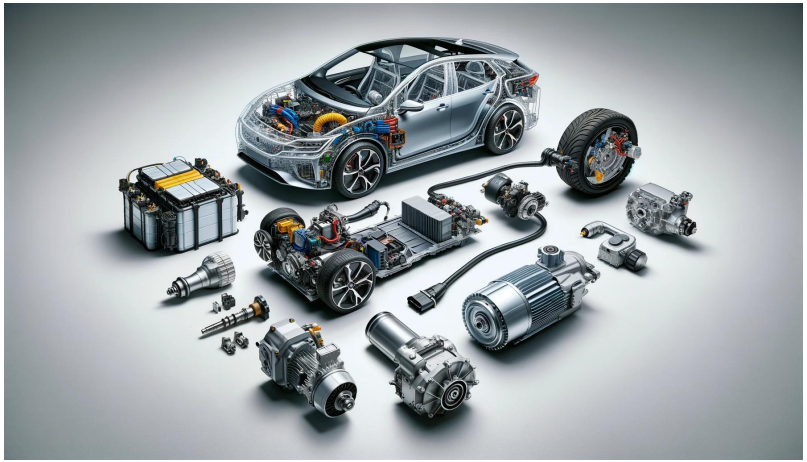
Cloud Database for Market Analysis of Electric Vehicle Powertrain Components



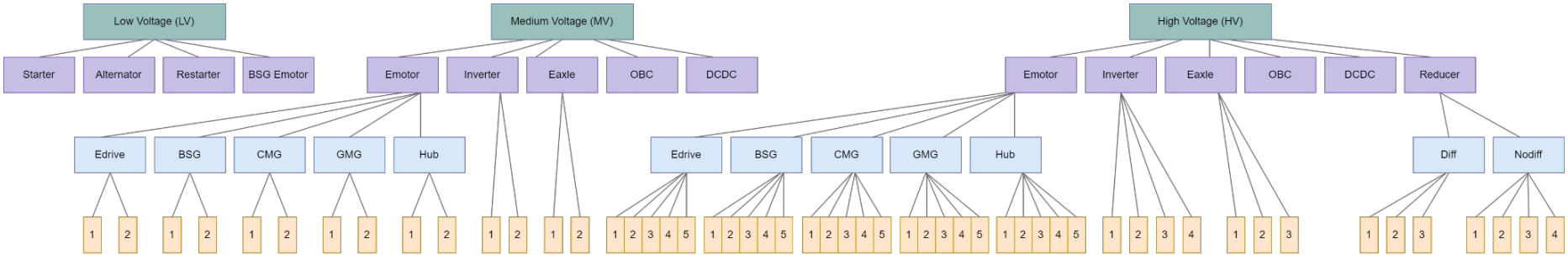
2024

Project Objectives: Conceptual Aspects

Initial position	• Third-party database containing only volumes for global vehicle sales
Enhancement	• Inclusion of powertrain components for each car model • Pricing for each component • Supplier details for each component • Addressability analysis for competing component suppliers
Addressing	• Total/addressable volume and turnover of components vary by electrification types • Regional distribution of total/addressable component volumes and turnover • Turnover attributed to different product types or design parents vary across regions • Market share distribution among different suppliers for by product type and region

Hierarchical Scheme of Powertrain Components Levels

The database enables calculations using four-tiered grouping levels



Level 1	Voltage type
Level 2	Product type

Level 3	Product subtype
Level 4	Product rank
*component position in powertrain system affects the price	

Project Objectives: Technical Aspects

Concept	Build an advanced database on GCP with cutting-edge cloud technologies, allowing the marketing team to effortlessly update it via Google Sheets integration

Step 1	GCP project concept development
Step 2	Approval from the Security Department
Step 3	Collaborating with the IT department on GCP element configuration
Step 4	Establishing Cloud Storage for data management
Step 5	Development of Colab Enterprise notebooks for processing and merging database segments
Step 6	Uploading and finalizing the database in BigQuery
Step 7	Linking BigQuery database with Looker Studio for dashboard design and integration
Step 8	Linking Google Sheets with Cloud Storage via API
Step 9	Automating the database update process using Cloud Functions

Developing database elements with the marketing team

Concept	Crafting database elements in Google Sheets with unique market insights contributed by the marketing team

value list (vl)

table detailing all potential vehicle architectures, outlining the contents of powertrain components specific to each architecture

power schedule (ps)

table with formulas for component power calculation, vital for pricing variations based on power differences

supplier dictionary (sd)

1. Powertrain components suppliers to vehicle models
2. Addressable suppliers (competitors that can be outperformed)

price list (pl)

table mapping prices of powertrain components to vehicle models based on component power and system voltage.

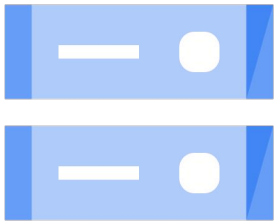
Workflow 1/3 - Google Sheets Updates

update google sheets → GS to GCP Cloud Storage → vehicle database to Cloud Storage → Cloud Functions run Colab scripts

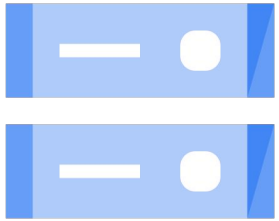
marketing specialists update google sheets:

- Value list
- Power schedule
- Supplier dictionaries for e-motor, OBC, and DCDC
- Supplier addressability
- Component prices

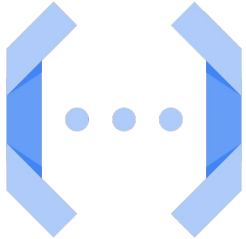
Updated google sheet files are automatically copied to GCP Cloud Storage via API



Responsible employee manually uploads the third-party vehicle database to Cloud Storage



Files upload triggers Cloud Functions, which execute a series of scripts in Colab Enterprise notebooks



Workflow 2/3 - Execution of scripts in Colab Enterprise

Script responsible for preprocessing all uploaded files for subsequent operations

Merge script combines third-party vehicle database with value list, adding components to each vehicle model while tracking unmerged lines

Script integrates the merged database with the power schedule to calculate component power

Script integrates the previously merged database with the supplier dictionary, implementing intricate mapping rules

Final stage involves database reorganization, focusing on individual powertrain components per year and removing redundant columns

Workflow 3/3 - BigQuery

CSV files to BigQuery	Add prices	Add addressability	Connect to Looker
• Upload pre-processed CSV files for prices and addressability to BigQuery • Adding the CSV file of the merged and transformed database to BigQuery	Execute a query to merge the database with the price table	Execute a query to integrate the database with the addressability table to identify competitors that can be outperformed	Final database connected to Google Sheets and Looker Studio

Deployment of the prepared database

Result	Team members can autonomously utilize the database in Looker Studio and Google Sheets to derive marketing insights