Continuous Improvement Toolkit

PUGH MATRIX

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A decision method used to **compare** and **select** the best option from a set of alternatives.

A qualitative technique that is used to determine which alternative is more valuable than the others based on predefined criteria.

A form of prioritization matrix
It allows for example to compare multiple design concepts versus a *baseline design* using customer requirements as the criteria for comparison.
In a Pugh matrix, the candidate alternatives are compared against a reference or standard which might be . . .

- The current solution that already exists.
- A goal or benchmark to be reached in the future.
Often used by engineers when making **design** decisions during the product development cycle.

Which product design proposal best matches customer needs and other organizational goals?
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Other uses . . .

- Deciding which **investment** to take
- Deciding which **vendor** to select
- Deciding which **improvement project** to initiate
Other uses . . .

When improving or redesigning processes to select the solution that will achieve the best performance results.

Which improvement option best matches customer and organizational goals?
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BENEFITS

- Helps making more informed and justifiable decisions
- Subjective opinions about one alternative versus can be made more objective
- Does not require a great amount of quantitative data
- Allows the team to agree on priorities and move toward the action collectively

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Evaluation Criteria

Represent defined **standards** by which the different alternatives can be measured and compared.

Developing a **list of criteria** is the first step before evaluating the candidate alternatives.
Evaluation Criteria

For **product design**, consider customer requirements to develop the evaluation criteria

For **process design**, consider the voice of the customer to develop the evaluation criteria

Should be easily measured and relevant to the situation
Evaluation Criteria

How to develop evaluation criteria?

- **Generate ideas** (Brainstorming)
- **Organize Ideas** (Affinity)
- **Reduce Ideas** (Voting)

An evaluation criteria development session
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Evaluation Criteria

- Each criteria item can optionally be given a weight value to indicate its importance as perceived by the team and other stakeholders.
- These weights can be set by a group of experts or by the team.
Baseline Solution

The baseline solution is always set to **Zero**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Baseline</th>
<th>1</th>
<th>2</th>
<th>Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
# PUGH MATRIX

## Comparing and Scoring

Indicate how the baseline solution is compared with each of the candidate alternatives by placing a plus, minus, or zero.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Baseline</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>+</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Score</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
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Comparing and Scoring

For each candidate alternative, determine whether it is better, same or worse than the baseline.

- Better than baseline
- Worse than baseline
- About the same
Final Scoring
The **final scores** can be obtained by adding up the weighted scores for each candidate alternative.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Baseline</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
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<td>1</td>
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<td>0</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0</td>
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<td>3</td>
<td>1</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Typically, the best alternative is the one with the most pluses and the fewest minuses.
How to Construct and Use the Pugh Matrix?
A Pugh matrix exercise is best when it is conducted in team.

It is important to include people with enough knowledge of the situation to avoid missing any critical point.
How to Construct and Use the Pugh Matrix?

1. With your team, clearly explain the **purpose** for constructing the Pugh matrix.

2. Prepare the list of candidate **alternatives** and Identify the relevant evaluation **criteria**.
How to Construct and Use the Pugh Matrix?

3. Draw a table, then place the evaluation criteria in the left-hand column and the candidate alternatives in the top row.

4. Select a **baseline solution** or benchmark to be used as the standard for comparison.
How to Construct and Use the Pugh Matrix?

5. Ask the team to indicate how the baseline solution is compared with each of the alternatives by placing a plus, minus, or zero.

6. Notice the highest score solutions, the one with the most pluses and the fewest minuses.
7. Look for opportunities to **combine** the best aspects of different solutions.

An **ideal solution** can be developed by mixing the positive aspects from multiple options.
Example – Concept selection from among three alternatives.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Baseline</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
</tr>
<tr>
<td>Durable</td>
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<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Weight</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Easy to assemble</td>
<td>+</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reliable</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cost</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NET SCORE</td>
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<td>-3</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANK</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTINUE?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## PUGH MATRIX

**Example** – Concept selection from among three alternatives – **Weighting Factor Applied**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Baseline</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Durable</td>
<td>+2</td>
<td>0</td>
<td>-2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Weight</td>
<td>-1</td>
<td>-1</td>
<td>+1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Easy to assemble</td>
<td>+2</td>
<td>0</td>
<td>-2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Reliable</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cost</td>
<td>+3</td>
<td>0</td>
<td>+3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**NET SCORE**
-4 | -3 | -1

**RANK**
1 | 3 | 2

**CONTINUE?**
Yes | No | No