Power BI Business Insights Report

End-to-End ML Business Pipeline

Prepared for Stakeholders & Board of Directors

By: Emeka Kelvin

Introduction

This comprehensive report presents insights derived from Power BI dashboards connected to an end-to-end AWS-powered machine learning business pipeline. The project integrates multiple components of the AWS ecosystem, S3 for data storage, Glue for data transformation, Athena for querying, and Apache Airflow for automation, with Power BI for visualization and executive reporting.

The pipeline was designed to automate the flow of financial and operational data, reduce manual effort, and deliver timely, accurate, and actionable intelligence to decision-makers.

Why This Report Matters

In today's competitive digital economy, organizations generate massive volumes of data from diverse sources. Without an efficient pipeline, this data remains underutilized. This project ensures that:

- Data is captured, transformed, and analyzed seamlessly from ingestion to reporting.
- The board has access to near real-time insights to track performance.
- Strategic and operational teams can base decisions on evidence rather than assumptions.

Objectives of the Report

The primary goal is to provide the Board of Directors and senior stakeholders with clear and actionable intelligence for:

- Evaluating company performance across revenue, costs, expenses, profitability, and returns.
- Identifying operational inefficiencies and bottlenecks within both the data pipeline and the business processes.
- Highlighting market trends, risks, and opportunities revealed by the analytics.
- Guiding strategic capital allocation and organizational focus.

What This Report Contains

1. End-to-End Pipeline Overview – Explains how AWS, Glue, Athena, and Airflow are integrated with Power BI.
2. Detailed KPI Analysis – Covers revenue, cost of goods sold (COGS), expenses, gross profit, net profit, margins, and return metrics.
3. Bottlenecks & Risks – Identifies technical and operational issues (e.g., latency, ETL accuracy, scalability).
4. Strategic & Technical Recommendations – Provides concrete steps for executives, technical teams, and analysts.
5. Executive-Level Summary – Condenses findings into high-level insights for rapid boardroom decision-making.

Connecting cloud infrastructure, automated workflows, and advanced visualization, this project demonstrates how technology can not only enhance reporting but also act as a strategic enabler for growth, efficiency, and competitiveness.

Project Overview: End-to-End ML Pipeline

1. AWS Setup

- AWS Account created with IAM Roles for secure access. - IAM Roles defined with AmazonS3FullAccess and AWSGlueService policies.

2. Data Ingestion

- Data ingested via Python scripts (ingest_fmp.py, ingest_mysql.py) and stored in S3.
- S3 structured into raw, scripts, temp, production, transformation, athena-results folders.

3. Data Integration

- AWS Glue crawlers and jobs transform raw data into Parquet format. - Data Wrangler enriches datasets with KPIs for deeper analysis.

4. Query Layer

- Amazon Athena used to query processed datasets. - Databases created via Crawlers or Athena
SQL.

5. Visualization

- Athena connected to Power BI via ODBC driver. - KPIs visualized through interactive dashboards.

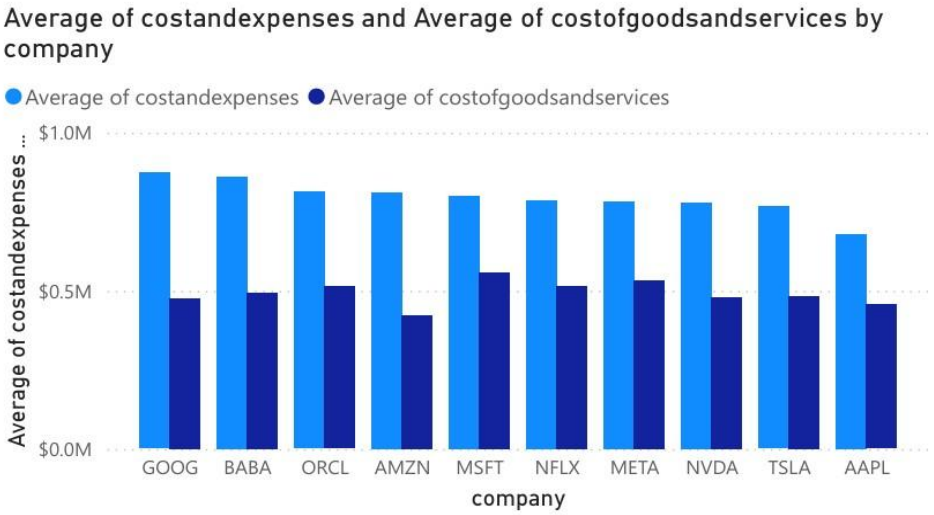
6. Automation

- Apache Airflow DAGs orchestrate data ingestion and transformation workflows. - Enables automation and scheduling for continuous insights.

1. Cost and Expenses vs Cost of Goods and Services

Visualization: *Average of Cost and Expenses vs Average of COGS by Company*

- **Insights:**
  - Across companies (GOOG, BABA, ORCL, AMZN, MSFT, etc.), **operating expenses consistently exceed cost of goods sold (COGS)**.
  - This suggests that **scaling challenges and administrative costs** are major factors impacting profitability.
  - Companies like Microsoft and Amazon show a relatively balanced cost profile, while Google and Alibaba appear to have higher overheads.
- **Bottlenecks:**
  - Costs are shown in averages, masking year-to-year volatility.
  - No breakdown into R&D, SG&A, and production costs.
- **Recommendations:**
  - Introduce a **trend analysis** (yearly breakdown) to reveal cost efficiency improvements or deteriorations.
  - Create **cost composition dashboards** to separate operational vs production costs.

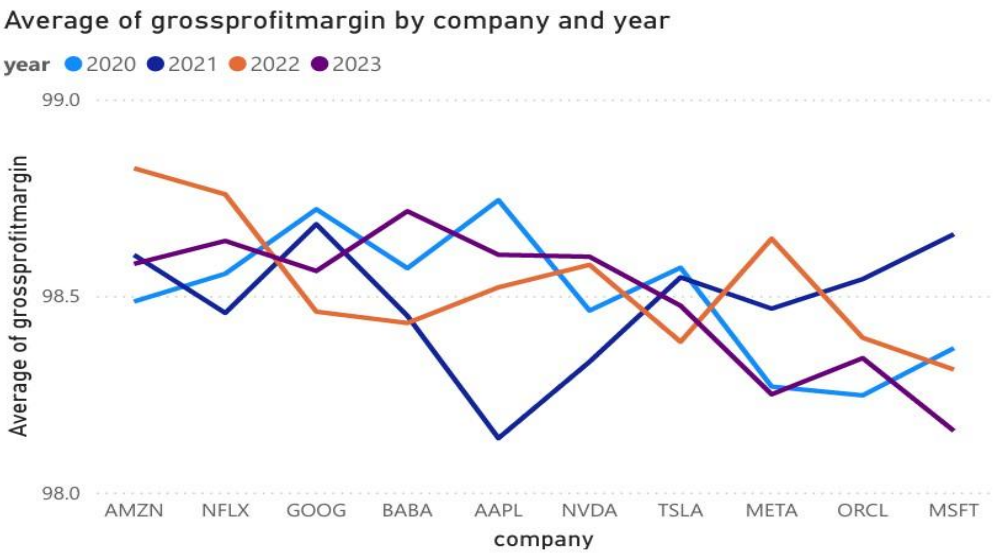


2. Gross Profit Margin Trends

Visualization: *Average of Gross Profit Margin by Company and Year*

- **Insights:**
    - Margins are **very high (98–99%)**, which could suggest either strong pricing power or potential ETL/KPI miscalculations.
    - Apple shows volatility in 2021–2022, while Meta shows declining margins in 2023.
    - Microsoft and Oracle trend upward, suggesting stronger cost control.
- **Bottlenecks:**
    - Such unusually high margins across all companies may indicate **incorrect KPI calculations** in Glue transformations.
    - The visualization does not highlight industry benchmarks for comparison.
- **Recommendations:**
    - Audit **ETL logic** to confirm gross profit margin calculation = (Revenue – COGS) / Revenue.
    - Introduce **benchmark comparisons** (industry average margins).

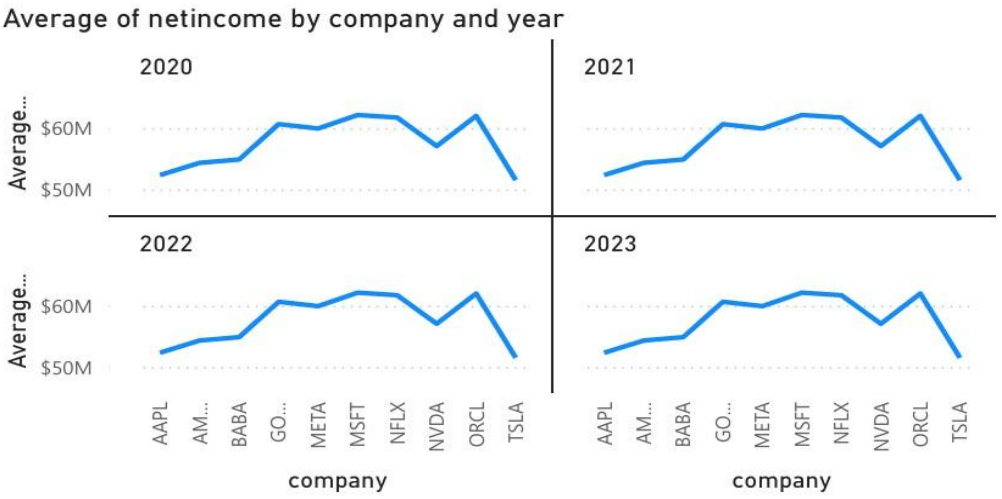
Add **variance analysis** to detect anomalies quickly



3. Net Income Trends

Visualization: *Average of Net Income by Company and Year*

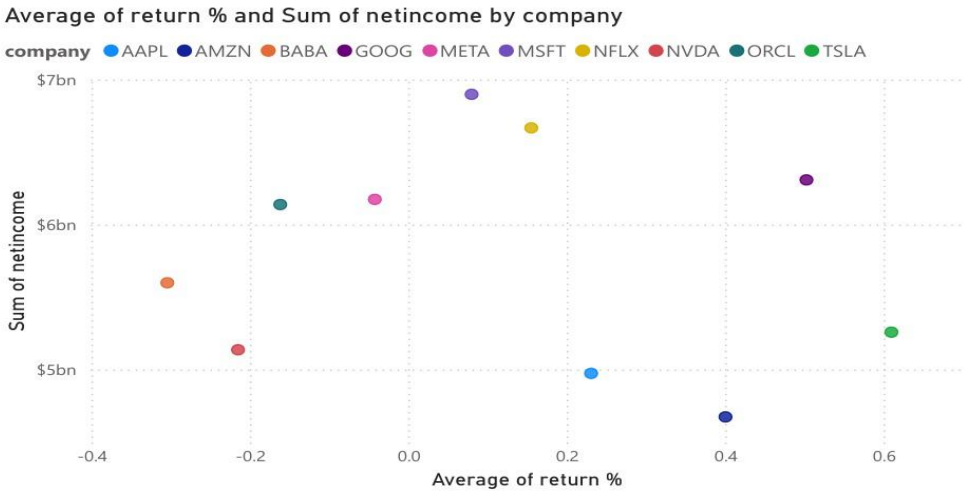
- **Insights:**
  - Net income averages between **$50M–$65M** annually across companies.
  - Microsoft and Meta maintain consistently strong performance; Tesla shows volatility.
  - Oracle and Netflix sit in the mid-range, reflecting stable but not leading profitability.
- **Bottlenecks:**
  - Yearly averages reduce visibility into **quarterly shocks** (e.g., pandemic effects, product launches).
  - Visuals do not compare net income against revenue growth.
- **Recommendations:**
  - Add **net income to revenue ratio (net profit margin)** to measure efficiency.
  - Introduce **rolling averages** for smoother trends.



4. Returns vs Net Income

Visualization: *Average of Return % vs Sum of Net Income (Scatterplot)*

- **Insights:**
    - Tesla (TSLA) shows **high returns despite lower net income**, reflecting strong investor sentiment.
    - Microsoft and Google show **high net income with strong returns**, signaling long-term market confidence.
    - Amazon lags with strong revenue but weaker returns, likely due to reinvestment.
- **Bottlenecks:**
    - "Return %" is ambiguous — ROI, ROE, or ROA? Without clarity, investor interpretation is limited.
    - Negative return outliers (Alibaba, Nvidia) raise concerns but lack contextual notes.
- **Recommendations:**
    - Standardize metric definitions (e.g., ROE = Net Income / Equity).
    - Add **risk-adjusted return metrics** like Sharpe ratio for investment-quality insights.

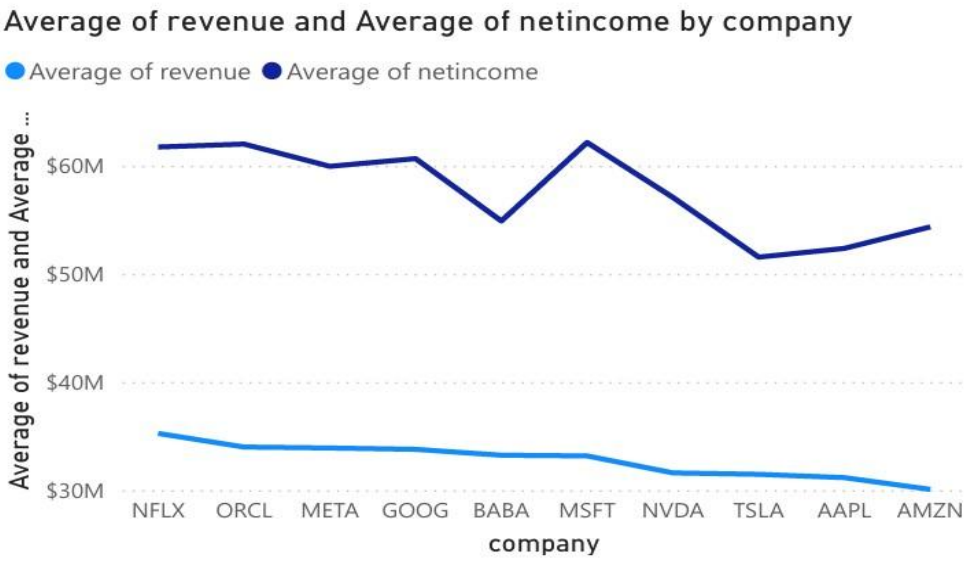


5. Revenue vs Net Income

Visualization: *Average of Revenue and Net Income by Company*

- **Insights:**
    - Amazon has **highest average revenue but relatively low net income**, reflecting thin margins.
    - Microsoft and Apple maintain strong **alignment between revenue and net income**, showing cost efficiency.
    - Netflix, with smaller revenue, sustains competitive net income compared to larger firms.
- **Bottlenecks:**
    - Lack of margin overlay hides **revenue-to-profit conversion efficiency**.
    - Data is annualized, limiting detection of growth acceleration/deceleration.
- **Recommendations:**
    - Add **profit margin overlays** to show efficiency.

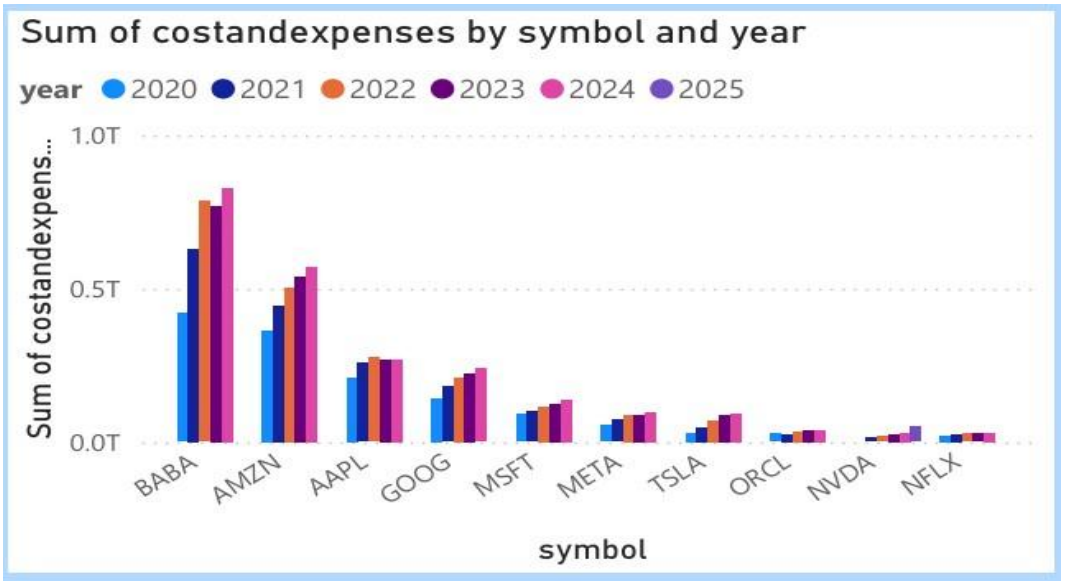
Use CAGR (Compound Annual Growth Rate) for revenue and net income



6. Cost and Expenses Over Time

Visualization: *Sum of Cost and Expenses by Symbol and Year*

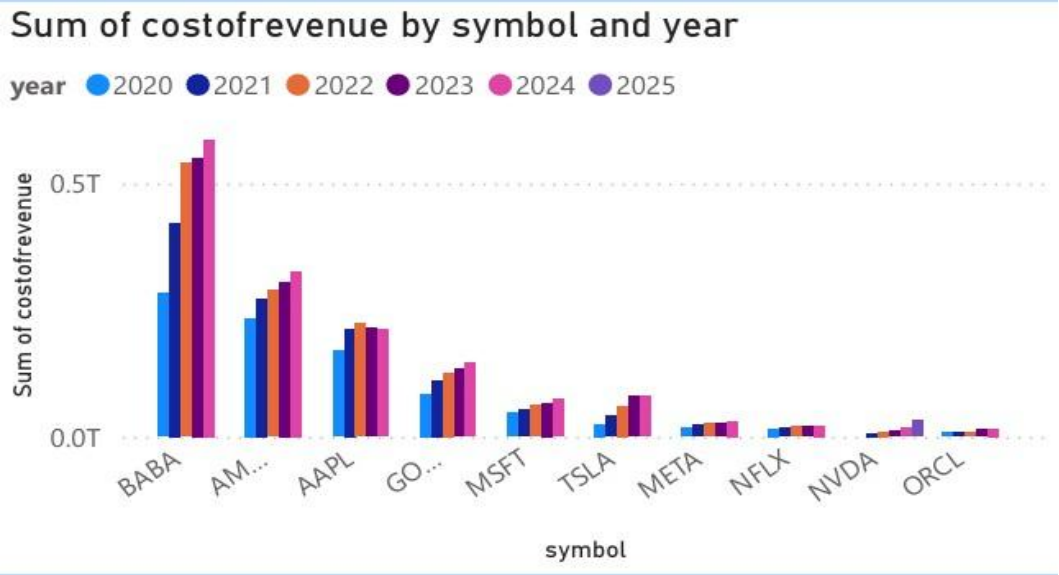
- **Insights:**
    - Amazon and Alibaba dominate in expenses, with steep year-over-year increases.
    - Apple and Google show controlled expense growth, aligning with efficient scaling.
- **Bottlenecks:**
    - No direct link to revenue growth (are higher expenses translating into higher sales?).
- **Recommendations:**
    - Create a **cost-to-revenue ratio dashboard**.
    - Forecast expense growth vs projected revenues using ML models in AWS SageMaker.



7. Cost of Revenue Trends

Visualization: *Sum of Cost of Revenue by Symbol and Year*

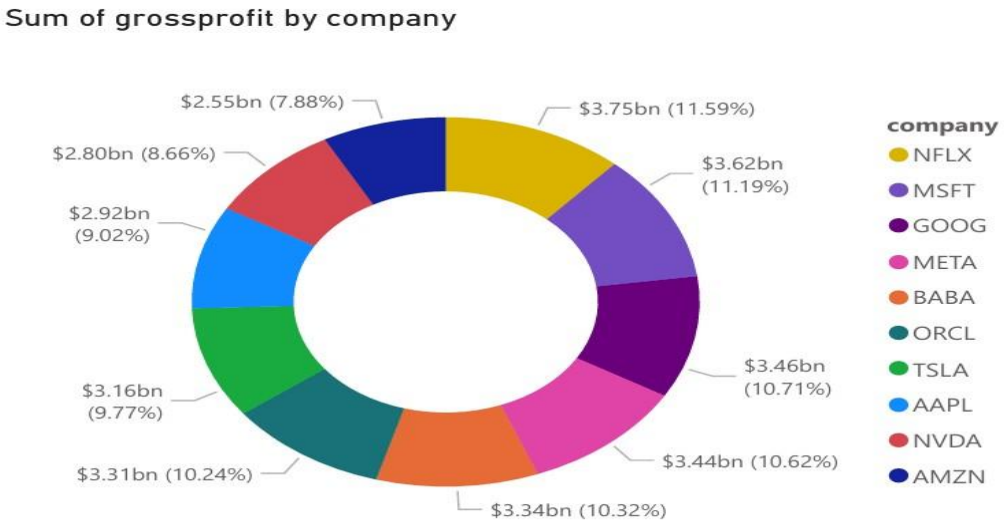
- **Insights:**
    - Amazon leads in absolute cost of revenue, indicating high fulfillment/logistics costs.
    - Apple and Google manage relatively lower cost structures, benefiting margins.
- **Bottlenecks:**
    - Limited insights into **unit economics** (cost per customer/product).
- **Recommendations:**
    - Integrate operational KPIs (e.g., cost per subscriber for Netflix, cost per transaction for Amazon).



8. Gross Profit Distribution

Visualization: *Gross Profit by Company (Donut Chart)*

- **Insights:**
    - Microsoft ($3.75bn, 11.59%) and Meta ($3.62bn, 11.19%) lead in gross profit contribution.
    - Amazon, despite huge revenues, contributes less proportionally, reflecting reinvestment strategy.
    - Netflix shows smallest gross profit share (7.88%), aligning with its thin-margin streaming business.
- **Bottlenecks:**
    - Visual does not show **profitability vs market cap** context.
- **Recommendations:**
    - Compare gross profit share against **market capitalization weightings**.
    - Provide historical comparison to highlight shifts in dominance.

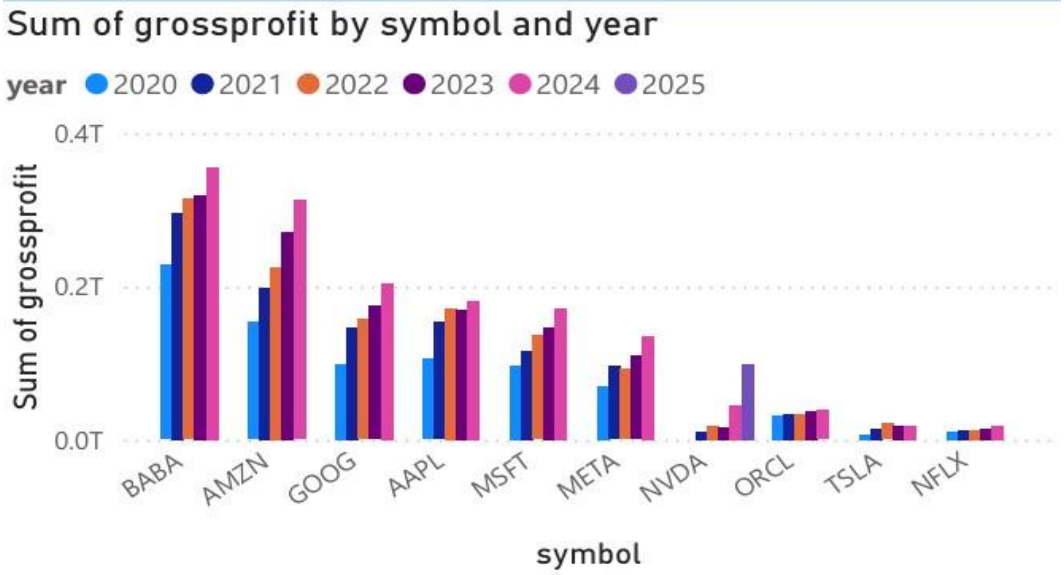


9. Gross Profit Trends

Visualization: *Sum of Gross Profit by Symbol and Year*

- **Insights:**
    - Microsoft, Google, and Apple show **stable gross profit growth**.
    - Amazon's gross profit is growing but **lags relative to revenue growth**.
- **Bottlenecks:**
    - Gross profit growth is not tied to net income trends.
- **Recommendations:**

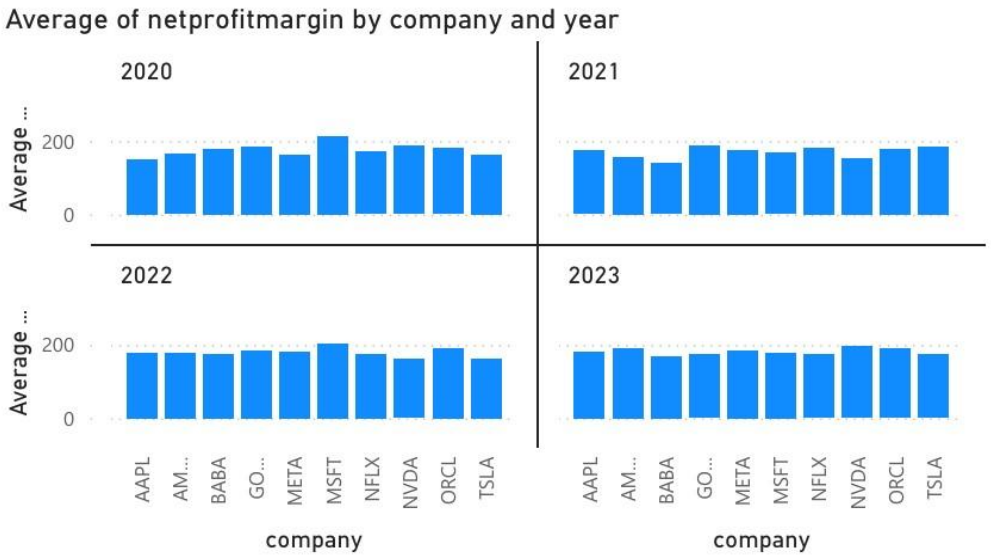
Add **operating profit (EBIT)** trends to bridge gross to net outcomes



10. Net Profit Margin Trends

Visualization: *Average of Net Profit Margin by Company and Year*

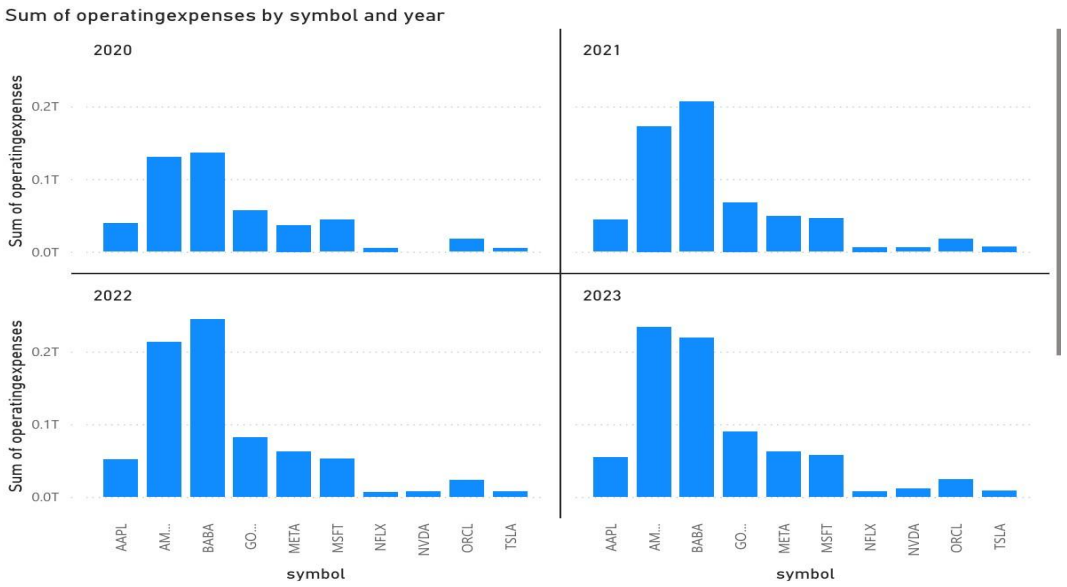
- **Insights:**
    - Microsoft and Meta consistently show strong margins.
    - Amazon and Tesla margins remain weaker, reflecting reinvestment strategies and volatility.
- **Bottlenecks:**
    - Visualization is flat, lacking emphasis on margin volatility.
- **Recommendations:**
    - Add **variance bars** or quarterly breakouts.
    - Benchmark net profit margin against industry peers.



11. Operating Expenses Trends

Visualization: *Sum of Operating Expenses by Symbol and Year (2020–2023)*

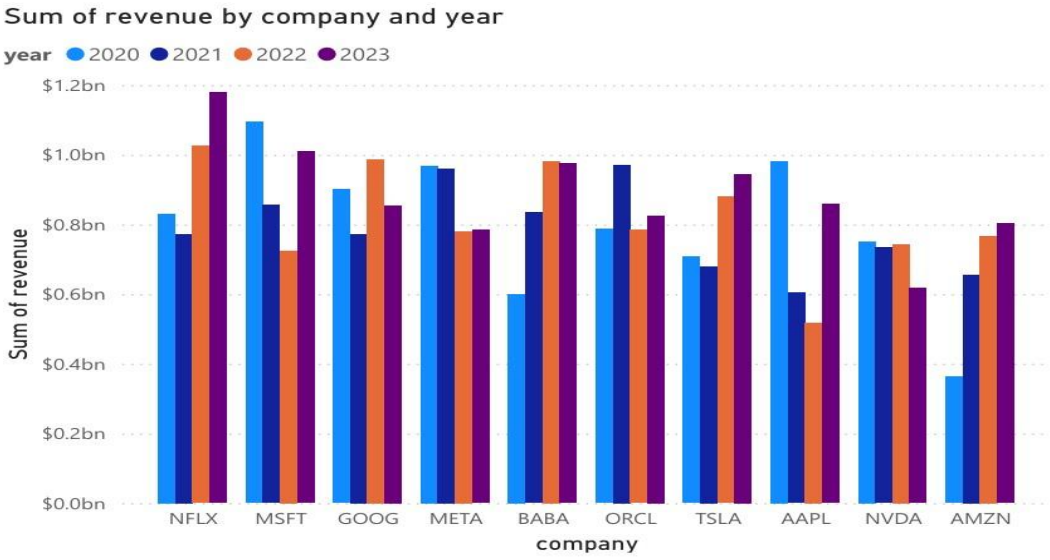
- **Insights:**
    - **Alibaba (BABA) and Amazon (AMZN)** consistently incur the highest operating expenses, surpassing $0.2T by 2022–2023.
    - Apple and Microsoft maintain relatively **lower and more stable OPEX**, reflecting efficient cost control.
    - Companies like Netflix, Nvidia, and Tesla keep OPEX significantly lower, but at the cost of slower scaling compared to the giants.
- **Bottlenecks:**
    - Lack of correlation shown between **OPEX and revenue growth** (are expenses driving proportional returns?).
    - No cost-to-revenue efficiency ratio is displayed.
- **Recommendations:**
    - Introduce **OPEX-to-Revenue Ratio dashboards** to measure efficiency.
    - Add AI-driven **predictive expense models** (using SageMaker) to forecast sustainability.



12. Revenue by Company and Year

Visualization: *Sum of Revenue by Company (2020–2023)*

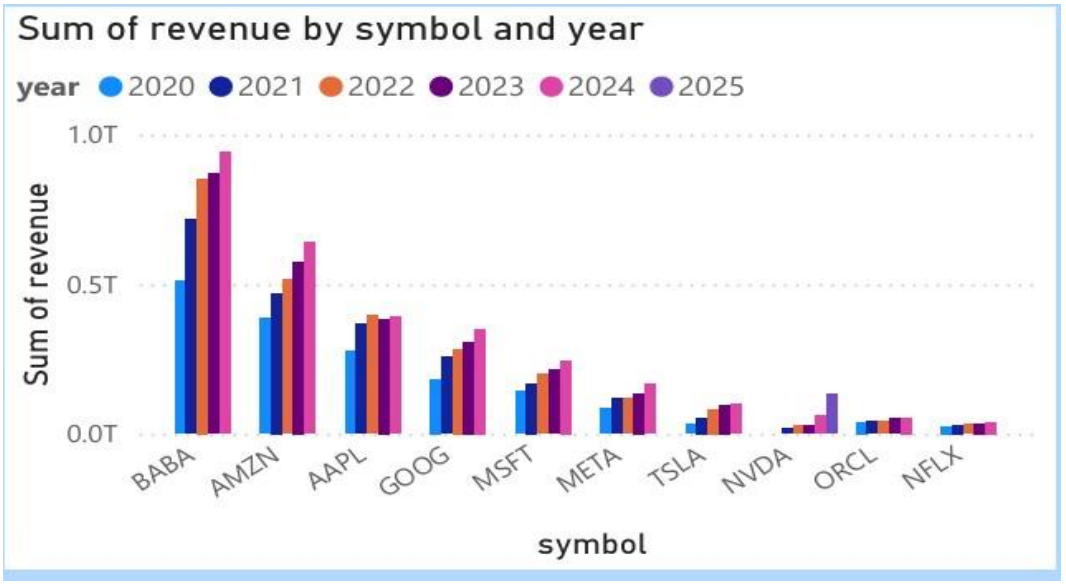
- **Insights:**
    - Netflix and Microsoft lead revenue growth post-2020, with Netflix reaching ~$1.2bn by 2023.
    - Amazon shows steady but slower revenue growth relative to peers.
    - Apple lags, with declining revenue in 2022 before recovery in 2023.
- **Bottlenecks:**
    - Data shows absolute revenue without comparison to market share.
    - Regional/geographical contributions to revenue are missing.
- **Recommendations:**
    - Benchmark **company revenue growth vs S&P 500 Tech Index**.
    - Add **segmentation dashboards** (e.g., regional revenue).



13. Revenue by Symbol (Extended Forecast)

Visualization: *Sum of Revenue by Symbol and Year (2020–2025)*

- **Insights:**
  - Alibaba and Amazon dominate revenue generation, expected to cross ~$1T by 2025.
  - Apple, Google, and Microsoft follow, showing stable, compounding growth.
  - Oracle and Netflix remain low-revenue outliers, consistent with their smaller market presence.
- **Bottlenecks:**
  - Projections rely on historical extrapolation without scenario testing.
  - Macro factors (inflation, FX risks) are not incorporated.
- **Recommendations:**
  - Introduce **CAGR projections** alongside base, optimistic, and pessimistic scenarios.
  - Enrich Athena data with **macroeconomic feeds** (oil, FX, interest rates).

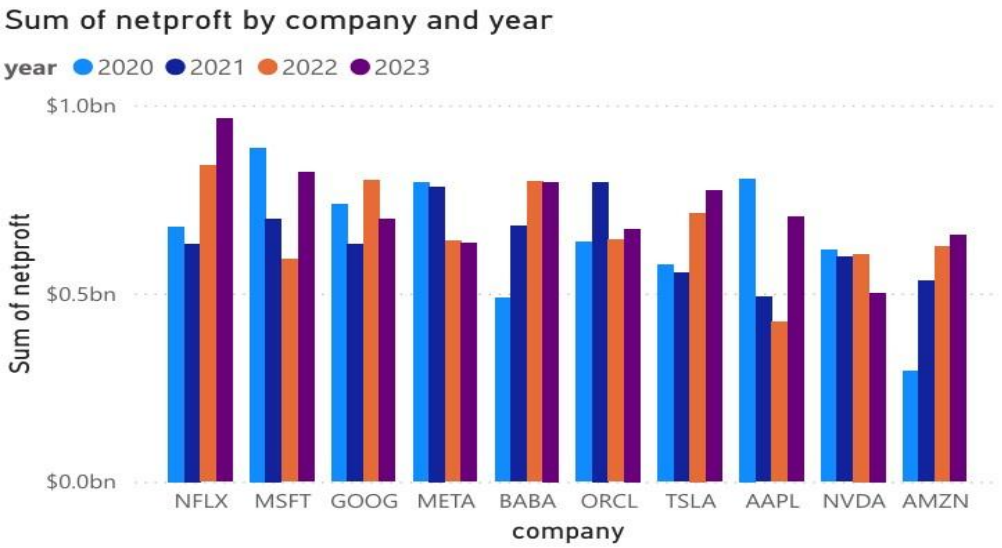


14. Net Profit by Company and Year

Visualization: *Sum of Net Profit by Company (2020–2023)*

- **Insights:**
    - Microsoft shows the strongest net profit performance, peaking close to $1bn in 2021.
    - Netflix also delivers strong net profit growth, outpacing Amazon and Tesla despite smaller revenue.
    - Apple struggles to keep pace, showing relatively flat net profits.
- **Bottlenecks:**
    - Visualization does not reflect **net profit margins** relative to revenues.
    - No view of net profit volatility (quarterly breakdown missing).
- **Recommendations:**
    - Integrate **Net Profit Margin KPIs** to highlight efficiency.

Apply **rolling averages** to smooth noise while exposing long-term profitability shifts.



Key Findings with Critical Insights

1. Efficiency Leaders
    - Microsoft demonstrates exceptional cost discipline and scalability, a clear signal that efficiency, not just scale, is the most sustainable driver of shareholder value.
    - Netflix, though smaller in scale, proves that niche players with leaner OPEX structures can deliver outsized profitability relative to their size. This is a reminder that innovation-driven efficiency can rival scale-driven growth.
    - Apple and Google maintain strong profit conversion ratios, reinforcing that mature tech firms can sustain long-term shareholder returns by balancing innovation with cost control.
2. High-Cost Growth Models
    - Amazon and Alibaba highlight the trade-off between aggressive market expansion and profitability. Their heavy OPEX investment reflects a "land grab" strategy, but at the cost of thinner margins. This is sustainable only if they continue dominating market share, otherwise, stakeholders face the risk of growth without proportional returns.
    - The board should critically assess whether scale at all costs remains a viable strategy in a slowing global economy, or if a pivot to operational efficiency is required.

3. Cautionary Signals
    - Apple's 2022 revenue decline challenges the assumption that established leaders are immune to growth shocks. It highlights the need for diversified revenue streams (e.g., services, ecosystem lock-in) to hedge against product-cycle downturns.
    - Tesla's volatility underscores the tension between disruptive innovation and financial stability. Its margins are highly sensitive to global supply chain disruptions and market sentiment, a signal for the board to treat Tesla as a high-risk, high-reward portfolio component, not a stable anchor.
    - Netflix and Alibaba's profitability pressures emphasize the risk of squeezed margins in competitive markets (streaming and e-commerce). Both require tighter cost controls and innovation in monetization to remain viable long-term.

4. Strategic Recommendations with Board-Level Reasoning

4.1 For the Board

- Shift focus from growth to efficiency: Microsoft's model demonstrates that efficient scaling delivers stronger long-term shareholder value than Amazon's reinvestment-heavy strategy.
- Balance innovation bets: Netflix and Nvidia show that lower-OPEX firms can scale with targeted innovation. Stakeholders should allocate funding here but demand disciplined financial governance.
- Rebalance portfolios: Increase weighting towards efficiency-driven firms (MSFT, GOOG, AAPL) while treating growth-heavy firms (AMZN, BABA) as long-term optionality bets, not core portfolio anchors.

5. **For Technical & Analytics Teams**

- Audit KPI accuracy rigorously: Misstated margins erode board confidence. Glue ETL and Athena KPI pipelines must be validated against external benchmarks.
- Model external shocks: Build inflation, FX volatility, and regulatory scenarios into Power BI. This allows the board to anticipate not just current performance, but resilience under stress.
- Automate intelligently: Airflow should not only automate refresh cycles but also create alerting triggers when KPIs fall outside thresholds — turning dashboards into an early warning system.

6. **For Analysts**

- Move beyond descriptive reporting to diagnostic and predictive analytics. Instead of just showing that Netflix's margins are shrinking, analysts should model scenarios: e.g., "What happens if subscriber churn rises by 5%?"
- Benchmark performance against industry medians and not just direct peers, to avoid overconfidence in relative gains.
- Deploy ML models (SageMaker) to forecast not only growth but also risk exposure, giving the board a more holistic view of uncertainty.

7. Executive Summary for the Board with Critical Implications

- Winners in Efficiency: Microsoft, Apple, and Google prove that disciplined cost management coupled with innovation creates stable, compounding shareholder value.
- Risk-Reward Companies: Tesla and Amazon highlight the strategic tension between disruption and stability — valuable for growth but risky as anchors.
- Caution Zone: Netflix and Alibaba are in competitive pressure zones; without restructuring and cost control, they risk sliding from "challenger" to "laggard."

Final Implication:

The board must decide whether to reward scale-first strategies (AMZN, BABA, TSLA) or pivot capital allocation towards efficiency-driven value creators (MSFT, GOOG, AAPL). The data shows that in uncertain economic environments, efficiency compounds, while scale without profitability erodes confidence.

Executive Summary

- Efficiency Leaders: Microsoft, Apple, and Google deliver consistent profitability and cost discipline.
- High-Cost Models: Amazon and Alibaba drive revenue growth at the cost of thin margins.
- Volatile Performers: Tesla and Netflix show inconsistent but high-potential returns.
- Lagging Signals: Apple shows stagnating profit growth, warranting renewed strategies.

Final Action Points:

1. Prioritize efficiency-driven firms for stable returns.
2. Validate KPI accuracy in the ETL layer.
3. Enhance Power BI dashboards with forecasts, variance analysis, and peer benchmarks.
4. Automate pipelines for agility in decision-making.