

Integration of social LCA with sustainability LCA: a case study on virgin olive oil production

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Scientific context

■ Global

- Economic, social and environmental crisis
- Need for sustainability

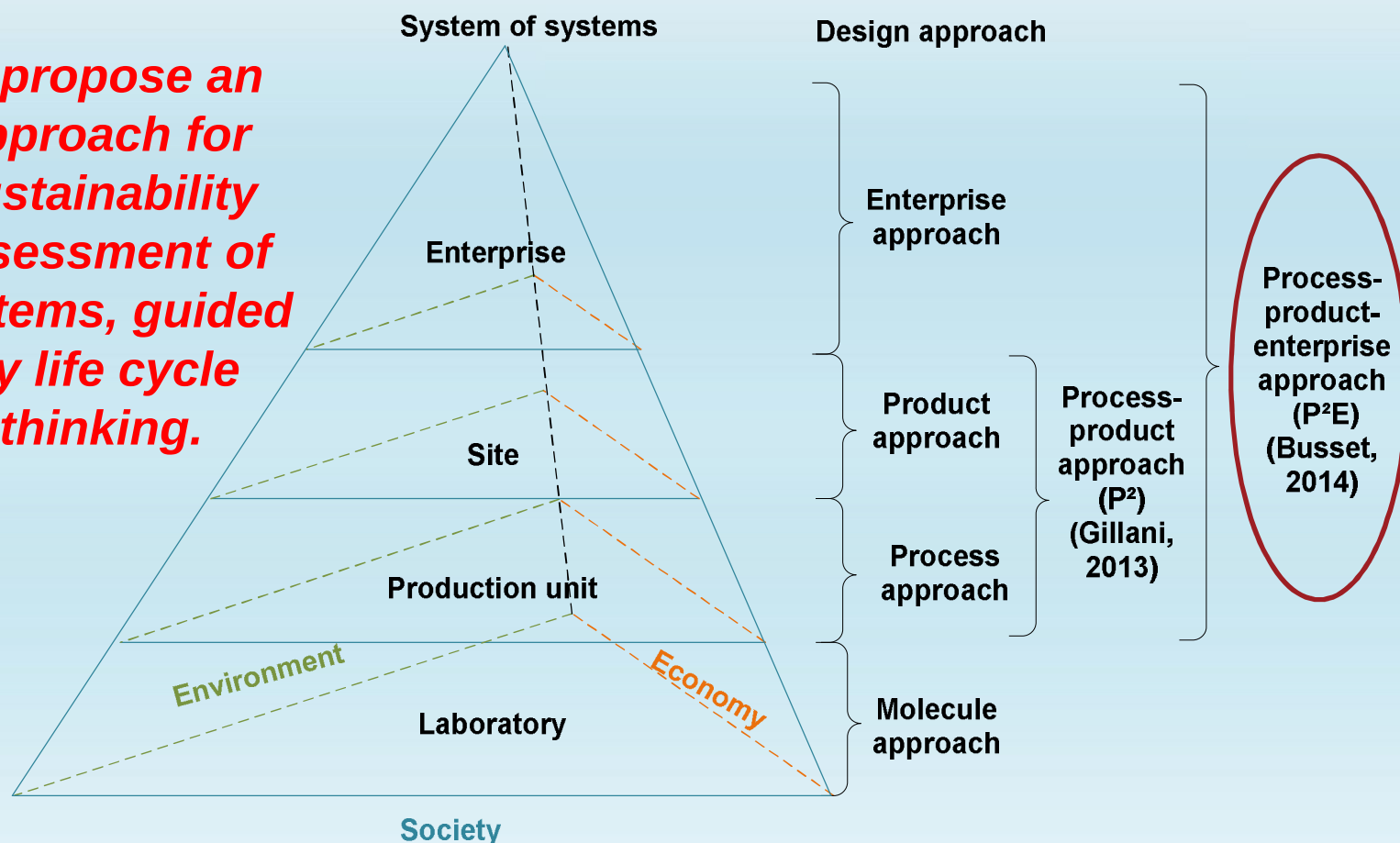
■ Life cycle assessment

- Environmental (ELCA) (ISO 14040, 2006) => proven ?
- Economic (LCC) => under development
- Social (SLCA) => under development
- Sustainable (LCSA) => under development

Scientific context

System design approaches

→ We propose an approach for sustainability assessment of systems, guided by life cycle thinking.



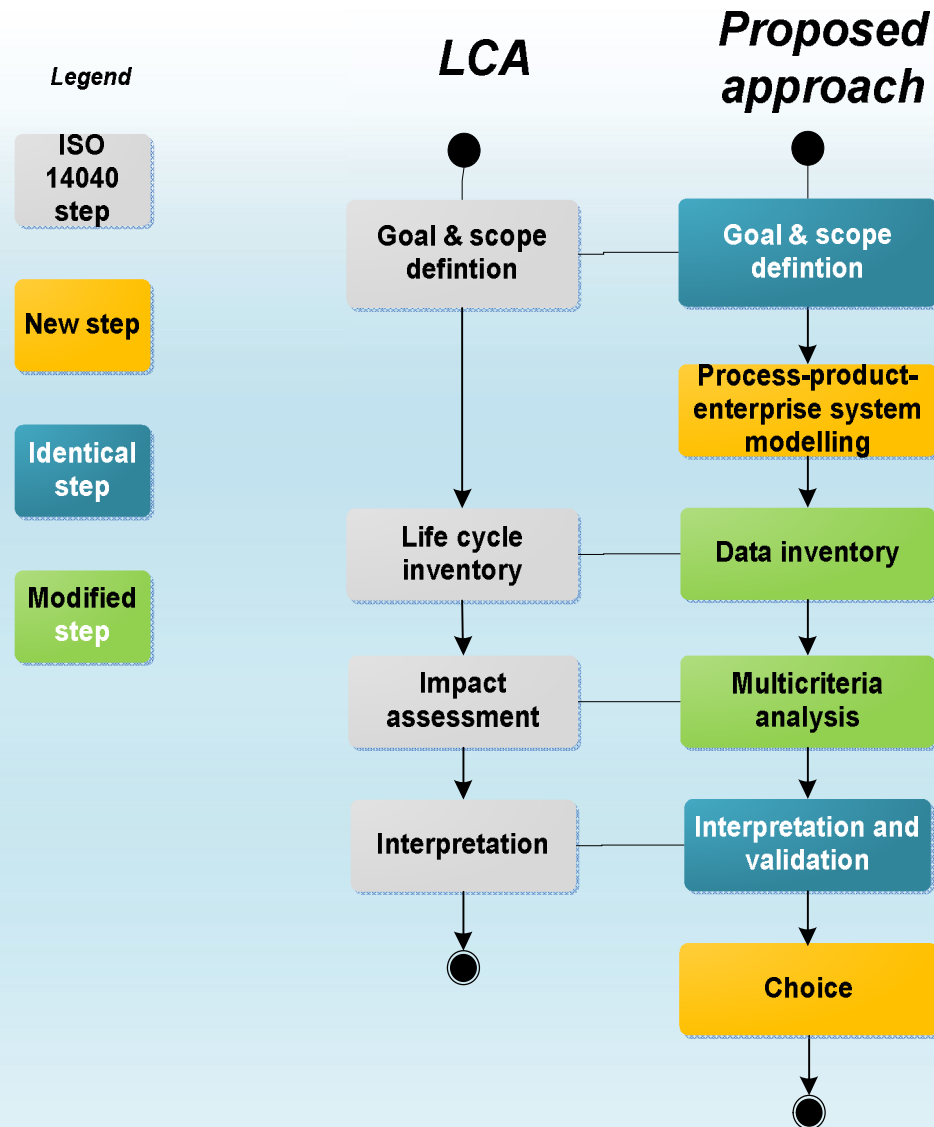
Approach for sustainability assessment

Goal

- It aims at assessing sustainability
- The approach is dedicated to decision makers
- It permits to:
 - Make a technologic choice of an industrial process
 - Make a choice of supply chain
 - Make a choice of input
- It is based on process-product-enterprise modelling

Approach for sustainability assessment

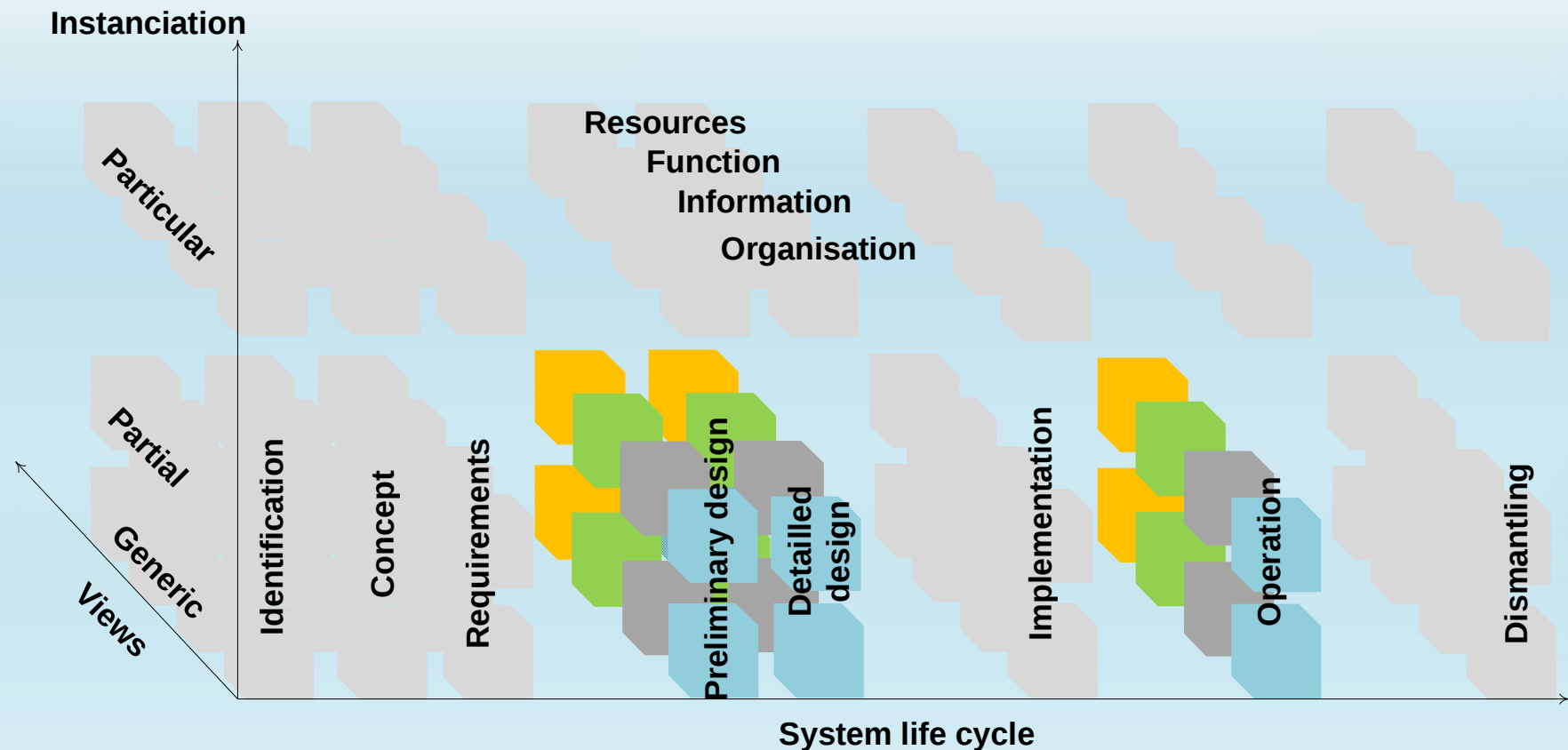
Structure



Approach for sustainability assessment

Characterisation

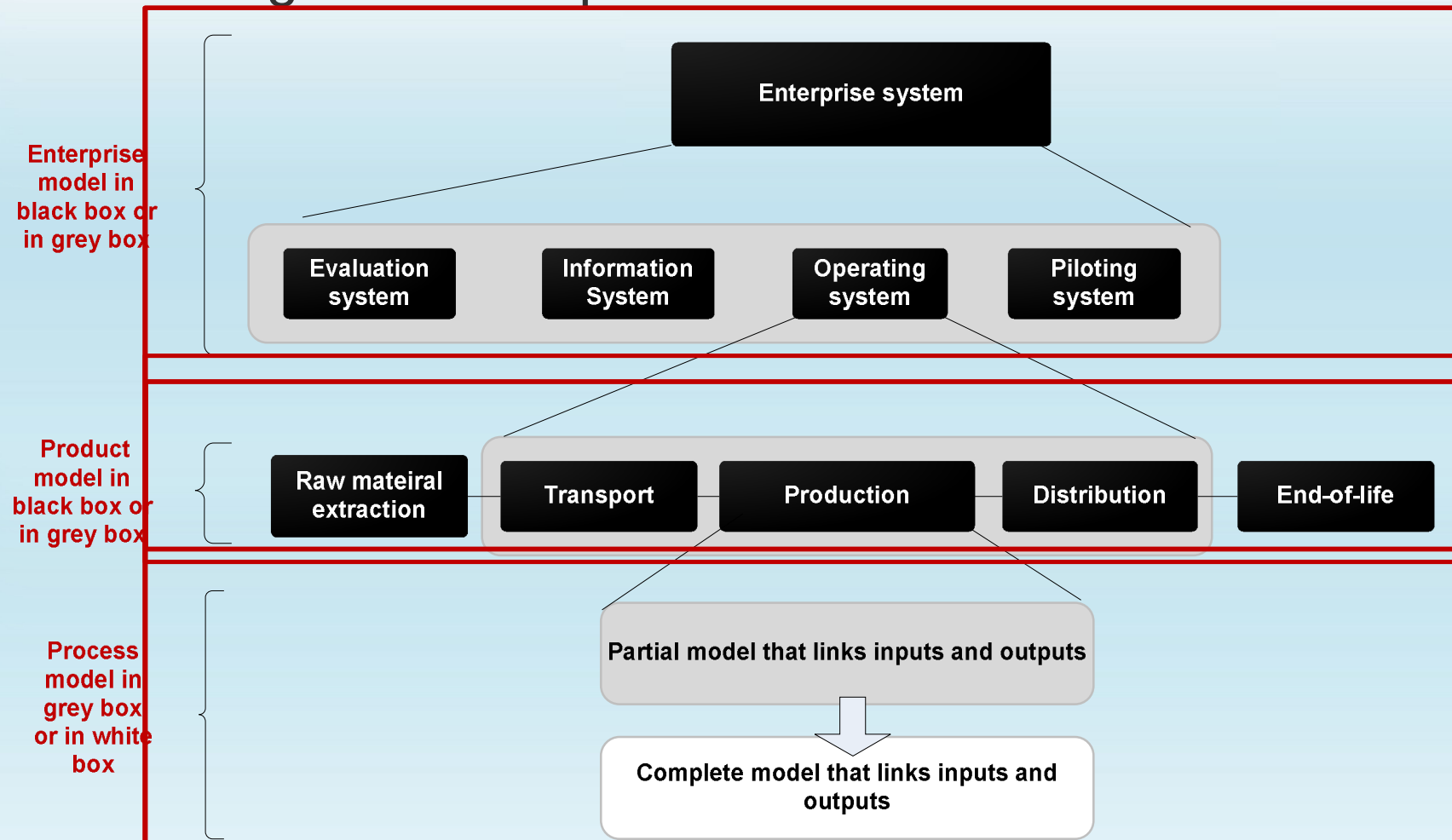
■ Sustainability assessment for design approach



Approach for sustainability assessment

Characterisation

Degree of completeness



Application to olive oil production

OiLCA project

■ Olive oil sector in Europe

- 2.5 millions of producers
- Large quantity of wastes
- Emergent competition



■ Characteristics

- Under the Innovation European Interreg IV program, funded by the “European Regional Development Fund (ERDF)”
- Led by technologic and research institutes
- Duration: 27 months (2011-2013)



Application to olive oil production

OiLCA project

Objectives

- ***OiLCA project***: “Enhancing the **competitiveness** and reducing the **carbon footprint** of the olive oil sector through waste management optimization and the establishment of an **ecological label**” (www.oilca.eu)



Software



Eco-label



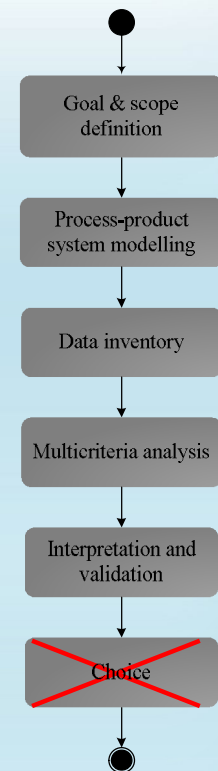
Website + network

- ***This presentation***: apply social LCA with LCSA to olive oil sector in order inform the discussion about social LCA

Application to olive oil production

Method

- Only product-enterprise degree
- Application to operating phase
- A unique inventory for the three aspects
- Social aspects = social LCA following UNEP/SETAC guidelines (2009)
- Sustainable indicators: from LCAs methods



Application to olive oil production

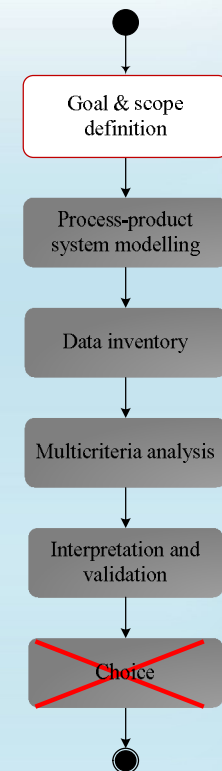
Method

Goal & scope

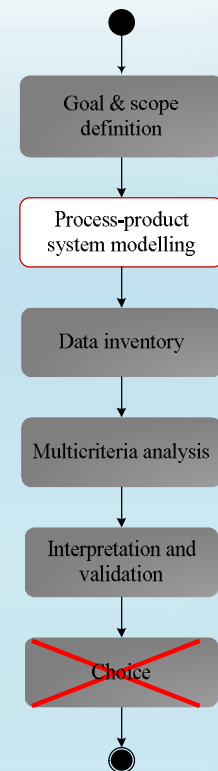
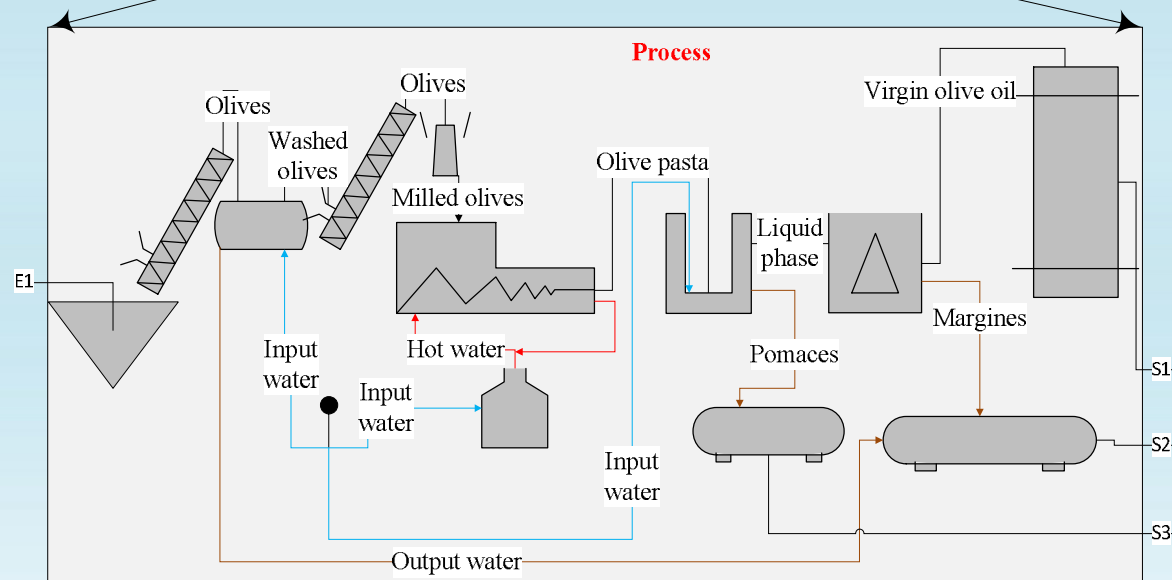
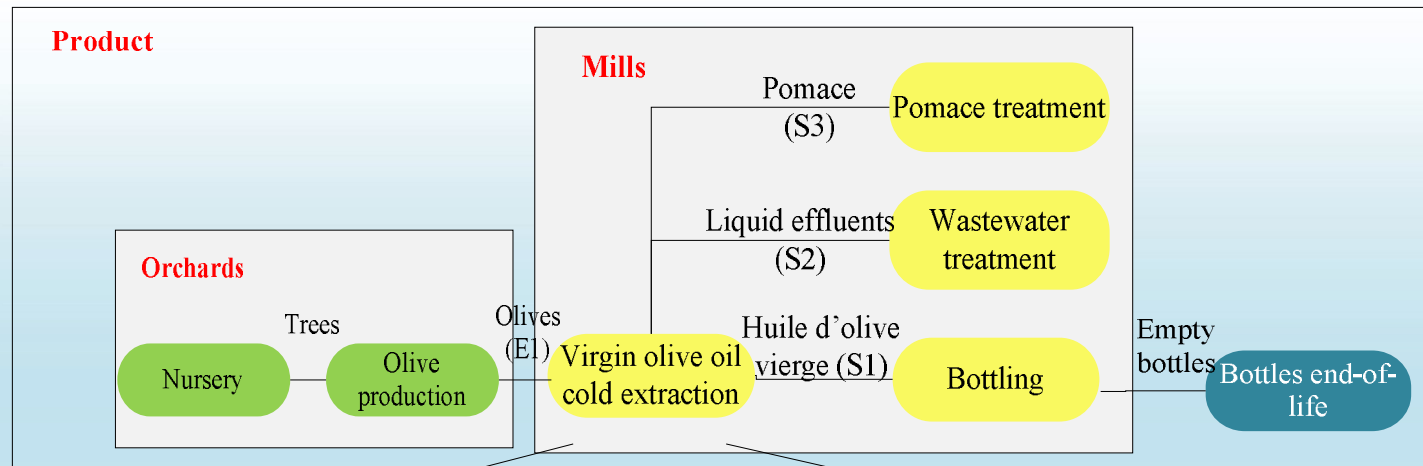
- *Virgin olive oil production sustainability analysis*
- *Functional unit = production of 1 L of virgin olive oil*

Hypothesis

- *Infrastructures and distribution **included***
- *Workers transport, use phase, emission due to fertilizers degradation, carbon storage **not included***
- *Cost of environmental and social impacts **not included***



Application to olive oil production



Application to olive oil production

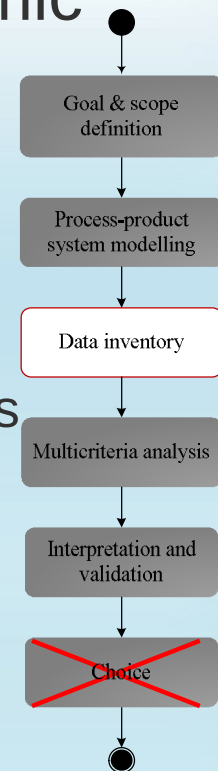
Method

Raw data collection (environmental, economic & social)

- Partner: “Centre technique de l'olivier” (CTO)
- Data collection method:
 - ✓ Visit and questionnaire (direct and specific)
 - ✓ Discussion with experts from CTO (specific as well as generic for the sector).

Extraction and emission calculation

- Ecoinvent 2.2 database
- Emission inventory guidebook B8100vs3.2 (for machinery emission)

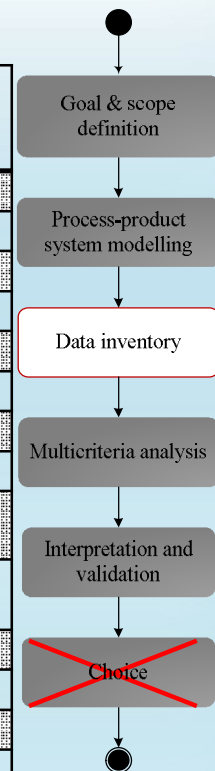


Application to olive oil production

Method

Direct and specific data (average)

Direct data	Unit	Olive production	Olive oil extraction
Diesel	kg/L of virgin olive oil	0.052	0.00020
Electricity	kWh /L of virgin olive oil	0.015	0.39
Water	m ³ /L of virgin olive oil	0.59	0.0022
Gasoline	kg /L of virgin olive oil	0.0032	
Fertilizers	kg /L of virgin olive oil	1.0	
Pesticides	kg /L of virgin olive oil	0.0099	
Number of fatal accidents per year	#/year	0	0
Preventive measures	no unit	yes	yes
Emergency protocols exist regarding accidents & injuries.	no unit	yes	yes
Preventive measures and emergency protocols exist regarding pesticide & chemical exposure	no unit	yes	no
Appropriate protective gear is required in all applicable situations	no unit	yes	yes
Number of full-time jobs	#	1	2
Quality of information/signs on product health and safety	no unit	enough	enough
Sector efforts in technology development (level of automation)	#	0	0
Relevance of the considered sector for the local economy	%	100	100
Number of consumer complaints to the company	%	100	50
Certifications	no unit	none	none



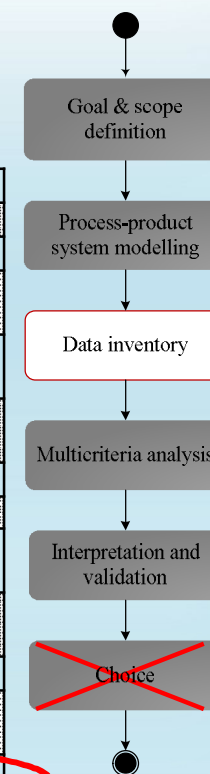
Application to olive oil production

Method

Data transformation (social)

- Following Foolmann *et al.* (2013) and Hsu *et al.* (2013)

Indicator	Value for midpoint category
Number of fatal accidents per year	1 if number of accidents is 0, -1 if it is ≥ 1
Preventive measures	-0 if no, 1 if yes
Emergency protocols exist regarding accidents & injuries.	-0 if no, 1 if yes
Preventive measures and emergency protocols exist regarding pesticide & chemical exposure	-0 if no, 1 if yes
Appropriate protective gear is required in all applicable situations	-0 if no, 1 if yes
Number of full-time jobs	1 if >0 , 0 else
Sector efforts in technology development (level of automation)	0 if no, 1 if yes
Relevance of the considered sector for the local economy	1 if taxes paid, 0 else
Number of consumer complaints to the company	1 if = 0 et -1 if ≥ 1
Quality of information/signs on product health and safety	0 if not enough, 0.5 if enough, 1 if more than enough
Percentage of workforce hired locally	0 entre 0 % et 20 %, 1 entre 20 % et 40 %, 2 entre 40 % et 60 %, 3 entre 60 % et 80 %, 4 entre 80 % et 100 %
Employees with higher education	0 between 0 % and 20 %, 1 between 20 % and 40 %, 2 between 40 % and 60 %, 3 between 60 % and 80 %, 4 between 80 % and 100 %
Employees with basic education	0 between 0 % and 20 %, 1 between 20 % and 40 %, 2 between 40 % and 60 %, 3 between 60 % and 80 %, 4 between 80 % and 100 %
Certifications	0 if none, 1 else.

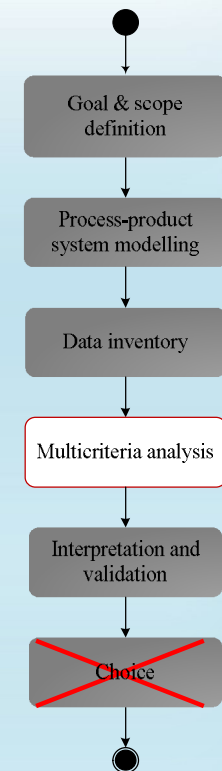


Application to olive oil production

Method

■ Multicriteria analysis

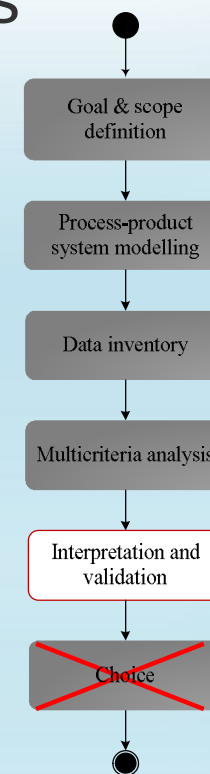
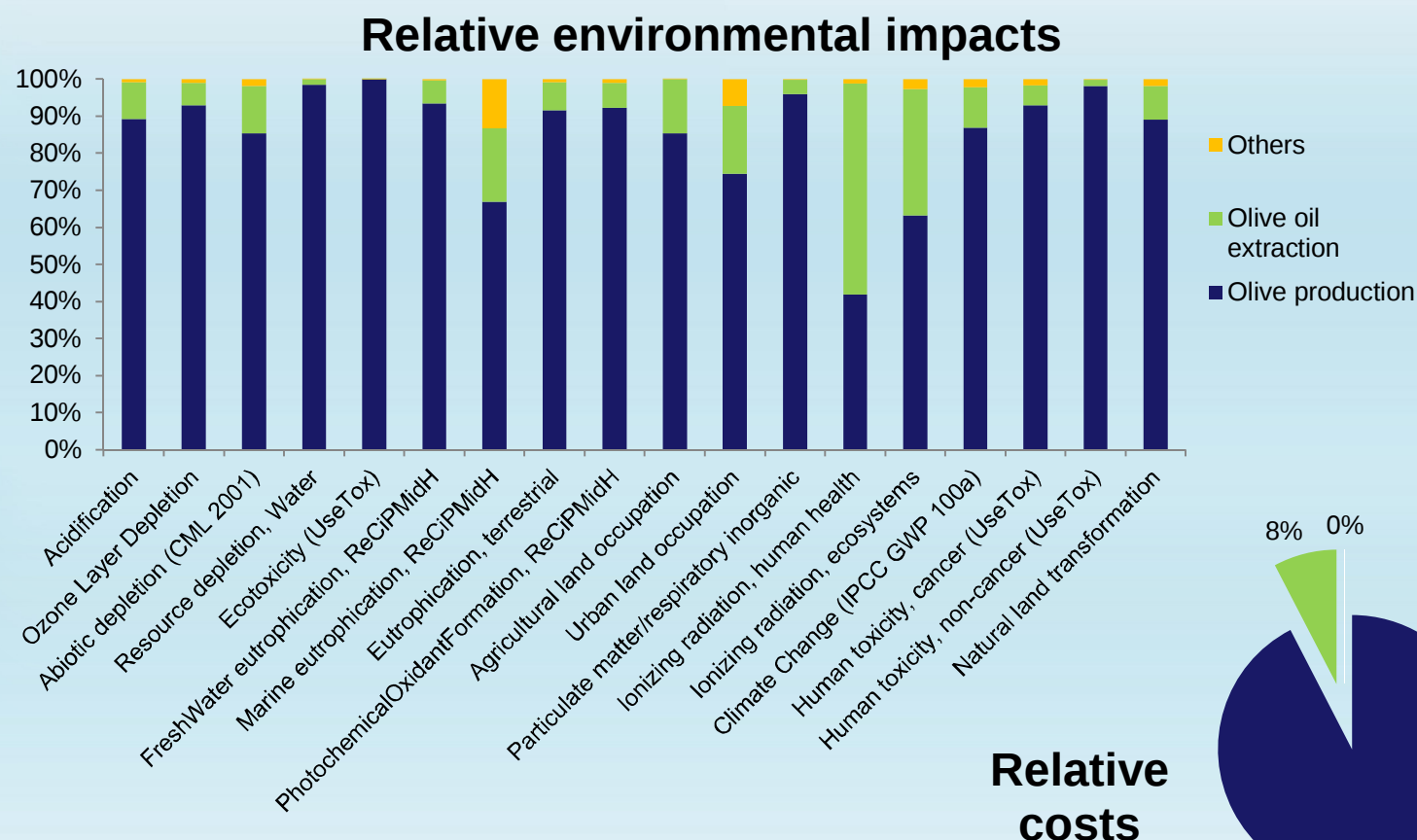
- Impact assessment
 - ✓ 18 environmental midpoint categories (Hauschild, 2012)
 - ✓ 1 economic indicator
 - ✓ 5 social sub-categories (UNEP, 2011)
- No aggregation to respect strong sustainability



Application to olive oil production

Results

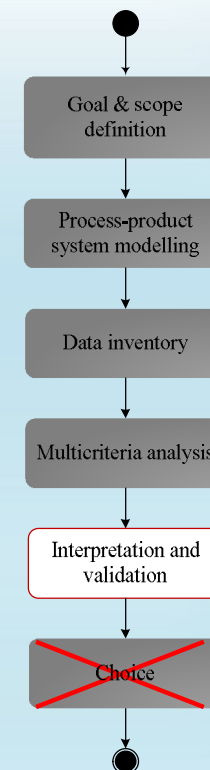
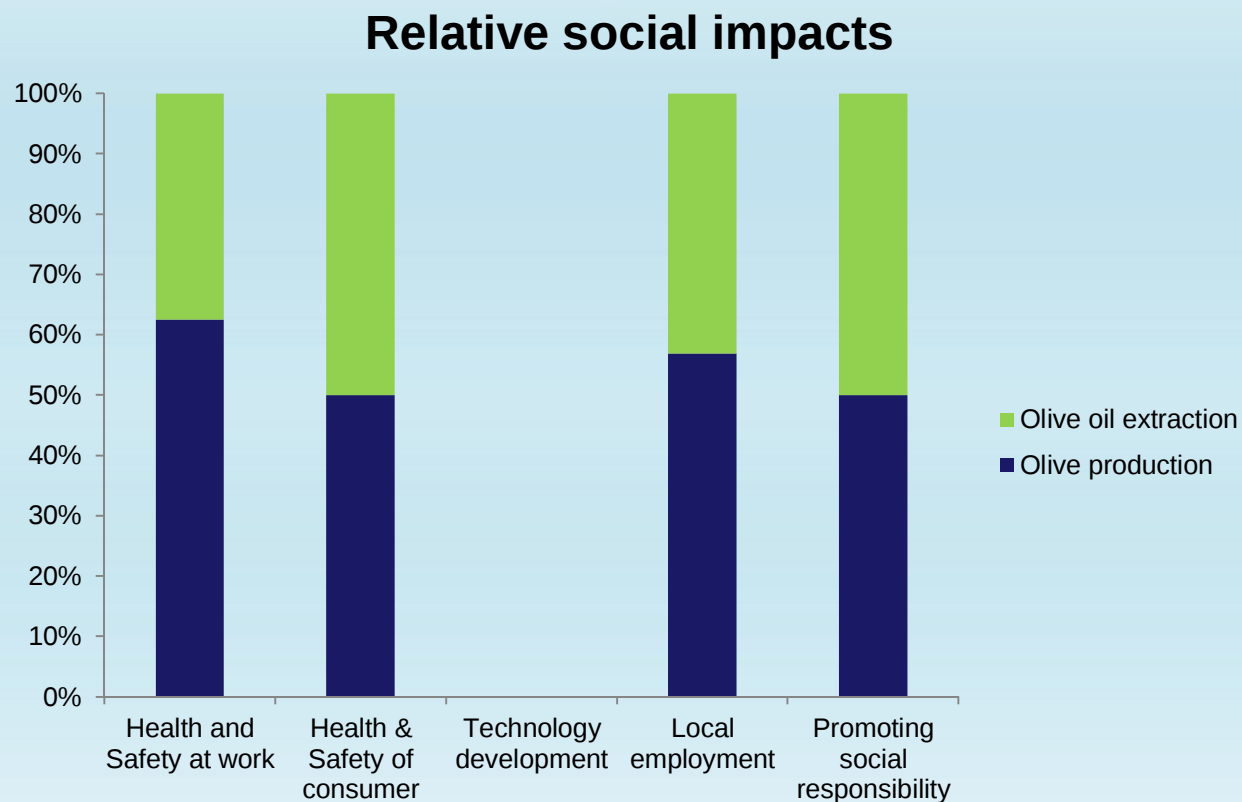
● Olive oil production life cycle midpoint results



Application to olive oil production

Results

- Olive oil production life cycle sub-categories results





Conclusion

- Proposal for sustainability assessment
 - A way to integrate three aspects of sustainability
 - A way to apply social LCA
- Application to Olive production
 - Cultivation has the most impacts economic and environmental impacts
 - Social results need further investigation



Main issues

Case study

- Aspects to consider in future
 - Environmental
 - ✓ Pomace emissions to soil and water
 - Economic
 - ✓ Cost of social and environmental impacts
 - Social
 - ✓ Extend the limit of the social study (not only gate-to-gate)

Main issues

Methodological

- Integration of social LCA with LCSA
 - Different boundaries
 - Type of data and functional unit
 - Uncertainty analysis of social data?
 - Difficulties to get social data (confidential)
 - Is product based approach relevant for social LCA ?
- product-enterprise approach and multicriteria analysis



Thanks for your attention !



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