

Analytic Hierarchy Process

(AHP):

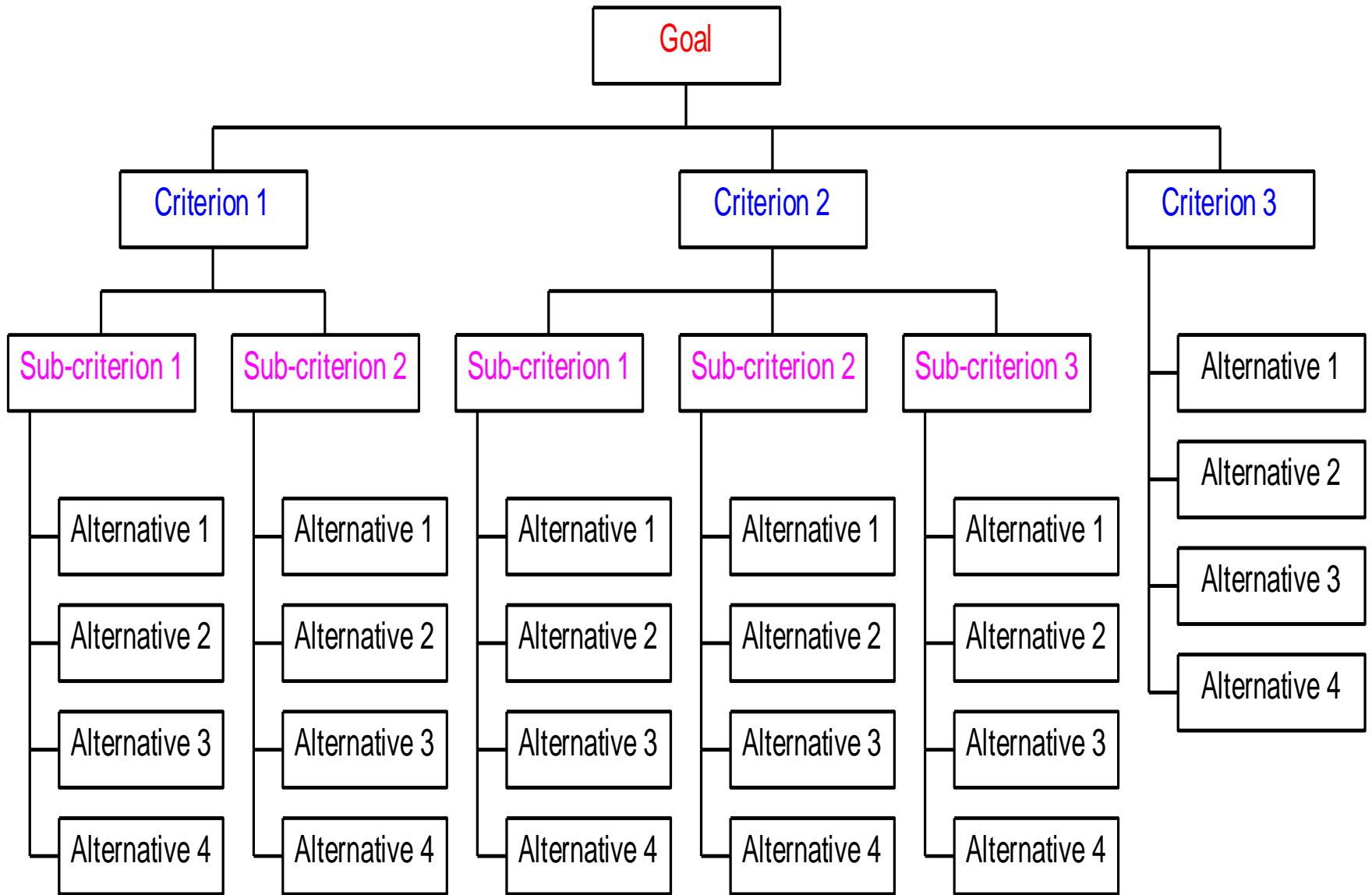
Relative Measurement



Areas of AHP Applications

- Accounting
- Banking & Finance
- Conflict Analysis
- Energy Planning
- Education
- Environmental Management
- Forecasting
- Healthcare
- Human Resource Management
- Information Systems
- Marketing
- Military
- Operations Management
- Politics
- Portfolio Management
- Project Management
- R & D Management
- Resource Allocation
- Risk Analysis
- Sports
- Strategic Management
- Technology
- Total Quality Management
- Transportation





AHP Method:

- Step 1:** Decompose the problem and identify the **criteria** and **alternatives**. Construct the **hierarchy**.
- Step 2:** Construct **pairwise comparison matrices** for all the criteria and alternatives.
- Step 3:** Determine the **weights** of the criteria and **local weights** of the alternatives from the above matrices by using a **suitable weight determination technique**.
- Step 4:** Obtain the **overall weights** of the alternatives by synthesizing the local weights.

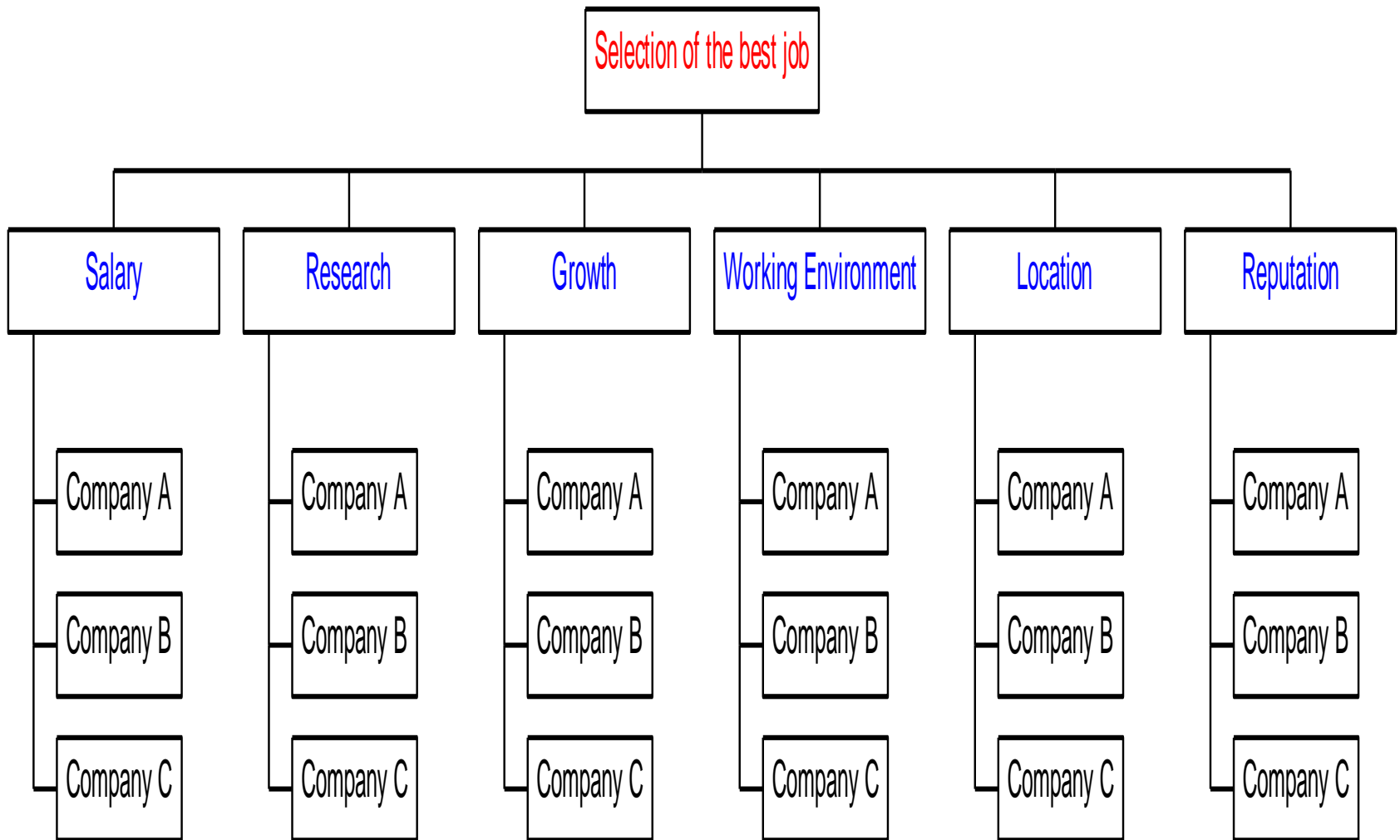


Example

Suppose, after graduation, in order to get a job, Khairul has appeared in a number of interviews. Ultimately, he has been offered by three companies, say Company A, Company B and Company C. The problem now before Khairul is to select (or decide) the company where he will join.

Six criteria: 1) Salary, 2) Research, 3) Growth, 4) Working Environment, 5) Location, and 6) Reputation. Discuss how to use AHP to assist Khairul in guiding him to select the best job.



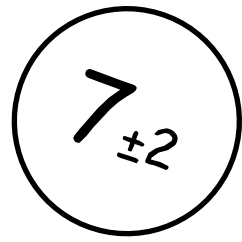


Semantic Interpretation of the ratios in the comparison matrices

Verbal judgment of importance	Rating
Equally important	1
Equally to moderately important	2
Moderately important	3
Moderately to strongly important	4
Strongly important	5
Strongly to very strongly important	6
Very strongly important	7
Very strongly to extremely important	8
Extremely important	9
Note: $a_{ji} = 1/a_{ij}$	



Justification of 1-9 scale



George A. Miller, in his paper

" The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information"

indicated that

- the capacity of human short term memory is seven separate items, plus or minus two.
- The brain of a regular human can simultaneously process, differentiate, and deal with at most 7 factors
- for some people this limit can be decreased to 5, for some other people it can be increased to 9
- (The Psychological Review, 1956, vol. 63, pp. 81-97)



General Form of A Pairwise Comparison Matrix

$$A =$$

	C_1	C_2	C_n
C_1	a_{11}	a_{12}	a_{1n}
C_2	a_{21}	a_{22}	a_{2n}
C_n	a_{n1}	a_{n2}	a_{nn}



Salary is

- ⇒ equally important with research (1)
- ⇒ equally important with growth (1)
- ⇒ moderately to strongly important compared to working environment (4)
- ⇒ equally important with location (1)
- ⇒ equally to moderately less important than reputation (1/2)



Research is

- ⇒ equally to moderately important compared to growth (2)
- ⇒ moderately to strongly important compared to working environment (4)
- ⇒ equally important with location (1)
- ⇒ equally to moderately less important than reputation (1/2)



Growth is

- Strongly more important compared to working environment(5)
- Moderately more important compared to location(3)
- Moderately less important than reputation(1/2)



Working Environment is

- Moderately less important than location
(1/3)
- Moderately less important than reputation
(1/3)



Location is

- Equally important with reputation (1)



Criteria Pairwise Comparison Matrix

	SAL	RES	GRO	WEN	LOC	REP
SAL		1	1	4	1	1/2
RES			2	4	1	1/2
GRO				5	3	1/2
WEN					1/3	1/3
LOC						1
REP						



English Premier League results

Team	Arsenal	Aston Villa	Chelsea	Everton	Leicester city	Liverpool
Arsenal		3-0	0-1	2-1	2-1	0-0
Aston Villa	0-3		0-3	1-1	1-1	0-6
Chelsea	1-0	3-0		3-0	2-0	1-3
Everton	1-2	1-1	0-3		2-3	1-1
Leicester city	1-2	1-1	0-2	3-2		2-0
Liverpool	0-0	6-0	3-1	1-1	0-2	



Criteria Pairwise Comparison Matrix

	SAL	RES	GRO	WEN	LOC	REP
SAL	1	1	1	4	1	1/2
RES	1	1	2	4	1	1/2
GRO	1	1/2	1	5	3	1/2
WEN	1/4	1/4	1/5	1	1/3	1/3
LOC	1	1	1/3	3	1	1
REP	2	2	2	3	1	1



Priority Extraction Methods

- Eigenvector Method
- Logarithmic Least Squares Method
(Geometric Mean method)
- Least Squares Method
- Mathematical Programming Method
- Row-Column Normalisation Method



Row-Column Normalization Procedure

This technique is applied in three steps:

- a) **Sum** the values in each column of the PCM.
- b) **Divide** each element in the matrix by its column total. The resulting matrix is referred to as the normalized pairwise comparison matrix.
- c) **Compute the average** of the elements in each row of the normalized matrix.



Step (a)							Step (b)						Step (c)
Cr.	SAL	RES	GR O	WE N	LOC	REP	SA L	RES	GR O	WE N	LOC	REP	Weight
SAL	1	1	1	4	1	1/2	.16	.174	.153	.2	.136	.130	.1588
RES	1	1	2	4	1	1/2	.16	.174	.306	.2	.136	.130	.1843
GR O	1	1/2	1	5	3	1/2	.16	.086	.153	.25	.41	.130	.198
WE N	1/4	1/4	1/5	1	1/3	1/3	.04	.043	.306	.05	.045	.087	.049
LOC	1	1	1/3	3	1	1	.16	.174	.050	.15	.136	.261	.155
REP	2	2	2	3	1	1	.32	.347	.306	.15	.136	.261	.253
	6.25	5.75	6.53	20	7.33	3.83	1	1	1	1	1	1	1



Criteria Pairwise Comparison Matrix

	SAL	RES	GRO	WEN	LOC	REP	Weights
SAL	1	1	1	4	1	1/2	0.159
RES	1	1	2	4	1	1/2	0.184
GRO	1	1/2	1	5	3	1/2	0.198
WEN	1/4	1/4	1/5	1	1/3	1/3	0.049
LOC	1	1	1/3	3	1	1	0.155
REP	2	2	2	3	1	1	0.253



AHP Software

- Superdecision (www.creativedecisions.net)
- Expertchoice (www.expertchoice.com)
- Excel adds-in (<http://bpmsg.com/ahp-excel-template/>)



Semantic Interpretation of the ratios in the comparison matrices

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Strongly preferred	5
Strongly to very strongly preferred	6
Very strongly preferred	7
Very strongly to extremely preferred	8
Extremely preferred	9
Note: $a_{ji} = 1/a_{ij}$	



PCM for Salary

SAL	A	B	C
A	1	$\frac{1}{4}$	$\frac{1}{2}$
B	4	1	3
C	2	$\frac{1}{3}$	1



PCM for Research

RES	A	B	C
A	1	$1/4$	$1/5$
B	4	1	$1/2$
C	5	2	1



PCM for Growth

GRO	A	B	C
A	1	3	1/3
B	1/3	1	1
C	3	1	1



PCM for Working Environment

WEN	A	B	C
A	1	$\frac{1}{3}$	5
B	3	1	7
C	$\frac{1}{5}$	$\frac{1}{7}$	1



PCM for Location

LOC	A	B	C
A	1	1	7
B	1	1	7
C	1/7	1/7	1



PCM for Reputation

REP	A	B	C
A	1	7	9
B	1/7	1	5
C	1/9	1/5	1



Determination of Weights of three Companies w.r.t. Salary

	Step (a)			Step (b)			Step (c)
SAL	A	B	C	A	B	C	
A	1	1/4	1/2	0.143	0.158	0.111	0.137
B	4	1	3	0.571	0.633	0.667	0.625
C	2	1/3	1	0.286	0.209	0.222	0.239
	7	1.58	4.5	1	1	1	1



Determination of Weights of three Companies w.r.t. Research

	Step (a)			Step (b)			Step (c)
RES	A	B	C	A	B	C	
A	1	1/4	1/5	0.100	0.077	0.118	0.098
B	4	1	1/2	0.400	0.308	0.294	0.334
C	5	2	1	0.500	0.615	0.588	0.568
	10	3.25	1.7	1	1	1	1



Determination of Weights of three Companies w.r.t. Growth

	Step (a)			Step (b)			Step (c)
GRO	A	B	C	A	B	C	
A	1	3	1/3	0.231	0.600	0.142	0.324
B	1/3	1	1	0.076	0.200	0.429	0.235
C	3	1	1	0.693	0.200	0.429	0.441
	4.33	5	2.33	1	1	1	1



Determination of Weights of three Companies w.r.t. Working Env.

	Step (a)			Step (b)			Step (c)
WEN	A	B	C	A	B	C	
A	1	1/3	5	0.238	0.224	0.385	0.282
B	3	1	7	0.714	0.679	0.538	0.644
C	1/5	1/7	1	0.048	0.097	0.077	0.074
	4.2	1.473	13	1	1	1	1



Determination of Weights of three Companies w.r.t. Location

	Step (a)			Step (b)			Step (c)
LOC	A	B	C	A	B	C	
A	1	1	7	0.467	0.467	0.467	0.467
B	1	1	7	0.467	0.467	0.467	0.467
C	1/7	1/7	1	0.067	0.067	0.067	0.067
	2.143	2.143	15	1	1	1	1



Determination of Weights of three Companies w.r.t. Reputation

	Step (a)			Step (b)			Step (c)
REP	A	B	C	A	B	C	
A	1	7	9	0.797	0.854	0.600	0.750
B	1/7	1	5	0.114	0.122	0.333	0.189
C	1/9	1/5	1	0.089	0.024	0.067	0.060
	1.254	8.200	15	1	1	1	1



Synthesis to obtain the global weights

	SAL (0.16)	RES (0.19)	GRO (0.20)	WEN (0.05)	LOC (0.15)	REP (0.26)	Overall Weights
A	0.14	0.10	0.32	0.28	0.47	0.75	0.38
B	0.63	0.33	0.24	0.64	0.47	0.19	0.36
C	0.24	0.57	0.44	0.07	0.07	0.06	0.26



Measuring Inconsistency

	Step (a)					
SAL	$1 \times .16$	$1 \times .18$	1	4	1	$\frac{1}{2}$
RES	$1 \times .16$	$1 \times .18$	2	4	1	$\frac{1}{2}$
GRO	$1 \times .16$	$\frac{1}{2} \times .18$	1	5	3	$\frac{1}{2}$
WEN	$\frac{1}{4} \times .16$	$\frac{1}{4} \times .18$	$\frac{1}{5}$	1	$\frac{1}{3}$	$\frac{1}{3}$
LOC	$1 \times .16$	$1 \times .18$	$\frac{1}{3}$	3	1	1
REP	$2 \times .16$	$2 \times .18$	2	3	1	1



Measuring Consistency

Criteria	Step a	Step b
SAL	$(1 \times 0.16) + (1 \times 0.18) + (1 \times 0.20) + (4 \times 0.05) + (1 \times 0.16) + (1/2 \times 0.25) = 1.025$	$1.025/0.16 = 6.41$
RES	$(1 \times 0.16) + (1 \times 0.18) + (2 \times 0.20) + (4 \times 0.05) + (1 \times 0.16) + (1/2 \times 0.25) = 1.225$	$1.225/0.18 = 6.81$
GRO	$(1 \times 0.16) + (1/2 \times 0.18) + (1 \times 0.20) + (5 \times 0.05) + (3 \times 0.16) + (1/2 \times 0.25) = 1.305$	$1.305/0.20 = 6.52$
WEN	$(1/4 \times 0.16) + (1/4 \times 0.18) + (1/5 \times 0.20) + (1 \times 0.05) + (1/3 \times 0.16) + (1/3 \times 0.25) = 0.310$	$0.310/0.05 = 6.21$
LOC	$(1 \times 0.16) + (1 \times 0.18) + (1/3 \times 0.20) + (3 \times 0.05) + (1 \times 0.16) + (1 \times 0.25) = 0.966$	$0.966/0.16 = 6.04$
REP	$(2 \times 0.16) + (2 \times 0.18) + (2 \times 0.20) + (3 \times 0.05) + (1 \times 0.16) + (1 \times 0.25) = 1.64$	$1.64/0.25 = 6.56$



$$\lambda_{\max} = \frac{6.41 + 6.81 + \dots + 6.56}{6} = 6.425$$



$$CI = \frac{\lambda - n}{n - 1} = \frac{6.425 - 6}{6 - 1} = 0.085$$



$$CR = \frac{CI}{RI} = \frac{0.085}{1.24} = 0.0685$$



Random Index for various sizes of PCM

Size of PCM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59



Example 2:

Suppose Government of Malaysia wants to determine the best strategy for high level nuclear waste disposal. The strategies are:

1. Geological disposal (A)
2. Very deep hole (B)
3. Island disposal (C)
4. Subseabed disposal (D)
5. Disposal into space (E)

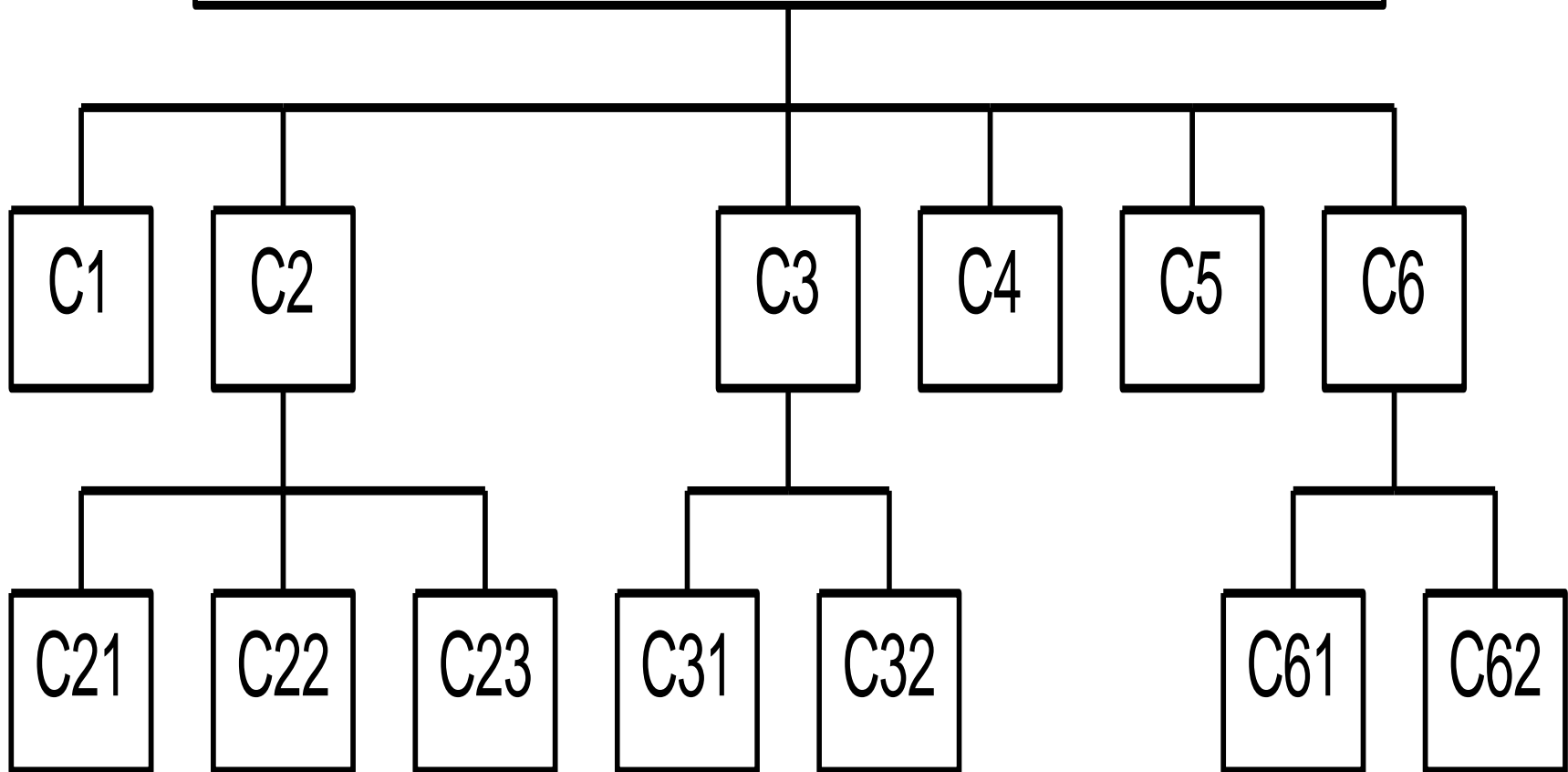
Suppose you are the consultant, guide the government in recommending the best option.



No.	Criteria	Sub-criteria
1.	State of technology (C_1)	
2.	Health, safety and environmental impacts (C_2)	i) Short-term radiological safety (C_{21}) ii) Long-term radiological safety (C_{22}) iii) Ecosystem impacts (C_{23})
3.	Cost (C_3)	i) Capital cost (C_{31}) ii) Cost of operation (C_{32})
4.	Socio-economic impact (C_4)	
5.	Lead time (C_5)	
6.	Political impact (C_6)	i) National (C_{61}) ii) International (C_{62})



Selecting the best nuclear waste disposal strategy



PCM to Determine of Criteria Weights

	C_1	C_2	C_3	C_4	C_5	C_6	Wts.
C_1	1	1	5	7	5	5	0.35
C_2		1	5	7	5	5	0.35
C_3			1	5	2	2	0.11
C_4				1	1/4	1/5	0.03
C_5					1	1	0.07
C_6						1	0.08
CR = 0.05							



PCM for sub-criteria of C_2

C_2	C_{21}	C_{22}	C_{23}	Wts.
C_{21}	1	1/3	1/5	0.10
C_{22}		1	1/3	0.26
C_{23}			1	0.64



PCM for sub-criteria of C_3

C_3	C_{31}	C_{32}	Weights
C_{31}	1	5	0.83
C_{32}	1/5	1	0.17
CR = 0.00			

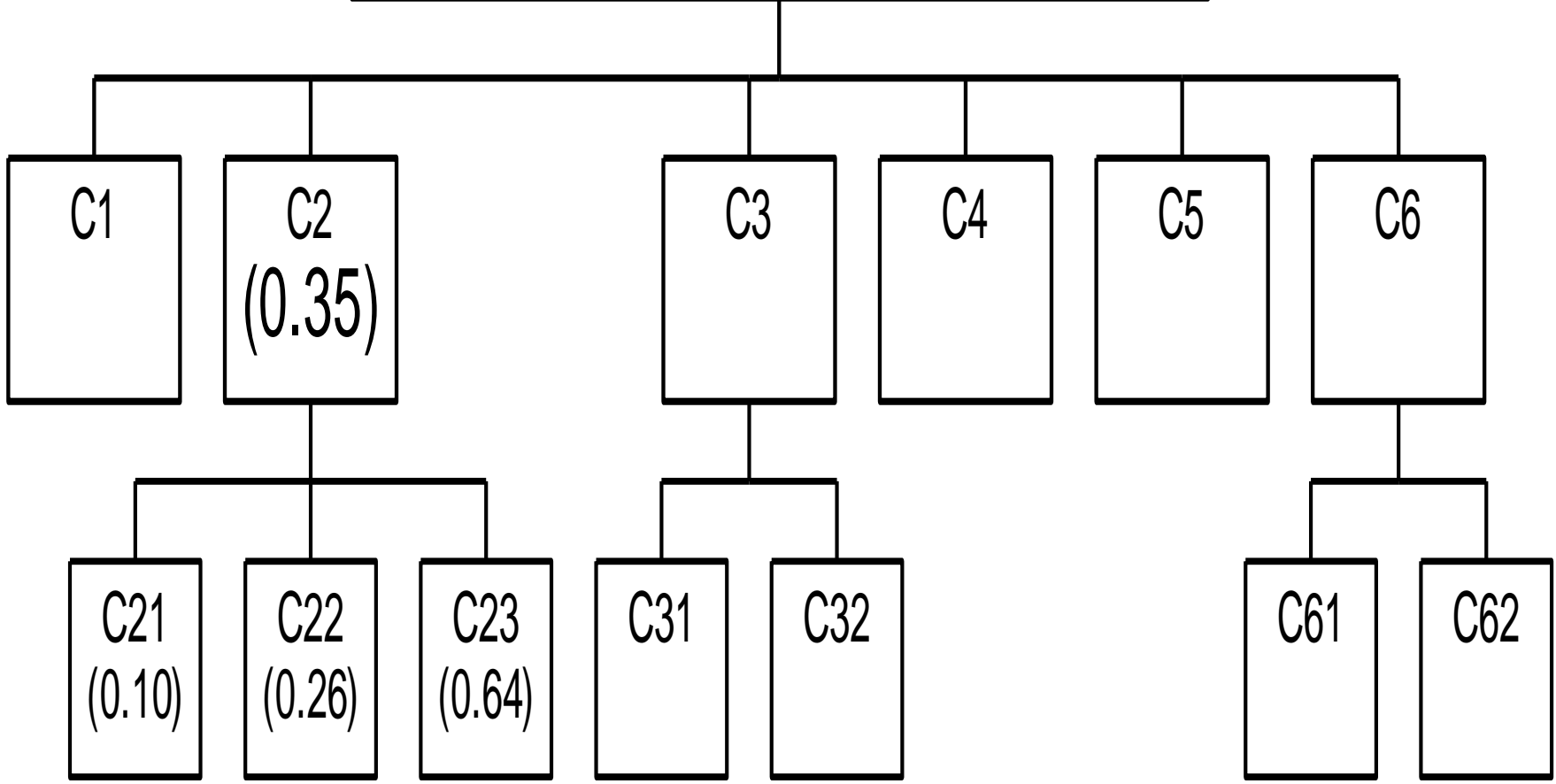


PCM for sub-criteria of C_6

C_6	C_{61}	C_{62}	Weights
C_{61}	1	1/2	0.33
C_{62}	2	1	0.67
CR = 0.00			



Selecting the best nuclear waste disposal strategy



No.	Criteria and Sub-criteria	Weight
1	State of technology	0.35
2	Health, safety and environment impact -Short- term radiological safety -Long-term radiological safety -Ecosystem impact	0.35 $(.35 \times .10) = .035$ $(.35 \times .26) = .09$ $(.35 \times .64) = .22$
3	Cost -Capital cost -Cost of operation	0.11 $(.11 \times .83) = .09$ $(.11 \times .17) = .02$
4	Socio-economic impact	.03
5	Lead time	.07
6	Political impact -national international	.08 $(.08 \times .33) = 0.03$ $(.08 \times .67) = 0.05$



PCM for Alternatives (C₁)

C1	A	B	C	D	E	Wts.
A	1	5	3	4	8	0.487
B		1	1/3	1/2	5	0.099
C			1	2	7	0.235
D				1	5	0.144
E					1	0.034



PCM for Alternatives (C₂₁)

C21	A	B	C	D	E	Wts.
A	1	2	3	2	7	0.388
B		1	2	1	6	0.222
C			1	1/2	5	0.132
D				1	6	0.222
E					1	0.038



PCM for Alternatives (C₂₂)

C22	A	B	C	D	E	Wts.
A	1	1/3	3	1/3	1/5	0.085
B		1	5	2	1/3	0.232
C			1	1/5	1/7	0.042
D				1	1/3	0.176
E					1	0.465



PCM for Alternatives (C₂₃)

C23	A	B	C	D	E	Wts.
A	1	1	3	2	1/3	0.184
B		1	3	2	1/3	0.184
C			1	1/2	1/5	0.066
D				1	1/4	0.106
E					1	0.459



PCM for Alternatives (C31)

C31	A	B	C	D	E	Wts.
A	1	1/5	5	1/4	1/7	0.067
B		1	7	3	1/3	0.256
C			1	1/7	1/9	0.028
D				1	1/5	0.147
E					1	0.500



PCM for Alternatives (C₃₂)

C32	A	B	C	D	E	Wts.
A	1	1/5	5	1/7	1/6	0.068
B		1	7	1/3	1/2	0.189
C			1	1/9	1/7	0.029
D				1	3	0.467
E					1	0.255



PCM for Alternatives (C₄)

C4	A	B	C	D	E	Wts.
A	1	1/3	5	1/2	1/5	0.097
B		1	7	3	1/3	0.250
C			1	1/5	1/7	0.035
D				1	1/5	0.127
E					1	0.490



PCM for Alternatives (C₅)

C5	A	B	C	D	E	Wts.
A	1	3	2	4	5	0.412
B		1	1/2	2	3	0.155
C			1	4	5	0.285
D				1	2	0.090
E					1	0.058



PCM for Alternatives (C₆₁)

C61	A	B	C	D	E	Wts.
A	1	1/3	1	1/4	1/5	0.068
B		1	3	1/2	1/3	0.169
C			1	1/4	1/5	0.068
D				1	1/2	0.270
E					1	0.425



PCM for Alternatives (C₆₂)

C62	A	B	C	D	E	Wts.
A	1	1	1	7	7	0.304
B		1	1	7	7	0.304
C			1	7	7	0.304
D				1	1	0.043
E					1	0.043



Synthesis

	C1 0.35	C21 .035	C22 .09	C23 .22	C31 .09	C32 .02	C4 0.03	C5 0.07	C61 0.03	C62 0.05	Glo bal
A	0.487	0.388	0.085	0.184	0.067	0.068	0.097	0.412	0.068	0.304	0.294 1
B	0.099	0.222	0.232	0.184	0.256	0.189	0.250	0.155	0.169	0.304	0.172
C	0.235	0.132	0.042	0.066	0.028	0.029	0.035	0.285	0.068	0.304	0.149
D	0.144	0.222	0.176	0.106	0.147	0.467	0.127	0.090	0.270	0.043	0.141
E	0.034	0.038	0.465	0.459	0.500	0.255	0.490	0.058	0.425	0.043	0.242



Global (Overall) Weights of the Alternatives

Alternative	Global Weight
A : Geological Disposal	0.294
B: Very Deep Hole	0.172
C: Island Disposal	0.149
D: Subseabed Disposal	0.141
E: Disposal into Space	0.242



Group Decision Making

Respondent 1: "State of Technology" is strongly more important than "H-S-E"

• Respondent 2 "H-S-E" is strongly more important than "State of Technology"

	S-o-T	H-S-E	Cost	SE Impact	Lead Time	Pol Impact	Priorities
S-o-T	1	5					
H-S-E		1					
Cost			1				
SE Impact				1			
Lead Time					1		
Pol impact						1	

	S-o-T	H-S-E	Cost	SE Impact	Lead Time	Pol Impact	Priorities
S-o-T	1	1/5					
H-S-E		1					
Cost			1				
SE Impact				1			
Lead Time					1		
Pol impact						1	



Group Decision Making

Respondent 1: "State of Technology" is strongly more important than "H-S-E"

• Respondent 2 "H-S-E" is strongly more important than "State of Technology"

	S-o-T	H-S-E
S-o-T	1	5
H-S-E		1

	S-o-T	H-S-E
S-o-T	1	1/5
H-S-E		1

• Combined Decision?

	S-o-T	H-S-E
S-o-T	1	?
H-S-E	1/?	1



Group Decision Making

•DM1

•very strongly
(7)

	A	B
A	1	X
B	$1/X$	1

•DM2

•moderately (3)

•Use arithmetic mean
to combine decisions?

NO

$$\cdot X = (7+3)/2 = 5$$

$$\cdot 1/X = (1/7+1/3)/2 = 0.24 \neq 1/5$$

•Use geometric mean
to combine decisions?

YES

$$\cdot X = \sqrt{7*3} = 4.58$$

$$\cdot 1/X = \sqrt{1/7*1/3} = 0.22 = 1/4.58$$



AHP:

Absolute Measurement



AHP : Absolute Measurement:

Step 1: Construct the hierarchy.

Step 2: Calculate weights of the criteria by using relative measurement

Step 3: Divide each criterion into several intensities and calculate the weights.

Step 4: Develop ranges for the intensities.

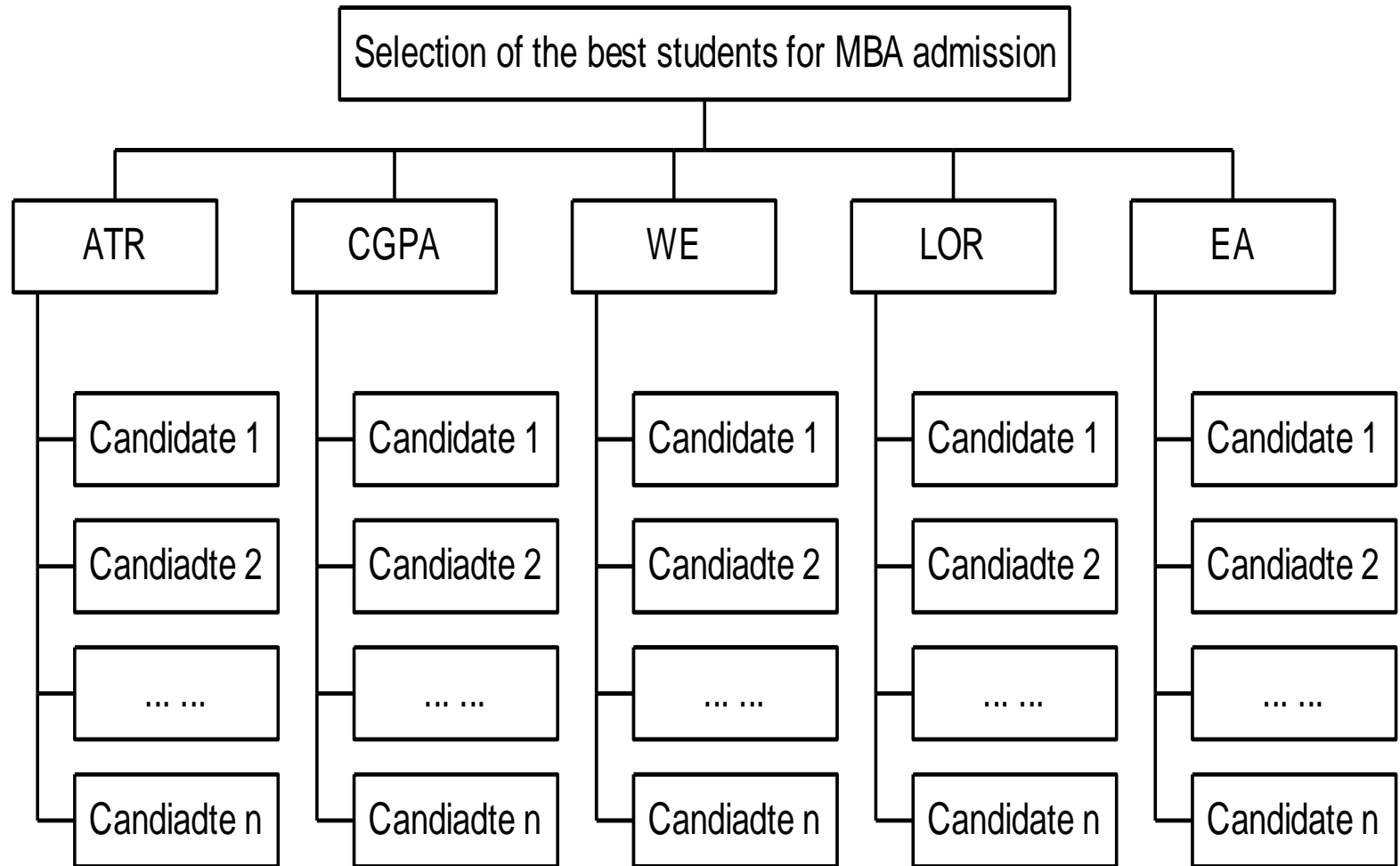
Step 5: Pick one alternative and measure its performance with respect to all the criteria.



Example:

Suppose UIA has kept the criteria: Admission Test Result, CGPA, Working Experience, Letter of Recommendation and Extra-curricular Activity for its MBA admission. By using absolute measurement procedure, guide UIA admission officers in selecting the MBA students.





	ATR	CGPA	WE	LOR	EA	Wts.
ATR	1	1/4	5	5	8	0.295
CGPA		1	6	6	9	0.510
WE			1	1	4	0.084
LOR				1	3	0.078
EA					1	0.033



Intensities and their weights

	EX	VG	G	A	BA	P	Weights
EX	1	2	3	5	7	9	0.384
VG	1/2	1	3	5	6	8	0.296
G	1/3	1/3	1	4	5	6	0.172
A	1/5	1/5	1/4	1	3	4	0.078
BA	1/7	1/6	1/5	1/3	1	3	0.042
P	1/9	1/8	1/6	1/4	1/3	1	0.028
CR = 0.05							
Legend: EX= excellent, VG = very good, G= good, A= average, BA = below average, P = poor							



Intensities and their weights

	EX	G	A	P	Weights
EX	1	4	5	7	0.554
G	1/4	1	4	6	0.289
A	1/5	1/4	1	3	0.106
P	1/7	1/6	1/3	1	0.051

CR = 0.06

Legend: EX = Excellent, G = Good, A = Average, P = Poor



Intensities	Admission Test (0.295)		CGPA (0.510)		Working Experience (0.084)		Letter of Recommendation (0.078)	Extra curricular activity (.033)
	Range	Weight	Range	Weight	Range	Weight	Weight	Weight
Excellent	90-100	0.384 (0.113)	3.6-4	0.384 (0.196)	>5	0.554 (0.046)	0.554 (0.043)	0.554 (0.018)
Very Good	80-90	0.296 (0.087)	3.25-3.6	0.296 (0.151)				
Good	70-80	0.172 (0.051)	3-3.25	0.172 (0.088)	3-5	0.288 (0.024)	0.288 (0.022)	0.288 (0.009)
Average	60-70	0.078 (0.023)	2.75-3	0.078 (0.040)	1-3	0.106 (0.008)	0.106 (0.008)	0.106 (0.003)
Below Average	50-60	0.042 (0.012)	2.5-2.75	0.042 (0.012)				
Poor	0-50	0.028 (0.008)	<2.5	0.028 (0.014)	<1	0.051 (0.004)	0.051 (0.004)	0.051 (0.002)



Candidates	ATR	CGPA	WE	LOR	EA	Overall	Rank
C-1	76 (0.051)	3.2 (0.088)	2 (0.008)	Good (0.022)	Poor (0.002)	0.171	4
C-2	95 (0.113)	3.5 (0.151)	Nil (0.004)	Excel (0.043)	Good (0.009)	0.320	1
C-3	56 (0.012)	3.7 (0.196)	4 (0.024)	Excel (0.043)	Excel (0.018)	0.293	2
C-4	92 (0.113)	2.9 (0.040)	Nil (0.004)	Avg. (0.008)	Excel (0.018)	0.183	3
C-5	66 (0.023)	2.75 (0.040)	3.5 (0.024)	Poor (0.004)	Good (0.009)	0.100	3



Example 2:

Let us consider the following problem of land suitability analysis for urban development. (this problem is a partial modification of project carried out on Bombay Metropolitan Region (BMR)).

The criteria considered are: Soil Depth, Soil Texture, Slope, Physiography, Flooding Hazard, Road Distance and Railhead Distance.

The possible areas considered are: Rest of Island, Eastern Suburbs, Western Suburbs, Rest of BMR, Thane Municipality Corporation, Kalyan Municipality Corporation and New Bombay.

Guide by using absolute measurement of AHP to select the best area for urbanization.



Determination of Criteria Weights

	SD	ST	SL	PG	FH	RD	RL	Weights
SD	1	5	2	1	3	8	7	0.29
ST		1	1/3	1	1/2	8	7	0.12
SL			1	1	1	8	7	0.19
PG				1	2	8	7	0.20
FH					1	8	7	0.15
RD						1	4	0.03
RL							1	0.02
CR = 0.091								



Soil Depth (0.29)		Soil Texture (0.12)		Slope (0.19)		Physiography (0.20)		Flooding Hazard (0.15)		Road Distance (0.03)		Railhead Distance (0.02)	
Range (cm)	Weight	Type	Weight	Range (cm)	Weight	Type	Weight	Type	Weight	Range (m)	Weight	Range (m)	Weight
>150	.35 (.10)	Loamy sand	.32 (.04)	<3%	.40 (.08)	Flat	.35 (.07)	None	.38 (.06)	<500	.36 (.01)	<500	.36 (.01)
100-150	.30 (.09)	Clay loam	0.28 (.03)	3-8%	.30 (.06)	Convex	.30 (.06)	Slight	.30 (.04)	500-1000	.26 (.01)	500-1000	.26 (.01)
50-100	.20 (.06)	Sandy	0.22 (.03)	8-15%	.20 (.04)	Undulated	.20 (.04)	Moderate	.22 (.03)	1000-2500	.20 (.01)	1000-2500	.20 (.01)
<50	.15 (.04)	Rocky	0.18 (.02)	>15%	.10 (.02)	Hilly	.15 (.03)	High	.10 (.01)	>2500	.18 (.01)	>2500	.18 (.01)



Area	SD (cm)	ST	SL (%)	PG	FH	RD (m)	RL (m)	Over. Scores	Rank
A	125 (0.09)	Loamy (0.04)	2 (0.08)	Hilly (0.03)	Moderate(0.03)	225 (0.01)	1000 (0.01)	0.29	4
B	76 (0.06)	Clay (0.03)	4 (0.06)	Convex (0.06)	High (0.01)	720 (0.01)	720 (0.01)	0.24	6
C	167 (0.10)	Rocky (0.02)	17 (0.02)	Hilly (0.03)	None (0.06)	1500 (0.01)	1500 (0.01)	0.25	5
D	117 (0.09)	Clay loam (0.03)	4 (0.06)	Convex (0.06)	Slight (0.04)	600 (0.01)	600 (0.01)	0.30	3
E	155 (0.10)	Loamy (0.04)	4 (0.06)	Flat (0.07)	Slight (0.04)	450 (0.01)	450 (0.01)	0.33	1
F	25 (0.04)	Sandy (0.03)	23 (0.02)	Undulated (0.04)	High (0.01)	2700 (0.01)	2700 (0.01)	0.16	7
G	145 (0.09)	Loamy (0.04)	9 (0.04)	Flat (0.07)	None (0.06)	700 (0.01)	700 (0.01)	0.32	2



Research Works Using AHP (Relative Measurement)

- Dimensions of Quality in Healthcare Sector
- Critical Success factors of Malaysian Vision 2020



Research Works Using AHP (Absolute Measurement)

- [Employee Performance Evaluation](#)
- [Wakf application](#)
- [Family institution](#)



Applications of AHP in Management

- Human Resource Management
- Total Quality Management
- Environmental Management
- Information Systems Management
- Strategic Management
- Operations Management
- Marketing Management



AHP References

- [Some Selected References](#)



AHP Questionnaires Design

- [Format 1](#)
- [Format 2](#)



Exercise:

- Consider the problem of selection of the best CEO in Malaysia in a particular year. What are the three most important criteria for this selection? Identify these and determine their weights by using AHP.
- Identify only three CEOs in Malaysia at present and determine their 'local' weights with respect to the criteria above.
- Synthesize the criteria and local weights of the CEOs in order to obtain their global or overall weights. (The CEO who obtains the highest weight in your working will be the winner of the award)



Thank You

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