Evaluation of Engineering Design Alternatives
Table - Evaluation Summary (three alternatives)

Source [1] adopted 2002-present, for ECET/CPET 491 Senior Design Project II, Indiana University-Purdue University Fort Wayne, Indiana

Item	Evaluation Parameter	Weighting Factor	Configuration A		Configuration B		Configuration C	
			Base Rate	Score	Base Rate	Score	Base Rate	Score
1	**Performance** – input, output, accuracy, range compatibility	14	6	84	9	126	3	42
2	**Operability** – simplicity and ease of operation	4	10	40	7	28	4	16
3	**Effectiveness** – Ao, MTBM, Mct, MDT, MLH/OH	12	5	60	8	96	7	84
4	**Design characteristics** – reliability, maintainability, human factors, supportability, producibility, inter-changeability	9	8	72	6	54	3	27
5	**Design data** – design drawing, specifications, logistics data, operating and maintenance procedure	2	6	12	8	16	5	10
6	**Test aids** – common and standard test equipment, calibration standards, maintenance and diagnostic computer programs	3	5	15	8	24	3	9
7	**Facilities and utilities** – space, weight, volumes, environment , power, heat, water, air conditioning	5	7	35	8	40	4	20
8	**Spare/repair parts** – part type and quality, standard parts, procurement time	6	9	54	7	42	5	30
9	**Flexibility/growth potential** – for reconfiguration, design change acceptability	3	4	12	8	24	6	18
10	**Schedule** – research and development, production	17	7	119	8	136	9	153
11	**Cost** – life cycle (R&D, investment, O &M)	25	10	250	9	225	5	125
Subtotal				753		811		534
Derating factor (development risk)				113 (15%)		81 (10%)		197 (20%)
Grand Total		100		640		730		427

Acronyms:

Ao – Operational Availability
MTBM – Mean Time Between Maintenance
MCT – Mean Corrective Maintenance Time
MPT – Mean Preventive Maintenance Time
MDT – Maintenance Down Time
O&M – Operation & Maintenance
MLH/OH – Maintenance Labor Hours per Operating Hours

C.6 Design Evaluation of Alternatives [1]

C.6.1 Definition of the Problem

Company DEF is responsible for the design and development of a major system, which, in turn, comprises a number of large subsystems. Subsystem XYZ is to be procured from an outside supplier, and there are three different configurations being evaluated for selection. Each of the configurations represents an existing design, with some redesign and additional development necessary to be compatible with the requirements for the new system. The evaluation criteria include various parameters, such as performance, operability, effectiveness, design characteristics, schedule, and cost. Both qualitative and quantitative considerations are covered in the evaluation process.

The Analysis Process and Computation Method [1]

- Develop a list of evaluation parameters; there is no single parameter (or figure or merit) that is appropriate by itself.
- Weighting Factors
  - Determine the level of importance of each; Quantitative weighting factors from 0 to 100 are assigned to each parameter in accordance with the degree of importance. The Delphi method, or an equivalent evaluation technique, may be used to establishing weighting factors. The sum of all weighting factor is 100.
  - For each of the 11 parameters in the table, the analyst may wish to develop a special checklist including criteria against which to evaluate the three proposed configurations. For instance, the parameter "performance" may be described in terms of degrees of desirability; that is "highly desirable," "desirable," or "less desirable." Although each configuration must comply with a minimum set of requirements, one may be more desirable than the next when looking at the proposed performance characteristics. In other words, the analyst should break down each evaluation parameter into "levels of goodness."
- Base Rate
  - Each of the three proposed configurations of subsystems XYZ is evaluated independently, using the special checklist. Based on rating values from 0 to 10 are applied according to the degree of compatibility with desired goal. If a "highly desirable" evaluation is realized, a rating of 10 is assigned.
- Score
  - The base-rate values are multiplied by the weighting factors to obtain a score.
- Total Score
  - The total score is then determined by adding the individual scores for each configuration.
- Derating Factor (risk)
  - Considering the redesign effort, a special derating factor is applied to cover the risk associated with the failure to meet a given requirement.
- The resultant score

- Total score = Total Score – Derating Factor

References

1. Benjamin S. Blanchard, *System Engineering Management*, 4th Ed, by, published by Wiley, pages 468-470
2. Delphi Method, http://en.wikipedia.org/wiki/Delphi_method
3. Kerstin Guhls and Fraunholder , Delphi Method, Institute for Systems and Innovation Research, Germany, http://www.unido.org/fileadmin/import/16959_DelphiMethod.pdf
4. NIST Engineering Statistics Handbook, http://www.itl.nist.gov/div898/handbook/