Data Analysis Final Project

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SSIS Pipeline

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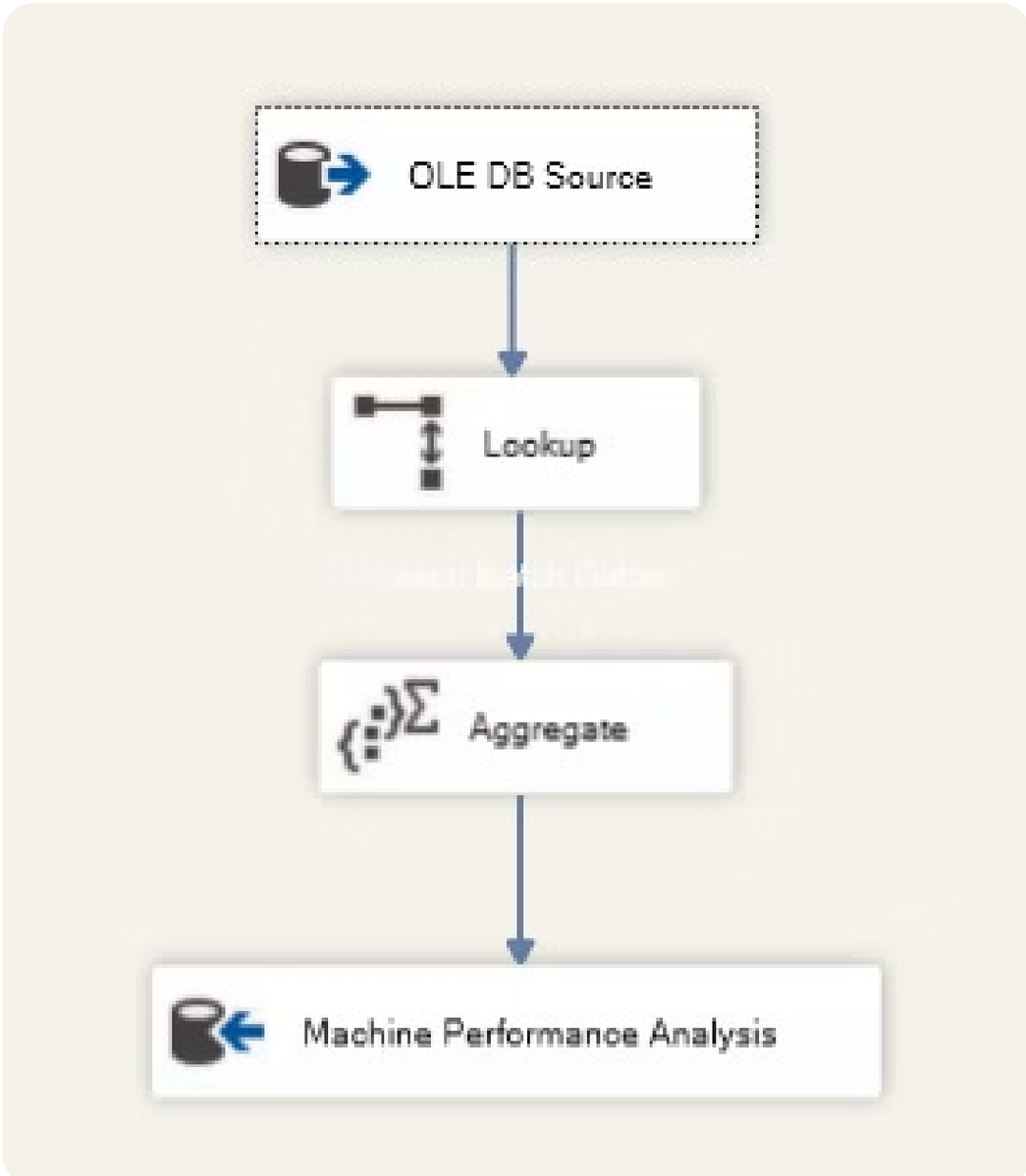
A- SSIS Pipeline – Machine Performance Analysis



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Stage 1 – Extract

Component: `OLE DB Source`

SQL:

```
SELECT
    m.MachineKey,
    m.MachineName,
    m.MachineType,
    m.Status,
    m.ServiceStartDate,
    m.DecommissionDate,
    m.VendorName,
    m.StoreKey,
    f.DateKey,
    f.CostAmount,
    f.CostType
FROM dbo.FactITMachine AS f
JOIN dbo.DimMachine AS m
    ON f.MachineKey = m.MachineKey;
```

Benefit:

- Brings together machine details and their associated cost records.
- Acts as the raw performance feed into the staging area.

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Stage 2 – Transform

2.1 Lookup – Machine Details from DimMachine

Component: `Lookup Transformation`

Lookup Table SQL:

```
SELECT
    MachineKey,
    MachineName,
    MachineType,
    Status,
    ServiceStartDate,
    DecommissionDate,
    VendorName,
    StoreKey
FROM dbo.DimMachine;
```

Match Column: `MachineKey` (from Fact → Dim)

Output Columns: `MachineName`, `MachineType`, `Status`, `ServiceStartDate`, `DecommissionDate`, `VendorName`, `StoreKey`

Benefit:

- Dynamically enriches the fact records with current descriptive attributes without hard-coding in the initial query.
- Makes it easier to handle late-arriving dimensions.

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2.2 Aggregate – Per Machine

Group By:

MachineType,
VendorName

Aggregations:

- SUM(CostAmount) → TotalCost
- COUNT(DISTINCT DateKey) → ActiveDaysReported
- MIN(ServiceStartDate) → FirstServiceDate
- MAX(DecommissionDate) → LastServiceDate

Benefit:

- Produces totals, counts, and operational activity metrics.
- Tracks first and last known lifecycle dates for each machine.

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Stage 3 – Load

Component: OLE DB Destination

Target Table: Machine Performance Analysis

Benefit: Stores enriched, aggregated KPIs for BI queries.

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Post-Load SQL Enhancements

After loading the aggregated machine performance data into the **Final.Machine_Performance_Analysis** table via SSIS, we add two calculated columns directly in SQL Server for easier use in Power BI and reporting.

Purpose:

- **ServicePeriod_Months**: Shows the total operational period in months for each machine.
- **AvgCostPerMonth**: Calculates cost efficiency by dividing total cost by operational period.

SQL Script:

```
-- Ensure the table is in the correct schema
ALTER SCHEMA Final TRANSFER dbo.Machine_Performance_Analysis;

-- Add ServicePeriod_Months column
ALTER TABLE [Final].[Machine_Performance_Analysis]
ADD [ServicePeriod_Months] INT;

-- Populate ServicePeriod_Months
UPDATE [Final].[Machine_Performance_Analysis]
SET [ServicePeriod_Months] = DATEDIFF(
    MONTH,
    FirstServiceDate,
    ISNULL(LastServiceDate, GETDATE())
);

-- Add AvgCostPerMonth column
ALTER TABLE [Final].[Machine_Performance_Analysis]
ADD [AvgCostPerMonth] INT;

-- Populate AvgCostPerMonth
UPDATE [Final].[Machine_Performance_Analysis]
SET [AvgCostPerMonth] = TotalCost / ServicePeriod_Months;
```

Benefits:

- Keeps the logic centralized in SQL so Power BI can simply consume pre-calculated metrics.
- Avoids repeated calculations in visuals, improving dashboard performance.
- Makes it easy to extend with more cost efficiency KPIs in the future.

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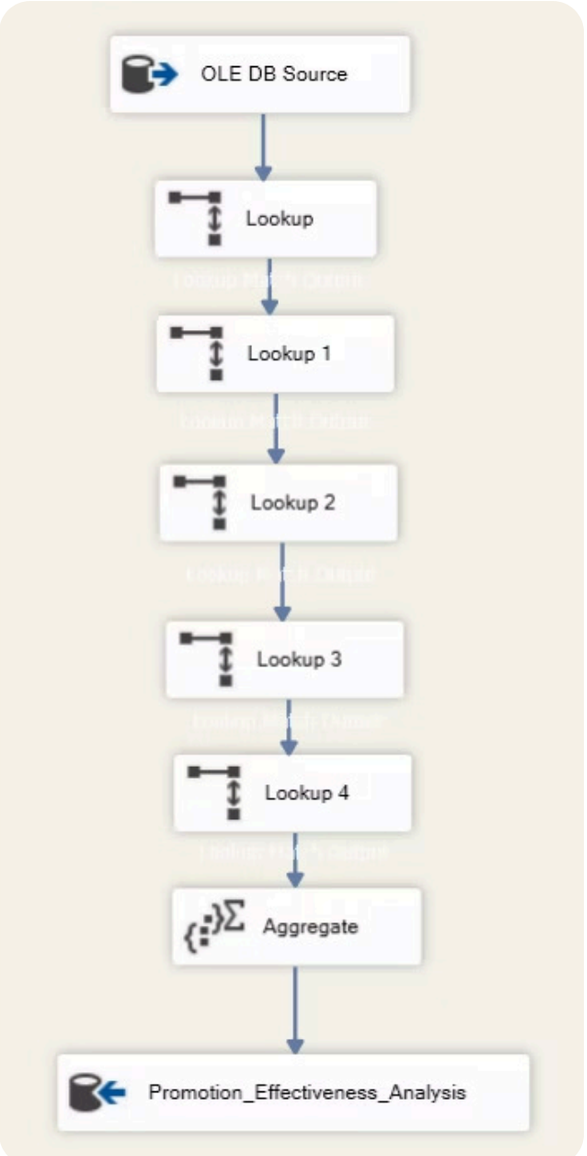
B- SSIS Pipeline – Promotion Effectiveness Analysis



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Stage 1 – Extract

Component: OLE DB Source

SQL:

```
SELECT
    s.SalesKey,
    s.DateKey,
    s.ProductKey,
    s.PromotionKey,
    s.UnitPrice,
    s.SalesQuantity,
    s.SalesAmount,
    s.StoreKey,
    p.PromotionName,
    p.PromotionType,
    p.StartDate,
    p.EndDate
FROM dbo.FactSales AS s
JOIN dbo.DimPromotion AS p
    ON s.PromotionKey = p.PromotionKey;
```

Benefit:

- Pulls all sales transactions that have associated promotions.
- Creates the base dataset containing promotion identifiers, product, store, and sales performance metrics.
- Acts as the **raw feed** into the pipeline for further enrichment

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Stage 2 – Transform

2.1 Lookup – Product Details from DimProduct

Lookup Table SQL:

```
SELECT
    ProductKey,
    ProductName,
    ProductSubcategoryKey
FROM dbo.DimProduct;
```

Match Column: ProductKey (Fact → Dim)
Output Columns: ProductName, ProductSubcategoryKey

Benefit:

- Adds product-level descriptive data without hardcoding in the initial extract.
- Ensures product names and hierarchy are up-to-date.

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2.2 Lookup – Product Subcategory

Lookup Table SQL:

```
SELECT
    ProductSubcategoryKey,
    ProductCategoryKey
FROM dbo.DimProductSubcategory;
```

Match Column: ProductSubcategoryKey (DimProduct → DimProductSubcategory)
Output Columns: ProductCategoryKey

Benefit:

- Bridges product data to the category level for broader aggregation.

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2.3 Lookup – Product Category

Lookup Table SQL:

```
SELECT
    ProductCategoryKey,
    ProductCategoryName
FROM dbo.DimProductCategory;
```

Match Column: ProductCategoryKey (DimProductSubcategory → DimProductCategory)
Output Columns: ProductCategoryName

Benefit:

- Enables category-level analysis of promotions.
- Useful for identifying which categories respond best to promotions.

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2.4 Lookup – Store Details

Lookup Table SQL:

```
SELECT
    StoreKey,
    StoreName,
    GeographyKey
FROM dbo.DimStore;
```

Match Column: StoreKey (Fact → DimStore)
Output Columns: StoreName, GeographyKey

Benefit:

- Enriches sales with store names and links to geography data.

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2.5 Lookup – Geography

Lookup Table SQL:

```
SELECT
    GeographyKey,
    CityName,
    RegionCountryName
FROM dbo.DimGeography;
```

Match Column: GeographyKey (DimStore → DimGeography)
Output Columns: CityName, RegionCountryName

Benefit:

- Provides regional and city-level data for geographic promotion effectiveness.

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2.6 Aggregate – Promotion Effectiveness

Group By:

- ProductName
- PromotionName
- PromotionType
- RegionCountryName

Aggregations:

- **SUM(SalesQuantity)** → TotalSalesQuantity
- **SUM(SalesAmount)** → TotalSalesAmount

Benefit:

- Produces concise, grouped promotion performance metrics.
- Supports comparisons across products, promotions, and regions.

Stage 3 – Load

Component: OLE DB Destination
Target Table: Promotion Effectivness Analysis

Benefit:

- Stores aggregated, enriched promotion metrics in a staging table.
- Ready for BI consumption without additional joins.

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Promotion_Effectiveness_Analysis Enhancements

Purpose:

- **SalePerUnit:** Calculates the sale price per unit for each promotion.
- **ProfitPerUnit:** Determines profit per unit by subtracting average cost from sale price.
- **Total_Profit:** Computes total profit for each promotion.

```
-- Add SalePerUnit column
ALTER TABLE [Final].[Promotion_Effectiveness_Analysis]
ADD [SalePerUnit] Decimal;

-- Populate SalePerUnit
UPDATE [Final].[Promotion_Effectiveness_Analysis]
SET [SalePerUnit] = SalesAmount / SalesQuantity;

-- Add ProfitPerUnit column
ALTER TABLE [Final].[Promotion_Effectiveness_Analysis]
ADD [ProfitPerUnit] Decimal;

-- Populate ProfitPerUnit using Avg.Cost_Per_Unit from Inventory_Status_Analysis
UPDATE t1
SET t1.[ProfitPerUnit] = t1.[SalePerUnit] - t2.[Avg.Cost_Per_Unit]
FROM [Final].[Promotion_Effectiveness_Analysis] AS t1
JOIN [Final].[Inventory_Status_Analysis] AS t2
    ON t1.ProductName = t2.ProductName;

-- Add Total_Profit column
ALTER TABLE [Final].[Promotion_Effectiveness_Analysis]
ADD [Total_Profit] Decimal;

-- Populate Total_Profit
UPDATE [Final].[Promotion_Effectiveness_Analysis]
SET [Total_Profit] = [ProfitPerUnit] * [SalesQuantity];
```

Benefits:

- Provides pre-calculated metrics for Power BI and reporting.
- Centralizes all profit-related calculations in SQL.
- Reduces repetitive calculations in dashboards and visuals.
- Simplifies future extensions for more KPIs or profit analysis.

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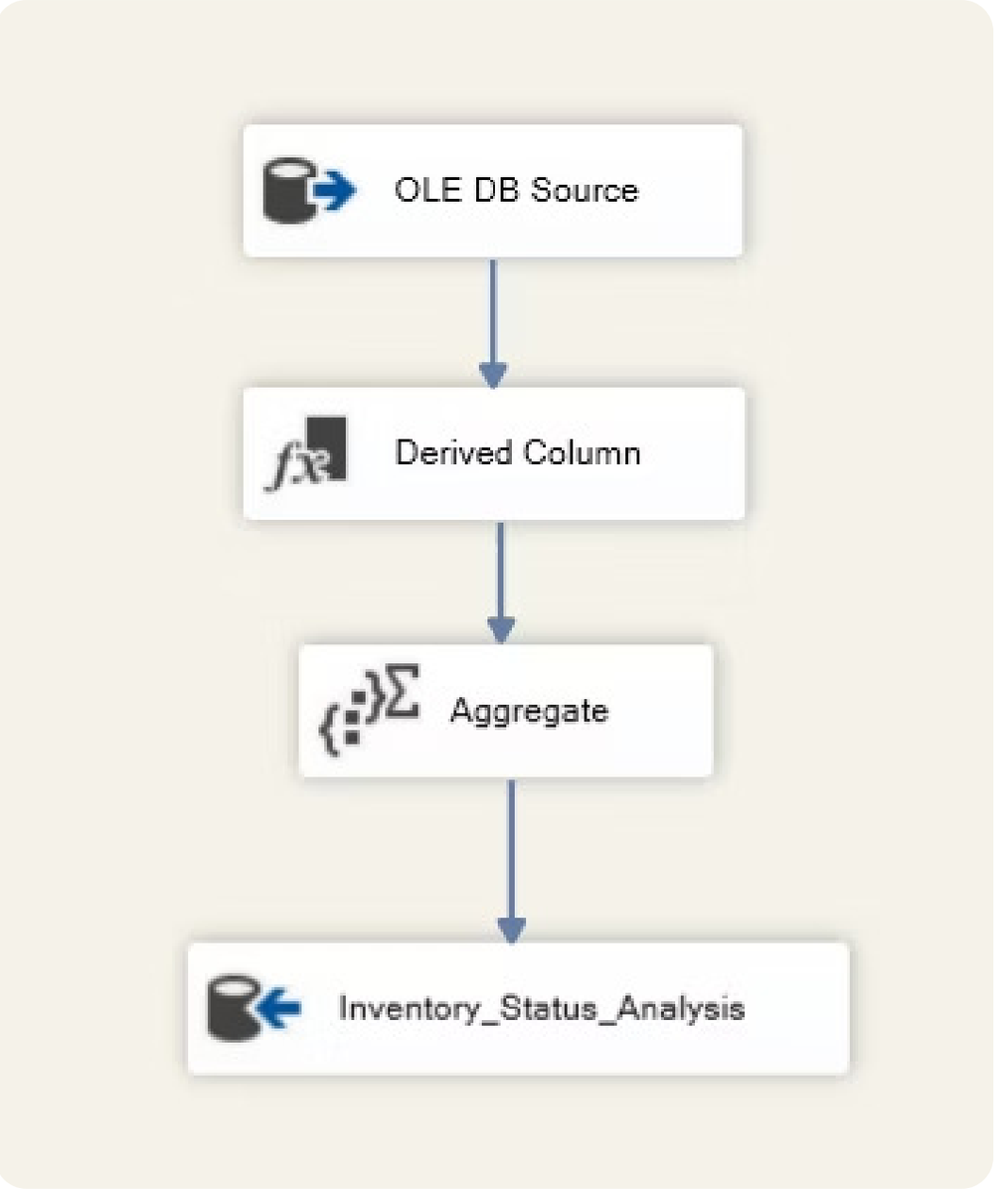
C- SSIS Pipeline – Inventory Status Analysis



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Stage 1 – Extract

Component: OLE DB Source

SQL:

```
SELECT
    i.DateKey,
    d.FullDateLabel,
    d.CalendarYear,
    d.CalendarMonthLabel,
    p.ProductName,
    pc.ProductCategoryName,
    ps.ProductSubcategoryName,
    i.InventoryKey,
    i.DaysInStock,
    i.MaxDayInStock,
    i.MinDayInStock,
    i.OnHandQuantity,
    i.OnOrderQuantity,
    i.Aging,
    i.UnitCost,
    (i.UnitCost * i.OnHandQuantity) AS TotalCost
FROM FactInventory AS i
JOIN dbo.DimProduct AS p
    ON i.ProductKey = p.ProductKey
JOIN dbo.DimProductSubcategory AS ps
    ON p.ProductSubcategoryKey = ps.ProductSubcategoryKey
JOIN dbo.DimProductCategory AS pc
    ON ps.ProductCategoryKey = pc.ProductCategoryKey
JOIN dbo.DimDate AS d
    ON i.DateKey = d.DateKey;
```

Benefit:

- Combines inventory measures with product hierarchy and date dimensions.
- Provides a complete view of stock levels, movement, and valuation.
- Forms the raw dataset for analysis.

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Stage 2 – Transform

2.1 Derived Column – InventoryCost

Expression:

```
InventoryCost = UnitCost * OnHandQuantity
```

Benefit:

- Calculates current value of on-hand stock.
- Ensures this KPI is ready for aggregation without recalculating downstream.

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2.2 Aggregate – Inventory Status Summary

Group By:

- ProductName
- ProductCategoryName
- ProductSubcategoryName

Aggregations:

- **SUM(OnHandQuantity)** → TotalOnHandQuantity
- **MAX(MaxDayInStock)** → MaxDaysInStock
- **MIN(MinDayInStock)** → MinDaysInStock
- **SUM(OnOrderQuantity)** → TotalOnOrderQuantity
- **SUM(InventoryCost)** → TotalInventoryCost
- **SUM(TotalCost)** → TotalCostValue

Benefit:

- Produces high-level inventory KPIs per product and category.
- Allows monitoring of stock levels, efficiency, and value at different hierarchy levels.

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Stage 3 – Load

Component: OLE DB Destination

Target Table: Inventory Status Analysis

Benefit:

- Stores summarized inventory metrics in a staging table for reporting and dashboarding.
- Enables quick retrieval for operational and management reports without re-running heavy joins.

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Inventory_Status_Analysis Enhancements

Purpose:

- **Avg.Cost_Per_Unit:** Measures the average cost per unit of inventory for better profit calculations.

```
-- Add Avg.Cost_Per_Unit column
ALTER TABLE [Final].[Inventory_Status_Analysis]
ADD [Avg.Cost_Per_Unit] INT;

-- Populate Avg.Cost_Per_Unit
UPDATE [Final].[Inventory_Status_Analysis]
SET [Avg.Cost_Per_Unit] = TotalCost / OnHandQuantity;
```

Benefits:

- Provides a ready-to-use metric for profit and margin calculations.
- Centralizes logic in SQL to simplify reporting in Power BI.
- Reduces computation in visuals, improving report efficiency.

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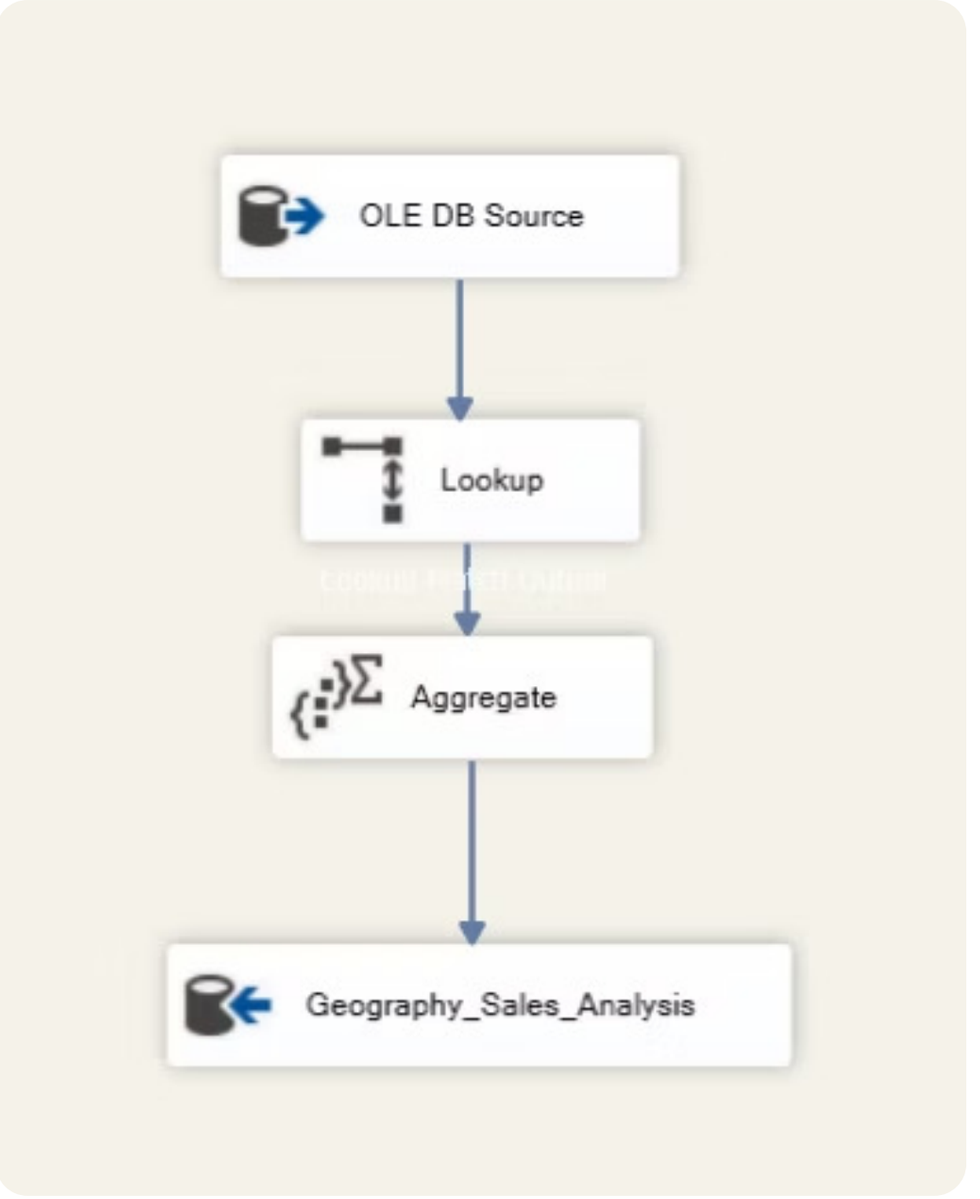
D- SSIS Pipeline – Geography Sales Analysis



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Stage 1 – Extract

Component: OLE DB Source

SQL:

```
SELECT
    fs.SalesKey,
    fs.DateKey,
    fs.StoreKey,
    s.StoreName,
    fs.ProductKey,
    fs.SalesQuantity,
    fs.SalesAmount,
    g.RegionCountryName,
    g.StateProvinceName,
    g.CityName,
    d.CalendarYear,
    d.CalendarMonth
FROM FactSales AS fs
JOIN dbo.DimStore AS s
    ON fs.StoreKey = s.StoreKey
JOIN dbo.DimGeography AS g
    ON s.GeographyKey = g.GeographyKey
JOIN dbo.DimDate AS d
    ON fs.DateKey = d.DateKey;
```

Benefit:

- Combines sales transactions with store details, geography, and date attributes.
- Creates the base dataset for regional sales analysis.

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Stage 2 – Transform

2.1 Lookup – Product Details (DimProduct)

Lookup Table SQL:

```
SELECT
    ProductKey,
    ProductName,
    ProductSubcategoryKey,
    BrandName
FROM dbo.DimProduct;
```

Match Column: `ProductKey` (FactSales → DimProduct)
Output Columns: `ProductName`, `ProductSubcategoryKey`, `BrandName`

Benefit:

- Enriches sales records with descriptive product attributes.
- Supports brand-level or subcategory-level reporting.

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2.2 Aggregate – Sales by Geography

Group By:

- RegionCountryName
- StateProvinceName
- CityName

Aggregations:

- **SUM(SalesQuantity)** → TotalSalesQuantity
- **SUM(SalesAmount)** → TotalSalesAmount

Benefit:

- Produces a geographic sales summary for trend analysis.
- Enables performance comparisons across regions and cities.

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Stage 3 – Load

Component: OLE DB Destination

Target Table: Geography Sales Analysis

Benefit:

- Stores aggregated, geography-based sales metrics for BI dashboards.
- Improves query performance by pre-summarizing data.

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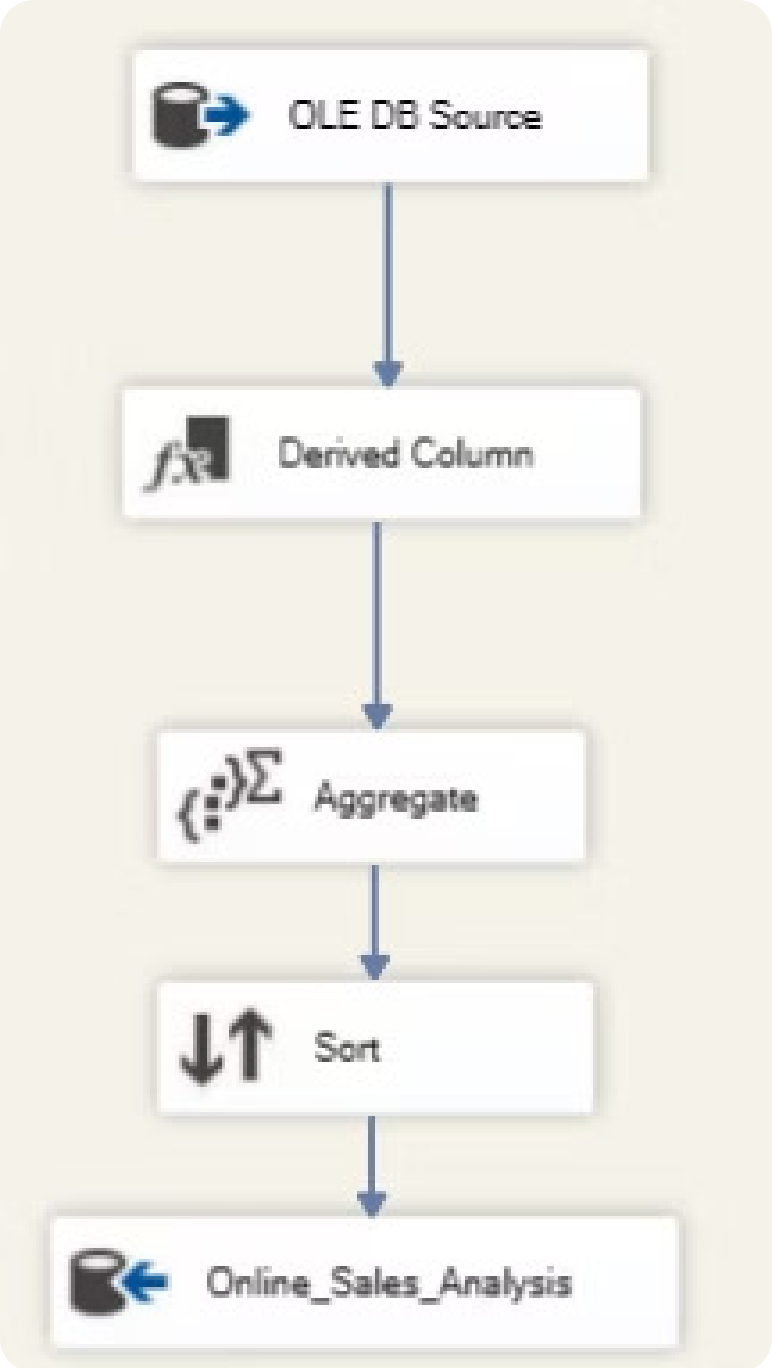
E- SSIS Pipeline – Online Sales Analysis



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Stage 1 – Extract

Component: OLE DB Source

SQL:

```
SELECT
fs.OnlineSalesKey,g.RegionCountryName,g.ContinentName,
    fs.SalesOrderNumber,
    fs.DateKey,
    d.CalendarYear,
    d.CalendarMonthLabel,
    fs.CustomerKey,
   c.CustomerType,
    c.FirstName,
    fs.SalesQuantity,
   fs.ReturnQuantity,
    fs.SalesAmount,
    fs.DiscountAmount,
    fs.ReturnAmount,
    fs.TotalCost,
    fs.UnitCost,
    fs.UnitPrice,
    c.DateFirstPurchase
 FROM FactOnlineSales AS fs
 JOIN dbo.DimDate AS d ON fs.DateKey = d.DateKey
 JOIN dbo.DimCustomer AS c ON fs.CustomerKey = c.CustomerKey
 JOIN dbo.DimGeography g
 ON c.GeographyKey=g.GeographyKey;
```

Benefit:

- Combines online sales with customer, geography, and date details.
- Supports regional sales and trend analysis.

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Stage 2 – Transform

2.1 Derived Columns – Sales Metrics

Expressions:

```
TotalQuantity = SalesQuantity - ReturnQuantity
NetRevenue    = SalesAmount - DiscountAmount - ReturnAmount
NetProfit     = SalesAmount - DiscountAmount - ReturnAmount - TotalCost
```

Benefit:

- Provides net sales, revenue, and profit.
- Forms the basis for KPIs like AOV and margin analysis.

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2.2 Aggregate – Sales Summary

Group By:

- CalendarYear
- CalendarMonthLabel
- DateKey
- ContinentName
- CustomerType
- OnlineSalesKey
- CustomerKey

Aggregations:

- **SUM(NetProfit)** → NetProfit
- **COUNT(TotalQuantity)** → Total Quantity
- **COUNT DISTINCT(SalesOrderNumber)** → OrderCount
- **SUM(NetRevenue)** → TotalSpend
- **SUM(SalesAmount)** → TotalSales
- **SUM(DiscountAmount)** → DiscountAmount
- **MAX(DateFirstPurchase)** → DateFirstPurchase
- **SUM(ReturnAmount)** → ReturnAmount

Benefit:

- Produces a consolidated online sales dataset across time, geography, and customers.
- Supports KPIs like AOV (Average Order Value), net profit.
- Enables performance tracking at monthly, yearly, and customer levels.

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2.3 Sort

Order By:

- DateKey (Descending)

Benefit:

- Ensures the dataset is ordered by the latest dates first.
- Prioritizes recent transactions for up-to-date reporting and analysis.

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Stage 3 – Load

Component: OLE DB Destination

Target Table: Online_Sales_Analysis

Benefit:

- Stores aggregated online sales metrics for BI dashboards.
- Improves reporting speed by pre-summarizing data.

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Data Model Relationships

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This data model connects different parts of the business in a way that makes analysis easier and more complete. Each table links to others to provide a full picture of operations, customers, and performance.

- **Geography ↔️ Sales**
  - Sales data is tied to geography (country, state, city).
  - This allows us to see *where* products are selling best and compare performance across regions.
- **Inventory ↔️ Sales**
  - Inventory is connected to sales through product keys.
  - This relationship helps track stock levels against demand and measure costs versus revenue.
- **Machine Performance ↔️ Time**
  - Machine usage and costs are joined with dates.
  - This makes it possible to compare machine efficiency with sales performance over the same periods.
- **Promotions ↔️ Sales & Geography**
  - Promotions are linked to both sales and regions.
  - This shows the impact of campaigns on revenue and whether results vary by location.

Why These Relationships Matter

By linking these tables, the model provides:

- A complete view of sales, operations, and campaigns in one place.
- The ability to analyse performance by time, location, and activity.
- Strong foundations for building KPIs and dashboards that support decision-making.

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Power BI Dashboard

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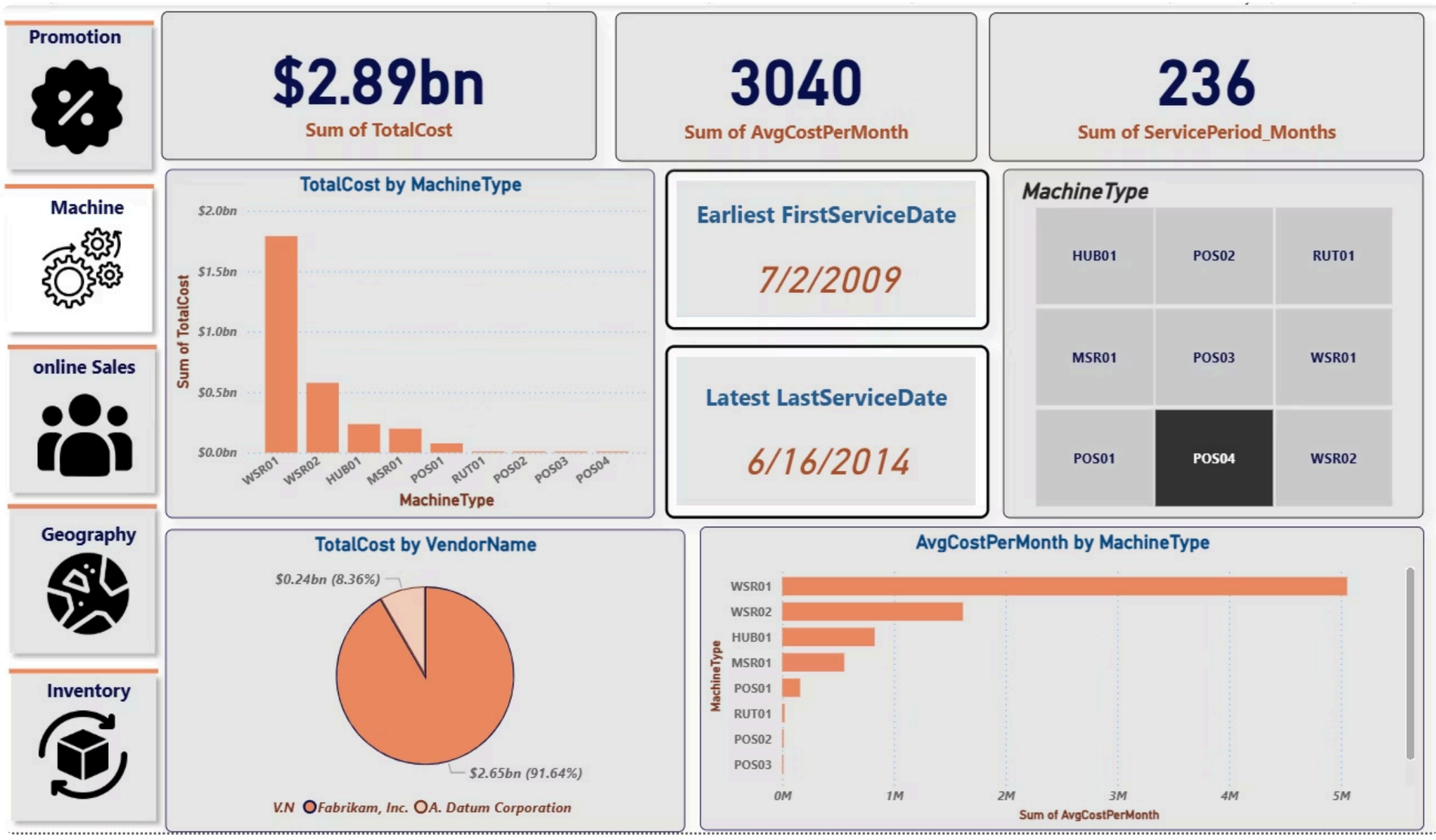
A- Power BI Dashboard for Machine Performance Analysis



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Power BI Dashboard for Machine Service Analysis

1. Top KPIs (Cards)

- **Sum of TotalCost**: $2.89bn
- **Sum of AvgCostPerMonth**: 3040
- **Sum of ServicePeriod_Months**: 236
- **Earliest FirstServiceDate**: 7/2/2009
- **Latest LastServiceDate**: 6/16/2014

Insights:
The total cost of machine services over the period was $2.89 billion, with an average monthly cost of 3040 units across 236 months of service. The service history spans nearly 5 years from July 2009 to June 2014.

Benefit:
Provides a quick overview of the total investment and service duration for machines.

Recommendations:

- Track these KPIs quarterly to monitor cost efficiency.
- Compare AvgCostPerMonth across machine types to identify cost-saving opportunities.

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2. Cost Distribution by Machine Type (Bar Chart)

Data:

- HUB01, POS02, RUT01, MSR01, POS03, WSR01, POS01, POS04, WSR02

Insights:
The TotalCost is distributed across various machine types, with values ranging between $50.00m and $52.00m.

Benefit:
Highlights which machine types contribute most to the total cost.

Recommendations:

- Investigate why certain machine types (e.g., HUB01, POS02) may have higher costs.
- Optimize maintenance schedules for high-cost machines to reduce expenses.

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3. Vendor Cost Distribution (Pie Chart)

- **Primary Vendors (Fabrikam & A. Datum): 91.64%**
- **Other Vendors: 8.36%**

Insights:

- The business is highly dependent on two key vendors, which could pose a risk if supply chain issues arise.
- The small share of other vendors suggests limited competition.

Recommendations:

- **Introduce competitive bidding** to reduce costs.
- **Monitor vendor performance metrics** (e.g., downtime, repair speed).
- **Develop contingency plans** in case of vendor disruptions

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4. AvgCostPerMonth by Machine Type (Bar Chart)

Data:

- WSB01, WSR02, HUB01, MSR01, POS01, RUT01, POS02, POS03
- AvgCostPerMonth ranges from 0M to 5M.

Insights:
Some machine types (e.g., WSB01, WSR02) have higher average monthly costs compared to others.

Benefit:
Helps pinpoint which machine types are the most expensive to maintain monthly.

Recommendations:

- Focus on reducing monthly costs for high-expense machines (e.g., WSB01).
- Standardize maintenance processes to lower AvgCostPerMonth across all types.

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5. Service Timeline (Timeline Card)

Data:

- **FirstServiceDate:** 7/2/2009
- **LastServiceDate:** 6/16/2014

Insights:
The service period lasted approximately 5 years, indicating a long-term investment in machine maintenance.

Benefit:
Provides context for the duration of service activities and associated costs.

Recommendations:

- Analyze if the service period aligns with the expected lifespan of the machines.
- Plan for future upgrades or replacements based on this timeline.

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Overall Recommendations

1. **Cost Optimization**: Focus on reducing AvgCostPerMonth for high-expense machine types (e.g., WSB01, WSR02).
2. **Inventory Management**: Address the disproportionate inventory costs (91.64%) by improving turnover or reducing excess stock.
3. **Machine Maintenance**: Standardize maintenance processes to lower costs and extend machine lifespans.
4. **Sales Growth**: Explore strategies to increase online sales, which currently account for only 8.36% of costs.
5. **Timeline Analysis**: Use the service timeline to plan future investments and replacements proactively.

Final Note:
This dashboard highlights significant opportunities to optimize costs and improve efficiency in machine services. By focusing on high-cost areas and balancing inventory with sales growth, the business can achieve better financial performance.

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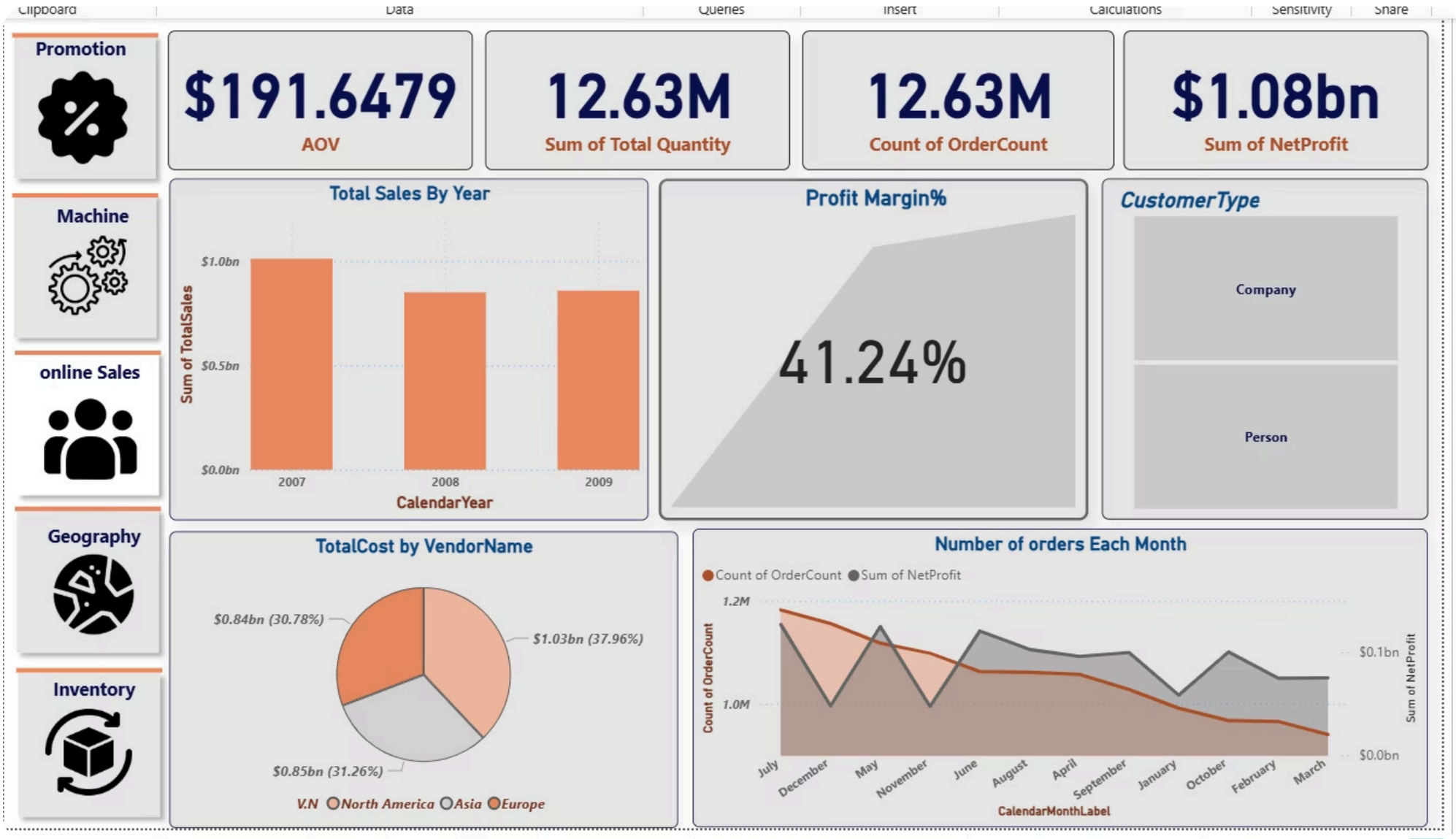
B- Power BI Dashboard for Online Sales Analysis



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Power BI Dashboard for Online Sales Analysis

1. Top KPIs (Cards) – AOV, Total Quantity, Order Count, Net Profit, Profit Margin

Insights:

- **Total Orders** = 12.63M
- **Net Profit** = $1.08bn
- **AOV** = $191.65
- **Profit Margin** = 41% — The business is overall profitable with strong efficiency.

Benefit:

Provides a quick snapshot of business health and profitability.

Recommendations:

- Track these KPIs as monthly/quarterly benchmarks.
- Set a profit margin target (42–45%) to ensure profitability discipline.
- Use AOV growth as a health indicator across Company vs Person customers.

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2. Yearly Trends (Bar Chart – Total Sales by Year)

Insights:

- **2007:** Strongest year (~$1bn sales, ~37% margin).
- **2008:** Sales/orders declined, but margin rose (~41%).
- **2009:** Stable compared to 2008 but below 2007 peak.

→ Growth peaked early, then slowed/stagnated. Margins improved despite fewer orders (likely fewer discounts or leaner operations).

Benefit:

Highlights long-term performance trends and signals sustainability issues.

Recommendations:

- Investigate what drove 2007 success (product mix, campaigns).
- Relaunch or adapt those drivers to reignite growth.
- Focus on balancing volume recovery with margin protection.

3. Customer Type Split (Filter Panel)

Company Customers:

- **Orders** = ~2.83M
- **Net Profit** = $241.7M
- **AOV** = $218.64 (higher than Persons)
- **Profit Margin** = 44.55% (most efficient)
- **Region:** Dominated by Europe (51.6%)

Person Customers:

- **Orders** = ~9.8M
- **Net Profit** = $834.1M
- **AOV** = $183.84 (lower)
- **Profit Margin** = ~41%
- **Spread evenly:** Asia (33%), NA (31%), EU (36%)

Insights:

- **Companies:** Fewer transactions but high-value, high-margin.
- **Persons:** Mass-market driver, but less efficient.

Benefit:

Clarifies efficiency differences between customer segments.

Recommendations:

- **Companies:** Expand B2B programs (bulk contracts, tailored offers), focus on Europe.
- **Persons:** Boost retention with loyalty/referral programs, run targeted promotions in Asia & NA.

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4. Geographic Performance (Pie Chart – Total Sales by Continent)

Insights:

- **North America** = $1.03bn (38%)
- **Asia** = $0.85bn (31%)
- **Europe** = $0.84bn (31%)

→ Balanced performance across regions, with NA slightly ahead.

Benefit:

Identifies regional balance and growth opportunities.

Recommendations:

- Defend share in North America through strong marketing presence.
- Push localized strategies in Asia & Europe (e.g., regional campaigns, tailored bundles).

5. Monthly Trends (Line Chart – Orders vs Net Profit)

Insights:

- Orders peak in **June–July**, then decline steadily to year-end.
- Profit does not always move with orders (margin differences).
- Some months: **Orders ↑ but Profit ↓** → possible discounts or higher returns.

Benefit:

Helps align promotions and identify seasonality gaps.

Recommendations:

- Align promotions with peak months but protect margins (bundle offers > deep discounts).
- Launch off-season campaigns (Feb–Mar) to smooth demand.
- Closely monitor returns to ensure profit grows alongside orders.

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6. Profitability Efficiency (KPI Card – Profit Margin %)

Insights:

- **Overall Profit Margin** = ~41%.
- **Companies** = 44.5% (more profitable per order).
- **Persons** = ~41% (volume-driven, lower AOV).

Benefit:

Tracks profitability discipline and detects margin risks.

Recommendations:

- Track Profit Margin % monthly with Orders & Net Profit.
- Maintain margin discipline → set floor target (42–45%).
- Use margin trends to spot issues in discounting or returns.

Overall Recommendations

- Double down on **B2B expansion** – high-value, profitable segment.
- Improve **loyalty and retention** programs for Person customers, with region-specific campaigns.
- Revisit **2007 product/marketing drivers** to replicate past growth success.
- Address **seasonality** with planned off-season promotions.
- Protect margins by **avoiding over-discounting** and monitoring returns.

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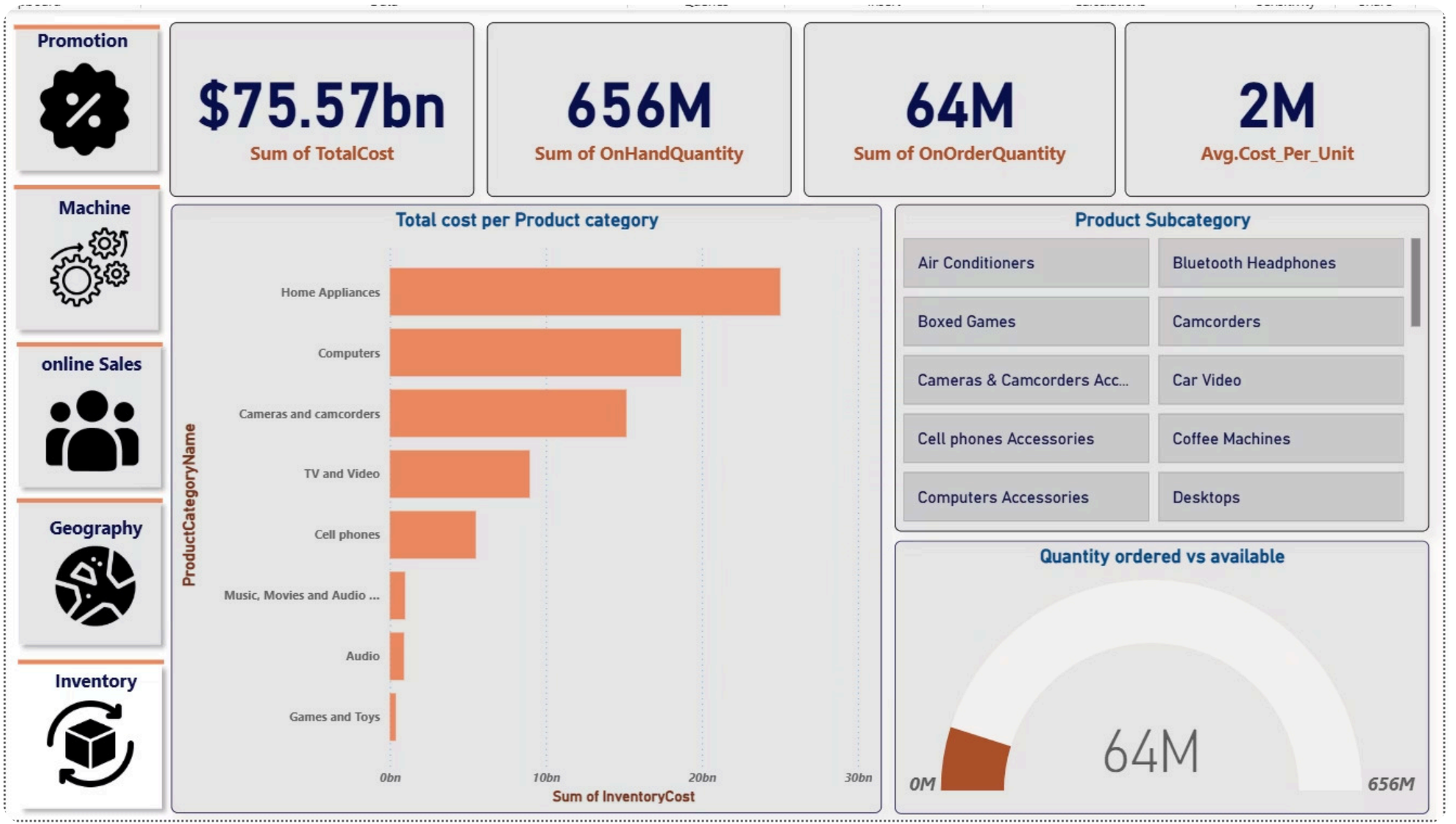
C- Power BI Dashboard for Inventory Status Analysis



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Category-Level Insights

1. **Home Appliances** → The largest share, nearly **2bn** in tied-up cost.
   - Represents the biggest financial exposure.
   - Likely high-value items (washers, dryers, refrigerators).
2. **Computers** → Second, slightly below **1.5bn**.
   - Another major cost-heavy category.
   - Laptops/desktops often have shorter product life cycles, so overstock is riskier.
3. **Cameras & Camcorders** → Around **1.2bn**.
   - Still significant, but consumer demand might be declining compared to smartphones.
4. **TV & Video** and **Cell Phones** → Moderate levels.
   - Together make up a large chunk of cost exposure too.
5. **Audio, Music/Movies, Games/Toys** → Very small share.
   - These categories tie up little financial cost but may have high stock units.
   - Useful for driving sales promotions since they don't risk much capital.

Quantity Ordered vs Available

- **Available (On Hand):** 53M
- **On Order:** 5M

📌 Interpretation:

- On-order stock = **9% of current stock** → This is relatively high if demand is not accelerating.
- Risk of **overstocking** exists if demand does not match supply, especially in high-value categories like *Home Appliances* and *Computers*.

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Product Subcategories

This shows the granularity (Air Conditioners, Desktops, Coffee Machines, Cameras, etc.).

- These can be used to **drill down** and identify which subcategories drive the majority of the **5.7bn**.
- For example, *Desktops* in Computers may tie up more cost than *Accessories*, but *Accessories* could hold more stock units.

Key Observations & Risks

1. **Capital Risk:**
   - Over **65%+ of cost** is locked in **Home Appliances + Computers**.
   - Any slowdown in sales there will severely affect cash flow.
2. **Overstocking:**
   - With 53M already on hand and 5M incoming, supply may exceed demand unless carefully monitored.
3. **Category Diversification:**
   - Some categories (Games, Music, Audio) hold little cost, but may represent opportunities for promotional campaigns to balance stock turnover.
4. **Product Lifecycle Risk:**
   - Tech-related categories (*Computers, Cameras, TVs, Cell Phones*) depreciate quickly.
   - Overstocking here is much riskier than in durable goods (e.g., Home Appliances).

✅ **Recommendation Path Forward**

- Apply **ABC analysis:**
  - A = High-cost categories (Home Appliances, Computers) → Strict demand planning.
  - B = Moderate (TV, Cell Phones).
  - C = Low (Games, Audio) → Could be used for volume promotions.
- Review **order policies** for Computers & Appliances (are new orders justified with current high stock?).
- Monitor **aging stock** in fast-moving tech categories to prevent obsolescence.

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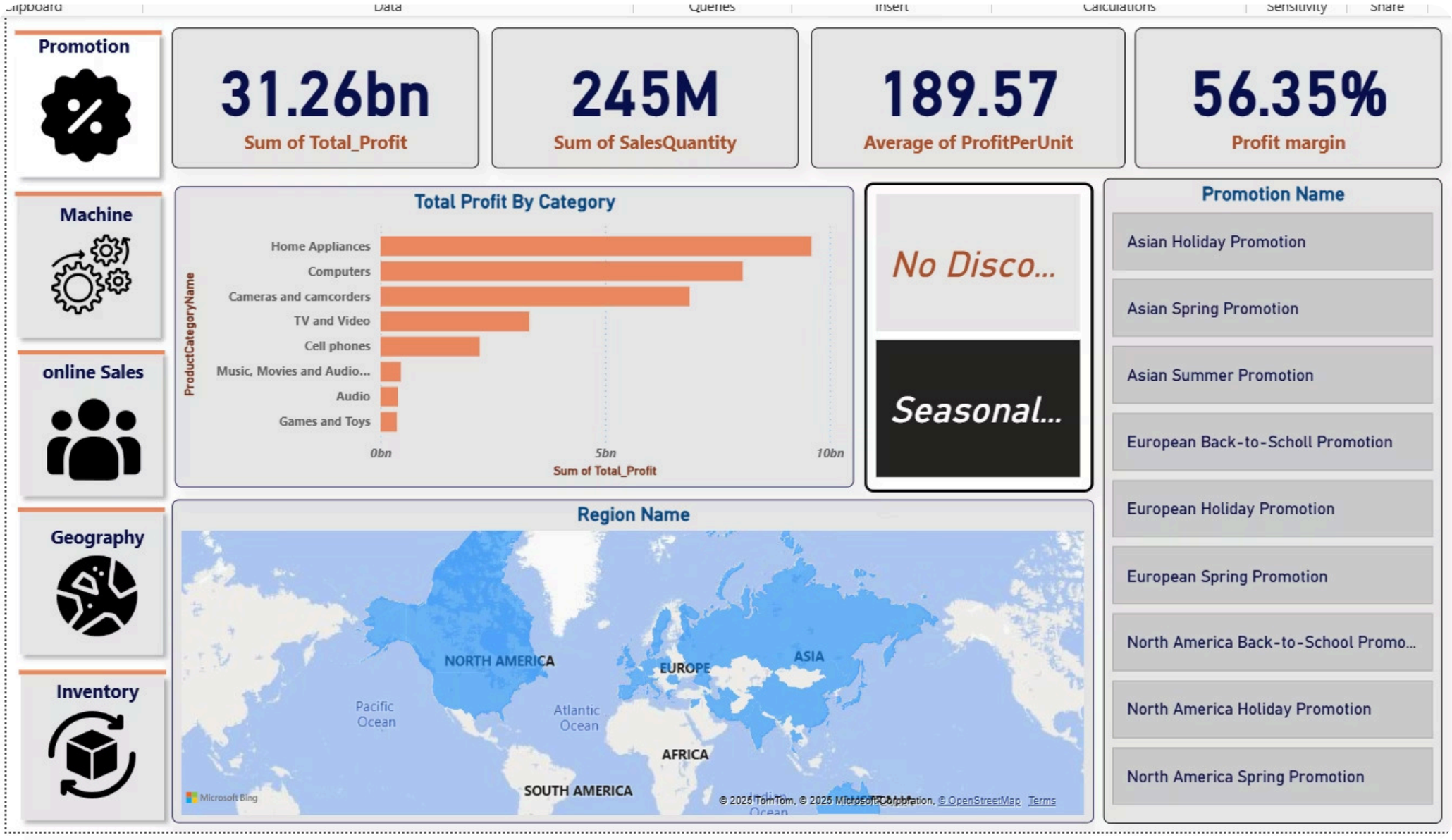
D- Power BI Dashboard for Promotion Effectiveness Analysis



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Top KPIs

1. **Sum of Total Profit: 31.26bn**
   - This is the aggregate profit generated.
   - A very high-level indicator of the company's success.
   - Must be tracked alongside cost and revenue for deeper context.
2. **Sum of Sales Quantity: 245M**
   - Total units sold across all regions and categories.
   - Shows market volume penetration.
   - When compared with profit, we can understand profitability per unit.
3. **Average Profit per Unit: 189.57**
   - On average, each unit sold brings in ~190 profit.
   - Indicates product mix profitability. High value means either premium pricing or strong margins.
4. **Profit Margin: 56.35%**
   - Extremely strong profit margin (more than half of sales price is profit).
   - Suggests either cost efficiency, premium products, or both.

1. **AvgCostPerMonth by MachineType (Bar Chart)**
   - Categories driving most profit:
     - **Home Appliances** (highest)
     - **Computers**
     - **Cameras & Camcorders**
   - Lower categories:
     - Games & Toys, Audio, Music/Movies – negligible contribution.
   - Insight: The business is heavily dependent on **electronics & appliances**.
     → Recommendation: Diversify categories to reduce reliance on top 2–3 product lines.
2. **Promotion Section (Right Side)**
   - Types of promotions displayed (Asian Holiday, European Spring, North America Holiday, etc.).
   - Some text cut off: *"No Disco..." (probably "No Discount") and "Seasonal..."*.
   - Insight: Promotions are tracked by region & seasonality.
     → Recommendation: Need performance comparison by promotion type (not visible here).

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Areas for Improvement

1. **Promotion Effectiveness Missing**
   - The dashboard shows promotion types but not their **impact on profit/sales**.
   - Add a KPI like "Profit Uplift from Promotions."
2. **Category Dependency**
   - Too much reliance on Home Appliances & Computers.
   - Need category-wise profit margins and growth trend analysis.
3. **Regional Insights**
   - Currently shows only a heatmap.
   - Better to add regional KPIs (e.g., Profit by Region, Sales Quantity by Region).
4. **Truncated Labels**
   - “No Disco…” and “Seasonal…” are incomplete → reduces readability.
5. **Trend Over Time Missing**
   - No time-series analysis (monthly/quarterly profit trends).
   - Without this, it's hard to see whether profits are growing, stable, or declining.

📊 Overall Analysis

This dashboard gives a **high-level executive summary**:

- Very profitable business (31.26bn profit, 56.35% margin).
- Strong reliance on **Home Appliances, Computers, and Cameras**.
- **Asia, Europe, and North America** drive most sales.
- Promotions and seasonality are important, but impact analysis is missing.
- Opportunities exist in **emerging markets** and **underperforming categories**.

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