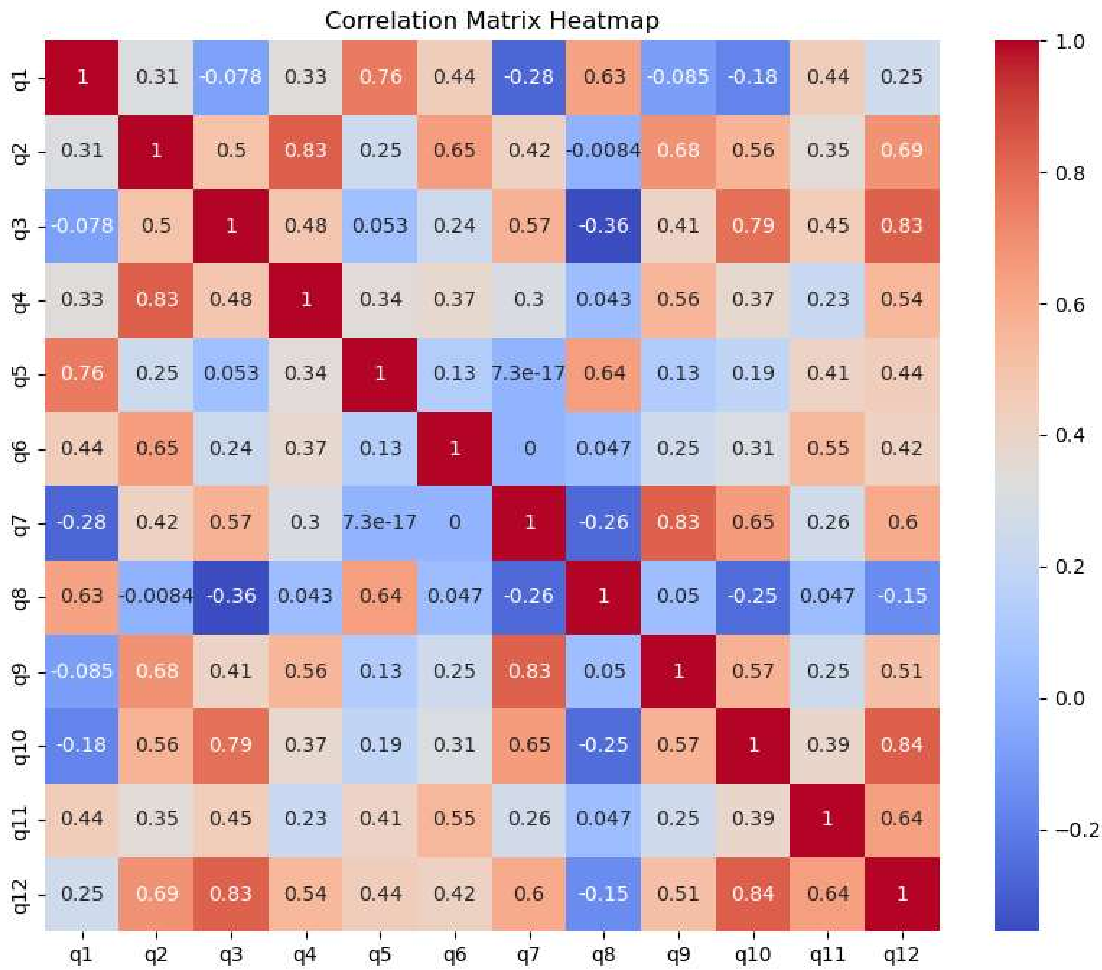
In [13]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import FactorAnalysis
from scipy.stats import pearsonr
from factor_analyzer import FactorAnalyzer
from factor_analyzer.factor_analyzer import calculate_bartlett_sphericity,
```

In [14]:
```python
data = pd.read_csv('data.csv')
```

In [28]:
```python
corr_matrix = data.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', cbar=True)
plt.title('Correlation Matrix Heatmap')
plt.show()
```



In [29]:
```
chi_square_value, p_value = calculate_bartlett_sphericity(data)
kmo_all, kmo_model = calculate_kmo(data)

print("Bartlett's test p-value:", p_value)
print("KMO:", kmo_model)
```

```
Bartlett's test p-value: nan
KMO: 0.41787015742401284

C:\Anaconda3\lib\site-packages\factor_analyzer\factor_analyzer.py:108: R
untimeWarning: invalid value encountered in log
  statistic = -np.log(corr_det) * (n - 1 - (2 * p + 5) / 6)
C:\Anaconda3\lib\site-packages\factor_analyzer\utils.py:244: UserWarnin
g: The inverse of the variance-covariance matrix was calculated using th
e Moore-Penrose generalized matrix inversion, due to its determinant bei
ng at or very close to zero.
  warnings.warn(
```

In [30]:
```
fa = FactorAnalyzer(n_factors=12, rotation=None)
fa.fit(data)
```

Out[30]:
```
FactorAnalyzer(n_factors=12, rotation=None, rotation_kwargs={})
```

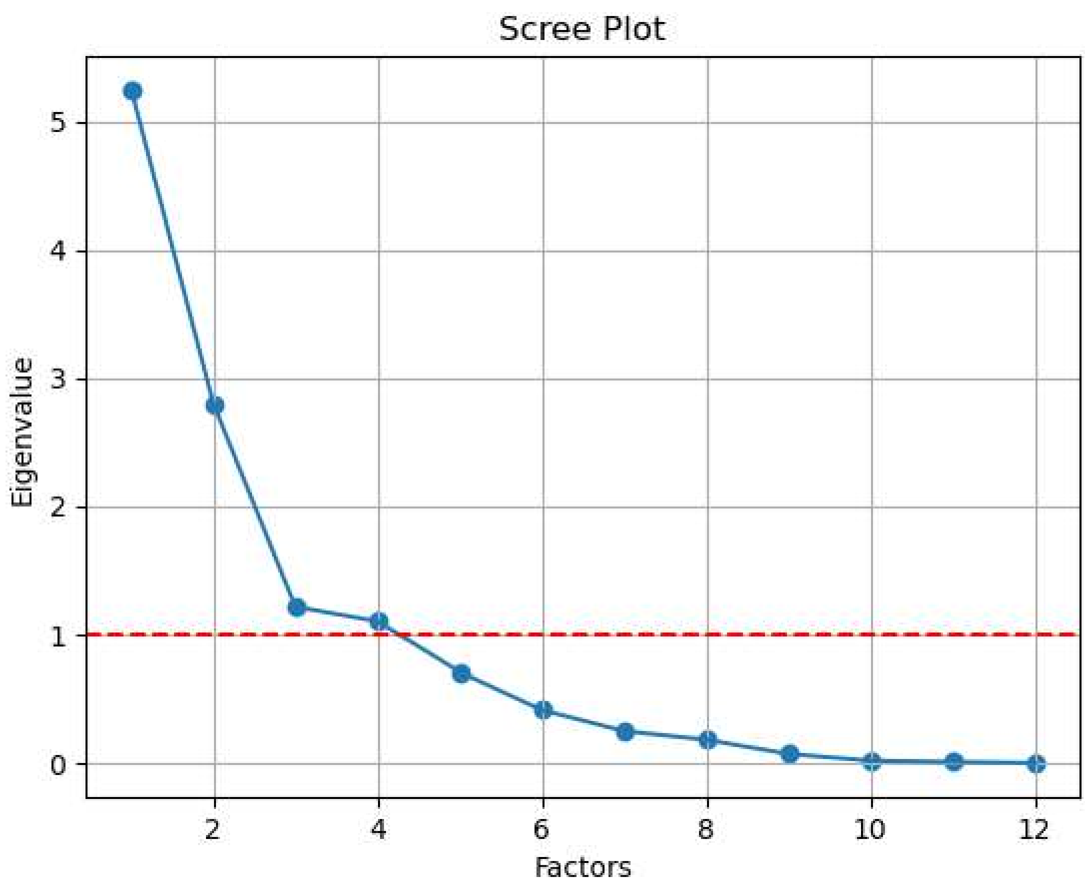
In [31]:
```
ev, v = fa.get_eigenvalues()
total_variance = np.sum(v)
explained_variance = v / total_variance
cumulative_variance = np.cumsum(explained_variance)

explained_variance_table = pd.DataFrame({'Total': ev, '% of variance': exp
print(explained_variance_table)
```

```
           Total  % of variance  Accumulated %
0   5.243090e+00      43.855405      43.855405
1   2.798730e+00      23.392500      67.247905
2   1.213487e+00      10.119259      77.367164
3   1.100978e+00       9.178906      86.546070
4   7.066555e-01       5.876164      92.422234
5   4.123137e-01       3.412298      95.834532
6   2.489738e-01       2.044956      97.879488
7   1.806400e-01       1.473955      99.353442
8   6.983187e-02       0.547178      99.900621
9   1.765525e-02       0.109825     100.010446
10  7.643564e-03       0.025745     100.036191
11  1.548347e-16      -0.036191     100.000000
```

In [32]:

```
plt.scatter(range(1, data.shape[1] + 1), ev)
plt.plot(range(1, data.shape[1] + 1), ev)
plt.axhline(y=1, color='r', linestyle='--')
plt.title('Scree Plot')
plt.xlabel('Factors')
plt.ylabel('Eigenvalue')
plt.grid()
plt.show()
```



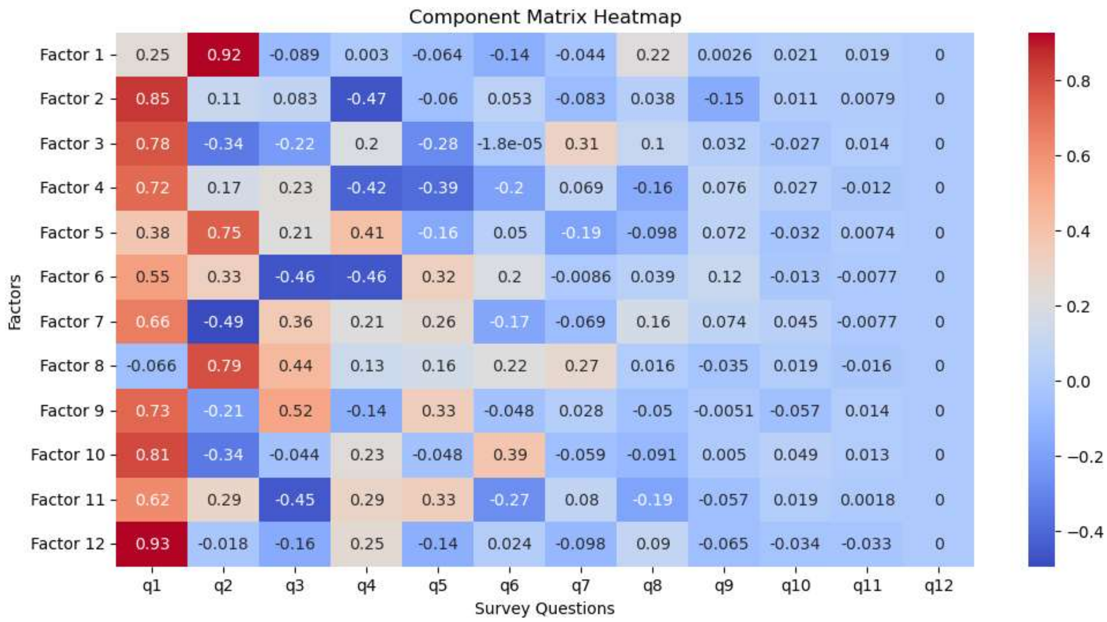

In [33]:

```
communalities = fa.get_communalities()
print('Communalities:', communalities)
```

```
Communalities: [0.99585362 0.99603047 0.99526646 0.99513599 0.99579346
0.99506102
 0.99537278 0.99501659 0.99560153 0.99547889 0.99500924 0.99537996]
```

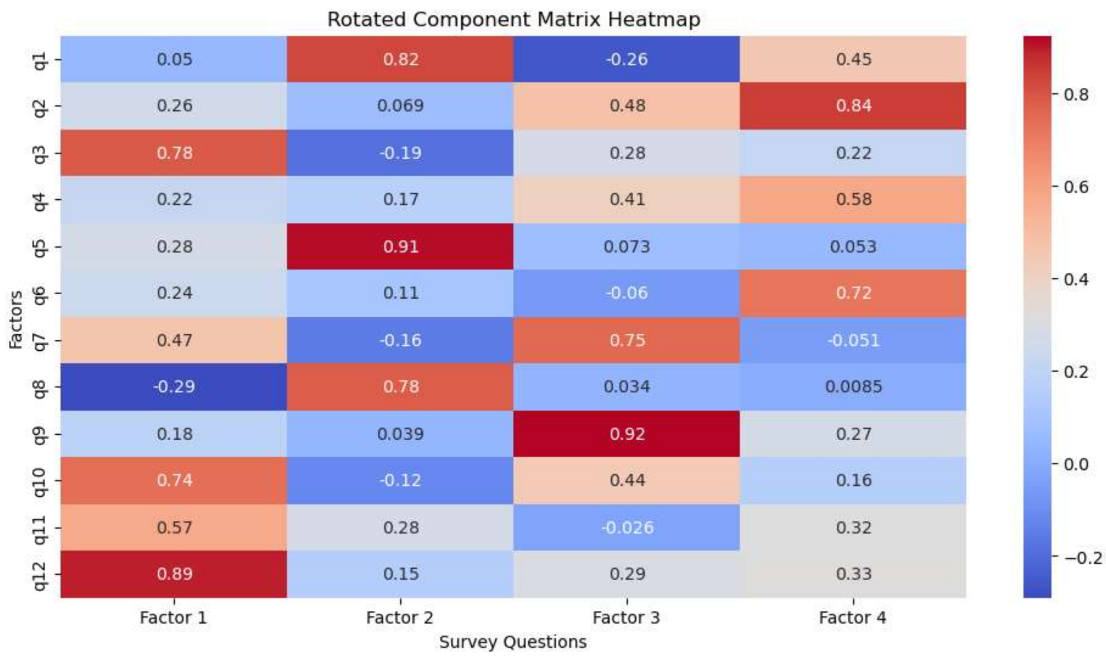
In [34]:

```
component_matrix = fa.loadings_
plt.figure(figsize=(12, 6))
sns.heatmap(component_matrix, annot=True, cmap='coolwarm', cbar=True, xtic
plt.title('Component Matrix Heatmap')
plt.xlabel('Survey Questions')
plt.ylabel('Factors')
plt.show()
```



In [27]:

```
fa_rotated = FactorAnalyzer(n_factors=4, rotation='varimax') # Use 4 facto
fa_rotated.fit(data)
rotated_component_matrix = fa_rotated.loadings_
plt.figure(figsize=(12, 6))
sns.heatmap(rotated_component_matrix, annot=True, cmap='coolwarm', cbar=Tr
plt.title('Rotated Component Matrix Heatmap')
plt.xlabel('Survey Questions')
plt.ylabel('Factors')
plt.show()
```




In [ ]: