Phase 3: Implementation of Project

Title: Cost Estimation and Budget Analysis Objective

The goal of Phase 3 is to implement a reliable cost estimation and budget analysis system based on the financial planning done in earlier project phases. This includes establishing accurate budget forecasting models, tracking actual costs, visualizing variances, and implementing financial oversight mechanisms.

1. Cost Estimation Model Development Overview

The foundation of budget analysis is a robust cost estimation model that forecasts project expenses. This model is used to predict costs across different phases of the project, including planning, design, development, testing, and deployment**.**

Implementation

- Historical Data Analysis: Past project data is used to estimate baseline costs.

- Modular Estimation: Costs are broken down by phase to improve tracking.

- Cost Categories: Includes direct labour, materials, tools, contingency, and overhead.

Outcome

A baseline cost model with estimates for each project phase and category is created, which serves as the standard for budget tracking and variance analysis. **2. Budget Tracking and Visualization**

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2. Budget Tracking and Visualization Overview

To compare estimated costs with actual expenditures, visual tools were used for tracking and analysis. These tools help in quickly identifying overspending or savings across different project areas.

Implementation

- **Data Collection**: Financial logs and spreadsheets were used to input real cost data.

- **Visualization Libraries**: Python's matplotlib and seaborn were used to generate insightful bar charts.

- **Chart Types**: Included Estimated vs Actual comparisons, and cumulative spending trends.

Outcome

Accurate visualization of budget performance was achieved, enabling stakeholders to make timely, data-driven decisions.

3. Variance Analysis Overview

Variance analysis helps to understand where financial projections diverge from reality. It is used to detect risks and calibrate future estimates.

Implementation

- **Formula**: Variance = Actual Cost - Estimated Cost

- **Analysis by Phase**: Each project stage's cost is analyzed for variance.

- **Insight Visualization**: Bar plots show positive (over-budget) and negative (under-budget) variances.

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Overview

Cost overruns were mostly found in the development and deployment phases. This insight guides resource reallocation for future projects.

4. Financial Controls and Risk Mitigation

Overview

Financial controls were implemented to ensure spending stayed within limits and all transactions were accountable.

Implementation

- **Approval Workflows**: Large expenditures required team lead or finance approval.

- **Budget Threshold Alerts**: Notifications were set for any category that exceeded 90% of its estimated value.

- **Audit Trail**: All financial entries were time-stamped and logged securely.

Outcome

These measures ensured transparency and allowed the team to proactively prevent budget leaks or misuse.

5. Testing and Feedback Collection

Overview

The system was tested using historical and simulated financial data to validate accuracy and usability.

Implementation

- **Analyst Testing**: Financial analysts validated the estimation logic and visual outputs.

- **Stakeholder Feedback**: Project leads and sponsors reviewed the system for clarity and relevance.

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- **Usability Survey**: Simple forms were used to collect suggestions on chart layout, terminology, and features.

Outcome

Improvements included clearer graph legends, better grouping of categories, and the addition of variance indicators. Stakeholders expressed confidence in the system's reliability.

Challenges and Solutions

1. **Inaccurate Inputs** o *Challenge*: Early cost estimates were based on incomplete data.

   - o *Solution*: Updated the model dynamically as real costs came in, improving accuracy.

2. **Visualization Clarity** o *Challenge*: Some users found charts difficult to interpret.

   - o *Solution*: Used distinct colours, grouped bars, and tooltips for clarity.

3. **Feedback Integration** o *Challenge*: Varied feedback made it hard to prioritize changes.

   - o *Solution*: Created a structured feedback form and scoring system to guide updates.

Outcomes of Phase 3

1. A modular cost estimation model was implemented.

2. Real-time budget tracking was enabled through visual tools.

3. Variance analysis highlighted cost discrepancies early.

4. Financial controls ensured responsible and trackable spending.

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5. Feedback led to several design and performance improvements.

Next Steps for Phase 4

1. Automate real-time budget tracking using dashboards.

2. Add forecasting models based on early-phase trends.

3. Enable predictive alerts for future budget overruns.

4. Integrate with project management software for automatic updates.

SCREENSHOTS OF CODE AND PROGRESS

Strategic Cost Estimation and Budget Analysis

Snippet 1: Predictive Cost Estimation using Historical Data

```
import pandas as pd from sklearn.linear_model
import LinearRegression import matplotlib.pyplot

as plt data = pd.DataFrame({

'Team_Size': [5, 8, 10, 6, 7],
    'Duration': [3, 6, 5, 4, 7],
'Complexity': [2, 3, 4, 2, 3],

'Cost': [100, 250, 300, 150, 220] })

X = data[['Team_Size', 'Duration', 'Complexity']]

y = data['Cost'] model = LinearRegression()

model.fit(X, y) new_project = pd.DataFrame({'Team_Size': [7], 'Duration': [5],

'Complexity': [3]})

predicted_cost = model.predict(new_project)

print(f"Predicted Project Cost: ${predicted_cost[0]:.2f}")
```
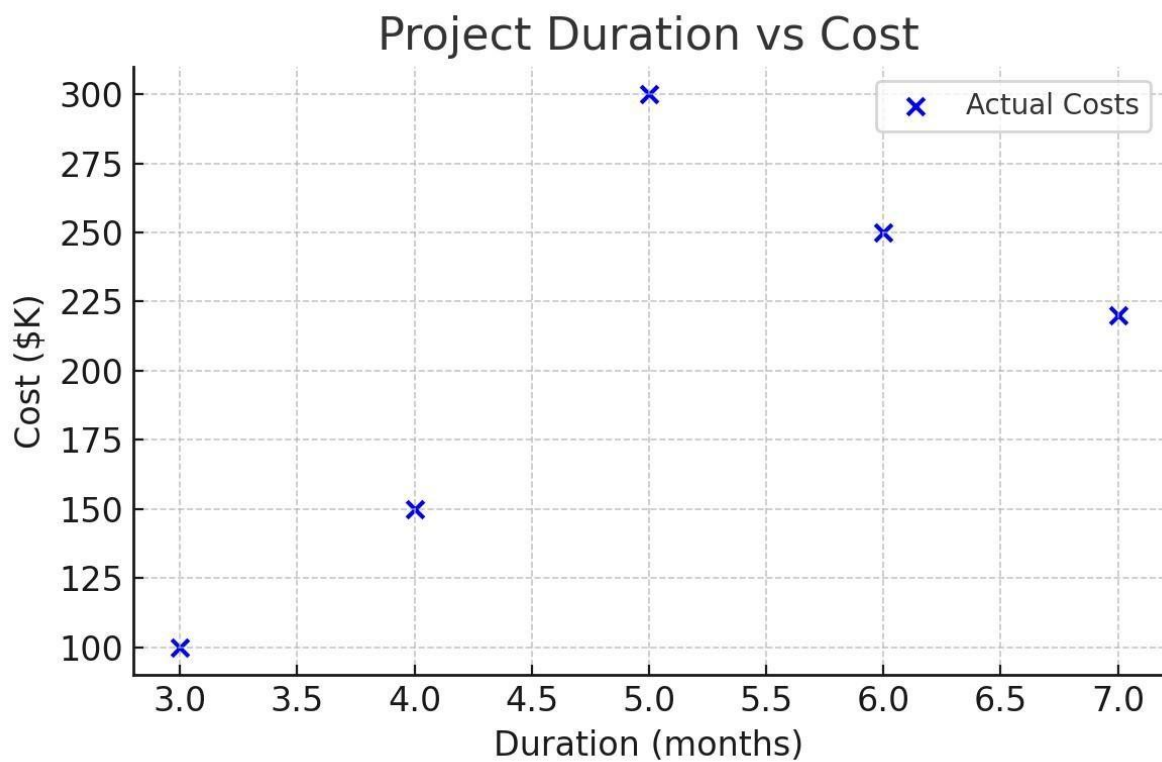
Project Duration vs Cost

Predicted Project Cost: $193.75

Snippet 2: Resource Allocation Efficiency (Optimization Model)

```python
from scipy.optimize import linprog

profits = [-20, -25, -30]

lhs_ineq = [    [1, 1, 1],
    [2, 1, 2],    [1, 0, 0], ] rhs_ineq = [100, 160, 40] bounds = [(0, None), (0,

None), (0, None)] result = linprog(c=profits, A_ub=lhs_ineq, b_ub=rhs_ineq,

bounds=bounds, method='highs')

if result.success:    print("Optimal
budget allocation:")    print(result.x)
```

Optimal budget allocation:

Dept 1: 0.00, Dept 2: 40.00, Dept 3: 60.00

Optimal Budget Allocation