```
# This Python 3 environment comes with many helpful analytics
libraries installed
# It is defined by the kaggle/python Docker image:
https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/"
directory
# For example, running this (by clicking run or pressing Shift+Enter)
will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/)
that gets preserved as output when you create a version using "Save &
Run All"
# You can also write temporary files to /kaggle/temp/, but they won't
be saved outside of the current session
import matplotlib.pyplot as plt
%matplotlib inline
import plotly.express as px
import plotly.subplots as sp
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
import seaborn as sns
sns.set_style('whitegrid')
```

```
/kaggle/input/supply-chain-optimization-for-a-fmcg-company/
FMCG_data.csv
/kaggle/input/supply-chain-optimization-for-a-fmcg-company/Problem
Statement.pdf
```

FMCG Warehouse: Optimizing Distribution Efficiency

Background: The company is facing challenges in ensuring efficient warehouse operations, resulting in frequent stockouts, delays in deliveries, and increased operational costs. The management has tasked you with analyzing the data from these warehouses to identify key issues and provide actionable insights to enhance warehouse efficiency.

Problem Statement Problem Statement: FMCG is experiencing inefficiencies in its warehouse operations. These inefficiencies are affecting the supply chain, leading to stockouts, delivery delays, and increased costs. Your task is to analyze warehouse data to uncover the root causes of these issues and propose data-driven solutions to optimize warehouse performance. Why is it Important to Solve? Addressing these inefficiencies is crucial for improving customer satisfaction, reducing operational costs, and ensuring timely delivery of products. Efficient warehouse operations are critical for maintaining a competitive edge in the retail market.

Data Dictionary:

1. Ware_house_ID: Unique identifier for each warehouse
2. WH_Manager_ID: Identifier for the warehouse manager
3. Location_type: Type of location (Urban/Rural)
4. WH_capacity_size: Size of warehouse capacity (Small/Mid/Large)
5. zone: Geographical zone of the warehouse
6. WH_regional_zone: Regional zone identifier
7. num_refill_req_l3m: Number of refill requests in the last 3 months
8. transport_issue_l1y: Number of transport issues in the last year
9. Competitor_in_mkt: Number of competitors in the market
10. retail_shop_num: Number of retail shops served by the warehouse
11. electric_supply: Availability of electric supply (1 = Yes, 0 = No)
12. dist_from_hub: Distance from central distribution hub (km)
13. workers_num: Number of workers in the warehouse
14. wh_est_year: Year of warehouse establishment
15. storage_issue_reported_l3m: Number of storage issues reported in the last 3 months
16. temp_reg_mach: Availability of temperature regulation machinery
17. approved_wh_govt_certificate: Type of government certification approved
18. wh_breakdown_l3m: Number of warehouse breakdowns in the last 3 months
19. govt_check_l3m: Number of government checks in the last 3 months
20. product_wg_ton: Weight of products stored (tons)

```
wh= pd.read_csv('/kaggle/input/supply-chain-optimization-for-a-fmcg-company/FMCG_data.csv')

wh
```

```
      Ware_house_ID WH_Manager_ID Location_type WH_capacity_size
zone  \
0         WH_100000     EID_50000         Urban             Small
West
1         WH_100001     EID_50001         Rural             Large
North
2         WH_100002     EID_50002         Rural               Mid
South
3         WH_100003     EID_50003         Rural               Mid
North
4         WH_100004     EID_50004         Rural             Large
North
```

```
...             ...           ...           ...               ...    ..
.
24995     WH_124995     EID_74995         Rural             Small
North
24996     WH_124996     EID_74996         Rural               Mid
West
24997     WH_124997     EID_74997         Urban             Large
South
24998     WH_124998     EID_74998         Rural             Small
North
24999     WH_124999     EID_74999         Rural               Mid
West

      WH_regional_zone  num_refill_req_l3m  transport_issue_l1y  \
0               Zone 6                   3                    1
1               Zone 5                   0                    0
2               Zone 2                   1                    0
3               Zone 3                   7                    4
4               Zone 5                   3                    1
...                ...                 ...                  ...
24995           Zone 1                   3                    0
24996           Zone 2                   6                    0
24997           Zone 5                   7                    0
24998           Zone 1                   1                    0
24999           Zone 4                   8                    2

       Competitor_in_mkt  retail_shop_num  ... electric_supply
dist_from_hub  \
0                      2             4651  ...               1
91
1                      4             6217  ...               1
210
2                      4             4306  ...               0
161
3                      2             6000  ...               0
103
4                      2             4740  ...               1
112
...                  ...              ...  ...             ...
...
24995                  4             5390  ...               1
142
24996                  4             4490  ...               1
130
24997                  2             5403  ...               1
147
24998                  2            10562  ...               1
60
24999                  4             5664  ...               1
```

```
239

       workers_num  wh_est_year  storage_issue_reported_l3m
temp_reg_mach  \
0             29.0          NaN                          13
0
1             31.0          NaN                           4
0
2             37.0          NaN                          17
0
3             21.0          NaN                          17
1
4             25.0       2009.0                          18
0
...            ...          ...                         ...
...
24995         34.0       2005.0                          22
1
24996         28.0       2012.0                          10
0
24997          NaN          NaN                          23
0
24998         25.0          NaN                          18
0
24999         39.0       2019.0                           4
0

       approved_wh_govt_certificate  wh_breakdown_l3m  govt_check_l3m
\
0                                 A                 5              15

1                                 A                 3              17

2                                 A                 6              22

3                                A+                 3              27

4                                 C                 6              24

...                             ...               ...             ...

24995                             A                 2              30

24996                             B                 4              18

24997                            B+                 5              25

24998                             A                 6              30

24999                            B+                 2              11
```

```
       product_wg_ton
0               17115
1                5074
2               23137
3               22115
4               24071
...               ...
24995           32093
24996           12114
24997           27080
24998           25093
24999            5058

[25000 rows x 24 columns]
```

```
wh.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25000 entries, 0 to 24999
Data columns (total 24 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   Ware_house_ID                   25000 non-null  object 
 1   WH_Manager_ID                   25000 non-null  object 
 2   Location_type                   25000 non-null  object 
 3   WH_capacity_size                25000 non-null  object 
 4   zone                            25000 non-null  object 
 5   WH_regional_zone                25000 non-null  object 
 6   num_refill_req_l3m              25000 non-null  int64  
 7   transport_issue_l1y             25000 non-null  int64  
 8   Competitor_in_mkt               25000 non-null  int64  
 9   retail_shop_num                 25000 non-null  int64  
 10  wh_owner_type                   25000 non-null  object 
 11  distributor_num                 25000 non-null  int64  
 12  flood_impacted                  25000 non-null  int64  
 13  flood_proof                     25000 non-null  int64  
 14  electric_supply                 25000 non-null  int64  
 15  dist_from_hub                   25000 non-null  int64  
 16  workers_num                     24010 non-null  float64
 17  wh_est_year                     13119 non-null  float64
 18  storage_issue_reported_l3m      25000 non-null  int64  
 19  temp_reg_mach                   25000 non-null  int64  
 20  approved_wh_govt_certificate    24092 non-null  object 
 21  wh_breakdown_l3m                25000 non-null  int64  
 22  govt_check_l3m                  25000 non-null  int64  
 23  product_wg_ton                  25000 non-null  int64  
dtypes: float64(2), int64(14), object(8)
memory usage: 4.6+ MB
```

```
wh = wh.dropna(subset=['wh_est_year'])

pd.options.mode.copy_on_write = True

wh['wh_est_year'] = wh['wh_est_year'].astype(int)

wh.wh_est_year.unique()
```

```
array([2009, 2010, 2013, 1999, 2017, 2022, 2008, 2001, 2016, 1997,
2003,
       2006, 2019, 2015, 2012, 1998, 2021, 2004, 2000, 2005, 2011,
2014,
       1996, 2020, 2023, 2002, 2007, 2018])
```

```
wh.shape
```

```
(13119, 24)
```

```
wh.isna().sum()
```

```
Ware_house_ID                    0
WH_Manager_ID                    0
Location_type                    0
WH_capacity_size                 0
zone                             0
WH_regional_zone                 0
num_refill_req_l3m               0
transport_issue_l1y              0
Competitor_in_mkt                0
retail_shop_num                  0
wh_owner_type                    0
distributor_num                  0
flood_impacted                   0
flood_proof                      0
electric_supply                  0
dist_from_hub                    0
workers_num                    538
wh_est_year                      0
storage_issue_reported_l3m       0
temp_reg_mach                    0
approved_wh_govt_certificate   473
wh_breakdown_l3m                 0
govt_check_l3m                   0
product_wg_ton                   0
dtype: int64
```

```
wh.describe()
```

```
       num_refill_req_l3m  transport_issue_l1y  Competitor_in_mkt  \
count        13119.000000         13119.000000       13119.000000
mean             5.486851             0.448815           3.112509
```

```
std              1.720691             0.906070           1.149449
min              3.000000             0.000000           0.000000
25%              4.000000             0.000000           2.000000
50%              5.000000             0.000000           3.000000
75%              7.000000             1.000000           4.000000
max              8.000000             4.000000          12.000000

       retail_shop_num  distributor_num  flood_impacted   flood_proof
\
count     13119.000000     13119.000000    13119.000000  13119.000000

mean       4986.216175        42.467337        0.096577      0.052824

std        1051.444496        16.104239        0.295393      0.223691

min        1821.000000        15.000000        0.000000      0.000000

25%        4320.000000        29.000000        0.000000      0.000000

50%        4860.000000        42.000000        0.000000      0.000000

75%        5492.000000        56.000000        0.000000      0.000000

max       11008.000000        70.000000        1.000000      1.000000


       electric_supply  dist_from_hub   workers_num   wh_est_year  \
count     13119.000000   13119.000000  12581.000000  13119.000000
mean          0.651193     163.544173     28.850807   2009.383185
std           0.476611      62.480858      7.918509      7.528230
min           0.000000      55.000000     10.000000   1996.000000
25%           0.000000     109.000000     23.000000   2003.000000
50%           1.000000     164.000000     28.000000   2009.000000
75%           1.000000     217.000000     33.000000   2016.000000
max           1.000000     271.000000     98.000000   2023.000000

       storage_issue_reported_l3m  temp_reg_mach  wh_breakdown_l3m  \
count                13119.000000   13119.000000      13119.000000
mean                    18.333333       0.398887          3.483040
std                      9.340444       0.489688          1.687329
min                      0.000000       0.000000          0.000000
25%                     11.000000       0.000000          2.000000
50%                     19.000000       0.000000          3.000000
75%                     25.000000       1.000000          5.000000
max                     39.000000       1.000000          6.000000

       govt_check_l3m  product_wg_ton
count    13119.000000    13119.000000
mean        18.791905    23915.513454
std          8.610438    11810.371414
```

```
min          1.000000     3062.000000
25%         11.000000    14127.000000
50%         21.000000    24102.000000
75%         26.000000    31129.000000
max         32.000000    55150.000000
```

```
wh.select_dtypes(include='object').describe()
```

```
       Ware_house_ID WH_Manager_ID Location_type WH_capacity_size
zone  \
count          13119         13119         13119             13119
13119
unique         13119         13119             2                 3
4
top        WH_100004     EID_50004         Rural             Large
North
freq               1             1         11994              5375
5403

       WH_regional_zone  wh_owner_type approved_wh_govt_certificate
count             13119          13119                        12646
unique                6              2                            5
top              Zone 6  Company Owned                            C
freq               4387           7090                         2801
```

```
wh.WH_capacity_size.mode()
```

```
0    Large
Name: WH_capacity_size, dtype: object
```

RECOMMENDED ANALYSIS

Q.1 What is the average capacity size of the warehouses?

```
wh.WH_capacity_size.value_counts().reset_index()
```

```
  WH_capacity_size  count
0            Large   5375
1              Mid   5306
2            Small   2438
```

Q.2 How many warehouses are located in urban areas versus rural areas?

```
wh.Location_type.value_counts().reset_index()
```

```
  Location_type  count
0         Rural  11994
1         Urban   1125
```

Q.3 What is the total number of retail shops served by each zone?

```
wh.groupby('zone')['retail_shop_num'].sum().reset_index()
```

```
    zone  retail_shop_num
0   East          1076159
1  North         27298465
2  South         16304018
3   West         20735528
```

Q.4 Calculate the average number of workers per warehouse.

```
wh.groupby('WH_regional_zone')['workers_num'].mean().reset_index()
```

```
  WH_regional_zone  workers_num
0           Zone 1    28.793380
1           Zone 2    28.894737
2           Zone 3    29.130944
3           Zone 4    28.663721
4           Zone 5    28.804007
5           Zone 6    28.873484
```

```
wh.groupby('zone')['workers_num'].mean()
```

```
zone
East     29.125581
North    28.820726
South    28.888065
West     28.846229
Name: workers_num, dtype: float64
```

```
wh.groupby('WH_capacity_size')['workers_num'].mean()
```

```
WH_capacity_size
Large    28.792669
Mid      28.864450
Small    28.949189
Name: workers_num, dtype: float64
```

```
# Fill the nulls with the average no. of workers
wh['workers_num'] =
wh['workers_num'].fillna(wh.groupby('WH_regional_zone')
['workers_num'].transform('mean'))

wh.workers_num.isna().sum()
```

```
0
```

Q.5 Determine the percentage of warehouses with electric supply.

```
wh.electric_supply.value_counts()
```

```
electric_supply
1    8543
0    4576
Name: count, dtype: int64

total_warehouses = len(wh)

warehouses_with_electric_supply = wh['electric_supply'].sum()

percentage_with_electric_supply = (warehouses_with_electric_supply /
total_warehouses) * 100

print(f"Percentage of warehouses with electric supply:
{percentage_with_electric_supply:.2f}%")

Percentage of warehouses with electric supply: 65.12%
```

Q.6 What is the average distance of warehouses from the central distribution hub?

```
wh.groupby('zone')['dist_from_hub'].mean().reset_index()

    zone  dist_from_hub
0   East     167.757848
1  North     162.054414
2  South     165.168515
3   West     163.976689

wh.groupby(['zone', 'WH_regional_zone'])['dist_from_hub'].mean()

zone   WH_regional_zone
East   Zone 1              166.500000
       Zone 3              179.189655
       Zone 4              165.576923
       Zone 5              154.081081
       Zone 6              168.875000
North  Zone 1              161.187354
       Zone 2              163.822844
       Zone 3              158.683594
       Zone 4              163.462366
       Zone 5              160.123506
       Zone 6              163.045798
South  Zone 1              162.706061
       Zone 2              166.391188
       Zone 3              163.617450
       Zone 4              168.388646
       Zone 5              163.159930
       Zone 6              165.541126
West   Zone 1              164.337255
       Zone 2              159.045822
       Zone 3              164.136273
```

```
       Zone 4              164.065465
       Zone 5              167.437659
       Zone 6              163.074883
Name: dist_from_hub, dtype: float64
```

Q.7 How many warehouses have reported storage issues in the last 3 months?

```
# Total number of warehouses
total_warehouses = len(wh)

# Total number of warehouses with storage issues in the last 3 months
total_issues = wh['storage_issue_reported_l3m'].sum()

# Count of warehouses with storage issues by zone and regional zone
issues_by_zone = wh[wh['storage_issue_reported_l3m'] >
0].groupby('zone').size().reset_index(name='issues_count')
issues_by_regional_zone = wh[wh['storage_issue_reported_l3m'] >
0].groupby('WH_regional_zone').size().reset_index(name='issues_count')

print(f"Total warehouses: {total_warehouses}")
print(f"Total warehouses with storage issues: {total_issues}")

print("Issues by Zone:")
print(issues_by_zone)

print("\nIssues by Regional Zone:")
print(issues_by_regional_zone)
```

```
Total warehouses: 13119
Total warehouses with storage issues: 240515
Issues by Zone:
    zone  issues_count
0   East           220
1  North          5202
2  South          3120
3   West          4104

Issues by Regional Zone:
  WH_regional_zone  issues_count
0           Zone 1           980
1           Zone 2          1500
2           Zone 3          1461
3           Zone 4          2169
4           Zone 5          2318
5           Zone 6          4218
```

Q.8 Identify the top 3 zones with the highest number of refill requests in the last 3 months.

```
wh.groupby('WH_regional_zone')
['num_refill_req_l3m'].sum().sort_values(ascending=False).head(3)
```

```
WH_regional_zone
Zone 6    24061
Zone 5    13190
Zone 4    12286
Name: num_refill_req_l3m, dtype: int64
```

Q.9 Calculate the average number of government checks per warehouse in the last 3 months.

```
wh.groupby(['zone','WH_regional_zone'])['govt_check_l3m'].mean()
```

```
zone   WH_regional_zone
East   Zone 1              27.666667
       Zone 3              27.000000
       Zone 4              26.000000
       Zone 5              14.000000
       Zone 6              15.000000
North  Zone 1              18.882904
       Zone 2              11.820513
       Zone 3              25.500000
       Zone 4              26.000000
       Zone 5              18.269920
       Zone 6              19.775630
South  Zone 1              20.339394
       Zone 2              24.185581
       Zone 3              21.362416
       Zone 4              23.019651
       Zone 5              17.089631
       Zone 6              14.854257
West   Zone 1              19.160784
       Zone 2               9.929919
       Zone 3              20.106212
       Zone 4              18.272296
       Zone 5              14.100509
       Zone 6              14.847114
Name: govt_check_l3m, dtype: float64
```

Q.10 Determine the most common type of government certification among warehouses.

```
wh.approved_wh_govt_certificate.value_counts()
```

```
approved_wh_govt_certificate
C     2801
B     2586
B+    2573
A     2459
```

```
A+    2227
Name: count, dtype: int64
```

Medium level

Q.1 What is the correlation between the number of workers and the number of reported storage issues in the last 3 months?

```
correlation = wh['workers_num'].corr(wh['storage_issue_reported_l3m'])
print(f"The correlation between the number of workers and the number
of reported storage issues is: {correlation}")

The correlation between the number of workers and the number of
reported storage issues is: -0.000913066197778624
```

Q.2 Analyze the relationship between warehouse capacity size and the number of refill requests in the last 3 months.

```
wh.pivot_table(index='WH_capacity_size', columns='num_refill_req_l3m',
values='Ware_house_ID', aggfunc='count')

num_refill_req_l3m    3    4    5    6    7    8
WH_capacity_size
Large               931  880  913  856  887  908
Mid                 932  870  872  837  892  903
Small               402  419  415  407  390  405
```

Q.3 Identify which geographical zone has the highest average number of transport issues in the last year.

```
wh.groupby('zone')['transport_issue_l1y'].mean().round(decimals=2)

zone
East     0.47
North    0.47
South    0.43
West     0.43
Name: transport_issue_l1y, dtype: float64
```

Q.4 Calculate the average product weight per ton for warehouses that have temperature regulation machinery.

```
filtered_wh = wh[wh['temp_reg_mach']==1]
avg_weight = filtered_wh['product_wg_ton'].mean().round(decimals=2)
print('\nAverage product weight per ton for warehouses with
temperature regulation machinery:', avg_weight)
```

```
Average product weight per ton for warehouses with temperature
regulation machinery: 25428.15
```

Q.5 Determine the top 5 warehouses with the highest number of government checks in the last 3 months and analyze their storage issue reports.

```
wh.groupby('govt_check_l3m')
['storage_issue_reported_l3m'].sum().sort_values(ascending=False).head
().reset_index()
```

```
   govt_check_l3m  storage_issue_reported_l3m
0              26                       28522
1              23                       18678
2              19                       15399
3              14                       13901
4              28                       13750
```

Q.6 Compare the average number of workers in warehouses located in urban areas versus rural areas.

```
wh.groupby('Location_type')['workers_num'].mean().round(decimals=2)
```

```
Location_type
Rural    28.86
Urban    28.73
Name: workers_num, dtype: float64
```

Q.7 What is the impact of the distance from the hub on the number of transport issues reported?

```
cor = wh['transport_issue_l1y'].corr(wh['dist_from_hub'])
print(cor)

fig = px.scatter(wh, x='transport_issue_l1y', y='dist_from_hub',
size='dist_from_hub')
fig.show()
```

```
-0.004667275849114954
```

Q.8 Analyze the effect of competitor presence in the market on the number of refill requests.

```
wh.pivot_table(index='Competitor_in_mkt',
columns='num_refill_req_l3m', values='Ware_house_ID', aggfunc='count')
```

```
num_refill_req_l3m      3      4      5      6      7      8
Competitor_in_mkt
0                     NaN    NaN    NaN    NaN    1.0    NaN
1                    39.0   40.0   32.0   36.0   38.0   33.0
```

```
2                    802.0  777.0  719.0  710.0  766.0  760.0
3                    634.0  589.0  647.0  580.0  615.0  641.0
4                    599.0  589.0  617.0  598.0  576.0  581.0
5                    117.0   97.0  112.0   98.0   95.0  126.0
6                     45.0   51.0   52.0   56.0   48.0   44.0
7                     18.0   20.0   14.0   16.0   18.0   17.0
8                      9.0    6.0    6.0    6.0    8.0   10.0
9                      1.0    NaN    NaN    NaN    2.0    2.0
10                     1.0    NaN    1.0    NaN    2.0    1.0
12                     NaN    NaN    NaN    NaN    NaN    1.0
```

```
wh.groupby('Competitor_in_mkt')['num_refill_req_l3m'].sum()
```

```
Competitor_in_mkt
0         7
1      1183
2     24811
3     20406
4     19506
5      3560
6      1623
7       562
8       253
9        33
10       30
12        8
Name: num_refill_req_l3m, dtype: int64
```

Q.9 Determine if there is a significant difference in the number of storage issues reported between warehouses with and without government certificates.

```
wh.pivot_table(index='storage_issue_reported_l3m',
columns='approved_wh_govt_certificate', values='Ware_house_ID',
aggfunc='count')
```

```
approved_wh_govt_certificate      A     A+      B     B+      C
storage_issue_reported_l3m
4                                31.0    NaN   61.0   74.0  147.0
5                               100.0   41.0  148.0  133.0  243.0
6                                93.0   43.0   96.0  101.0  169.0
7                                28.0    4.0   39.0   55.0   86.0
8                                 8.0    4.0   50.0   50.0   94.0
9                                83.0   78.0  104.0   74.0   86.0
10                               74.0   71.0   70.0   37.0   68.0
11                               84.0   83.0   76.0   41.0   81.0
12                               73.0   81.0   80.0   45.0   71.0
13                               93.0   80.0   67.0   43.0   71.0
14                               51.0   49.0   56.0  118.0   49.0
15                               50.0   56.0   76.0  125.0   81.0
16                               95.0   70.0   73.0   77.0   70.0
```

```
17                                94.0   84.0   84.0   85.0   75.0
18                               111.0  125.0  135.0  130.0  110.0
19                               124.0  105.0  130.0  119.0  111.0
20                               114.0  109.0  102.0  138.0  118.0
21                                66.0   73.0   80.0   72.0   48.0
22                                95.0   74.0  123.0  118.0  119.0
23                                84.0   72.0  108.0  121.0  112.0
24                               200.0  191.0  182.0  160.0  161.0
25                               171.0  175.0  131.0  145.0  122.0
26                                68.0   22.0   73.0   70.0   59.0
27                                66.0   22.0   81.0   49.0   63.0
28                                47.0   47.0   39.0   39.0   50.0
29                                47.0   37.0   57.0   33.0   36.0
30                                50.0   51.0   38.0   60.0   52.0
31                                47.0   42.0   43.0   35.0   38.0
32                                47.0   42.0   42.0   45.0   40.0
33                                38.0   43.0   30.0   45.0   44.0
34                                33.0   47.0   25.0   40.0   48.0
35                                18.0   42.0   16.0   26.0   16.0
36                                26.0   40.0   20.0   15.0   15.0
37                                10.0   44.0   14.0   14.0   16.0
38                                21.0   45.0   20.0   17.0   20.0
39                                19.0   35.0   17.0   24.0   12.0
```

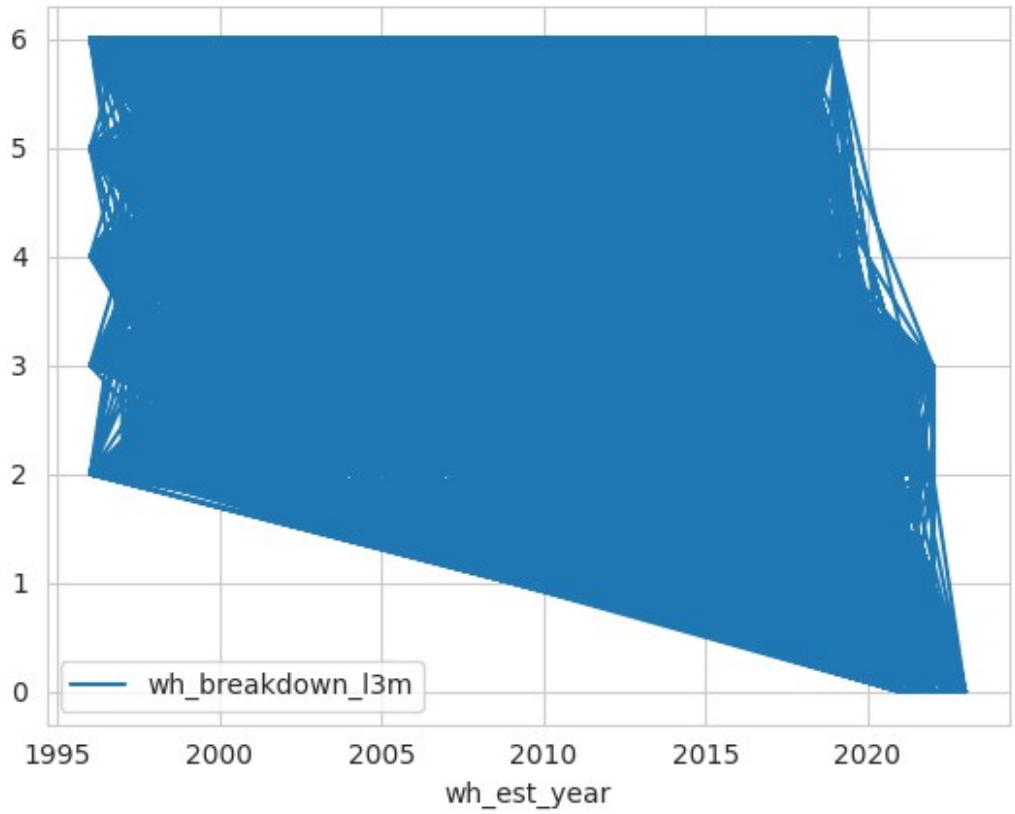
```
wh.groupby('approved_wh_govt_certificate')
['storage_issue_reported_l3m'].sum()
```

```
approved_wh_govt_certificate
A     48178
A+    47496
B     48217
B+    48771
C     47853
Name: storage_issue_reported_l3m, dtype: int64
```

Q.10 Investigate the relationship between warehouse establishment year and the number of breakdowns reported in the last 3 months.

```
plt.figure(figsize=(14,8), dpi=80, frameon=True)
wh.plot(kind='line', x='wh_est_year', y='wh_breakdown_l3m')
plt.show()
```

```
<Figure size 1120x640 with 0 Axes>
```




```
wh.columns
```

```
Index(['Ware_house_ID', 'WH_Manager_ID', 'Location_type',
'WH_capacity_size',
       'zone', 'WH_regional_zone', 'num_refill_req_l3m',
'transport_issue_l1y',
       'Competitor_in_mkt', 'retail_shop_num', 'wh_owner_type',
       'distributor_num', 'flood_impacted', 'flood_proof',
'electric_supply',
       'dist_from_hub', 'workers_num', 'wh_est_year',
       'storage_issue_reported_l3m', 'temp_reg_mach',
       'approved_wh_govt_certificate', 'wh_breakdown_l3m',
'govt_check_l3m',
       'product_wg_ton'],
      dtype='object')
```

```
wh.isna().sum()
```

```
Ware_house_ID                  0
WH_Manager_ID                  0
Location_type                  0
WH_capacity_size               0
zone                           0
WH_regional_zone               0
num_refill_req_l3m             0
```

```
transport_issue_l1y                0
Competitor_in_mkt                  0
retail_shop_num                    0
wh_owner_type                      0
distributor_num                    0
flood_impacted                     0
flood_proof                        0
electric_supply                    0
dist_from_hub                      0
workers_num                        0
wh_est_year                        0
storage_issue_reported_l3m         0
temp_reg_mach                      0
approved_wh_govt_certificate     473
wh_breakdown_l3m                   0
govt_check_l3m                     0
product_wg_ton                     0
dtype: int64
```