Web-HIPRE: Eight years of decision analysis software on the Web

History, users and applications

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Outline

- Use of multicriteria decision analysis (MCDA) in e-Democracy
- History of Web-HIPRE
  - HIerarchical PREference analysis on the World Wide Web (MAVT and AHP)
- Opportunities to apply Web-HIPRE in e-Democracy
- Applications and user experiences
- Conclusions

Use of MCDA in e-Democracy

- e-Democracy problems typically involve multiple criteria
  - E.g. environmental problems – many stakeholders, conflicting interests
- Multicriteria decision analysis is needed
  - Understanding of the structure of complex problems
  - Presenting different stakeholders' preferences in a common framework

→ Web-HIPRE a testing platform

History of Web-HIPRE

HIPRE (First version 1988), HIPRE 3+ (1992)

- General purpose MCDA software
  - Supports both multiattribute value theory (MAVT) and AHP methodologies
- MS-DOS platform
- Development started from the needs of energy policy cases
  - Decision analysis interviews with members of the Finnish parliament (Hämäläinen, 1988, 1992)

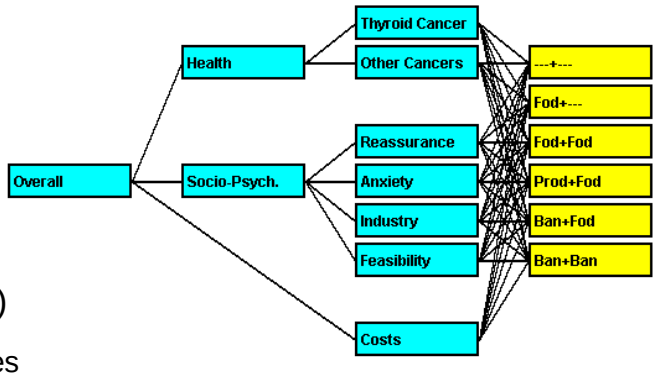
History of Web-HIPRE

Web-HIPRE (First published in 1998)

- Web based successor of HIPRE 3+
- Development started from the need to have MCDA tools for public participation
  - Environmental applications (Marttunen and Hämäläinen, 1995; Mustajoki et al., 2004)
  - Can we utilize the opportunities provided by the Web?

Multiattribute value tree analysis

- MCDA approach to model DMs' preferences
- Value tree:

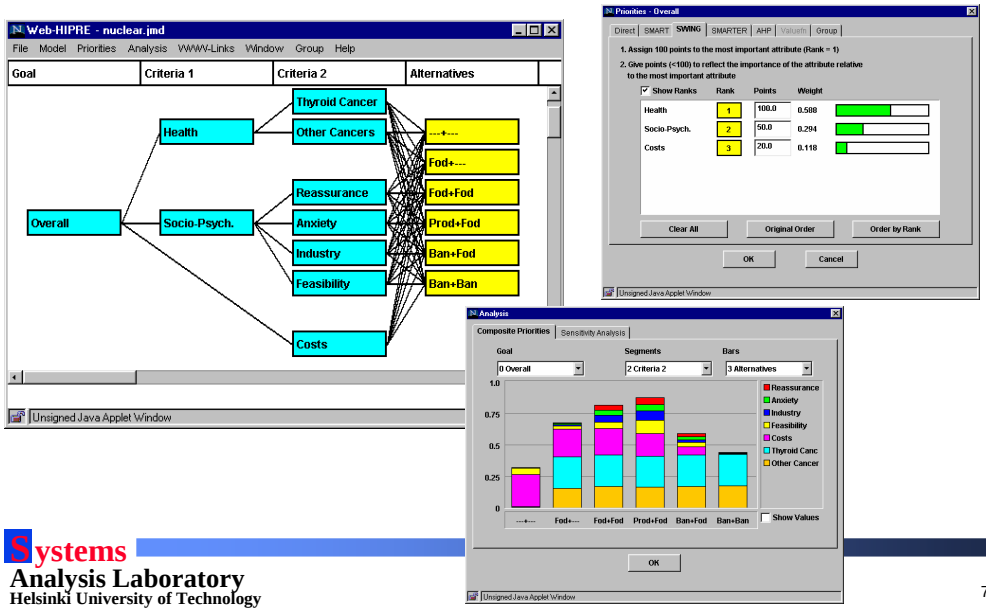


- Overall value of alternative x:

$$v(x) = \sum_{i=1}^{n} w_i v_i(x_i)$$

n = number of attributes
w_i = weight of attribute i
x_i = consequence of alternative x with respect to attribute i
$v_i(x_i)$ = rating of x_i

Web-HIPRE user interface



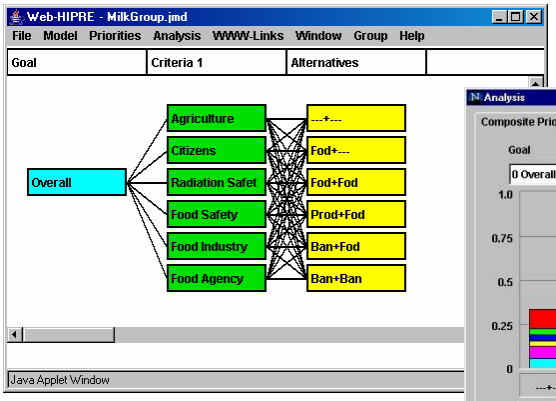
Web features in Web-HIPRE

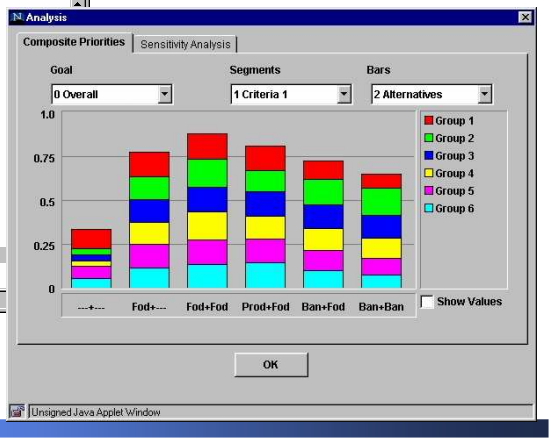
- Publicly available on the Web
  - Platform independence – no local installations
- Links to Web pages
  - Additional information about the alternatives and the case
- Group model
  - Aggregation of individual preferences to group preferences through the Web

→ Potentially useful features in e-Democracy

Group decision support

Individual results aggregated with the Weighted Arithmetic Mean Method





How to benefit from Web-HIPRE in e-Democracy?

1. Assisted decision analysis in a stakeholder group
2. Studying of other stakeholders' models on a project Web site – Sensitivity analysis
3. e-Learning of decision analytical methods

   …
4. Independent use by the public through the Web

1. Assisted decision analysis in a stakeholder group

- A group of e.g. 10-20 stakeholders set up to represent different interest groups
- MCDA interviews with members of this group
  - Analyst helps and assures the proper use of the methods
- Preference models discussed collaboratively
  - Results communicated with the public
- Very applicable but also laborious approach

MAVT in e-Participation

- Enables to input stakeholders' preferences systematically into the process
- Helps understanding the pros and cons of different alternatives
- Provides a common language for communication

→ e-Democracy process based on consistent analysis of the values of public

2. Studying of other stakeholders' models

- Examples of the models elicited in MCDA interviews can be published on the Web
- Public can independently analyze these
  - Understanding of other stakeholders' preferences
  - Sensitivity analysis of group members' weights (power)
- Possibly Ok – still risk of misunderstandings
  - Basic skills on MCDA needed
- How to commit public to analyze the models?

3. e-Learning of decision analysis

(www.mcda.hut.fi)

- e-Learning Web site on value tree analysis
  - Theory, cases, quizzes, assignments, videos
  - Demostrations how to use Web-HIPRE in practice
- Makes decision analysis interviews through the Web possible?
- Gives basic skills to study other stakeholders' models
- More reseach needed

4. Independent use by the public

- The public can be allowed to independently evaluate Web-HIPRE models on the Web
  - Any stakeholder can elicit his/her preferences
- Elements of the model can have Web links
  - Additional information about the policy options
- Requires methodological support

  → Not easily applicable with general public
- Do we need to elicit all the stakeholders' preferences?

Application: Lake regulation policy

- Case: Regulation of Lake Päijänne
- Several stakeholders: summer cottage residents, conservationists, water power companies, fishermen, …
- Steering group of 20 members to represent different stakeholders
- Public participated in different phases of the process

Use of Web-HIPRE

- Decision analysis interviews of steering group members with HIPRE and Web-HIPRE
  - Results analyzed collaboratively to get a view of the differences between the stakeholder groups
- Web-HIPRE models of different stakeholders available on the Web
  - Testing of new technology

Experiences of using Web-HIPRE

- MCDA interviews very applicable approach to clarify the differences between opinions
- Communication between the steering group and the public very important
- Analyzing independently the models of the stakeholders could be too demanding
  - Even if the public does not analyze the models, the awareness of these could increase openness and trust

Application: Nuclear emergency management

- Simulated nuclear accident
- Milk case: Planning of countermeasures for the milk pathway in a nuclear accident
- Urban case: Planning of clean-up actions in inhabitated areas
  - Similar workshops in seven European countries
- A day-long decision workshop exercise held to consider the problem from different perspectives

Use of Web-HIPRE in the workshop

- Value tree constructed collaboratively
- Weights given by each participant group
  - Hands-on use of the system
- Results analyzed together
  - Aim to understand the other participants' preferences
- Individual models aggregated into a group model

Experiences

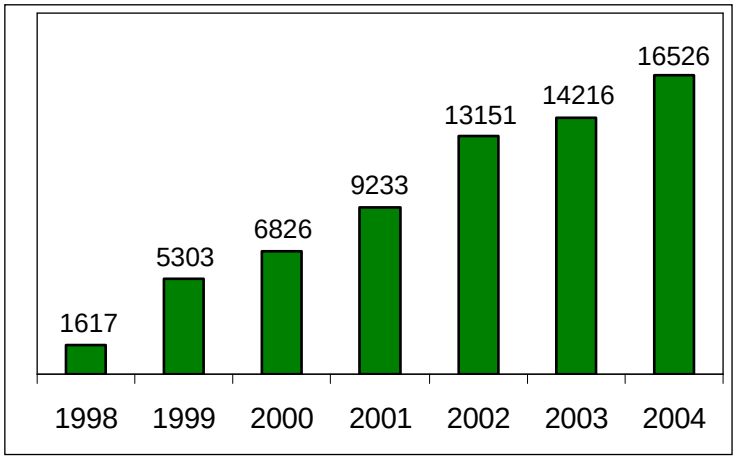
- Web-HIPRE provides a very applicable way to support decision conference workshops
  - Analyzing the other participants' preference models helps to understand their viewpoints
  - Group model gives an averaged overview
- Simple models needed
  - A comprehensive overall view can still be provided
- Preference models on the Web
  - Participants can study them afterwards

RODOS project

(http://www.rodos.fzk.de)

- European project: Realtime Online Decision Support System for nuclear emergency management
- Web-HIPRE integrated as a part of the RODOS system
- Explanation module integrated to generate natural language reports (Papamichail and French, 2003)
  - Applied successfully on agricultural countermeasure strategy analysis (Geldermann et al., 2005)

Visits to Web-HIPRE



- It takes time to practitioners to find the software

Who is using Web-HIPRE?

- User survey (June 2006)
  - Submitted by e-mail to all registered users (~3200)
  - 119 replies

Used Web-HIPRE as a	Amount	Per cent
Student	61	51.3 %
Reseracher	41	34.5 %
Teaching instructor	20	16.8 %
Decision analyst	14	11.8 %
Other	7	5.9 %
Total:	**119 participants**	

Application areas

The area of application	Amount	Per cent
Business strategy	28	23.5 %
Environmental decision making	28	23.5 %
energy policy	6	5.0 %
Public policy	4	3.4 %
R & D	16	13.4 %
Product design	2	1.7 %
Product/project selection	26	21.8 %
Performance evaluation	12	10.1 %
Human resources/personnel evaluation	7	5.9 %
Other	20	16.8 %
Total:	**119 participants**	

Projects using Web-HIPRE

Environmental:

- Forest management (Levy et al., 2000)
- Lake regulation policy (Mustajoki et al., 2004)
- Agricultural countermeasure strategy analysis (Geldermann et al., 2005)
- Nuclear emergency management (Mustajoki et al., 2006)
- Conservation of Florida panthers (Thatcher et al., 2006)
- Energy analysis in Bangkok (Phdungsilp, 2006)

Projects using Web-HIPRE

Product/strategy evaluation:

- PC disposition in banking industry (Shah and Sarkis, 2003)
- e-Commerce software for a supply chain (Sarkis and Talluri, 2004)
- e-Business process composition (Shaikh and Mehandjiev, 2004)
- Performance based building (Porkka et al., 2004)
- Company strategy selection (Sale and Sale, 2005)

User survey

How did you learn about Web-HIPRE?	Amount	Per cent
Reference in a book or a journal article	10	8.4 %
Through a Web link	17	14.3 %
By a search engine	25	21.0 %
From a colleague	34	28.6 %
As a participant of a related course using Web-HIPRE	20	16.8 %
Other	12	10.1 %
Total:	**119 participants**	

- How can we better promote the approach?

Conclusions

- Web-HIPRE provides a general platform for MCDA in e-Democracy
- Experiences strongly support the applicability of the MAVT approach in e-Democracy
  - Especially in decision analysis interviews
- Web makes remote interaction possible
  - Independent use of the software requires methodological support – not easily applicable
  - How can e-Learning sites be applied to enhance independent use?

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