Improving inventory and sales management and optimizing sales performance

Importing Libraies

In [1]:
```
import pandas as pd
import numpy as np

import warnings
warnings.filterwarnings('ignore')

import matplotlib.pyplot as plt
import seaborn as sns

#pd.set_option('display.max_columns', None)
#pd.set_option('display.max_rows', None)
```

In [2]:
```
df = pd.read_csv('Warehouse_and_Retail_Sales.csv')
df.head()
```

Out[2]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
0	2020	1	REPUBLIC NATIONAL DISTRIBUTING CO	100009	BOOTLEG RED - 750ML	WINE	0.00	0.0	2.0
1	2020	1	PWSWN INC	100024	MOMENT DE PLAISIR - 750ML	WINE	0.00	1.0	4.0
2	2020	1	RELIABLE CHURCHILL LLLP	1001	S SMITH ORGANIC PEAR CIDER - 18.7OZ	BEER	0.00	0.0	1.0
3	2020	1	LANTERNA DISTRIBUTORS INC	100145	SCHLINK HAUS KABINETT - 750ML	WINE	0.00	0.0	1.0
4	2020	1	DIONYSOS IMPORTS INC	100293	SANTORINI GAVALA WHITE - 750ML	WINE	0.82	0.0	0.0

Data Understanding

In [3]:
```
df.shape
```

Out[3]:
```
(307645, 9)
```

In [4]:
```
df['YEAR'].unique()
```

Out[4]:
```
array([2020, 2017, 2018, 2019], dtype=int64)
```

In [5]:
```
df['YEAR'].value_counts().sort_values()
```

Out[5]:
```
YEAR
2018     26445
2020     46278
2017     96284
2019    138638
Name: count, dtype: int64
```

In [6]:
```
df.head(2)
```

Out[6]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
0	2020	1	REPUBLIC NATIONAL DISTRIBUTING CO	100009	BOOTLEG RED - 750ML	WINE	0.0	0.0	2.0
1	2020	1	PWSWN INC	100024	MOMENT DE PLAISIR - 750ML	WINE	0.0	1.0	4.0

This Data Contains four years details with 307645 rows and 9 columns

Understanding the Columns

1. Year: The year, the sales transfers, and warehouse activities occurred.
2. Month: The month corresponding to the year in which the sales transfers and warehouse activities occurred.
3. Supplier: This column identifies the name of the supplier who distributes the item
4. Item Code: The unique identifier for each item and product distributed

5. Item Description: This column provides a description Name of the item and product.
6. Item Type: The category of the item based on its product type.
7. Retail Sales: This column represents the quantity of items sold at retail locations.
8. Retail Transfers: This column indicates the quantity of items transferred from the warehouse to retail locations.
9. Warehouse Sales: This column shows the quantity of items sold directly from the warehouse.

In [7]:
```
df.nunique()
```

Out[7]:
```
YEAR                   4
MONTH                 12
SUPPLIER             396
ITEM CODE          34056
ITEM DESCRIPTION   34822
ITEM TYPE              8
RETAIL SALES       10674
RETAIL TRANSFERS    2504
WAREHOUSE SALES     4895
dtype: int64
```

Data Cleaning

In [8]:
```
df2 = df.copy()
```

In [9]:
```
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 307645 entries, 0 to 307644
Data columns (total 9 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   YEAR              307645 non-null  int64  
 1   MONTH             307645 non-null  int64  
 2   SUPPLIER          307478 non-null  object 
 3   ITEM CODE         307645 non-null  object 
 4   ITEM DESCRIPTION  307645 non-null  object 
 5   ITEM TYPE         307644 non-null  object 
 6   RETAIL SALES      307642 non-null  float64
 7   RETAIL TRANSFERS  307645 non-null  float64
 8   WAREHOUSE SALES   307645 non-null  float64
dtypes: float64(3), int64(2), object(4)
memory usage: 21.1+ MB
```

Clean the Year and Month Column

- change the datatype
- format and replace the month number with the month name

In [10]:
```
# change the datatype from int to str

df2['YEAR'] = df2['YEAR'].astype(str)

df2['MONTH'] = df2['MONTH'].astype(str)
```

In [11]:
```
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 307645 entries, 0 to 307644
Data columns (total 9 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   YEAR              307645 non-null  object 
 1   MONTH             307645 non-null  object 
 2   SUPPLIER          307478 non-null  object 
 3   ITEM CODE         307645 non-null  object 
 4   ITEM DESCRIPTION  307645 non-null  object 
 5   ITEM TYPE         307644 non-null  object 
 6   RETAIL SALES      307642 non-null  float64
 7   RETAIL TRANSFERS  307645 non-null  float64
 8   WAREHOUSE SALES   307645 non-null  float64
dtypes: float64(3), object(6)
memory usage: 21.1+ MB
```

In [12]:
```
# Replace the month number with the month name

df2['MONTH'] = df2['MONTH'].str.replace('1','January')
df2['MONTH'] = df2['MONTH'].str.replace('2','February')
df2['MONTH'] = df2['MONTH'].str.replace('3','March')
df2['MONTH'] = df2['MONTH'].str.replace('4','April')
df2['MONTH'] = df2['MONTH'].str.replace('5','May')
```

```
df2['MONTH'] = df2['MONTH'].str.replace('6','June')
df2['MONTH'] = df2['MONTH'].str.replace('7','July')
df2['MONTH'] = df2['MONTH'].str.replace('8','August')
df2['MONTH'] = df2['MONTH'].str.replace('9','September')
df2['MONTH'] = df2['MONTH'].str.replace('10','October')
df2['MONTH'] = df2['MONTH'].str.replace('11','November')
df2['MONTH'] = df2['MONTH'].str.replace('12','December')
df2['MONTH'].unique()
```

Out[12]:
```
array(['January', 'July', 'March', 'September', 'June', 'August',
       'JanuaryFebruary', 'January0', 'JanuaryJanuary', 'February',
       'April', 'May'], dtype=object)
```

10 replace with January0, 11 replace with JanuaryJanuary, 12 replace with JanuaryFebruary

In [13]:
```
# Format the incorrect replace with the correct Month (October, November, December)

df2['MONTH'] = df2['MONTH'].str.replace('January0','October')
df2['MONTH'] = df2['MONTH'].str.replace('JanuaryJanuary','November')
df2['MONTH'] = df2['MONTH'].str.replace('JanuaryFebruary','December')
df2['MONTH'].unique()
```

Out[13]:
```
array(['January', 'July', 'March', 'September', 'June', 'August',
       'December', 'October', 'November', 'February', 'April', 'May'],
      dtype=object)
```

In [14]:
```
df2.SUPPLIER.unique()
```

Out[14]:
```
array(['REPUBLIC NATIONAL DISTRIBUTING CO', 'PWSWN INC',
       'RELIABLE CHURCHILL LLLP', 'LANTERNA DISTRIBUTORS INC',
       'DIONYSOS IMPORTS INC', 'KYSELA PERE ET FILS LTD',
       'SANTA MARGHERITA USA INC', 'BROWN-FORMAN BEVERAGES WORLDWIDE',
       'JIM BEAM BRANDS CO', 'INTERNATIONAL CELLARS LLC',
       'HEAVEN HILL DISTILLERIES INC', 'BACCHUS IMPORTERS LTD',
       'MONSIEUR TOUTON SELECTION',
       'THE COUNTRY VINTNER, LLC DBA WINEBOW', 'ROYAL WINE CORP',
       'STE MICHELLE WINE ESTATES', 'Default', 'SAZERAC CO',
       'SALVETO IMPORTS LLC', 'HUB WINE CORPORATION',
       'ALLAGASH BREWING COMPANY', 'CAMPARI AMERICA LLC',
       'PERNOD RICARD USA LLC', 'PRESTIGE BEVERAGE GROUP OF MD LLC',
       'BACARDI USA INC', 'YOUNG WON TRADING INC',
       'TROEGS BREWING COMPANY', 'CASTLE BRANDS USA CORP', 'LEGENDS LTD',
       'WASHBURN WINE CO', 'CELICAR LLC DBA TWIN VALLEY DISTILLERS',
       'DOPS INC', 'JACKSON FAMILY ENTERPRISES INC',
       'BUCK DISTRIBUTING COMPANY INC', 'PUNTO VINO LLC',
       'VICTORY BREWING COMPANY LLC', 'THE WINE GROUP',
       'ELITE WINES IMPORTS', 'LUNEAU USA INC', 'BARON FRANCOIS LTD',
       'PROXIMO SPIRITS INC', 'SOUTHERN GLAZERS WINE AND SPIRITS',
       'DIAGEO NORTH AMERICA INC', 'OPICI FAMILY DISTRIBUTING OF MD',
       'MICHAEL R DOWNEY SELECTIONS INC', nan, 'ATLAS BREW WORKS LLC',
       'FRONT PORCH MICRO WINERY LLC',
       'TREASURY WINE ESTATES AMERICAS COMPANY',
       'TRADEWINDS SPECIALTY IMPORTS LLC', 'CONSTELLATION BRANDS',
       'SIERRA NEVADA BREWING CO', 'DUGGANS DISTILLERS PROD',
       'VINTAGE WINE ESTATES INC', 'SAGAMORE WHISKEY LLC',
       'J LOHR WINERY', 'LUXCO SPIRITED BRANDS', 'NEW PARROTT & CO',
       'CRAFT WINE & SPIRITS OF MARYLAND LLC', 'MHW LTD',
       'WILLIAM GRANT AND SONS INC', 'INTERBALT PRODUCTS CORP',
       'ARTISANS & VINES LLC', 'BRONCO WINE COMPANY',
       'TI BEVERAGE GROUP LTD', 'DELMAR BREWING COMPANY LLC',
       'UNITED STATES DISTILLED PRODUCTS', 'RIGHT FORWARD LLC',
       'A I G WINE & SPIRITS', 'GRAPES OF SPAIN INC',
       'DEUTSCH FAMILY WINE & SPIRITS', 'MARK ANTHONY BRANDS INC',
       'SUTTER HOME WINERY INC', 'DUVEL MOORTGAT USA LTD',
       'BACKUP BEVERAGE', 'NORTH LOCK LLC DBA PORT CITY BREWING CO',
       'PATERNO IMPORTS LTD', 'BANFI PRODUCTS CORP', 'HEINEKEN USA',
       'CONSTANTINE WINES INC', 'JOS VICTORI WINES',
       'STOLI GROUP (USA) LLC', 'E & J GALLO WINERY',
       'DUCKHORN WINE COMPANY', 'TRI-VIN IMPORTS', 'PIPE CREEK WINES LLC',
       'TREFETHEN VINEYARDS', 'BOSTON BEER CORPORATION',
       'DON SEBASTIANI & SONS', 'VIGNOBLES LVDH USA INC',
       'TRICANA SHIPPERS & IMPORT', 'LAPHAM SALES & MARKETING DBA LAPHAM',
       'SCHUG CARNEROS ESTATE WINERY', 'PARK STREET IMPORTS LLC',
       'AREL GROUP WINE & SPIRITS', 'MILLER BREWING COMPANY',
       'KOBRAND CORPORATION', 'EASTERN LIQUOR DISTRIBUTORS INC',
       'THE EDRINGTON GROUP USA LLC', 'FRANCIS COPPOLA WINERY LLC',
       'SURVILLE ENTERPRISES CORP', 'SERRALLES USA LLC',
       'DELICATO FAMILY VINEYARDS', 'REMY COINTREAU USA',
       'CHASSEUR WINE LLC', 'AMERICAN BEVERAGE CORPORATION',
       'MOET HENNESSY USA', 'KATCEF BROTHERS INC', 'FIVE GRAPES LLC',
       'PRECEPT BRANDS LLC', 'DMV DISTRIBUTING LLC', 'FETZER VINEYARDS',
       'TESTA WINES OF THE WORLD LTD', 'THE HESS COLLECTION',
       'AMERICAN BEVERAGE MARKETERS', 'TAPWINES',
```

'HONIG VINEYARD AND WINERY', 'PREMIUM DISTRIBUTORS INC',
'JACK POUST & COMPANY INC', 'MONTEBELLO BRANDS INC',
'SIDNEY-FRANK IMPORTING CO', 'OREGON BREWING COMPANY',
'NARRAGANSETT BREWING COMPANY', 'ANHEUSER BUSCH INC',
'NEW BELGIUM BREWING INC', 'CROWN IMPORTS', 'PABST BREWING CO',
'ST SUPERY INC', 'THE BROOKLYN BREWERY CORPORATION',
'LABATT USA OPERATING CO LLC',
'GLOBAL OCEAN AND AIR CARGO SERVICES',
'BANVILLE & JONES WINE MERCHANTS', 'FLYING DOG BREWERY LLLP',
'MASS BAY BREWING CO', 'C MONDAVI & SONS',
'CANTINIERE IMPORTS & DISTRIBUTING INC', 'FOWLES WINE USA INC',
'FREIXENET MIONETTO USA INC', 'NICKOLAS IMPORTS LLC',
'DANGEROUS WINE GROUP LLC', 'MACK & SCHUHLE INC',
'NICHE IMPORTERS', 'FREE RUN WINE MERCHANTS LLC',
'QUINTESSENTIAL LLC', 'GROTH VINEYARDS & WINERY', 'TAP26MD LLC',
'SMT AQUISITIONS LLC', 'ATLANTIC WINE & SPIRITS', 'FREIXENET USA',
'CARROLL CREEK WHISKEY LLC', 'FERRARI CARANO WINERY',
'ALLIED IMPORTERS USA LTD', 'FN CELLARS LLC', 'YUENGLING BREWERY',
'THE SPANISH WINE IMPORTERS LLC', 'GAMBRINUS',
'EVEREST SPIRITS LLC', 'TENTH HARVEST LLC', 'SOVEREIGN BRANDS LLC',
'MADIDUS LLC', 'MCNEILL INDEPENDENT SPIRIT CREATORS LLC',
'RVWC LLC', 'THE RIVER WINE', 'HOME BREW MART INC',
'ST KILLIAN IMPORTING CO INC', 'COASTAL BREWING COMPANY LLC',
'CLIPPER CITY BREWING CO', 'VERMONT HARD CIDER COMPANY LLC',
'DC BRAU BREWING LLC', 'SPAINS BEST BEERS INC', 'BBL INC',
'BINDING BRAUEREI USA INC', 'TERRAPIN BEER COMPANY',
'BOLD ROCK PARTNERS LP', 'STEFANO INCORPORATED',
'WAGNER WINE COMPANY LLC', 'IMPERO WINE DISTRIBUTORS VIRGINIA INC',
'CHARLES JACQUIN ET CIE INC', 'WINE BRIDGE IMPORTS INC',
'ZURENA LLC', 'SAN ANTONIO WINERY INC', 'GOOSE RIDGE LLC',
'SOKOL BLOSSER LTD', "O'NEILL BEVERAGES CO LLC",
'SCHMITT SOHNE INC', 'GEORGIAN HOUSE OF GREATER WASHINGTON',
'MEXCOR INTERNATIONAL', 'THE SANDY BOTTOM ENTERPRISES LLC',
'E M D SALES INC', 'CABERNET CORPORATION',
'FOLEY FAMILY WINES INC', 'PLUME RIDGE IRREVOCABLE TRUST',
'OSLO ENTERPRISE', 'THE TRITON COLLECTION INC',
'SWEETWATER BREWING COMPANY LLC', 'PHILLIPS FARMS LLC',
'ELK RUN VINEYARDS', 'LCF WINE COMPANY LLC',
'ROBERT OATLEY VINEYARDS INC', 'TREANA WINERY LLC',
'VINTAGE POINT LLC', 'AIKO IMPORTERS INC',
'WELL OILED WINE COMPANY LLC', 'FILIBUSTER BARRELS LLC',
'POTOMAC SELECTIONS INC', 'RED INK IMPORTS',
'MAST-JAEGERMEISTER US INC', 'VINTURE WINE COMPANY LLC',
'SCOPERTA IMPORTING COMPANY INC', 'PARAGON VINEYARD CO INC',
'KLEIN FAMILY VINTNERS', 'ROOTS RUN DEEP LLC', 'WI INC',
'WILLIAM HARRISON IMPORTS', 'FLAVOR SEEKERS LLC',
'FIFTH GENERATION INC', 'RUSSIAN STANDARD VODKA (USA) INC',
'COPPER CANE LLC', 'STELLAR IMPORTING CO LLC',
'LEGACY PARTNERS DISTRIBUTION LLC', 'REPUBLIC RESTORATIVES',
'SPLINTER GROUP NAPA LLC', 'FREDERICK WILDMAN & SONS',
'THREE STARS BREWING COMPANY LLC', 'PRESTIGE WINE IMPORTS',
'AZABU DISTILLING CO LLC', 'IMPERO WINE DISTRIBUTORS',
'VINTUS LLC', 'AMERICAN FIDELITY TRADING', 'HOTALING & CO LLC',
'PALM BAY IMPORTS', 'BASQUE BAR LLC', 'COMETE WINES LLC',
'SANGLIER SELECTIONS LLC', 'GF WINES, LLC DBA GARY FARRELL WINERY',
'MACCHU PISCO LLC', 'INFINIUM SPIRITS INC', 'VIN DIVINO LTD',
'FAR NIENTE WINERY INC', 'JORDAN VINEYARD', 'ST RICE WINE INC',
'DISARONNO INTERNATIONAL LLC', 'ADAMBA IMPORTS INTL',
'SUGARLOAF MOUNTAIN SUNLIGHT VINEYARD LLC', 'LAIRD AND COMPANY',
'RUTHERFORD WINE COMPANY', 'NOVELTY MD INC',
'WARSTEINER IMPORTERS', 'SLIGO MILL BREWING LLC',
'HOUTON PURVEYORS LLC', 'OHMRONE WINE AND LIQUOR LLC',
'MOUNT DEFIANCE CIDERY & DISTILLERY LLC',
'NEGUS BREWING COMPANY LLC', 'NEXTERRA WINE COMPANY',
'CITIZENS BREWING LLC', 'WESTERN SPIRITS BEVERAGE COMPANY LLC',
'LYON DISTILLING COMPANY LLC', 'BULLSHINE DISTILLERY LLC',
'DRAGON DISTILLERY LLC', 'OCEAN CITY BREWING CO LLC',
'LION NATHAN USA INC', 'KAHN PAPER COMPANY INC', 'CHEVAL QUANCARD',
'FRUIT OF THE VINES INC', 'SUGARLOAF MOUNTAIN VINEYARD LLC',
'KING ESTATE WINERY', 'ASAHI BEER USA INC',
'SINGHA NORTH AMERICA INC', 'HAMCO DC', 'BROOKEVILLE BREWING LLC',
'MESOZOIC TECHNOLOGIES LLC', 'BITTERMILK LLC',
'HARVEST IMPORTING LLC', 'REGAL WINE IMPORTS INC',
'THE WINE SOURCE INC', 'WINERY EXCHANGE INC',
'Z WINE GALLERY IMPORTS LLC', 'SAWM IMPORTS LLC',
'ST GEORGE SPIRITS INC', 'WILLIAMS CORNER WINE', 'LOOK VODKA LLC',
'BREWDOG BREWING COMPANY LLC', 'TRUE RESPITE BREWING COMPANY LLC',
'CROOK & MARKER LLC', 'RSL HOLDINGS INC', 'SNR HOLDINGS LLC',
'PARALLEL WORLD BREWING COMPANY', 'GJS SALES INC',
'VINIFERA DISTRIBUTING OF MARYLAND INC', 'MARQUEE SELECTIONS LLC',
'SMITH-ANDERSON ENTERPRISES INC', 'TOBACCO BARN DISTILLERY',
'RAPP CAPITAL LLC', 'WITH MALUS AFORETHOUGHT LLC', 'FIORE WINERY',
'A VINTNERS SELECTIONS', 'DUCLAW BREWERY LLC',

```
 'AMERICAN VINTAGE BEVERAGE INC', 'GRAPES & BARLEY LLC',
 'SOUTHERN WINE & SPIRITS OF MARYLAND', 'CALVERT BREWING COMPANY',
 'STARR HILL BREWERY LLC', 'GRAIL POINT BREWERY LLC',
 'DOMAINE SELECT WINE & SPIRITS LLC', 'DOGFISH HEAD CRAFT BREWERY',
 'WILSON DANIELS LTD', 'BOUTIQUE VINEYARDS LLC',
 'ROBERT KACHER SELECTIONS LLC', 'EXCELSIOR WINE COMPANY LLC',
 'FREDERICK P WINNER LTD', 'BOND DISTRIBUTING CO',
 'ARCHER ROOSE LLC', 'AZIZ SHAFI TANNIC TONGUE',
 'MONOCACY BREWING CO LLC', 'BASIGNANI WINERY',
 'FX MATT BREWING CO', 'CRAFT BREW ALLIANCE INC',
 'BOORDY VINEYARDS', 'SIMON N CELLARS LLC', 'VINTAGE WINES INC',
 'ONE TRUE VINE', 'SPADA ENTERPRISES INC', 'USA WINE WEST LLC',
 'A&W BORDERS LLC', 'OENOS LLC', 'CAPE STARZ WINE LLC', 'A&E INC',
 'LATITUDE BEVERAGE COMPANY', 'USA WINE IMPORTS',
 'THREE HENS LLC T/A TENTH HARVEST', 'JOHN GIVEN WINES INC',
 'BARREL ONE INC', 'SCHEID VINEYARDS CALIFORNIA INC',
 'NOBLE VINTNERS INC', 'FRANK LIN MD', '8 VINI INC',
 'INTERNATIONAL SPIRITS & WINES LLC',
 'CLASSIC WINE IMPORTS INC DBA VISION WINE', 'FRITZ IMPORTS LLC',
 'PLATA WINE PARTNERS LLC', 'DOGFISH HEAD DISTILLERY LLC',
 'WETTEN IMPORTERS INC', 'THE VINERY LLC', 'BORVIN BEVERAGE',
 'VOLUBILIS IMPORTS INC', 'WEIN-BAUER INC', 'A HARDY USA LTD',
 'AW DIRECT LLC', 'ROBERT GIRAUD', 'DESCHUTES BREWERY INC',
 'ALTITUDE SPIRITS INC', 'CLASSIC WINE IMPORTS INC',
 'SUBARASHII KUDAMONO CO INC', 'GRAND ENCLOS DU CHATEAU DE CERONS',
 'CHEF SOUS LLC', "GATOR RON'S LLC",
 'PREMIUM DISTRIBUTORS OF MARYLAND', 'UNITED STATES BEVERAGE',
 'URUGUAY IMPORTS LTD', 'WINEBOW INC', 'CHATEAU DIANA LLC',
 'G GAUTHIER CELLARS INC', 'FREELANCE WINES LLC',
 'MERRYVALE VINEYARDS', "D'AQUINO ITALIAN IMPORTING CO INC",
 'MONDO VINO', 'ORGANIC VINTNERS INC', 'ARIS A ZISSIS',
 'WHITE ROCK DISTILLERS INC', 'LINNE CALODO INC',
 'LA ISLA CORPORATION', 'FAROPIAN SPIRITS LTD', 'MAISON JOMERE LTD',
 'RED MOUNTAIN DISTILLING & SPIRITS LLC', 'PACIFIC RIM WINEMAKERS',
 'ROBERT OATLEY', 'SABLE RIDGE VINEYARD LLC',
 'HEIMBUCH ESTATE VINEYARDS AND WINERY LLC', 'NICE LEGS LLC',
 'CHADDSFORD WINERY LTD', 'VINTAGE VIRGINIA APPLES',
 'DREYFUS ASHBY INC', 'MEIOMI',
 'PAMPA BEVERAGES LLC DBA TRANSNATIONAL SU', 'DCD ENTERPRISES LLC',
 'CASA CHIRICO LLC', 'BLACK ANKLE VINEYARDS LLC',
 'DOGFISH HEAD CRAFT BREWERY LLC',
 'NIEBAUM COPPOLA ESTATE WINERY LP', 'DISTRICT CIDER COMPANY INC',
 'ONE EIGHT DISTILLING LLC',
 'RED MOUNTAIN DISTILLING AND SPIRITS LLC',
 'CHARM CITY BEVERAGE LLC', 'CHEERS DISTRIBUTING INC',
 'THE DOG BEVERAGE CO INC', 'MARKERS EDGE LLC', 'FIOR DI SOLE LLC'],
dtype=object)
```

In [15]:
```
df2['ITEM DESCRIPTION'].value_counts().head(50)
```

Out[15]:
```
ITEM DESCRIPTION
BURGANS ALBARINO - 750ML                        44
SANTA JULIA TORRONTES SUSTAINABLE - 750ML       39
LA VIELLE FERME CDV RED - 750ML                 35
LINGANORE BLACK RAVEN - 750ML                   34
MCCLINTOCK HERITAGE WHITE WHISKEY - 750ML       33
LAS PERDICES VIOG - 750ML                       32
DAVID NICHOLSON 1843 BOURBON -750ML             32
MARIETTA OV RED - 750ML                         32
CA LUNGHETTA P/GRIG - 750ML                     32
THE WINERY AT OLNEY CHARD - 750ML               31
ELOUAN P/NOIR - 750ML                           31
DONA PAULA LOS CARDOS MAL - 750ML               31
PASOTE ANEJO TEQUILA - 750ML                    30
WOODFORD RESERVE KY STRAIT - 1.75L              30
ANGELINE RES CHARD - 750ML                      29
CHOPIN VODKA - 750ML                            29
STONESTREET ESTATE A/V CHARD - 750ML            29
PONGA S/BLC - 750ML                             28
U MES U FAN CAVA BRUT - 750ML                   28
BARON HERZOG CAB JEUNESSE - 750ML               28
JAM JAR SWEET SHZ - 750ML                       28
VINACEOUS RACONTEUR CAB - 750ML                 28
VILLA JOLANDA PROSECCO - 750ML                  28
MU SAKE JUNMAI DIAGINJYO - 720ML                28
RAMEY RR VLY CHARD - 750ML                      27
SUN GARDEN RIES - 750ML                         27
DOMINIO DE EGUREN PROTOCOLO RED - 750ML         27
GRAN MORAINE P/NOIR - 750ML                     27
DEEP EDDY RUBY RED GRAPEFRUIT VODKA - 50ML      27
LANDMARK OVERLOOK CHARD - 750ML                 27
ASBACH URALT BRANDY - 750ML                     27
CONO SUR S/BLC - 750ML                          27
LOUIS ROEDERER BRUT PREM 6/CS - 750ML           26
HATSUMAGO SAKE JUN MAI SHU - 300ML              26
GRAND VENEUR CDR ROUGE - 750ML                  26
POEMA CAVA BRUT - 750ML                         26
LAN RIOJA RES - 750ML                           26
LA RIOJA ALTA RES ARDANZA - 750ML               26
ABADAL CAB FRANC TEMPRANILLO - 750ML            26
MT GAY RUM - BLACK BARREL - 750ML               26
SIEMA VYDS P/GRIG - 750ML                       26
ALLAN SCOTT VYDS S/BLC - 750ML                  26
SILVER OAK A/V CAB - 750ML                      26
FAMILIA ZUCCARDI Q MAL - 750ML                  26
PAUL HOBBS CROSSBARN CAB - 750ML                26
TWO OCEANS CHARD - 1.5L                         26
BLANDYS RAINWATER MEDIUM DRY - 750ML            25
PLANTATION  5 YR GR RES RUM - 750ML             25
ROSATELLO MOSCATO - 750ML                       25
FREEMARK ABBEY MERLOT - 750ML                   25
Name: count, dtype: int64
```

In [16]:
```
df2['ITEM TYPE'].unique()
```

Out[16]:
```
array(['WINE', 'BEER', 'LIQUOR', 'STR_SUPPLIES', 'KEGS', 'REF', 'DUNNAGE',
       'NON-ALCOHOL', nan], dtype=object)
```

In [17]:
```
df2['ITEM TYPE'].value_counts()
```

Out[17]:
```
ITEM TYPE
WINE            187640
LIQUOR           64910
BEER             42413
KEGS             10146
NON-ALCOHOL       1908
STR_SUPPLIES       405
REF                127
DUNNAGE             95
Name: count, dtype: int64
```

In [18]:
```
df2.head(3)
```

Out[18]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
0	2020	January	REPUBLIC NATIONAL DISTRIBUTING CO	100009	BOOTLEG RED - 750ML	WINE	0.0	0.0	2.0
1	2020	January	PWSWN INC	100024	MOMENT DE PLAISIR - 750ML	WINE	0.0	1.0	4.0
2	2020	January	RELIABLE CHURCHILL LLLP	1001	S SMITH ORGANIC PEAR CIDER - 18.7OZ	BEER	0.0	0.0	1.0

EDA

In [19]:
```
df3 = df2.copy()
```

In [20]:
```
df3.isnull().sum()
```

Out[20]:
```
YEAR                  0
MONTH                 0
SUPPLIER            167
ITEM CODE             0
ITEM DESCRIPTION      0
ITEM TYPE             1
RETAIL SALES          3
RETAIL TRANSFERS      0
WAREHOUSE SALES       0
dtype: int64
```

Insights on missing values:

1. It was indicate that 167 name of our supplier is missing
2. Also 1 Category Item Type is missing
3. Also 3 quantity of items sold at retail Sales is missing

ANALYSIS TO PERFORM:

Inventory Optimization:

1. what is the Total, average, and max quantity sold in Retails and Warehouse Sales?
2. What is the total, quantity sold in Retails and Warehouse Sales?
3. What is the yearly quantity for (RETAIL SALES), transfers (RETAIL TRANSFERS), and warehouse sales (WAREHOUSE SALES)?
4. What is the Monthly quantity for (RETAIL SALES), transfers (RETAIL TRANSFERS), and warehouse sales (WAREHOUSE SALES) for each Year?

In [21]:
```
df3.head(2)
```

Out[21]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
0	2020	January	REPUBLIC NATIONAL DISTRIBUTING CO	100009	BOOTLEG RED - 750ML	WINE	0.0	0.0	2.0
1	2020	January	PWSWN INC	100024	MOMENT DE PLAISIR - 750ML	WINE	0.0	1.0	4.0

1. what is the total, average and max quantity sold in Retails and Warehouse Sales

In [22]:
```
# 1a. what is the total, average and max quantity sold in Retails Sales

avg_retail = df3.groupby('ITEM TYPE')['RETAIL SALES'].agg(['mean','max','sum'])
avg_retail
```

Out[22]:

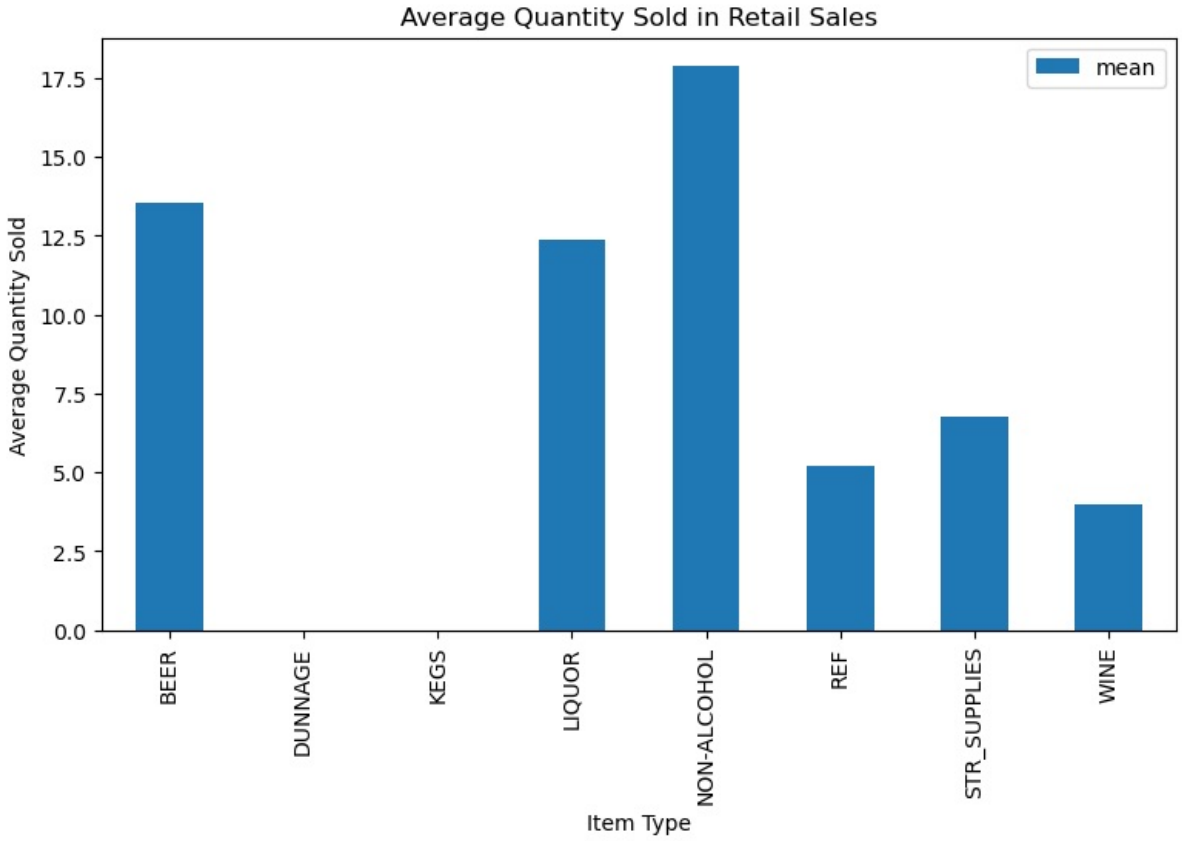
ITEM TYPE	mean	max	sum
BEER	13.538786	1494.00	574220.53
DUNNAGE	0.000000	0.00	0.00
KEGS	0.000000	0.00	0.00
LIQUOR	12.366221	1816.49	802691.43
NON-ALCOHOL	17.892026	2739.00	34084.31
REF	5.225433	36.00	663.63
STR_SUPPLIES	6.767605	368.64	2740.88
WINE	3.978355	813.84	746498.59

- IN Retail Sales The total quantity of Beer sold is 574220.5 quantity, the maximum is 1490 quantity and the average is 13.5 quantity
- DUNNAGE and Kegs Items don't have any sales
- The total quantity of Liquor sold is 802691 quantity, the Maximum is 1816 and the Average is 12 Quantity
- Non-alcohol has a total of 34084 quantity sold, the maximum is 2739 quantity, and the Average is 17.8 quantity
- Ref has a total of 663.6 quantities sold, the maximum is 36 quantities, and the average is 5 quantities

- The total quantity of Str_Supplies sold is 2740.8 quantity, the Maximum is 368.8 and the Average is 6.7 Quantity
- The total quantity of Wine sold is 746498.5 quantity, the Maximum is 813.8 and the Average is 3.9 Quantity

In [23]:
```
# (1ai). what is the average sold in Retails Sales

avg_retail = df3.groupby('ITEM TYPE')['RETAIL SALES'].agg(['mean'])
avg_retail.plot.bar(figsize =(9,5))
plt.title('Average Quantity Sold in Retail Sales')
plt.xlabel('Item Type')
plt.ylabel('Average Quantity Sold')
```

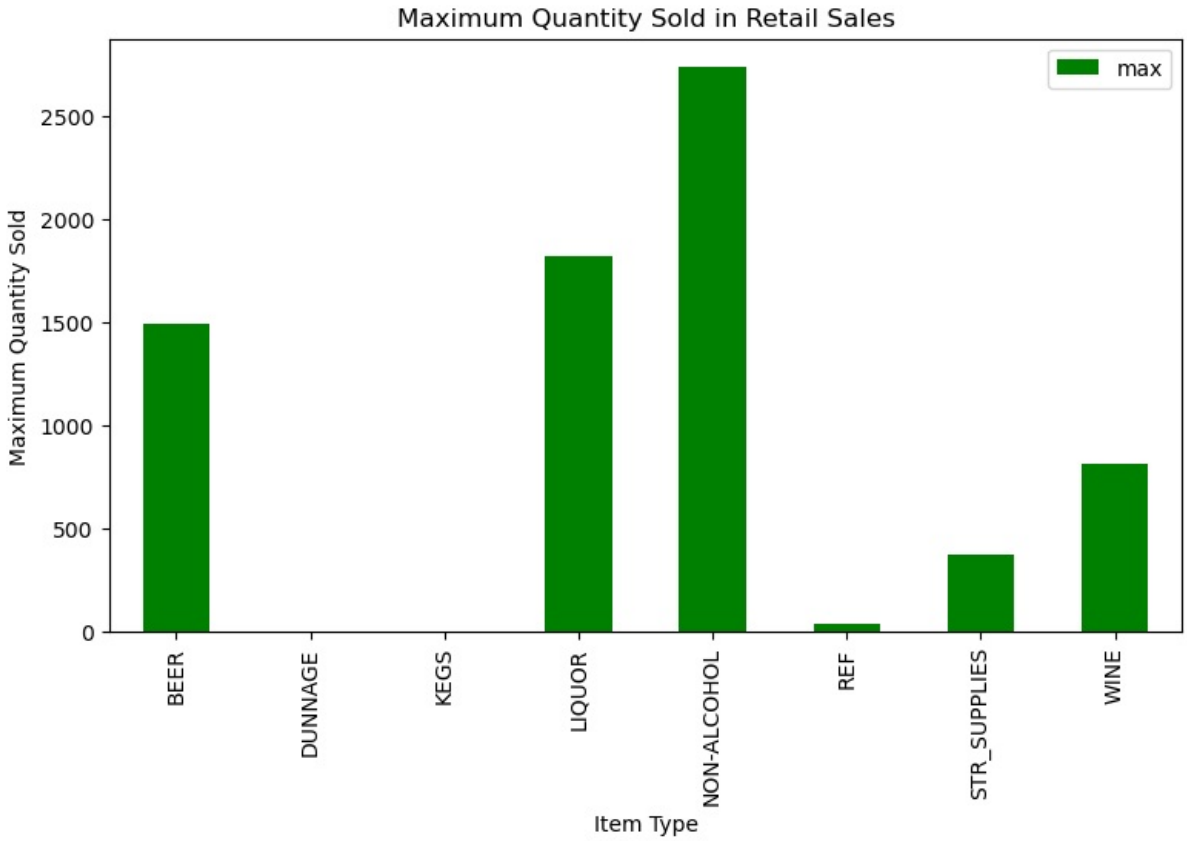
Out[23]:
```
Text(0, 0.5, 'Average Quantity Sold')
```



- DUNNAGE and Kegs Items don't have any quantity sold in retail Sales
- Non-alcohol has the most average quantity sold with 17.8 followed by Beer with 13.5 quantity sold
- Liquor has a moderate average sold with 12 quantities, followed by str_supplies with 6.7 quantities sold
- Ref has the lowest average sold with 5 quantities and Wine has 3.9 quantities Sold

In [24]:
```
# (1aii). what is the maximum quantity sold in Retails Sales

avg_retail = df3.groupby('ITEM TYPE')['RETAIL SALES'].agg(['max'])
avg_retail.plot.bar(figsize =(9,5), color=('green'))
plt.title('Maximum Quantity Sold in Retail Sales')
plt.xlabel('Item Type')
plt.ylabel('Maximum Quantity Sold')
```

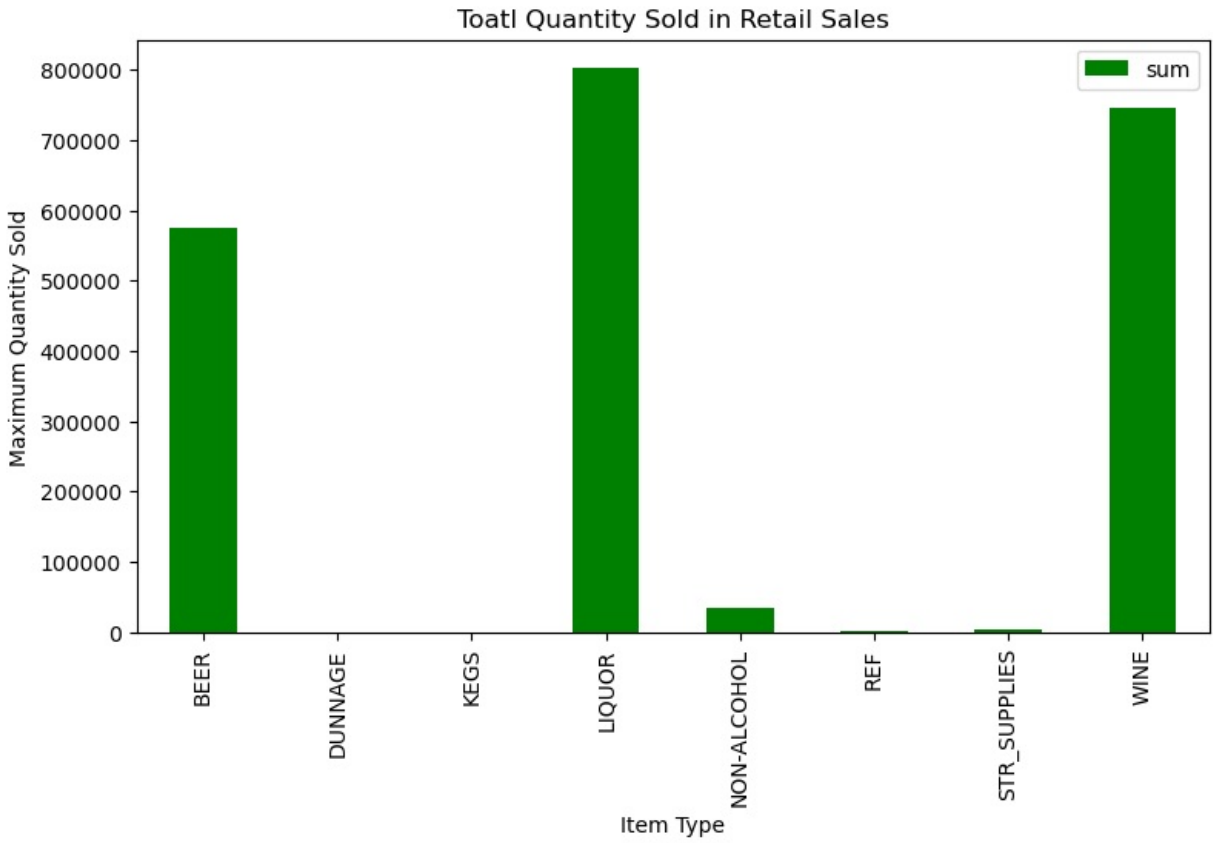
Out[24]:
```
Text(0, 0.5, 'Maximum Quantity Sold')
```



- DUNNAGE and Kegs Items don't have any quantity sold in retail Sales
- Non-alcohol has the highest maximum sold with 2739 quantity
- Liquor has a moderate maximum sold with 1816 quantities, followed by Beer with 1494 quantities sold
- Wine has a low maximum sold with 813 quantities, followed by Str_Supplies with lower sold of 368 quantities
- Ref has the lowest maximum sold with 36 quantities

In [25]:
```
# (1aiii). what is the total quantity sold in Retails Sales

avg_retail = df3.groupby('ITEM TYPE')['RETAIL SALES'].agg(['sum'])
avg_retail.plot.bar(figsize =(9,5), color=('green'))
plt.title('Toatl Quantity Sold in Retail Sales')
plt.xlabel('Item Type')
plt.ylabel('Maximum Quantity Sold')
```

Out[25]:
```
Text(0, 0.5, 'Maximum Quantity Sold')
```



- DUNNAGE and Kegs Items don't have any quantity sold in retail Sales
- Liquor has the highest total sold with 802691 quantities, followed by Wine with 746498.5 quantities sold
- Beer has a moderate total sold with 574220 quantities
- Non-alcohol has a low total sold with 34084 quantities, followed by Str_Supplies with lower sold of 2740 quantities
- Ref has the lowest total sold with 663 quantities

In [26]:
```
# 1b. what is the total, average and max quantity sold in Warehouse Sales

avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['mean','max','sum'])
avg_warehouse
```

Out[26]:

ITEM TYPE	mean	max	sum
BEER	153.897072	18317.0	6527236.51
DUNNAGE	-1278.463158	-1.0	-121454.00
KEGS	11.672679	604.0	118431.00
LIQUOR	1.462121	438.0	94906.27
NON-ALCOHOL	13.705236	297.0	26149.59
REF	-161.409449	298.0	-20499.00
STR_SUPPLIES	0.000000	0.0	0.00
WINE	6.165982	662.0	1156984.91

IN Warehouse Sales

- The total quantity of Beer sold is 6527236.5 quantity, the maximum is 183170 quantity and the average is 15.3 quantity
- Dunnage sold in debit with the total quantity of (-121454), the maximum debit is (-1) quantity, and the average debt is (-1278) quantity

- The total quantity of Kegs sold is 118431 quantity, the maximum is 604 quantity and the average is 11.6 quantity
- The total quantity of Liquor sold is 94906 quantity, the Maximum is 438 and the Average is 1.4 Quantity
- Non-alcohol has a total of 26149.5 quantity sold, the maximum is 297 quantity, and the Average is 13.7 quantity
- Ref has a debit of total sold (-20499) quantities, the maximum is 298 quantities, and the average debt is (-161) quantities
- Str_supplies Items don't have any quantity sold in Warehouse Sales
- The total quantity of Wine sold is 1156984.9 quantity, the Maximum is 662 and the Average is 6 Quantity

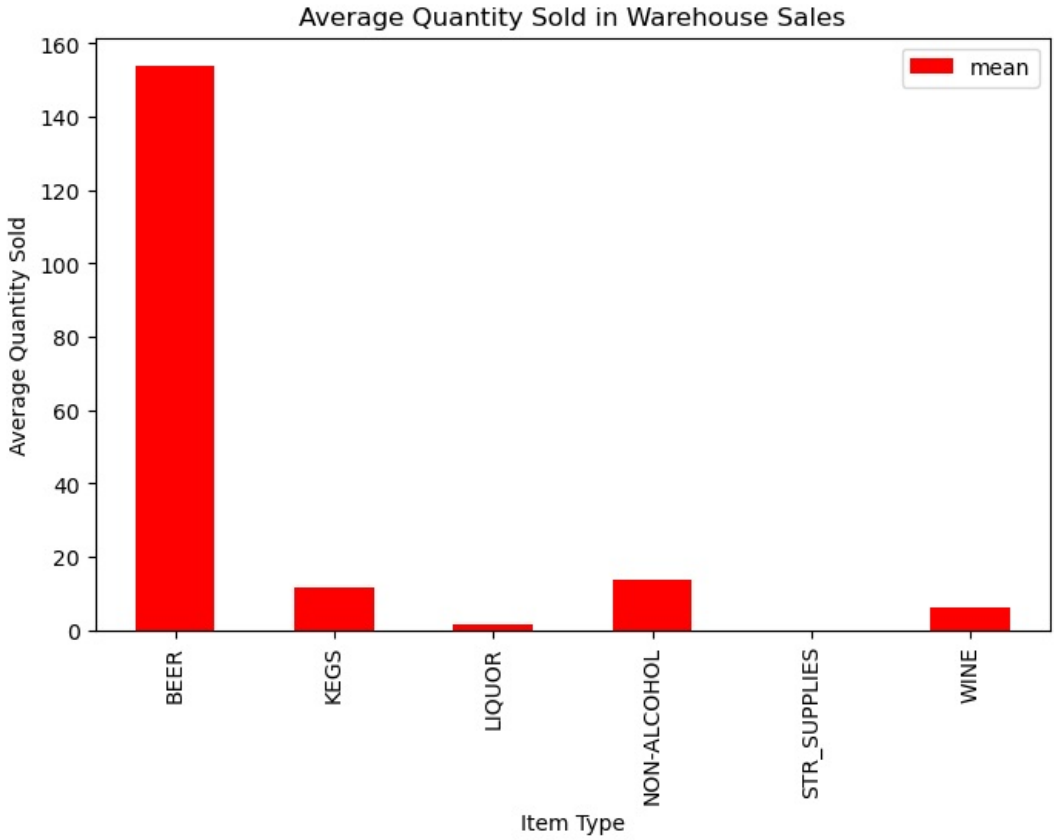
In [27]:
```
# inspect the Warehouse sales column

warehouse_sale = df3[['ITEM TYPE','WAREHOUSE SALES']]
warehouse_sale.query('`ITEM TYPE` in ["DUNNAGE","REF"]').head(20)
```

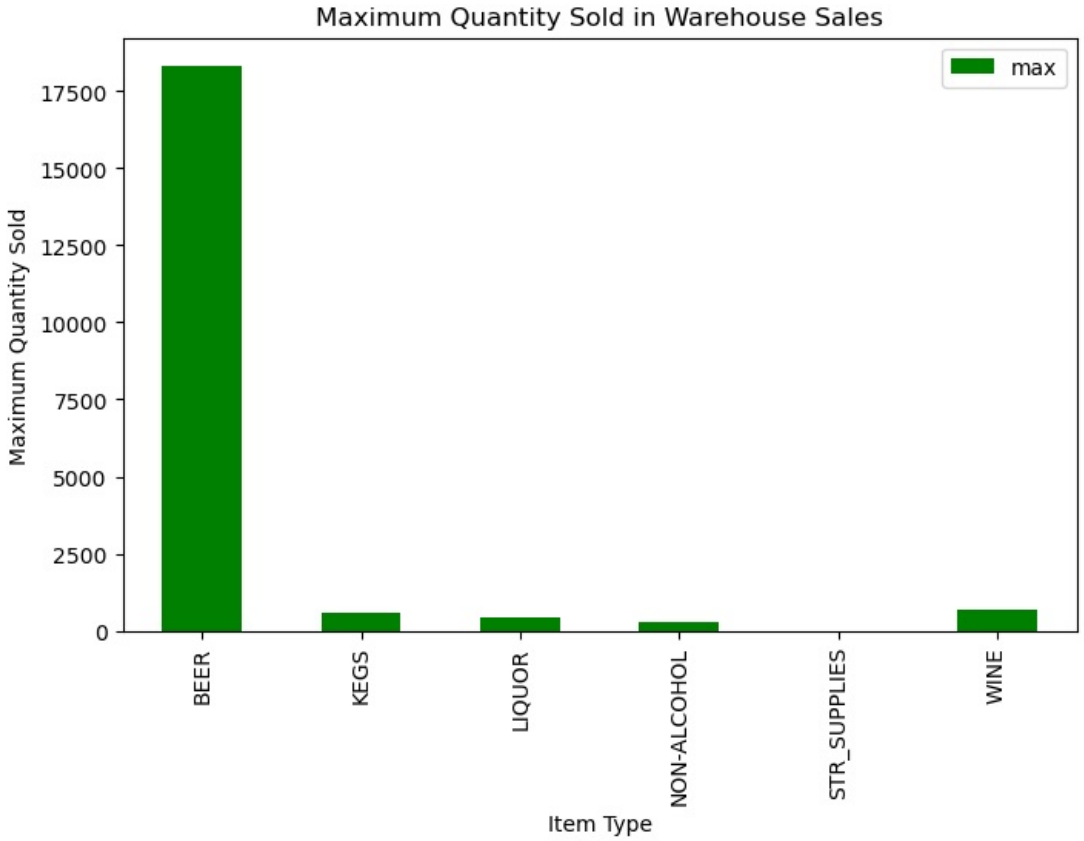
Out[27]:

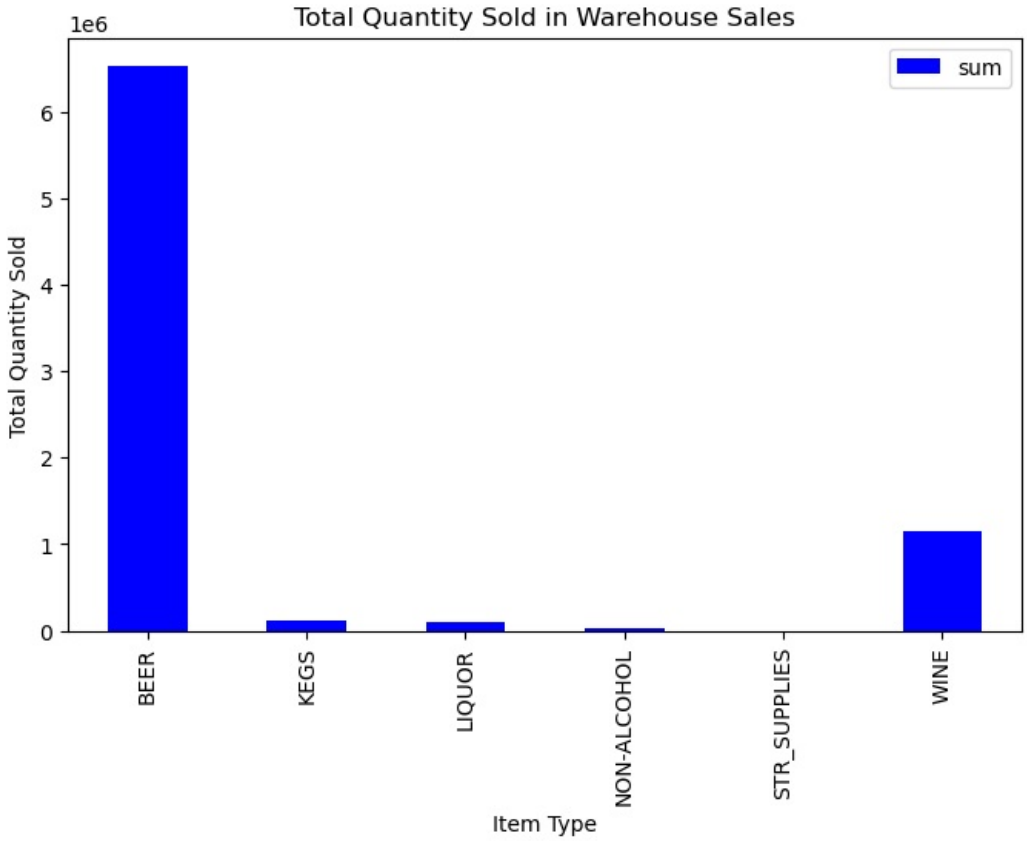
	ITEM TYPE	WAREHOUSE SALES
177	REF	0.0
405	DUNNAGE	-12.0
822	DUNNAGE	-3999.0
1011	DUNNAGE	-934.0
2310	DUNNAGE	-287.0
8434	REF	0.0
11985	REF	-1028.0
11986	REF	-77.0
12186	REF	0.0
12382	DUNNAGE	-2.0
12786	DUNNAGE	-1675.0
12965	DUNNAGE	-362.0
14357	DUNNAGE	-168.0
23212	REF	-190.0
23213	REF	-34.0
24236	REF	0.0
24448	DUNNAGE	-2.0
24866	DUNNAGE	-2070.0
25055	DUNNAGE	-562.0
26380	DUNNAGE	-166.0

In [28]:
```
# (1bi). what is the Total, average and maximum quantity sold in the Warehouse

# Average Quantity Sold in Warehouse Sales
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['mean'])
avg_warehouse.query('`ITEM TYPE` not in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5), title = ('Average Quantity Sold in Warehouse Sales'),\
         xlabel = ('Item Type'),ylabel = ('Average Quantity Sold'),color = 'red')

# Maximum Quantity Sold in Warehouse Sales
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['max'])
avg_warehouse.query('`ITEM TYPE` not in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5), title = ('Maximum Quantity Sold in Warehouse Sales'),\
         xlabel = ('Item Type'),ylabel = ('Maximum Quantity Sold'), color = 'green')

# Total Quantity Sold in Warehouse Sales
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['sum'])
avg_warehouse.query('`ITEM TYPE` not in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5), title = ('Total Quantity Sold in Warehouse Sales'),\
         xlabel = ('Item Type'),ylabel = ('Total Quantity Sold'), color = 'blue')
```

Out[28]:
```
<Axes: title={'center': 'Total Quantity Sold in Warehouse Sales'}, xlabel='Item Type', ylabel='Total Quantity S
old'>
```


Average Quantity Sold in Warehouse Sales
mean
Average Quantity Sold
0
20
40
60
80
100
120
140
160
BEER
KEGS
LIQUOR
NON-ALCOHOL
STR_SUPPLIES
WINE
Item Type

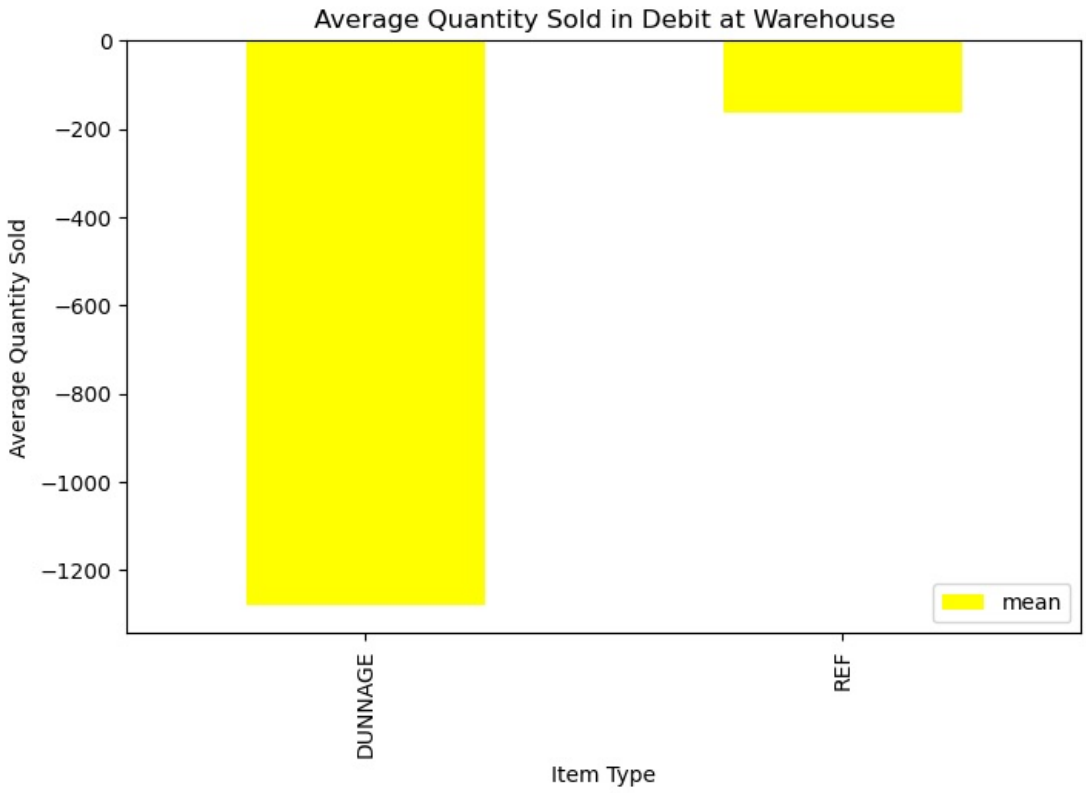

Maximum Quantity Sold in Warehouse Sales
max
Maximum Quantity Sold
0
2500
5000
7500
10000
12500
15000
17500
BEER
KEGS
LIQUOR
NON-ALCOHOL
STR_SUPPLIES
WINE
Item Type

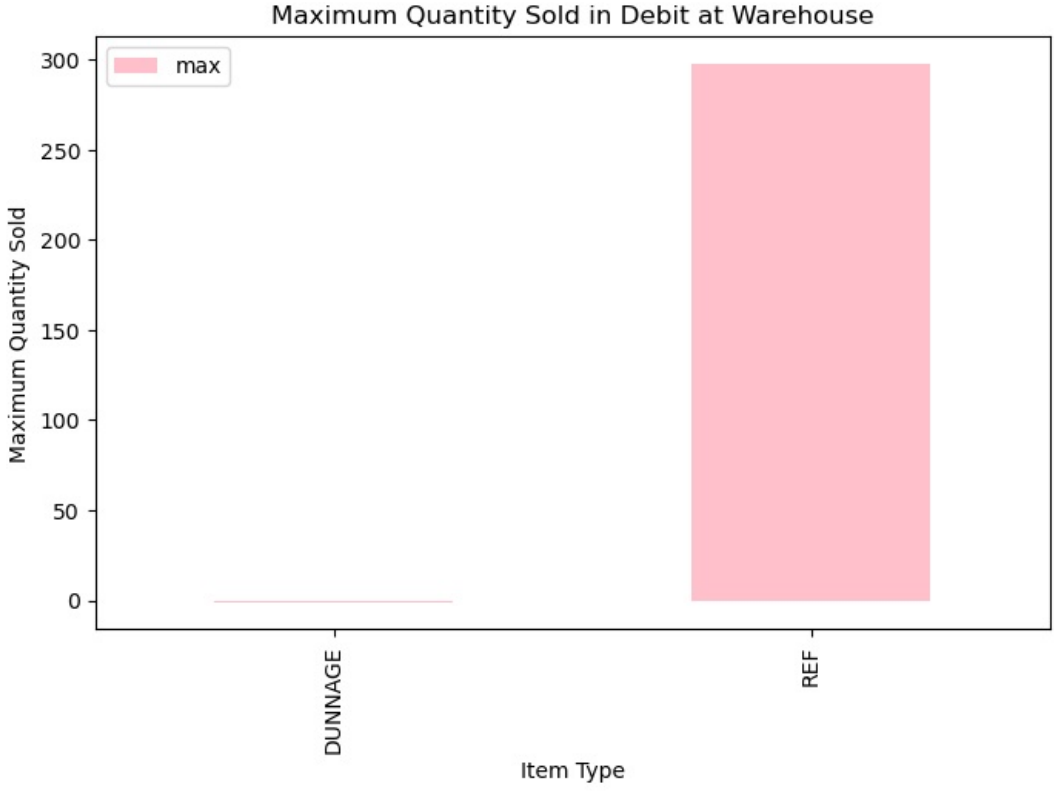


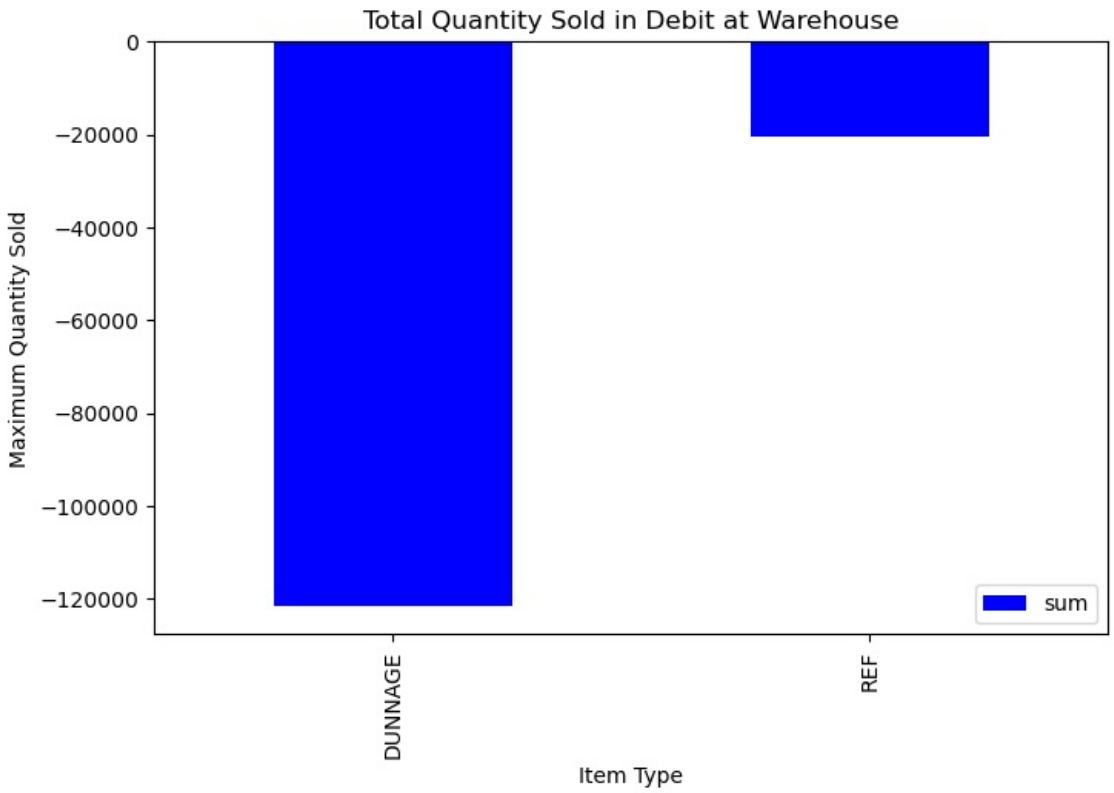
- Bear as the highest Average, maximum, and total quantity sold at Warehouse
- The Other items Types contribute low to the Average, maximum, and total quantity sold at Warehouse

In [29]:
```
# (1bii). what is the average and maximum quantity sold Debit at Warehouse

# Average Quantity Sold in Debit at Warehouse
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['mean'])
avg_warehouse.query('`ITEM TYPE` in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5), title = ('Average Quantity Sold in Debit at Warehouse'),\
          xlabel = ('Item Type'),ylabel = ('Average Quantity Sold'), color = 'yellow')

# Maximum Quantity Sold in Debit at Warehouse
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['max'])
avg_warehouse.query('`ITEM TYPE` in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5),title = ('Maximum Quantity Sold in Debit at Warehouse'),\
        xlabel = ('Item Type'),ylabel = ('Maximum Quantity Sold'),color = 'pink')

# Total Quantity Sold in Debit at Warehouse
avg_warehouse = df3.groupby('ITEM TYPE')['WAREHOUSE SALES'].agg(['sum'])
avg_warehouse.query('`ITEM TYPE` in ["DUNNAGE","REF"]')\
.plot.bar(figsize = (8,5),title = ('Total Quantity Sold in Debit at Warehouse'),\
        xlabel = ('Item Type'),ylabel = ('Maximum Quantity Sold'),color = 'blue')
```

Out[29]:
```
<Axes: title={'center': 'Total Quantity Sold in Debit at Warehouse'}, xlabel='Item Type', ylabel='Maximum Quant
ity Sold'>
```


Average Quantity Sold in Debit at Warehouse
0
−200
−400
−600
−800
−1000
−1200
Average Quantity Sold
mean
DUNNAGE
REF
Item Type


Maximum Quantity Sold in Debit at Warehouse
max
300
250
200
150
100
50
0
Maximum Quantity Sold
DUNNAGE
REF
Item Type



- Dunnage has the highest total, and average quantity sold in debt and has the lowest maximum quantity sold debt in the warehouse
- Ref has the lower average and total quantity sold in debt and has the moderate maximum that isn't sold in debt in the warehouse

2. what is the total quantity sold in Retail Sales and Warehouse Sales

In [30]:
```
# (2ai) What is the total quantity sold in Retail Sales

retail_quantity_sold = df3['RETAIL SALES'].agg('sum')
print(f'The told Quantity sold in Retail Sales for four years is: {retail_quantity_sold}')
```

```
The told Quantity sold in Retail Sales for four years is: 2160899.37
```

In [31]:
```
# (2aii) what is the total quantity sold in Warehouse Sales

warehouse_quantity_sold = df3['WAREHOUSE SALES'].agg('sum')
print(f'The told Quantity sold in Warehouse Sales for four years is: {warehouse_quantity_sold}')
```

```
The told Quantity sold in Warehouse Sales for four years is: 7781756.280000001
```

3.calculate yearly quantity for (RETAIL SALES), transfers (RETAIL TRANSFERS), and warehouse sales (WAREHOUSE SALES).

In [32]:
```
year_sale = df3.groupby('YEAR')[['RETAIL SALES','RETAIL TRANSFERS','WAREHOUSE SALES']].agg('sum')
year_sale
```

Out[32]:

YEAR	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
2017	686734.57	676620.50	2333849.13
2018	153595.90	153652.92	519526.19
2019	960191.20	957562.40	3543371.23
2020	360377.70	346132.81	1385009.73

In [33]:
```
year_sale.plot.bar(title = 'Yearly Quantity Retail Sales Retail Transfers and Warehouse', figsize = (9,6))
```

Out[33]:
```
<Axes: title={'center': 'Yearly Quantity Retail Sales Retail Transfers and Warehouse'}, xlabel='YEAR'>
```

- Throughout the Year Warehouse sales have the highest quantity sold
- Retail sales and Retail Transfers have a moderate quantity sold
- 2018 has the lowest quantity sold
- In 2019 warehouse had the highest quantity sold, followed by 2017, 2020, and 2018
- In 2019 Retail sales and Retail Transfers had a moderate quantity sold, followed by 2017, 2020, and 2018

4. What is the Monthly quantity for (RETAIL SALES), transfers (RETAIL TRANSFERS), and warehouse sales (WAREHOUSE SALES) for each year.

In [34]:
```
df3.head(3)
```

Out[34]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
0	2020	January	REPUBLIC NATIONAL DISTRIBUTING CO	100009	BOOTLEG RED - 750ML	WINE	0.0	0.0	2.0
1	2020	January	PWSWN INC	100024	MOMENT DE PLAISIR - 750ML	WINE	0.0	1.0	4.0
2	2020	January	RELIABLE CHURCHILL LLLP	1001	S SMITH ORGANIC PEAR CIDER - 18.7OZ	BEER	0.0	0.0	1.0

In [35]:
```
df3['YEAR'].value_counts()
```

Out[35]:
```
YEAR
2019    138638
2017     96284
2020     46278
2018     26445
Name: count, dtype: int64
```

In [36]:
```
# use filter to query 2017 come out

year2017 = df3[df['YEAR'] == 2017]
year2017.sample(4)
```

Out[36]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
132279	2017	December	CLIPPER CITY BREWING CO	3140	HEAVY SEAS PEG LEG STOUT 4/6NR - 12OZ	BEER	32.33	35.0	58.96
84327	2017	August	LUXCO SPIRITED BRANDS	79758	LIONELLO STOCK ITALIAN SWEET VERMOUTH - 1.5L	WINE	6.41	8.0	0.00
74654	2017	August	LEGENDS LTD	23559	BUTTERNUT HENNIEWEISSEN 4/6 CANS - 12OZ	BEER	0.00	0.0	1.00
93266	2017	September	CONSTANTINE WINES INC	347911	CUVEE JEAN PAUL GASCOGNE ROSE 750 ML	WINE	0.00	0.0	1.00

In [37]:
```
# check how many unique Months we have in 2017

year2017['MONTH'].unique()
```

Out[37]:
```
array(['June', 'July', 'August', 'December', 'September', 'October',
       'November'], dtype=object)
```

- There is only 7 column in 2017 get supply

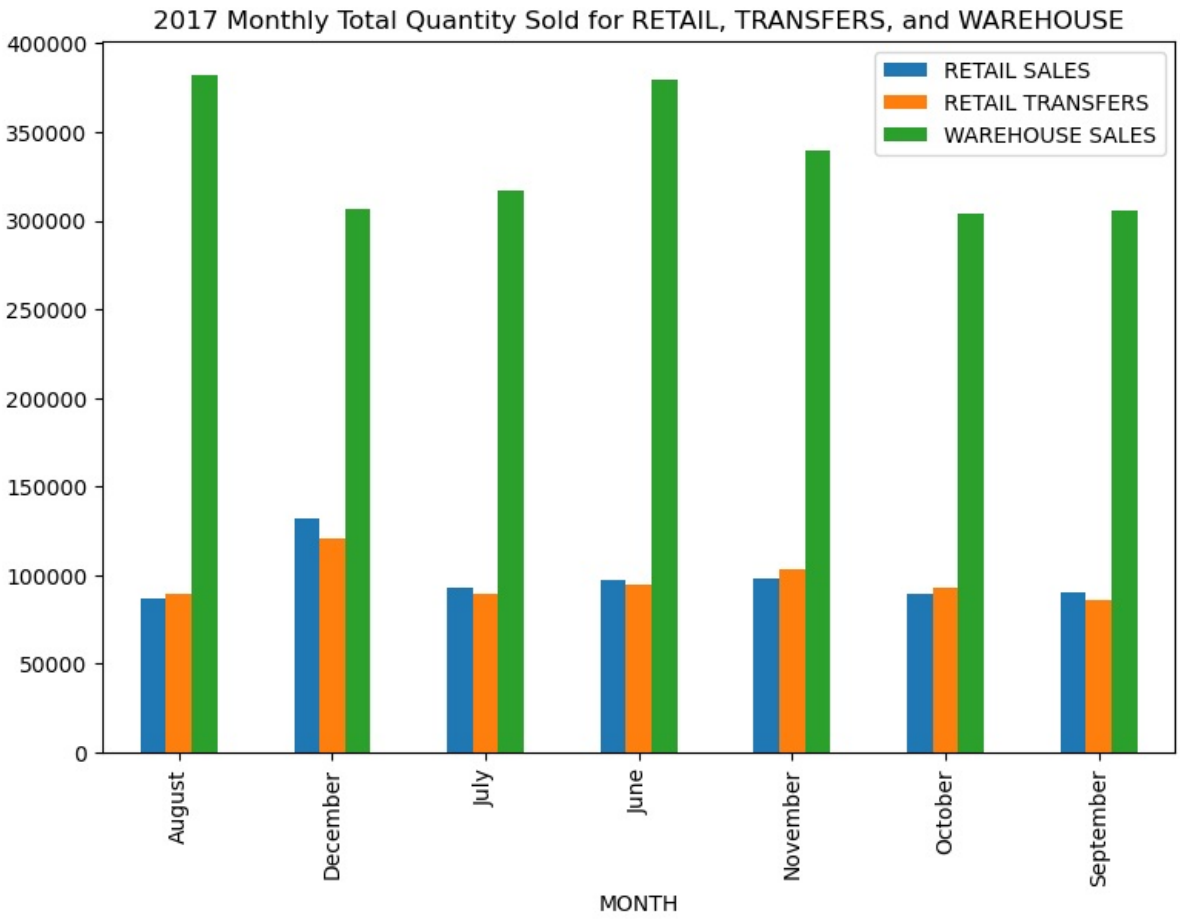
In [38]:
```
# Calculate your the Monthly Total quantity sold in 2017

year2017 = year2017.groupby('MONTH')[['RETAIL SALES','RETAIL TRANSFERS','WAREHOUSE SALES']].agg('sum')
year2017
```

Out[38]:

MONTH	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
August	87111.78	89486.43	382186.69
December	131634.49	121129.51	306957.22
July	92625.29	89083.25	316853.29
June	97357.26	94720.00	379390.83
November	98316.19	103230.96	339305.66
October	89236.96	93035.97	303714.91
September	90452.60	85934.38	305440.53

In [39]:
```
# visulize it

year2017.plot.bar(figsize =(9,6),
        title = ('2017 Monthly Total Quantity Sold for RETAIL, TRANSFERS, and WAREHOUSE'))
```

Out[39]:
```
<Axes: title={'center': '2017 Monthly Total Quantity Sold for RETAIL, TRANSFERS, and WAREHOUSE'}, xlabel='MONTH
'>
```



- In 2017 Month Warehouse sales had the highest quantity sold
- Retail sales and Retail Transfers have a moderate quantity sold

In [40]:
```
# use filter to query 2018 come out

year2018 = df3[df['YEAR'] == 2018]
year2018.sample(4)
```

Out[40]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
159360	2018	February	E & J GALLO WINERY	311839	TALBOTT SLEEPY HOLLOW P/NOIR - 750ML	WINE	0.91	0.0	0.00
152227	2018	January	PALM BAY IMPORTS	66125	CAVIT P/GRIG - 1.5L	WINE	99.75	64.0	122.83
156439	2018	February	MONSIEUR TOUTON SELECTION	155020	MAPRECO VINHO VERDE - 750ML	WINE	0.00	0.0	2.00
156088	2018	February	LEGENDS LTD	12236	LONG TRAIL BLAZE BOX - 12.OZ 2/12 NR	BEER	1.50	6.0	0.00

In [41]:
```
# check how many unique Month we have in 2018

year2018['MONTH'].unique()
```

Out[41]:
```
array(['January', 'February'], dtype=object)
```

In [42]:
```
# Calculate your the Monthly Total quantity sold in 2018

year2018 = year2018.groupby('MONTH')[['RETAIL SALES','RETAIL TRANSFERS','WAREHOUSE SALES']].agg('sum')
year2018
```

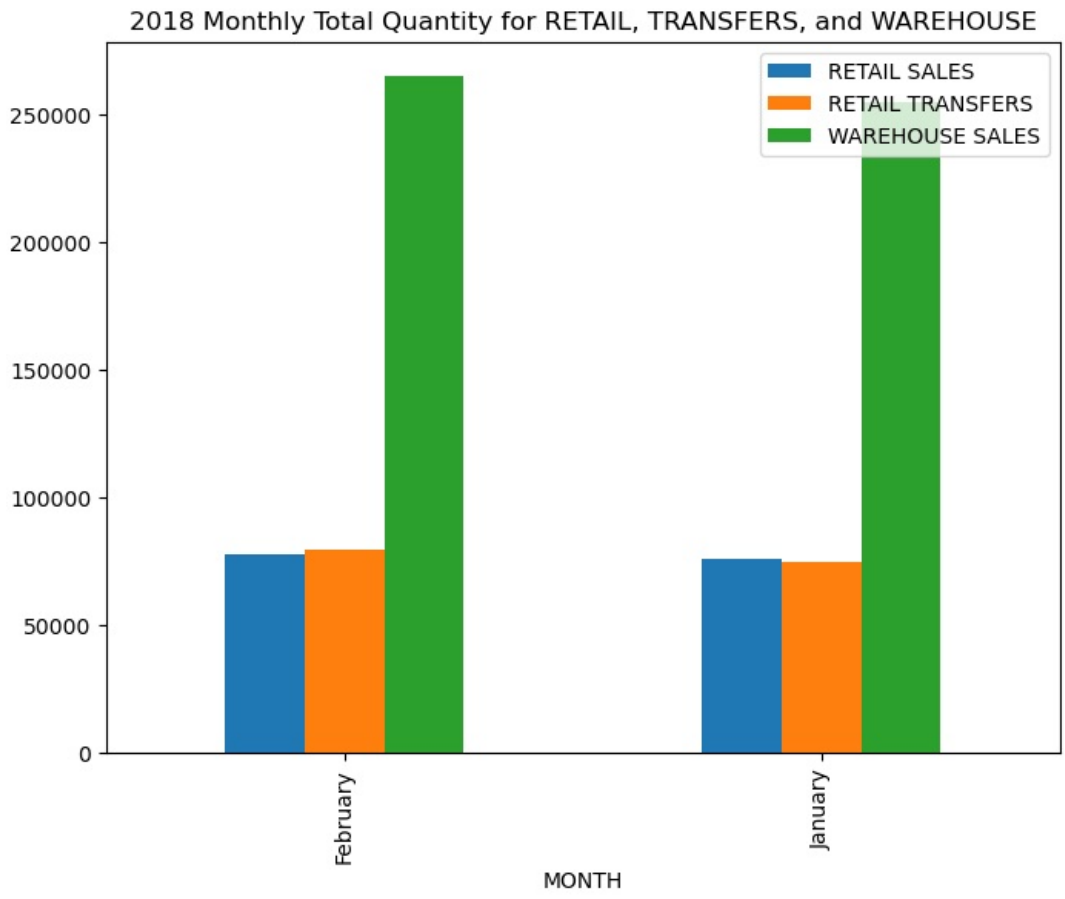
Out[42]:

MONTH	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
February	77804.13	79256.78	265008.52
January	75791.77	74396.14	254517.67

- There is only 2 months in 2018 get supply

In [43]:
```
# visulize it

year2018.plot.bar(figsize =(8,6),
        title = ('2018 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'))
```

Out[43]:
```
<Axes: title={'center': '2018 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'}, xlabel='MONTH'>
```



- In 2018 Month Warehouse sales had the highest quantity sold
- Retail sales and Retail Transfers have a moderate quantity sold

In [44]:
```
# use filter to query 2019 come out

year2019 = df3[df['YEAR'] == 2019]
year2019.sample(4)
```

Out[44]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
253179	2019	July	LEGENDS LTD	63115	ANCHOR FOG BREAKER 4/6 NR	BEER	0.00	0.0	6.0
258905	2019	August	DOPS INC	26447	UINTA HOP NOTCH IPA 4/6 CANS - 12OZ	BEER	0.75	1.0	3.0
245982	2019	July	SOUTHERN GLAZERS WINE AND SPIRITS	238076	OLE SMOKY MOONSHINE PICKLES - 750ML	LIQUOR	12.05	48.0	0.0
265032	2019	August	MILLER BREWING COMPANY	51051	CAPE LINE 2/12 PK 12OZ VARIETY PACK CAN	BEER	49.50	36.0	89.0

In [45]:
```
# check how many unique Months we have in 2019

year2019['MONTH'].unique()
```

Out[45]:
```
array(['January', 'November', 'February', 'March', 'April', 'May', 'June',
       'July', 'August', 'September', 'October'], dtype=object)
```

- In 2019 There are 11 Months get supply

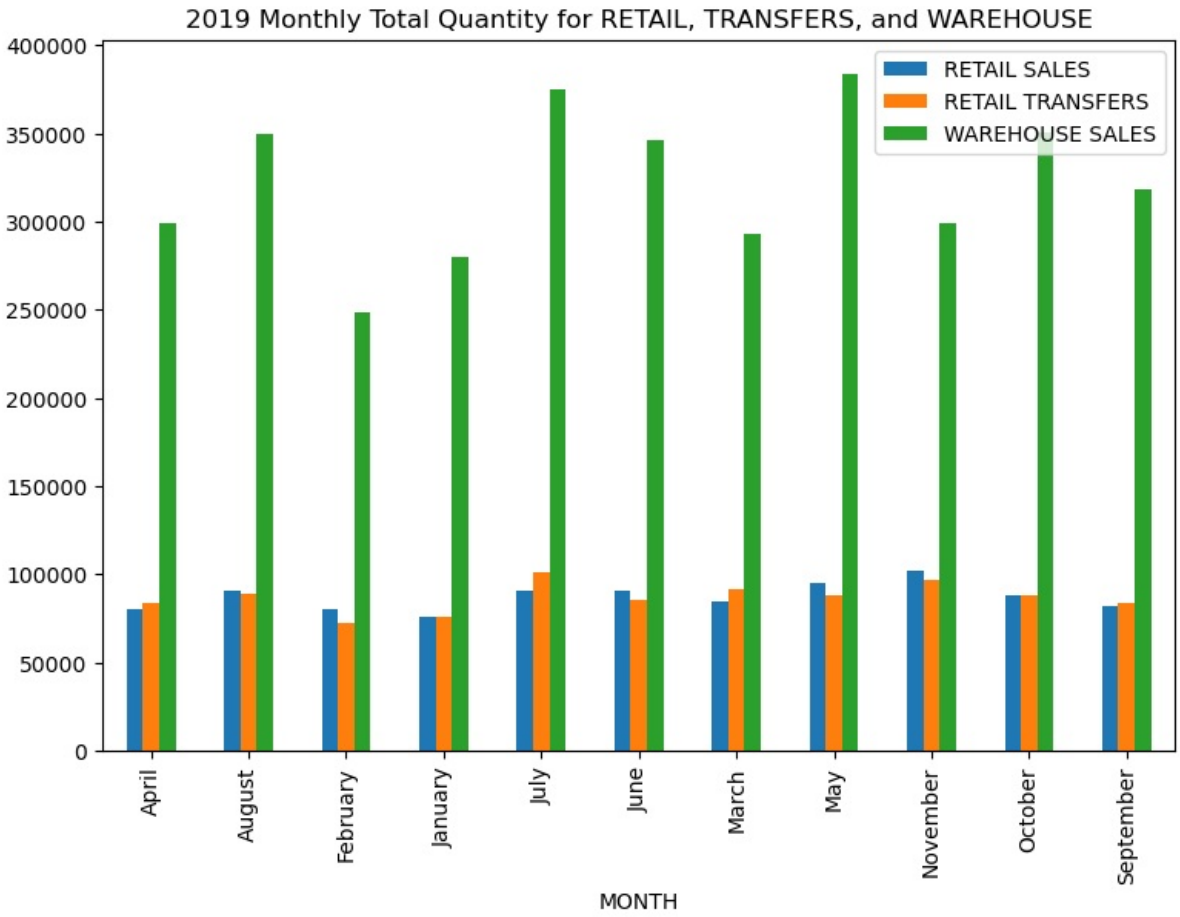
In [46]:
```
# Calculate your the Monthly Total quantity sold in 2019

year2019 = year2019.groupby('MONTH')[['RETAIL SALES','RETAIL TRANSFERS','WAREHOUSE SALES']].agg('sum')
year2019
```

Out[46]:

MONTH	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
April	80342.58	83633.90	298840.87
August	90628.61	88873.70	349603.09
February	80113.54	72415.98	248587.68
January	76100.53	76295.63	280381.24
July	90763.48	101509.34	374971.48
June	90860.39	85743.73	346587.08
March	84441.04	91321.61	293260.72
May	94953.10	88056.80	383791.58
November	101631.31	97169.75	299098.44
October	88230.41	88425.59	350203.03
September	82126.21	84116.37	318046.02

In [47]:
```
# visulize it

year2019.plot.bar(figsize =(9,6),
        title = ('2019 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'))
```

Out[47]:
```
<Axes: title={'center': '2019 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'}, xlabel='MONTH'>
```



- In 2019 Month Warehouse sales had the highest quantity sold
- Retail sales and Retail Transfers have a moderate quantity sold

In [48]:
```
# use filter to query 2020 come out

year2020 = df3[df['YEAR'] == 2020]
year2020.sample(4)
```

Out[48]:

	YEAR	MONTH	SUPPLIER	ITEM CODE	ITEM DESCRIPTION	ITEM TYPE	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
22620	2020	July	E & J GALLO WINERY	85697	DARK HORSE S/BLC - CAN - 375ML	WINE	8.09	7.0	9.0
18960	2020	July	DELICATO FAMILY VINEYARDS	432245	NOBLE VINES 181 MERLOT - 750ML	WINE	15.42	7.0	4.0
18135	2020	July	REPUBLIC NATIONAL DISTRIBUTING CO	370152	CALINA RES CHARD - 750ML	WINE	0.00	0.0	2.0
2734	2020	January	YOUNG WON TRADING INC	301119	HAKUSHIKA SNOW BEAUTY - 720ML	WINE	0.00	0.0	2.0

In [49]:
```
# check how many unique Month we have in 2020

year2020['MONTH'].unique()
```

Out[49]:
```
array(['January', 'July', 'March', 'September'], dtype=object)
```

- In 2020 There only 4 Months get supply

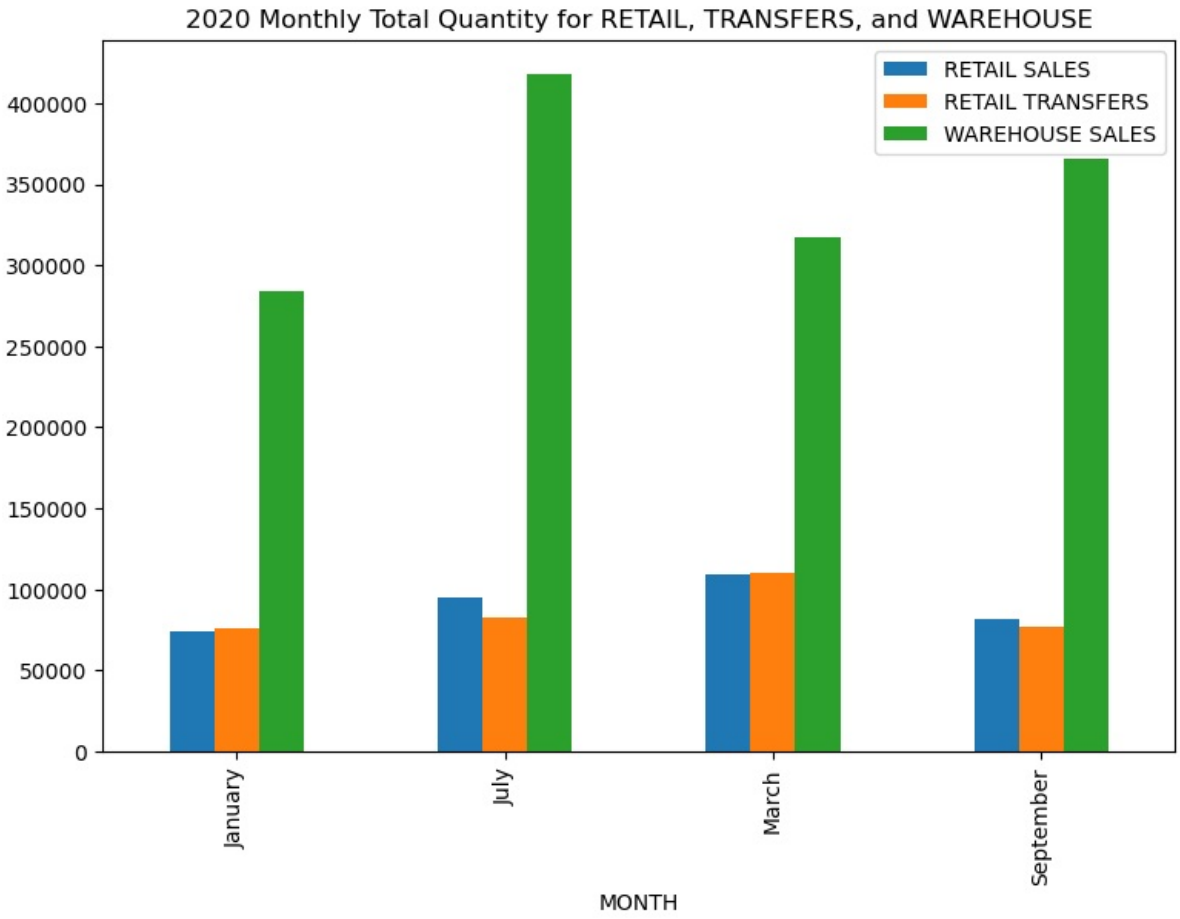
In [50]:
```
# Calculate your the Monthly Total quantity sold in 2020

year2020 = year2020.groupby('MONTH')[['RETAIL SALES','RETAIL TRANSFERS','WAREHOUSE SALES']].agg('sum')
year2020
```

Out[50]:

MONTH	RETAIL SALES	RETAIL TRANSFERS	WAREHOUSE SALES
January	74318.77	75997.35	284114.72
July	94538.96	82706.57	418094.42
March	109411.29	110598.89	317452.98
September	82108.68	76830.00	365347.61

In [51]:
```
# visulize it

year2020.plot.bar(figsize =(9,6),
        title = ('2020 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'))
```

Out[51]:
```
<Axes: title={'center': '2020 Monthly Total Quantity for RETAIL, TRANSFERS, and WAREHOUSE'}, xlabel='MONTH'>
```



- In 2020 Month Warehouse sales had the highest quantity sold
- Retail sales and Retail Transfers have a moderate quantity sold

General Insight

What is the total quantity sold in Retail Sales and Warehouse Sales

- The told Quantity sold in Retail Sales for four years is: 2160899.37
- The told Quantity sold in Warehouse Sales for four years is: 7781756.280000001

What is the average, maximum, and total Quantity sold in Retails Sales

- DUNNAGE and Kegs Items don't have any quantity sold in retail Sales

- Non-alcohol has the highest maximum, Average, and lowest total quantity sold in the retail sale
- Liquor has the highest total and a moderate maximum, average quantity sold in retail sale
- Wine has a higher total quantity and a low maximum quantity with the lowest average sold in the retail sale
- Beer has a moderate average, maximum, and total quantity sold in retail sale
- str_supplies has a lower average, maximum, and total quantity sold in the retail sale
- Ref has the lowest average, maximum, and total quantity sold in retail sale

What is the average, maximum, and total Quantity sold in warehouse Sales

- Str_supplies Items don't have any quantity sold in Warehouse Sales
- DUNNAGE and Kegs items sold their quantity in Debit at warehouse sales
- Bear as the highest Average, maximum, and total quantity sold at Warehouse
- The Other item Types contribute low to the Average, maximum, and total quantity sold at the Warehouse

Yearly Analysis

- 2019 and 2017 had the most hike quantity sold, especially in Warehouse sale
- Retail sales and Retail Transfers have a moderate quantity sold
- 2018 has the lowest quantity sold

Monthly Analysis

- 2017 has 7 months of supply
- 2018 has only 2 months of supply
- 2019 has 11 months of supply
- 2020 has 4 months of supply
- Trought out the Month and the Year Warehouse as the most quantity sold

Recommendations for Improving Inventory Sale Management

- Investigate and reassess the stock levels of products like DUNNAGE, Str_supplies, and KEGS that have negative warehouse sales but no retail sales and warehouse sales and Implement regular reviews of stock turnover for both retail and warehouse channels to ensure better balance in inventory allocation and reduce overstocking.
- Increase the stock supply for Beer, which has consistently high average, maximum, and total sales in the warehouse, and implement advanced analysis techniques such as machine learning algorithm used to forecasting model to anticipate demand surge for hike performing products to adjust warehouse stock accordingly.
- For Item Types like STR_SUPPLIES and REF that have low sales in both retail and warehouse, re-evaluate the stock levels, and pricing strategies, reallocate marketing efforts, and introduce discounts to stimulate sales of underperforming products.
- Products Item Types like Liquor and Wine that have high sales potential in retail should be given a quicker replacement in retail stores to meet demand and avoid stockouts and set up an automated stock replacement to ensure popular products are always available for customers, both in retail and the warehouse.

Recommendations for Improving Sales Performance Optimization

- Focus efforts on Retail sale item types like Liquor and Non-Alcoholic products that have strong retail performance, and optimize warehouse strategies for products like Beer, which perform better in warehouse sales. Tailor a marketing promotional to channel For instance, increase retail promotions for Liquor and Wine while driving warehouse promotions and bulk offers for Beer.
- Capitalize on high-selling months by running targeted campaigns and stock promotions and offer bulk purchase discounts to drive more sales.
- For Item Types like Liquor that show high total sales but moderate maximum sales, focus on boost promotions to drive further engagement and Introduce seasonal offers, bundle deals, or loyalty rewards to drive higher sales for popular products.
- Implement dynamic pricing for top-performing products based on demand forecasts, and consider discounting or offering incentives on low-demand products like STR_SUPPLIES.
- Look at the factors that contributed to 2018 lowest overall sales drop, and develop a strategy to prevent similar trends in future years.

In [ ]:

In [ ]: