BPMSG's AHP Online System

Rational Decision Making Made Easy

Klaus D Goepel - latest update 2022-02-19

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

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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.

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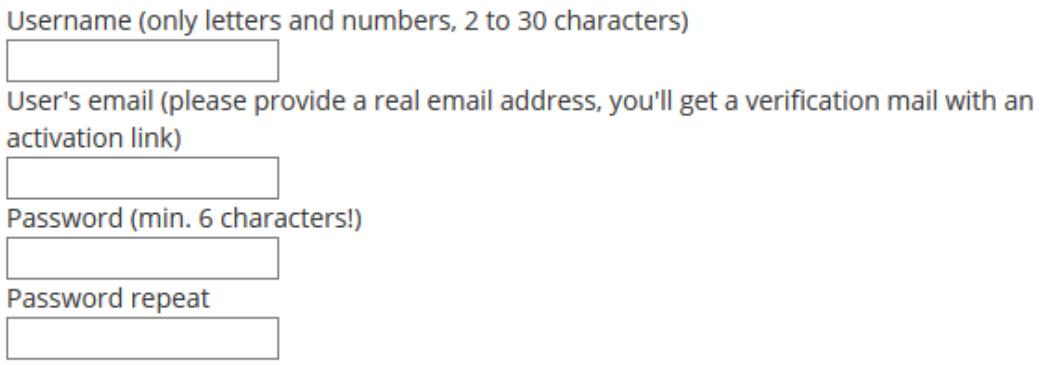
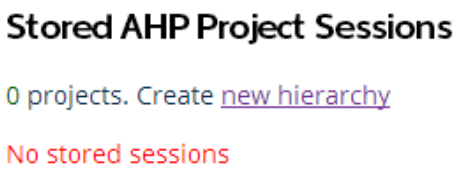
When you click on “Register” a registration form will appear:



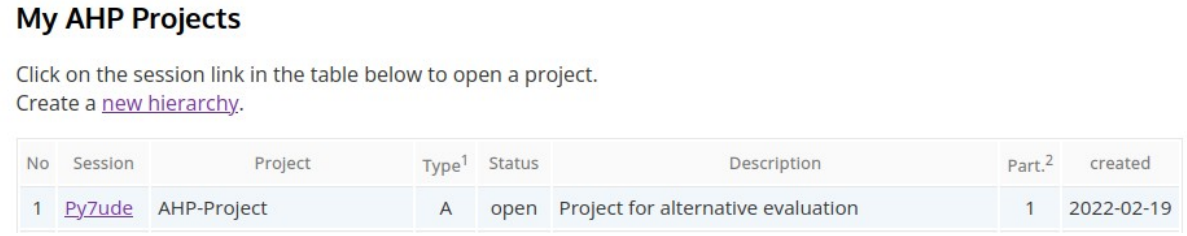
Provide a user name and your valid email address. You will receive an activation e-mail. When you click on the link in the activation e-mail, your account will be activated, und you can login.

3. AHP project administration

After login the AHP-OS project page is shown:



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



A click on the session code will open the project.

Session:	Unique session code of the project
Project:	Project title
Type:	H = hierarchy priority evaluation, A = alternative evaluation
Status:	Open/Closed: for closed projects, no pairwise comparison is allowed
Description:	Short description of the project
Part.:	Number of participants
Created:	Date, when the project was created

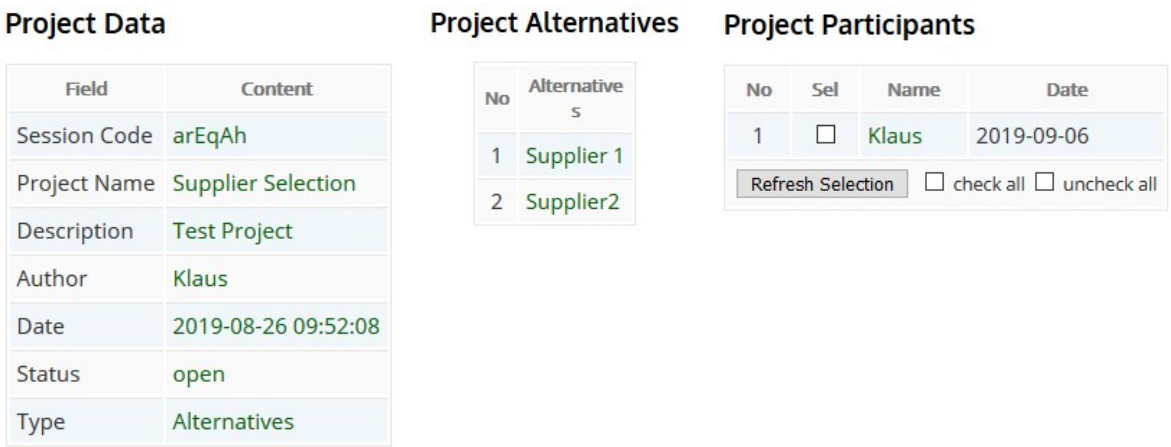
You can also open a project by selecting the session code from the selection list in the session administration menu.

Open Project: Opens the project summary page of the selected project
Import Project: New - Import a project from a json text file.
New Project: Opens the hierarchy page to define a new project.

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

Project Summary Information:



AHP project Import Menu

Browse: Select json file to upload (extension json)
Import: Import selected project

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The project administration menu allows you to manage your existing projects.

- *View Result* - view the group results if the project has participants
- *PWC Input* - Input your judgments using pairwise comparisons
- *Use Hierarchy* – use the project's decision hierarchy to modify and save as a new project
- *Rename* – Rename project or modify short description
- *Edit* – edit hierarchy, alternatives or project description of a saved project
- *Del. sel. Participant(s)* – Remove selected participants input data
- *Delete* – delete the complete project with all its data
- *Toggle Project Status* – Toggle between open and closed. For a closed project no additional pairwise comparison inputs are possible.
- *Export Project* – New - Export current project as text file in json format.
- *Done*– close the currently opened project and go back to the project table

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 leafs (the sub-categories). The node is followed by a *colon*, leafs are separated by *comma*, and a branch is closed by a *semicolon*:

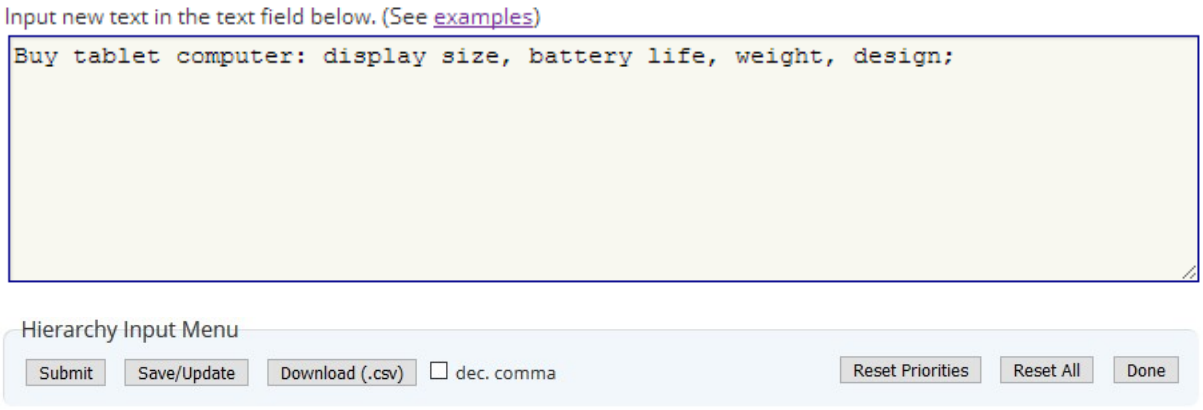
```
category: sub-category 1, sub-category 2, sub-category 3;
```

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):

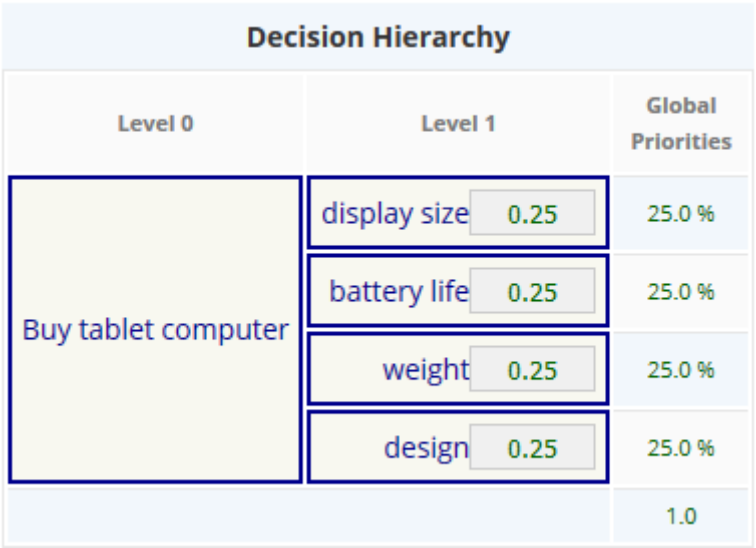
```
sub-category1: sub-sub-1, sub-sub-2;
```

Note: Text input is case sensitive.

Input a new hierarchy



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

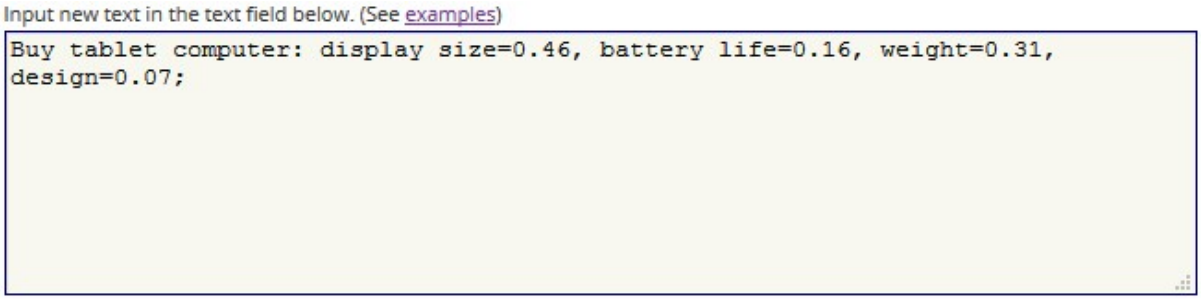


Decision Hierarchy

Level 0	Level 1	Global Priorities
Buy tablet computer	display size 0.25	25.0 %
	battery life 0.25	25.0 %
	weight 0.25	25.0 %
	design 0.25	25.0 %
		1.0

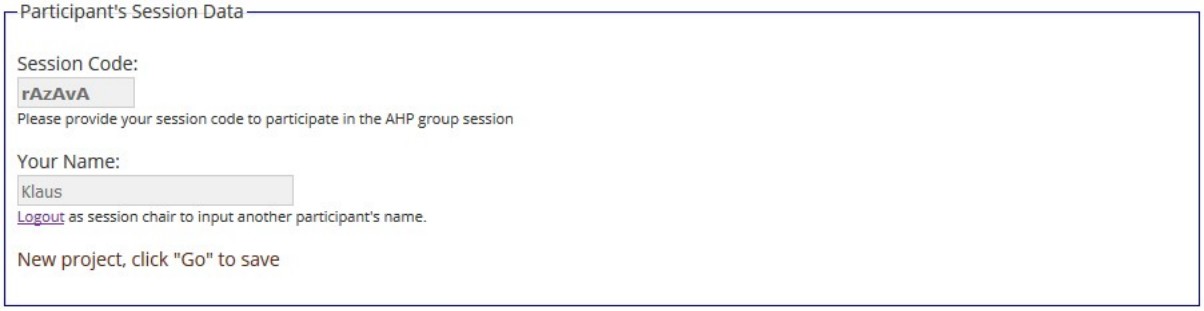
Note: If you have a project with already defined criteria, you can skip Step 2 (compare criteria) and go immediately to Step 5 and define your alternatives.

Predefine criteria cam be set by adding a "=" and the priority into the hierarchy definition:

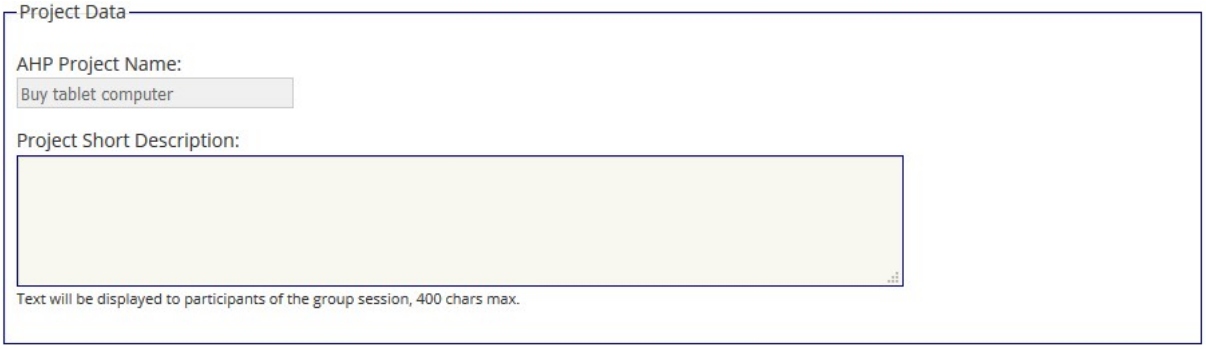


The predefined weights in each category have to sum-up to 100%.

Press *Save/Update* to save the hierarchy into your project list.



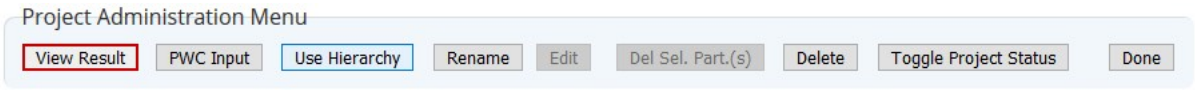
The new project session code (a unique 6 letter identifier for each project) is shown with your login name as project author.



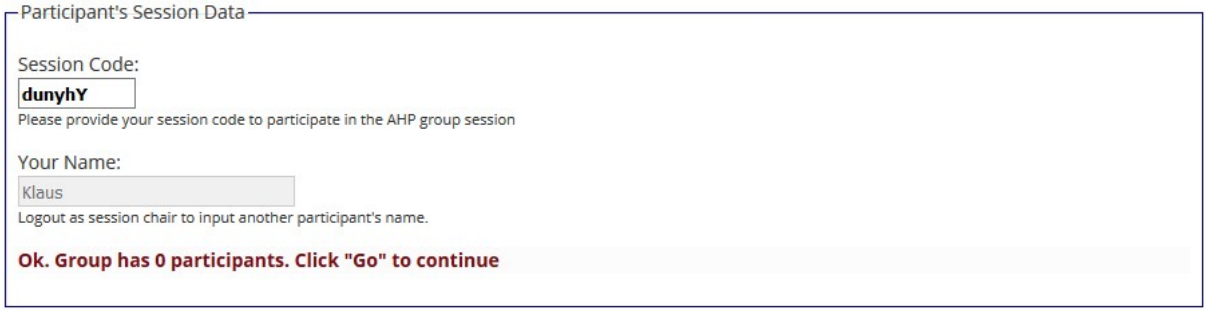
You can add a project short description in the text field below. Then press Go to save the project.

Step 2 – Compare criteria

Open the newly saved project from the project list. Click on *PWC 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:

	A - wrt *Buy tablet computer* - or B?			Equal	How much more?
1	◉ display size	or	○ battery life	1 ○	2 ○ **3** ◉ 4 ○ **5** ○ 6 ○ **7** ○ 8 ○ **9** ○
2	◉ display size	or	○ weight	1 ○	2 ◉ **3** ○ 4 ○ **5** ○ 6 ○ **7** ○ 8 ○ **9** ○
3	◉ display size	or	○ design	1 ○	2 ○ **3** ○ 4 ○ **5** ◉ 6 ○ **7** ○ 8 ○ **9** ○
4	○ battery life	or	◉ weight	1 ○	2 ◉ **3** ○ 4 ○ **5** ○ 6 ○ **7** ○ 8 ○ **9** ○
5	◉ battery life	or	○ design	1 ○	2 ○ **3** ◉ 4 ○ **5** ○ 6 ○ **7** ○ 8 ○ **9** ○
6	◉ weight	or	○ design	1 ○	2 ○ **3** ○ 4 ○ **5** ○ 6 ◉ **7** ○ 8 ○ **9** ○

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:

	Category	Priority	Rank
1	display size	46.4%	1
2	battery life	16.3%	3
3	weight	30.8%	2
4	design	6.5%	4

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:

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	A - wrt *Buy tablet computer* - or B?		Equal	How much more?
1	display size	or battery life	1	2 3 4 5 6 7 8 9
2	display size	or weight	1	2 3 4 5 6 7 8 9
3	display size	or design	1	2 3 4 5 6 7 8 9
4	battery life	or weight	1	2 3 4 5 6 7 8 9
5	battery life	or design	1	2 3 4 5 6 7 8 9
6	weight	or design	1	2 3 4 5 6 7 8 9

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 you answers, press *Submit* to submit.

Calculate Submit

Decision Hierarchy

Level 0	Level 1	Global Priorities
Buy tablet computer AHP	display size 0.4809	48.1 %
	battery life 0.1189	11.9 %
	weight 0.2972	29.7 %
	design 0.103	10.3 %
		1.0

Completed branches in the hierarchy tree are marked green, and global priorities are calculated and color-coded according to their rankings.

Group Input Menu
Save Judgments View Group Result Done

Once you have completed the judgments, click on *Save judgments* to store them with the project.

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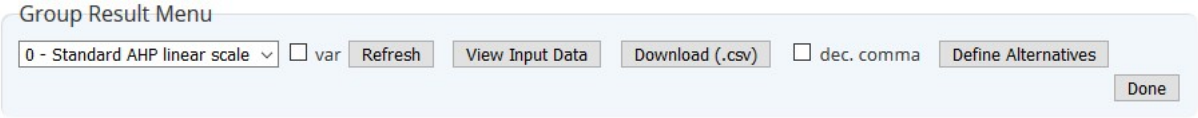
Step 3 – View the Results

You then 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.

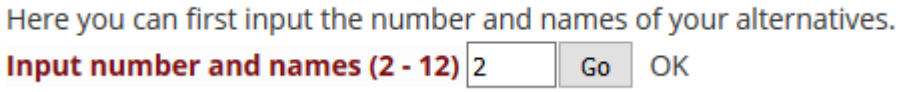
Step 4 – Definition of Alternatives

From the *Group Result Menu* it is possible to use the calculated priorities of the decision hierarchy for further alternative evaluation.



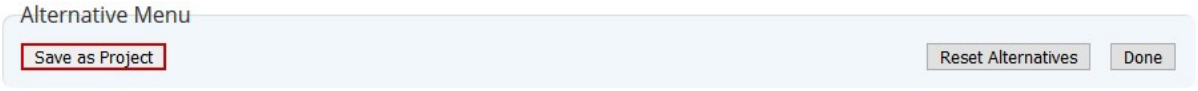
In the *Group Result Menu* click on *Define Alternatives*.

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



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:

	Criterion	Node	Glb Priorities	Compare	Alt-1	Alt-2
1.	display size	Buy tablet computer	46.9%	AHP	0.5	0.5
2.	battery life	Buy tablet computer	24.6%	AHP	0.5	0.5
3.	weight	Buy tablet computer	21.7%	AHP	0.5	0.5
4.	design	Buy tablet computer	6.8%	AHP	0.5	0.5
				Total weight of alternatives:	0.5	0.5

The procedure of pairwise comparisons is exactly the same as for criteria. Each completed comparison is highlighted in green:

	Criterion	Node	Glb Priorities	Compare	Model 1	Model 2	Model 3
1.	display size	Buy tablet computer	46.4%	AHP	0.333	0.333	0.333
2.	battery life	Buy tablet computer	16.3%	AHP	0.667	0.167	0.167
3.	weight	Buy tablet computer	30.8%	AHP	0.333	0.333	0.333
4.	design	Buy tablet computer	6.5%	AHP	0.333	0.333	0.333
				Total weight of alternatives:	0.388	0.306	0.306

When all evaluations are done, the result is shown:

Ranking for Buy tablet computer:

	Category	Priority	Rank
1	Model 1	28.7%	3
2	Model 2	34.2%	2
3	Model 3	37.1%	1

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%.

Decision Hierarchy

Level 0	Level 1	Global Priorities	Model 1	Model 2	Model 3
Buy tablet computer AHP	display size 0.4644	46.4 %	0.0634	0.1107	0.2902
	battery life 0.1633	16.3 %	0.1089	0.0272	0.0272
	weight 0.3077	30.8 %	0.0983	0.1718	0.0375
	design 0.0646	6.5 %	0.0161	0.0323	0.0161
OK. Submit for group eval or alternative eval. Evaluate Alternatives		1.0	28.7 %	34.2 %	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) dec. comma

Format:

Project: AHP Project - bpmsg.com						
Level 1	p (L1)	Glb. Pr.	Alt-1	Alt-2	Alt-1	Alt-2
Crit-1	0.652631	0.652631	0.9	0.1	0.587368	0.065263
Crit-2	0.285112	0.285112	0.1	0.9	0.028511	0.256601
Crit-3	0.062256	0.062256	0.8	0.2	0.049805	0.012451
Total					0.665685	0.334315

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.

AHP Project			
Crit-1	1	3	8
Crit-2	0.333333	1	6
Crit-3	0.125	0.166667	1

Alternatives show the heading "Alternatives for" and the respective criterion:

Alternatives for Crit-1		
Alt-1	1	9
Alt-2	0.111111	1

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:

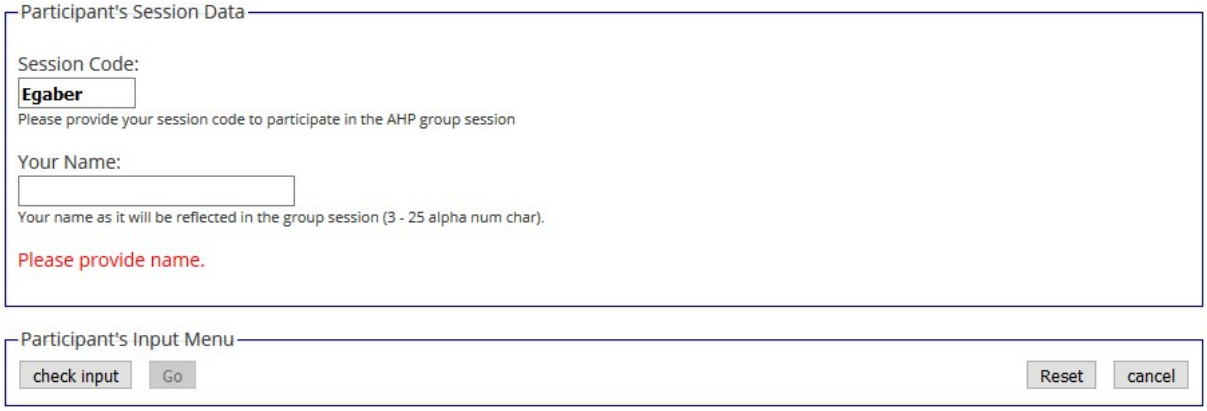
Group Input Link

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

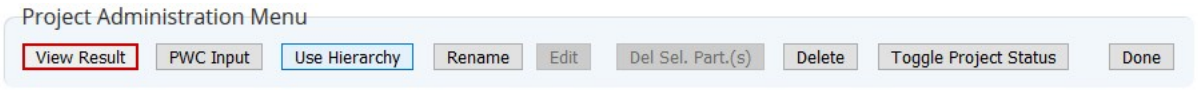
```
http://bpmsg.com/academic/ahp-hiergini.php?sc=Egaber
```

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.

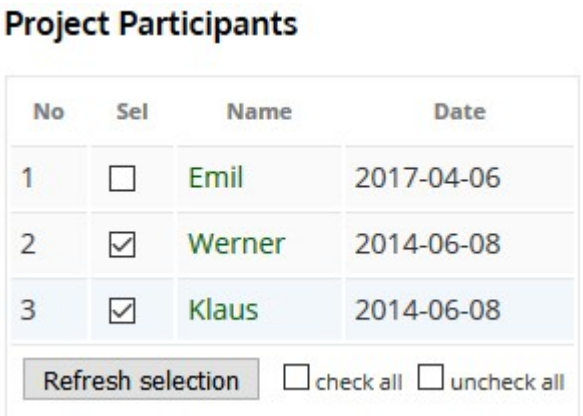


Once they have entered their name, they can start the pairwise comparisons as described under step 2 above. Results can be called from project administration menu by clicking on *View Result*.



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.



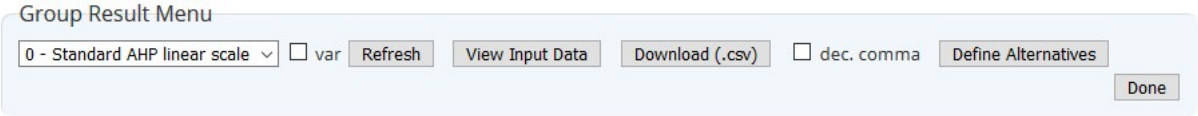
The consolidated result is shown in the hierarchy (local and global priorities), as well as in a diagram for the selected participants only. This is indicated with a message

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.

	Category	Consol. Priorities		P-1	P-2
1	display size	3	24.4%	25.9%	21.7%
2	battery life	2	29.3%	19.9%	41.2%
3	weight	1	39.6%	47.5%	30.5%
4	design	4	6.7%	6.6%	6.6%
5	Consistency Ratio		3.4%	6.2%	6.1%

(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 outcoming 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)

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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.

References

In your work please cite:

Goepel, K.D. (2018). Implementation of an Online Software Tool for the Analytic Hierarchy Process (AHP-OS). *International Journal of the Analytic Hierarchy Process*, Vol. 10 Issue 3 2018, pp 469-487, https://doi.org/10.13033/ijahp.v10i3.590

The article describes the implementation of AHP-OS with all mathematical calculations and further references.

Other

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Contact and Feedback

Please feel free to leave a comment or contact me.

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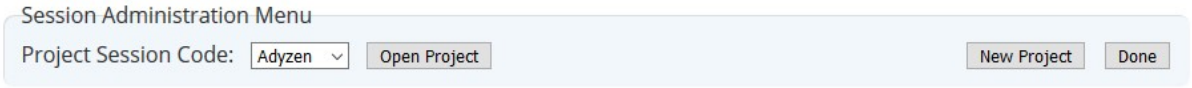
Annex 1: AHP-OS Menus

1. Session Administration

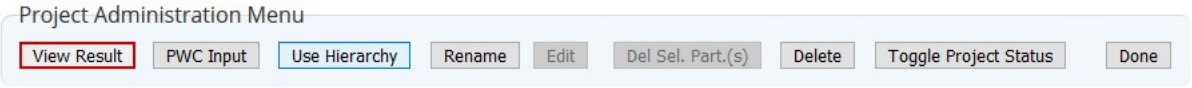
The **Session Administration Menu** allows you to open your AHP projects. You can also open a project by *clicking on the link of the session code in the project table*.



Open Project	Open project summary of selected project session.
Import Project	Import project from json text file
New Project	Start a new project (hierarchy definition) – opens hierarchy page.
Done	Back to AHP main page.

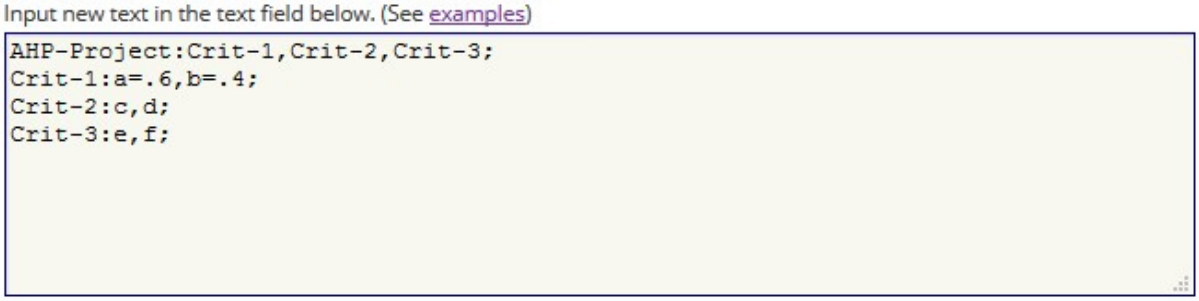
2. Project Administration

The **Project Administration Menu** allows you to manage a selected AHP project.



View Result	View result (greyed, if no result available).
PWC Input	Start your pairwise comparisons input as participant.
Use Hierarchy	Use decision hierarchy of the selected project to define a new one.
Rename	Rename project name or edit project description.
Edit	Edit a saved project (greyed, when project has participants' inputs).
Del Sel. Part.(s)	Delete selected participant(s) (greyed, if no participant is selected.) Select participants in the participants table and refresh.
Delete Project	Delete the whole project.
Toggle Project Status	New: Toggle project status between open and closed
Export Project	Import project from json text file
Done	Close the selected project. Go back to session table.

3. Decision Hierarchy



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The syntax is defined as follows:

```
<hierarchy> → <branch>; [{<branch>;}]
<branch>    → <node>: <leafs>, <leafs> [,<leafs>]
<leafs>     → {<leaf> [ = <weight>]}
```

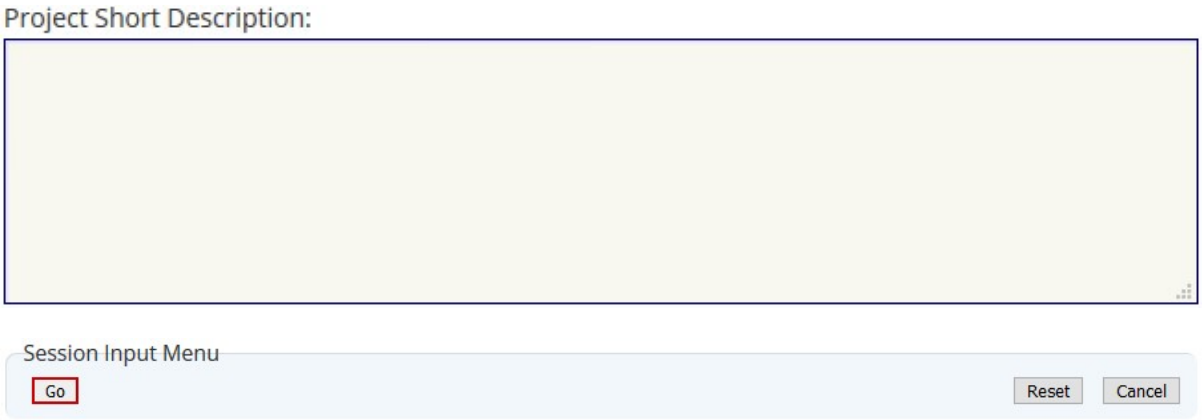
For all <leafs> in a <branch> the sum of <weight> has to be one. A <node> of the second and any further <branch> has to be one of the <leaf> in <leafs>. Each <node> represents a decision matrix, and the corresponding priority vector's dimension is the number of <leafs>. The example shown has defined weights for the two criteria a (60%) and b (40%. For all other criteria weights are automatically set to the default value $1/n_{leaf}$.

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

Submit	Submit new hierarchy text input
Save/Update	Save hierarchy definition as new project
Download (.csv)	Export data as comma separated value file
dec. comma	Export with "," as decimal separator when checked
Reset Priorities	Reset all priority values given within the hierarchy text input. Clears also alternative names
Reset all	Reset hierarchy definition and all other session parameter
Done	Go back to Session Administration

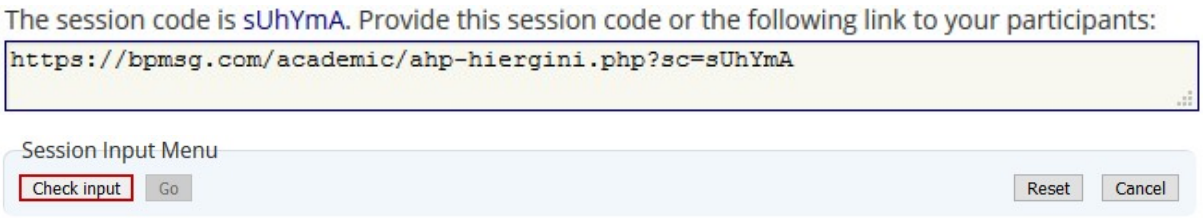
4. Save New/Modified Projects

When you want to save a new or modified project, or rename the project name or description, the AHP Session Input Page will open. You can edit the AHP Project Name and input a Project Short Description. The project short description (max. 400 chars) will be shown to the participants/respondents.



5. Group Input (Participants)

Start project evaluation inputs as participant: Click on *Group Input* in the project administration menu, or follow the group link provided on the project administration page.



Check Input	Check your input (session code and participants' name. Red outline when required.
Go	Start: will show decision hierarchy with AHP buttons to click and start pairwise comparisons.
Reset	Reset form.
Cancel	Cancel input.

6. Pairwise Comparisons

AHP AHP	Start pairwise comparison (red) for selected node of the hierarchy. Once the comparison is done, the button outline will be green.
Check Consistency	Check consistency of the pairwise comparison.
Submit_Priorities	Submit priorities and go back to the hierarchy to continue evaluation.

Once all judgments are completed, they can be saved to the database.

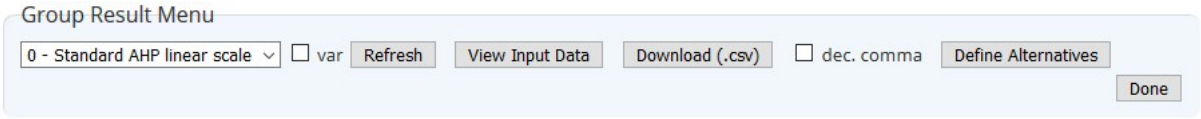
Save Judgments	Submit judgment for group evaluation – red outline, when all comparisons are completed.

View Group Result — View consolidated group results.

Done — Exit the Group input page – red outline, when judgments are saved.

7. Group Results

The **Group Result Menu** allows you to analyse the results and download them as csv text file.



0 - Standard AHP linear scale — Scale selection

var — Uncertainty evaluation and sensitivity analysis (alternatives).

wpm — Weighted product method instead of weighted sum method.

Refresh — Refresh page – outlined red when required.

View Input Data — View participants input data.

Download (.csv) dec. comma — Download results as csv text file.

Define Alternatives — Use hierarchy with resulting priorities for definition of alternatives.

Done — Go back to project list.

8. Define Alternative Project

Click *Use Consol. Prio* in the Group Result Menu and click on *Alternatives* in the hierarchy table. Define number and names of alternatives.

Save as new project.

Save as Project — Hierarchy with consolidated priorities and defined alternatives will be saved as a new project (mode alternative evaluation).

Reset Alternatives — Reset al defined alternative names to input new ones.

Done — Go back to hierarchy page.

Decision hierarchy (table)

AHP AHP — Start pairwise comparison (red) for selected node of the hierarchy, once the comparison is done, the button outline will be green.

Alternatives — Switch to alternative display to start definition and evaluation of alternatives (only, when pairwise comparison completed)

AHP Pairwise comparison menu

Check Consistency	Calculate priorities based on pairwise comparisons and check consistency of judgment
Submit_Priorities	Submit calculated priorities for further calculation

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9. Results Page

On the result page following details are shown:

Project result data	Selected judgment scale, Number of judgment variation for uncertainty estimation, Weighted Product Method (WPM) if selected. - Project summary table, - Alternative table (if any), - Project participants table with checkbox for selection of individual participants.
Hierarchy with consolidated priorities	"All" or selected participants from participant's table, decision hierarchy table with alternatives (if any) and consolidated weights from all or selected participants.
Consolidated global priorities or weights of alternatives	Graph with priorities and uncertainties (if selected).
Sensitivity analysis	1. Weight uncertainties overlap, 2. Robustness (for alternative evaluation).
Alternatives by Participants (alternative evaluation)	Group result of alternative weights, uncertainties and breakdown by participant.
Breakdown by nodes (Details/Hide)	Consistency Ratio CR, AHP group consensus, Table with weights and uncertainties, Consolidated decision matrix, Group result and weights for individual participants.
Global priorities (hierarchy evaluation)	Group consensus and global weights, uncertainties and breakdown by participants.

Annex 2: AHP Hierarchy Example

Decision Hierarchy (table)

Decision Hierarchy

Level 0	Level 1	Level 2	Global Priorities
Supplier Selection	Quality 0.3333	Product Variety 0.3333	11.1 %
		Product Quality Features 0.3333	11.1 %
		Production Quality 0.3333	11.1 %
	Reliability 0.3333	Management & Organization 0.25	8.3 %
		References 0.25	8.3 %
		Capital 0.25	8.3 %
		Annual Turnover 0.25	8.3 %
	Service 0.3333	Communication 0.3333	11.1 %
		Delivery Lead Time 0.3333	11.1 %
		Customization Capability 0.3333	11.1 %
			1.0

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;
```


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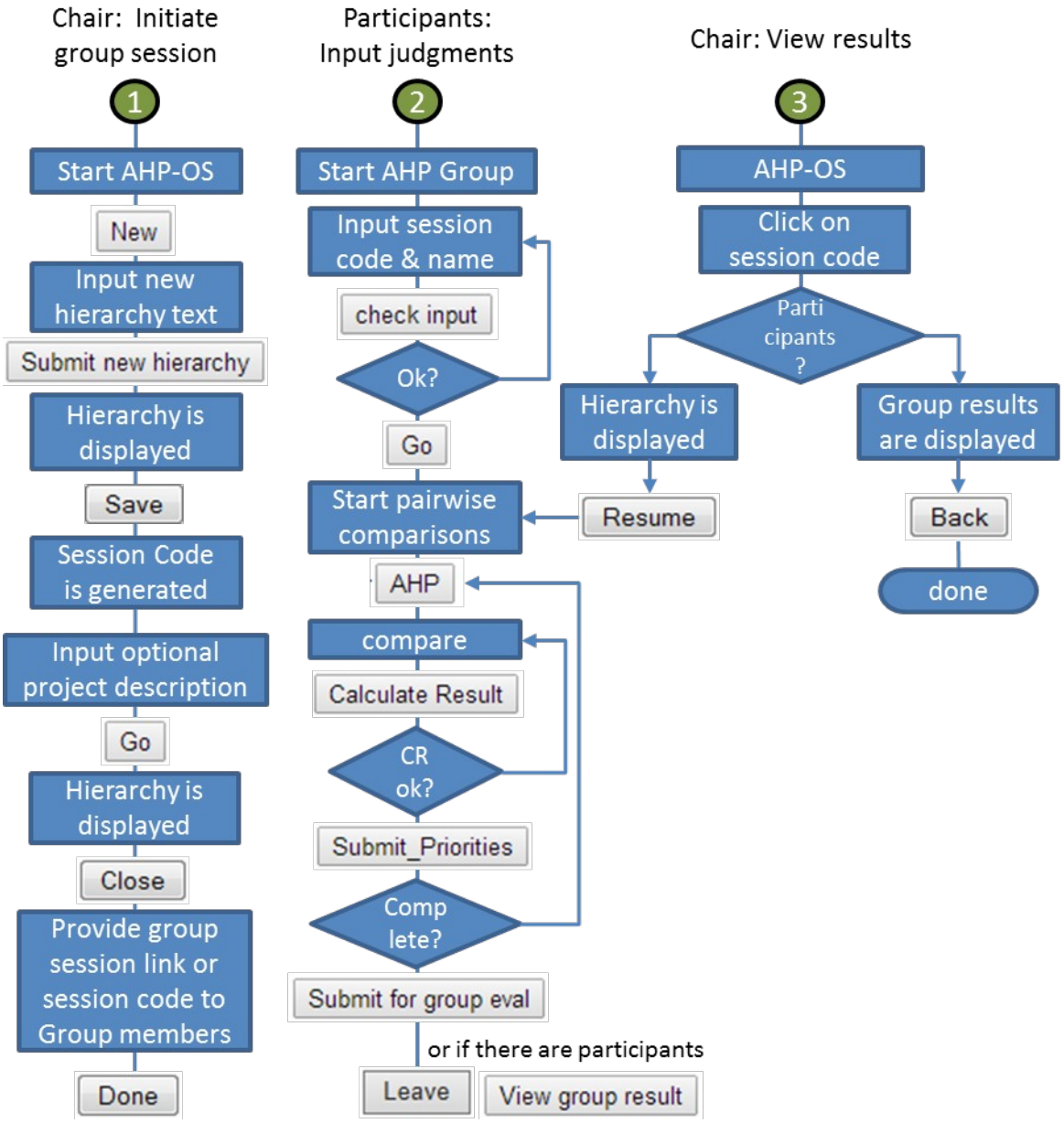
Annex 3: Conducting a group session

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 sessions. A six character session code is generated. Participants can use this session code to log into the group session and provide their judgements.



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Annex 4: Evaluation of Alternatives Example

Evaluation of Alternatives

	Criterion	Node	Glb Priorities	Compare	House A	House B	House C
1.	Size of house	Satisfaction with house	17.3%		0.333	0.333	0.333
2.	Transportation	Satisfaction with house	5.4%		0.333	0.333	0.333
3.	Neighborhood	Satisfaction with house	18.8%		0.333	0.333	0.333
4.	Age of house	Satisfaction with house	1.8%		0.333	0.333	0.333
5.	Yard space	Satisfaction with house	3.1%		0.333	0.333	0.333
6.	Modern facilities	Satisfaction with house	3.6%		0.333	0.333	0.333
7.	General condition	Satisfaction with house	16.7%		0.333	0.333	0.333
8.	Financing	Satisfaction with house	33.3%		0.333	0.333	0.333
				Total weight of alternatives:	0.333	0.333	0.333

0 out of 8 comparisons completed

How to make a decision? The analytic hierarchy process. Saaty, European Journal of Operational Research 48 (1990) 9 - 26 - Alternative evaluation

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Annex 5: Data Structure

Pairwise Comparisons:

Array['pwc'][$node]['a']{0,1,0}['Intense']{3,6,2}

'pwc'																		
Delivery						'Color'							'Memory					
'A'			'Intense'			'A'				'Intense'				'A'			'Intense'		
0	1	0	3	6	2	0	1	0	0	2	4	1	7	0	1	0	3	6	1	7

```
1. function convertPwcToString($pwc) from Array to SQL
2. function convertPwc($pwc) from SQL format to Array
3. function getPwc($sc, $participant, $nod)
```

SQL table pwc					
Project_sc	**pwc_part**	**pwc_timestamp**	**pwc_node**	**pwc_ab**	**pwc_intense**
expl02	Klaus	1397794301	Delivery	010	362
expl02	Klaus	1397794302	Color	0100	2417
expl02	Klaus	1397794303	Memory	010	3617

Class ahpGroup

Priorities in ahpGroup->prio

ahpGroup->prio	**participant**	**[$node]**	**[branch]**	**priority**
ahpGroup->prio	0	Color	red	0,6
			blue	0,4
		Memory	16MB	0,2
			32MB	0,5
			64MB	0,3
		pGlb	all leafs	
	1	Color	red	0,4
			blue	0,6
		Memory	16MB	0,1
			32MB	0,6
			64MB	0,3
		pGlb	all leafs	
	2	…	…	…

Participant with index 0 contains consolidated result

CR in ahpGroup->cr

ahpGroup->cr	participant	[$node]	CR
ahpGroup->cr	0	Color	0,1
		Memory	0,05
		pGlb	avgCR
	1	Color	0,07
		Memory	0,12
		pGlb	avgCR
	2	Color	0,03
		Memory	0,05
		pGlb	avgCR

For alternatives

ahpGroup->prio	participant	$leaf	$alt	priority
ahpGroup->prio	0	blue	0	0,6
			1	0,4
		red	0	0,2
			1	0,5
	1	blue	0	…
			1	
		Color	0	
			1	
	2	blue	0	
			1	
		Color	0	
			1	
	3	…	…	…

Annex 6: Project Export Example


```
    {
    "pj": [
        {
            "project_id": "6512",
            "project_sc": "Ubates",
            "project_name": "Compromise",
            "project_description": "Compromise Problem 3 alternatives\r\
nWPM gives the correct results",
            "project_hText": "Compromise: Sales Skills=0.5, Engineering
skills=0.5;",
            "project_datetime": "2017-06-30 09:06:21",
            "project_author": "Klaus",
            "project_status": "0"
        }
    ],
    "pwc": [
        {
            "project_sc": "Ubates",
            "pwc_part": "Klaus",
            "pwc_timestamp": "1498813840",
            "pwc_node": "Sales Skills",
            "pwc_ab": "000",
            "pwc_intense": "494",
            "pwc_id": "794"
        },
        {
            "project_sc": "Ubates",
            "pwc_part": "Klaus",
            "pwc_timestamp": "1498813840",
            "pwc_node": "Engineering skills",
            "pwc_ab": "111",
            "pwc_intense": "494",
            "pwc_id": "795"
        },
        {
            "project_sc": "Ubates",
            "pwc_part": "Klaus1",
            "pwc_timestamp": "1560243394",
            "pwc_node": "Sales Skills",
            "pwc_ab": "000",
            "pwc_intense": "397",
            "pwc_id": "2755"
        },
        {
```

```
            "project_sc": "Ubates",
            "pwc_part": "Klaus1",
            "pwc_timestamp": "1560243394",
            "pwc_node": "Engineering skills",
            "pwc_ab": "111",
            "pwc_intense": "892",
            "pwc_id": "2756"
        }
    ],
    "alt": [
        {
            "project_sc": "Ubates",
            "alt": "A"
        },
        {
            "project_sc": "Ubates",
            "alt": "B"
        },
        {
            "project_sc": "Ubates",
            "alt": "C"
        }
    ]
}
```