Example

- Example: Selecting a Software Supplier
- Criteria:
- Quality (Q)
- Cost (C)
- Delivery Time (D)

- Step 1: Ranking (By Expert)
- The expert ranks the criteria from most important to least important:
- Quality (Most Important)
- Cost
- Delivery Time (Least Important

Step 2 & 3: Relative Importance (s_j) and Coefficient (k_j)

- **Quality ($j = 1$):** No s_j value for the first one. So, $\boldsymbol{k_1 = 1}$.
- **Cost ($j = 2$):** Expert says Cost is **0.20** points less important than Quality. So, $\boldsymbol{s_2 = 0.20}$.
  - $k_2 = s_2 + 1 = \mathbf{1.20}$
- **Delivery ($j = 3$):** Expert says Delivery is **0.50** points less important than Cost. So, $\boldsymbol{s_3 = 0.50}$.
  - $k_3 = s_3 + 1 = \mathbf{1.50}$

Step 4: Recalculated Weight (q_j)

- $\boldsymbol{q_1}$ **(Quality):** Always **1.00**.
- $\boldsymbol{q_2}$ **(Cost):** $q_1/k_2 = 1.00/1.20 = \mathbf{0.833}$
- $\boldsymbol{q_3}$ **(Delivery):** $q_2/k_3 = 0.833/1.50 = \mathbf{0.555}$

Sum of q_j: $1.00 + 0.833 + 0.555 = \mathbf{2.388}$

Step 5: Final Normalized Weights (w_j)

Divide each q_j by the Sum (2.388):

- w_1 **(Quality):** $1.00/2.388 = \mathbf{0.419}$ **(41.9%)**
- w_2 **(Cost):** $0.833/2.388 = \mathbf{0.349}$ **(34.9%)**
- w_3 **(Delivery):** $0.555/2.388 = \mathbf{0.232}$ **(23.2%)**

Criterion	Rank	s_j	$k_j = s_j + 1$	$q_j = q_{j-1}/k_j$	Weight (w_j)
Quality	1	-	1.00	1.000	**0.419**
Cost	2	0.20	1.20	0.833	**0.349**
Delivery	3	0.50	1.50	0.555	**0.232**
Total				**2.388**	**1.000**

Example 2

- Choosing a New Smartphone
- Criteria (Criteria Set):
- Camera Quality (C)
- Price (P)
- Battery Life (B)
- Storage Capacity (S)

Criterion	Rank	s_j	k_j	q_j	Final Weight (w_j)
Price	1	-	1.00	1.000	**32.8%**
Camera	2	0.25	1.25	0.800	**26.3%**
Battery	3	0.10	1.10	0.727	**23.9%**
Storage	4	0.40	1.40	0.519	**17.0%**
Total				**3.046**	**100%**

Example 3: Industrial Site Selection

- **Proximity to Raw Materials (RM)**
- **Labor Cost (LC)**
- **Infrastructure Quality (IQ)**
- **Transportation Costs (TC)**
- **Government Incentives (GI)**
- **Environmental Regulations (ER)**
- **Land Cost (LdC)**

Criterion (j)	Rank	s_j (Importance Ratio)	$k_j = s_j + 1$	$q_j = q_{j-1}/k_j$	Weight (w_j)
Raw Materials	1	-	1.00	1.000	**0.222**
Labor Cost	2	0.10	1.10	0.909	**0.202**
Infrastructure	3	0.15	1.15	0.790	**0.175**
Transportation	4	0.05	1.05	0.752	**0.167**
Incentives	5	0.30	1.30	0.578	**0.128**
Environment	6	0.20	1.20	0.481	**0.106**
Land Cost	7	1.20	2.20	0.218	**0.048**
Total Sum				**4.728**	**1.000**

Task: Sustainable Supplier Selection (10 Criteria)

Criterion (j)	Rank	s_j (Importance Ratio)
Quality	1	-
Cost	2	0.05
Delivery	3	0.10
Financials	4	0.15
Technical	5	0.20
Environment	6	0.40
Social	7	0.50
Resources	8	1.00
Location	9	1.50
Reputation	10	3.00

Case Study: Weighting 3 Suppliers

Supplier	Price (C_1)	Quality Score (C_2)	Distance (C_3)
A	100	80	50
B	102	40	55
C	101	95	52

Step 0: Initial Decision Matrix (x_{ij})

We start with the raw data for 3 Suppliers across 3 Criteria.

Supplier	Price (C_1)	Quality Score (C_2)	Distance (C_3)
A	100	80	50
B	102	40	55
C	101	95	52
Sum ($\sum x_{ij}$)	**303**	**215**	**157**

Step 1: Normalization ($r_{ij} = x_{ij} / \sum x_{ij}$)

Divide each cell by its column sum to make the data comparable.

Supplier	Price (C_1)	Quality Score (C_2)	Distance (C_3)
A	$100/303 = \mathbf{0.3300}$	$80/215 = \mathbf{0.3721}$	$50/157 = \mathbf{0.3185}$
B	$102/303 = \mathbf{0.3366}$	$40/215 = \mathbf{0.1860}$	$55/157 = \mathbf{0.3503}$
C	$101/303 = \mathbf{0.3333}$	$95/215 = \mathbf{0.4419}$	$52/157 = \mathbf{0.3312}$

Step 2, 3 & 4: Entropy (e_j), Diversification (d_j), and Weights (w_j)

- **Constant (k):** $1/\ln(3) = \mathbf{0.9102}$
- **Calculations:** We find the entropy (e_j) of each column.

	Price (C_1)	Quality Score (C_2)	Distance (C_3)
$\sum r_{ij}\ln(r_{ij})$	-1.0985	-1.0558	-1.0971
Entropy (e_j)	**0.9998**	**0.9610**	**0.9986**
Diversification ($d_j = 1 - e_j$)	**0.0002**	**0.0390**	**0.0014**
Final Weight (w_j)	**0.0049 (0.5%)**	**0.9606 (96.1%)**	**0.0345 (3.4%)**

Evaluating **3 Laptop Models** based on technical specs.

Alternative	RAM (GB)	Storage (GB)	Weight (kg)
Laptop X	16	512	1.2
Laptop Y	16	1024	2.5
Laptop Z	16	256	1.8

Step 0: Initial Decision Matrix (x_{ij})

Location	Rent (C_1)	Distance (C_2)	Workers (C_3)
Site A	5000	10	100
Site B	5200	50	110
Site C	5100	30	105
Sum ($\sum$)	**15300**	**90**	**315**

Step 1: Normalization ($r_{ij} = x_{ij} / \sum x_{ij}$)

Location	r_{i1} (Rent)	r_{i2} (Dist)	r_{i3} (Work)
Site A	0.3268	0.1111	0.3175
Site B	0.3399	0.5556	0.3492
Site C	0.3333	0.3333	0.3333

Step 2: Entropy Value (e_j)

Using $k = 1/ln(3) = 0.9102$ and calculating $r_{ij} \times ln(r_{ij})$ for each cell:

- e_1 (Rent): $-0.9102 \times (-1.0984) = \mathbf{0.9997}$
- e_2 (Dist): $-0.9102 \times (-0.9728) = \mathbf{0.8854}$
- e_3 (Work): $-0.9102 \times (-1.0971) = \mathbf{0.9986}$

Step 3 & 4: Diversification (d_j) and Final Weight (w_j)

Metric	Rent (C_1)	Distance (C_2)	Workers (C_3)
$d_j = 1 - e_j$	0.0003	0.1146	0.0014
$w_j = d_j / \sum d_j$	**0.3%**	**98.5%**	**1.2%**

Example 2: Evaluation of 3 Smartphones

Step 0: Initial Decision Matrix (x_{ij})

Phone	Price (C_1)	Camera (C_2)	Battery (C_3)
Phone 1	800	12	4000
Phone 2	850	48	4500
Phone 3	1200	108	5000
Sum ($\sum$)	**2850**	**168**	**13500**

Step 1: Normalization (r_{ij})

Phone	r_{i1} (Price)	r_{i2} (Cam)	r_{i3} (Bat)
Phone 1	0.2807	0.0714	0.2963
Phone 2	0.2982	0.2857	0.3333
Phone 3	0.4211	0.6429	0.3704

Step 2, 3 & 4: Final Weighted Analysis

- Constant $k = 0.9102$.

Calculation Step	Price (C_1)	Camera (C_2)	Battery (C_3)
Entropy (e_j)	0.9815	0.7725	0.9972
Diversification (d_j)	0.0185	0.2275	0.0028
Final Weight (w_j)	**7.4%**	**91.5%**	**1.1%**

Task Evaluating Job Candidates

Candidate	Experience (C_1)	Test Score (C_2)	Salary (C_3)
John	5	85	3000
Sarah	10	90	4500
Mike	2	88	2800