

In [16]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
```

In [17]:

```
convert_data = pd.read_csv("forced_convert.csv")
```

In [18]:

```
convert_data.head()
```

Out[18]:

	District	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0	Badin*	109.0	156.0	151.0	195.0	196.0	133.0	109.0	121.0	197.0	211.0	175.0	40.0
1	Tando Allahyar	NaN	26.0	23.0	22.0	20.0	178.0	NaN	13.0	86.0	130.0	73.0	74.0
2	Mirpurkhas	NaN	7.0	NaN	36.0	34.0	49.0	6.0	66.0	101.0	71.0	58.0	67.0
3	Thatta*	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	45.0	41.0	29.0	NaN
4	Umerkot	NaN	NaN	NaN	16.0	NaN	4.0	1.0	49.0	106.0	77.0	51.0	9.0

In [19]:

```
convert_data.tail()
```

Out[19]:

	District	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	202
29	Khanewal	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	NaN	NaN	NaN	Na
30	Lahore	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	NaN	NaN	NaN	NaN	Na
31	Multan	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1
32	Islamabad	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	Na
33	Sadiqabad	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1.0	Na

In [20]:

convert_data.shape

Out[20]:

(34, 15)

In [21]:

convert_data.columns

Out[21]:

```
Index(['District', '2008', '2009', '2010', '2011', '2012', '2013', '2014',
      '2015', '2016', '2017', '2018', '2019', '2020', 'Total_District_Wis
e'],
      dtype='object')
```

In [22]:

convert_data.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 34 entries, 0 to 33
Data columns (total 15 columns):
#   Column                Non-Null Count  Dtype
---  -
0   District              34 non-null    object
1   2008                  2 non-null     float64
2   2009                  4 non-null     float64
3   2010                  7 non-null     float64
4   2011                  7 non-null     float64
5   2012                  9 non-null     float64
6   2013                  12 non-null    float64
7   2014                  7 non-null     float64
8   2015                  16 non-null    float64
9   2016                  18 non-null    float64
10  2017                  17 non-null    float64
11  2018                  22 non-null    float64
12  2019                  19 non-null    float64
13  2020                  25 non-null    float64
14  Total_District_Wise  34 non-null    int64
dtypes: float64(13), int64(1), object(1)
memory usage: 4.1+ KB
```

In [23]:

```
convert_data.describe()
```

Out[23]:

	2008	2009	2010	2011	2012	2013	2014	
count	2.000000	4.00000	7.000000	7.000000	9.000000	12.000000	7.000000	1
mean	74.500000	57.25000	38.857143	45.857143	38.000000	40.083333	22.714286	2
std	48.790368	67.20801	50.814790	67.098009	60.541308	57.892468	40.639530	3
min	40.000000	7.00000	7.000000	6.000000	1.000000	2.000000	1.000000	
25%	57.250000	21.25000	11.000000	11.000000	10.000000	3.000000	1.000000	
50%	74.500000	33.00000	23.000000	22.000000	20.000000	8.000000	1.000000	
75%	91.750000	69.00000	34.500000	38.000000	34.000000	49.500000	23.000000	2
max	109.000000	156.00000	151.000000	195.000000	196.000000	178.000000	109.000000	12

In [24]:

```
convert_data.isnull().sum()
```

Out[24]:

```
District      0
2008           32
2009           30
2010           27
2011           27
2012           25
2013           22
2014           27
2015           18
2016           16
2017           17
2018           12
2019           15
2020            9
Total_District_Wise  0
dtype: int64
```

In [25]:

```
for i in convert_data.columns:
    convert_data[i] = convert_data[i].fillna(0)
```

In [26]:



```
convert_data.isnull().sum()
```

Out[26]:

```
District      0
2008           0
2009           0
2010           0
2011           0
2012           0
2013           0
2014           0
2015           0
2016           0
2017           0
2018           0
2019           0
2020           0
Total_District_Wise  0
dtype: int64
```

In [27]:



```
convert_data.head()
```

Out[27]:

	District	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0	Badin*	109.0	156.0	151.0	195.0	196.0	133.0	109.0	121.0	197.0	211.0	175.0	40.0
1	Tando Alahyar	0.0	26.0	23.0	22.0	20.0	178.0	0.0	13.0	86.0	130.0	73.0	74.0
2	Mirpurkhas	0.0	7.0	0.0	36.0	34.0	49.0	6.0	66.0	101.0	71.0	58.0	67.0
3	Thatta*	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	45.0	41.0	29.0	0.0
4	Umerkot	0.0	0.0	0.0	16.0	0.0	4.0	1.0	49.0	106.0	77.0	51.0	9.0

In [29]:



```
forced_convert_by_district = convert_data.groupby('District').sum()
```

In [30]:



```
forced_convert_by_district.head()
```

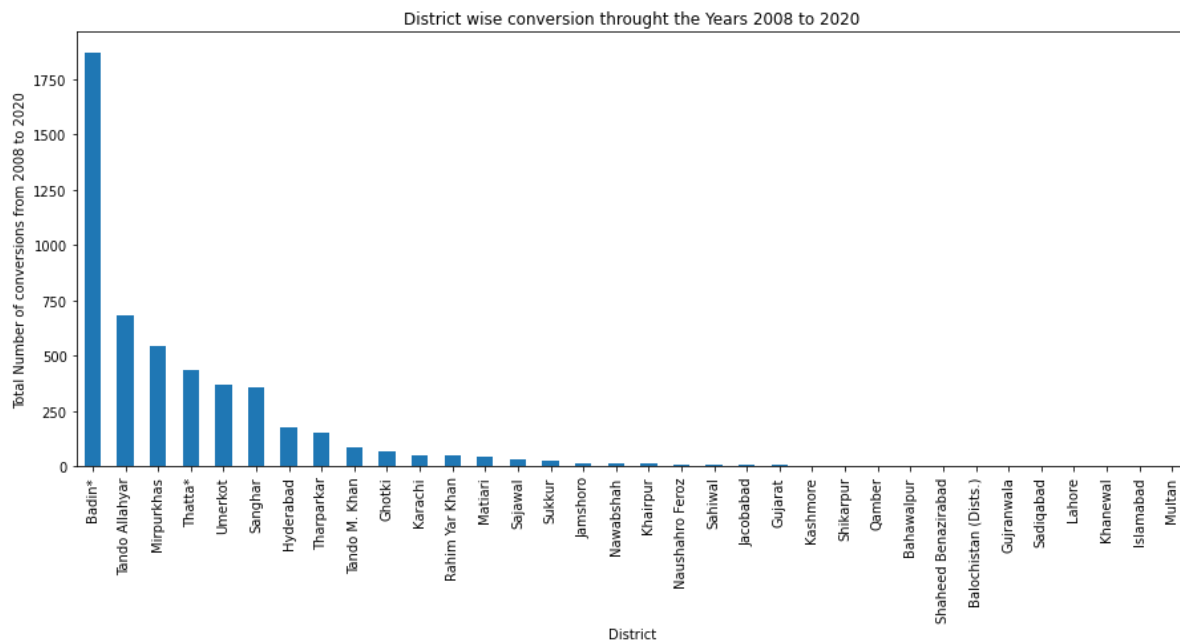
Out[30]:

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
District													
Badin*	109.0	156.0	151.0	195.0	196.0	133.0	109.0	121.0	197.0	211.0	175.0	40.0	
Bahawalpur	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	
Balochistan (Dists.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ghotki	0.0	0.0	11.0	0.0	0.0	3.0	0.0	1.0	3.0	2.0	6.0	21.0	
Gujarat	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	



In [31]:

```
plt.subplots(figsize = (15, 6))
cr = forced_convert_by_district['Total_District_Wise'].sort_values(ascending = False)
ax = cr.plot.bar()
ax.set_xlabel('District')
ax.set_ylabel('Total Number of conversions from 2008 to 2020')
ax.set_title('District wise conversion throught the Years 2008 to 2020')
plt.show()
print(cr)
```



District	
Badin*	1870
Tando Allahyar	682
Mirpurkhas	544
Thatta*	438
Umerkot	372
Sanghar	357
Hyderabad	178
Tharparkar	153
Tando M. Khan	88
Ghotki	69
Karachi	51
Rahim Yar Khan	48
Matiari	42
Sajawal	33
Sukkur	25
Jamshoro	17
Nawabshah	14
Khairpur	14
Naushahro Feroz	11
Sahiwal	10
Jacobabad	9
Gujarat	7
Kashmore	5
Shikarpur	5
Qamber	2
Bahawalpur	2
Shaheed Benazirabad	2

```
Balochistan (Dists.)    1
Gujranwala              1
Sadiqabad               1
Lahore                  1
Khanewal                1
Islamabad               1
Multan                  1
Name: Total_District_Wise, dtype: int64
```

In [32]:

```
forced_year_data = pd.read_csv('forced_convert_year.csv')
```

In [33]:

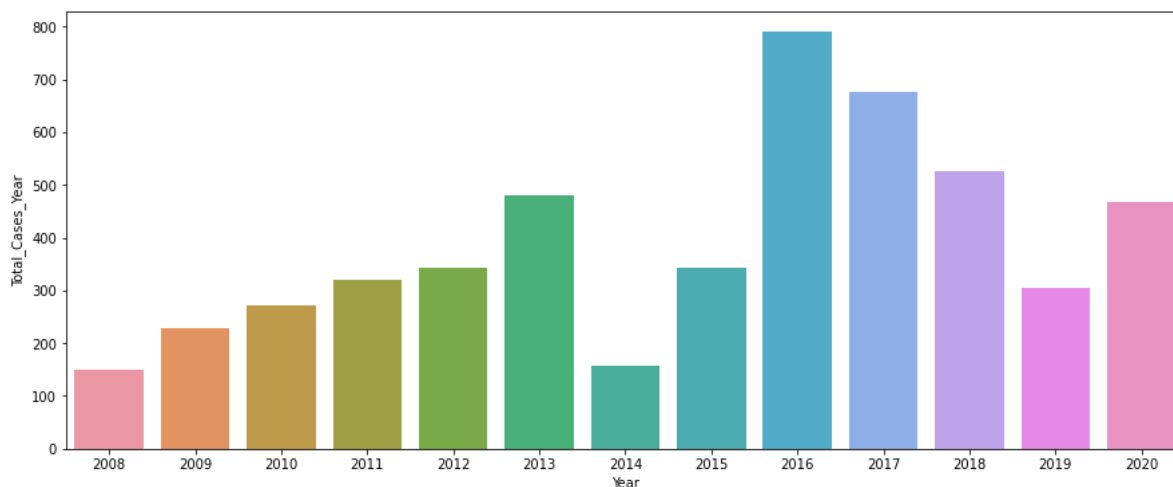
```
forced_year_data
```

Out[33]:

	Year	Total_Cases_Year
0	2008	149
1	2009	229
2	2010	272
3	2011	321
4	2012	342
5	2013	481
6	2014	157
7	2015	344
8	2016	790
9	2017	675
10	2018	525
11	2019	305
12	2020	467

In [36]:

```
plt.figure(figsize=(15,6))
sns.barplot(y = 'Total_Cases_Year', x = 'Year', data = forced_year_data)
plt.xticks(rotation = 0)
plt.show()
```



In [38]:

```
x = convert_data.drop(['District', 'Total_District_Wise'], axis = 1)
y = convert_data['Total_District_Wise']
```

In [39]:

```
x.shape
```

Out[39]:

```
(34, 13)
```

In [40]:

```
y.shape
```

Out[40]:

```
(34,)
```

In [41]:

```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size = 0.2)
```


In [42]:

```
model = LogisticRegression()
model.fit(X_train, y_train)
```

Out[42]:

```
LogisticRegression()
```

In [43]:

```
y_pred = model.predict(X_test)
```

In [44]:

```
print("Training Accuracy :", model.score(X_train, y_train))
print("Testing Accuracy :", model.score(X_test, y_test))
```

```
Training Accuracy : 0.9629629629629629
```

```
Testing Accuracy : 0.14285714285714285
```

In [45]:

```
from sklearn import metrics
from sklearn.metrics import accuracy_score
```

In [46]:

```
print("Classification report for classifier %s:\n%s\n" % (model,
    metrics.classification_report(y_test, y_pred)))
```

```
Classification report for classifier LogisticRegression():
```

	precision	recall	f1-score	support
1	0.33	1.00	0.50	1
2	0.00	0.00	0.00	1
5	0.00	0.00	0.00	1
9	0.00	0.00	0.00	0
11	0.00	0.00	0.00	1
25	0.00	0.00	0.00	0
33	0.00	0.00	0.00	0
42	0.00	0.00	0.00	1
178	0.00	0.00	0.00	1
438	0.00	0.00	0.00	1
1870	0.00	0.00	0.00	0
accuracy			0.14	7
macro avg	0.03	0.09	0.05	7
weighted avg	0.05	0.14	0.07	7

In [51]:

```
from sklearn.tree import DecisionTreeRegressor
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size = 0.2)
```

In [52]:

```
model1 = DecisionTreeRegressor(max_depth=6)
model1.fit(X_train, y_train)
```

Out[52]:

```
DecisionTreeRegressor(max_depth=6)
```

In [53]:

```
y_pred = model1.predict(X_test)
```

In [54]:

```
print("Training Accuracy :", model1.score(X_train, y_train))
print("Testing Accuracy :", model1.score(X_test, y_test))
```

```
Training Accuracy : 0.9999979322050068
```

```
Testing Accuracy : 0.4012366871026326
```

In [56]:

```
from sklearn.naive_bayes import GaussianNB
```

In [57]:

```
classifier = GaussianNB()
classifier.fit(X_train, y_train)
```

Out[57]:

```
GaussianNB()
```

In [58]:

```
y_pred = classifier.predict(X_test)
```

In [59]:

```
print("Training Accuracy :", classifier.score(X_train, y_train))
print("Testing Accuracy :", classifier.score(X_test, y_test))
```

```
Training Accuracy : 0.8888888888888888
```

```
Testing Accuracy : 0.2857142857142857
```

In [60]:



```
Classification report for classifier %s:\n%s\n" % (classifier,  
                                                metrics.classification_report(y_test, y_pred)))
```

```
Classification report for classifier GaussianNB():  
              precision    recall  f1-score   support  
  
     1           1.00        0.50        0.67         2  
     2           0.50        1.00        0.67         1  
     5           0.00        0.00        0.00         1  
     7           0.00        0.00        0.00         1  
    14           0.00        0.00        0.00         0  
    48           0.00        0.00        0.00         1  
   682           0.00        0.00        0.00         0  
  1870           0.00        0.00        0.00         1  
  
accuracy              0.29         7  
macro avg           0.19        0.19        0.17         7  
weighted avg        0.36        0.29        0.29         7
```