

Enhancing Budget Business Activities through Automation and Integrated Web App

Department of Industrial Systems Engineering and Management (ISEM)

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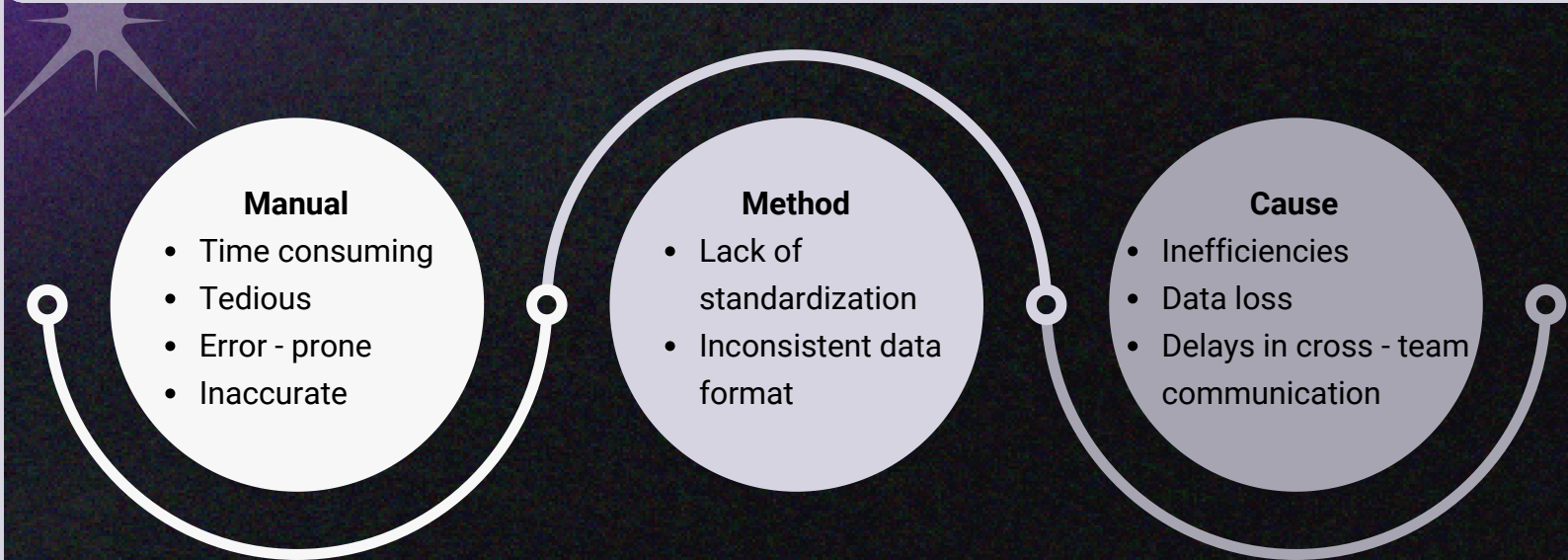
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Background

- Micron Technology Inc.
 - Global leader in memory and storage solutions.
 - Provide innovative semiconductor products that power data-driven applications.
- Tool Commissioning Update
 - Ensure materials & commodities meet tool capacity, usage & operational needs.
 - Conduct budget expense calculations twice quarterly (pre & final).
- BOM change summary
 - The BOM lists all components, materials, and steps for wafer production at Micron.
 - BOM changes occur due to:
 - Process modifications (adding/removing steps).
 - Cost updates (changes in material unit cost).
 - Material allocation adjustments (e.g., increasing required quantity).

Problem Description



Objectives

- Automate budget change calculations and eliminate errors due to manual processing.
- Standardize processes and calculation for BOM Change Summary & Tool Commissioning Update.
- Reduce manpower hours & provide a common platform for data results.

Web App Tech Stacks



Flask



HTML



CSS



JavaScript

Data Processing Tech Stacks



SQL Server



Python



Pandas

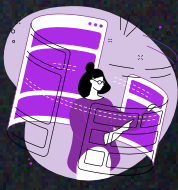


Power Automate

Integrated Web App



One Stop Platform



User Friendly Interface

Welcome!

Choose your Budget Activity

Tool Commissioning

BOM Change Summary



Integrate both business activities



Scalable for future automation of other business activities

BOM Change Summary

Methodology

End-to-End Processing

From retrieving data 11 tables from database to data processing and outputting BOM Change Summary Report in one go.

Data Processing

To ensure data is clean for processing imputing missing values, correcting data entry errors, standardizing text columns and column names, ensuring consistent column mappings, grouping data based on relevant attributes, merging datasets from multiple sources, and derived new columns for further processing.

Standardized Calculation

Defined formulas to calculate budget change magnitude according to each category with a standardized formula.

$$\begin{aligned} \text{usage wafer } \Delta &= \alpha \times ma_{old} \times p_{old} \times (u_{new} - u_{old}) \\ \text{unit cost } \Delta &= \alpha \times u_{new} \times ma_{old} \times (p_{new} - p_{old}) \\ \text{material allocation } \Delta &= \alpha \times p_{new} \times u_{new} \times (ma_{new} - ma_{old}) \end{aligned}$$

where: α is the adjusting factor
 ma is the material allocation
 p is the material price
 u is the material usage per wafer

Data Wrangling & Output Formatting

Ensure standardized report formatting for analyzing budget changes by applying data transformations. Maintain consistency with existing Excel formatting, including colors and column naming conventions.

Automated Accuracy Check

Validate results in the resulting BOM Change Summary report with actual number of BOM Changes.

Automated Working File

Includes background data and calculations beyond what is documented in the BOM Change Summary for a comprehensive understanding of modifications, streamlining validation process.

Automated Data Integrity Check

Validate integrity of data used in the BOM Change Summary to ensure correctness, facilitate anomaly detection, and streamline feedback to the relevant department.

Tool Commissioning Update

Methodology

Python powered budget calculations and forecast

A python - based automation framework to replace manual data processing. The script will:

- Extract information from layout files
- Retrieve data from Micron's database
- Filter for relevant data (eg. filter for those starting from the next budget cycle)
- Perform budget forecasting calculations:

$$\text{Expense of Workstation} = \sum_{i=1}^n (\text{Unit Requirement}_i \times \text{Unit Cost (USD)}_i)$$

where i represents each material used in the workstation

Each planner is responsible for their assigned commodity and must independently input their commodity and most recent layout file in the web app to generate the final output.

Automated updating of missing workstations in a common file

Every week one planner download and save the layout files into a designated folder, the script will automatically identify new workstations and update the common shared file for the counterpart teams to complete material specifications

Power Automate bi - weekly reminders

To ensure timely updates to the common shared file and remove the need for manual follow-ups, the power automate workflow can help to improve cross - team coordination. Together with automatic weekly updates of missing data, This increases the accuracy of budget forecasting, by ensuring up-to-date data is provided when material planners perform their calculations.

Automated material requirement forecast

The Python script generates the material forecast for all fabs (NX, A & W) by summing the unit requirements for each material in a structured dataframe: materials as rows and workweeks as columns. This provides a clear weekly breakdown of projected requirements across a three-year horizon.

Find difference in Micron capital (Micap)

Micap serves as a primary identifier for tool activities. A python script was developed to analyze Micap variations across budget cycles. Variations include: new additions, removals from previous budget cycle & changes in either expense allocation or fab assignment or both.

Impact



(BOM Change Summary)
Enable closed loop of reporting accuracy and data integrity check



(BOM Change Summary)
Reduced manpower from 6 to 1 and working time from 45.5 hrs/quarter to ~1.5 minutes (~1800x faster).



(Both activities)
Standardized reporting and change categorization preventing confusion and discrepancies.



(Tool Commissioning)
Reduced working time from 39 hrs/quarter to ~2 minutes (~1200x faster).



(Tool Commissioning)
Improved communication between the material planning team and the counterpart teams.

Future Improvements

BOM Change Summary

- Full automation of data integrity feedback loop
- Restructuring of MSP file in Micron's database

Tool Commissioning Update

- Creation of a file retrieval system
- Personalization of Power Automate reminder