



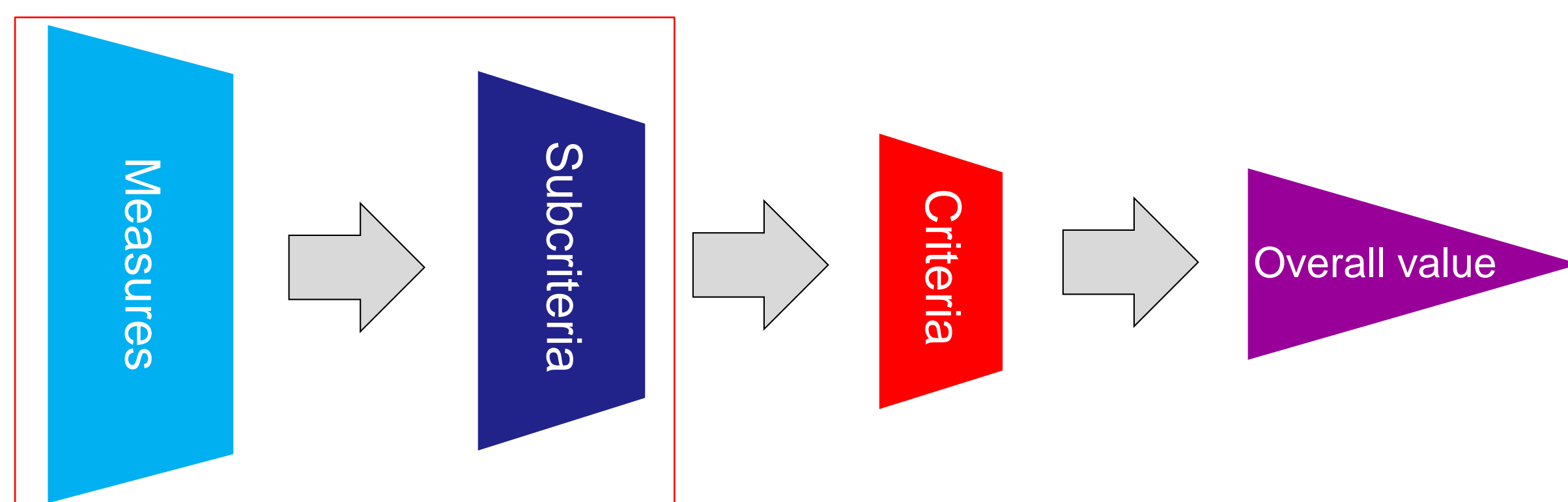
Development of a multicriteria evaluation system to assess animal welfare

Introduction / Aim of this study

- Animal welfare is a multidimensional concept, and its assessment should be based on different measures
- Considerable efforts have been made to develop assessment protocols for farm animal species (e.g. Welfare Quality®)
- One of the main challenges for the application of the protocols is the aggregation of the information into overall scores
- This study proposes an alternative method to aggregate the information, different from the existing approaches

Data basis

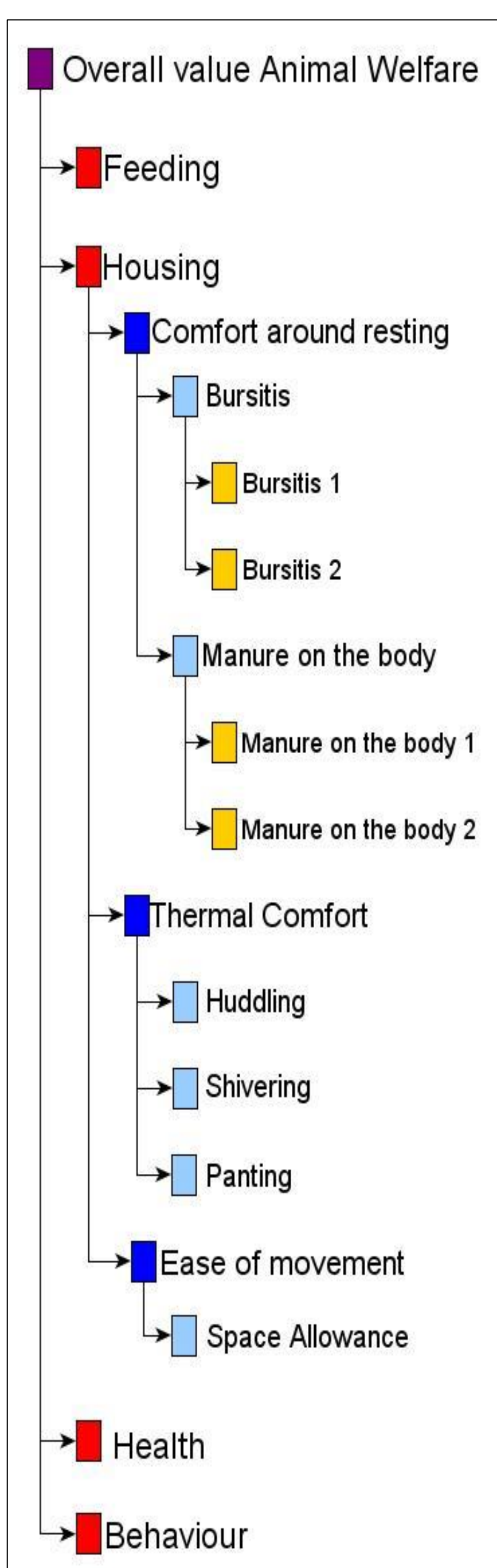
- In a first step, the Welfare Quality® protocol for fattening pigs was implemented
- Eleven simulated farms were used as an example to draw conclusions about the preferences of the decision maker



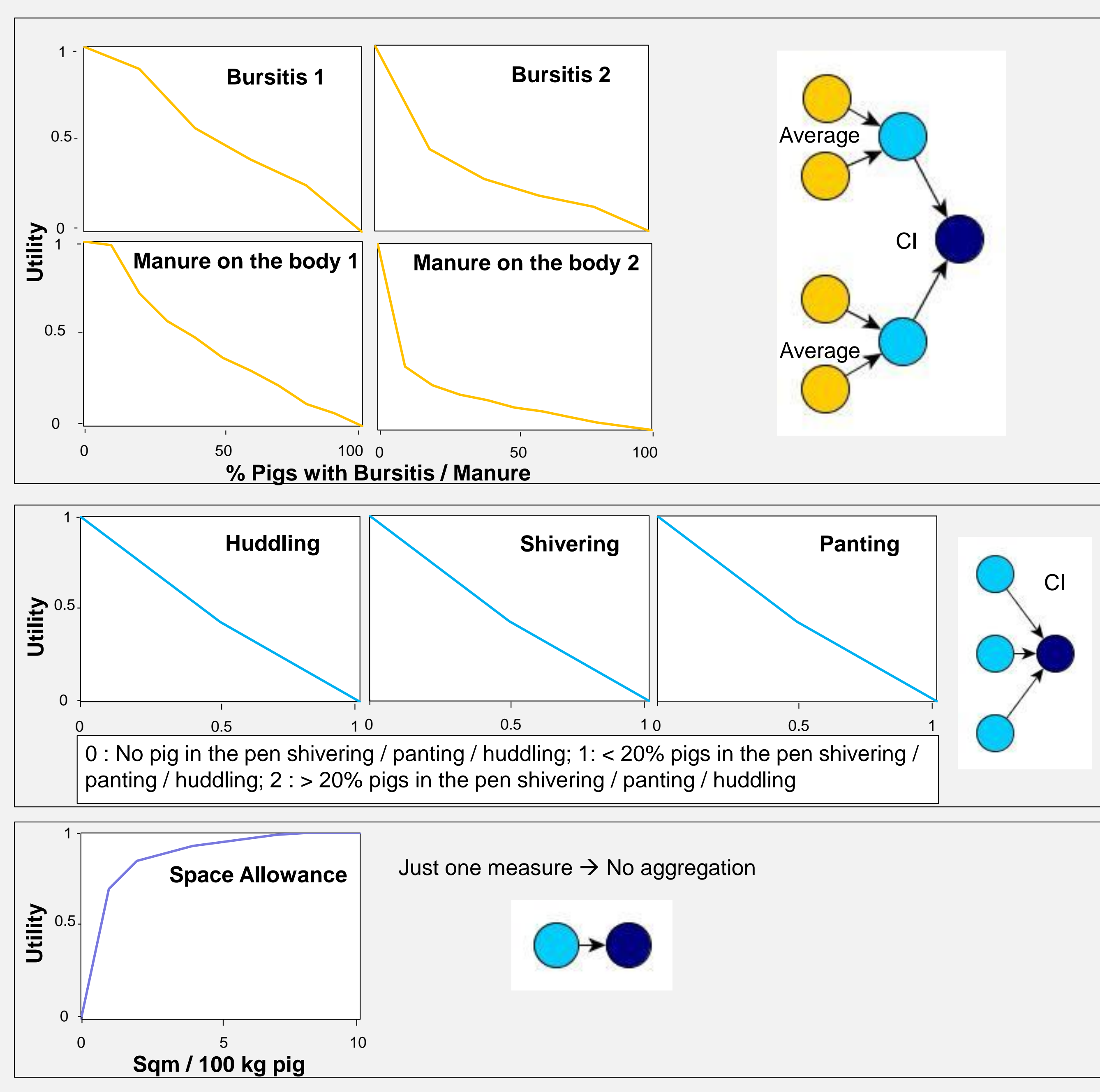
Methods / Model

- Multiattribute utility theory was used to aggregate the 32 welfare measures into the corresponding subcriteria
- The utility functions and the aggregation functions were constructed in two separated steps:
 - Utility functions for each measure were determined with the MACBETH method
 - Measures were aggregated using the Choquet Integral (CI). Minimum variance approach was implemented. Shapley value and/or interaction indices constraints were imposed

Results:



Example of the utility functions determined with the MACBETH method for the Housing criterion



Example of the aggregation with the CI of the Thermal Comfort measures for the 11 simulated farms

Decision maker preferences:
 Importance of the criteria: Panting > Shivering > Huddling
 Compensation allowed only between Huddling and Shivering
 Weak order over farms: a > f > d > b > i > e > g > c > j > h > k

Farm	Huddling		Shivering		Panting		CI
	Value	Utility	Value	Utility	Value	Utility	
a	No	1	No	1	No	1	1
b	No	1	No	1	<20%	0.43	0.784
c	No	1	No	1	>20%	0	0.622
d	No	1	<20%	0.43	No	1	0.810
e	No	1	>20%	0	No	1	0.667
f	<20%	0.43	No	1	No	1	0.824
g	<20%	0.43	<20%	0.43	No	1	0.632
h	<20%	0.43	>20%	0	No	1	0.489
i	>20%	0	No	1	No	1	0.691
j	>20%	0	<20%	0.43	No	1	0.499
k	>20%	0	>20%	0	No	1	0.354
Shapley value	0.309		0.324		0.366		

Interaction indices	Huddling	Shivering	Panting
Huddling	NA	-0.004	0.003
Shivering	-0.004	NA	0.021
Panting	0.003	0.021	NA

Conclusion

- MACBETH allows to judge the different attractiveness of all the measures although they are collected in different scales (cardinal, ordinal) and different units, which reduces the model complexity → one single utility function determination method
- The interactive approach used in the CI determination allow us to modify progressively the interaction indices and the importance values depending on the preferences of the DM (further project steps, ≠ stakeholders opinion is considered)

