

DSS5202 Sustainability Systems Analysis Solutions to Assignment #3

1.

| | Product | Sustainability | Company | RGM | $w \approx$ | $\lambda \approx$ |
|----------------|---------|----------------|---------|---------|-------------|-------------------|
| Product | 1 | 3 | 4 | 2.28943 | 0.62501 | 3.0183 |
| Sustainability | 1/3 | 1 | 2 | 0.87358 | 0.23849 | 3.0183 |
| Company | 1/4 | 1/2 | 1 | 0.50000 | 0.13650 | 3.0183 |
| | | | | 3.66301 | 1.0000 | 3.0383 |

Using the RGM method, the approximate weights of the 3 main criteria are

1. Product: 0.62501
2. Sustainability: 0.23849
3. Company: 0.13650

Main criterion Product is the most important as it has the highest local weight.
Main criterion Company is the least important as it has the lowest local weight.

2. From Q1: $\lambda_{\max} \approx 3.0383$
 $CI = (3.0383 - 3)/(3 - 1) = 0.009147$
 $CR = 0.01577 < 0.1 \Rightarrow$ Inconsistency is **Acceptable**.

3. From the matrix:

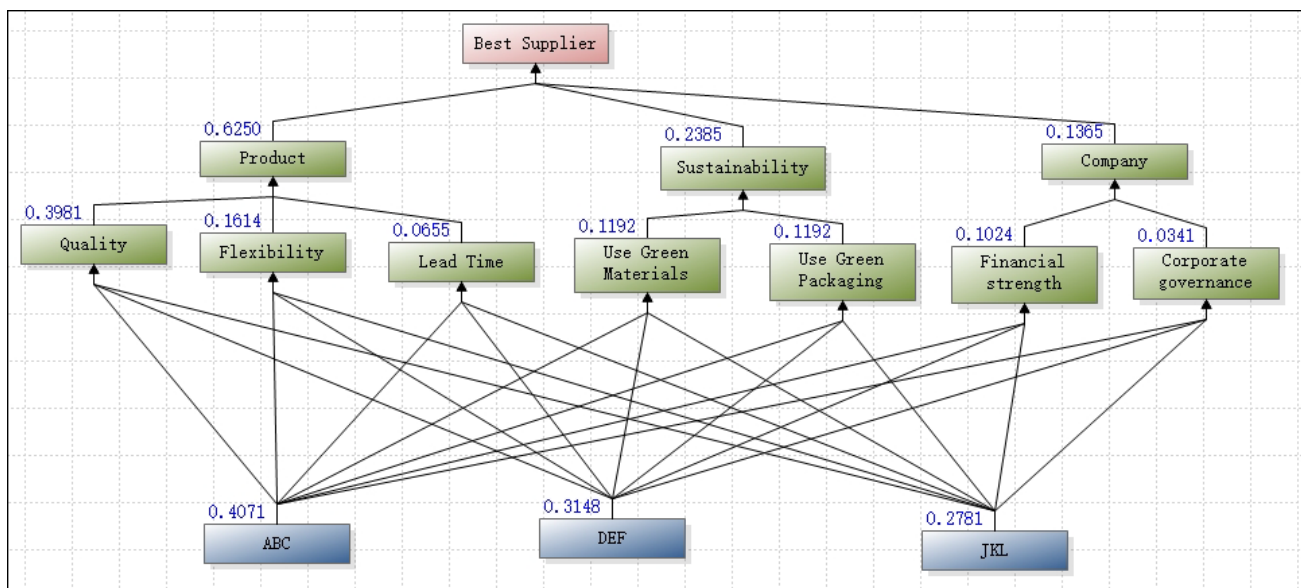
$$a_{12} = 3 > 1 \Rightarrow \text{"Product"} \text{ is more important than "Sustainability"}$$

$$a_{13} = 4 > 1 \Rightarrow \text{"Product"} \text{ is more important than "Company"}$$

$$a_{23} = 2 > 1 \Rightarrow \text{"Sustainability"} \text{ is more important than "Company"}$$

Hence the matrix satisfies the transitivity of preference property.

4.



Main criteria weights

Product : 0.625013
Sustainability : 0.238487
Company : 0.136500

Sub-criteria weights wrt Product

Quality : 0.636986
Flexibility : 0.258285
Reliability : 0.104729

Sub-criteria weights wrt Sustainability

Green materials : 0.500000
Green packaging : 0.500000

Sub-criteria weights wrt Company

Financial strength : 0.750000
Corporate governance : 0.250000

Alternatives' local weights

Product > Quality

ABC : 0.636986
DEF : 0.258285
JKL : 0.104729

Product > Flexibility

ABC : 0.636986
DEF : 0.104729
JKL : 0.258285

Product > Reliability

ABC : 0.122020
DEF : 0.229651
JKL : 0.648329

Sustainability > Green materials

ABC : 0.104729
DEF : 0.636986
JKL : 0.258285

Sustainability > Green packaging

ABC : 0.142857
DEF : 0.571429
JKL : 0.285714

Company > Financial strength

ABC : 0.104729
DEF : 0.258285
JKL : 0.636986

Company > Corporate governance

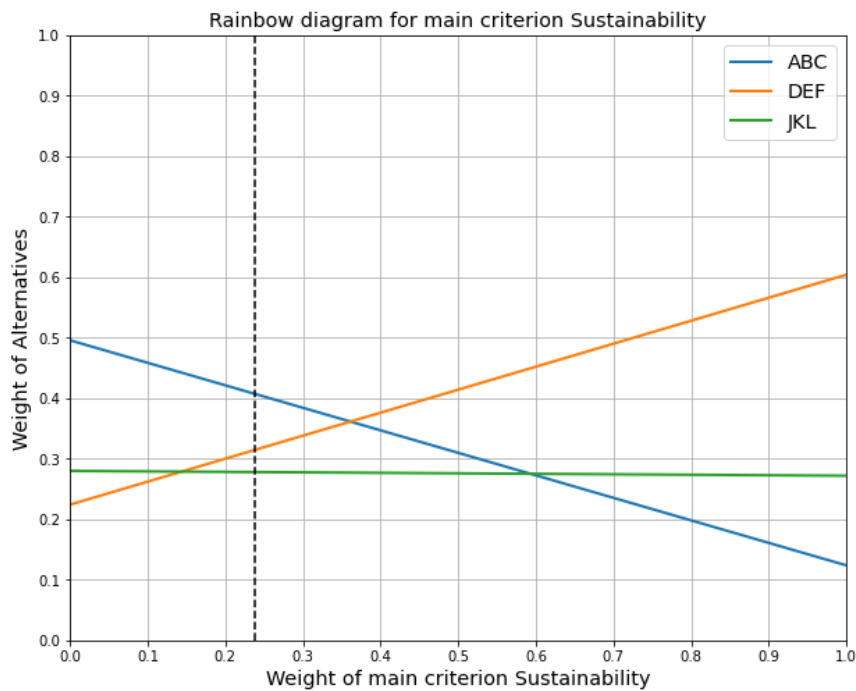
ABC : 0.071927
DEF : 0.278955
JKL : 0.649118

Alternatives' weights wrt Best Supplier

ABC : 0.407115
DEF : 0.314825
JKL : 0.278059

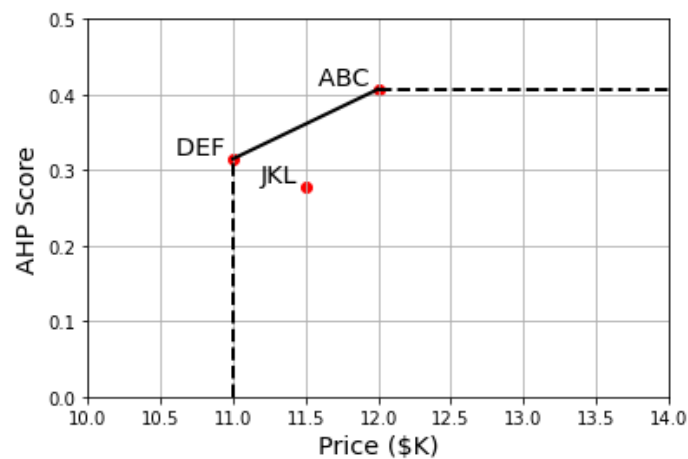
Best Supplier without consideration of cost = ABC.

5. If the priority weight for the main criterion “Sustainability” is varied from 0 to 1, the following rainbow diagrams are obtained:



Supplier DEF is the best supplier when the weight of the criterion “Sustainability” is between 0.37 and 1.0.

6. The efficient frontier based on the prices quoted by the suppliers is:



Supplier JKL is dominated by the supplier DEF and can be eliminated from further consideration. The DSS Printer should not purchase anything from JKL. The other two companies ABC and DEF can be selected depending on the acceptable trade-off between cost and effectiveness.