EDA On Environmental & Financial Performance

Import Essential Libraries

In [391]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [392]:
```
df = pd.read_csv(r"C:\Users\Aksha\Downloads\environmental and financial data.csv")
```

In [393]:
```
df.head(10)
```

Out[393]:

	company	country	economic_sector	sub_industry	pollution	Total assets	Dividend	ROA
0	ACCENTURE PLC	Ireland	Technology	IT Consulting & Other Services	non polluter	16992039	44.66	18.14
1	AIRBUS SE	Netherlands	Industrials	Aerospace & Defense	polluter	99922000	37.88	3.30
2	AKZO NOBEL N.V.	Netherlands	Basic Materials	Speciality Chemicals	polluter	14906000	39.24	7.19
3	ALSTOM SA	France	Industrials	Construction Machinery & Heavy Transportation ...	polluter	32501000	0.00	-1.72
4	AP MOELLER MAERSK	Denmark	Industrials	Marine Transportation	polluter	422739287	NaN	1.62
5	ARCELORMITTAL SA	Luxembourg	Basic Materials	Steel	polluter	64673541	0.00	-8.49
6	BASF SE	Germany	Basic Materials	Diversified Chemicals	polluter	69045000	66.81	6.32
7	CAPGEMINI SE	France	Technology	IT Consulting & Other Services	non polluter	14819000	20.23	9.48
8	CARGOTEC CORP	Finland	Industrials	Industrial Machinery & Supplies & Components	polluter	3387200	36.20	4.63
9	CORBION NV	Netherlands	Basic Materials	Speciality Chemicals	polluter	792100	65.82	10.85

In [394]:
```
df.shape
```

Out[394]:
```
(63, 12)
```

In [395]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 63 entries, 0 to 62
Data columns (total 12 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   company             63 non-null     object 
 1   country             63 non-null     object 
 2   economic_sector     63 non-null     object 
 3   sub_industry        63 non-null     object 
 4   pollution           63 non-null     object 
 5   Total assets        63 non-null     int64  
 6   Dividend            49 non-null     float64
 7   ROA                 63 non-null     float64
 8   ROE                 62 non-null     float64
 9   Direct emissions    63 non-null     int64  
 10  Indirect emissions  63 non-null     int64  
 11  quartile            63 non-null     object 
dtypes: float64(3), int64(3), object(6)
memory usage: 6.0+ KB
```

Since here we can see that the column ROE (Return On Equity) has 1 null value. Let's fill it by calculating the mean of other values

In [396]:
```
df["ROE"].fillna(df["ROE"].mean(),
                 inplace = True)
```

Here we can see that since all non values are equal except for Dividend column. Our Data is now ready for exploration

In [397]:
```
# Let's check if the value has been filled or not
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 63 entries, 0 to 62
Data columns (total 12 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   company             63 non-null     object 
 1   country             63 non-null     object 
 2   economic_sector     63 non-null     object 
 3   sub_industry        63 non-null     object 
 4   pollution           63 non-null     object 
 5   Total assets        63 non-null     int64  
 6   Dividend            49 non-null     float64
 7   ROA                 63 non-null     float64
 8   ROE                 63 non-null     float64
 9   Direct emissions    63 non-null     int64  
 10  Indirect emissions  63 non-null     int64  
 11  quartile            63 non-null     object 
dtypes: float64(3), int64(3), object(6)
memory usage: 6.0+ KB
```

In [398]:
```
df.describe()
```

Out[398]:

	Total assets	Dividend	ROA	ROE	Direct emissions	Indirect emissions
count	63.00	49.00	63.00	63.00	63.00	63.00
mean	30876491.22	36.79	4.20	8.21	8101643.25	1151689.57
std	61240002.84	24.62	6.85	21.76	24256759.30	2602476.22
min	792100.00	0.00	-19.28	-103.84	100.00	500.00
25%	6130223.00	20.23	1.74	2.88	51500.00	63898.50
50%	12115000.00	39.24	4.22	10.02	525883.00	260010.00
75%	29687600.00	51.93	7.40	17.05	3209490.00	1036117.00
max	422739287.00	80.79	20.46	59.56	176000000.00	16000000.00

Sorting The Dataset

In [399]:
```
df.sort_values(by=["Total assets", "Direct emissions"], ascending=False, inplace=Tru
```

In [400]:
```
df.reset_index(drop=True, inplace=True)
df.head(5)
```

Out[400]:

	company	country	economic_sector	sub_industry	pollution	Total assets	Dividend	ROA	R
0	AP MOELLER MAERSK	Denmark	Industrials	Marine Transportation	polluter	422739287	NaN	1.62	2
1	TOTALENERG	France	Energy	Integrated Oil & Gas	polluter	203082342	NaN	2.58	5
2	ENI GROUP	Italy	Energy	Integrated Oil & Gas	polluter	130443000	NaN	-5.52	-15
3	SIEMENS AG	Germany	Technology	Industrial Conglomerates	polluter	117757000	39.58	7.17	22
4	AIRBUS SE	Netherlands	Industrials	Aerospace & Defense	polluter	99922000	37.88	3.30	41

Renaming Columns For Better Readability

In [401]:
```
df.rename(columns={"Direct emissions": "Direct emissions in tons",
                   "Indirect emissions": "Indirect emissions in tons"}, inplace=True
```

In [402]:
```
df['country'].unique()
```

Out[402]:
```
array(['Denmark', 'France', 'Italy', 'Germany', 'Netherlands',
       'Luxembourg', 'Spain', 'Ireland', 'Austria', 'Finland', 'Greece'],
      dtype=object)
```

In [403]:
```
df.corr()
```

```
C:\Users\Aksha\AppData\Local\Temp\ipykernel_37504\1134722465.py:1: FutureWarning: T
he default value of numeric_only in DataFrame.corr is deprecated. In a future versi
on, it will default to False. Select only valid columns or specify the value of num
eric_only to silence this warning.
  df.corr()
```

Out[403]:

	Total assets	Dividend	ROA	ROE	Direct emissions in tons	Indirect emissions in tons
Total assets	1.00	0.09	-0.11	-0.02	0.33	0.13
Dividend	0.09	1.00	0.48	0.49	-0.19	-0.08
ROA	-0.11	0.48	1.00	0.89	-0.29	-0.14
ROE	-0.02	0.49	0.89	1.00	-0.24	-0.12
Direct emissions in tons	0.33	-0.19	-0.29	-0.24	1.00	0.79
Indirect emissions in tons	0.13	-0.08	-0.14	-0.12	0.79	1.00

Here's a brief explanation of the correlation matrix:

Total assets:

Positive correlation with Direct emissions (0.33) and Indirect emissions (0.13), indicating that companies with higher total assets tend to have higher direct and indirect emissions. Weak negative correlation with ROA (-0.11) and ROE (-0.02), suggesting that higher total assets might be associated with lower Return on Assets (ROA) and Return on Equity (ROE).

Dividend:

Positive correlation with ROA (0.48) and ROE (0.49), implying that companies paying higher dividends tend to have higher Return on Assets (ROA) and Return on Equity (ROE). Negative correlation with Direct emissions (-0.18) and Indirect emissions (-0.07), indicating that companies paying higher dividends tend to have lower direct and indirect emissions.

ROA (Return on Assets):

Weak negative correlation with Total assets (-0.11) and Direct emissions (-0.29), suggesting that companies with higher Return on Assets (ROA) might have lower total assets and lower direct emissions. Strong positive correlation with ROE (0.890356), indicating a strong positive relationship between Return on Assets (ROA) and Return on Equity (ROE).

ROE (Return on Equity):

Weak negative correlation with Total assets (-0.02) and Direct emissions (-0.24), suggesting that companies with higher Return on Equity (ROE) might have lower total assets and lower direct emissions. Strong positive correlation with ROA (0.89), indicating a strong positive relationship between Return on Equity (ROE) and Return on Assets (ROA).

Direct emissions:

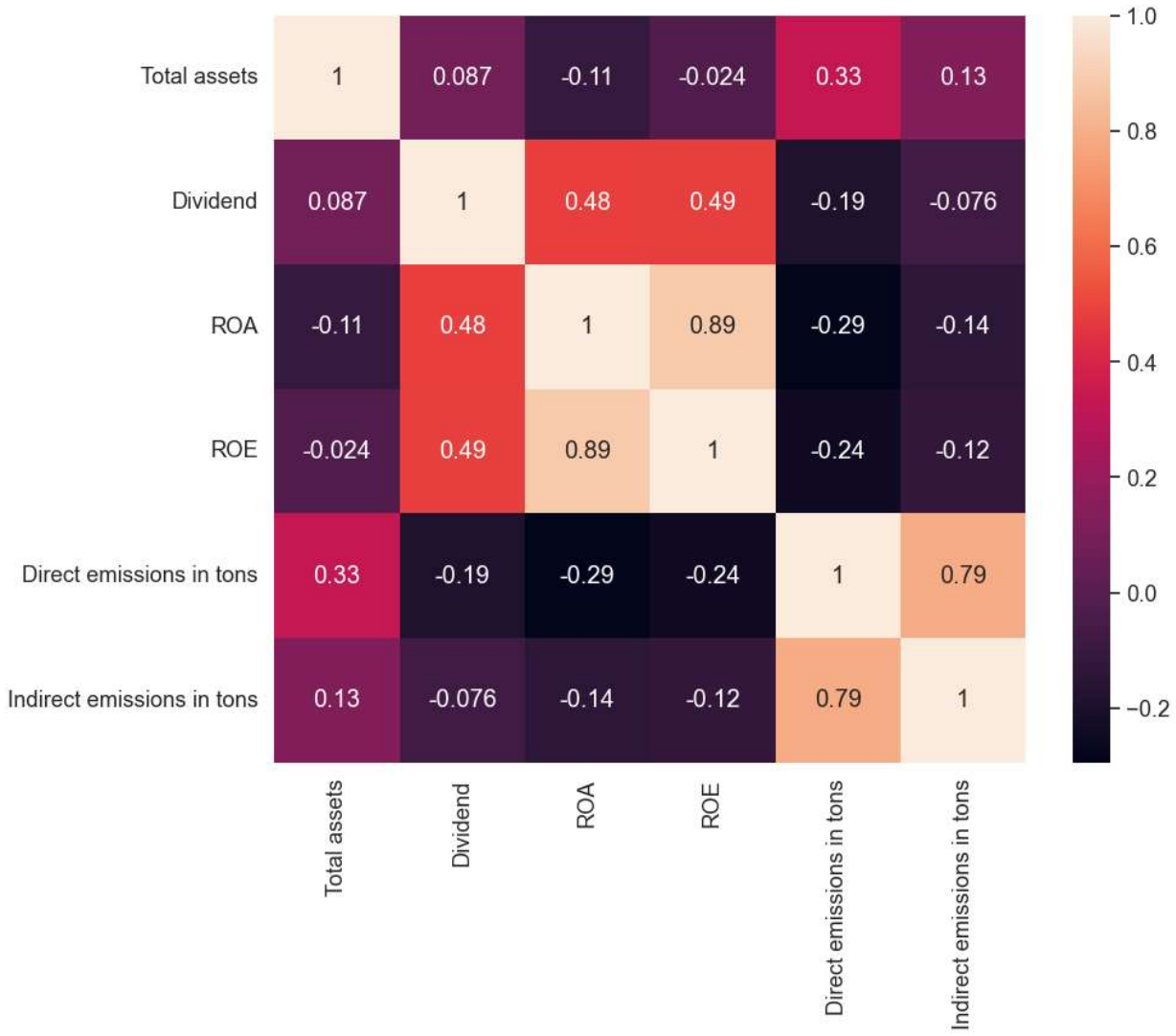
Positive correlation with Total assets (0.33) and Indirect emissions (0.79), suggesting that companies with higher direct emissions also tend to have higher total assets and higher indirect emissions. Weak negative correlation with ROA (-0.29) and ROE (-0.24), implying that companies with higher direct emissions might have lower Return on Assets (ROA) and Return on Equity (ROE).

Indirect emissions:

Positive correlation with Total assets (0.13) and Direct emissions (0.79), suggesting that companies with higher indirect emissions also tend to have higher total assets and higher direct emissions. Weak negative correlation with ROA (-0.13) and ROE (-0.12), implying that companies with higher indirect emissions might have lower Return on Assets (ROA) and Return on Equity (ROE).

In [404]:
```
sns.heatmap(df.corr(), annot = True)
plt.rcParams['figure.figsize'] = (10,8)
```

```
C:\Users\Aksha\AppData\Local\Temp\ipykernel_37504\207034926.py:1: FutureWarning: Th
e default value of numeric_only in DataFrame.corr is deprecated. In a future versio
n, it will default to False. Select only valid columns or specify the value of nume
ric_only to silence this warning.
  sns.heatmap(df.corr(), annot = True)
```



Group By Economic Sectors

In [405]:
```
df2=df.set_index(['economic_sector','company']).sort_index()
```

In [406]:
```
df2.sort_values(by="Total assets", ascending=False).sort_index()
```

Out[406]:

economic_sector	company	country	sub_industry	pollution	Total assets	Dividend
Basic Materials	AKZO NOBEL N.V.	Netherlands	Speciality Chemicals	polluter	14906000	39.24
	ARCELORMITTAL SA	Luxembourg	Steel	polluter	64673541	0.00
	BASF SE	Germany	Diversified Chemicals	polluter	69045000	66.81
	CORBION NV	Netherlands	Speciality Chemicals	polluter	792100	65.82
	CRH PLC	Ireland	Construction Materials	polluter	31858000	70.12
...	...	...	...	...	...	...
Technology	NOKIA OYJ	Finland	Communications Equipment	non polluter	18292000	38.70
	SEAGATE TECHNOLOGY	Ireland	Technology Hardware, Storage & Peripherals	non polluter	9349000	NaN
	SIEMENS AG	Germany	Industrial Conglomerates	polluter	117757000	39.58
	STMICROELECTRONICS	Netherlands	Semiconductors	polluter	7833105	NaN
	TIETOEVRY	Finland	IT Consulting & Other Services	non polluter	1054700	NaN

63 rows × 10 columns

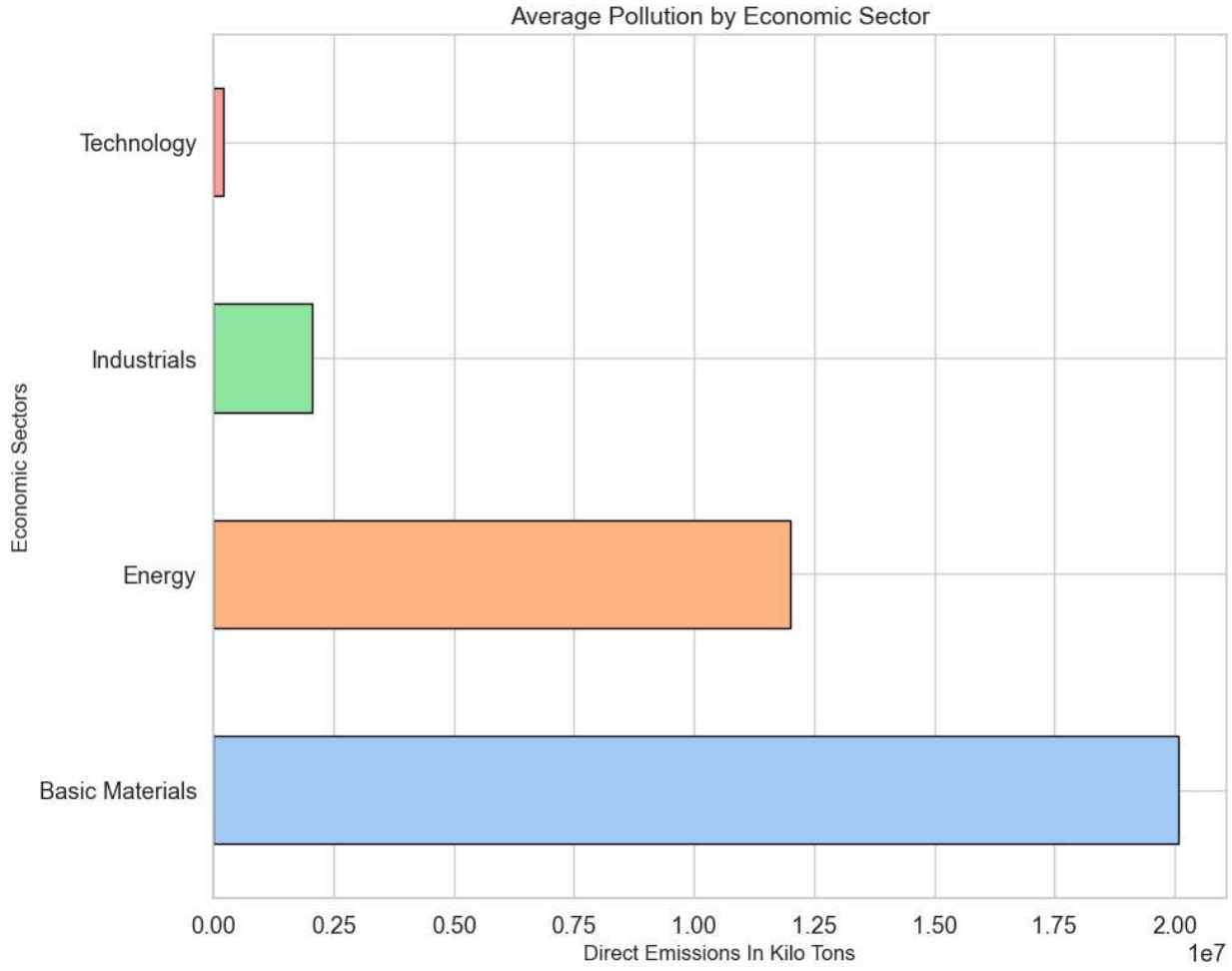
Calculating Average Pollution By Economic Sector

In [408]:
```
sns.set_style("whitegrid")

plt.figure(figsize=(10,8))
avg_pollution.plot(kind='barh', color=sns.color_palette("pastel"),
                   edgecolor='black')

plt.xlabel('Direct Emissions In Kilo Tons', fontsize=12)
plt.ylabel('Economic Sectors', fontsize=12)
plt.title('Average Pollution by Economic Sector', fontsize=14)

plt.tight_layout()
plt.show()
```



Finding Top 10 Companies By Dividend

In [390]:
```
sns.set_style("whitegrid")
df2 = df.sort_values(by='Dividend', ascending=False).head(10)
sns.set(style='whitegrid', font_scale=1.2)

plt.figure(figsize=(10, 8))
ax = sns.scatterplot(data=df2, x='company', y='Dividend', color='blue',
                     alpha=0.7, s=150)

ax.set_xlabel('Company', fontsize=18)
ax.set_ylabel('Dividend $', fontsize=18)
ax.set_title('Top 10 Companies by Dividend', fontsize=20)

ax.set_xticklabels(df2['company'], rotation=45, ha='right', fontsize=14)

plt.tight_layout()
plt.show()
```

```
C:\Users\Aksha\AppData\Local\Temp\ipykernel_37504\774075632.py:12: UserWarning: Fix
edFormatter should only be used together with FixedLocator
  ax.set_xticklabels(df2['company'], rotation=45, ha='right', fontsize=14)
```