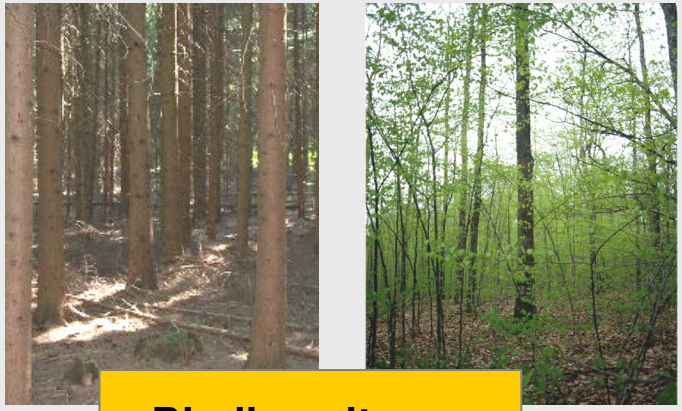
What is MCDM?

Timber production



Biodiversity

Indicators

- deadwood
- Species diversity
- Soil vegetation
- Vertical structure
- Texture
- (...)

Monetary valuation approaches | **Multi criteria methods (MCDM)**

Timber production & Biodiversity

Cost/benefit-Analysis
[Contingent Valuation (...)]

MCDM

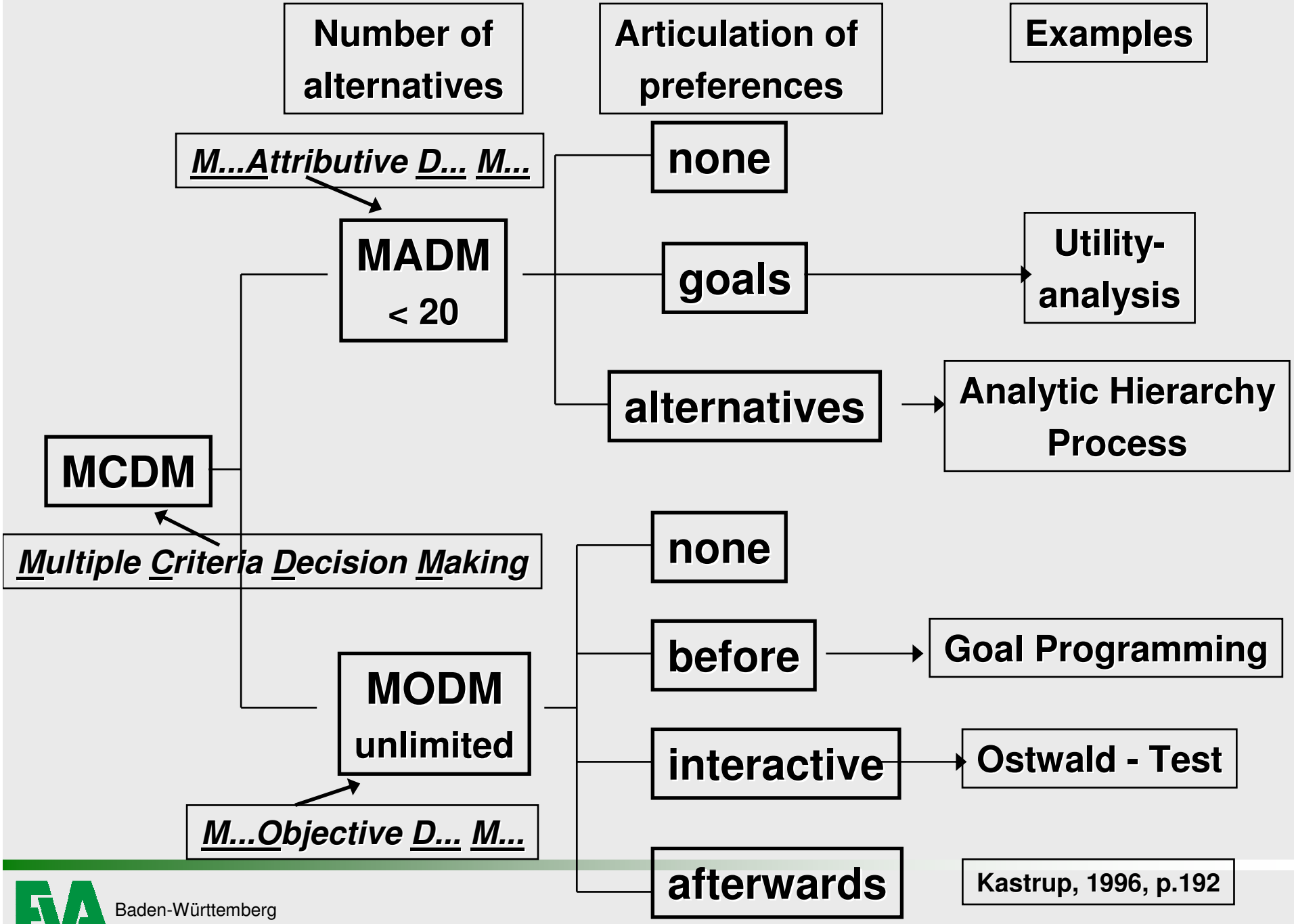
Baden-Württemberg
Forest Research Institute

Lexer, 2005

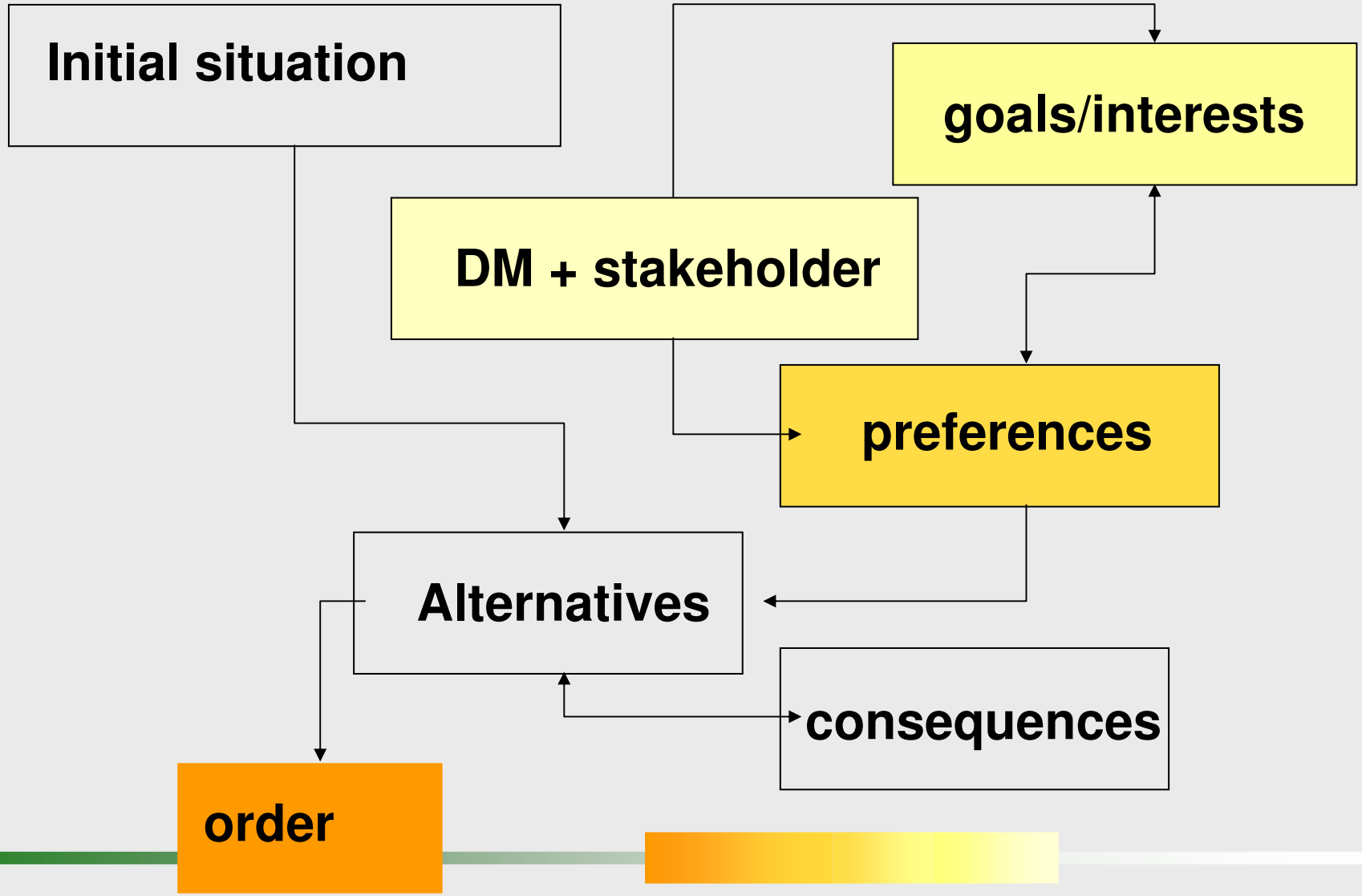
How does planning science reacte to the new challenges?

Development and test of :

- Multi-Criteria Decision Making methods (MCDM)
- Participatory Planning approaches
- Decision Support Systems (DSS)


Number of alternatives
Articulation of preferences
Examples
M...Attributive D... M...
MADM
< 20
none
goals
Utility-analysis
alternatives
Analytic Hierarchy Process
MCDM
Multiple Criteria Decision Making
none
before
Goal Programming
MODM
unlimited
interactive
Ostwald - Test
M...Objective D... M...
afterwards
Kastrup, 1996, p.192

Decision analysis & MCDM



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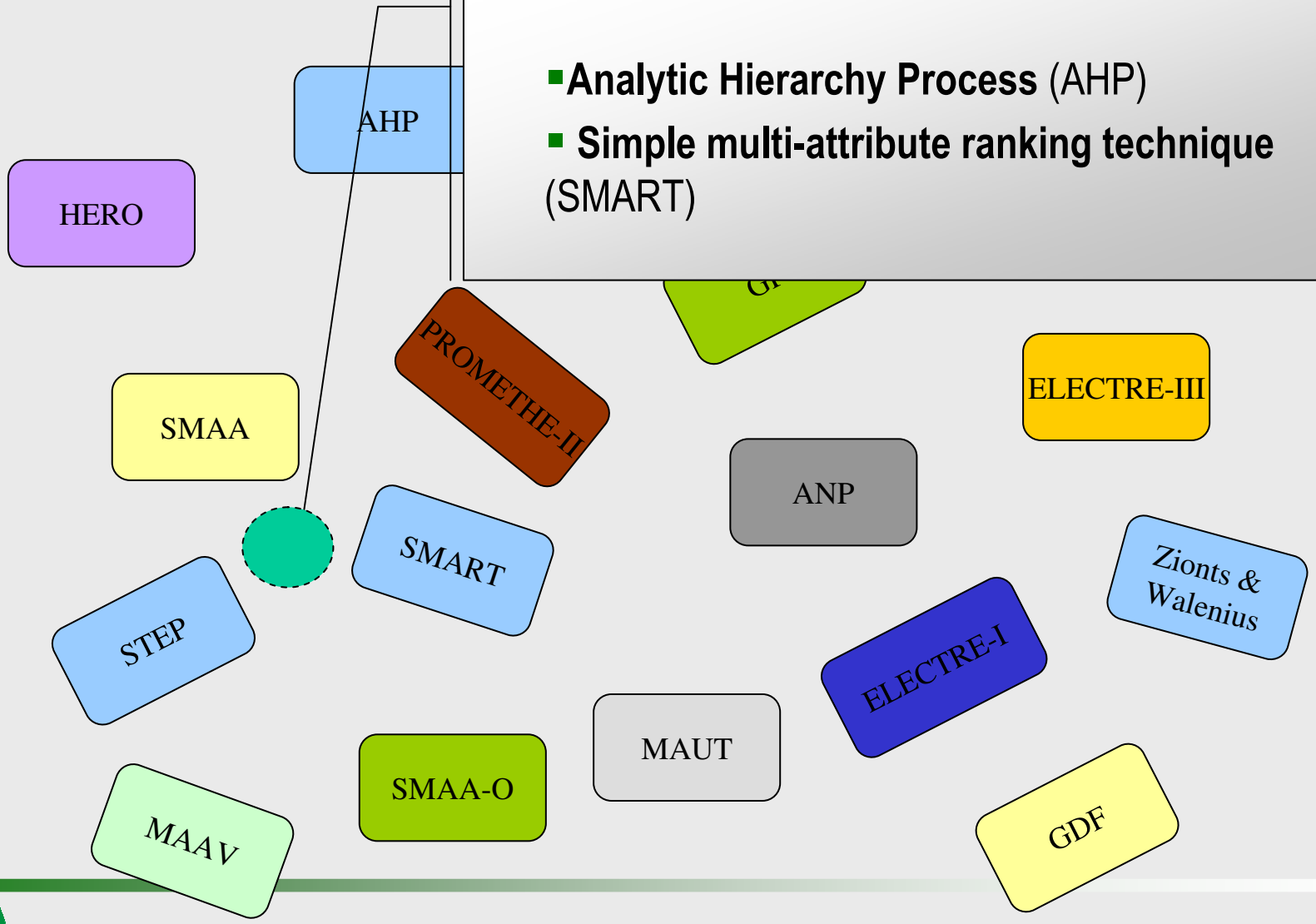
Methods, Methods ...

- **Analytic Hierarchy Process** (AHP)
- **Simple multi-attribute ranking technique** (SMART)



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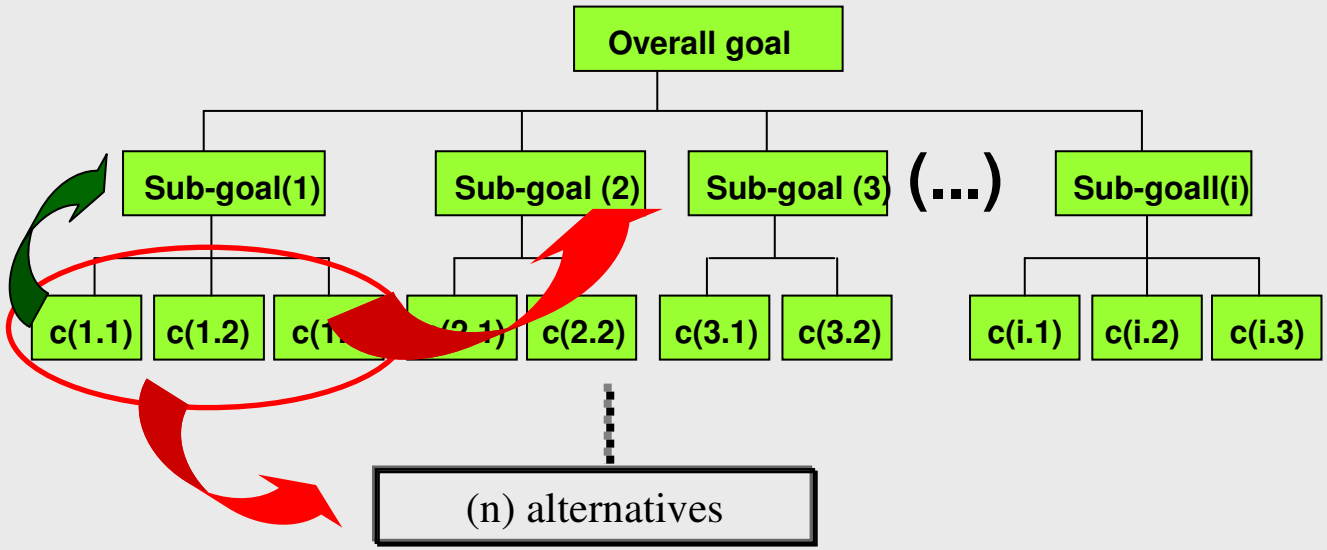
AHP (Analytic Hierarchy Process)

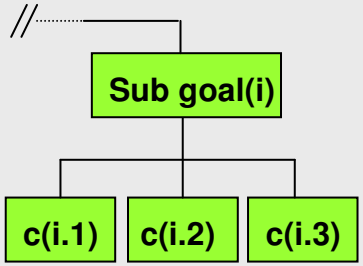
- hierarchical goal-structure
- cardinal preferences assessed via comparison of pairs („eigenvalue“ -approach)
- rel. weighting of elements of one hierarchy level for the respective superior element
- additive aggregation of preferences for each alternative results in cardinal order



- Weights of criteria refer to the superior element
- Not dependent of the element of the subordinate level
- Should not depend on the elements of the superior level

Lexer, 2005

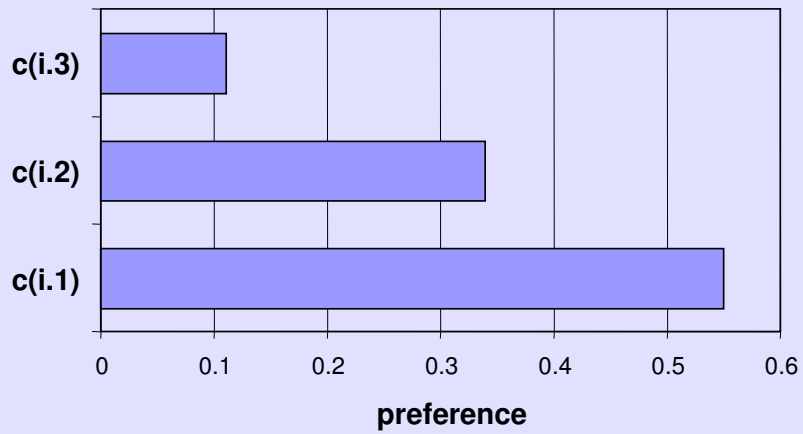
Analytic Hierarchy Process estimation of parameters using Saaty´s Eigenvalue method



Pair comparison matrix

$$\begin{array}{c|ccc} & c(i.1) & c(i.2) & c(i.3) \\ \hline c(i.1) & 1 & 2 & 4 \\ c(i.2) & 1/2 & 1 & 4 \\ c(i.3) & 1/4 & 1/4 & 1 \end{array}$$

Relative weights of criteria



Relative scale

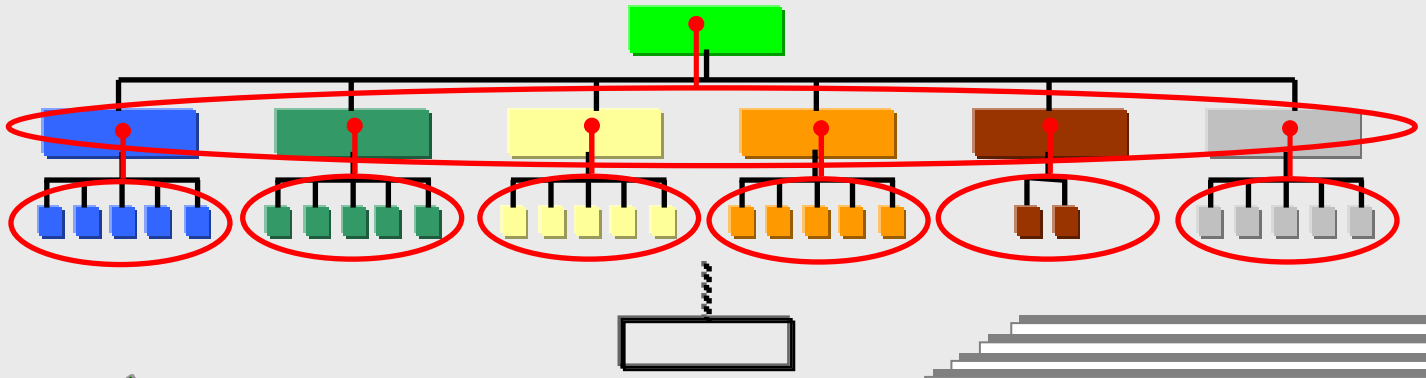
1/9	1/7	1/5	1/3	1	3	5		
extremly	very much	much	slightly	equally	slightly	much	very much	extremly
Less important				important	More important			
Less preferred				preferred	More preferred			

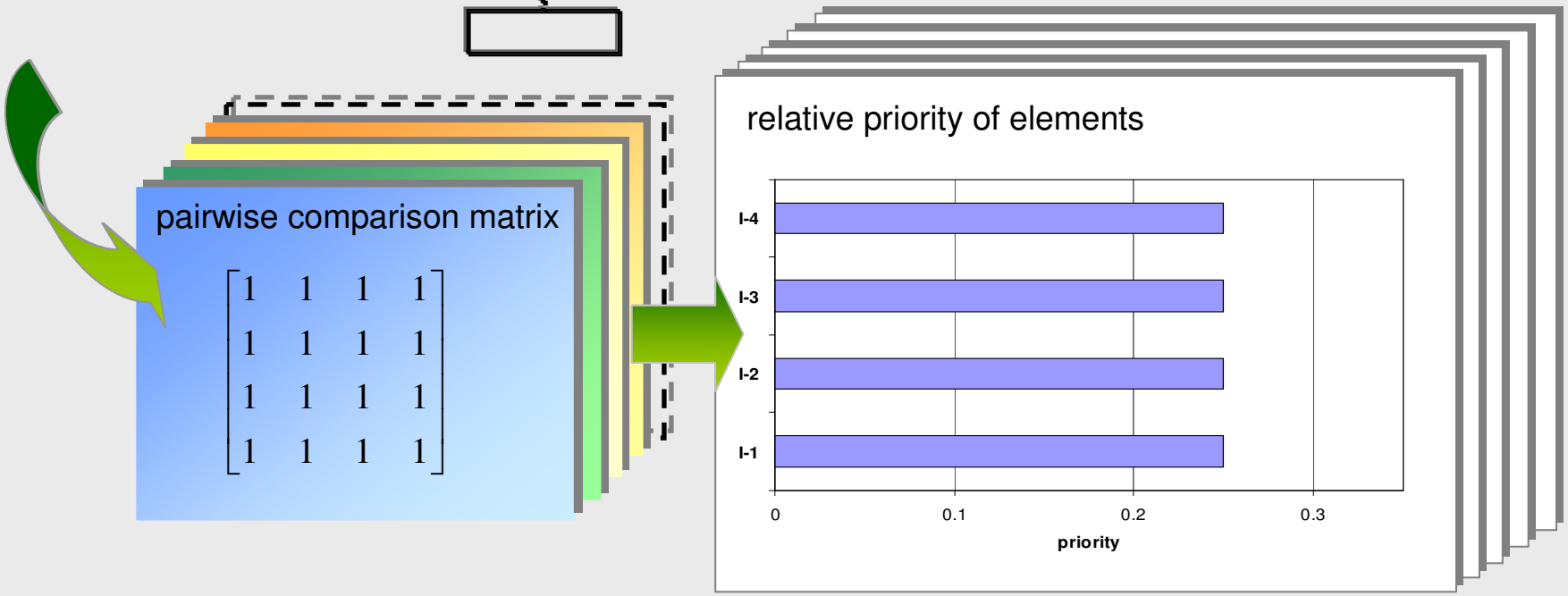
2, 4, 6, 8, and ½, ¼, 1/6, 1/8 are intermediate values

Lexer, 2005

AHP: calculating priorities...

Lexer, 2005



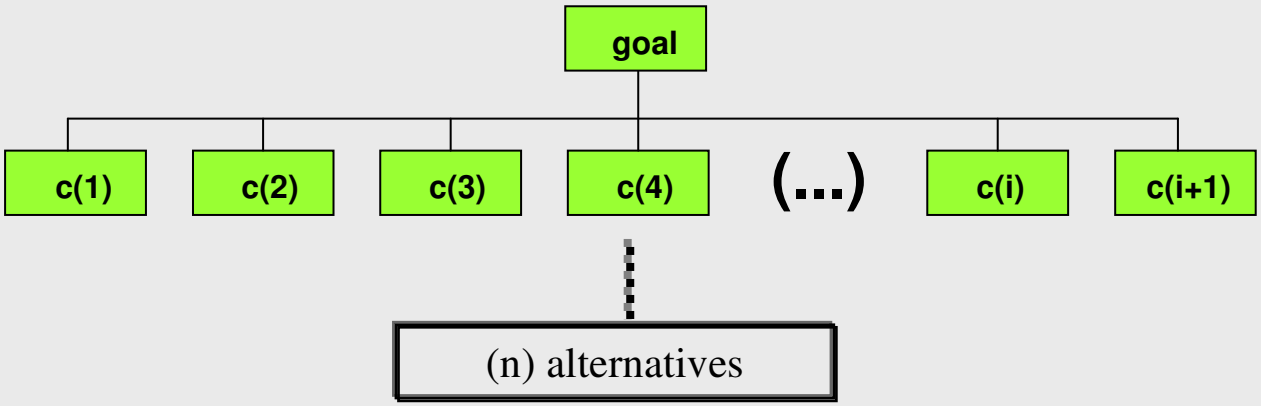


additive aggregation of priorities

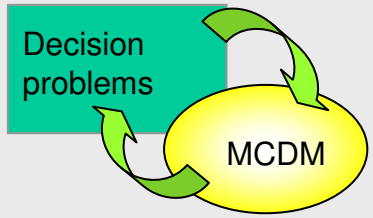
(Saaty, 1977)

SMART (Simple Multi-Attribute Rating Technique)

- Basis version: no goal hierarchy > „flat“ multi-criteria approach
- cardinal order of alternatives related to each criterion
- direct rating on (e.g.) 0 -100 scale (many variants)
- relative weight of criteria (many approaches to assess)
- additive connection of criteria-scores for each alternative



Choice of MCDM-Methods



Attributes of the Decision Makers (DM) / Analysts

- Time budget of the DM
- Know How - Level of the DM
- Ability of the DM to articulate preferences

Features of the found solution

- Ordinale/cardinal order
- Consistency of the results
- Usefulness of the solutions for the DM

Attributes of the Decision Problem

- How to deal with uncertainty
- Number of possible alternatives/goals
- How to deal with non-numeric information

Features of the method

- Usability
- Specialized software necessary?
- Transparency of the solution
- Flexibility
- Compensation/ possibility of veto

(after Al-Shemmeri et al. 1997)

How to use MCDM

- define the goals of the decision makers – not yours !
- analyse preferences of the relevant stakeholder groups – not yours !
- choose the simplest adequate method
- be understandable !
- be a good moderator !