Oil and Gas Asset Management Analysis.
Case Study

Problem Statement:

In the dynamic landscape of the global upstream oil and gas industry, understanding the historical trends and future projections is essential for informed decision-making and strategic planning. Despite the vast amount of data available through UCube Global, there remains a need to harness its potential to address critical challenges and opportunities within the sector. This case study aims to delve into the complexities of the industry by leveraging the UCube database to analyze production, economics, costs, revenues, and valuation of over 80,000 assets across more than 3,500 companies. The goal is to uncover insights that can drive macro analyses, inform market strategies, aid in company valuation, facilitate business development, and shed light on the oil service industry's market dynamics. By conducting a thorough analysis of the historical and projected E&P activities from 1900 to 2100, this study seeks to provide actionable recommendations and strategic direction to stakeholders aiming to navigate the ever-evolving landscape of the oil and gas sector.

What is Expected?

The data engineering objectives for this project encompass constructing a comprehensive data framework that enables rigorous analysis and informed decision-making across various dimensions of the oil and gas industry. This involves designing a sophisticated data pipeline that integrates diverse datasets pertaining to global supply trends, deal screening criteria, merger and acquisition considerations, benchmarking metrics, and market assessments. The primary goal is to organize, cleanse, and harmonize this data to facilitate macro analyses, deal identification, portfolio assessment, benchmarking, and market evaluation. By structuring the data in a way that allows for seamless querying and analysis, the project aims to empower stakeholders to make data-driven decisions related to supply sources, field acquisitions, mergers, performance comparisons, and market strategies, thus enhancing their understanding of the industry landscape and its potential opportunities.

1. How much crude oil will be produced in Denmark?
2. Which are the most valuable fields in Denmark's portfolio?
3. Which Locations will see the largest investments in oil and gas in 2023?
4. What is the projected production trend of crude oil in Denmark over the next decade, considering various price scenarios?
5. Which companies have the highest ownership share in Denmark's most valuable oil and gas fields?
6. Compare the breakeven oil prices across different valuable fields in Denmark's portfolio. Which fields demonstrate the lowest breakeven prices?

Data Dictionary:

https://github.com/manojkumarsingh77/Shell2023/blob/main/AssetManagement/DataDictionary/AssetManagement_DataDictionary.pdf

Data Sets:

https://github.com/manojkumarsingh77/Shell2023/blob/main/AssetManagement/DataSets/AssetDataSet.zip

Case Study Execution Plan:

- The execution of each Case Study will involve a group of 4 or 5 members, with each member assigned specific tasks to align with the project's objectives.
- Each group member will work concurrently on their designated tasks, ensuring parallel progress, and the integration of individual contributions will occur during the Final Stage of the project.
- On the Final day, the completed Case Study will be presented to the Shell Subject Matter Experts (SME) and UNext Mentors, providing an opportunity to showcase the project's outcomes and achievements.
- The entire project development process will be implemented using a Continuous Integration/Continuous Deployment (CI/CD) pipeline. This approach ensures seamless integration of code changes, automated testing, and efficient deployment, promoting collaboration and efficiency throughout the project lifecycle.

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Technicalities:

In order to address the given problem statement, we will adhere to a standard data pipeline pattern. This structured approach will ensure a systematic and efficient workflow for data processing and transformation.

The data pipeline will consist of the following key stages:

- Data Ingestion.
- Data Processing.
- Data Storage.
- Data Visualization and Reporting.

Data Layers:

As part of a structured data storage approach, you will implement measures to ensure efficient data organization and management. The data will be divided into separate parent folders, one for each team, with sub-folders for **RAW**, **STG (Staging),** and **CURATED** data:

Parent Folders: Each team involved in the project will have its dedicated parent folder to manage their data processing activities. This ensures data isolation and promotes collaboration within the team.

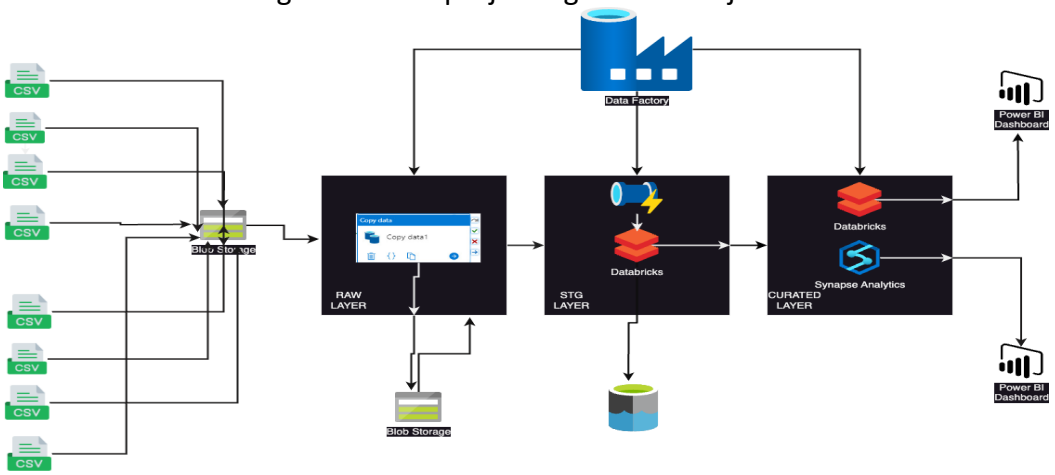
RAW Sub-folder: The RAW sub-folder within each team's parent folder will be used to store the raw and unprocessed data acquired from various sources. This includes the data ingested through Azure Data Factory or any other data ingestion mechanism.

STG (Staging) Sub-folder: The STG sub-folder will serve as an intermediate storage location where data from the RAW sub-folder is transformed and prepared for further processing. This staging step ensures data quality and consistency before moving it to the CURATED sub-folder.

CURATED Sub-folder: The CURATED sub-folder will hold the processed and curated data ready for visualization and analysis. This data is transformed, cleansed, and enriched to meet specific business requirements.

Reference architecture diagram:

The provided architecture diagram serves as a foundational reference for each team to envision their own version while building upon it. This diagram presents a clear and structured visualization of the system's components and their interactions. Each team is tasked with developing their own iteration of the architecture diagram, using the provided sample as a foundation. This approach fosters creativity and empowers teams to tailor the solution to meet specific requirements and address unique challenges. By building upon the initial reference, teams can explore diverse design choices and leverage individual expertise, resulting in a comprehensive and adaptable solution. This collaborative process ensures a successful outcome that aligns with the project's goals and objectives.



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Activity Breakdown:

In the case study, data engineers will perform data ingestion and cleansing activities to ensure data quality and integrity. They will create a reusable and secured connection for data ingestion and handle tasks like removing duplicate records, handling missing values through imputation techniques, and correcting data anomalies.

For ETL and analysis, data engineers will filter out irrelevant or incomplete data, aggregate data to calculate summary statistics, transform data types and create derived columns, perform data joining based on common keys, and apply data partitioning for improved query performance. They will also conduct data deduplication and implement validation checks to ensure data quality and adherence to business rules.

The Case Study is divided into two parallel streams, each handled by separate teams:

i. **Stream 1:** This stream utilizes SQL Data Warehouse/Database (SQL DW/DB) as the data storage and management solution. The team in charge of this stream will leverage the capabilities of Power BI for data visualization and creating interactive dashboards. The combination of SQL DW/DB and Power BI ensures efficient data processing, storage, and analysis, providing stakeholders with valuable insights to support data-driven decision-making.

ii. **Stream 2:** In this stream, the team will employ Azure Databricks with SQL End-point (ADB SQL End-point) as the data processing and analysis platform. Power BI will be used for data visualization and interactive dashboard creation. By leveraging the distributed data processing capabilities of Azure Databricks and combining it with Power BI's visualization capabilities, this stream enables efficient and scalable data processing, ensuring stakeholders have access to timely and insightful information.

By splitting the case study into these two streams, the project benefits from parallel efforts, maximizing efficiency and expertise in both SQL-based and Databricks-based data processing approaches. This approach allows for a comprehensive exploration of different technologies, resulting in a well-rounded and robust solution for meeting the specified data processing and visualization requirements.

Deliverables:

Create a presentation which has:

Slide 1: BatchName_FirstName_SecondName
Slide 2: Problem statement
Slide 3: Implemented data flow diagram showing various technical components and Layers.
Slide 4-6: Snapshots of developments in each layer (RAW, STAGING(STG), CURATED)
Slide 7: Screenshot of dashboards built on Power BI.
Slide 8: GitHub link where solution is available
Slide 9: System Demo
Slide 10: Q&A
Slide 11: Challenges faced, learnings, suggestions, and feedback.

Rubrics for Case Study Evaluation:

Deliverables / milestones	Remarks	Max Marks
▪ GitHub account creation (5 Marks) ▪ Proposing your own Architecture design and details (15Marks)	Activities	20
▪ Data Management and Storage (10 marks)	Activities	10
▪ Data ingestion and Transformation technique details (20 marks)	Activities	20
▪ Visualization of data, by keeping scope of Business User (10 Marks) ▪ Story telling by visualizing data (10 marks)	Activities	20
▪ Live presentation of Solution on Azure portal (15 marks) ▪ Viva (15 marks)	Activities	30
	Total Marks	**100**