AHP-OS is a web-based tool to support rational decision making based on the Analytic Hierarchy Process (AHP). It allows you to define a hierarchy of criteria for a decision problem, to calculate priorities and evaluate a set of decision alternatives against those criteria.

1. Introduction

AHP stands for Analytic Hierarchy Process. It is a method to support multi-criteria decision making, and was originally developed by Prof. Thomas L. Saaty. AHP derives ratio scales from paired comparisons of criteria, and allows for some small inconsistencies in judgments. Inputs can be actual measurements, but also subjective opinions. As a result, ratio scales (weightings) and a consistency index will be calculated. A simple introduction to the method is given here.

Benefits of AHP

Using AHP as a supporting tool for decision making will help to gain a better insight in complex decision problems. As you need to structure the problem as a hierarchy, it forces you to think through the problem, consider possible decision criteria and select the most significant criteria with respect to the decision objective. Using pairwise comparisons helps to discover and correct logical inconsistencies. The method also allows "translating" subjective opinions, such as preferences or feelings, into measurable numeric relations. AHP helps to makes decisions in a more rational way and to make them more transparent and better understandable.

Method

Mathematically the method is based on the solution of an Eigen value problem. The results of the pair-wise comparisons are arranged in a matrix. The first (dominant) normalized right eigen vector of the matrix gives the ratio scale (weighting), the Eigen value determines the consistency ratio.

Programs

We have developed a web based AHP solution, as a supporting tool for decision making processes. Please feel free to try it out. It can not only be helpful in your daily work for simple decision problems, but also support complex decision making problems. Internationally AHP is used in a wide range of applications, for example for the evaluation of suppliers, in project management, in the hiring process or the evaluation of company performance.

To start a program, click on one of the links in the table on the entry page:
1. **AHP Projects** (AHP-OS)
   - Handle complete AHP projects including group decision support
   - **The complete AHP online program package**
     Manage complete AHP projects and *group sessions*. To use the full functionality, you need to login. Please register as new user, if you don't have an account yet. It's all free!

2. **AHP Priority Calculator**
   - Calculate priorities based on pairwise comparisons
   - **The AHP priority calculator** can be used to "translate" individual preferences into numbers. It calculates priorities or weights for a set of criteria based on pairwise comparisons.

3. **AHP Hierarchies**
   - Define complete hierarchies and evaluate priorities and alternatives
   - With **AHP Hierarchy** it is possible to handle complete decision problems under AHP. It allows you to define a hierarchy of criteria, calculate weights for all criteria based on pairwise comparisons, and evaluate alternatives.

4. **AHP Group Session**
   - Participate in AHP group sessions.
   - Participate in **AHP group sessions** to evaluate criteria or alternatives. The group session code is provided by your session chair.

Please make a reference to the author and website, when you use the tool. For terms of use please see our user agreement and privacy policy.

### 2. User registration

To use the full features of the program, you need to register as a user.

Username or email  password  

Log in  (forgot)  Register

When you click on “Register” a registration form will appear:

Username (only letters and numbers, 2 to 30 characters)  

User’s email (please provide a real email address, you’ll get a verification mail with an activation link)  

Password (min. 6 characters!)  

Password repeat  
Provide a user name and your valid email address. You will receive an activation e-mail. When you click on the link in the activation e-mail, your account will be activated, and you can login.

3. AHP project administration

After login the AHP-OS project page is shown:

**Stored AHP Project Sessions**

0 projects. Create new hierarchy

No stored sessions

Once you have initiated new projects, they will be shown in the project table:

**Stored AHP Project Sessions**

<table>
<thead>
<tr>
<th>Session</th>
<th>Project</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>

A click on the session code will open the project.

Session: session code of the project
Project: project title
Type: H = hierarchy priority evaluation, A = alternative evaluation
Part.: Number of participants

You can also open a project by selecting the session code from the selection list in the session administration menu.

When you open a saved project, a project summary is shown:

- Project Data: session code, project name, description, etc.
- Project Participants: list of participants with name and date of their input (if any)
- Project Alternatives: list of defined alternatives (if any)
- Group Input link: link for other participants, you want to give their judgment
- Decision hierarchy
- Hierarchy definition text

The project menu allows you to manage your existing projects.
4. How to use the program

The online software is easy to use in five steps:

1. Define the objective and relevant criteria of your decision problem and structure them in a hierarchy.
2. Compare criteria in categories and sub-categories with respect to the objective to find their weights based on pairwise comparisons.
3. View the results.
4. Name a set of alternatives.
5. Compare, how good they match your decision criteria. Again pairwise comparisons based on the AHP are used.

Once completed, you will get a total weight for each alternative, which could help you to select the appropriate alternative and make the final decision.

Step 1 – Define a hierarchy

Hierarchies are defined in a text field using the following simple syntax:

Each branch in the hierarchy is defined by its node (the category) and the node’s leaves (the sub-categories). The node is followed by a colon, leaves are separated by comma, and a branch is closed by a semicolon.

category: sub-category 1, sub-category 2, sub-category 3;

If a sub-category branches out in further sub-categories, you add a line, repeating the sub-category’s name as a new node (followed by a colon):

sub-category1: sub-sub-1, sub-sub-2;

Note: Text input is case sensitive.
Input a new hierarchy

Input new text in the text field below. (See examples)

Buy tablet computer: display size, battery life, weight, design;

Then press Submit new hierarchy and the hierarchy table will be displayed:

<table>
<thead>
<tr>
<th>Decision Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 0</strong></td>
</tr>
<tr>
<td>Buy tablet computer</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Note:** If you have a project with already defined criteria, you can skip Step 2 (compare criteria) and go immediately to Step 5 and define your alternatives.

Predefine criteria can be set by adding a “=” and the priority into the hierarchy definition:

Input new text in the text field below. (See examples)

Buy tablet computer: display size=0.46, battery life=0.16, weight=0.31, design=0.07;

The predefined weights in each category have to sum-up to 100%.

Press Save/Update to save the hierarchy into your project list.
The new project session code (a unique 6 letter identifier for each project) is shown with your login name as project author.

You can add a project short description in the text field below. Then press Go to save the project.

**Step 2 – Compare criteria**

Open the newly saved project from the project list. Click on *Group Input* in the Project Administration menu.

A new page will open showing the project’s session code and your name, as well as the Participant’s Input Menu.

**Note:** You need to logout, if you want to input your judgment under a different name.
Click on Go. The hierarchy will now show an additional “AHP” button with red outline:

You can now start to compare the criteria.

To find the weight (importance) of criteria, click AHP to start pairwise comparisons. The following form is shown:

Compare each pair of criteria with respect to the project and category: which criterion in each pair is more important, and how much more on a 1 - 9 scale? Once you have finished click Check Consistency. A table with priorities for each criterion is shown:
It could happen that your pairwise comparisons are not consistent; then the most inconsistent judgments are highlighted, and the consistent judgments are marked light green:

In order to improve consistency, check whether you are able to adjust your original mark by ± two points on the scale. Click *Calculate* to re-calculate. Once finished, and you are satisfied with your answers, press *Submit Priorities* to submit.
Completed branches in the hierarchy tree are marked green, and global priorities are calculated and color-coded according to their rankings. Submit your judgment for group evaluation using *Submit for group eval* in the Group Input Menu.

**Step 3 – View the Results**

Once successfully submitted, you can view the (group) result.

The decision hierarchy will be shown with local and global priorities, and a breakdown by the nodes with their corresponding priority vector and their (consolidated) decision matrix. Data can be downloaded in csv format for further use in a spreadsheet program. From the *Group Result Menu* it is possible, to use the calculated priorities *Use consol. Priorities* of the decision hierarchy for further alternative evaluation.

**Step 4 – Definition of Alternatives**

When all comparisons in the hierarchy are done, you might continue to define and evaluate alternatives. In the *Group Result Menu* click on *Use consol. priorities*.

The decision hierarchy will be show with a button *Alternatives*. From there you can define the number and names of alternatives.

Here you can first input the number and names of your alternatives.

**Input number and names (2 - 12)**

Enter required number of alternatives and press *Go* to get the following screen:
Input the names of alternatives, then press ok. Once defined, save the project with Save as project in the Alternative Menu.

The project will be stored under a new session code with Type “A” (Alternative Evaluation).

**Step 5 – Alternative Evaluation**

Open a project of Type “A” (alternative evaluation) with the group input link, or click on the Group Input button. A table with criteria and alternatives will be displayed:

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Node</th>
<th>Gib Priorities</th>
<th>Compare</th>
<th>Alt-1</th>
<th>Alt-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. display size</td>
<td>Buy tablet computer</td>
<td>46.9%</td>
<td>AHP</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2. battery life</td>
<td>Buy tablet computer</td>
<td>24.6%</td>
<td>AHP</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>3. weight</td>
<td>Buy tablet computer</td>
<td>21.7%</td>
<td>AHP</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>4. design</td>
<td>Buy tablet computer</td>
<td>6.8%</td>
<td>AHP</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

The procedure of pairwise comparisons is exactly the same as for criteria. Each completed comparison is highlighted in green:
When all evaluations are done, the result is shown:

Click on Submit for group eval to submit and save your judgments.

In this case, alternative 1 (Model 1) gets a weight of 28.7%, alternative 2 (Model 2) 34.2%, and alternative 3 (Model 3) 37.1%.
6. Download

You might download the data in csv format (comma separated values) for further processing in a spread sheet program.

Download complete project for import in Excel: Download (.csv)  

Format:

<p>| Project: AHP Project - bpmg.com |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Level</th>
<th>p (L1)</th>
<th>Glb. Pr.</th>
<th>Alt-1</th>
<th>Alt-2</th>
<th>Alt-1</th>
<th>Alt-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crit-1</td>
<td>0.652631</td>
<td>0.652631</td>
<td>0.9</td>
<td>0.1</td>
<td>0.587368</td>
<td>0.065263</td>
</tr>
<tr>
<td>Crit-2</td>
<td>0.285112</td>
<td>0.285112</td>
<td>0.1</td>
<td>0.9</td>
<td>0.028511</td>
<td>0.256601</td>
</tr>
<tr>
<td>Crit-3</td>
<td>0.062256</td>
<td>0.062256</td>
<td>0.8</td>
<td>0.2</td>
<td>0.049805</td>
<td>0.012451</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.665685</td>
<td>0.334315</td>
</tr>
</tbody>
</table>

Title line, then each row shows one criterion with the columns: (hierarchy level, local priority), global priority, alternatives (local and global priority).

All (decision) matrices are shown below, with category name as heading and criteria for the matrix rows.

<table>
<thead>
<tr>
<th>AHP Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crit-1</td>
</tr>
<tr>
<td>Crit-2</td>
</tr>
<tr>
<td>Crit-3</td>
</tr>
</tbody>
</table>

Alternatives show the heading “Alternatives for” and the respective criterion:

<table>
<thead>
<tr>
<th>Alternatives for Crit-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt-1</td>
</tr>
<tr>
<td>Alt-2</td>
</tr>
</tbody>
</table>

7. AHP Group Sessions

The software allows for group inputs, to calculate consolidated weights for priorities or alternatives. When you open a saved project from your project list, the session code and a link is provided in the project summary:

**Group Input Link**

The session code is Egaber. Provide this session code or the following link to your participants:


Copy and Paste the link and provide it to your participants. **Note:** Participants don’t need to register for the software. You can also just provide the session code to them.
Group members can participate by either following the given link, or going to the AHP-OS main site, and click on **AHP Group Session**, providing the session code and their name.

Once they have entered their name, they can start the pairwise comparisons as described under step 2 above. Results can be called from project administration menu by clicking on **View Result**.

### Selection of participants

All participants are shown on the project summary page and the group result page. You can select individual participants and, after a click on **Refresh selection**, only the consolidated result of the selected participants is calculated.

**Project Participants**

<table>
<thead>
<tr>
<th>No</th>
<th>Sel</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Emil</td>
<td>2017-04-06</td>
</tr>
<tr>
<td>2</td>
<td>✔</td>
<td>Werner</td>
<td>2014-06-08</td>
</tr>
<tr>
<td>3</td>
<td>✔</td>
<td>Klaus</td>
<td>2014-06-08</td>
</tr>
</tbody>
</table>

The consolidated result is shown in the hierarchy (local and global priorities), as well as in a diagram for the selected participants only. This is indicated with a message

**Selected participants: Werner, Klaus**

above the Decision Hierarchy.

A breakdown for each node of the hierarchy is given in table form, showing the resulting priorities for each individual group member, as well as the consolidated priorities under the node.
Click on Download (.csv) in the Group Result Menu to download the results as csv text file.

View Input Data will display the decision matrices from each participant and make them available for download.

<table>
<thead>
<tr>
<th>Category</th>
<th>Consol. Priorities</th>
<th>P-1</th>
<th>P-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 display size</td>
<td>3</td>
<td>24.4%</td>
<td>25.9%</td>
</tr>
<tr>
<td>2 battery life</td>
<td>2</td>
<td>29.3%</td>
<td>19.9%</td>
</tr>
<tr>
<td>3 weight</td>
<td>1</td>
<td>39.6%</td>
<td>47.5%</td>
</tr>
<tr>
<td>4 design</td>
<td>4</td>
<td>6.7%</td>
<td>6.6%</td>
</tr>
<tr>
<td>5 Consistency Ratio</td>
<td>3.4%</td>
<td>6.2%</td>
<td>6.1%</td>
</tr>
</tbody>
</table>

(P-1: participant 1, P-2: participant 2 etc.)

AHP Group Consensus

For more than one participant, the software calculates an AHP consensus indicator to quantify the consensus of the group, i.e. to have an estimate of the agreement on the outcome priorities between participants. This indicator ranges from 0% to 100%. Zero percent corresponds to no consensus at all, 100% to full consensus. This indicator is derived from the concept of diversity based on Shannon alpha and beta entropy. It is a measure of homogeneity of priorities between the participants and can also be interpreted as a measure of overlap between priorities of the group members.

If we would categorise group consensus in the three categories low, moderate and high, I would assign the following percentages to these categories:

- Very low consensus: below 50% (disagreement)
- Low consensus: 50% to 65%
- Moderate consensus: 65% to 75%
- High consensus: 75% - 85%
- Very high consensus: above 85% (excellent agreement)

Values below 50% indicate that there is practically no consensus within the group and a high diversity of judgments. Values in the 85% – 95% range indicate a high overlap of priorities and excellent agreement of judgments from the group members.
Other

Please make a reference to the author and the website, when you use the tool.

For terms of use please see our user agreement and privacy policy.

Contact and Feedback

Please feel free to leave a comment or contact me.
Annex 1: AHP-OS Menus

Session Administration Menu
The Session Administration Menu allows you to open your AHP projects.

- **Open Project**: Open project summary
- **New Project**: Start a new project (hierarchy definition)
- **Exit**: Back to AHP main page

You can also open a project by clicking on the link of the session code in the project table.

Project Administration Menu
The Project Administration Menu allows you to manage your AHP projects.

- **View Result**: View result (greyed, if no result available)
- **Group Input**: Start evaluation as participant
- **Use Hierarchy**: Use or modify decision hierarchy
- **Edit Project**: Edit a saved project (greyed, project has participants)
- **Delete sel. Participant(s)**: Delete selected participant(s) (greyed, if no participant selected)
- **Delete Project**: Delete the whole project
- **Close**: Close project

Hierarchy Input Menu
In the Hierarchy Input menu you can define a new hierarchy and save it as new project.

- **Submit new hierarchy**: Submit new hierarchy text input
- **Save as project**: Save hierarchy definition as new project
- **Download (.csv)**: Export data as comma separated value file
- **Reset Priorities**: Export with “,” as decimal separator when checked
- **Reset all**: Reset all priority values given within the hierarchy text input. Clears also alternative names
- **Reset hierarchy definition and all other session parameter**: Go back to Session Administration
Group Input menu
In the group session menu you can participate as an evaluator in the projects and/or view consolidated group results. *Submit for group eval* only shows, as long as you have not submitted your evaluation as participant.

<table>
<thead>
<tr>
<th>Group Input Menu</th>
<th>Submit for group eval</th>
<th>View group result</th>
<th>Done</th>
</tr>
</thead>
</table>

- **Submit judgment for group evaluation (if not done yet)**
- **View consolidated group results (when participants have voted)**
- **Go back project table**

Group Result menu
The group result menu allows you to analyse the results and download them as csv text file.

<table>
<thead>
<tr>
<th>Group Result Menu</th>
<th>View Input Data</th>
<th>Download (.csv)</th>
<th>Use consol. priorities</th>
<th>Done</th>
</tr>
</thead>
</table>

- **View decision matrices of all participants**
- **Download results as csv text file**
- **Use hierarchy with resulting priorities for definition of alternatives**
- **Go back to project list**

Decision hierarchy (table)
Start pairwise comparison (red) for selected node of the hierarchy, once the comparison is done, the button outline will be green. Switch to alternative display to start definition and evaluation of alternatives (only, when pairwise comparison completed).

<table>
<thead>
<tr>
<th>Decision hierarchy (table)</th>
<th>AHP</th>
<th>AHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternatives</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AHP Pairwise comparison menu
Calculate priorities based on pairwise comparisons and check consistency of judgment. Submit calculated priorities for further calculation.

<table>
<thead>
<tr>
<th>AHP Pairwise comparison menu</th>
<th>Check Consistency</th>
<th>Submit Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHP</td>
<td>Balanced scale</td>
<td></td>
</tr>
</tbody>
</table>

- **AHP 1 to 9 scale or Balanced scale (AHP: default)**
### Annex 2: AHP Hierarchy Example

#### Decision Hierarchy (table)

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Global Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Selection</td>
<td>Quality 0.3333</td>
<td>Product Variety 0.3333</td>
<td>11.1 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product Quality Features 0.3333</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production Quality 0.3333</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reliability 0.3333</td>
<td>Management &amp; Organization 0.25</td>
<td>8.3 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>References 0.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capital 0.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service 0.3333</td>
<td>Annual Turnover 0.25</td>
<td>8.3 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication 0.3333</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delivery Lead Time 0.3333</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customization Capability 0.3333</td>
<td></td>
</tr>
</tbody>
</table>

#### Text field input for hierarchy above

Input new text in the text field below. (See examples)

- Supplier Selection: Quality, Reliability, Service;
- Quality: Product Variety, Product Quality Features, Production Quality;
- Reliability: Management & Organization, References, Capital, Annual Turnover;
- Service: Communication, Delivery Lead Time, Customization Capability;
Annex 3: Conducting a group session

The figure below shows how a group session is conducted to determine group priorities using BPMSG’s AHP online system. The group session chair must be a registered user to initiate a group session. A six character session code is generated. Participants can use this session code to log into the group session and provide their judgements.

Chair: Initiate group session

1. Start AHP-OS
   - New
   - Input new hierarchy text
     - Submit new hierarchy
       - Hierarchy is displayed
       - Save
       - Session Code is generated
   - Input optional project description
     - Go
     - Hierarchy is displayed
     - Close
     - Provide group session link or session code to Group members
     - Done

Participants: Input judgments

2. Start AHP Group
   - Input session code & name
     - check input
     - Ok?
       - Go
     - Hierarchy is displayed
   - Start pairwise comparisons
     - AHP
     - compare
     - CR
       - ok?
         - Submit Priorities
       - Submit for group eval
     - Complete?
       - Submit for group eval
       - Leave
       - View group result
     - Resume
     - Back
     - done

Chair: View results

3. AHP-OS
   - Click on session code
   - Participants?
   - Group results are displayed
   - Back
   - done

or if there are participants
## Annex 4: Evaluation of Alternatives Example

### Evaluation of Alternatives

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Node</th>
<th>Gtb Priorities</th>
<th>Compare</th>
<th>House A</th>
<th>House B</th>
<th>House C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Size of house</td>
<td>Satisfaction with house</td>
<td>17.3%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>2. Transportation</td>
<td>Satisfaction with house</td>
<td>5.4%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>3. Neighborhood</td>
<td>Satisfaction with house</td>
<td>16.8%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>4. Age of house</td>
<td>Satisfaction with house</td>
<td>1.6%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>5. Yard space</td>
<td>Satisfaction with house</td>
<td>3.1%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>6. Modern facilities</td>
<td>Satisfaction with house</td>
<td>3.6%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>7. General condition</td>
<td>Satisfaction with house</td>
<td>16.7%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>8. Financing</td>
<td>Satisfaction with house</td>
<td>33.3%</td>
<td>0.333</td>
<td>0.333</td>
<td>0.333</td>
<td></td>
</tr>
</tbody>
</table>

Total weight of alternatives: 0.333 0.333 0.333

0 out of 8 comparisons completed