

# AdventureWorks2014 – BI Flow

## Overview

This implementation follows a classical **Data Warehouse lifecycle**, starting from system setup and source system preparation, moving through ETL processes, semantic modeling with SSAS Tabular, and ending with analytical reporting in Power BI. The AdventureWorks2014 database is used as the operational source system, and the final output is an interactive BI dashboard answering key business questions related to sales performance.

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## 0. Software and Server Setup

The initial step focused on preparing a development environment

- **SQL Server 2025** was installed with the **Analysis Services (SSAS)** feature enabled, allowing both relational database management and tabular analytical modeling.
- **Visual Studio** was installed as the primary development IDE.
- **SSIS and SSAS extensions** were added to Visual Studio to support:
  - SSIS package development for ETL pipelines
  - SSAS Tabular project creation and deployment

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## 1. Creating Database Objects

### a. Source Database

- The AdventureWorks2014 database was restored in SQL Server Management Studio (SSMS) and used as the transactional source system.

### b. Staging Database

- SQL script 1\_AWN\_STG\_Demo was executed to create schemas, tables, and views in the staging database.

### c. Data Warehouse Schema

- SQL script 2\_AWN\_DW\_Demo was executed up to line 326 to create the core data warehouse schema.

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## 2. ETL: Source to Staging

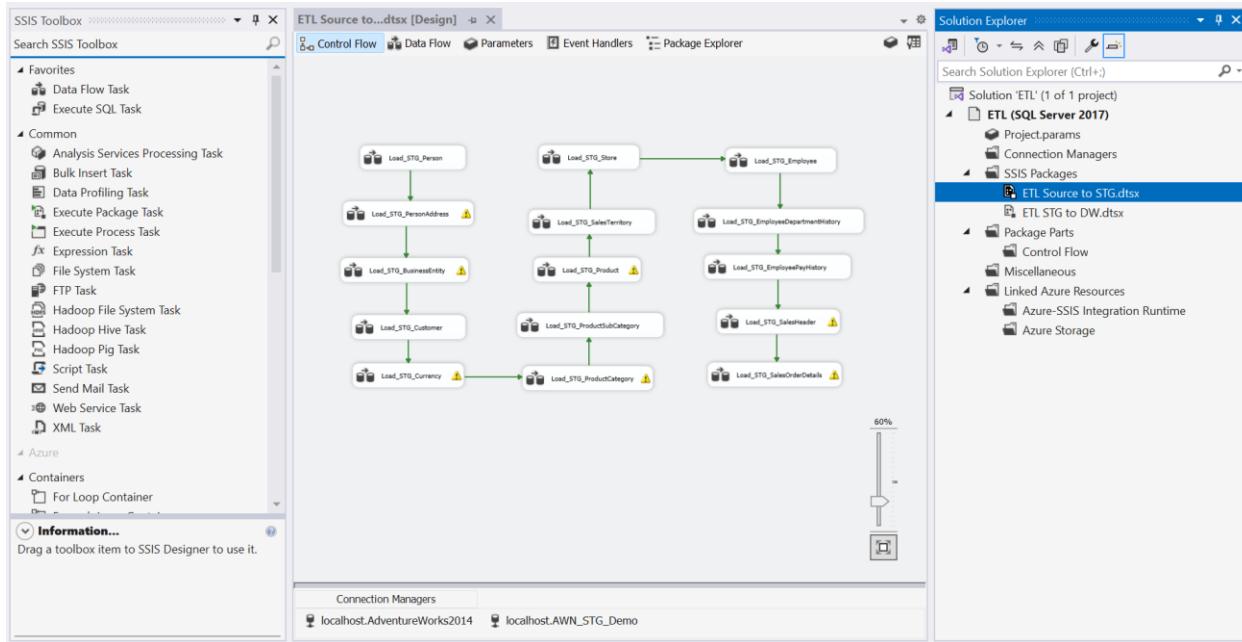
This stage focused on extracting data from the operational system and loading it into the staging database.

### a. SSIS Package Creation

- A new SSIS package was created in Visual Studio.
- Data source: AdventureWorks2014
- Destination: AWN\_STG\_Demo (staging database)

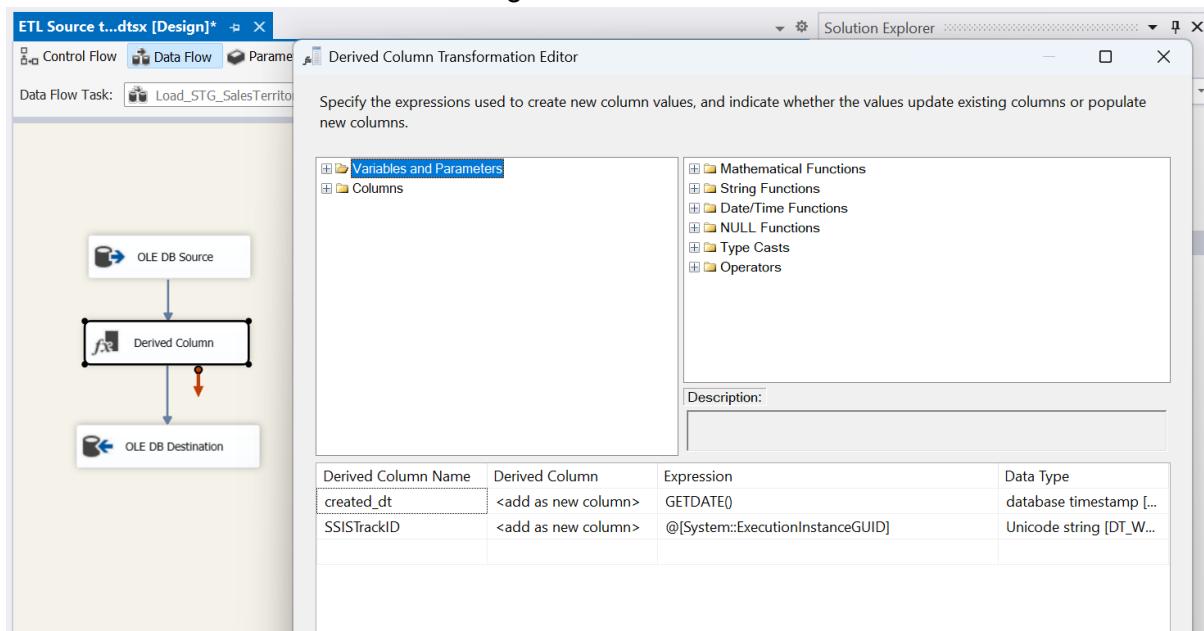
### b. Data Population

The package populated the following staging tables:



- Master data:  
Business\_Entity, Currency, Customer, Person, Product, ProductCategory,  
ProductSubCategory, Store
  - Transactional data:  
SalesHeader, SalesOrderDetails
  - HR data:  
Employee, EmployeeDepartmentHistory, EmployeePayHistory
  - Supporting dimensions:  
PersonAddress, SalesTerritory

Some tables in AWN\_STG\_Demo require CreatedDate\_dt and SSISTrackID, so we used Derived Column to create the according columns.



### c. Validation

- The package was executed successfully.
- Data integrity and row counts were verified in SSMS to ensure accurate extraction and loading.

## 3. ETL: Staging to Data Warehouse

This stage transformed staged data into **analytics-ready dimensional structures**.

### a. Dimension and Procedure Setup

- Stored procedures were created by executing:
  - 2\_AWN\_DW\_Demo (from line 326 to end)
  - 3\_AWN\_HR\_Demo (from line 102 to end)

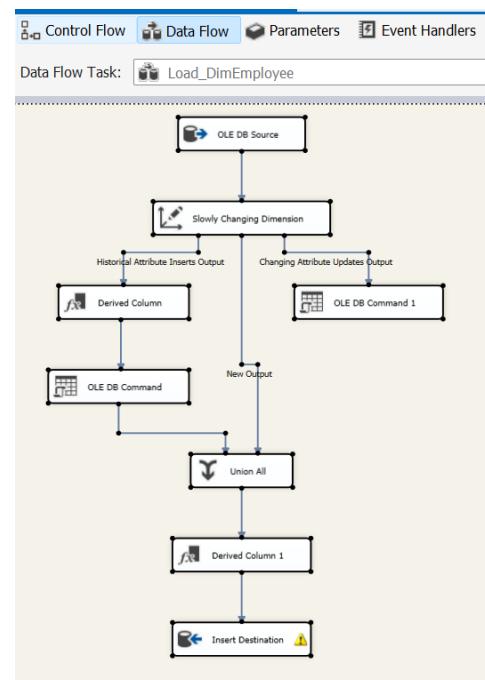
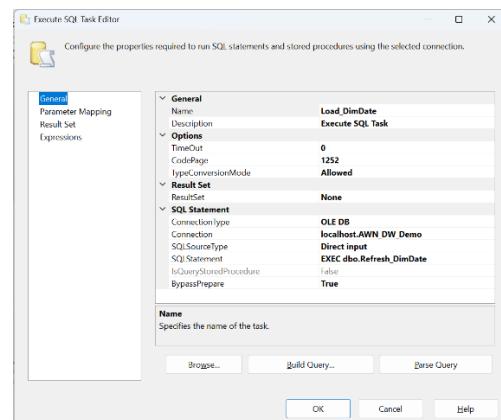
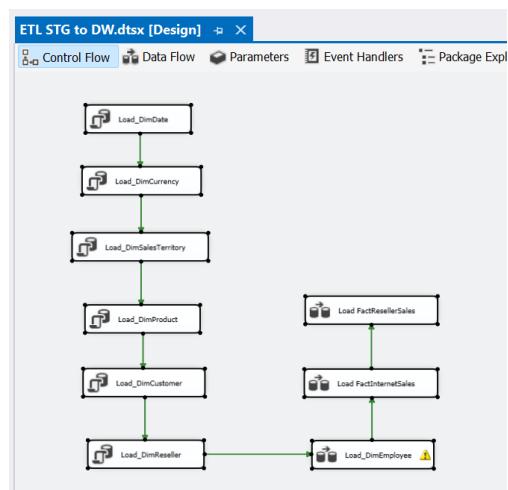
These procedures encapsulate transformation logic and ensure repeatable, auditable loads.

### b. Loading Dimensions and FactEmployeePay

- SSIS Data Flow Tasks were created to execute the following procedures:
  - EXEC dbo.Refresh\_DimDate
  - EXEC dbo.Refresh\_DimCurrency
  - EXEC dbo.Refresh\_DimCustomer
  - EXEC dbo.Refresh\_DimProduct
  - EXEC dbo.Refresh\_DimSalesTerritory
  - EXEC dbo.Refresh\_Reseller
  - EXEC dbo.Refresh\_FactEmployeePay

### c. Slowly Changing Dimension (DimEmployee)

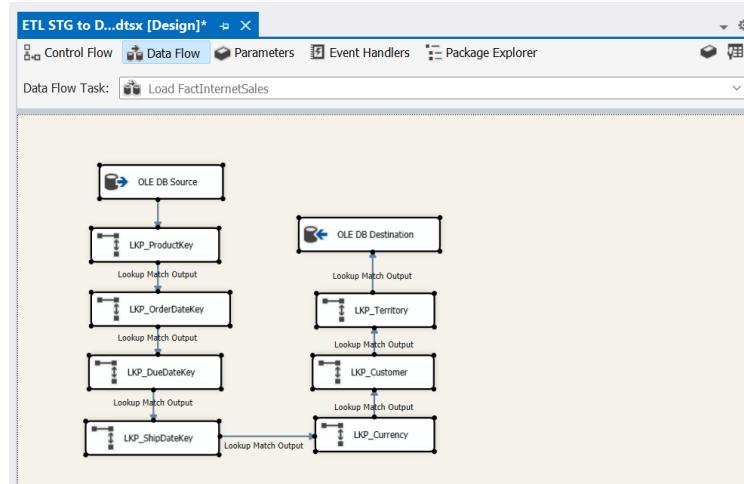
- A dedicated SSIS package was built using the **Slowly Changing Dimension (SCD)** component.
- This allows tracking historical changes in employee attributes (e.g., department changes over time).



#### d. Fact Table Population

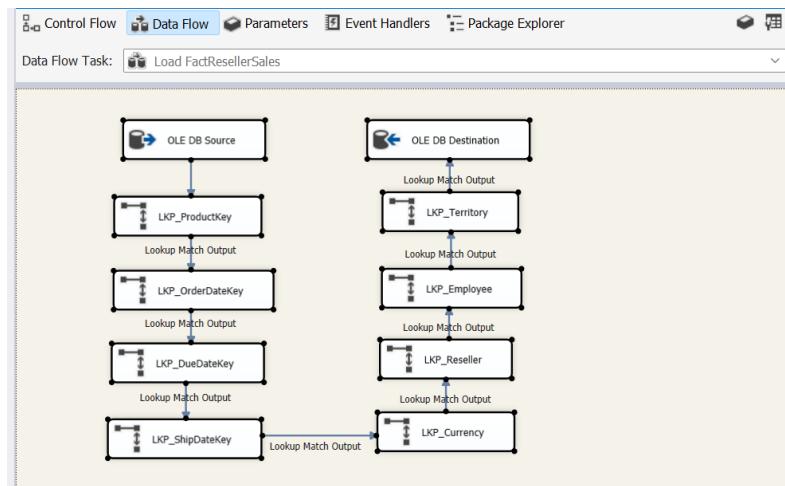
##### FactInternetSales

- Source: Stg\_vw\_Erp\_Fact\_InternetSales
- Lookup transformations were used to resolve foreign keys to dimensions.



##### FactResellerSales

- Source: Stg\_vw\_Erp\_Fact\_ResellerSales
- Lookup transformations mapped dimension keys consistently.



#### e. Execution and Validation

- All ETL packages were executed.
- Fact and dimension tables were validated in SSMS for completeness and correctness.

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## 4. Creating SSAS Tabular Model

This stage introduced the **semantic layer**, optimized for analytical queries.

#### a. Project Setup

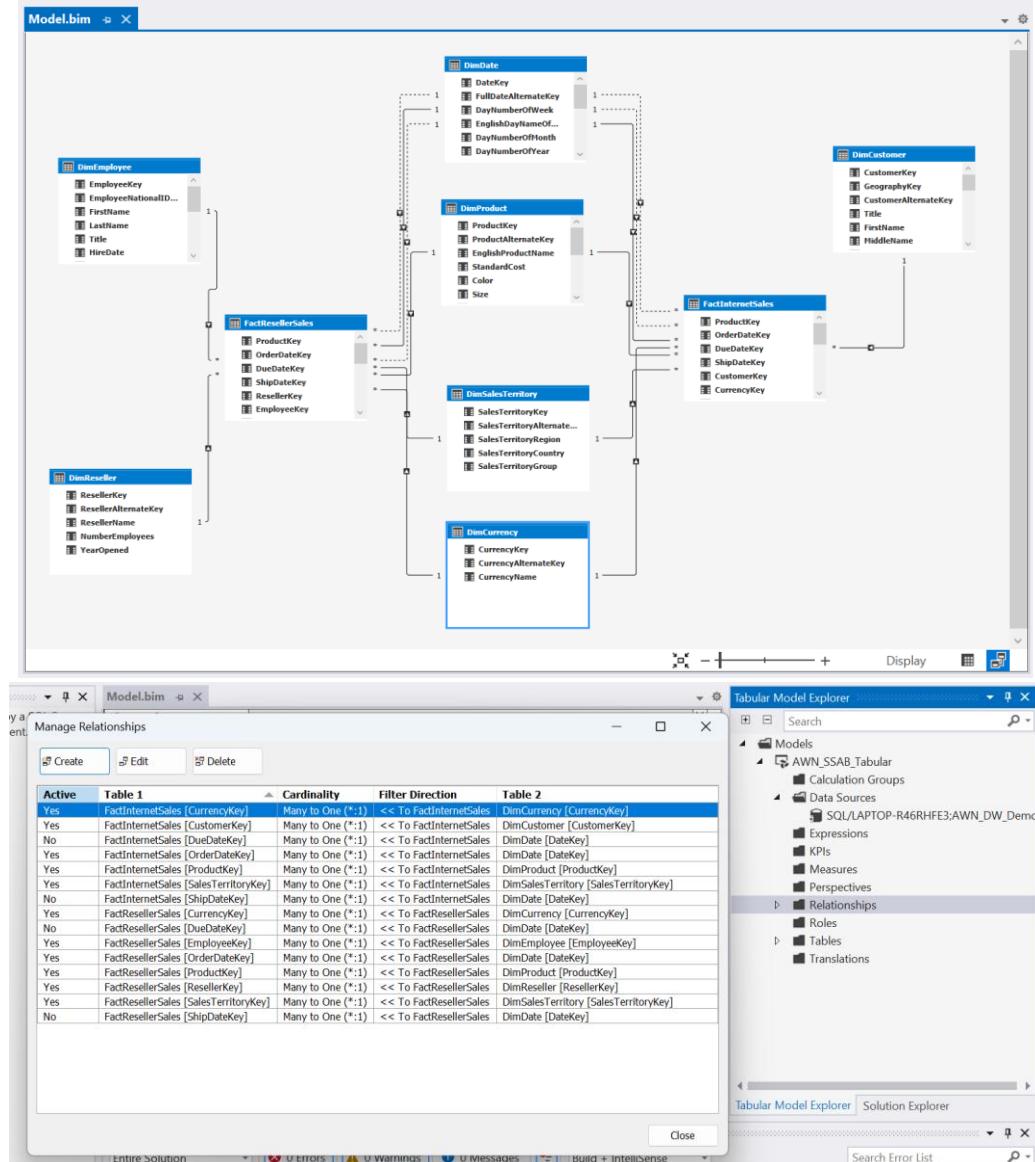
- A new **SSAS Tabular Project** was created in Visual Studio.
- The data warehouse was configured as the data source.

#### b. Data Import

- All relevant dimension and fact tables were imported.

### c. Model Validation

- Relationships were reviewed and manually created where missing.
- Cardinality and filter directions were verified.



### d. Deployment

- The tabular model was successfully built and deployed to SQL Server Analysis Services.

## 5. Creating Power BI Reports

The final stage focused on **business analysis and visualization**.

### a. Connection

- Power BI connected to SSAS using a **live connection**, ensuring real-time interaction with the semantic model.

### b. Business Questions

Key analytical questions included:

- Comparison of sales performance across channels
- Sales trends over time
- Performance by product category and territory

### c. Dashboard Design

- A clean dashboard layout was designed with time-series charts, categorical comparisons, and KPIs.
- 3 pages:
  - Overview
  - Reseller Sales
  - Internet Sales

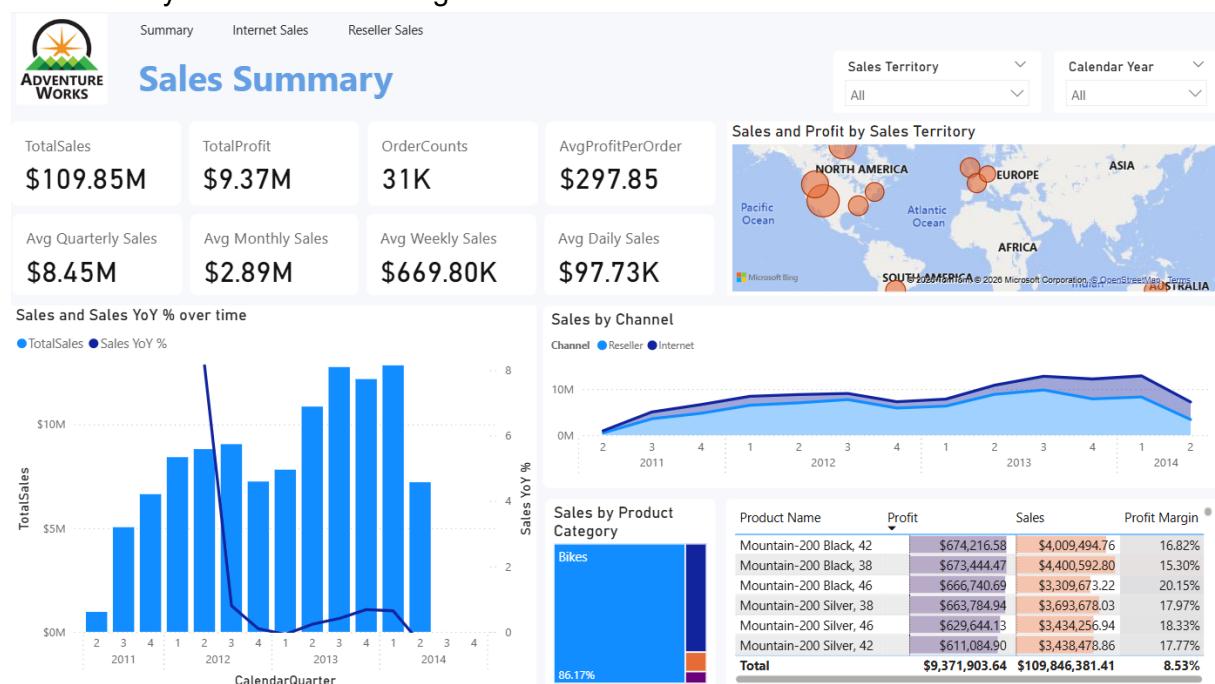
### d. DAX Measures

Custom measures were created, including:

- TotalSales
- TotalCost
- TotalProfit
- Sales LY
- Sales YoY%
- ProfitMargin
- OrderCounts
- AvgProfitPerOrder
- AverageQuarterlySales
- AverageMonthlySales
- AverageWeeklySales
- AverageDailySales

### e. Final Output

- The dashboard provides interactive, drillable insights suitable for management and analytical decision-making.



### Reseller Sales

**Sales Amount**  
**80.49M**

**Profit**  
**(\$2.32M)**

**Profit Margin %**  
**-2.88%**

**Calendar Year**  
All

**Sales Territory**  
 Europe  
 North America  
 Pacific

**Productcategory...**  
Bikes

**EnglishProductN...**  
Mountain-200 Black, 38  
Mountain-200 Black, 42  
Mountain-200 Silver, 38  
Mountain-200 Silver, 42

**Sales Amount**  
80,487,704.19

**Table** **Heatmap**

Group	Country	Region	Sales	# of resellers	Order Volume
Europe	FR	France	4,607,537.93	34	188
Europe	DE	Germany	2,021,095.26	32	139
Europe	GB	United Kingdom	4,279,008.83	38	188
North America	CA	Canada	14,377,925.59	106	692
North America	US	Central	7,906,008.18	61	376
North America	US	Northeast	6,932,842.01	49	342
North America	US	Northwest	12,435,076.00	87	536
North America	US	Southeast	7,867,416.22	79	469
<b>Total</b>			<b>80,487,704.19</b>	<b>635</b>	<b>3806</b>

**Reseller Name**

Reseller Name	Sales	Profit	Profit Margin %
Brakes and Gears	877,107.19	\$38,042.24	4.34%
Excellent Riding Supplies	853,849.18	(\$63,507.64)	-7.44%
Vigorous Exercise Company	841,908.77	(\$29,577.75)	-3.51%
Totes & Baskets Company	816,755.58	(\$60,114.74)	-7.36%
Retail Mall	799,277.90	(\$65,776.97)	-8.23%
Corner Bicycle Supply	787,773.04	(\$55,915.38)	-7.10%
Outdoor Equipment Store	746,317.53	(\$67,828.49)	-9.09%
Thorough Parts and Repair Services	740,985.83	(\$49,161.78)	-6.63%
Health Spa, Limited	730,798.71	(\$59,331.01)	-8.12%
Fitness Toy Store	727,272.65	(\$63,705.35)	-8.76%
Latest Sports Equipment	724,299.64	\$37,916.96	5.23%
First Bike Store	711,864.76	(\$56,391.11)	-7.92%
Great Bikes	700,803.79	\$33,670.45	4.80%
Farthermost Bike Shop	693,502.49	(\$53,011.31)	-7.64%
Field Trip Store	671,618.03	\$32,627.68	4.86%
Metropolitan Equipment	643,745.90	(\$51,646.62)	-8.02%
Eastside Department Store	636,226.47	(\$59,152.48)	-9.30%
The Gear Store	618,616.13	\$30,727.20	4.97%
Sheet Metal Manufacturing	617,340.46	(\$46,361.09)	-7.51%
<b>Total</b>	<b>80,487,704.19</b>	<b>(\$2,316,039.24)</b>	<b>-2.88%</b>

### Internet Sales

**Sales Amount**  
**29.36M**

**Profit**  
**\$11.69M**

**Profit Margin %**  
**39.81%**

**Calendar Year**  
All

**Sales Territory**  
 Europe  
 North America  
 Pacific

**Productcategory...**  
Bikes

**EnglishProductN...**  
Mountain-200 Black, 46  
Mountain-200 Black, 42  
Mountain-200 Silver, 38  
Mountain-200 Silver, 42

**Sales Amount**  
29,358,677.22

**Table** **Heatmap**

**Sales by Territory**

Microsoft Bing

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**rID** **Customer Name**

rID	Customer Name	Sales	Profit	Profit Margin %
i97	Nichole Nara	13,295.38	\$5,250.42	39.49%
i18	Kaitlyn Henderson	13,294.27	\$5,273.81	39.67%
i44	Margaret He	13,269.27	\$5,254.60	39.60%
i25	Randall Dominguez	13,265.99	\$5,232.02	39.44%
i07	Adriana Gonzalez	13,242.70	\$5,237.24	39.55%
i06	Rosa Hu	13,215.65	\$5,221.03	39.51%
i76	Brandi Gill	13,195.64	\$5,208.51	39.47%
i63	Brad She	13,173.19	\$5,198.01	39.46%
i89	Francisco Sara	13,164.64	\$5,189.10	39.42%
i55	Maurice Shan	12,909.67	\$5,050.43	39.12%
i21	Janet Munoz	12,489.17	\$4,928.12	39.46%
i20	Lisa Cai	11,469.19	\$4,668.94	40.71%
i48	Lacey Zheng	11,248.46	\$4,555.70	40.50%
i88	Jordan Turner	11,200.77	\$4,520.56	40.36%
i64	Larry Munoz	11,068.01	\$4,442.01	40.13%
i11	Larry Vazquez	10,899.62	\$4,340.97	39.83%
i05	Kate Anand	10,872.06	\$4,323.72	39.77%
i62	Lawrence Alonso	10,836.90	\$4,317.94	39.84%
i16	Terrance Rodriguez	10,829.22	\$4,288.92	39.61%
i57	Aaron Wright	10,813.63	\$4,286.29	39.64%
i72	Clarence Gao	10,799.52	\$4,302.39	39.84%
i59	Bonnie Nath	10,793.27	\$4,294.19	39.79%
i82	Andres Nara	10,789.53	\$4,296.14	39.82%
i99	Ethan Bryant	10,778.61	\$4,289.30	39.79%
i05	Ricky Vazquez	10,580.35	\$4,358.08	41.19%
<b>total</b>	<b>29,358,677.22</b>	<b>\$11,687,942.88</b>	<b>39.81%</b>	

## Conclusion

This implementation demonstrates a **complete BI pipeline**, from raw operational data to executive-level analytics. Each stage reinforces core data warehousing principles: separation of concerns, controlled transformations, semantic abstraction, and business-oriented reporting. The result is a scalable and maintainable analytical solution aligned with industry best practices.