

Prioritization Matrices

This tool can help you decide what to do after key actions, criteria or Critical To Quality (CTQ) characteristics have been identified, but their relative importance (priority) is not known with certainty. Prioritization matrices are especially useful if problem-solving resources, such as people, time or money, are limited, or if the identified problem-solving actions or CTQs are strongly interrelated.

To create a matrix, you must judge the relative ability of each possible action to effectively deliver the results you want compared to every other identified action. The product of your work is a weighted ranking of all the possible actions you are considering. The finished matrix can help a team make an overall decision or determine the sequence in which to attack a problem or work toward an objective.

Prioritization matrices are especially useful in the *project bounding* and *analyze* phases of Lean Six Sigma quality.

What can it do for you?

You should consider creating a prioritization matrix if:

- You cannot do everything at once,
- You are uncertain about the best use of your resources or energy or
- You are looking toward specific improvement goals.

This tool can also help you make a decision in situations where the criteria for a good solution are known or accepted, but their relative importance is either unknown or disputed. For example, a prioritization matrix might be used to help decide the purchase of a major piece of equipment or the selection of a single-source supplier. Depending on how much time you have and how complex your problem is, there are a number of options for constructing a prioritization matrix.

How do you do it?

1. The first step in applying the Full Analytical Criteria Method is to ensure that the people working on the matrix agree on the ultimate goal they are trying to achieve.
2. Next, create a list of criteria or characteristics needed to achieve the goal or meet the objective. (The idea is simply to list the criteria without considering their relative importance. That happens later.) The team can do this by discussion or brainstorming. The purpose is to list all of the criteria that might be applied to all of the options. For example, if the team is considering which improvement step to attack first, some of their criteria might be:
 - a. Low investment cost
 - b. Maximum use of existing technology
 - c. High potential dollar savings
 - d. High improvement potential for process speed
 - e. High improvement potential for defect reduction
 - f. High customer satisfaction potential
 - g. Minimum impact on other processes
 - h. Ease of implementation
 - i. High probability of quick results Note the way the criteria are worded. They should clearly convey the desired outcome. “Low investment cost” is a much clearer criterion than “cost” would be.
3. Once the total list is developed, the next step is to judge the relative importance of each criterion compared to every other criterion. To do that, make an L-shaped matrix with all the criteria listed on both the horizontal and the vertical legs of the *L*.

Criteria	Criteria being compared to									Row	%
	<i>Low cost</i>	<i>Use of technology</i>	<i>Potential savings</i>	<i>Increased speed</i>	<i>Decreased defects</i>	<i>Cust. satisfaction</i>	<i>Minimum impact</i>	<i>Easy to implement</i>	<i>Quick results</i>	T O T A L	
	a.	b.	c.	d.	e.	f.	g.	h.	i.		
a. Low cost		5									
b. Use of technology	0.2										
c. Potential savings											
d. Increased speed											
e. Decreased defects											
f. Cust. satisfaction											
g. Minimum impact											
h. Easy to implement											
i. Quick results											
Column Total											

Compare the importance of each criterion on the vertical side of the matrix to each criterion listed along the horizontal side using these numeric weightings:

- 1.0** = The criterion being considered is equally important or equally preferred when judged against the criterion you are comparing it to.
- 5.0** = The criterion being considered is significantly more important or more preferred.
- 10.0** = The criterion is extremely more important or more preferred.
- 0.2** = It is significantly less important or preferred.
- 0.1** = It is extremely less important or preferred.

Although these specific numeric ratings are to some extent arbitrary, by applying them consistently in a prioritization matrix, you will generate a valid understanding of relative importance. When completing or interpreting the matrix, read across the rows (not down the columns). For example, if criterion *a* was significantly more important than criterion *b*, where row *a* intersects column *b* write 5. Remember that, if criterion *a* is *significantly more* important than criterion *b*, criterion *b* must be *significantly less* important than criterion *a*. Where row *b* intersects column *a* write 0.2.

Continuing in a similar manner, compare each criterion to every other criterion, reach a decision about relative importance, and enter the appropriate values. Do this until the matrix is full. Remember that, whenever you compare two criteria, you should mark the rating where the row of the criterion being compared intersects the column of the criterion you are comparing it to. The inverse of this value should be entered where the column of the criterion being compared intersects the row of the criterion you are comparing it to. That is, you should enter 1 and 1, 5 and 0.2, or 10 and 0.1 for each comparison.

Add the values recorded in each column, then add the column totals to get the grand total.

Add the values recorded in each row, then add the row totals to get the grand total. The grand total across the columns should agree with the grand total down the rows. If it does not, check your work. Divide each row total by the grand total. *This percentage is the weighting that shows the relative importance of each criterion.*

4. Now that you know the relative importance of each criterion, the next step is to evaluate how well each of your possible choices meet each of the weighted criteria. Those *possible choices* could be such things as which improvement steps to take first, which piece of equipment to buy or which supplier to use.

To complete this step, make a new L-shaped matrix with all your *possible choices* on both the horizontal and the vertical legs. If you are considering which improvement steps to take, your *possible choices* might look something like this:

- A. Error prevention training
- B. Purchase new equipment A
- C. Purchase new equipment B
- D. Refurbish existing equipment C
- E. Refurbish existing equipment D
- F. Rewrite procedures for clarity
- G. Implement barcoding
- H. Cellularize operation 1
- I. Cellularize operation 2

5. Pick the first criterion you wish to consider and compare each *possible choice* with every other *possible choice* by asking how well it will deliver that criterion or characteristic. For example, if the first criterion you were considering was *high potential dollar savings*, you would compare each option with every other option, in terms of its potential to deliver high monetary savings. Build the matrix as you did when initially evaluating the relative importance of the criteria by putting numeric values in the matrix intersections:

- 1.0 = The choice being considered is equally able to deliver the desired criterion or equally preferred when judged against the choice you are comparing it to.
- 5.0 = The choice being considered is significantly more important or more preferred.
- 10.0 = The choice is extremely more important or more preferred.
- 0.2 = It is significantly less important or preferred.
- 0.1 = It is extremely less important or preferred. Complete the matrix; add the rows and columns and calculate the percentages as you did with the criteria matrix.

For Criterion:

c. High Money Saving Potential

Option	Option being compared to									Row TOTAL	%
	<i>Error proofing</i>	<i>New equipment A</i>	<i>New equipment B</i>	<i>Fix equipment C</i>	<i>Fix equipment D</i>	<i>New procedures</i>	<i>Barcoding</i>	<i>Cellularize Op. 1</i>	<i>Cellularize Op. 2</i>		
	A.	B.	C.	D.	E.	F.	G.	H.	I.		
A. Error proofing		5	1	5	10	1	0.2	5	1	28.2	16.7
B. New equipment A	0.2		0.2	1	1	0.2	0.1	0.2	1	3.9	2.3
C. New equipment B	1	5		5	5	5	0.2	5	1	27.2	16.2
D. Fix equipment C	0.2	1	0.2		0.2	0.2	0.1	1	0.2	3.1	1.8
E. Fix equipment D	0.1	1	0.2	5		1	0.1	5	0.2	12.6	7.5
F. New procedures	1	5	0.2	5	1		1	1	1	15.2	9.0
G. Barcoding	5	10	5	10	10	1		5	5	51.0	30.3
H. Cellularize Op. 1	0.2	5	0.2	1	0.2	1	0.2		0.2	8.0	4.8
I. Cellularize Op. 2	1	1	1	5	5	1	0.2	5		19.2	11.4
Column Total	8.7	33.0	8.0	37.0	32.4	10.4	2.1	27.2	9.6	168.4	100.0

The example above is what a matrix comparing the possible choices for *high potential for dollar savings* might look like.

- In the same way; complete a matrix comparing each of the *possible choices* for each of the remaining criteria. If we did that for all our criteria, we would have to create a total of nine matrices comparing every combination of *possible choices* for its relative ability to deliver on each of the identified criteria.

You may choose to simplify this process by eliminating some criteria that had a very low percentage weighting. (In our example, we limited ourselves to the five highest-ranking criteria. Besides the matrix for *high potential dollar savings*, we would create additional matrices for *high improvement potential for process speed*, *high improvement potential for defect reduction*, *high customer satisfaction potential* and *high probability of quick results*. These additional matrices are not shown here.)

- The final step in the Full Analytical Criteria Method is to merge the relative ability of a *possible choice* to deliver a desired criterion with the relative weighting of that criterion. To do this, make a new L-shaped matrix with all the options or *possible choices* on the vertical leg and all the criteria considered on the horizontal leg. Make the columns fairly wide to allow some calculation.

Again, in our example, we eliminated some of the criteria to make things simpler.

- Under each criterion, in the *weight* row, note the *percentage* weighting you got from your first matrix, the one that compared each criterion with every other criterion.
- In each criterion column, enter the *percentage* numbers you got when you compared each option with every other option for that criterion. (The actual matrices for criteria *d*, *e*, *f* and *i* are not shown.) Enter these numbers as the first numbers in each column of the completed prioritization matrix.
- Multiply each *option* percentage by the *criterion* percentage weight for that criterion. (The results are the second numbers, the ones after the equal signs in our example.)
- Add the results of your multiplication down each column. The result for each column should be approximately the same as that criterion's percentage weight (the number in the *weight* row).

	Criteria					Row T O T A L	%
	c. High potential savings	d. High potential speed	e. High decrease of defects	f. Customer satisfaction	i. Quick results		
Options	Weight .303 X	Weight .114 X	Weight .167 X	Weight .162 X	Weight .090 X		
A. Error proofing	.167 = .051	.111 = .013	.074 = .012	.169 = .027	.197 = .018	.121	14.4
B. New equipment A	.023 = .007	.131 = .015	.060 = .010	.041 = .007	.028 = .003	.042	5.0
C. New equipment B	.162 = .049	.091 = .010	.089 = .015	.153 = .025	.096 = .009	.108	12.9
D. Fix equipment C	.018 = .005	.223 = .025	.087 = .015	.113 = .018	.079 = .007	.070	8.4
E. Fix equipment D	.075 = .023	.184 = .021	.173 = .029	.274 = .044	.224 = .020	.137	16.3
F. New procedures	.090 = .027	.029 = .003	.214 = .036	.029 = .005	.091 = .008	.079	9.4
G. Barcoding	.303 = .092	.037 = .004	.101 = .017	.147 = .024	.063 = .006	.143	17.1
H. Cellularize Op. 1	.048 = .015	.104 = .012	.093 = .016	.044 = .007	.175 = .016	.066	7.9
I. Cellularize Op. 2	.114 = .035	.090 = .010	.109 = .018	.030 = .005	.047 = .004	.072	8.6
Column Total	.304	.113	.168	.162	.091	.838	100.0

- Add the *column total* row to come up with a *grand total*.
- Now, add the results of your multiplication across each row, and add the *row total* column. The result should be the same as the *grand total* you got by adding the *column total* row.

- Divide each *row total* by the *grand total* to get the *percentage* for each option. (Add the *percentage* scores as a check. The sum should be approximately 100 %.) This is the answer to your question.
- These numbers show the relative value of a number of options or possible choices when considered against a collection of independent criteria or critical to quality (CTQ) characteristics.

Now what?

Any time a choice must be made, some form of prioritization occurs. Those responsible for making the choice may play a hunch, take a vote or analyze for some specific impact they think is important, but they *will* decide what they think is best, most important or should be done first. If the prioritization process is incomplete or arbitrary, chances of success are lessened.

The discipline of a prioritization matrix allows you to avoid setting arbitrary priorities that have less likelihood of helping you reach your desired objectives. The Full Analytical Method does take considerable time and effort, however, and should be used only if the risks or potential benefits make it worthwhile.



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