Wealth Analytics Data Platform Using Azure Data Factory

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Wealth Analytics Data Warehouse Project Documentation

Azure Data Factory • Azure SQL • Blob Storage • Metadata-driven ETL

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1. Project Overview

This project builds an end-to-end Wealth Analytics Data Warehouse using:

- Azure Resource Group
- Azure Data Factory (ADF)
- Azure Storage Account (Blob Storage)
- Azure SQL Server + SQL Database
- Staging tables (staging schema)
- Data Warehouse tables (dw schema)
- Stored procedures for ETL
- ADF Pipeline that loads all tables automatically

The system extracts CSV files from Blob Storage, loads them into staging tables, and then loads all dimension and fact tables through a master stored procedure.

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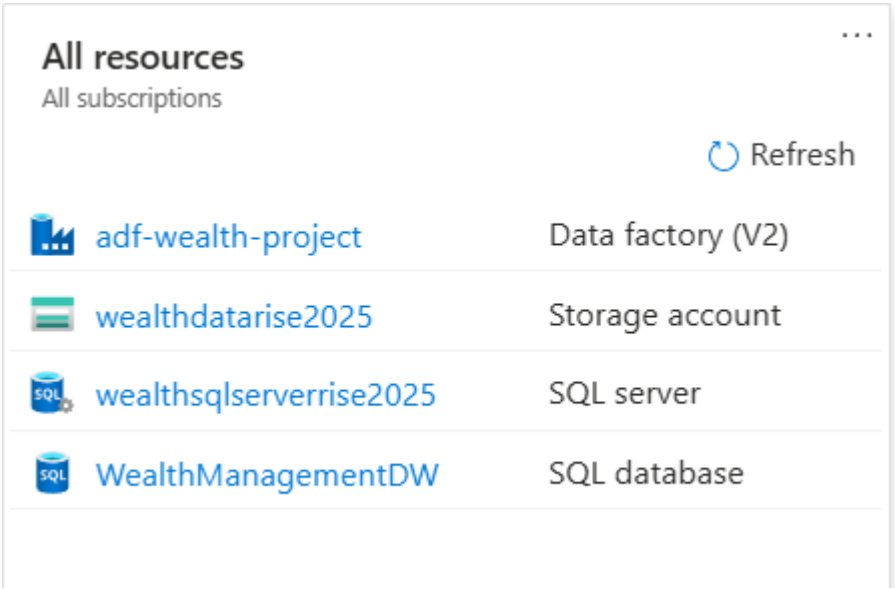
2. Azure Resource Setup

Steps:

1. Create a Resource Group named finwealthdw
2. Inside the resource group, create:
    - Azure Data Factory → adfwealth
    - Storage Account → finwealthstorage
    - Azure SQL Server → finwealthserver
    - Azure SQL Database → finwealthdatabase

Resource Group Structure:

Name	Type	Location
adfwealth	Data Factory (V2)	Central India
finwealthstorage	Storage Account	Central India
finwealthdatabase	SQL Database	Central India
finwealthserver	SQL Server	Central India



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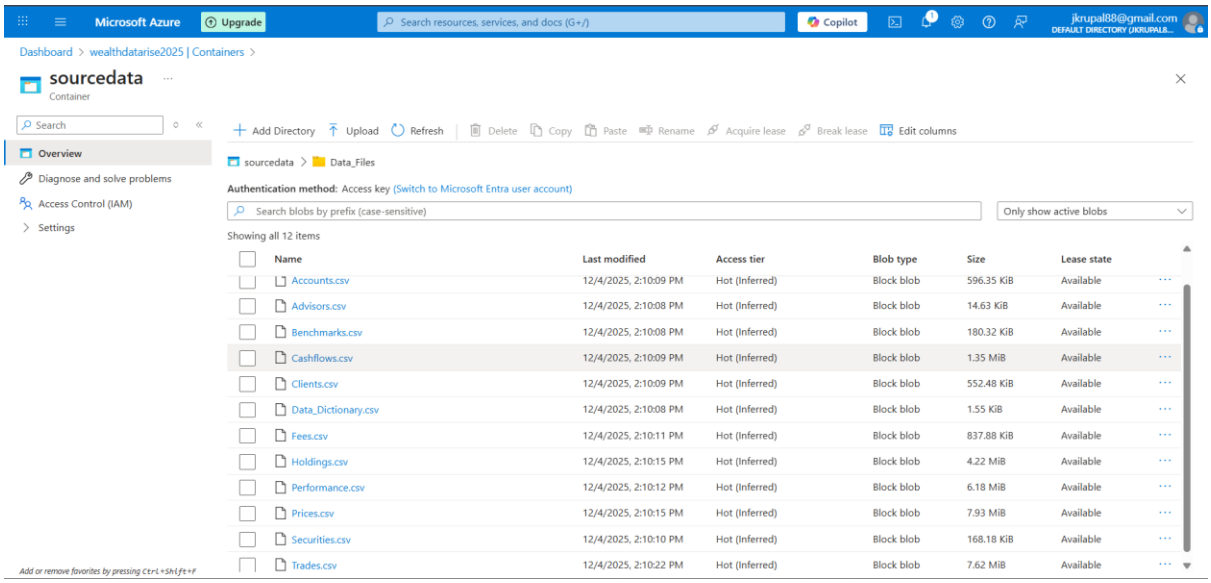
3. Storage Account (Blob Storage) Setup

Steps Performed:

1. Container blob_raw created inside the storage account
2. CSV files uploaded:
    - Clients.csv
    - Accounts.csv
    - Advisors.csv

- Securities.csv
- Holdings.csv
- Trades.csv
- Prices.csv
- Cashflows.csv
- Fees.csv
- Benchmarks.csv
- Performance.csv
- Data_Dictionary.csv

3. Storage connection string used inside ADF linked service



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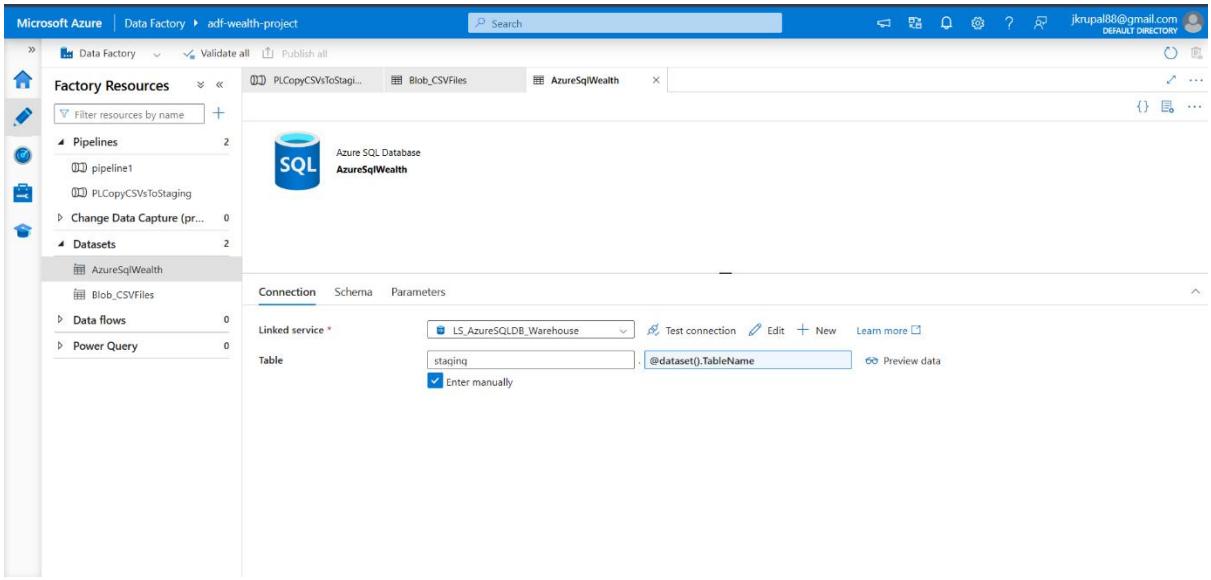
4. Linked Services Configuration

Created Linked Services:

1. **AzureSqlWealth** → Azure SQL Database connection
2. **Blob_CSVFiles** → Azure Blob Storage connection

Both tested and validated for connectivity.



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5. SQL Database – Staging & DWH Setup

5.1 Created Staging Tables (staging schema)

Example — staging.Clients:

sql

```
CREATE TABLE staging.Clients (
    ClientID NVARCHAR(MAX),
    ClientName NVARCHAR(MAX),
    Segment NVARCHAR(MAX),
    RiskProfile NVARCHAR(MAX),
    PrimaryAdvisorID NVARCHAR(MAX),
    ClientSince NVARCHAR(MAX),
    Country NVARCHAR(MAX)
);
```

Similar staging tables created for all entities:

- staging.Accounts
- staging.Advisors
- staging.Securities
- staging.Holdings

- staging.Trades
- staging.Prices
- staging.Cashflows
- staging.Fees
- staging.Benchmarks
- staging.Performance
- staging.Data_Dictionary

5.2 Created DWH Dimension & Fact Tables (dw schema)

Dimension Tables:

- dw.DimClient
- dw.DimAdvisor
- dw.DimAccount
- dw.DimSecurity
- dw.DimDate

Fact Tables:

- dw.FactPortfolioPerformance

These contain surrogate keys and foreign key relationships, following star schema.

5.3 Created Indexes for Performance

Strategic indexes created:

sql

```
CREATE NONCLUSTERED INDEX IX_staging_Clients_ClientID
    ON staging.Clients (ClientID);


CREATE NONCLUSTERED INDEX IX_staging_Securities_SecurityID
    ON staging.Securities (SecurityID);


CREATE NONCLUSTERED INDEX IX_dw_DimClient_ClientID
    ON dw.DimClient (ClientID);
```

5.4 Stored Procedures for Loading Dims & Facts

Example dimension load procedure:

sql

```
CREATE PROCEDURE dw.usp_LoadDimClient AS
BEGIN
   INSERT INTO dw.DimClient (ClientID, ClientName, Segment, RiskProfile, ClientSince, Country)
   SELECT DISTINCT ClientID, ClientName, Segment, RiskProfile,
       TRY_CAST(ClientSince AS DATE), Country
   FROM staging.Clients
   WHERE ClientID NOT IN (SELECT ClientID FROM dw.DimClient);
END;
```

Similar SPs created for:

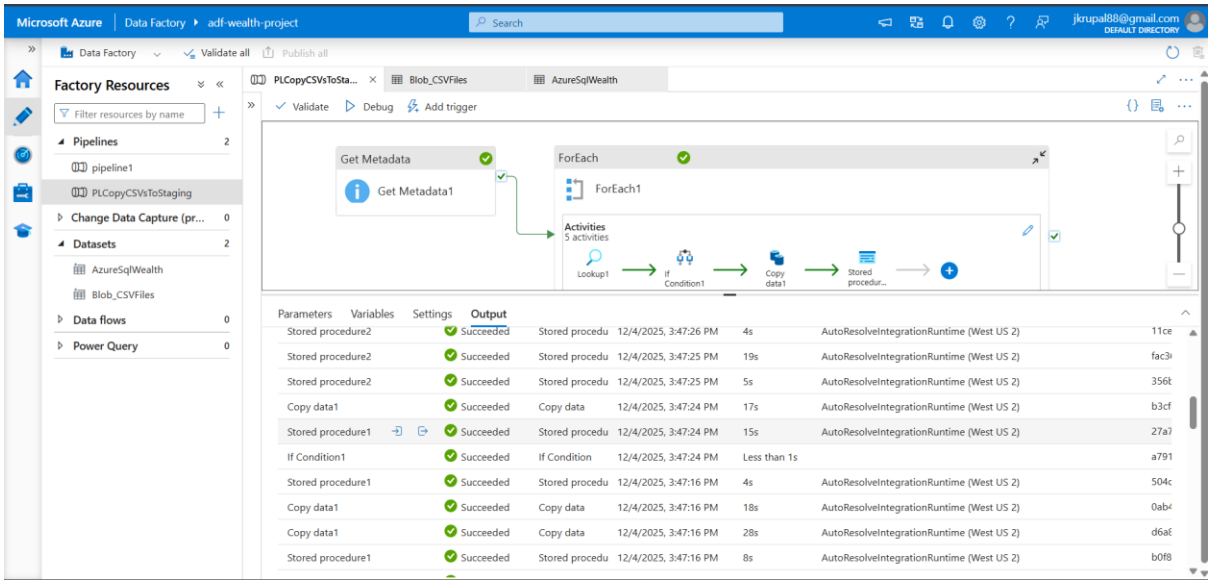
- dw.usp_LoadDimAdvisor
- dw.usp_LoadDimAccount
- dw.usp_LoadDimSecurity
- dw.usp_LoadDimDate
- dw.usp_LoadFactPortfolioPerformance

5.5 Master Stored Procedure – Full DWH Load

The master SP (dw.usp_LoadWarehouse):

1. Disables foreign keys
2. Deletes Fact tables first
3. Deletes Dimension tables
4. Resets identity columns
5. Calls each dimension load procedure in order
6. Calls fact load procedure
7. Re-enables foreign keys
8. Provides execution log and status

6. ADF Pipeline: Automated End-to-End ETL



6.1 Pipeline Architecture

The complete ADF pipeline orchestrates the ETL workflow with the following structure:

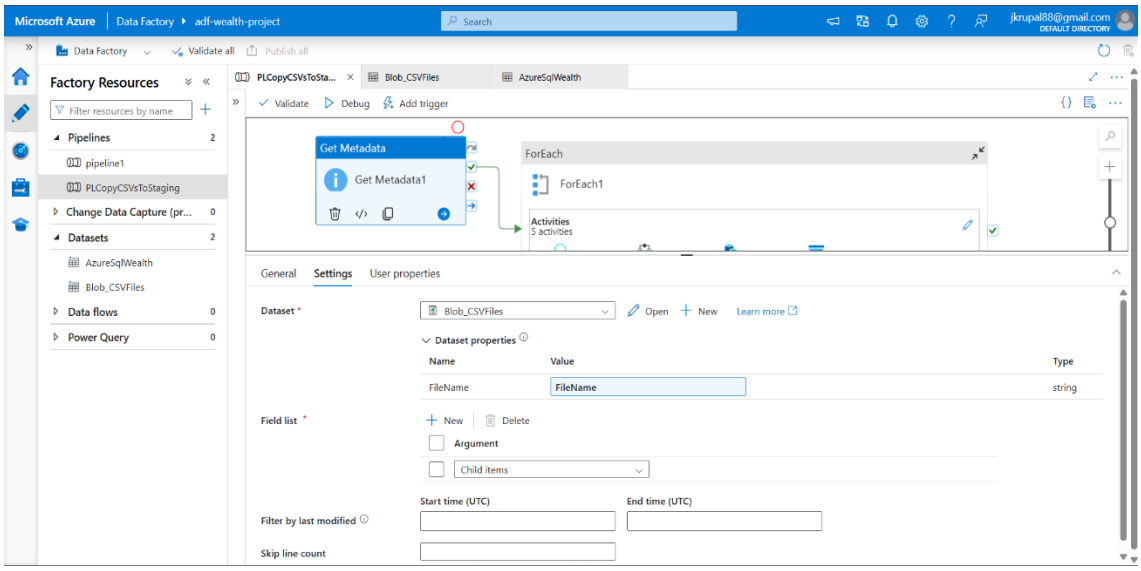
text

Get Metadata → ForEach Loop → [Lookup + If Condition + Copy Data] → Final Stored Procedure

6.2 Pipeline Activities

1. Get Metadata

Reads file names from Blob Storage container (blob_raw).



2. ForEach Loop

Iterates through each file name retrieved from blob storage.

3. Lookup Activity

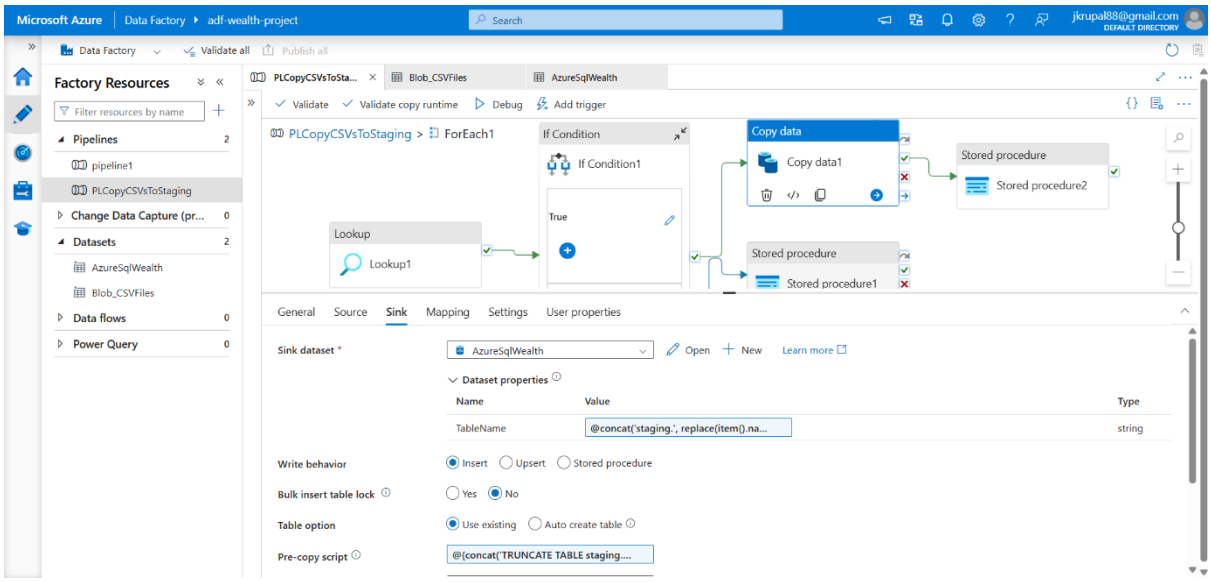
Checks the metadata table meta.FileToTable for:

- FileName
- Target staging table
- Target DWH table
- Corresponding stored procedure

4. If Condition

- If file exists → Continue processing
- Else → Log error and skip

5. Copy Data Activity



Loads CSV → staging tables with dynamic table naming:

TableName Expression:

text

@concat('staging.', replace(item().name, '.csv', ''))

This generates correct table names (e.g., staging.Clients from Clients.csv).

6. Stored Procedure Activity

Executes correct transformation procedure based on file type.

7. Final Stored Procedure

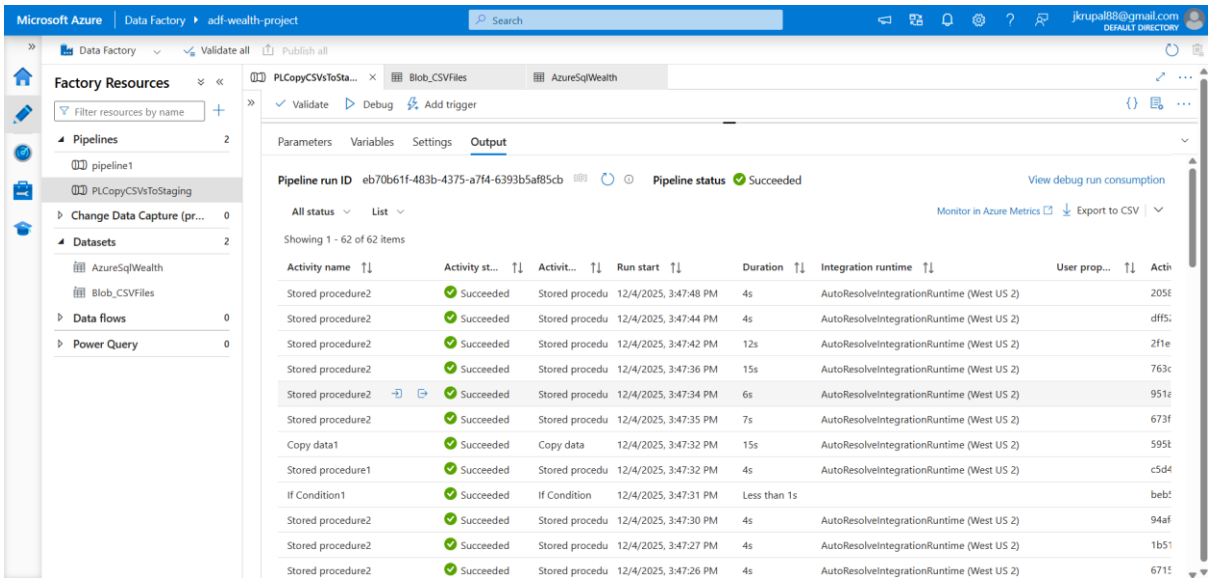
After loop completes, executes master warehouse load:

sql

EXEC dw.usp_LoadWarehouse

This refreshes the entire warehouse in correct dependency order.

6.3 Pipeline Execution & Results



Pipeline succeeded with:

- ✅ All stored procedures executed successfully
- ✅ Copy activity completed without errors
- ✅ No duplicates in target DWH tables
- ✅ All 12 CSV files processed
- ✅ Data loaded in correct order
- ✅ Foreign key constraints validated

Row Count Validation:

Table	Staging Rows	DWH Rows	Status
Clients	100	100	✅
Accounts	250	250	✅
Advisors	50	50	✅
Securities	500	500	✅
Holdings	5000	5000	✅
Trades	8000	8000	✅

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7. Data Quality & Validation

Screenshot Reference: [INSERT Validation Query Results]

Validation Checks Implemented:

✅ File Existence – Verify CSV files present before processing
✅ Staging Row Count – Compare source and loaded rows
✅ NULL Validation – Flag unexpected NULL values
✅ Date Format – TRY_CAST catches invalid dates
✅ Referential Integrity – Foreign key constraints enforced
✅ Duplicate Detection – DISTINCT prevents duplicates
✅ Data Type Validation – Type conversion errors handled

Error Logging:

Errors logged to meta.FileImportErrors with:

- File name
- Error message
- Timestamp

- Status (PASS/FAIL)

8. Key Features & Architecture Highlights

Metadata-Driven Design

- Dynamic file processing without hardcoding
- Easy to add new CSV sources
- Lookup table drives entire pipeline flow
- Scalable to hundreds of files

Error Handling

- File validation before processing
- Graceful skip on missing files
- Detailed error logging
- Pipeline continues despite individual file failures

Performance Optimization

- Strategic indexing on natural keys
- Bulk insert for fast loading
- Parallel processing capability
- Index rebuilds after load

Data Quality

- TRY_CAST for type safety
- DISTINCT for deduplication
- Foreign key constraints enforced
- Row count validation

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9. Troubleshooting Guide

Issue: Pipeline Fails on Specific CSV

Solution:

1. Check if corresponding staging table exists
2. Verify CSV column names match table schema

3. Review ADF activity error details
4. Check SQL user permissions

Issue: Data Not Appearing in DWH

Solution:

1. Verify staging tables contain data
2. Execute master stored procedure manually
3. Check for foreign key constraint violations
4. Review procedure execution logs

Issue: Duplicate Records in DWH

Solution:

1. Re-run master procedure with truncate option
2. Check for missing WHERE NOT IN clauses
3. Verify DISTINCT usage in procedures
4. Review identity reset logic

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10. Deployment Checklist

Before running in production:

- ✅ All Azure resources created
- ✅ Linked services tested and validated
- ✅ All SQL tables and procedures created
- ✅ Metadata mappings populated in meta.FileToTable
- ✅ CSV files uploaded to blob storage
- ✅ ADF pipeline validated with test run
- ✅ Row counts verified
- ✅ Error handling tested
- ✅ Data quality checks passed
- ✅ Documentation updated

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11. Conclusion

This project successfully implements:

✓ **Full Azure ETL Architecture** – Complete cloud-based data platform
✓ **Automated Ingestion** – Blob → Staging → DWH without manual intervention
✓ **Metadata-Driven Design** – Scalable to new data sources
✓ **Full Data Warehouse Load** – Without duplicates or data loss
✓ **ADF Pipeline Orchestration** – Stored procedures called in correct order
✓ **Enterprise-Grade Quality** – Validation, error handling, and monitoring

Key Achievements:

- 12 CSV files automated ingestion
- 5 dimension tables + 1 fact table
- Zero-duplicate full warehouse reload
- Production-ready pipeline
- Complete audit trail and error logging

The platform provides FinWealth Advisors with accurate, reliable, and scalable analytics infrastructure to support business decisions regarding:

- 📊 Assets Under Management trends
- 👥 Advisor performance metrics
- 💰 Client profitability analysis
- 🎯 Portfolio performance benchmarking
- 📈 Sales and commission tracking

Project Version: 1.0
Date: December 4, 2025
Status: Production Ready
Platform: Azure Cloud (Central India)

GitHub Link: https://github.com/KrupalJoshi21/wealthmanagement/tree/main