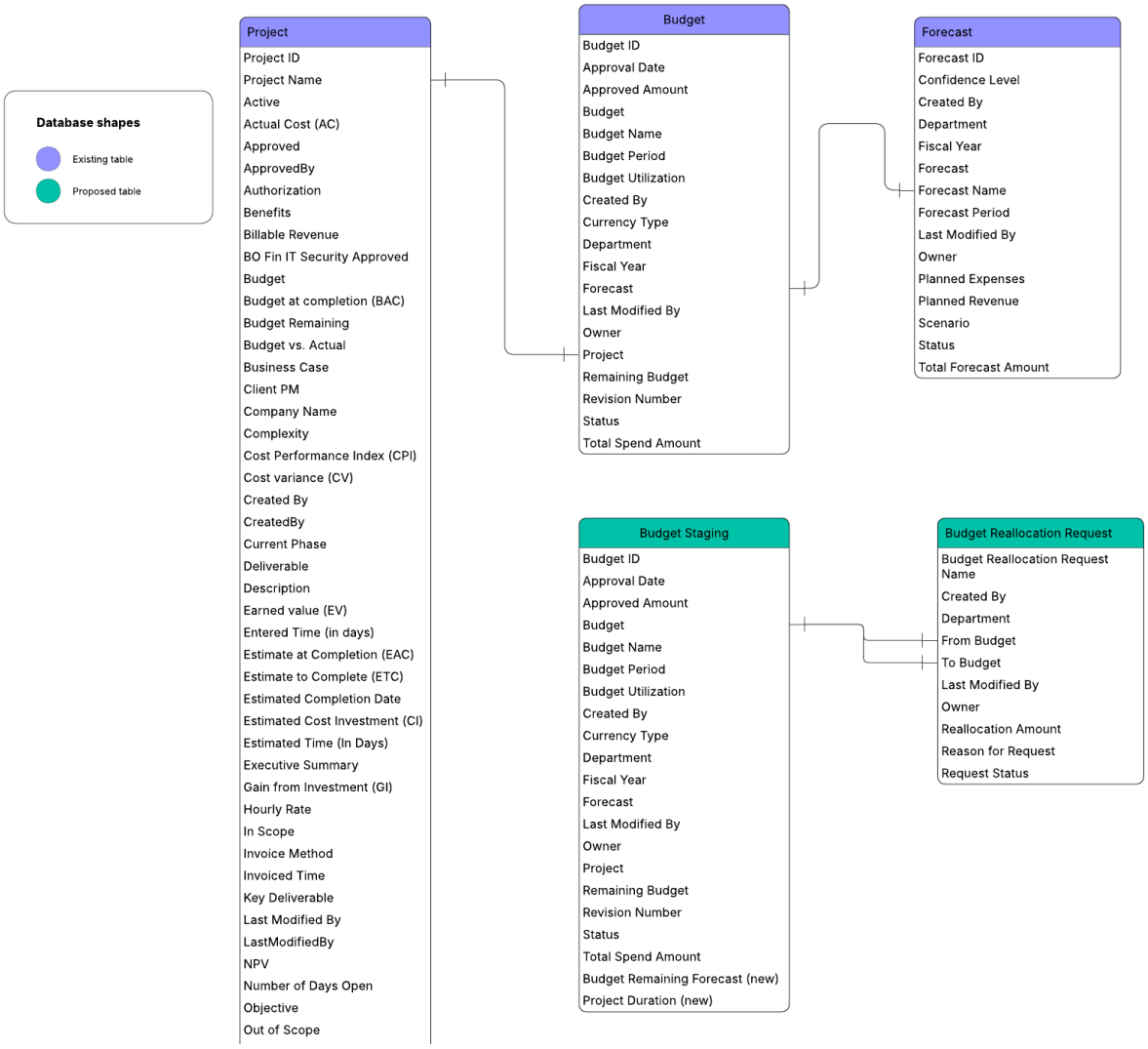
1. **External (Batch Processing):** First functional solution involves exporting data from TracAnything, running the Random Forest model from an offline Jupyter notebook to predict values for the entire dataset, and importing the data with forecast values back into TracAnything.
2. **External (Real-time Jupyter notebook):** The real-time solution using Jupyter notebook running on admins system. The logical flow is as follows:
    - A user clicks a "Predict Budget" button on a Lightning Record Page in Salesforce.
    - This action triggers a Salesforce Flow, which in turn calls an Invocable Apex class.
    - The Apex class makes a REST API call to the Jupyter notebook hosting the ML model.
    - The Python endpoint returns the predicted amount, which is then automatically written back to a custom field (SalesHub__Predicted_Amount__c) on the Salesforce record.
3. **External (Real-time GCP):** This is not fully functional but the implementation logic is complete. The real-time solution using Google Cloud Platform (GCP). The logical flow is as follows:
    - A user clicks a "Predict Budget" button on a Lightning Record Page in Salesforce.
    - This action triggers a Salesforce Flow, which in turn calls an Invocable Apex class.
    - The Apex class makes a REST API call to a Google Cloud Vertex AI Endpoint hosting the ML model.
    - The GCP endpoint returns the predicted amount, which is then automatically written back to a custom field (SalesHub__Predicted_Amount__c) on the Salesforce record.
4. **Internal (Future):** Salesforce Einstein. This could be explored in the future when available once access to the Einstein model platform is provided.

3. Project Deliverables

Our work has produced several key components within the Salesforce environment that bring the Dynamic Budget Adjuster to life.

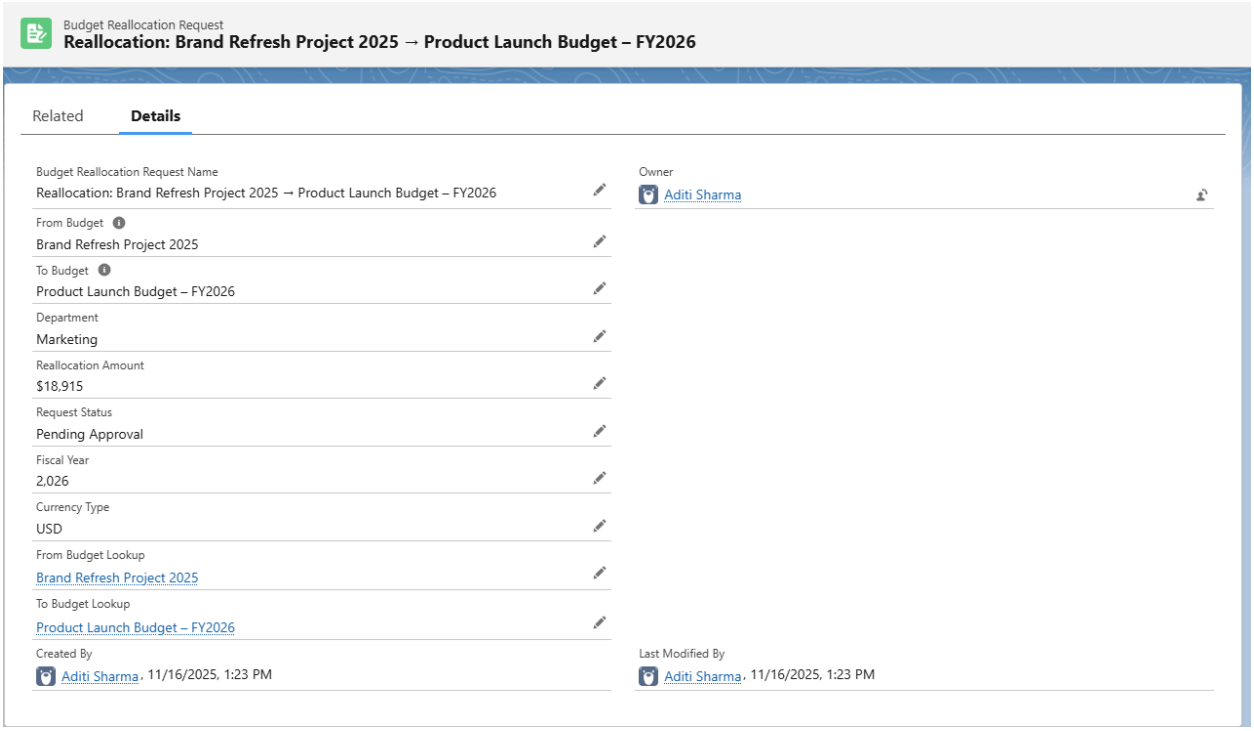
3.1. Data Model (ERD)

To support this functionality, we introduced new custom fields to the *Budget* duplicate object *Budget Staging* (e.g. Budget Remaining Forecast and Project Duration) due to limited access to some managed fields in the *Budget* object. We also created a new custom object, *Budget Reallocation Request*, to store data related to dynamic budget adjustments.



Budget Reallocation Request Object:

Below is an example of the Budget Reallocation Request Object using sample budgets to make a mock reallocation request.



3.2. Reports and Dashboards

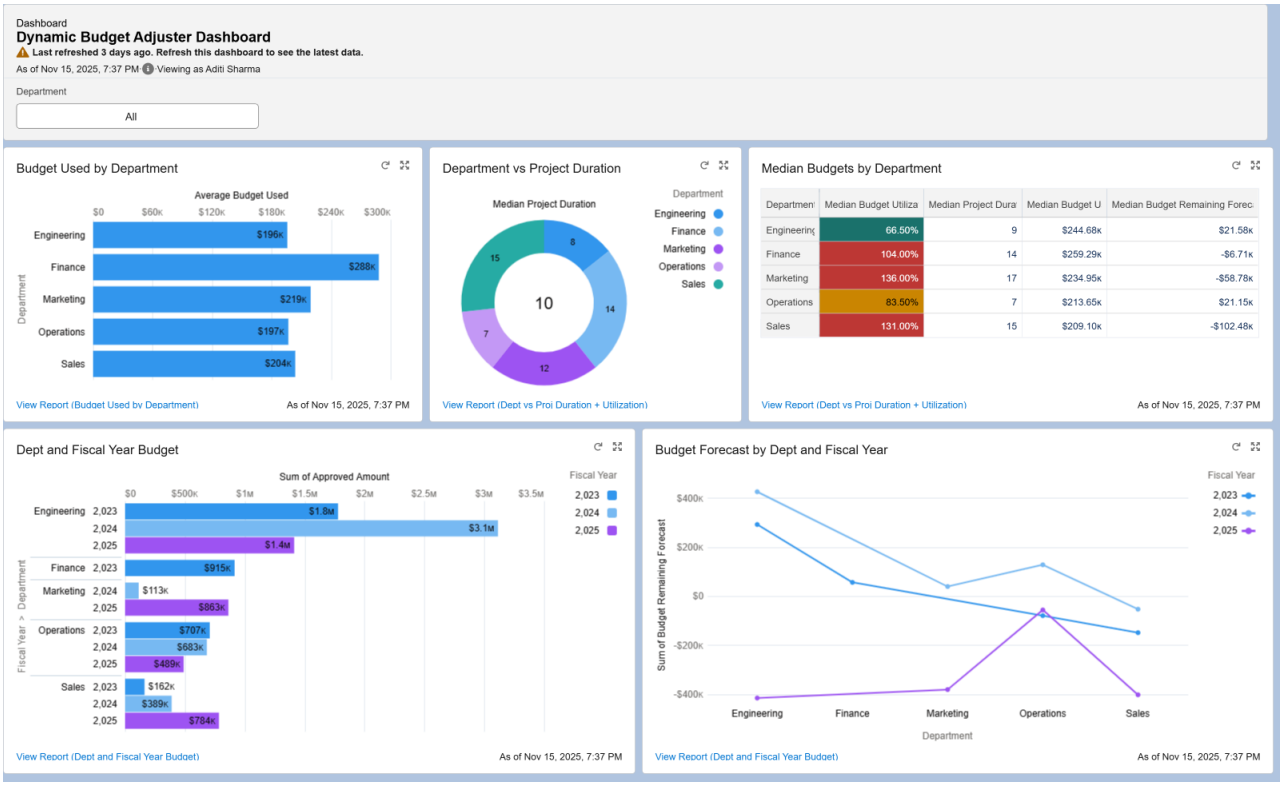
We developed a Dynamic Budget Adjuster dashboard to give business executives a clear, actionable view of budget performance across the organization. The dashboard highlights projects that are either over-utilizing or under-utilizing their budgets and breaks these insights down by key dimensions such as department and fiscal year. By surfacing these trends, leadership can identify inefficiencies, anticipate future constraints, and make informed budget reallocation decisions.

To support this analysis, the dashboard includes a suite of visualizations:

- **Budget Used by Department** – A horizontal bar chart comparing how much budget each department has already used, making it easy to spot high spenders or departments that may need reallocation support.
- **Department vs. Project Duration** – A donut chart showing median project duration by department. This helps identify whether longer or shorter projects correlate with higher budget usage.
- **Median Budgets by Department** – A summarized comparison table showing: Median budget utilization, Median project duration, Median budget used, and Remaining budget forecast. This provides a concise at-a-glance benchmark for executive review.
- **Department and Fiscal Year Budget** – A detailed bar chart showing the sum of approved budget amounts across multiple fiscal years, helping leaders understand how funding shifts over time and where the largest budget commitments are made.
- **Budget Forecast by Department and Fiscal Year** – A trend line visualization that forecasts remaining budgets across fiscal years. This chart identifies future budget surpluses or deficits and supports proactive planning.

Together, these charts give leaders a holistic, forward-looking understanding of organizational budget health.

Sample Dashboard:



3.3. Salesforce Screen Flow

Created two Salesforce Screen Flows to streamline and automate the budget reallocation process. When the Budget Remaining Forecast shows that a budget is projected to exceed its budget, the flows automatically initiate and perform the appropriate budget adjustments, reducing manual intervention and improving accuracy.

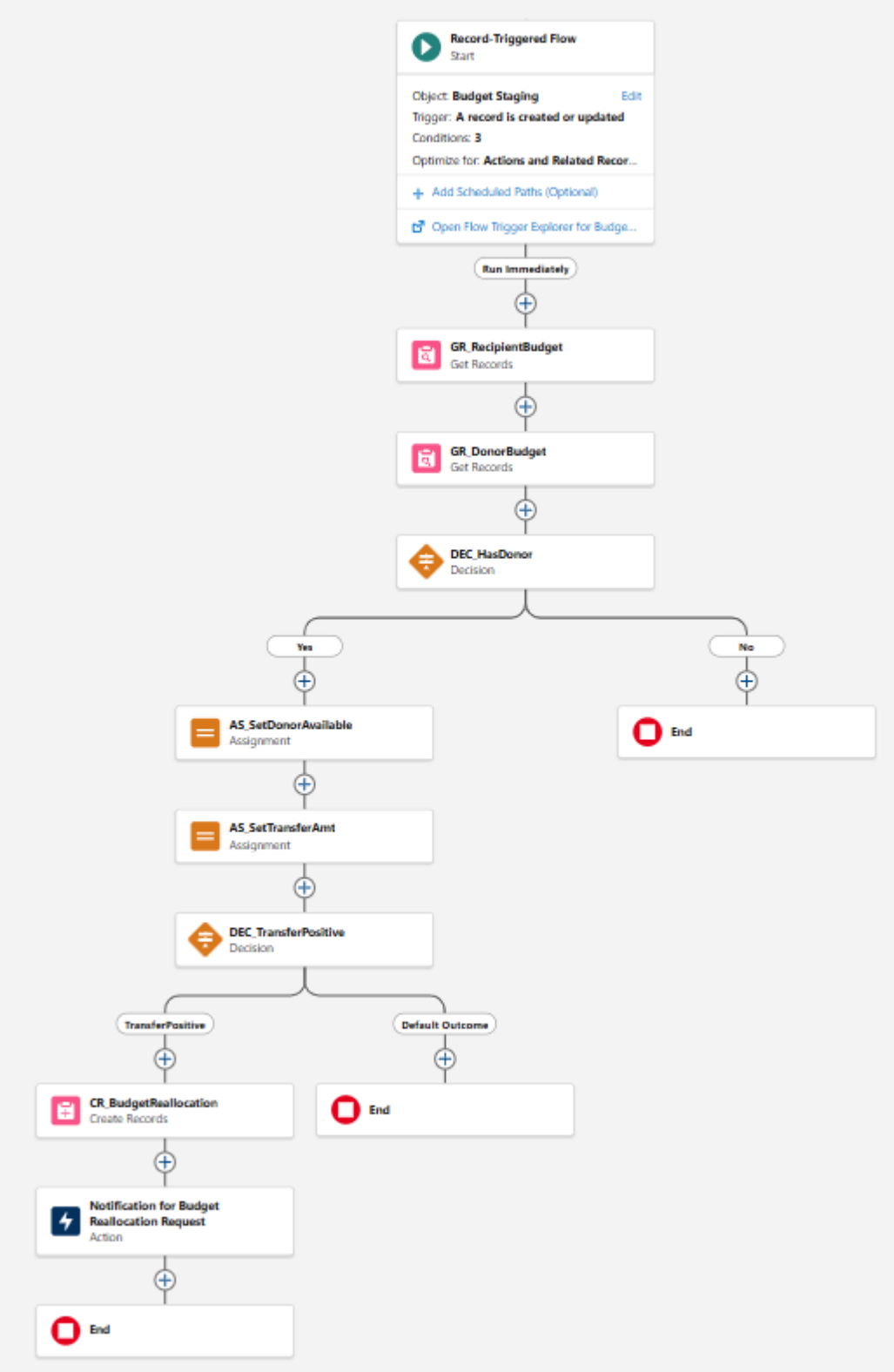
3.3.1 Auto Budget Reallocation Request Flow

The Auto Budget Reallocation Request Flow is a record triggered automation flow created in Salesforce that is designed to streamline the process of redistributing funds across project budgets when overutilization is forecasted. It automatically detects when a record in 'Budget Staging records' exceeds its remaining forecast triggers the actual reallocation of funds between budgets. This flow will support an automated financial governance process by ensuring any possible reallocation will go through an approval workflow.

Data Components

Object	Purpose	Key Fields
Budget Staging (Budget_Staging__c)	Represents each project's financial line item, including approved amount, and remaining forecasts.	Budget_Name__c, Budget_Remaining_Forecast__c, Department__c, Fiscal_Year__c, Currency_Type__c
Budget Reallocation Request (Budget_Reallocation_Request__c)	Stores proposed transfers between budgets, pending approval.	From_Budget__c (Text), To_Budget__c (Text), From_Budget_Lookup__c (Lookup), To_Budget_Lookup__c (Lookup), Reallocation_Amount__c, Request_Status__c, Approved_Amount__c, Currency_Type__c, Department__c, Fiscal_Year__c

Flow Architecture



Trigger: When a Budget_Staging__c record is created or updated, and its Budget Remaining Forecast falls below zero (overspend condition).

Purpose: Automatically generate a new Budget Reallocation Request.

Key Steps

1. **Start Conditions**
    a. Object: Budget_Staging__c
    b. Trigger: On update (and/or create)
    c. All Conditions are Met (AND):
        i. Budget_Remaining_Forecast__c < 0
        ii. Department != Blank Value (Empty String)
        iii. Status = Submitted
    d. Run: After Save
2. **Get Recipient Budget (GR_RecipientBudget)**
    a. Get the recipient budget with a negative remaining forecast.
    b. Filter:
        i. Id = {!$Record.Id}
3. **Get Donor Budget (GR_DonorBudget)**
    a. Identify potential donor budget with a positive remaining forecast.
    b. Filter - All Conditions are Met (AND):
        i. Budget_Remaining_Forecast__c > 0
        ii. Id != {!GR_RecipientBudget.Id}
        iii. Department__c = {!$Record.Department__c}
        iv. Fiscal_Year__c = {!GR_RecipientBudget.Fiscal_Year__c}
        v. Currency_Type__c = {!GR_RecipientBudget.Currency_Type__c}
        vi. Status__c = Submitted
        vii. Budget_Period__c = {!GR_RecipientBudget.Budget_Period__c}
    c. Sorting – Descending on Budget_Remaining_Forecast__c
4. **Decision: Has Donor**
    a. If {!GR_DonorBudget.Id} != Blank Value (Empty String)
    b. If {!GR_DonorBudget.Budget_Remaining_Forecast__c} > 0

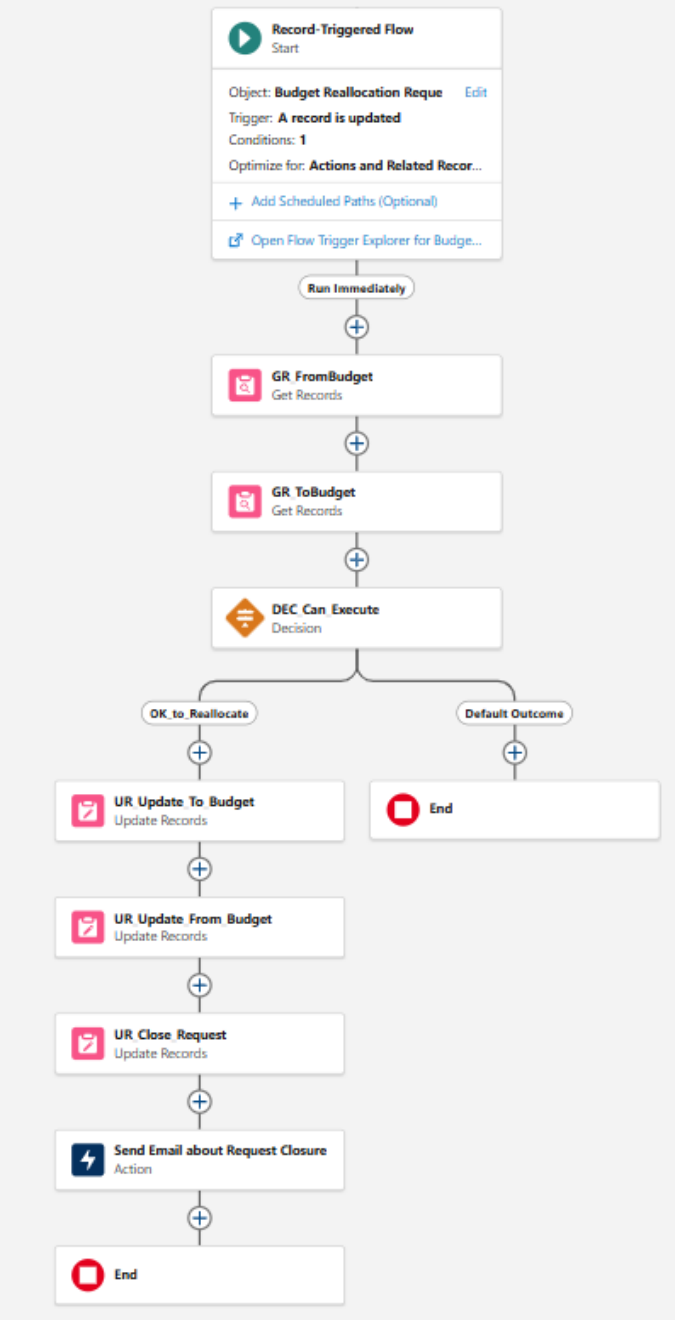
5. **Set Variable Assignments**
    a. varDonorAvailable = {!GR_DonorBudget.Budget_Remaining_Forecast__c}
        i. How much available (surplus) funds the selected donor budget has
    b. varTransferAmt = TransferAmt_Formula
        i. TransferAmt_Formula = MIN({!varOverspendAbs}, {!varTransferCap}, {!varDonorAvailable})
        ii. varTransferCap = Policy-defined max (e.g., $5,000).
        iii. varOverspendAbs = ABS({!$Record.Budget_Remaining_Forecast__c})
        iv. Minimum of overspend amount and available donor amount.
6. **Decision: Can Transfer**
    a. If varTransferAmt > 0, continue; else end.
7. **Create Budget Reallocation Request (CR_BudgetReallocation)**
    a. Creates a new Budget_Reallocation_Request__c record.
    b. Field mappings:
        i. From_Budget_Lookup__c = {!GR_DonorBudget.Id}
        ii. To_Budget_Lookup__c = {!GR_RecipientBudget.Id}
        iii. From_Budget__c = {!GR_DonorBudget.Name}
        iv. To_Budget__c = {!GR_RecipientBudget.Name}
        v. Reallocation_Amount__c = {!varTransferAmt}
        vi. Request_Status__c = Pending Approval
        vii. Currency_Type__c = {!GR_RecipientBudget.Currency_Type__c}
        viii. Department__c = {!GR_RecipientBudget.Department__c}
        ix. Fiscal_Year__c = {!GR_RecipientBudget.Fiscal_Year__c}
        x. Budget Reallocation Request Name = {!Budget_Reallocation_Name}
            1. Budget_Reallocation_Name = CONCAT({!GR_DonorBudget.Name}, " → ", {!$Record.Budget_Name__c})
8. **Send Email – Notification for Budget Reallocation Request**
    a. Sends a Notification email to whoever created the record in Budget_Staging_c
9. **End of Flow**

a. No budget adjustments occur yet; pending approval.

3.3.2 Dynamic Budget Adjuster Flow

The Dynamic Budget Adjuster Flow is the second Salesforce flow that runs when a Budget Reallocation Request is Approved. This flow will automatically update the Budgets in the Budget Staging object.

Flow Architecture:



Trigger: When a Budget_Reallocation_Request__c record's status changes to Approved.

Purpose: Execute the actual reallocation by adjusting the related budgets.

Key Steps

1. **Start** Conditions
    - Object: Budget_Reallocation_Request__c
    - Trigger: On update
    - Condition: Request_Status__c = 'Approved'
2. **Get Records from Budget Staging**
    - GR_FromBudget (Any Condition is Met (OR))
        1. Id = {!$Record.Id}
        2. Budget = {!$Record.From_Budget__c}
    - GR_ToBudget (Any Condition is Met (OR))
        1. Id = {!$Record.Id}
        2. Budget = {!$Record.To_Budget__c}
3. **Decision: Can Execute**
    - Ensure both budgets are retrieved successfully.
4. **Update Budgets**
    - From Budget (donor):
        1. Approved_Amount__c = Approved_Amount_To_Reallocation
            1. Approved_Amount_To_Reallocation = !GR_FromBudget.Approved_Amount__c} + {!$Record.Reallocation_Amount__c}
    - To Budget (recipient):
        1. Approved_Amount__c = Approved_Amount_To_Reallocation
            1. Approved_Amount_To_Reallocation = {!GR_ToBudget.Approved_Amount__c} + {!$Record.Reallocation_Amount__c}
5. **Update Reallocation Request**
    - Update Status to Closed
6. **Send Notification**

- Email alert to budget creator confirming the reallocation closure.

4. Challenges and Future Enhancements

Throughout this project, we encountered several challenges and identified opportunities to expand and strengthen the solution in future iterations.

4.1. Challenges

- **Data Accuracy:** The mock data, while effective for building the model, does not reflect the actual accuracy we would achieve with real-world data. We cannot fully evaluate the model's performance until it is tested on live data.
- **GCP Integration:** The real-time GCP solution is a work in progress and has faced hurdles due to a lack of Admin rights and inaccessibility to certain managed fields within the TracAnything Salesforce environment.
- **Einstein Access:** Exploration of the internal Salesforce Einstein model is pending accessibility to the tool.

4.2. Future Enhancements

Future iterations will focus on expanding the solution beyond its current on-premise setup. Moving to a cloud-based architecture will provide better scalability, real-time processing, and integration capabilities. Additional enhancements may include incorporating predictive analytics through Salesforce Einstein, enabling deeper automation, and improving the accuracy of budget forecasts with real operational data.

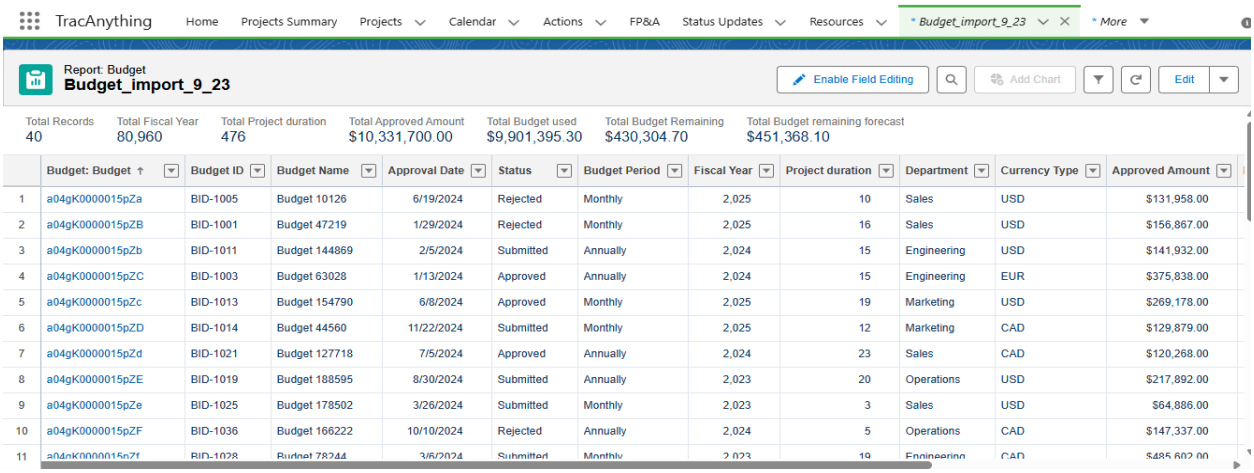
5. Workload distribution

Task	Description	Team Member Contribution
Mock Data Creation - ETL	Budget mock data creation with the existing managed fields and new custom fields	Ankit Kumar
Data Cleaning/Transformation	Handling Missing value, Excluding ID variables from model, Feature engineering- dependent variable, mock variables, Categorical variables to numeric encoding	Ankit Kumar
EDA	Study the feature correlation/association with the dependent variable	All 3 contributed equally
Model Prediction	Creation of Train/Test sample & Multiple models like Linear regression, Random Forest and Gradient boosting	Amit Raj
Link with TracAnything	Export the data from TracAnything (Salesforce), Creating the model forecast and importing back to Salesforce environment. External – batch processing, External – real time from user's Jupyter notebook External – real time from GCP (WIP)	Amit Raj
Dashboard	Charts and report for consumer across multiple dimensions with respect to the budget forecast and optimization	Aditi Sharma
ERD/ Reports / Dynamic Budget Adjuster Screen Flows	To show the Data and attributes linking and process automation flows	Aditi Sharma
Analysis and Results	Final Results, recommendations and challenges	All 3 contributed equally
Final Report	PDF report and all the required submissions	All 3 contributed equally

Appendix

Report:

Summarized view of the data. Total Budget Actual vs Forecast



	Budget: Budget	Budget ID	Budget Name	Approval Date	Status	Budget Period	Fiscal Year	Project duration	Department	Currency Type	Approved Amount
1	a04gK0000015pZa	BID-1005	Budget 10126	6/19/2024	Rejected	Monthly	2,025	10	Sales	USD	$131,958.00
2	a04gK0000015pZB	BID-1001	Budget 47219	1/29/2024	Rejected	Monthly	2,025	16	Sales	USD	$156,867.00
3	a04gK0000015pZb	BID-1011	Budget 144869	2/5/2024	Submitted	Annually	2,024	15	Engineering	USD	$141,932.00
4	a04gK0000015pZC	BID-1003	Budget 63028	1/13/2024	Approved	Annually	2,024	15	Engineering	EUR	$375,838.00
5	a04gK0000015pZc	BID-1013	Budget 154790	6/8/2024	Approved	Monthly	2,025	19	Marketing	USD	$269,178.00
6	a04gK0000015pZD	BID-1014	Budget 44560	11/22/2024	Submitted	Monthly	2,025	12	Marketing	CAD	$129,879.00
7	a04gK0000015pZd	BID-1021	Budget 127718	7/5/2024	Approved	Annually	2,024	23	Sales	CAD	$120,268.00
8	a04gK0000015pZE	BID-1019	Budget 188595	8/30/2024	Submitted	Annually	2,023	20	Operations	USD	$217,892.00
9	a04gK0000015pZe	BID-1025	Budget 178502	3/26/2024	Submitted	Monthly	2,023	3	Sales	USD	$64,886.00
10	a04gK0000015pZF	BID-1036	Budget 166222	10/10/2024	Rejected	Annually	2,024	5	Operations	CAD	$147,337.00
11	a04gK0000015pZf	BID-1028	Budget 78244	3/6/2024	Submitted	Monthly	2,023	19	Engineering	CAD	$485,602.00