Collaborative Decision Making Process: A flexible, preferences based, methodology

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Content

- Collaborative Decision
- Tools for Collaborative Decision
- Group Support Systems & Facilitation Process
- MCDM Group Decision Making
- Methodology to support Co-Decision Processes
- GRUS System
- Conclusion
ICT Introduction in Organizations

- ICT: Decision Making processes modification
  - Organizational: Multi-actors
  - Cognitive: Sorting Step reinforcement

- Collaborative Decision
  - Process orientation
  - Electronic Teams
  - Asynchronous / Distributed Processes

- Needs to design new tools: Collaborative Decision Support Systems
Cooperative DSS

(Dynamical HCI)

Tasks Management

Knowledge Management

Interpersonal Communication

Dynamical HCI

CDSS

MBMS

DBMS

Knowledge Base

User

Other User

(Zaraté, 2013)
Group Support Systems

- Improve quality of Decision Processes
- Facilitation is needed particularly in Asynchronous / Distributed situations
- Facilitation Process (Adla, 2010)
  - Difficulties to agree on common criteria of Decision Making
Facilitation Process

Fig. 1: Group facilitation process

(Adla, 2010)
MCDM Group Decision Making

- Macharis et al. (1998)
  - GDSS: Promethee
  - Decision Makers
    - Individual Preferences ➔ One performance matrix by Decision Maker
    - Same or Different Weight for each criteria
  - Global aggregation for the group ➔ Weighted Sum

- Advantage: Sensitive Analysis among Stakeholders

- Limit: No Collaboration, No Co-Decision
Proposed Methodology

- Sharing information for Co-decision Processes
- 2 levels of preferences
  - Common Criteria discussed among the stakeholders
  - Individual Criteria
Criteria

- Suitability Function
  - Scoring Scale
  - Indifference Score
  - Reject Score
  - Shape of Interpolation

(a) linear improvement of the suitability
(b) sigmoide improvement of the suitability
(c) plateau improvement of the suitability
Step 1: Collective Evaluation

Agreement on

- Collective Criteria Definition
- Scoring scale
- Score of each alternatives for these common criteria
- Weight of each participant
- Which level of sharing information
- How many iterations
Methodology

- Step 2: Individual evaluation
  - Individual Criteria ➔ private no shown
  - Personnal Weights for all criteria
  - Personnal Suitability Functions for all determinant criteria
  - Dependences of all criteria
Methodology

- Step 3: Aggregation and Analysis
  System computes
  - Global Weight ➔ Sum of all weights (individual and collective)
  - Statistics: Average and Standard deviation of weight of collective criteria
  - Statistics of Suitability Function for Collective Criteria ➔ Average, Standard Deviation, Min, Max
  - Collective Assessment of each alternatives (median, standard deviation and extremum values)
  - Sensitivity Analysis
Methodology

- Step 4: Discussion
  - Allow participants to see all data
  - Discussion fed by the results computed by the system
  - Justification of some preferences
  - Come back to step 2 if necessary
GRoUp System (GRUS)

» Web Application : ToolBox

» Based on Grails web application framework
  > Open Source Framework

» GRUS is a fully open source system : available upon request
GRUS Features 1/2

» Can be used in several situations

- Same Time
  - Same Place
    (Synchronous and collocated)
- Different Time
  - Same Place
    (Asynchronous and collocated)

  Indifferent to Time
  Indifferent to Place

- Same Time
  - Different Place
    (Synchronous and distributed)
- Different Time
  - Different Place
    (Asynchronous and distributed)

» In GDSS, 2 roles of user
  > One facilitator (meeting manager)
  > Several Participants (meeting contributors)
GRUS Features 2/2

» 2 kinds of meetings are available
  > Public meetings
    + All registered users in GRUS system can participate
  > Private meetings
    + Only invited users can participate to a private meeting

» Some collaborative tools are available
  > Electronic Brainstorming
  > Categorizer
  > Vote
  > Agenda
  > Report...

» User with the role of facilitator can for her/his meeting
  > Define the meeting type
    + Group process (sequence of collaborative tools)
  > Invite users
  > Manage the group process (stop, add, delete,...) tools
GRUS Objectives

» Open System for
  > Sharing collaborative tools
  > Sharing group processes

» Promote the use of GDSS in organizations

» Improve the efficiency of group work
MCDA aggregation tools:
- Weighted Sum / Choquet
- Other technics: to be implemented

MCDA aggregation tools use:
- Definition of alternatives (=ideas)
- Definition of criteria: public or private
- Definition of suitability functions
- Definition of performances

Weight of participants:
- Equi-weighted
- Could be parametrizable
GRUS: Creation of a New Process

Create Process

Title: My 1st process

Choose your tools: brainstormingWs, clustering, consensus, vote

Filter

Create
GRUS: Process Modification

Logo and Project Name

Home | Open meeting | Support | Developer | Plugin | About

Options

Brainstorming | Clustering | Consensus

Click to update the current process

Topic: My topic to discuss

Edit meeting

Edit your current process: My 1st process: My topic to discuss

Brainstorming

Vote | Clustering

Consensus

Remove last tool

Save changes

brainstorming

brainstormingWs

clustering

consensus

vote
## Collective Preferences

**Topic**: Selection of PhD Student

### Vote

Please introduce performances for each alternative.

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Age</th>
<th>Cursus</th>
<th>Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>18</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>John</td>
<td>14</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Helena</td>
<td>14</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>

Objectif(s): We have to choose one candidate among three for a PhD Position.

Example: PhD Student selection
**Individual Preferences**

Weight and preference function

Please introduce the weight and the parameters for the preference function for each criterion.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Mark</th>
<th>Minimum</th>
<th>Desired</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>12</td>
<td>1</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Cursus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publications</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Example: PhD Student selection
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<table>
<thead>
<tr>
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<th>Age</th>
<th>Cursus</th>
<th>Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Cursus</td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Publications</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Criteria Aggregation

**Topic : Selection of PhD Student**

### Consensus

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Desired</th>
<th>Maximum</th>
<th>Authorized minimal performance</th>
<th>Authorized maximal performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of the weights attributed by the decision-makers</td>
<td></td>
<td></td>
<td>Global preference</td>
<td></td>
<td></td>
<td>Tolerated minimal and maximal performances</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>20</td>
<td>20</td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>

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The importance of the criterion --Age-- in the model: 1.198
Final Ranking

Summary of the mark for the alternatives

- **Results of the alternative--John --**
  - Global mark obtained by integral of Choquet: 1.44
  - Global mark obtained by balanced sum: 1.8

- **Results of the alternative--John --**
  - Global mark obtained by integral of Choquet: 1.26
  - Global mark obtained by balanced sum: 1.8

- **Results of the alternative--Helena --**
  - Global mark obtained by integral of Choquet: 0.9
  - Global mark obtained by balanced sum: 1.5

Example: PhD Student selection
Conclusion

- Proposed methodology for Co–Decision
  - Co–construction of the Decisional Process
  - Process oriented
- GDSS Platform under development: to be improved
- Aggregation technic simple (weighted sum)
  - Limit: to be improved
Methodology allows a participatory decision making process including 2 levels of preferences

- Individual: Citizen could be involved in the Individual preferences evaluation
- Collective: Citizen could be involved in the decision making process and problem definition

Remark: Finite set of stakeholders