# ASSIGNMENT-1

**Name:** Aakash Patel

**Banner ID:** B00807065

**Subject:** Data management, warehousing and analytics

## A. Feasibility Analysis:

I have acquired different datasets related to motor vehicles, schools and related to economics and industry domains to identify relationships between them and gain business-level insights from it. With the help of them, I have created a content management system, which can be scaled up to make further content rich system and gain much better business intelligence.

1. Do you have enough datasets to start building the CMS?

   Yes. There are enough datasets to start building the CMS. Considering the wideness of the domain there will always be other datasets which will be required to be added at a later stage (to make it more information rich).

2. List all the datasets, you find critical for the project.

   - Name: New motor vehicle sales, by type of vehicle
     URL: https://open.canada.ca/data/en/dataset/f6e7e871-79b7-49e1-90a2-e3c913f1951d
     Reason for selection: This dataset provides information about sales of new vehicles annually and thus it can serve to better understand sales demographic for new vehicles across Canada.

   - Name: Manufacturers' sales, inventories, orders and inventory to sales ratios, by industry (dollars unless otherwise noted)
     URL: https://open.canada.ca/data/en/dataset/2e6f30d9-857d-4364-8611-5625b59562be
     Reason for selection: This dataset provides industry based financial information about manufacturer's sales, new orders, unfilled orders, raw materials, goods or work in process, finished goods, total inventories, inventory to sales ratios and finished goods to sales ratios. All this information is useful for study financial performance of manufacturing domain linked to the transport industry. Thus, it can link Economics and Industry domain to the Transport domain.

   - Name: Sales of fuel used for road motor vehicles, annual
     URL: https://open.canada.ca/data/en/dataset/6797dd39-8a2d-4ec3-b285-6123ef61699b
     Reason for selection: This dataset provides information about fuel sales for road motor vehicles and can be utilised to know fuel consumption across the provinces.

   - Name: School board revenues, by direct source of funds and geography
     URL: https://open.canada.ca/data/en/dataset/7dabde2e-d383-490e-b8e4-acfa9e88edec
     Reason for selection: This dataset provides statistical information about revenues by school boards by their source of funds and geography. It can be useful to know revenues to school boards from different sources.

   - Name: School board expenditures, by function and economic classification
     URL: https://open.canada.ca/data/en/dataset/c5e55cde-19fb-4dda-b36f-bcee966fb430
     Reason for selection: This dataset provides puts forward statistical information about expenses of school boards. It can be utilised to know trends of school board expenses by function and economic classification

- Name: Combined public and private expenditure on educational institutions, by level of education
  URL: https://open.canada.ca/data/en/dataset/ed5b6abd-5f22-467b-b3a1-e1ff5a689225
  Reason for selection: This dataset provides public and private expenditure statistics of educational institutions according to level of education. It is useful to understand total expenditure on education.

- Name: Wholesale trade, sales
  URL: https://open.canada.ca/data/en/dataset/57fff1ed-1240-4004-9b37-8c43c0fc249a
  Reason for selection: This dataset can be utilised to study and understand wholesale trade sales for different provinces as per the NAICS (North American Industry Classification system).

- Name: Trade in goods by exporter characteristics, by enterprise employment size and export size
  URL: https://open.canada.ca/data/en/dataset/700c4c4e-66f1-46be-9d47-cf8b5797f7c9
  Reason for selection: This dataset can be used to evaluate goods trade information of Canada by exporter characteristics, enterprise employment size and export size.

3. From your selected datasets, identify entity sets and their attributes.

   Following are the entities which I had visualised by identifying the above-mentioned datasets:

   1. School board Expense: It has attributes like Expenditure function, economic classification from "School board expenditures, by function and economic classification" dataset. I removed 5 attribute columns of 16 from the dataset namely COORDINATE, STATUS, SYMBOL, TERMINATED, DECIMALS as they were unimportant to the database.
   2. Expenditure Function: It enlists type of expenditure functions on basis on which expense statistics can be performed. Attributes can be id (newly created surrogate key), and description.
   3. Economic Classification: It has types of Economic classification categories and has id and description attributes like in case of "Expenditure function".
   4. School board revenue: It has 10 attributes from "School Board revenue" dataset with 5 removed as they were non-useful.
   5. Revenue Source: It has two attributes one being newly created surrogate key (for primary key) and other description to list possible revenue sources by their source.
   6. Vehicle Fuel Sales: It has 11 attributes from "New motor vehicle sales" dataset out of 16 attributes available. 5 attributes were discarded since they were unimportant.
   7. Fuel Sales type: This entity has possible fuel sales type under "Type of fuel sales" attribute along with ID (from newly created surrogate key) to distinguish it uniquely.
   8. New Vehicle Sales: This entity has 11 attributes out of 16 attributes which were found to be useful.
   9. Vehicle Type: It can have id and vehicle type attribute to be used by any other entities.
   10. Location: It can have id and location attribute to be used by most of the other entities.
   11. Measurement: It can have attribute for measurement unit and newly created id (generated by surrogate key).
   12. Scale: It can contain id and corresponding scale factors clubbed into an entity.

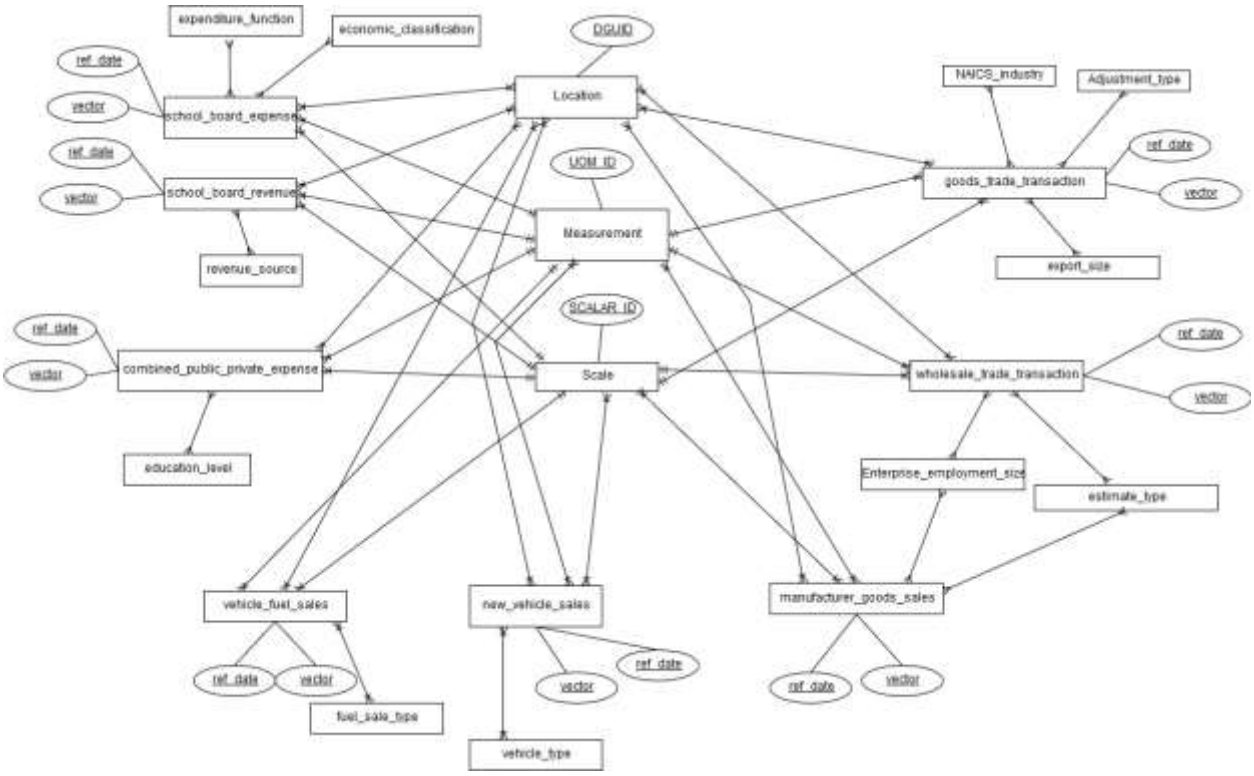
13. NAICS Industry: It can contain id and corresponding NAICS industry classification clubbed into an entity.
14. Adjustment Type: It can contain id and corresponding Adjustment type possible, clubbed into an entity.
15. Goods Trade Transaction: It contains 12 attributes from 17 attributes of "Goods trade transaction" dataset. 5 were discarded since being un-useful.
16. Export Size: It can contain id and Export size attribute to list different types of possible export size types for "Goods trade transaction" entity.
17. Wholesale trade transaction: It contains 12 attributes out of 16 attributes of "Wholesale trade transaction" dataset.
18. Enterprise employment size: It would contain and id and corresponding Enterprise employment size for "Goods trade transaction" dataset.
19. Estimate Type: It would contain id and corresponding description for types of estimate for "Goods trade transaction" data set.
20. Manufacturer Good Sales: This entity contains 12 fields out of "Manufacturer sales transactions" dataset. 5 fields were discarded since being un-useful.

4. List the strong/weak entity sets in your system. In addition, display the total participation

Here, "Location", "Measurement" and "Scale" are some entities over which most other entities depend. If there is no "Scale", "Measurement" or "Location" other entities like "School_board_expenditure" wouldn't exist. Thus, these three are strong entities and all the entities related to it are weak entity. Similarly, entity "Measurement_for_new_vehicle_sales" is a strong entity since it can exist on its own. Hence, entity "New_vehicle_sales_data" which is linked to it is thus a weak entity. There is total participation for "Location" entity in the database as each entity in entity set occurs inside at least one relationship in that relationship set.

## B. Data Modelling

### Initial Design

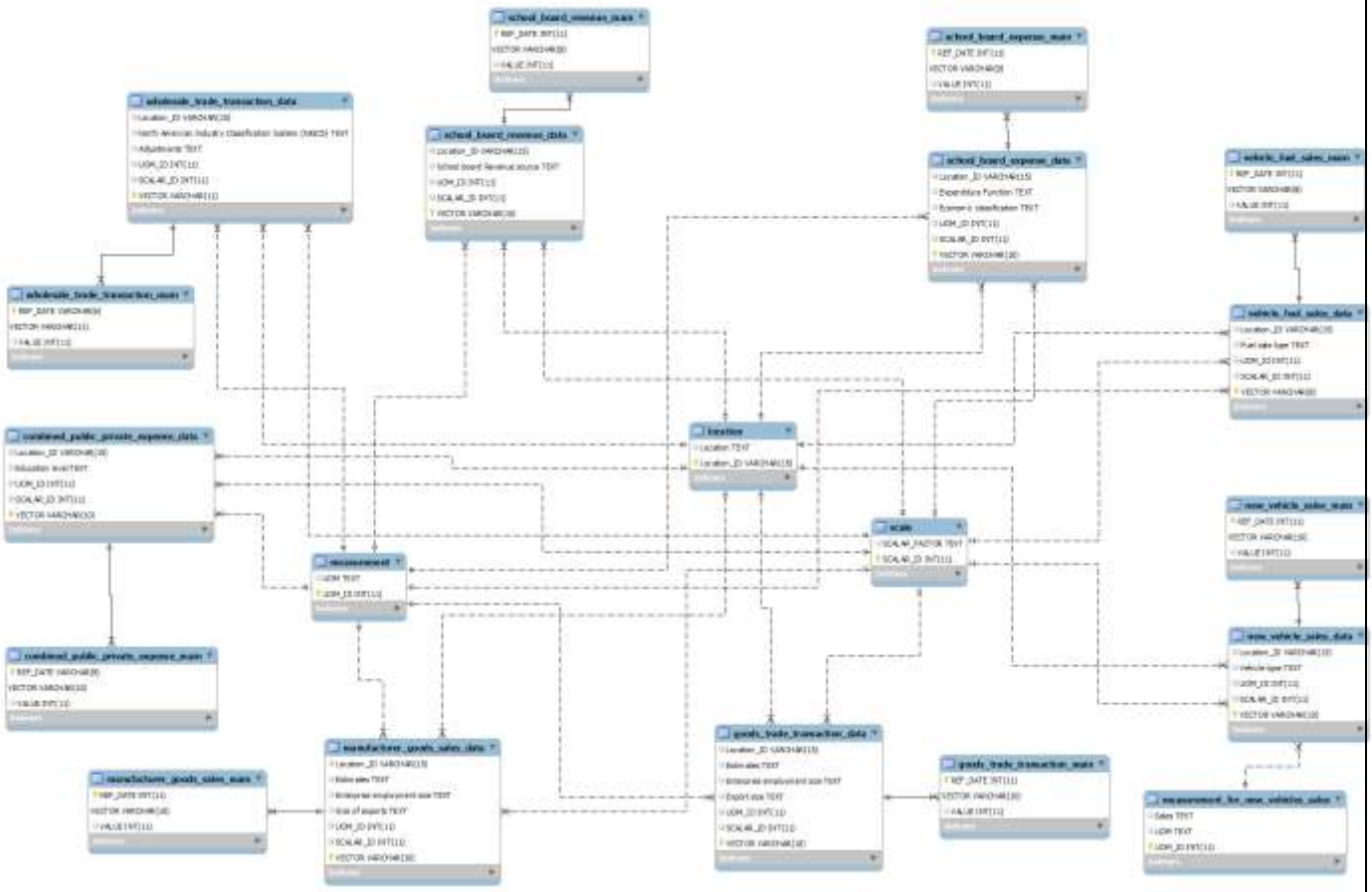



The above entity relationship diagram shows how different entities where found to be related to each other. It describes Entities in rectangle shape and their attributes inside oval. Attributes are shown only for few major entities after initial database design. It helps us to visualise and get a glimpse of how database is going to get developed. Attributes underlined show primary keys for the entities. Cardinalities are based on data available from the datasets selected. For instance, Measurement and Scale are related to some entities using one to many relationships, which is according to the data available and which may sometimes contradict general intuitive sense one may have after before careful examination.

The flaws / design issues in the diagram as below:

- The data for some entity is time variant data. There may arise changes in the design later, as new data gets added in the newer format.
- There is a Fan trap issue for Scale and Measurement entities. Both these entities are related to many other entities with one to many relationships. Thus, they pose a fan trap issue to the design.

## Final Design



The above entity relationship diagram represents final design in crow-foot notation. There is decrease in the data redundancy among entities, however there is still some redundancy left. This may be improved by further normalising the database.

## Normalization Process

- Before Normalization is datasets selected were pruned to remove un-useful attributes. Some attributes were renamed for better understanding by third person who wants to understand the database. Ex: GEO named as “Location” and DGUID as “LocationID”.
- Then entities were analysed for the data to deciding keys to uniquely identify records.
- Each table then happened to be satisfying conditions for 1NF like identification of key attributes, no repetition of groups and all attributes being dependent on primary key. Thus, database was already in 1 NF.

## 1st Normal Form:

| REF_DATE | Location | Location_ID | Education_level | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|
| 2007/2008 | Canada | 2016A000011124 | All levels combined | Current dollars | 75 | millions | 6 | v113534375 | 91666 |
| 2007/2008 | Canada | 2016A000011124 | Pre-elementary, elem... | Current dollars | 75 | millions | 6 | v113534376 | 53931 |
| 2007/2008 | Canada | 2016A000011124 | Post-secondary level... | Current dollars | 75 | millions | 6 | v113534377 | 37735 |
| 2007/2008 | Canada | 2016A000011124 | College | Current dollars | 75 | millions | 6 | v113534378 | 13971 |
| 2007/2008 | Canada | 2016A000011124 | University | Current dollars | 75 | millions | 6 | v113534379 | 23764 |
| 2007/2008 | Newfoundland a... | 2016A000210 | All levels combined | Current dollars | 75 | millions | 6 | v113534380 | 1322 |
| 2007/2008 | Newfoundland a... | 2016A000210 | Pre-elementary, elem... | Current dollars | 75 | millions | 6 | v113534381 | 736 |
| 2007/2008 | Newfoundland a... | 2016A000210 | Post-secondary level... | Current dollars | 75 | millions | 6 | v113534382 | 586 |

*Figure 1: combined_public_private_expense*

| REF_DATE | Location | Location_ID | Estimates | Enterprise_employment_size | Export_size | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | All export sizes | Dollars | 81 | thousands | 3 | v108797305 | 359917422 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | Less than $1 million | Dollars | 81 | thousands | 3 | v108797306 | 4426875 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | $1 million to $24.9 million | Dollars | 81 | thousands | 3 | v108797307 | 39371559 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | $25 million to $99.9 million | Dollars | 81 | thousands | 3 | v108797308 | 37511665 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | $100 million to $499.9 million | Dollars | 81 | thousands | 3 | v108797309 | 56262242 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | $500 million to $999.9 million | Dollars | 81 | thousands | 3 | v108797310 | 30879901 |
| 2010 | Canada | 2016A0000... | Value of exports | All enterprise employment ... | $1 billion or greater | Dollars | 81 | thousands | 3 | v108797311 | 191465180 |

*Figure 2: goods_trade_transaction*

| REF_DATE | Location | Location_ID | Estimates | Enterprise_employmen | Size_of_exports | UOM | UOM_ID | SCALAR_FACTOR | SCALA | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | All export sizes | Dollars | 81 | thousands | 3 | v108797305 | 359917422 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | Less than $1 million | Dollars | 81 | thousands | 3 | v108797306 | 4426875 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | $1 million to $24.9 million | Dollars | 81 | thousands | 3 | v108797307 | 39371559 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | $25 million to $99.9 million | Dollars | 81 | thousands | 3 | v108797308 | 37511665 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | $100 million to $499.9 m... | Dollars | 81 | thousands | 3 | v108797309 | 56262242 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | $500 million to $999.9 m... | Dollars | 81 | thousands | 3 | v108797310 | 30879901 |
| 2010 | Canada | 2016A000011124 | Value of exports | All enterprise emplo... | $1 billion or greater | Dollars | 81 | thousands | 3 | v108797311 | 191465180 |

*Figure 3: manufacturer_goods_sales*

| REF_DATE | Location | Location_ID | Vehicle_type | Sales | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | Canada | 2016A000011124 | Total, new motor vehicles | Units | Units | 300 | units | 0 | v53846122 | 1584499 |
| 2010 | Canada | 2016A000011124 | Total, new motor vehicles | Dollars | Dollars | 81 | thousands | 3 | v53846123 | 52315609 |
| 2010 | Canada | 2016A000011124 | Passenger cars | Units | Units | 300 | units | 0 | v53846124 | 710214 |
| 2010 | Canada | 2016A000011124 | Passenger cars | Dollars | Dollars | 81 | thousands | 3 | v53846125 | 18982437 |
| 2010 | Canada | 2016A000011124 | Trucks | Units | Units | 300 | units | 0 | v53846126 | 874285 |
| 2010 | Canada | 2016A000011124 | Trucks | Dollars | Dollars | 81 | thousands | 3 | v53846127 | 33333173 |
| 2010 | Canada | 2016A000011124 | Light trucks | Units | Units | 300 | units | 0 | v53846128 | 847615 |

*Figure 4: new_vehicle_sales*

| REF_DATE | Location | Location_ID | Expenditure_Function | Economic_classification | UOM | UOM_ID | SCALAR_FACTOR | SCALAI | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Salary and wages expenditures | Dollars | 81 | thousands | 3 | v1025922 | 97640 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Fringe benefits expenditures | Dollars | 81 | thousands | 3 | v1025923 | 7190 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Supply and services expenditures | Dollars | 81 | thousands | 3 | v1025924 | 18600 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Fees and contractual services expe... | Dollars | 81 | thousands | 3 | v1025925 | 19294 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Other operating expenditures | Dollars | 81 | thousands | 3 | v1025926 | 17960 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Capital expenditures (non-allocable... | Dollars | 81 | thousands | 3 | v1025927 | 886 |
| 1973 | Canada | 2016A000011124 | Business administration expenditures | Total expenditures by economic cla... | Dollars | 81 | thousands | 3 | v1025928 | 161570 |

*Figure 5: school_board_expense*

| REF_DATE | Location | Location_ID | School_board_Revenue_source | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|
| 1900 | Canada | 2016A000011124 | Local taxation sources | Dollars | 81 | thousands | 3 | v1025844 | 7743 |
| 1900 | Canada | 2016A000011124 | Provincial government sources | Dollars | 81 | thousands | 3 | v1025845 | 1817 |
| 1900 | Canada | 2016A000011124 | Federal government sources | Dollars | 81 | thousands | 3 | v1025846 | 0 |
| 1900 | Canada | 2016A000011124 | Student and other school fees | Dollars | 81 | thousands | 3 | v1025847 | 50 |
| 1900 | Canada | 2016A000011124 | Other private sector sources | Dollars | 81 | thousands | 3 | v1025848 | 777 |
| 1900 | Canada | 2016A000011124 | Total revenues | Dollars | 81 | thousands | 3 | v1025849 | 10387 |
| 1900 | Prince Edward Island | 2016A000211 | Local taxation sources | Dollars | 81 | thousands | 3 | v1025856 | 34 |

*Figure 6: school_board_revenue*

| REF_DATE | Location | Location_ID | Fuel_sale_type | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|
| 1993 | Canada | 2016A000011124 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74726 | 32563430 |
| 1993 | Newfoundland and Labrador | 2016A000210 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74727 | 585091 |
| 1993 | British Columbia | 2016A000259 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74728 | 3869461 |
| 1993 | Yukon | 2016A000260 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74729 | 61276 |
| 1993 | Northwest Territories including Nunavut | 2011A000261 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74730 | 33126 |
| 1993 | Prince Edward Island | 2016A000211 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74731 | 174007 |
| 1993 | Nova Scotia | 2016A000212 | Net sales of gasoline | Litres | 203 | thousands | 3 | v74732 | 1085350 |

*Figure 7: vehicle_fuel_sales*

| REF_DATE | Location | Location_ID | North_American_Industry_Classification_System_( | Adjustments | UOM | UOM_ID | SCALAR_FACTOR | SCALAR | VECTOR | VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 01-Apr | Canada | 2016A000011124 | Wholesale trade | Unadjusted | Dollars | 81 | thousands | 3 | v52367636 | 30829599 |
| 01-Apr | Canada | 2016A000011124 | Wholesale trade | Seasonally adjusted | Dollars | 81 | thousands | 3 | v52367637 | 31047847 |
| 01-Apr | Canada | 2016A000011124 | Pharmaceuticals and pharmacy supplies mercha... | Unadjusted | Dollars | 81 | thousands | 3 | v52367644 | 1414097 |
| 01-Apr | Canada | 2016A000011124 | Pharmaceuticals and pharmacy supplies mercha... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v52367645 | 1505223 |
| 01-Apr | Canada | 2016A000011124 | Motor vehicle and motor vehicle parts and acce... | Unadjusted | Dollars | 81 | thousands | 3 | v52367648 | 6506419 |
| 01-Apr | Canada | 2016A000011124 | Motor vehicle and motor vehicle parts and acce... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v52367649 | 5963090 |
| 01-Apr | Canada | 2016A000011124 | Motor vehicle merchant wholesalers | Unadjusted | Dollars | 81 | thousands | 3 | v52367650 | 5221453 |

*Figure 8: wholesale_trade_transaction*

- After being in 1st Normal Form, partial dependencies were identified on the key attributes.
- Removal of partial dependencies made the database to transition to 2nd Normal form.

## 2nd Normal form:

| Location | Location_ID | Education level | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|
| Canada | 2016A000011124 | All levels combined | Current dollars | 75 | millions | 6 | v113534375 |
| Canada | 2016A000011124 | Pre-elementary, elementary-secondary | Current dollars | 75 | millions | 6 | v113534376 |
| Canada | 2016A000011124 | Post-secondary levels combined | Current dollars | 75 | millions | 6 | v113534377 |
| Canada | 2016A000011124 | College | Current dollars | 75 | millions | 6 | v113534378 |
| Canada | 2016A000011124 | University | Current dollars | 75 | millions | 6 | v113534379 |
| Newfoundland and Labrador | 2016A000210 | All levels combined | Current dollars | 75 | millions | 6 | v113534380 |

*Figure 9: combined_public_private_expense_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2007/2008 | v113534375 | 91666 |
| 2007/2008 | v113534376 | 53931 |
| 2007/2008 | v113534377 | 37735 |
| 2007/2008 | v113534378 | 13971 |
| 2007/2008 | v113534379 | 23764 |
| 2007/2008 | v113534380 | 1322 |
| 2007/2008 | v113534381 | 736 |

*Figure 10: combined_public_private_expense_main*

| Location | Location_ID | Estimates | Enterprise employment size | Export size | UOM | UOM_I | SCALAR_FA | SCALA | VECTOR |
|---|---|---|---|---|---|---|---|---|---|
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | All export sizes | Dollars | 81 | thousands | 3 | v108797305 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | Less than $1 million | Dollars | 81 | thousands | 3 | v108797306 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $1 million to $24.9 million | Dollars | 81 | thousands | 3 | v108797307 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $25 million to $99.9 million | Dollars | 81 | thousands | 3 | v108797308 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $100 million to $499.9 mil... | Dollars | 81 | thousands | 3 | v108797309 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $500 million to $999.9 mil... | Dollars | 81 | thousands | 3 | v108797310 |

*Figure 11: goods_trade_transaction_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2010 | v108797305 | 359917422 |
| 2010 | v108797306 | 4426875 |
| 2010 | v108797307 | 39371559 |
| 2010 | v108797308 | 37511665 |
| 2010 | v108797309 | 56262242 |
| 2010 | v108797310 | 30879901 |
| 2010 | v108797311 | 191465180 |

*Figure 12: goods_trade_transaction_main*

| Location | Location_ID | Estimates | Enterprise employment size | Size of exports | UOM | UOM_ID | SCALAR_FACTOR | SCALAF | VECTOR |
|---|---|---|---|---|---|---|---|---|---|
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | All export sizes | Dollars | 81 | thousands | 3 | v108797305 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | Less than $1 million | Dollars | 81 | thousands | 3 | v108797306 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $1 million to $24.9 million | Dollars | 81 | thousands | 3 | v108797307 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $25 million to $99.9 million | Dollars | 81 | thousands | 3 | v108797308 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $100 million to $499.9 million | Dollars | 81 | thousands | 3 | v108797309 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $500 million to $999.9 million | Dollars | 81 | thousands | 3 | v108797310 |
| Canada | 2016A000011124 | Value of exports | All enterprise employment sizes | $1 billion or greater | Dollars | 81 | thousands | 3 | v108797311 |
| Canada | 2016A000011124 | Value of exports | Small and medium-sized enterprises... | All export sizes | Dollars | 81 | thousands | 3 | v108797312 |
| Canada | 2016A000011124 | Value of exports | Small and medium-sized enterprises | Less than $1 million | Dollars | 81 | thousands | 3 | v108797313 |

*Figure 13: manufacturer_goods_sales_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2010 | v108797305 | 359917422 |
| 2010 | v108797306 | 4426875 |
| 2010 | v108797307 | 39371559 |
| 2010 | v108797308 | 37511665 |
| 2010 | v108797309 | 56262242 |
| 2010 | v108797310 | 30879901 |

*Figure 14: manufacturer_goods_sales_main*

| Location | Location_ID | Vehicle type | Sales | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|---|
| Canada | 2016A000011124 | Total, new motor vehicles | Units | Units | 300 | units | 0 | v53846122 |
| Canada | 2016A000011124 | Total, new motor vehicles | Dollars | Dollars | 81 | thousands | 3 | v53846123 |
| Canada | 2016A000011124 | Passenger cars | Units | Units | 300 | units | 0 | v53846124 |
| Canada | 2016A000011124 | Passenger cars | Dollars | Dollars | 81 | thousands | 3 | v53846125 |
| Canada | 2016A000011124 | Trucks | Units | Units | 300 | units | 0 | v53846126 |
| Canada | 2016A000011124 | Trucks | Dollars | Dollars | 81 | thousands | 3 | v53846127 |

*Figure 15: new_vehicle_sales_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2010 | v53846122 | 1584499 |
| 2010 | v53846123 | 52315609 |
| 2010 | v53846124 | 710214 |
| 2010 | v53846125 | 18982437 |
| 2010 | v53846126 | 874285 |
| 2010 | v53846127 | 33333173 |
| 2010 | v53846128 | 847615 |
| 2010 | v53846129 | 29780756 |

*Figure 16: new_vehicle_sales_main*

| Location | Location_ID | Expenditure Function | Economic classification | UOM | UOM_ID | SCALAR_FA | SCAL | VECTOR |
|---|---|---|---|---|---|---|---|---|
| Canada | 2016A000011124 | Business administration expenditures | Salary and wages expenditures | Dollars | 81 | thousands | 3 | v1025922 |
| Canada | 2016A000011124 | Business administration expenditures | Fringe benefits expenditures | Dollars | 81 | thousands | 3 | v1025923 |
| Canada | 2016A000011124 | Business administration expenditures | Supply and services expenditures | Dollars | 81 | thousands | 3 | v1025924 |
| Canada | 2016A000011124 | Business administration expenditures | Fees and contractual services expenditures | Dollars | 81 | thousands | 3 | v1025925 |
| Canada | 2016A000011124 | Business administration expenditures | Other operating expenditures | Dollars | 81 | thousands | 3 | v1025926 |
| Canada | 2016A000011124 | Business administration expenditures | Capital expenditures (non-allocable, outlay and ... | Dollars | 81 | thousands | 3 | v1025927 |
| Canada | 2016A000011124 | Business administration expenditures | Total expenditures by economic classification | Dollars | 81 | thousands | 3 | v1025928 |

*Figure 17: school_board_expense_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1973 | v1025922 | 97640 |
| | 1973 | v1025923 | 7190 |
| | 1973 | v1025924 | 18600 |
| | 1973 | v1025925 | 19294 |
| | 1973 | v1025926 | 17960 |
| | 1973 | v1025927 | 886 |

*Figure 18: school_board_expense_main*

| | Location | Location_ID | School board Revenue source | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|---|
| ▶ | Canada | 2016A000011124 | Local taxation sources | Dollars | 81 | thousands | 3 | v1025844 |
| | Canada | 2016A000011124 | Provincial government sources | Dollars | 81 | thousands | 3 | v1025845 |
| | Canada | 2016A000011124 | Federal government sources | Dollars | 81 | thousands | 3 | v1025846 |
| | Canada | 2016A000011124 | Student and other school fees | Dollars | 81 | thousands | 3 | v1025847 |
| | Canada | 2016A000011124 | Other private sector sources | Dollars | 81 | thousands | 3 | v1025848 |
| | Canada | 2016A000011124 | Total revenues | Dollars | 81 | thousands | 3 | v1025849 |
| | Newfoundland and Labrador | 2016A000210 | Local taxation sources | Dollars | 81 | thousands | 3 | v1025850 |

*Figure 19: school_board_revenue_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1900 | v1025844 | 7743 |
| | 1900 | v1025845 | 1817 |
| | 1900 | v1025846 | 0 |
| | 1900 | v1025847 | 50 |
| | 1900 | v1025848 | 777 |
| | 1900 | v1025849 | 10387 |

*Figure 20: school_board_revenue_main*

| | Location | Location_ID | Fuel sale type | UOM | UOM_ID | SCALAR_FACTOR | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|---|
| ▶ | Northwest Territories | 2016A000261 | Net sales of gasoline | Litres | 203 | thousands | 3 | v1454626 |
| | Nunavut | 2016A000262 | Net sales of gasoline | Litres | 203 | thousands | 3 | v1454627 |
| | Northwest Territories | 2016A000261 | Gross sales of gasoline | Litres | 203 | thousands | 3 | v1454628 |
| | Nunavut | 2016A000262 | Gross sales of gasoline | Litres | 203 | thousands | 3 | v1454629 |
| | Northwest Territories | 2016A000261 | Net sales of diesel oil | Litres | 203 | thousands | 3 | v1454634 |
| | Nunavut | 2016A000262 | Net sales of diesel oil | Litres | 203 | thousands | 3 | v1454635 |
| | Northwest Territories | 2016A000261 | Net sales of liquefied petroleum gas | Litres | 203 | thousands | 3 | v1454636 |
| | Nunavut | 2016A000262 | Net sales of liquefied petroleum gas | Litres | 203 | thousands | 3 | v1454637 |

*Figure 21: vehicle_fuel_sales_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1993 | v74726 | 32563430 |
| | 1993 | v74727 | 585091 |
| | 1993 | v74728 | 3869461 |
| | 1993 | v74729 | 61276 |
| | 1993 | v74730 | 33126 |
| | 1993 | v74731 | 174007 |
| | 1993 | v74732 | 1085350 |

*Figure 22: vehicle_fuel_sales_main*

| | Location | Location_ID | North American Industry Classification System (NAICS) | Adjustments | UOM | UOM_ID | SCALAR_F | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|---|---|
| ▶ | Newfoundland and Labrador | 2016A000210 | Food, beverage and tobacco merchant wholesa... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624003 |
| | Newfoundland and Labrador | 2016A000210 | Personal and household goods merchant wholes... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624004 |
| | Newfoundland and Labrador | 2016A000210 | Motor vehicle and motor vehicle parts and acce... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624005 |
| | Newfoundland and Labrador | 2016A000210 | Building material and supplies merchant wholesa... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624006 |
| | Newfoundland and Labrador | 2016A000210 | Machinery, equipment and supplies merchant w... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624007 |
| | Prince Edward Island | 2016A000211 | Food, beverage and tobacco merchant wholesa... | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624010 |
| | Nova Scotia | 2016A000212 | Farm product merchant wholesalers | Seasonally adjusted | Dollars | 81 | thousands | 3 | v114624016 |

*Figure 23: wholesale_trade_transaction_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 01-Apr | v52367636 | 30829599 |
| | 01-Apr | v52367637 | 31047847 |
| | 01-Apr | v52367644 | 1414097 |
| | 01-Apr | v52367645 | 1505223 |
| | 01-Apr | v52367648 | 6506419 |
| | 01-Apr | v52367649 | 5963090 |
| | 01-Apr | v52367650 | 5221453 |

*Figure 24: wholesale_trade_transaction_main*

- After converting into 2nd Normal form we remove transitive dependencies to get 3rd Normal form.
- In this process we just split up existing tables in 2nd NF.

## 3nd Normal Form:

| Location_ID | Education level | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|
| 2016A000011124 | All levels combined | 75 | 6 | v113534375 |
| 2016A000011124 | Pre-elementary, elementary-secondary | 75 | 6 | v113534376 |
| 2016A000011124 | Post-secondary levels combined | 75 | 6 | v113534377 |
| 2016A000011124 | College | 75 | 6 | v113534378 |
| 2016A000011124 | University | 75 | 6 | v113534379 |

*Figure 25: combined_public_private_expense_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2007/2008 | v113534375 | 91666 |
| 2007/2008 | v113534376 | 53931 |
| 2007/2008 | v113534377 | 37735 |
| 2007/2008 | v113534378 | 13971 |
| 2007/2008 | v113534379 | 23764 |

*Figure 26: combined_public_private_expense_main*

| Location_ID | Estimates | Enterprise employment size | Export size | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|
| 2016A000011124 | Value of exports | All enterprise employment sizes | All export sizes | 81 | 3 | v108797305 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | Less than $1 million | 81 | 3 | v108797306 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | $1 million to $24.9 million | 81 | 3 | v108797307 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | $25 million to $99.9 million | 81 | 3 | v108797308 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | $100 million to $499.9 million | 81 | 3 | v108797309 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | $500 million to $999.9 million | 81 | 3 | v108797310 |
| 2016A000011124 | Value of exports | All enterprise employment sizes | $1 billion or greater | 81 | 3 | v108797311 |
| 2016A000011124 | Value of exports | Small and medium-sized enterprises (0 to 499 e... | All export sizes | 81 | 3 | v108797312 |

*Figure 27: goods_trade_transaction_data*

| REF_DATE | VECTOR | VALUE |
|---|---|---|
| 2010 | v108797305 | 359917422 |
| 2010 | v108797306 | 4426875 |
| 2010 | v108797307 | 39371559 |
| 2010 | v108797308 | 37511665 |
| 2010 | v108797309 | 56262242 |
| 2010 | v108797310 | 30879901 |

*Figure 28: goods_trade_transaction_main*

| | Location | Location_ID |
|---|---|---|
| ▶ | Canada | 2016A000011124 |
| | Newfoundland and Labrador | 2016A000210 |
| | Prince Edward Island | 2016A000211 |
| | Nova Scotia | 2016A000212 |
| | New Brunswick | 2016A000213 |
| | Quebec | 2016A000224 |
| | Ontario | 2016A000235 |

*Figure 29: location*

| | Location_ID | Estimates | Enterprise employment size | Size of exports | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|---|
| ▶ | 2016A000011124 | Value of exports | All enterprise employment sizes | All export sizes | 81 | 3 | v108797305 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | Less than $1 million | 81 | 3 | v108797306 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | $1 million to $24.9 million | 81 | 3 | v108797307 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | $25 million to $99.9 million | 81 | 3 | v108797308 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | $100 million to $499.9 million | 81 | 3 | v108797309 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | $500 million to $999.9 million | 81 | 3 | v108797310 |
| | 2016A000011124 | Value of exports | All enterprise employment sizes | $1 billion or greater | 81 | 3 | v108797311 |

*Figure 30: manufacturer_goods_sales_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 2010 | v108797305 | 359917422 |
| | 2010 | v108797306 | 4426875 |
| | 2010 | v108797307 | 39371559 |
| | 2010 | v108797308 | 37511665 |
| | 2010 | v108797309 | 56262242 |
| | 2010 | v108797310 | 30879901 |

*Figure 31: manufacturer_goods_sales_main*

| | UOM | UOM_ID |
|---|---|---|
| ▶ | Current dollars | 75 |
| | Dollars | 81 |
| | Litres | 203 |
| | Number | 223 |
| | Units | 300 |

*Figure 32: measurement*

| | Sales | UOM | UOM_ID |
|---|---|---|---|
| ▶ | Dollars | Dollars | 81 |
| | Units | Units | 300 |

*Figure 33: measurement_for_new_vehicles_sales*

| | Location_ID | Vehicle type | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|
| ▶ | 2016A000011124 | Total, new motor vehicles | 300 | 0 | v53846122 |
| | 2016A000011124 | Total, new motor vehicles | 81 | 3 | v53846123 |
| | 2016A000011124 | Passenger cars | 300 | 0 | v53846124 |
| | 2016A000011124 | Passenger cars | 81 | 3 | v53846125 |
| | 2016A000011124 | Trucks | 300 | 0 | v53846126 |
| | 2016A000011124 | Trucks | 81 | 3 | v53846127 |
| | 2016A000011124 | Light trucks | 300 | 0 | v53846128 |

*Figure 34: new_vehicle_sales_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 2010 | v53846122 | 1584499 |
| | 2010 | v53846123 | 52315609 |
| | 2010 | v53846124 | 710214 |
| | 2010 | v53846125 | 18982437 |
| | 2010 | v53846126 | 874285 |
| | 2010 | v53846127 | 33333173 |

*Figure 35: new_vehicle_sales_main*

| | SCALAR_FACTOR | SCALAR_ID |
|---|---|---|
| ▶ | units | 0 |
| | thousands | 3 |
| | millions | 6 |

*Figure 36: scale*

| | Location_ID | Expenditure Function | Economic classification | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|
| ▶ | 2016A000011124 | Business administration expenditures | Salary and wages expenditures | 81 | 3 | v1025922 |
| | 2016A000011124 | Business administration expenditures | Fringe benefits expenditures | 81 | 3 | v1025923 |
| | 2016A000011124 | Business administration expenditures | Supply and services expenditures | 81 | 3 | v1025924 |
| | 2016A000011124 | Business administration expenditures | Fees and contractual services expenditures | 81 | 3 | v1025925 |
| | 2016A000011124 | Business administration expenditures | Other operating expenditures | 81 | 3 | v1025926 |
| | 2016A000011124 | Business administration expenditures | Capital expenditures (non-allocable, outlay and ... | 81 | 3 | v1025927 |
| | 2016A000011124 | Business administration expenditures | Total expenditures by economic classification | 81 | 3 | v1025928 |

*Figure 37: school_board_expense_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1973 | v1025922 | 97640 |
| | 1973 | v1025923 | 7190 |
| | 1973 | v1025924 | 18600 |
| | 1973 | v1025925 | 19294 |
| | 1973 | v1025926 | 17960 |
| | 1973 | v1025927 | 886 |

*Figure 38: school_board_expense_main*

| | Location_ID | School board Revenue source | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|
| ▶ | 2016A000011124 | Local taxation sources | 81 | 3 | v1025844 |
| | 2016A000011124 | Provincial government sources | 81 | 3 | v1025845 |
| | 2016A000011124 | Federal government sources | 81 | 3 | v1025846 |
| | 2016A000011124 | Student and other school fees | 81 | 3 | v1025847 |
| | 2016A000011124 | Other private sector sources | 81 | 3 | v1025848 |
| | 2016A000011124 | Total revenues | 81 | 3 | v1025849 |

*Figure 39: school_board_revenue_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1900 | v1025844 | 7743 |
| | 1900 | v1025845 | 1817 |
| | 1900 | v1025846 | 0 |
| | 1900 | v1025847 | 50 |
| | 1900 | v1025848 | 777 |
| | 1900 | v1025849 | 10387 |
| | 1900 | v1025856 | 34 |
| | 1900 | v1025857 | 116 |

*Figure 40: school_board_revenue_main*

| | Location_ID | Fuel sale type | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|
| ▶ | 2016A000261 | Net sales of gasoline | 203 | 3 | v1454626 |
| | 2016A000262 | Net sales of gasoline | 203 | 3 | v1454627 |
| | 2016A000261 | Gross sales of gasoline | 203 | 3 | v1454628 |
| | 2016A000262 | Gross sales of gasoline | 203 | 3 | v1454629 |
| | 2016A000261 | Net sales of diesel oil | 203 | 3 | v1454634 |
| | 2016A000262 | Net sales of diesel oil | 203 | 3 | v1454635 |
| | 2016A000261 | Net sales of liquefied petroleum gas | 203 | 3 | v1454636 |

*Figure 41: vehicle_fuel_sales_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 1993 | v74726 | 32563430 |
| | 1993 | v74727 | 585091 |
| | 1993 | v74728 | 3869461 |
| | 1993 | v74729 | 61276 |
| | 1993 | v74730 | 33126 |
| | 1993 | v74731 | 174007 |
| | 1993 | v74732 | 1085350 |

*Figure 42: vehicle_fuel_sales_main*

| | Location_ID | North American Industry Classification System (NAICS) | Adjustments | UOM_ID | SCALAR_ID | VECTOR |
|---|---|---|---|---|---|---|
| ▶ | 2016A000210 | Food, beverage and tobacco merchant wholesa... | Seasonally adjusted | 81 | 3 | v114624003 |
| | 2016A000210 | Personal and household goods merchant wholes... | Seasonally adjusted | 81 | 3 | v114624004 |
| | 2016A000210 | Motor vehicle and motor vehicle parts and acce... | Seasonally adjusted | 81 | 3 | v114624005 |
| | 2016A000210 | Building material and supplies merchant wholesa... | Seasonally adjusted | 81 | 3 | v114624006 |
| | 2016A000210 | Machinery, equipment and supplies merchant w... | Seasonally adjusted | 81 | 3 | v114624007 |
| | 2016A000211 | Food, beverage and tobacco merchant wholesa... | Seasonally adjusted | 81 | 3 | v114624010 |
| | 2016A000212 | Farm product merchant wholesalers | Seasonally adjusted | 81 | 3 | v114624016 |

*Figure 43: wholesale_trade_transaction_data*

| | REF_DATE | VECTOR | VALUE |
|---|---|---|---|
| ▶ | 01-Apr | v52367636 | 30829599 |
| | 01-Apr | v52367637 | 31047847 |
| | 01-Apr | v52367644 | 1414097 |
| | 01-Apr | v52367645 | 1505223 |
| | 01-Apr | v52367648 | 6506419 |
| | 01-Apr | v52367649 | 5963090 |

*Figure 44: wholesale_trade_transaction_main*

## REFERENCES


[1] 2019. [Online]. Available: https://www.academia.edu/5158113/Business_Analysis_Report_of_Singapur_and_south_Korea_Name_of_Student_Name_of_Course_Name_of_Institution_Date_Table_of_Contents_Executive_Summary_3_Business_Analysis_Report_of_Singapur_and_South_Korea_4_1_Introduction-Background_about_countries_4_2_Reasons_for_investing_in_these_countries_4_3?auto=download. [Accessed: 31- May- 2019].

[2]2019. [Online]. Available: https://open.canada.ca/en/open-data. [Accessed: 31- May- 2019].

[3]2019. [Online]. Available: https://www.studocu.com/en/document/queensland-university-of-technology/global-business/mandatory-assignments/two-country-analysis-report/1435233/view. [Accessed: 31- May- 2019].

[4] V. Walpola, "Total Participation Vs Partial Participation", *SAMITHA'S Tech Blog*, 2019. [Online]. Available: https://swtechworld.wordpress.com/2017/05/01/total-participation-vs-partial-participation/. [Accessed: 31- May- 2019].