

## Simple Multi-Attribute Rating Technique

### Simple Multi-Atribute Rating Technique

- 1 Identify the decision maker (or decision makers).
- 2 Identify the alternative courses of action.
- 3 Identify the attributes which are relevant to the decision.
- 4 Assign values to measure the alternatives of that attribute.
- 5 Determine a weight for each attribute.
- 6 For each alternative, take a weighted average of the values assigned to that alternative.
- 7 Make a provisional decision.
- 8 Perform sensitivity analysis.



## Step 1: Identify the Decision Maker

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### Step 1: Identify the decision maker.

#### Scenario

A small printing & photocopying business must move from its existing office because the site has been acquired for redevelopment. The owner will be the decision maker.



## Step 2: Identify the Alternative Courses of Action

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### Step 2: Identify the alternative courses of action.

In this case, the owner is considering seven possible locations:

Location		Rent (\$)
Addison Square	A	30 000
Bilton Village	B	15 000
Carlisle Walk	C	5 000
Denver Street	D	12 000
Elton Street	E	30 000
Filton Village	F	15 000
Gorton Square	G	10 000

Keeping costs low is important but there are other factors. For example, Addison is in a prestigious location but is expensive; it is also dark and not very comfortable. Bilton is new and the working conditions would be great but it is several miles from town and the customer base!

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## Step 3: Identify Relevant Attributes

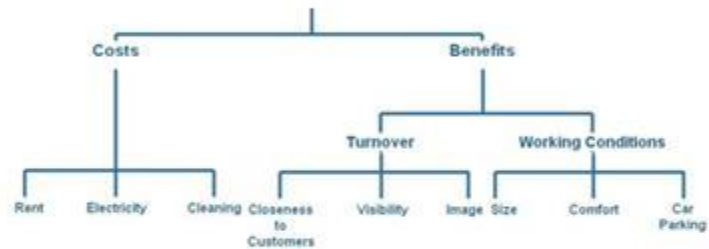
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Step 3: Identify the attributes which are relevant to the decision.

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In this case , let's construct a value tree:

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Five Criteria

1. **Completeness:** all necessary attributes have been included
2. **Operationality:** all attributes are specific enough to allow evaluation
3. **Decomposability:** the attractiveness of one is independent of the others
4. **Absence of redundancy:** no duplication among attributes
5. **Minimum Size:** only necessary & meaningful attributes are included

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## Step 4: Assign Values

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### Step 4: Assign Values

In this case, cost is easy to evaluate:

<b>Location</b>	<b>Rent</b>	<b>Annual cleaning costs</b>	<b>Annual electricity costs</b>	<b>Total cost</b>
Addison Square	\$30,000	\$3,000	\$2,000	\$35,000
Bilton Village	\$15,000	\$2,000	\$800	\$17,800
Carlisle Walk	\$5,000	\$1,000	\$700	\$6,700
Denver Street	\$12,000	\$1,000	\$1,100	\$14,100
Elton Street	\$30,000	\$2,500	\$2,300	\$34,800
Filton Village	\$15,000	\$1,000	\$2,600	\$18,600
Gorton Square	\$10,000	\$1,100	\$900	\$12,000

But how do you evaluate attributes like image and comfort? There are two options:

Direct  
Rating

Value  
Functions



### Step 4: Method One - Direct Rating

Start by ranking the alternatives from most preferred to least preferred.  
In this case, let's start with "image" and assume the following ranking:

- (1) Addison Square
- (2) Elton Street
- (3) Filton Village
- (4) Denver Street
- (5) Gorton Square
- (6) Bilton Village
- (7) Carlisle Walk

Rank on an interval  
scale of 100



Repeat for all attributes:

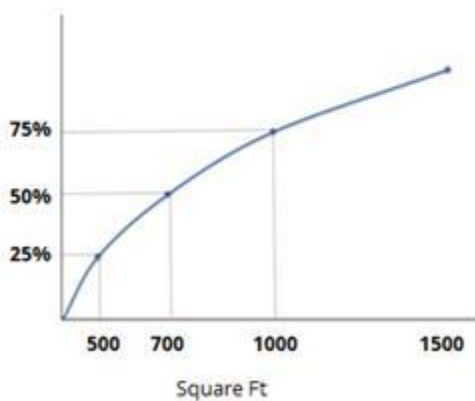
Attribute	Office						
	A	B	C	D	E	F	G
Closeness	100	20	80	70	40	0	60
Visibility	60	80	70	50	60	0	100
Image	100	10	0	30	90	70	20
Size	75	30	0	55	100	0	50
Comfort	0	100	10	30	60	80	50
Car Parking	90	30	100	90	70	0	80



### Step 4: Method Two - Value Functions

Using the attribute "size," determine the optimal value. In this case, assume the owner likes large offices so he would assign the optimal value, i.e.  $v(1500)=100$ , to Elton Street as it has 1500 square feet. Similarly,  $v(400)=0$  as Carlisle has 400 square feet.

Determining the midpoint requires some subjectivity but assume that owner settles on  $v(700)=50$ . In order to plot this curve, you will need the quarter points. The owner selected the following quarter points (based on preference):  $v(500)=25$  and  $v(1000)=75$ .



Curves can be inverted;  
here is the value curve for "closeness:"





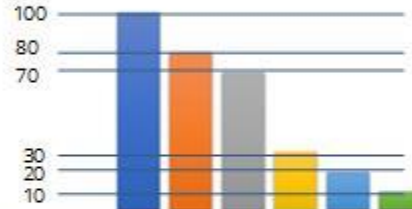
## Step 5: Determine Weights

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### Step 5: Determine Weights

List the alternatives in descending order and determine the "swing" between attributes:

- (1) Closeness to customers
- (2) Visibility
- (3) Image
- (4) Size
- (5) Comfort
- (6) Car Parking



In this case, the "swing" in visibility is 80% as important as the swing in closeness; hence of value of 80% is assigned to visibility.

Now divide each raw weight by the sum of the raw weights and multiply by 100

Attribute	Raw Weight	Normalized Weight
Closeness	100	32
Visibility	80	26
Image	70	23
Size	30	10
Comfort	20	6
Car Parking	10	3
	310	100

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## Step 6: Take a Weighted Average

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Aggregate for each attribute using the additive model. Here is one example:

Attribute	Addison	Normalized	
	Square	Weight	Value x Weight
Closeness	100	32	3200
Visibility	60	26	1560
Image	100	23	2300
Size	75	10	750
Comfort	0	6	0
Car Parking	90	3	270
			8080

Values, weights, and aggregate averages are as follows:

Attribute	Weight	Office						
		A	B	C	D	E	F	G
Closeness	32	100	20	80	70	40	0	60
Visibility	26	60	80	70	50	60	0	100
Image	23	100	10	0	30	90	70	20
Size	10	75	30	0	55	100	0	50
Comfort	6	0	100	10	30	60	80	50
Car Parking	3	90	30	100	90	70	0	80
Aggregate Benefits		80.8	39.4	47.4	52.3	64.8	20.9	60.2

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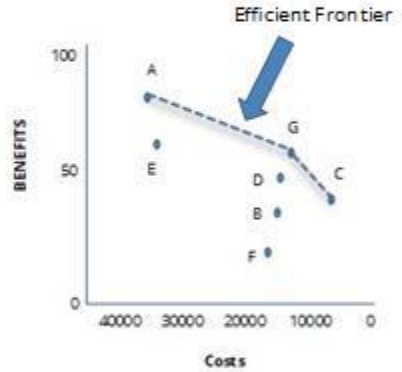
## Step 7: Make a Provisional Decision

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### Step 7: Make a Provisional Decision

Using the financial costs as your x axis and the aggregate value score as your y axis, plot the benefits against costs:



Offices A, G, and C are on the "efficient frontier" and are said to dominate the other offices. These offices are your leading alternatives.



## Step 8: Perform Sensitivity Analysis

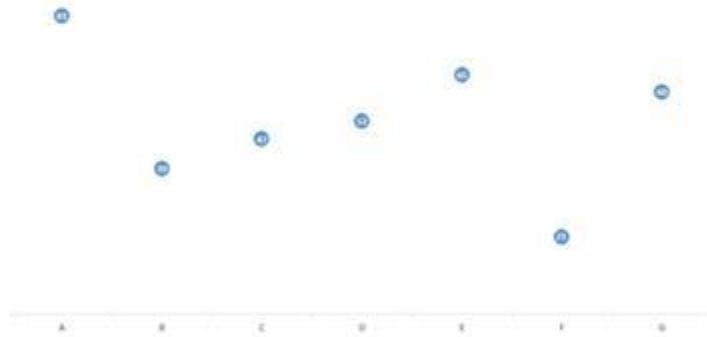
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### Step 8: Sensitivity Analysis

Sensitivity analysis is used to examine the robustness of a decision.

What if the raw weight placed on image, for example, was errant? How might that impact the value of benefits for the locations? By extension, would the original provisional decision be well-informed?



Click on the image to see the impact of toggling the value of the image score upon the aggregate benefit scores:



## Sensitivity

