Industry Project Evaluation with the Analytic Hierarchy Process

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1. Research interest

2. Analytical Hierachy Process

3. Project evaluation in the power plant industry

4. Project evaluation with the AHP

5. Conclusion
1. Research interest

- Qualitative and quantitative criteria influence failure and success in the power plant industry
- Strong competition
  - Only 5 to 10% of the proposals lead to an order
- Low profit margins
- Individual customer requirements
- Technical complexity
- Proposal costs account for 2 to 5% of the total project volume
- Risk evaluation
- Limited resources (qualified engineering and management staff)

Significant project losses by inadequate project evaluation
2. Analytical Hierarchy Process

- AHP was shaped in the seventies by Saaty
- AHP solves realistic multi-criteria decisions problems in a structure
- The qualitative and quantitative criteria are structured analytically in a hierarchical order
2. Analytical Hierarchy Process

- Pair-wise comparison of the criteria based on a fundamental scale
- Convert individuals' preferences into ratio scale weights
- Fulfillment of 4 axioms
  - Reciprocal condition
  - Homogeneity
  - Dependence
  - Integrity

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<thead>
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<tbody>
<tr>
<td>1</td>
<td>Equal Importance</td>
<td>Two activities contribute equally to the objective</td>
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<tr>
<td>2</td>
<td>Weak Importance</td>
<td></td>
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<tr>
<td>3</td>
<td>Moderate Importance</td>
<td>Experience and judgment slightly favor one activity over another</td>
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<td>4</td>
<td>Moderate plus</td>
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<tr>
<td>5</td>
<td>Strong Importance</td>
<td>Experience and judgment strongly favor one activity over another</td>
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<td>6</td>
<td>Strong plus</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Very Strong or demonstrated Importance</td>
<td>An activity is favored very strongly over another; its dominance is demonstrated in practice</td>
</tr>
<tr>
<td>8</td>
<td>Very, very strong Importance</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Extreme Importance</td>
<td>The evidence favoring one activity over another is of the highest possible order of affirmation</td>
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</table>
2. Analytical Hierarchy Process

**Reciprocal condition:** Given two alternatives or criteria i and j from a finite amount of elements. The intensity of preference i over j must be reciprocal to j over i.

\[ a_{ij} = \frac{1}{a_{ji}} \quad \text{for all } i, j \in A \]

**Homogenity:** When two alternatives i, j ∈ A are compared with regard to criteria i, j ∈ A one alternative cannot be infinitely better than the other one.

\[ a_{ij} \neq \infty \quad \text{for all } i, j \in A \]

**Dependence:** All elements in a hierarchy are allocated to different levels. A level influences and is influenced only by the next higher or lower level. The elements within a level must not influence each other.

**Integrity:** The hierarchy contains all relevant criteria and alternatives. When adding or leaving out criteria or alternatives the hierarchy and thus the result might change.
The first step in this procedure is a preliminary check for K.O. criteria:

- Financing
- Price level
- Technical requirements

The second step based on three basic criteria:

- Realization chance (go)
- Award chance (get)
- Profitability

1.) Preliminary check K.O. criteria

2.) Detailed evaluation of criteria go, get and profitability

3.) Release for bid preparation

Yes → Stop

No → Stop

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Zimmer/KlumppAbidi: Project Evaluation with the AHP
4. Project evaluation with the AHP

The main advantages of the AHP are listed below:

- Structure complexity
- Measurement on a ratio scale
- Interdependence of preferences
- Synthesize results
- Consistency check
- Process repetition
4. Project evaluation with the AHP
5. Conclusion

- Development of AHP structure based on criteria:
  - Realization chance (go)
  - Award chance (get)
  - Profitability
- Individual weightings were obtained for a German power plant industry company
- Application of IT based systems for obtaining, processing and recording information
- Development of different criteria data sets for relevant market segments and clients as further research
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Thank you for your attention!

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