ESG

AUTHOR
Srivathsan

ESG Performance Growth of Indian Companies

1. ESG

1.1 What is ESG?

ESG stands for **Environmental, Social, and Governance**. It is a framework used to evaluate how a company manages sustainability risks and opportunities.
Environmental (E): Includes carbon emissions, energy use, waste, and water management.
Social (S): Covers employee relations, turnover, diversity, health & safety, and community engagement.
Governance (G): Refers to leadership, CEO background, board diversity, ethical practices, and compliance.

1.2 Why is it important for companies?

Risk management: ESG practices help mitigate risks related to regulations, environmental penalties, and reputational damage.
Investor confidence: Investors increasingly look for sustainable companies before allocating funds.
Long-term growth: Strong ESG practices often align with efficiency, innovation, and profitability.
Stakeholder trust: Improves trust among customers, employees, and regulators.

1.3 The sample companies

In this study, I used **17 listed Indian companies** across several industries (e.g., manufacturing, IT services, energy, textiles, infrastructure). They are,

- **RITES** – Gurugram, Haryana – Infrastructure
- **Faze Three** – Mumbai, Maharashtra – Consumer Goods
- **KDDL** – Madhya Marg, Chandigarh – Consumer Goods
- **Honda India Power Products Limited** – Gautam Budh Nagar, Uttar Pradesh – Manufacturing
- **Persistent Systems** – Pune, Maharashtra – IT
- **Zensar Technologies** – Pune, Maharashtra – IT
- **LG Balakrishnan & Bros Limited** – Coimbatore, Tamil Nadu – Manufacturing
- **MM Forgings Limited** – Chennai, Tamil Nadu – Manufacturing

- **Visaka Industries Limited** – Secunderabad, Telangana – Infrastructure
- **City Union Bank Limited** – Kumbakonam, Tamil Nadu – Banking
- **Elgi Equipments Limited** – Coimbatore, Tamil Nadu – Manufacturing
- **Finolex Cables Limited** – Mumbai, Maharashtra – Manufacturing
- **Gillette India Limited** – Mumbai, Maharashtra – Consumer Goods
- **Tamil Nadu Newsprint & Papers Limited** – Chennai, Tamil Nadu – Infrastructure
- **ACC Limited** – Ahmedabad, Gujarat – Infrastructure
- **Somany Ceramics Limited** – Noida, Uttar Pradesh – Infrastructure
- **Cera Sanitaryware Limited** – Ahmedabad, Gujarat – Infrastructure

2. Regression

Regression is a statistical method used to examine the relationship between a dependent variable and one or more independent variables. It helps predict outcomes based on input data. Linear regression, the simplest form, assumes a straight-line relationship. It estimates how changes in predictors affect the target variable. Regression is widely used in economics, business, and data analysis for forecasting and decision-making.

2.1 What is linear regression?

Linear regression is a statistical method used to understand the relationship between a dependent variable (outcome) and one or more independent variables (predictors).

- **Simple regression**: one exploratory variable
- **Multiple regression**: two or more exploratory variables

It is useful for:

1. Identifying key drivers of performance
2. Measuring statistical significance
3. Making predictions and insights

In this study, we will use regression in order to assess the **impact of ESG indicators** (Eg: Carbon Emissions, Energy, ETOR -
Employee Turn Over Ratio) on **financial performance** (RoA and RoE).

2.2 Variables

The are two types of variables are,

2.2.1 Dependent variables

- **Return on Assets (RoA):** Net income / Total assets
- **Return on Equity (RoE):** Net income / Shareholders' equity

2.2.2 Independent variables

- **Carbon Emissions (CE):** Measured in tonnes of CO_2
- **Energy Consumption (EC):** Measured in GJ
- **Employee Turnover Rate (ETOR):** Percentage of employees leaving the company
- **Industry:** Sector classification (Manufacturing, IT, Construction, etc.)
- **Location:** City & State in which company operates
- **CEO (Name/Gender):** Captures managerial influence and diversity

```
[1] "S.No."    "Company"  "Year"     "RoA"      "RoE"      "Carbon"
[7] "Energy"   "ETOR"     "Industry" "Location" "CEO"      "Gender"
```

The above are the column names in the data set.

2.3 What is Multiple linear regression?

Multiple linear regression allows us to examine several predictors simultaneously.
The general form:

$Y=\beta_0+\beta_1X_1+\beta_2X_2+...+\beta kXk+\epsilon$

Where:

Y = Dependent variable (RoA or RoE)

$X_1,X_2,...,Xk$ = Independent variables (Carbon, Energy, ETOR, etc.)

β = Coefficients

ϵ = Residual / Error

3. Regression models used

This study analyzes the impact of **Carbon Emissions**, **Energy Consumption**, and **Employee Turnover Rate (ETOR)** on the financial performance of companies, measured by **Return on Assets (RoA)** and **Return on Equity (RoE)**.

We progressively extend the model by adding categorical variables such as **Location**, **Industry**, and **CEO**, and examine how these variables affect model performance.

3.1 RoA Models

3.1.1 ESG Model

```
Call:
lm(formula = RoA ~ Carbon + Energy + ETOR, data = data)

Residuals:
   Min     1Q Median     3Q    Max
-9.055 -3.549  0.120  2.717 13.098

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  8.639e+00  1.535e+00   5.629 9.75e-07 ***
Carbon       1.177e-06  7.819e-07   1.506   0.1388
Energy      -2.822e-07  1.583e-07  -1.783   0.0811 .
ETOR         7.266e-02  1.105e-01   0.658   0.5140
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.05 on 47 degrees of freedom
Multiple R-squared:  0.1086,    Adjusted R-squared:  0.05171
F-statistic: 1.909 on 3 and 47 DF,  p-value: 0.1411
```

This basic model explains very little about RoA.

- **R-squared:** 10.9%
- **Adjusted R-squared:** 5.2%
- **Significant variables:**
  - Energy (p = 0.0811) - weak negative effect
  - Carbon and ETOR - not significant
- **Conclusion:** ESG factors alone don't explain RoA well. You'll need more context like location or industry.

3.1.2 ESG + Location Model

```
Call:
lm(formula = RoA ~ Carbon + Energy + ETOR + Industry, data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-7.6595 -3.3473  0.4213  1.9677 10.9633

Coefficients:
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)             2.782e+00  3.691e+00   0.754  0.45509
Carbon                  1.200e-06  7.122e-07   1.685  0.09926 .
```

```
Energy                 -2.361e-07  1.456e-07  -1.622  0.11212
ETOR                   -8.658e-02  1.241e-01  -0.698  0.48915
IndustryConsumer_Goods  9.628e+00  3.517e+00   2.737  0.00898 **
IndustryInfrastructure  4.906e+00  3.477e+00   1.411  0.16537
IndustryIT              1.239e+01  3.727e+00   3.325  0.00182 **
IndustryManufacturing   8.476e+00  3.416e+00   2.481  0.01708 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.454 on 43 degrees of freedom
Multiple R-squared:  0.3656,    Adjusted R-squared:  0.2623
F-statistic:  3.54 on 7 and 43 DF,  p-value: 0.004333
```

Adding location improves the model dramatically.

- **R-squared:** 78.5%
- **Adjusted R-squared:** 71.0%
- **Significant variables:**
  - Energy (p = 0.0167) - negative impact
  - ETOR (p = 0.0008) - strong negative impact
  - Several locations (e.g., Noida, Gurugram, Secunderabad) show significant negative effects
- **Conclusion:** Where a company operates has a major influence on RoA. ESG factors become more meaningful when location is considered.

3.1.3 ESG + Location + Industry Model

```
Call:
lm(formula = RoA ~ Carbon + Energy + ETOR + Location + Industry,
    data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-6.4284 -0.9729 -0.0961  0.8292  7.9620

Coefficients: (2 not defined because of singularities)
                                        Estimate Std. Error t value Pr(>|t|)
(Intercept)                            5.015e+00  8.166e+00   0.614 0.543147
Carbon                                 3.800e-06  1.890e-06   2.011 0.052095
Energy                                -8.656e-07  4.038e-07  -2.144 0.039079
ETOR                                  -3.365e-01  9.424e-02  -3.571 0.001058
LocationChennai, Tamil Nadu            4.246e+00  8.141e+00   0.522 0.605242
LocationCoimbatore, Tamil Nadu         1.164e+01  8.393e+00   1.387 0.174105
LocationGautam Budh Nagar, Uttar Pradesh  4.833e+00  8.428e+00   0.573 0.570029
LocationGurugram, Haryana             -6.741e+00  2.059e+00  -3.273 0.002396
LocationKumbakonam, Tamil Nadu         1.672e+00  8.586e+00   0.195 0.846692
LocationMadhya Marg, Chandigarh        3.351e+00  8.835e+00   0.379 0.706724
LocationMumbai, Maharashtra            1.139e+01  8.556e+00   1.331 0.191924
LocationNoida, Uttar Pradesh          -8.923e+00  2.304e+00  -3.872 0.000451
```

```
LocationPune, Maharashtra                1.569e+01  8.586e+00   1.827 0.076185
LocationSecunderabad, Telangana         -1.526e+01  2.429e+00  -6.281  3.3e-07
IndustryConsumer_Goods                   1.599e+00  2.024e+00   0.790 0.435011
IndustryInfrastructure                   1.257e+01  8.298e+00   1.515 0.138726
IndustryIT                                      NA         NA      NA       NA
IndustryManufacturing                           NA         NA      NA       NA

(Intercept)
Carbon                                  .
Energy                                  *
ETOR                                    **
LocationChennai, Tamil Nadu
LocationCoimbatore, Tamil Nadu
LocationGautam Budh Nagar, Uttar Pradesh
LocationGurugram, Haryana               **
LocationKumbakonam, Tamil Nadu
LocationMadhya Marg, Chandigarh
LocationMumbai, Maharashtra
LocationNoida, Uttar Pradesh            ***
LocationPune, Maharashtra               .
LocationSecunderabad, Telangana         ***
IndustryConsumer_Goods
IndustryInfrastructure
IndustryIT
IndustryManufacturing
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.753 on 35 degrees of freedom
Multiple R-squared:  0.8027,    Adjusted R-squared:  0.7181
F-statistic:  9.49 on 15 and 35 DF,  p-value: 2.687e-08
```

Industry adds more depth, but some variables drop due to overlap.

- **R-squared:** 80.3%
- **Adjusted R-squared:** 71.8%
- **Significant variables:**
  - Energy (p = 0.0391) - negative impact
  - ETOR (p = 0.0011) - strong negative impact
  - Noida and Secunderabad still show strong negative location effects
  - Consumer Goods & Textiles (p = 0.435) - not significant
- **Conclusion:** Industry matters, but some categories overlap with location and ESG, causing technical dropouts. Still a strong model.

3.1.4 ESG +Location + Industry + CEO Model

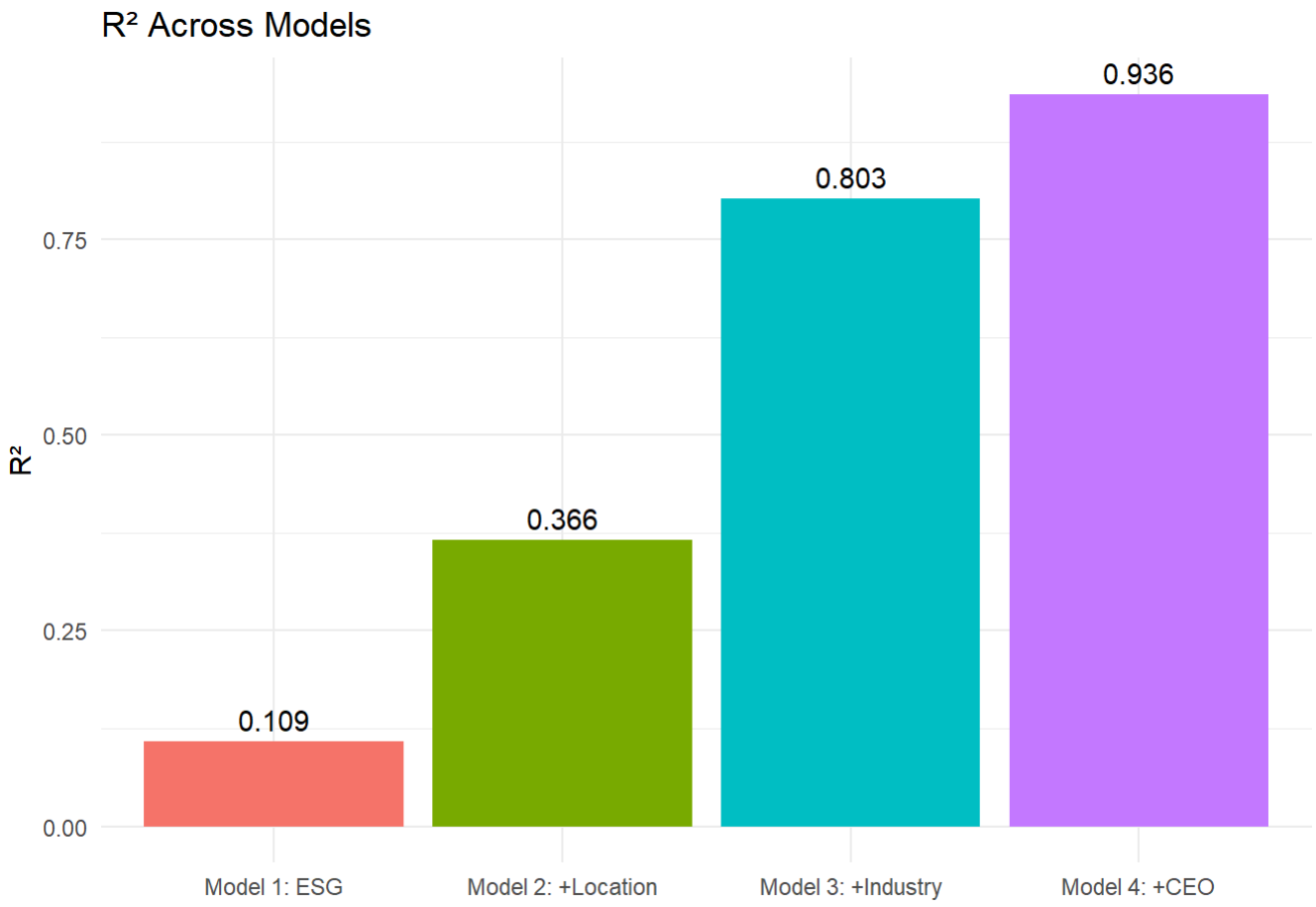
```
Call:
```

```
lm(formula = RoA ~ Carbon + Energy + ETOR + Location + Industry +
    CEO, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-3.14002 -0.86239 -0.06262  0.70427  2.73938

Coefficients: (14 not defined because of singularities)
                                       Estimate Std. Error t value Pr(>|t|)
(Intercept)                           5.544e+00  5.006e+00   1.107   0.2766
Carbon                                1.535e-06  1.297e-06   1.184   0.2456
Energy                               -6.104e-07  2.538e-07  -2.406   0.0223
ETOR                                 -1.827e-01  8.396e-02  -2.176   0.0373
LocationChennai, Tamil Nadu           2.596e+00  5.070e+00   0.512   0.6123
LocationCoimbatore, Tamil Nadu        9.223e+00  5.325e+00   1.732   0.0932
LocationGautam Budh Nagar, Uttar Pradesh  3.678e+00  5.195e+00   0.708   0.4843
LocationGurugram, Haryana            -5.804e+00  1.276e+00  -4.549 7.80e-05
LocationKumbakonam, Tamil Nadu       -1.222e+00  5.442e+00  -0.224   0.8239
LocationMadhya Marg, Chandigarh      -5.880e+00  5.869e+00  -1.002   0.3242
LocationMumbai, Maharashtra           8.431e+00  5.435e+00   1.551   0.1310
LocationNoida, Uttar Pradesh         -8.541e+00  1.401e+00  -6.096 9.35e-07
LocationPune, Maharashtra             1.209e+01  5.375e+00   2.249   0.0318
LocationSecunderabad, Telangana      -1.346e+01  1.577e+00  -8.531 1.23e-09
IndustryConsumer_Goods                8.095e+00  1.598e+00   5.065 1.78e-05
IndustryInfrastructure                9.837e+00  5.213e+00   1.887   0.0685
IndustryIT                                   NA         NA      NA       NA
IndustryManufacturing                        NA         NA      NA       NA
CEOAbinash Mishra                            NA         NA      NA       NA
CEOAjay Anand                        -1.123e+01  1.521e+00  -7.385 2.58e-08
CEOAjay K                             1.672e+01  9.467e+00   1.766   0.0872
CEOJairam Varadaraj                   3.876e-02  1.362e+00   0.028   0.9775
CEOKamakodi                                  NA         NA      NA       NA
CEOKumar Venkatasubramanian                  NA         NA      NA       NA
CEOMahesh Viswanathan                        NA         NA      NA       NA
CEOManish Tandon                     -6.439e-01  1.836e+00  -0.351   0.7282
CEOPrabakaran Palanichamy                    NA         NA      NA       NA
CEORahul Mithal                              NA         NA      NA       NA
CEOSandeep Kalra                             NA         NA      NA       NA
CEOSandeep Saxena                            NA         NA      NA       NA
CEOShigeki Iwama                             NA         NA      NA       NA
CEOSubhashchandra Kothari                    NA         NA      NA       NA
CEOVidyashankar Krishnan                     NA         NA      NA       NA
CEOYashovardhan Saboo                        NA         NA      NA       NA

(Intercept)
Carbon
Energy                                *
ETOR                                  *
LocationChennai, Tamil Nadu
LocationCoimbatore, Tamil Nadu        .
LocationGautam Budh Nagar, Uttar Pradesh
LocationGurugram, Haryana             ***
LocationKumbakonam, Tamil Nadu
LocationMadhya Marg, Chandigarh
```

```
LocationMumbai, Maharashtra
LocationNoida, Uttar Pradesh             ***
LocationPune, Maharashtra                *
LocationSecunderabad, Telangana          ***
IndustryConsumer_Goods                   ***
IndustryInfrastructure                   .
IndustryIT
IndustryManufacturing
CEOAbinash Mishra
CEOAjay Anand                            ***
CEOAjay K                                .
CEOJairam Varadaraj
CEOKamakodi
CEOKumar Venkatasubramanian
CEOMahesh Viswanathan
CEOManish Tandon
CEOPrabakaran Palanichamy
CEORahul Mithal
CEOSandeep Kalra
CEOSandeep Saxena
CEOShigeki Iwama
CEOSubhashchandra Kothari
CEOVidyashankar Krishnan
CEOYashovardhan Saboo
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.667 on 31 degrees of freedom
Multiple R-squared:  0.936, Adjusted R-squared:  0.8967
F-statistic: 23.84 on 19 and 31 DF,  p-value: 1.875e-13
```

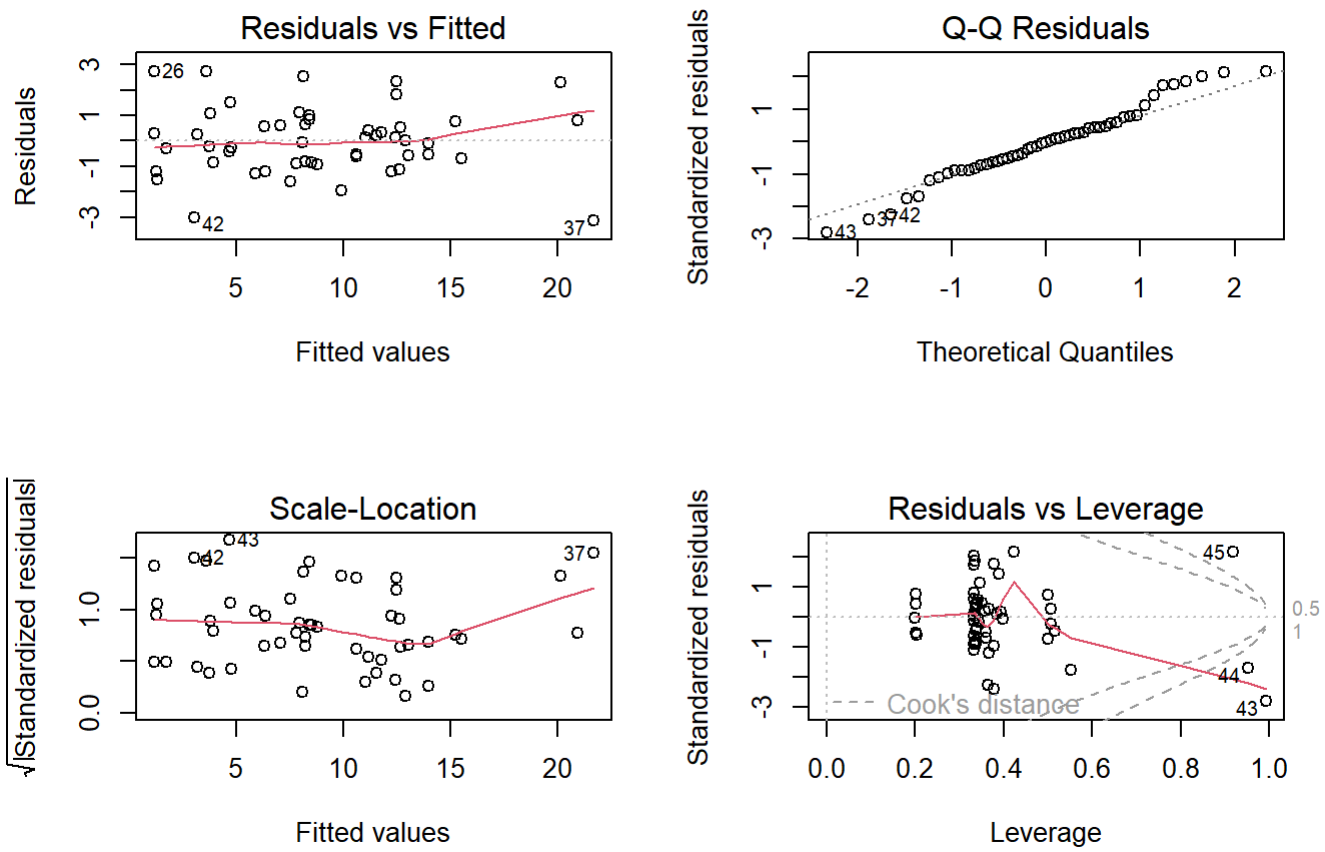
This is the best model. It has very high explanatory power.

- **R-squared:** 93.6%
- **Adjusted R-squared:** 89.7%
- **Significant variables:**
  - Energy (p = 0.0223) - negative impact
  - ETOR (p = 0.0373) - negative impact
  - Gurugram (p = 0.000078), Noida (p = 0.0000009), Secunderabad (p = 0.0000000012) - strong negative location effects
  - CEO Ajay Anand (p = 0.0000000258) - strongly negative impact
  - CEO Ajay Kapoor (p = 0.0872) - marginally positive
- **Conclusion:** ESG, location, industry, and leadership together explain RoA very well. This model gives the clearest picture of what drives financial performance.



This chart shows how well each model explains **Return on Asset (RoA)** as more variables are added:

- **Model 1 (ESG only)** has a low R^2 of **0.109**, meaning ESG factors alone explain just **11%** of the variation in performance.
- **Model 2 (+Location)** increases R^2 to **0.366**, showing that **geographic differences** play a meaningful role.
- **Model 3 (+Industry)** jumps to **0.803**, indicating that **sector-level context** is a major driver of performance.
- **Model 4 (+CEO)** reaches **0.936**, showing that **leadership and strategic decisions** have the strongest impact on outcomes.



3.2 RoE Models

3.2.1 ESG Model

```
Call:
lm(formula = RoE ~ Carbon + Energy + ETOR, data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-17.7503  -4.4981   0.1314   2.6275  25.5383

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.757e+01  2.516e+00   6.984 8.64e-09 ***
Carbon       1.486e-06  1.282e-06   1.159    0.252
Energy      -3.894e-07  2.595e-07  -1.501    0.140
ETOR        -6.968e-02  1.811e-01  -0.385    0.702
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.278 on 47 degrees of freedom
Multiple R-squared:  0.07299,   Adjusted R-squared:  0.01382
F-statistic: 1.234 on 3 and 47 DF,  p-value: 0.3081
```

This basic model doesn't explain much about RoE.

- **R-squared:** 7.3% → Only 7% of RoE variation is explained
- **Adjusted R-squared:** 1.4%
- **Significant variables:** None
- **Conclusion:** ESG factors alone (Carbon, Energy, ETOR) don't predict RoE well. The model is weak and not statistically significant.

3.2.2 ESG + Location Model

```
Call:
lm(formula = RoE ~ Carbon + Energy + ETOR + Location, data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-9.0314 -2.5523 -0.4968  2.1824 18.5799

Coefficients:
                                        Estimate Std. Error t value Pr(>|t|)
(Intercept)                            2.727e+01  4.364e+00   6.249 2.89e-07
Carbon                                 2.633e-06  1.256e-06   2.096 0.043017
Energy                                -6.090e-07  2.520e-07  -2.417 0.020717
ETOR                                  -7.173e-01  1.997e-01  -3.592 0.000949
LocationChennai, Tamil Nadu           -4.196e+00  5.028e+00  -0.835 0.409324
LocationCoimbatore, Tamil Nadu         9.370e-01  4.339e+00   0.216 0.830200
LocationGautam Budh Nagar, Uttar Pradesh -1.405e+01  5.879e+00  -2.390 0.022063
LocationGurugram, Haryana             -2.705e+00  4.575e+00  -0.591 0.557936
LocationKumbakonam, Tamil Nadu        -4.151e+00  5.638e+00  -0.736 0.466289
LocationMadhya Marg, Chandigarh       -4.946e+00  5.029e+00  -0.984 0.331733
LocationMumbai, Maharashtra            3.926e+00  4.092e+00   0.960 0.343521
LocationNoida, Uttar Pradesh          -9.020e+00  5.051e+00  -1.786 0.082325
LocationPune, Maharashtra              7.417e+00  4.724e+00   1.570 0.124878
LocationSecunderabad, Telangana       -2.276e+01  5.364e+00  -4.244 0.000141

(Intercept)                           ***
Carbon                                *
Energy                                *
ETOR                                  ***
LocationChennai, Tamil Nadu
LocationCoimbatore, Tamil Nadu
LocationGautam Budh Nagar, Uttar Pradesh *
LocationGurugram, Haryana
LocationKumbakonam, Tamil Nadu
LocationMadhya Marg, Chandigarh
LocationMumbai, Maharashtra
LocationNoida, Uttar Pradesh          .
LocationPune, Maharashtra
LocationSecunderabad, Telangana       ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.165 on 37 degrees of freedom
```

```
Multiple R-squared:  0.5953,    Adjusted R-squared:  0.4531
F-statistic: 4.186 on 13 and 37 DF,  p-value: 0.0002962
```

Adding location improves the model a lot.

- **R-squared:** 59.5%
- **Adjusted R-squared:** 45.3%
- **Significant variables:**
  - Carbon (p = 0.043) → Slight positive effect
  - Energy (p = 0.021) → Negative effect
  - ETOR (p = 0.0009) → Strong negative effect
  - Secunderabad (p < 0.001) and Gautam Budh Nagar (p = 0.022) → Lower RoE
- **Conclusion:** ESG factors become meaningful when location is considered. Some regions clearly perform worse.

3.2.3 ESG + Location + Industry Model

```
Call:
lm(formula = RoE ~ Carbon + Energy + ETOR + Location + Industry,
    data = data)

Residuals:
     Min       1Q   Median       3Q      Max
-12.7422  -1.9931  -0.5384   1.5154  14.8351

Coefficients: (2 not defined because of singularities)
                                        Estimate Std. Error t value Pr(>|t|)
(Intercept)                            1.574e+00  1.650e+01   0.095  0.92450
Carbon                                 7.772e-06  3.817e-06   2.036  0.04937
Energy                                -1.723e-06  8.156e-07  -2.113  0.04182
ETOR                                  -6.263e-01  1.904e-01  -3.290  0.00229
LocationChennai, Tamil Nadu            2.003e+01  1.644e+01   1.218  0.23147
LocationCoimbatore, Tamil Nadu         2.559e+01  1.695e+01   1.509  0.14016
LocationGautam Budh Nagar, Uttar Pradesh  1.131e+01  1.702e+01   0.664  0.51082
LocationGurugram, Haryana             -2.741e+00  4.160e+00  -0.659  0.51430
LocationKumbakonam, Tamil Nadu         2.017e+01  1.734e+01   1.163  0.25274
LocationMadhya Marg, Chandigarh        8.076e+00  1.785e+01   0.453  0.65368
LocationMumbai, Maharashtra            2.108e+01  1.728e+01   1.219  0.23082
LocationNoida, Uttar Pradesh          -7.269e+00  4.655e+00  -1.562  0.12736
LocationPune, Maharashtra              3.113e+01  1.734e+01   1.795  0.08134
LocationSecunderabad, Telangana       -2.234e+01  4.907e+00  -4.552 6.16e-05
IndustryConsumer_Goods                 1.137e+01  4.089e+00   2.781  0.00867
IndustryInfrastructure                 2.497e+01  1.676e+01   1.490  0.14523
IndustryIT                                    NA         NA      NA       NA
IndustryManufacturing                         NA         NA      NA       NA

(Intercept)
```

```
Carbon                                  *
Energy                                  *
ETOR                                    **
LocationChennai, Tamil Nadu
LocationCoimbatore, Tamil Nadu
LocationGautam Budh Nagar, Uttar Pradesh
LocationGurugram, Haryana
LocationKumbakonam, Tamil Nadu
LocationMadhya Marg, Chandigarh
LocationMumbai, Maharashtra
LocationNoida, Uttar Pradesh
LocationPune, Maharashtra               .
LocationSecunderabad, Telangana         ***
IndustryConsumer_Goods                  **
IndustryInfrastructure
IndustryIT
IndustryManufacturing
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.562 on 35 degrees of freedom
Multiple R-squared:  0.6884,    Adjusted R-squared:  0.5548
F-statistic: 5.155 on 15 and 35 DF,  p-value: 3.172e-05
```

Adding industry makes the model stronger and more detailed.

- **R-squared:** 68.8%
- **Adjusted R-squared:** 55.5%
- **Significant variables:**
  - Carbon (p = 0.049) → Positive effect
  - Energy (p = 0.042) → Negative effect
  - ETOR (p = 0.002) → Strong negative effect
  - Secunderabad (p < 0.001) → Very low RoE
  - Consumer Goods industry (p = 0.0087) → Higher RoE
- **Conclusion:** Industry matters—Consumer Goods companies perform better. ESG and location effects remain strong.

3.2.4 ESG +Location + Industry + CEO Model

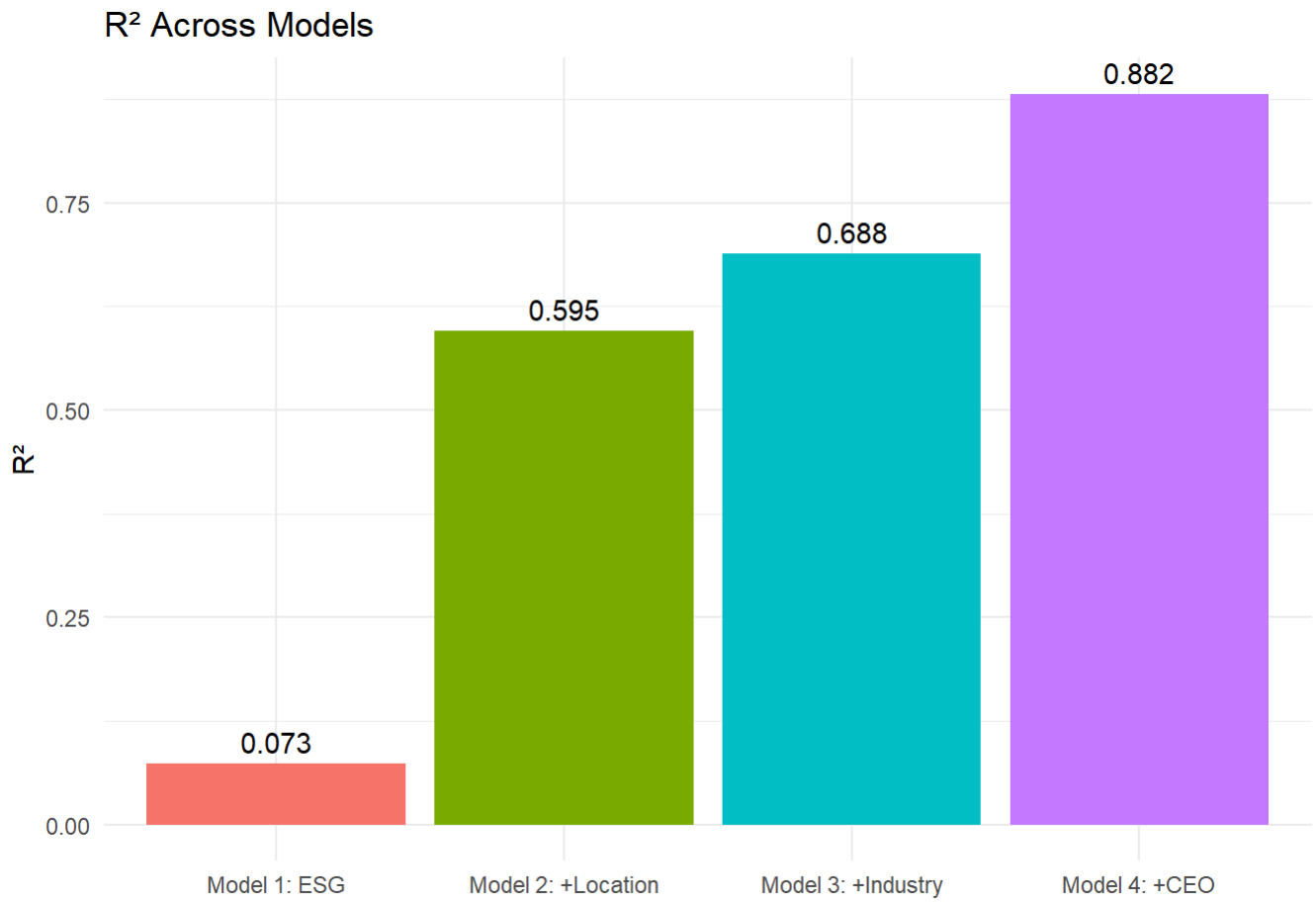
```
Call:
lm(formula = RoE ~ Carbon + Energy + ETOR + Location + Industry +
    CEO, data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-9.1308 -1.5842 -0.2932  1.4319  8.6262
```

```
Coefficients: (14 not defined because of singularities)
                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                               4.488e+00  1.094e+01   0.410   0.6844
Carbon                                    4.218e-06  2.832e-06   1.489   0.1465
Energy                                   -1.144e-06  5.543e-07  -2.063   0.0475
ETOR                                     -2.314e-01  1.834e-01  -1.262   0.2165
LocationChennai, Tamil Nadu               1.412e+01  1.107e+01   1.275   0.2117
LocationCoimbatore, Tamil Nadu            1.540e+01  1.163e+01   1.324   0.1951
LocationGautam Budh Nagar, Uttar Pradesh  6.785e+00  1.135e+01   0.598   0.5543
LocationGurugram, Haryana                -6.679e-01  2.787e+00  -0.240   0.8122
LocationKumbakonam, Tamil Nadu            1.113e+01  1.189e+01   0.937   0.3562
LocationMadhya Marg, Chandigarh          -1.394e+01  1.282e+01  -1.087   0.2852
LocationMumbai, Maharashtra               1.186e+01  1.187e+01   0.999   0.3254
LocationNoida, Uttar Pradesh             -6.717e+00  3.061e+00  -2.195   0.0358
LocationPune, Maharashtra                 2.143e+01  1.174e+01   1.826   0.0776
LocationSecunderabad, Telangana          -1.818e+01  3.446e+00  -5.277 9.71e-06
IndustryConsumer_Goods                    2.480e+01  3.491e+00   7.104 5.55e-08
IndustryInfrastructure                    1.672e+01  1.139e+01   1.468   0.1521
IndustryIT                                       NA         NA      NA       NA
IndustryManufacturing                            NA         NA      NA       NA
CEOAbinash Mishra                                NA         NA      NA       NA
CEOAjay Anand                            -2.225e+01  3.323e+00  -6.696 1.72e-07
CEOAjay K                                 1.192e+01  2.068e+01   0.577   0.5684
CEOJairam Varadaraj                       4.806e+00  2.975e+00   1.615   0.1164
CEOKamakodi                                      NA         NA      NA       NA
CEOKumar Venkatasubramanian                      NA         NA      NA       NA
CEOMahesh Viswanathan                            NA         NA      NA       NA
CEOManish Tandon                         -3.890e+00  4.012e+00  -0.970   0.3397
CEOPrabakaran Palanichamy                        NA         NA      NA       NA
CEORahul Mithal                                  NA         NA      NA       NA
CEOSandeep Kalra                                 NA         NA      NA       NA
CEOSandeep Saxena                                NA         NA      NA       NA
CEOShigeki Iwama                                 NA         NA      NA       NA
CEOSubhashchandra Kothari                        NA         NA      NA       NA
CEOVidyashankar Krishnan                         NA         NA      NA       NA
CEOYashovardhan Saboo                            NA         NA      NA       NA

(Intercept)
Carbon
Energy                                   *
ETOR
LocationChennai, Tamil Nadu
LocationCoimbatore, Tamil Nadu
LocationGautam Budh Nagar, Uttar Pradesh
LocationGurugram, Haryana
LocationKumbakonam, Tamil Nadu
LocationMadhya Marg, Chandigarh
LocationMumbai, Maharashtra
LocationNoida, Uttar Pradesh             *
LocationPune, Maharashtra                .
LocationSecunderabad, Telangana          ***
IndustryConsumer_Goods                   ***
IndustryInfrastructure
IndustryIT
```

```
IndustryManufacturing
CEOAbinash Mishra
CEOAjay Anand                          ***
CEOAjay K
CEOJairam Varadaraj
CEOKamakodi
CEOKumar Venkatasubramanian
CEOMahesh Viswanathan
CEOManish Tandon
CEOPrabakaran Palanichamy
CEORahul Mithal
CEOSandeep Kalra
CEOSandeep Saxena
CEOShigeki Iwama
CEOSubhashchandra Kothari
CEOVidyashankar Krishnan
CEOYashovardhan Saboo
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.641 on 31 degrees of freedom
Multiple R-squared:  0.8817,    Adjusted R-squared:  0.8092
F-statistic: 12.16 on 19 and 31 DF,  p-value: 1.572e-09
```

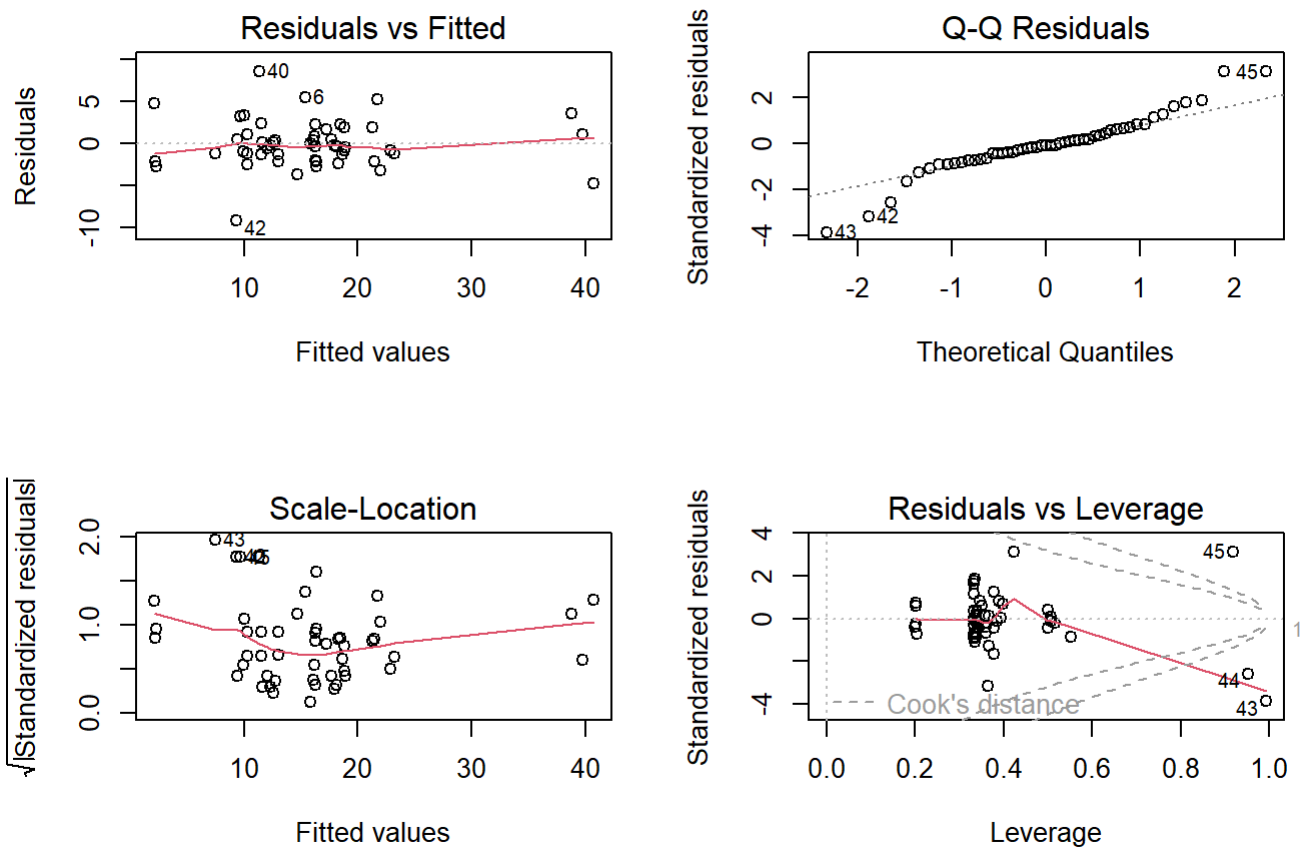
This is your best model. It explains nearly everything.

- **R-squared:** 88.2%
- **Adjusted R-squared:** 80.9%
- **Significant variables:**
  - Energy (p = 0.047) → Negative effect
  - Noida (p = 0.036) and Secunderabad (p < 0.00001) → Lower RoE
  - Consumer Goods industry (p < 0.000001) → Much higher RoE
  - CEO Ajay Anand (p < 0.0000002) → Strong negative impact
- **Conclusion:** ESG, location, industry, and CEO together explain RoE very well. Leadership and sector matter a lot.



This chart shows how well each model explains **Return on Equity (RoE)** as more variables are added:

- **Model 1 (ESG only)** has a very low R^2 of **0.073**, meaning ESG factors alone explain just **7.3%** of RoE variation.
- **Model 2 (+Location)** improves R^2 to **0.595**, showing that **geographic location** plays a major role in equity performance.
- **Model 3 (+Industry)** increases R^2 to **0.688**, suggesting that **industry type** adds further explanatory power.
- **Model 4 (+CEO)** reaches **0.882**, indicating that **leadership decisions and CEO influence** are critical in driving RoE.



4. Conclusion

This study shows that ESG factors have a measurable link with financial performance of Indian companies. Among the variables analyzed, energy consumption and employee turnover rate (ETOR) had significant effects on Return on Assets (RoA), suggesting that efficient resource use and stable workforce management contribute directly to profitability. When we included company location and industry, the model fit improved, highlighting that external factors such as infrastructure, regulatory environment, and sectoral practices play an important role in shaping ESG outcomes and financial returns. Adding CEO as a categorical variable further boosted explanatory power, but it also introduced singularities, signaling potential overfitting and the need to capture leadership effects through broader attributes rather than names alone.

Overall, the findings emphasize that ESG is more than a compliance requirement—it is a strategic driver of growth. Companies that actively reduce emissions, optimize energy use, and retain skilled employees are more likely to achieve sustainable profitability. Leadership commitment to ESG further strengthens this link, and investors increasingly reward such firms with capital and trust. While the limited sample size poses constraints, the results underline the importance of embedding ESG practices into governance and strategy to build resilience and long-term financial performance.