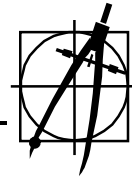


Evaluation Matrices



Evaluation matrices are used to evaluate a number of options against prioritized criteria. This process is relatively simple to apply and aids the team in making objective decisions.

Project activities in which evaluation matrices are useful:

- * Evaluating customer “wants” against functional requirements; functional requirements against design requirements; and design requirements against potential design solutions.

Other tools that are useful in conjunction with evaluation matrices:

- * Brainstorming
- * Engineering Records
- * Kano Model
- * Material Selection and Acquisition
- * Prioritization Matrices
- * Quality Function Deployment
- * Requirements Management
- * Sources of Ideas and Information

Introduction

The use of an evaluation matrix is one method of objectively evaluating a number of options against a number of criteria. These criteria are prioritized before the evaluation is made with greater weighting to those items of most importance. If there are criteria that absolutely must be met, two levels of evaluation matrices can be used. The first level acts as a filter with each option evaluated against the mandatory criteria. Those options that meet every mandatory criterion go on to the second level to be evaluated against prioritized criteria.

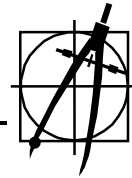
Application of Evaluation Matrices

If the evaluation matrix is being used to evaluate various design solutions, previously established requirements are usually used as the criteria. Since requirements are generally written in terms of “shall” or “should”, the mandatory criteria used in the first level of the evaluation are represented by the “shall” requirements while the “should” requirements are prioritized and used in the second level evaluation.

Establishing Evaluation Criteria

If criteria have not been established, they should be generated by the design team and be representative of the current “problem” under investigation. When establishing the criteria, the team should make every effort not to reflect on the options under consideration to help ensure that the criteria are developed without bias. Care should be taken in the wording of each criterion so there is consistent interpretation by all involved

Evaluation Matrices



in the evaluation process. Each criterion should be distinct from all others and each should be inspected to ensure that none are in conflict with another.

Prioritizing Criteria

Criteria should first be assigned to one of two categories – mandatory or desirable.

Mandatory Criteria

Mandatory criteria are requirements that absolutely must be satisfied for an option to be considered feasible. These can be considered “go/no-go” criteria. Further prioritization is not done within the mandatory group of criteria.

Desirable Criteria

Desirable criteria are requirements that should be met to some degree as reflected by some benefit. Satisfaction of these criteria is highly desirable but some criteria may be sacrificed to others if the result allows a net benefit.

The rating of desirable criteria is left to the discretion of the evaluation team. In general, the greater the importance or value of a criterion, the higher the value assigned. A “high, medium, low” scale can be used with numeric representation used for each level (e.g., high=5, medium=3, low=1) or a scale of 1 to 10 can be employed.

When assigning importance to criteria, there is often the tendency to assess all criteria as relatively important. This can lead to lack of differentiation in the evaluation of the different options. If this is a concern, consider establishing some guidelines. For example, if there are 20 criteria to be prioritized and a 1 to 10 scale is being used, then each rating should be used twice on average. Therefore, an appropriate rule could be that each rating must be used at least once and no more than three times.

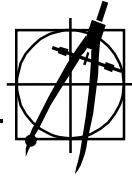
For evaluation purposes, a single requirement can be expressed as both a mandatory and a desirable criterion. For example, a weight requirement may require that the weight of the product must be less than 50 kg. and should be less than 30 kg.

First Level Evaluation

If mandatory criteria are being used, each option under consideration should be evaluated against these mandatory criteria. This step can be skipped if only desirable criteria are being used in the evaluation.

The first level evaluation is fairly simple. Essentially, each option is considered against each of the mandatory criteria. If any option fails to meet one or more mandatory criteria, that option is not considered any further.

Evaluation Matrices



Example:

	Option 1	Option 2	Option 3
Mandatory Criterion A	Pass	Pass	Pass
Mandatory Criterion B	Fail	Pass	Pass
Mandatory Criterion C	Pass	Pass	Pass
Mandatory Criterion D	Pass	Pass	Pass

In the example, Option 1 failed to meet Mandatory Criterion B, therefore unless the team decides that further consideration is warranted, it is dropped from the group of feasible options and is not considered in the second level evaluation.

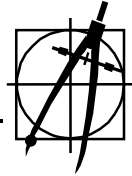
Second Level Evaluation

This evaluation matrix assesses the options that have met all of the mandatory criteria against the desired criteria. Each option is assigned a score reflecting how well the option satisfies each criterion. As with the weightings, the team can determine the method of scoring. A simple approach would be to score each option as exceeds, full compliance, partial compliance, non-compliance with assigned values of 5, 3, 1 and 0 respectively. If finer granularity is required, a ten-point scale can be used as long as each unit of the scale is defined such that scores can be applied consistently.

If desired, and if criteria can be appropriately divided into the Kano Model sub-categories of performance (more is better) and threshold criteria (no gains made by exceeding threshold), two scoring scales may be used. The scale used for performance criteria would assign high scores to options exceeding the criteria, while the scale used for threshold criteria would assign a maximum score for meeting the criteria. Exceeding threshold criteria would not provide a greater score as this excess would have no value.

Once all options have been scored for all criteria, each individual score is multiplied by the appropriate criterion weighting. The total score is then calculated for each option. The greater the score, the better the option satisfies the criteria. Options that score within ~10% of one another should be considered relatively equal in satisfying the criteria.

Evaluation Matrices



Example:

	<i>Weighting</i>	Option 2 Scores		Option 3 Scores	
		Assigned	Weighted	Assigned	Weighted
Criteria A	5	5	25	1	5
Criteria B	1	3	3	5	5
Criteria C	3	3	9	5	15
Totals			37		25

Although both Options 2 and 3 both had assigned scores that would total 11, Option 2 had a significantly higher weighted total score. This greater score indicates that Option 2 either satisfies more criteria or better satisfies criteria that have been determined to be of greater importance. In the above example, the latter explanation applies.

Interpreting Results

As with most tools utilized in design, it is important to consider results carefully. One should not change requirements or criteria to favour any particular option. However, if the team feels that an option should be seriously considered although the “numbers” say otherwise, it is prudent to conduct further exploration until a definitive decision is made with which the team feels comfortable.