****

**Post Graduate Programme in Management**

**Batch: 2022-24**

**Subject: Decision Analytics for Managers**

**Case Title: ESG Portfolio: Automation of Fundamental Analysis**

**Team 4**

**Team Members**

|  |  |
| --- | --- |
| **Name** | **Roll No.** |
| Meenakshi S. | 2201031 |
| M Sai Vikramadithya | 2201055 |
| Rajjyoti Mazumdar | 2201051 |
| Maharshi Tripathy | 2201027 |

# PROBLEM STATEMENT

Creation of an ESG based portfolio in the Indian economy highly customizable to the user requirement

## QUESTIONS

1. Ranking the Industries based on various parameters
2. Ranking the companies in each industry based on various parameters
3. According to the users ;number of stocks in portfolio and the amount invested in large cap, mid cap and small cap, prepare a portfolio of companies

# SOLUTIONS

## Ranking the Industries based on various parameters

*Data Extraction:*

1. Future Growth Rate of the Industry is obtained from CRISIL
2. Industry’s GDP Contribution is obtained from iebf.org
3. Industry’s Market Size is obtained from ibef.org and Neilseniq.com
4. Threat of new Entrants is obtained from the Industry Reports iebf.org
5. Type of Sector (Organized/ Unorganized) is obtained from Company Annual Reports
6. Business Cyclicity is obtained from RBI Quarterly report on the Indian economy
7. Dependence on Government policies is obtained from iebf.org
8. Dependence in Number of Technologies is obtained from iebf.org

*Parameters:*

Let m be the number of alternatives used

Let n be the number of criteria used

Let i be an index used for alternatives

Let j be an index used for criteria

Let xij be values in the evaluation matrix

Let Wi be the original weight given to criteria j

*Steps:*

**Step 1:** Create an evaluation matrix consisting of ‘m’ alternatives and ‘n’ criteria with the intersection of each alternative and criteria given as Xij, hence matrix (Xij)m x n

**Step 2:** Take weights assigned by the user

**Step 3:** Normalize the weights Wj for all j = 1,2,…n (Assigned weight/ Sum of Weights)

**Step 4:** Normalize the matrix (Xij)m x n to form the matrix R=(rij)m x n using the normalization method rij = Xij/ Square root (sum of X2kj) from k=1 to k=m

**Step 5:** Calculate the values of the weighted normalized decision matrix T= (Wj . Rij)m x n

**Step 6:** Determine the worst alternative (Aw) and the best alternative (Ah)

Aw = {twj | j= 1,2,….n}

For cost criteria, twj is alternative with maximum value

For benefit criteria, twj is alternative with minimum value

Ab = {tbj | j= 1,2,….n}

For cost criteria, tbj is alternative with minimum value

For benefit criteria, tbj is alternative with maximum value

Step 7: Calculate the L2- distance between the target alternative i and worst condition

diw = Square root (sum of (tij – twj)2) for i= 1,2,….m

the L2- distance between the target alternative i and best condition

dib = Square root (sum of (tij – tbj)2) for i= 1,2,….m

Step 8: Calculate the relative closeness to the ideal solution for each alternative i:

Si = diw/(diw+dib)

Si = 1 if and only if the alternative has the best condition and

Sj = 0 if and only if the alternative has the worst condition.

## Ranking the companies in each industry based on various parameters

*Data Extraction:*

1. ESG Scores and CRISIL Scores are obtained from CRISIL website.
2. The future growth rate of the companies was obtained from their annual reports.
3. The Current Market Price, Market Cap, ESP Growth for three years, Average volume traded, Revenue Growth, Outstanding Debt, Debt to Equity Ratio, Return on Equity Ratio and EV/EBITDA Ratio were obtained from Screener website.
4. Market Share was obtained ibef.org and Neilseniq.com.

*Parameters:*

Let m be the number of alternatives used

Let n be the number of criteria used

Let i be an index used for alternatives

Let j be an index used for criteria

Let xij be values in the evaluation matrix

Let Wi be the original weight given to criteria j

*Steps:*

**Step 1**: Create an evaluation matrix consisting of ‘m’ alternatives and ‘n’ criteria with the

intersection of each alternative and criteria given as Xij, hence matrix (Xij)m x n

**Step 2**: Take weights assigned by the user

**Step 3**: Normalize the weights Wj for all j = 1,2,…n (Assigned weight/ Sum of Weights)

**Step 4**: Normalize the matrix (Xij)m x n to form the matrix R=(rij)mXn using the normalization

method rij = Xij/ Square root (sum of X2kj) from k=1 to k=m

**Step 5**: Calculate the values of the weighted normalized decision matrix T= (Wj . Rij)mxn

**Step 6**: Determine the worst alternative (Aw) and the best alternative (Ah)

Aw = {twj | j= 1,2,….n}

For cost criteria, twj is alternative with maximum value

For benefit criteria, twj is alternative with minimum value

Ab = {tbj | j= 1,2,….n}

For cost criteria, tbj is alternative with minimum value

For benefit criteria, tbj is alternative with maximum value

**Step 7**: Calculate the L2- distance between the target alternative i and worst condition

diw = Square root (sum of (tij – twj)2) for i= 1,2,….m

the L2- distance between the target alternative i and best condition

dib = Square root (sum of (tij – tbj)2) for i= 1,2,….m

**Step 8**: Calculate the relative closeness to the ideal solution for each alternative i:

Si = diw/( diw + dib)

Si = 1 if and only if the alternative has the best condition and

Sj = 0 if and only if the alternative has the worst condition.

## According to the users Industry, number of stocks in portfolio and the amount invested in large cap, mid cap and small cap, prepare a portfolio of companies

*Data Extraction:*

1. The top 3 companies from TOPSIS conducted for the top 6 industries (Received from TOPSIS of industries)
2. Returns and Risk is calculated from the monthly adjusted closing price for last 5 years (21 August 2018 – 21 August 2023)
3. Average ESG Score calculated from Company data (Exhibit 4)

*Parameters:*

Let i be the index for the goals and j be the index for the companies.

Let Rj be the return for j company

Let ERj be the expected return

Let Ej be the ESG Score for the company

Let Fj be desired ESG Score per company

Let Pi be the penalty for goal i.

Let Yi be the number of companies desired to be in the portfolio

Let Ii be the total amount that can be invested

Let L, M and S be the amount invested in large, mid, and small-cap

Let Tj be the categorization of companies

*Decision Variables:*

Let Xj be the number of to be selected in portfolio.

Let Di+ and Di- be the deviation over and under goal i.

Let Bi be the amount to be invested in each company

*Objective:*

Minimize the weighted sum,

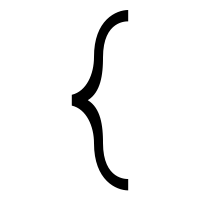
Z = Σ(Di+ \* Pi+) + Σ(Di- \* Pi-)

*Constraints:*

Σ Xi = Yi

Σ Bi = Ii

Bi <= Ii \* Xi



Large Cap, (Tj \* Bi)+Di- -Di+ = L\*Ii

Mid Cap, (Tj \* Bi)+Di- -Di+ = M\*Ii

Small Cap, (Tj \* Bi)+Di- -Di+ = M\*Ii = S\*Ii

(Σ Ej \* Xi)+Di- -Di+ = Fj \* Yi

Σ Bi \* (1 + Rj)+Di- -Di+ = Ii \* (1+ERj)

Bi >= Ii \* 0.05

Bi is Binary Function