Multiscale scoring method for socioeconomic sustainability assessment of value chains

Advances in Value Chain Assessments for Sustainable Livestock Systems

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L. Forzoni[1], M. Moretti[1], S. Righi[1], S. Van Schoubroeck[2]

[1] Department of Agricultural, Food and Agro-environmental Sciences, University of Pisa

[2] Department of Engineering Management, University of Antwerp

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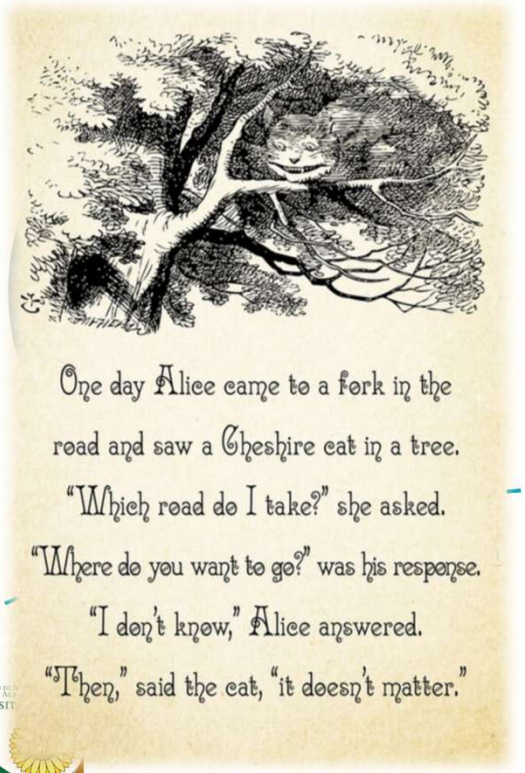
(1) Source [Website of Grotte Di Stiffe]

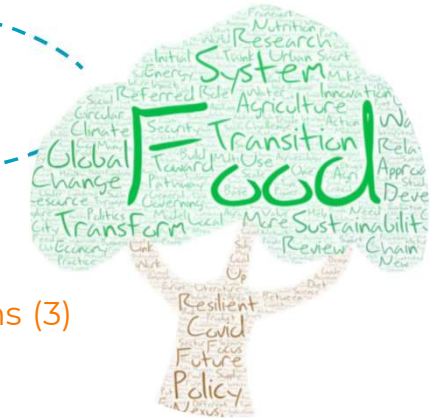
INTRODUCTION

Sustainability solutions do not pre-exist ?

Transition/Transformation

"they provide nuanced perspectives on how to describe, interpret and support desirable radical and non-linear societal change." (2)





Food system transitions/transformations (3)

Conceptual framing

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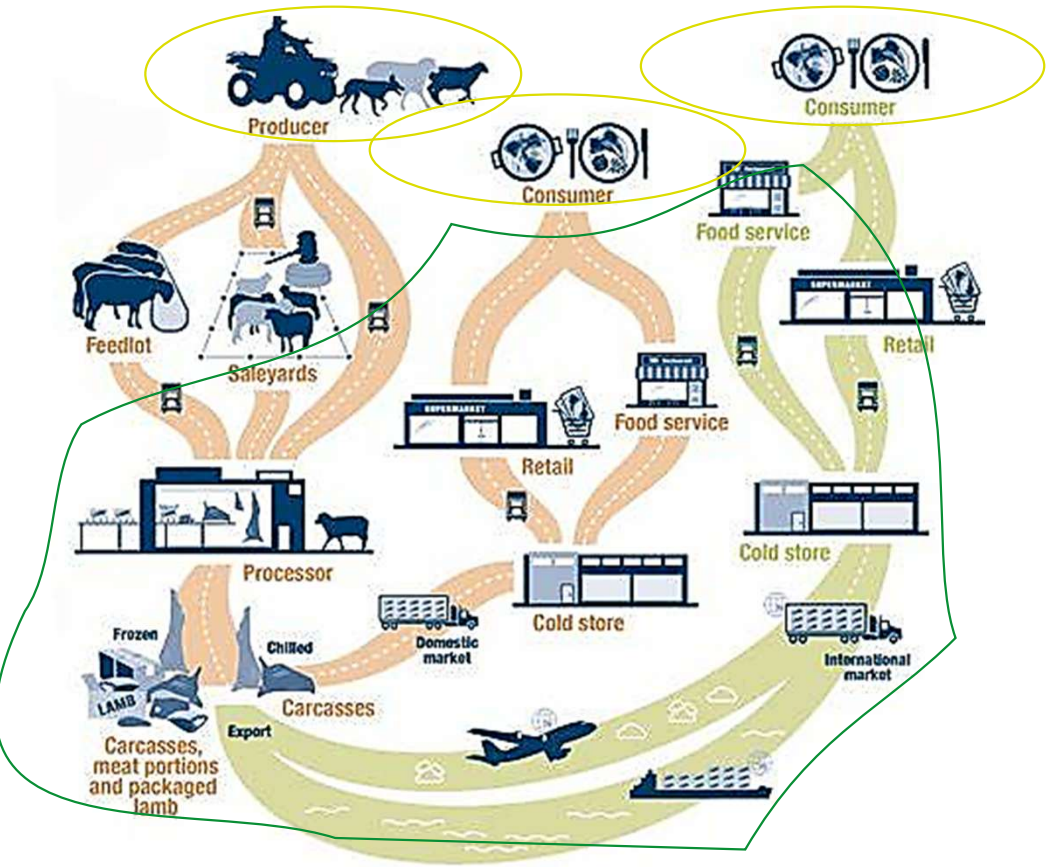
RESEARCH GAP



Being agri-food system and agri-food value chains characterized by **decentralized decision making**, it is relevant to observe the mid-terms actors, between the farmers and the consumers, where most value is added and where large companies stand, often overlooked by political debates (4)

If we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it...
- Abraham Lincoln, speech to the Illinois Republican state convention, June 16, 1858

RESEARCH GOAL

A SUSTAINABILITY ASSESSMENT TOOL...

...FOR...

- The **expected final users** are researchers, companies, field practitioners and policy makers working on transformation of livestock sector toward sustainability, particularly the post-farm actors of animal-based products value chains.

...TO...

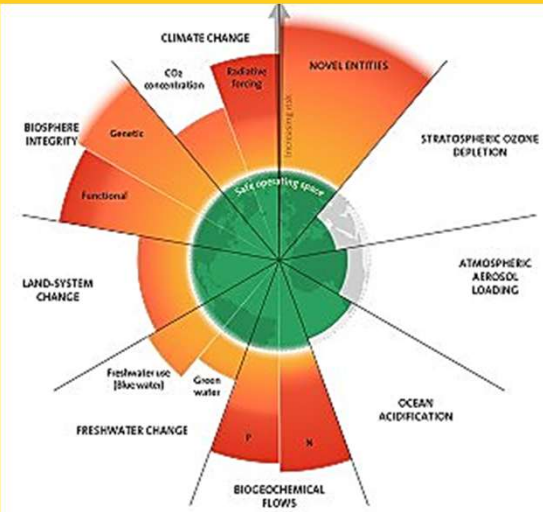
- The sustainability assessment may **describe and compare** phase by phase the livestock value chains bringing to the market the similar products and spot aeras of improvement of their socio-economic sustainability.

CONCEPTUAL FRAMEWORK

Our starting point: reconciling livestock sector with **Planetary boundaries** (5) (*Environmental sustainability*)

...transition of the value chain toward sustainability...

The sustainability of value chain actors (post-farm but before final consumers) (*Socio-economic sustainability*)



The 2023 update to the Planetary boundaries. Licensed under CC BY-NC-ND 3.0. Credit: "Azote for Stockholm Resilience Centre, based on analysis in Richardson et al 2023".

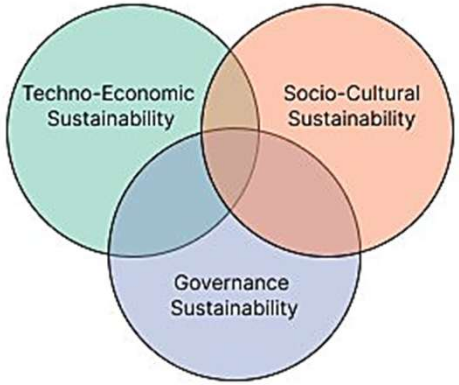
Safe Operating Space for Humanity

Organic

Agro-ecology

...

Livestock structural change (Regulation and practices)



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RESEARCH QUESTION

1

Which are the **relevant themes** in the **transformation** of the value chain **towards sustainability**?

2

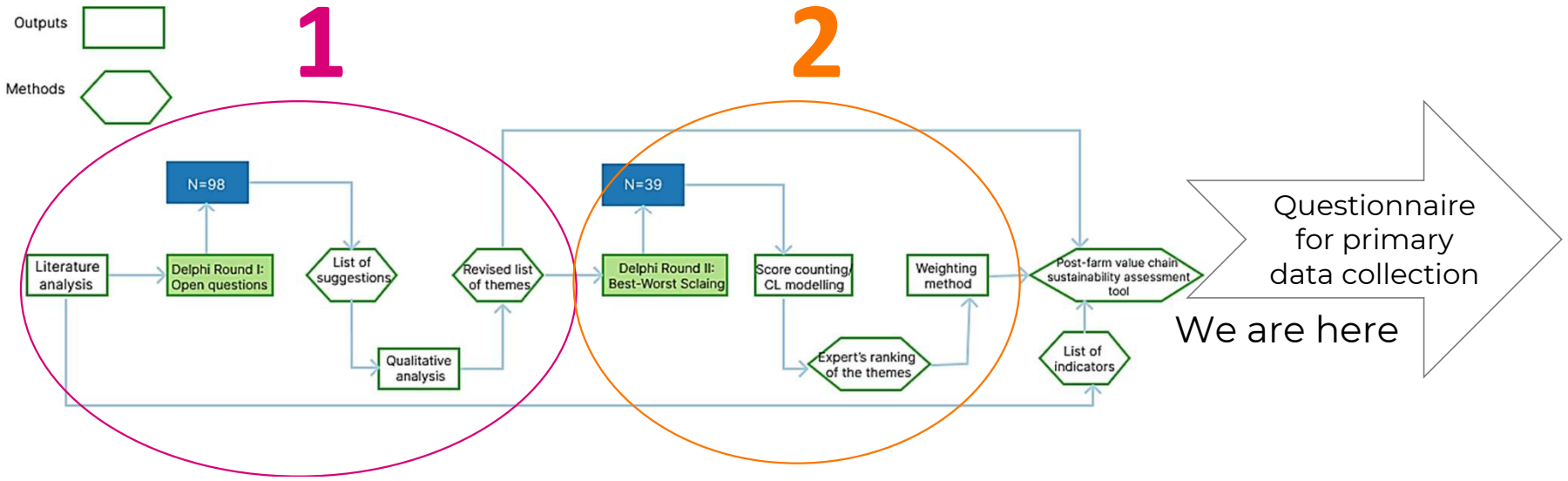
How much **relevant** are those themes in the **sustainability assessment**?

METHODOLOGY

The chosen technique was a two-rounds **Delphi study** (6), conducted between April and June 2024, submitting an online questionnaire to livestock experts (316 potential experts in Europe were contacted).

The main objective was **to identify the relevant themes** that together enables the evaluation of socio-economic sustainability performances of the post-farm gate livestock value chains.

Flowchart of the research steps



RESEARCH QUESTION IN THE SURVEY

1

Which are the **relevant themes** in the **transformation** of the value chain **towards sustainability**?

"Does the theme have the capacity to inform about relevant aspects in the process of transformation of livestock value chains toward sustainability?"

"Is any theme missing from the list?"

"Is any theme mis defined and/or misplaced across the three sustainability dimensions?"

2

How much **relevant** are those themes in the **sustainability assessment**?

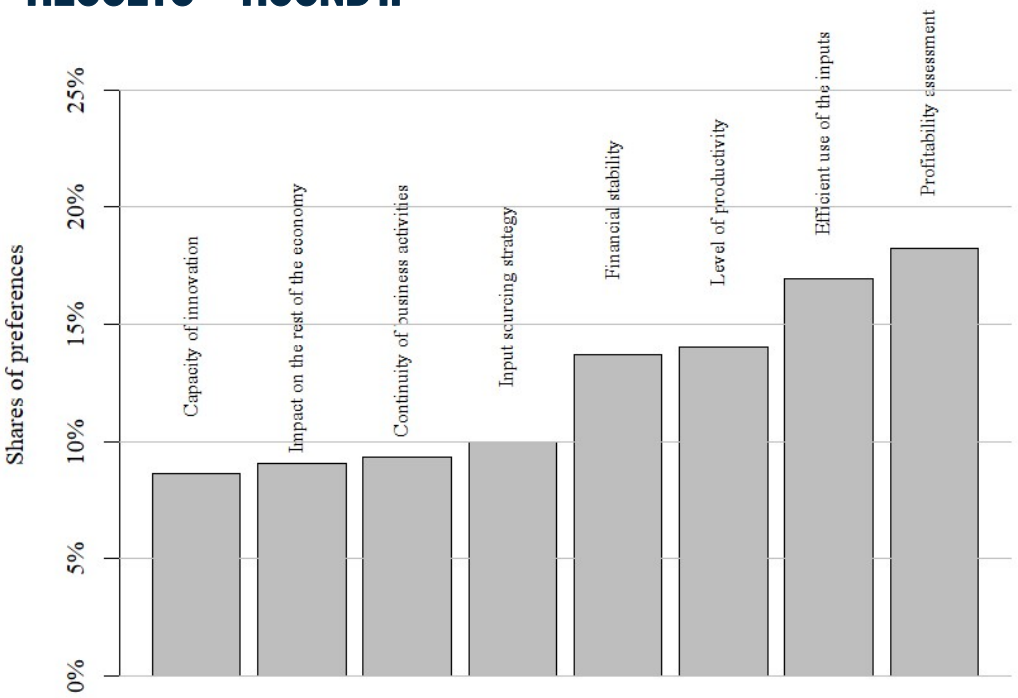
«Among the following themes, which theme is relatively the most important and which is the least important to take into account when measuring the "techno-economic" sustainability performance of the livestock value chain?»

RESULTS – ROUND I

List of themes - Techno-Economic sustainability dimension	
Efficient use of the inputs	Measuring the efficiency of resource use
Input sourcing strategy	Ability to self-produce inputs or dependency on third parties
Level of productivity	Productivity level of production factors (ex: labor, livestock)
Financial stability	Capacity of being solvent, access to loans and manage risk
Profitability assessment	Capacity to generate and increase profits over the long run
Continuity of business activities	Capacity to survive through management education and Strategic Business Planning
Capacity of innovation	Private/public investment on R&D and innovation adoption
Impact on the rest of the economy	Impact on the level of employment & value creation at different level (ex: local, regional, national)

The table shows the outcome of the first Delphi round and reports the revised set of themes for the three categories and the relative description, created by qualitative analysis of the responses and the previous literature review.

RESULTS – ROUND II

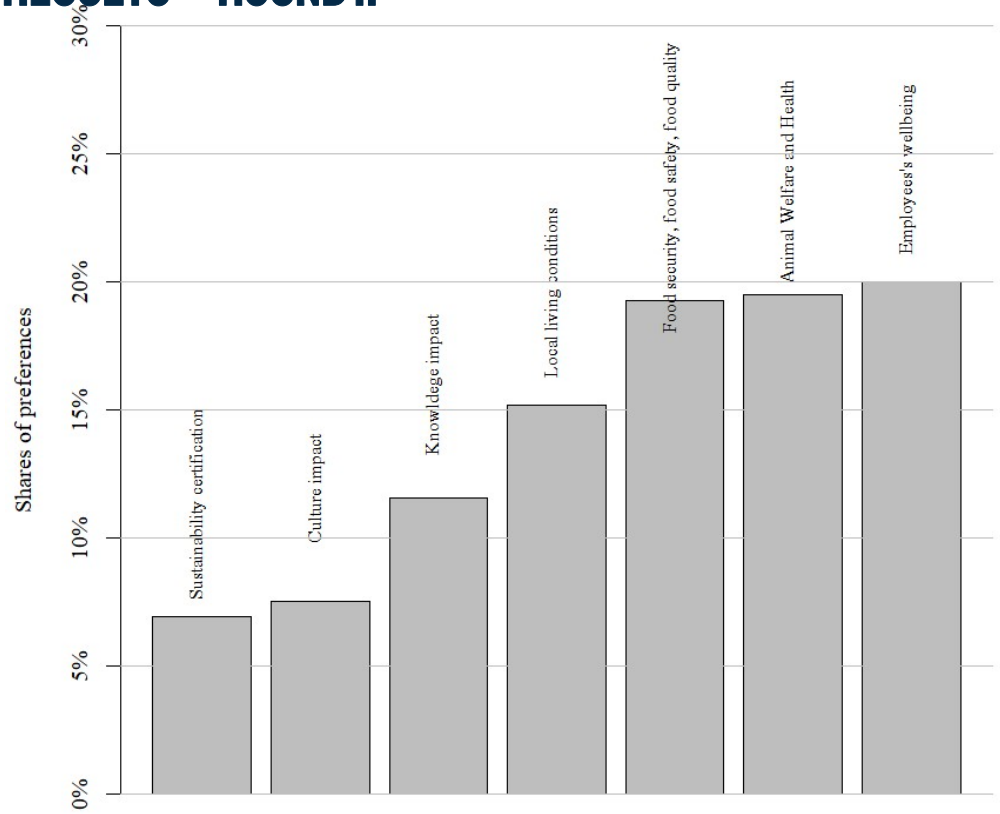


RESULTS – ROUND I

List of themes- Socio-Cultural sustainability dimension	
Animal Welfare and Health	Practices to ensure animal health and animal welfare
Knowledge impact	Promotion of training and exchange of knowledge, good practices, advice
Culture impact	Enhancement of local culture, products and traditional customs
Food safety, food quality	Contribution of the value chain to food safety, food security and food quality
Local living conditions	Impact on local living conditions (ex: health)
Sustainability certification	Adoption of systems of sustainability reporting and/or certifications (voluntary and obligatory)
Employees' wellbeing	Practices to guarantee wellbeing for the employees (ex: moral and physical welfare)

The table shows the outcome of the first Delphi round and reports the revised set of themes for the three categories and the relative description, created by qualitative analysis of the responses and the previous literature review.

RESULTS – ROUND II

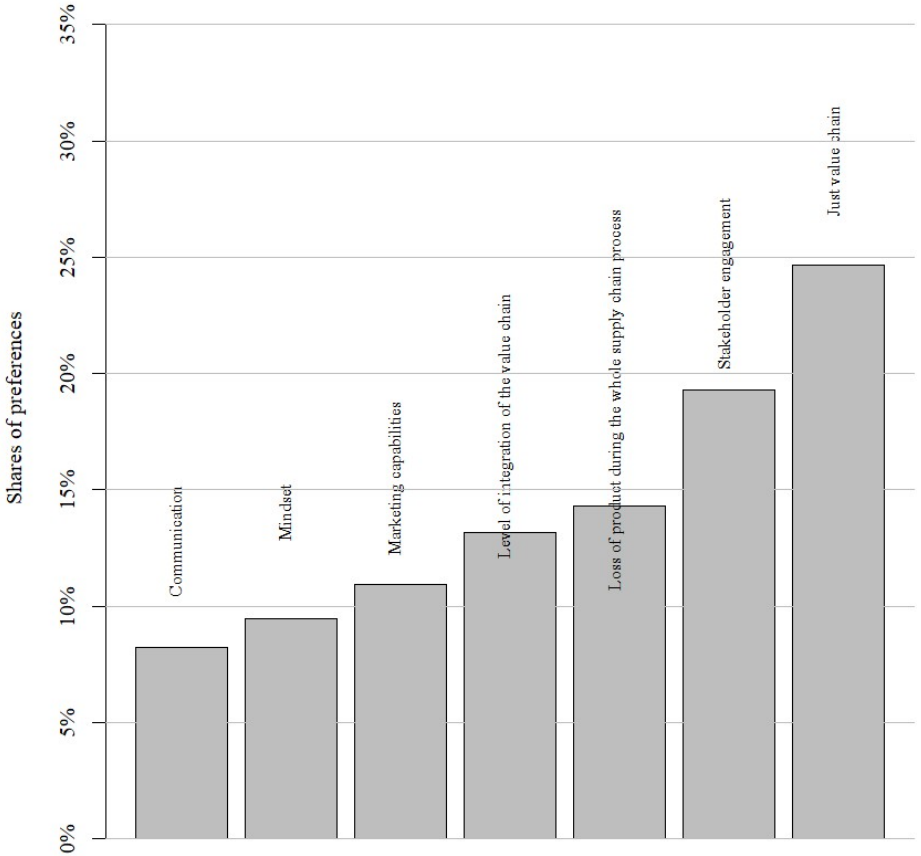


RESULTS – ROUND I

List of themes – Governance sustainability dimension	
Just value chain	Fair working and commercial contracts among and inside the businesses of the value chain
Level of integration of the value chain	The length of the value chain, level of coordination & collaboration among actors
Marketing capabilities	Ability to analyse and access to new markets
Loss of product during the whole supply chain process	The food loss and the waste production occurring along the value chain stages.
Communication	Communication of the adopted practices (ex: B2B, B2C, B2G)
Stakeholder engagement	Identify, dialogue, and engage with all those affected by the activities of the firm
Mindset	Corporate ethics (ex: Code of conduct)

The table shows the outcome of the first Delphi round and reports the revised set of themes for the three categories and the relative description, created by qualitative analysis of the responses and the previous literature review.

RESULTS – ROUND II



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RESULTS – ROUND II

Ranking of themes based on the 'Most-Least' criterion and corresponding model outputs.
Results of Delphi Study round II for the **Techno-Economic section** (n=35). *p<0.1; **p<0.05; ***p<0.01

	Counting analysis			Conditional Logit Model	
	Most	Least	Most-Least	Mean (Standard Error)	Shares of preferences
Profitability assessment	95	39	56	0.745*** (0.125)	0.182
Efficient use of the inputs	86	40	46	0.669*** (0.124)	0.169
Level of productivity	67	46	21	0.482*** (0.123)	0.140
Financial stability	57	39	18	0.460*** (0.123)	0.137
Input sourcing strategy	49	74	-25	0.142 (0.122)	0.100
Continuity of business activities	49	83	-34	0.076 (0.122)	0.093
Impact on the rest of the economy	50	88	-38	0.045 (0.122)	0.091
Capacity of innovation	37	81	-44	0	0.087

RESULTS – ROUND II

Ranking of themes based on the 'Most-Least' criterion and corresponding model outputs.
Results of Delphi Study round II for the **Socio-Cultural** section (n=38). *p<0.1; **p<0.05; ***p<0.01

	Counting analysis			Conditional Logit Model	
	Most	Least	Most-Least	Mean (Standard Error)	Shares of preference
Employees' wellbeing	53	20	33	1.061*** (0.173)	0.201
Animal Welfare and Health	54	23	31	1.036*** (0.172)	0.195
Food safety, food quality	52	22	30	1.023*** (0.172)	0.192
Local living conditions	43	32	11	0.784*** (0.168)	0.152
Knowledge impact	28	39	-11	0.514*** (0.166)	0.116
Culture impact	20	64	-44	0.086 (0.169)	0.075
Sustainability certification	16	66	-50	0	0.070

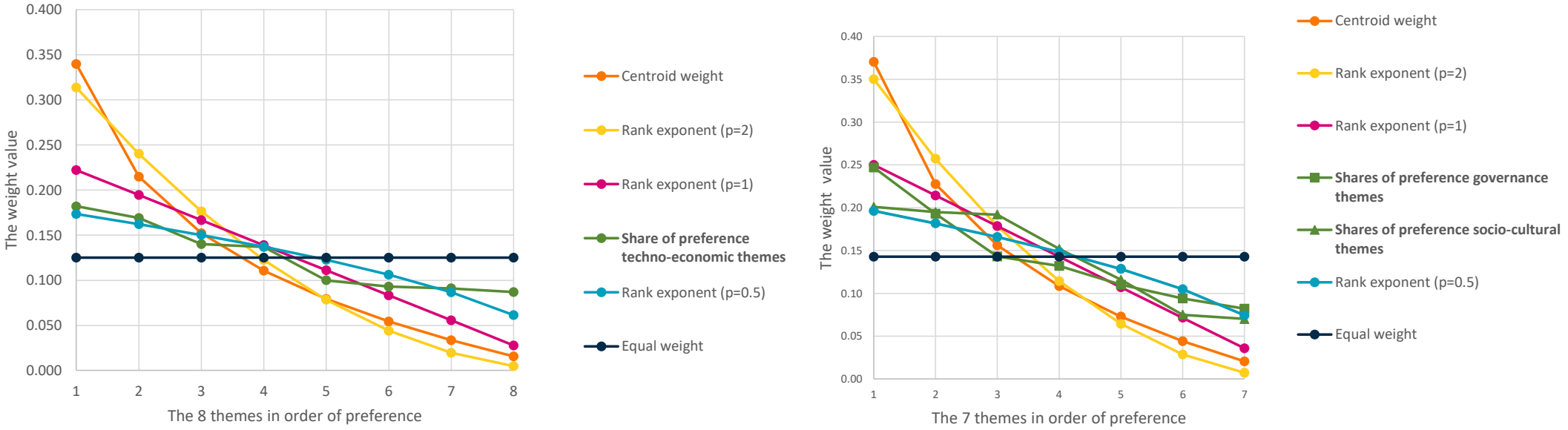
RESULTS – ROUND II

Ranking of themes based on the 'Most-Least' criterion and corresponding model outputs. Results of Delphi Study round II for the **Governance** section (n=39). *p<0.1; **p<0.05; ***p<0.01

	Counting analysis			Conditional Logit Model	
	Most	Least	Most-Least	Mean (Standard Error)	Shares of preference
Just value chain	67	17	50	1.099*** (0.170)	0.247
Stakeholder engagement	52	21	31	0.852*** (0.163)	0.193
Loss of product during the whole supply chain process	37	31	6	0.553*** (0.159)	0.143
Level of integration of the value chain	42	43	-1	0.471*** (0.158)	0.132
Marketing capabilities	33	50	-17	0.283* (0.158)	0.110
Mindset	25	54	-29	0.138 (0.159)	0.094
Communication	17	57	-40	0	0.082

RESULTS – ROUND II

The **weight value distribution among ranked themes** according to different **weighting methods (7)**



Since the results were not always significant, for the three themes, a safe choice could be to adopt the "Equal weight method". On the other hand, to valorise the prioritization made by participants, the "Rank exponent method" with p = 0,5 or with p = 1 seem the best fitting options.

DISCUSSION

- How to disentangle the complex relationships between themes?
- “Sustainability assessment of food and agriculture systems” (SAFA) (8) stands out for several qualities, like being holistic, flexible, credible, transparent, comprehensive, which have led to its frequent use as a reference here.
- Themes that ranked lowest: “capacity of innovation”, “sustainability certification” and “communication” themes for Techno-Economic, Socio-Cultural and Governance dimension.
- The experts indicate “profitability assessment”, “employees’ wellbeing” and “just value chain” as the most crucial themes for Techno-Economic, Socio-Cultural and Governance dimension.

LIMITATIONS

- The **rate of adherence** to both the first and second rounds was not high, which also explains the small p-values of the CL's model, however it was still possible to apply the Best-Worst Scaling (BWS) experiment, as found in the literature (9). GU1
- The **composition of the expert's sample**: expertise on social sustainability and governance sustainability were a minority, which could be improved and compensated through a thematic follow-up focus group.
- **The final result have not been disseminated yet** to the participants of the Delphi Study. This could allow them to review and provide feedback on the overall prioritization of the identified themes.
- The assessment tool should be validated through **empirical application** to animal product value chains, integrating multiple data sources.

GU2

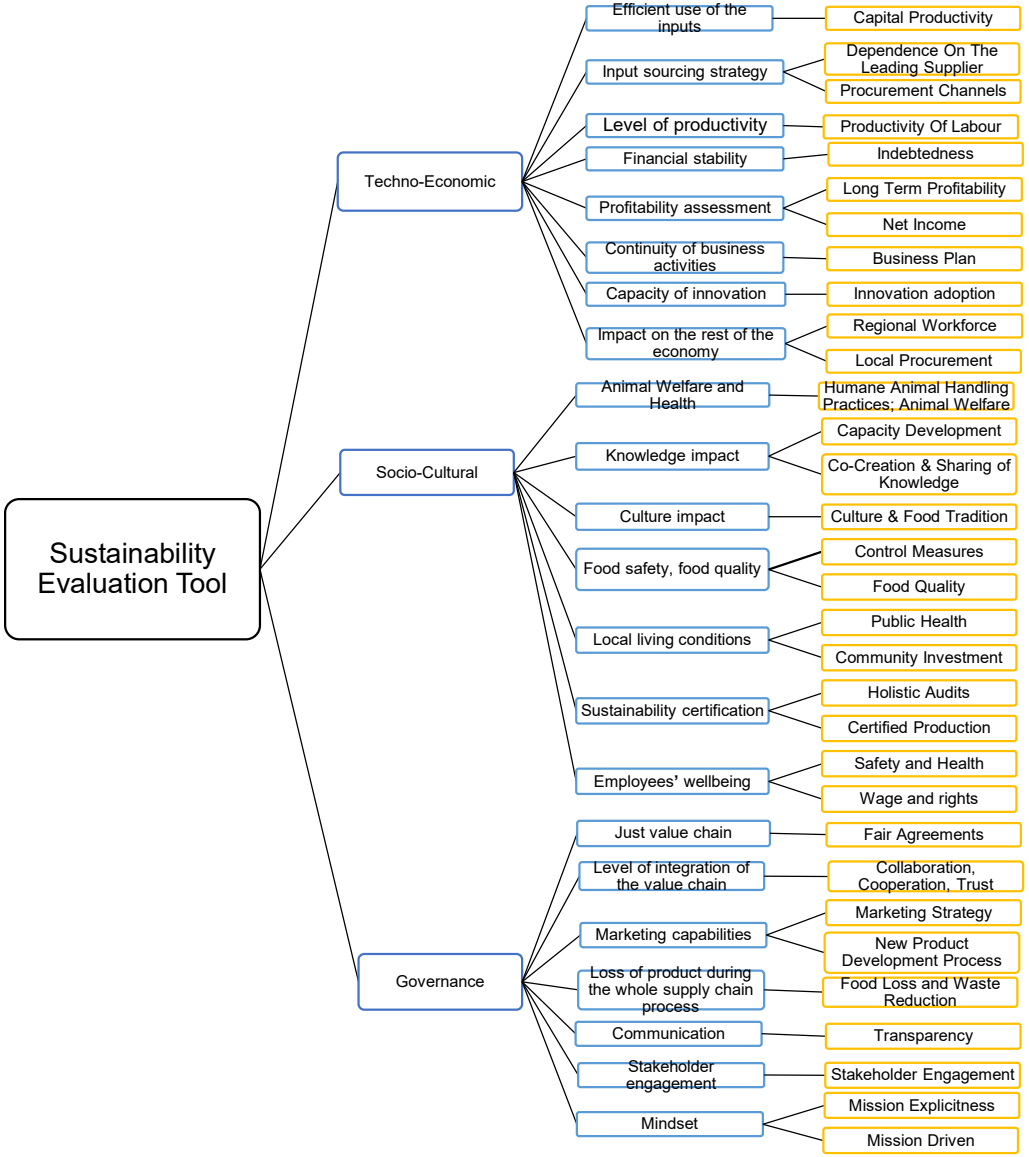
Slide 18

GU1 Non è un risultato del nostro studio, ma una nota bibliografica, che al limite potrebbe andare nell'introduzione
Guest User, 2025-08-18T10:57:51.959

GU2 Questa è una limitazione.
Guest User, 2025-08-18T10:58:17.288

WORK IN PROGRESS

- **22 sustainability themes** of livestock post-farm stages of livestock supply chains, 8 for Techno-Economic, 7 for the Socio-Cultural and 7 for the Governance dimension.
- **Quantitative and qualitative primary data** could be collected through interviews.
- The **multiscale feature** need to be developed, trying to apply the assessment tool at different geographical level.



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Thanks for your attention!

Letizia Forzoni
letizia.forzoni@phd.unipi.it

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