

Investigating sustainability assessment methods of product-services systems

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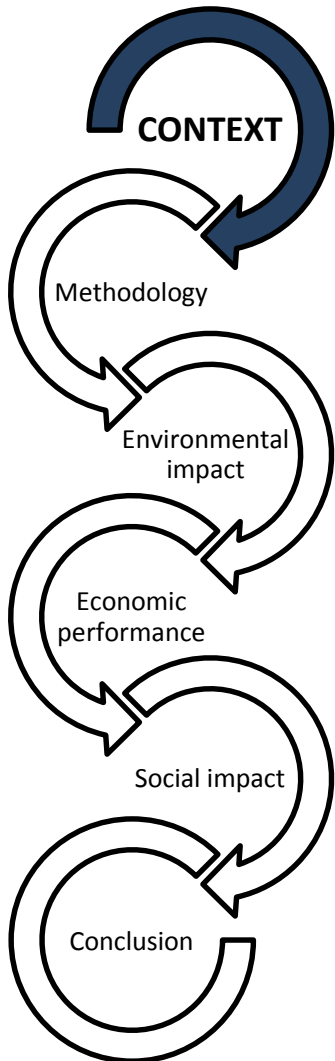
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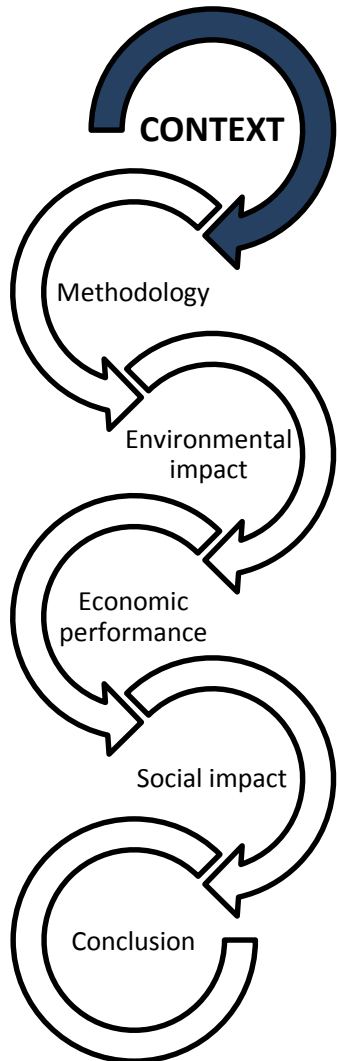
Motivation



- Innovative business strategies became necessary to remain competitive
- Environmental regulations are constraining industries to produce more sustainable goods (or products)
- Consumer are being aware about their own impact and demanding about the industrial offer with:
 - A need of transparency about their social impact
 - An aim to reduce their individual environmental impact
 - A demand which fulfils their specific needs

➔ The PSS-offer could answer these sustainability and competition challenges

Objective

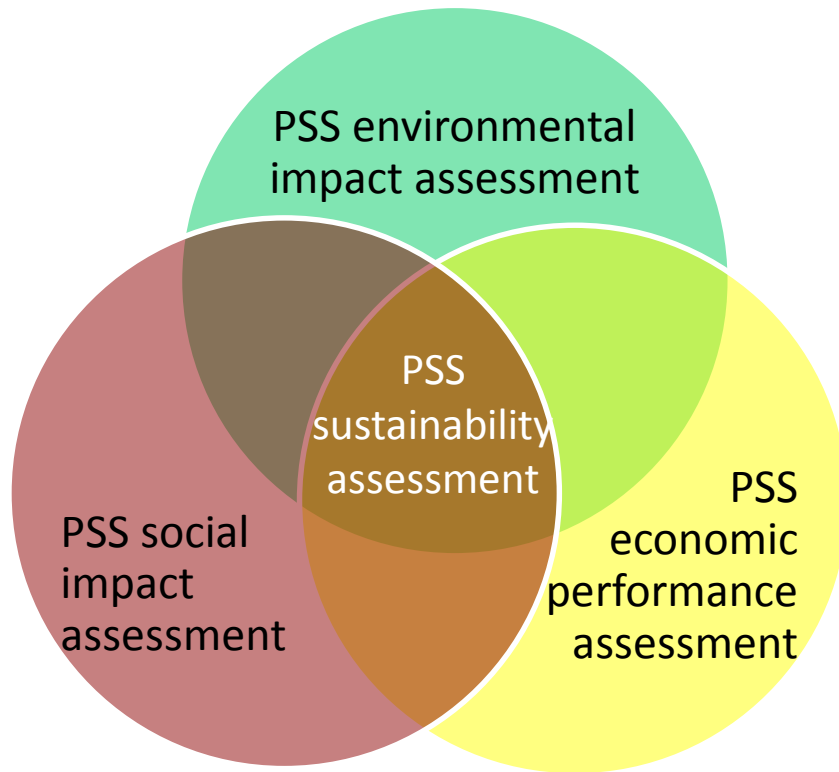
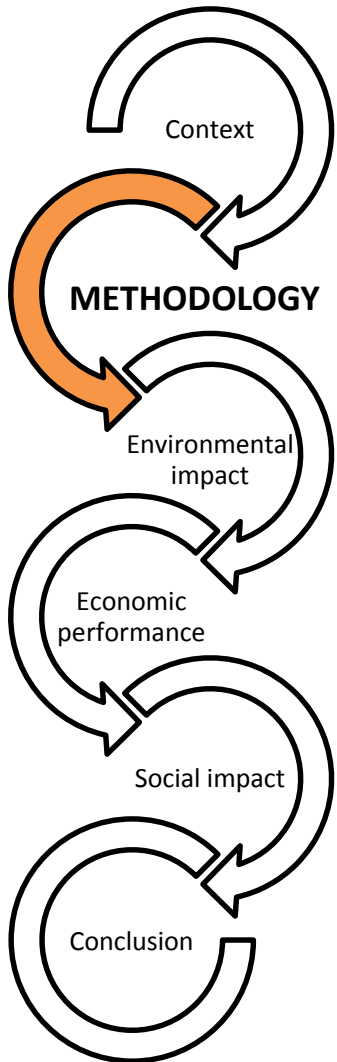


- Sustainability
 - Economically effective
 - Environmentally sustainable
 - Socially fair

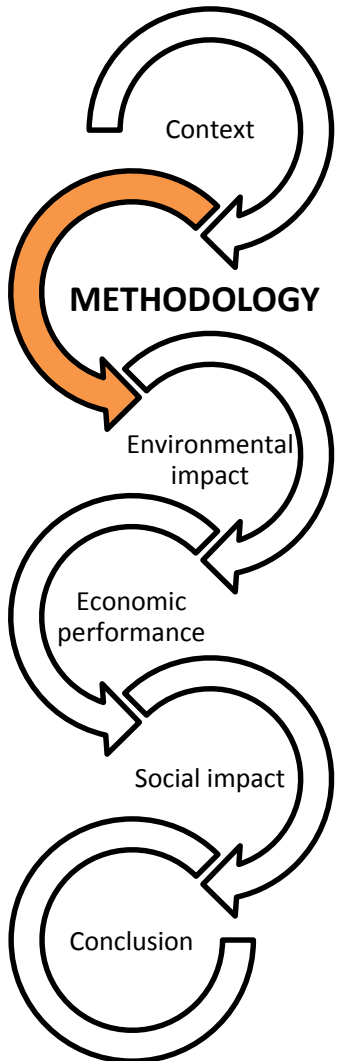
- Life cycle thinking
 - Extension of the responsibility of the provider
 - More attention has to be paid to some phases comparing to classical scheme

- ➔ **The objective of this study is to underlie the key point of the sustainability assessment method in order to integrate the evaluation into the design process**

Scope of this investigation



Methodology

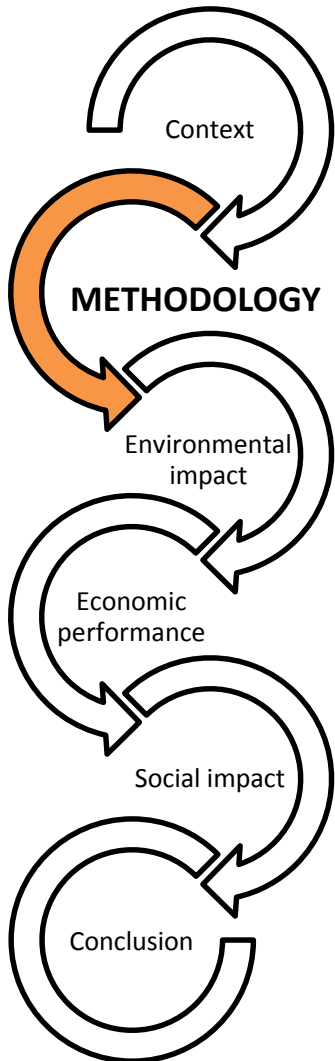


SUSTAINABILITY ASSESSMENT FROM A LIFE CYCLE PERSPECTIVE	PRODUCT-SERVICE SYSTEM
Life cycle cost / LCC	Product-service system
Social assessment	Servizing
Sustainable assessment	Servitization
Environmental assessment	Service economy
Economic assessment	Functional economy
Sustainability	Dematerialization
Life cycle assessment / LCA	
Performance indicator	

- These keywords were searched in titles, keywords and abstract of Elsevier and Springer database
- An analysis of the procedia from CIRP IPSS conference was conducted
- And the papers referenced in the selected papers was analysed

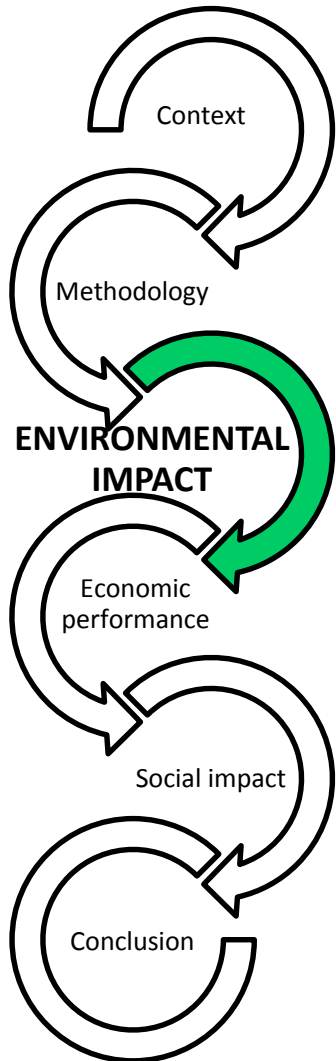
Articles selected

- Around 40 articles selected
- Half discarded after deeper analysis



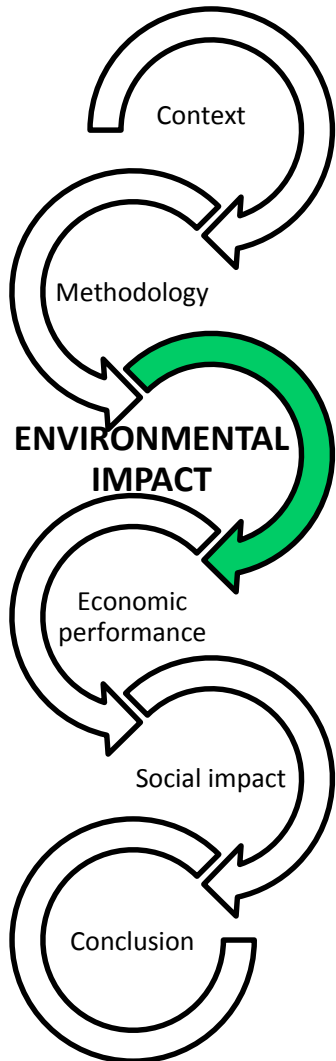
Pillars of sustainability			Type of indicators		Reference
Environmental	Economic	Social	Qualitative	Quantitative	
X	X	X	X		Abramovici et al., 2014
X				X	Amaya et al., 2012
X				X	Bonvoisin et al., 2014
X			X	X	Cor et al., 2014
X				X	Lelah et al., 2011
X	X			X	Lindahl et al., 2014
X	X	X	X		Omann, 2007
X	X	X	X	X	Partidario et al., 2007
X	X			X	Shih et al., 2009
X				X	Trevisan et al., 2013
X	X	X	X		Maxwell et al., 2003
X	X	X	X	X	Heijungs et al., 2010
X	X	X	X		Chou et al., 2014
X	X	X	X		Halme et al., 2004
	X			X	Mannweiler et al., 2010
	X			X	Garetti et al., 2012

Life cycle thinking



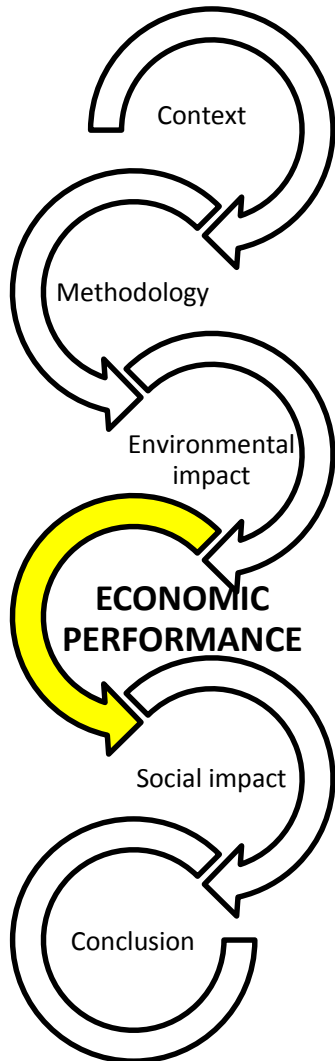
- Life Cycle Assessment (LCA) is the method used
- Life Cycle Impact Assessment methodologies used (Eco-indicator99, EIME) are not the commonly used by LCA-Community
 - comprehensive results for non-LCA-specialist
 - Synthesized results for stakeholders
- But aggregating results (as *Ecopoint* indicator) may introduce biases
 - Pollution transfer
 - Value judgement of the impacts

Input / Output



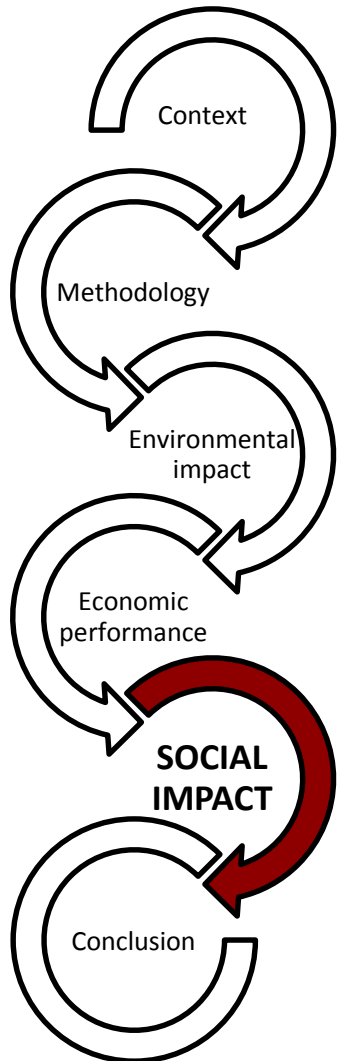
- The concept functionality and functional unit is not discussed in the papers
 - PSS may introduce an issue when defining it
 - And the functions of the system globally
- In most of the reported case studies, the results are presented in relative results
 - Compare different scenarios/alternative solutions

Key issue



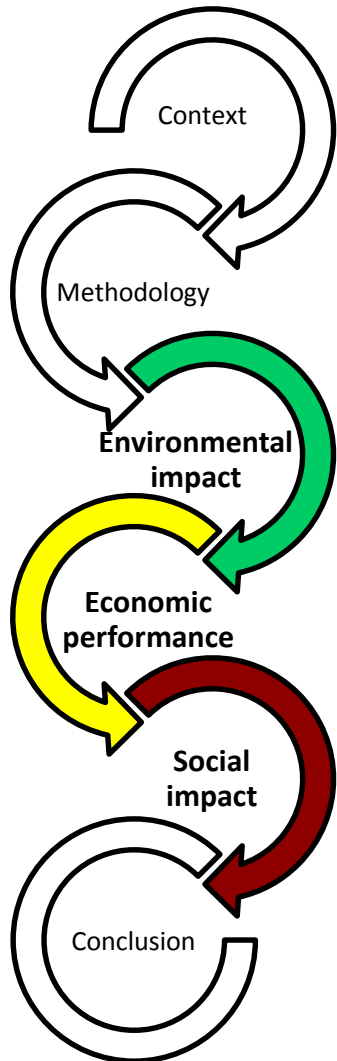
- PSS economic assessment is needed for different points of view :
 - PSS Provider
 - Customer
- Different indicators identified are goal dependent
- The uncertainty is not often taken into account
 - About the input data
 - About the modelling and the parameters
- Focus on global cost assessment
 - Excluding revenue
 - Excluding the cash flow dynamics

Key issue



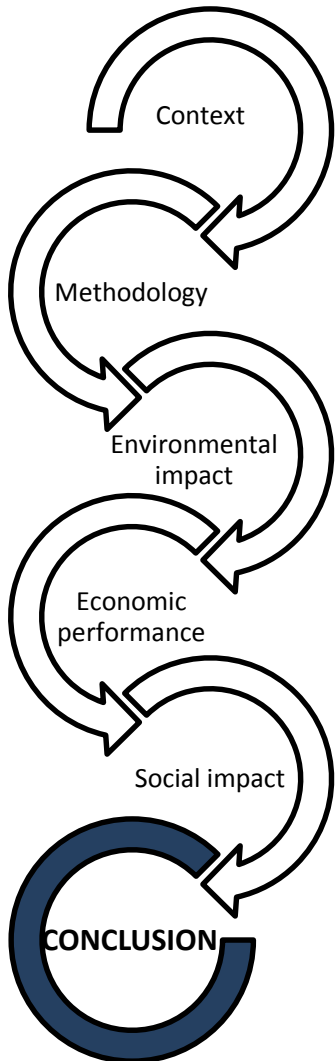
- The social impact assessment aims to evaluate the relationship between the stakeholders
 - Customer <-> PSS provider
 - PSS Provider <-> Society
 - ...
- The social impact assessment faces some issues
 - high uncertainty about the data
 - Subjectivity of the social aspect
- ➔ **It tends to be qualitative assessment of the social aspect**
- Few attempts translate the social impact through indicators shed more light on social assessment.

Discussion



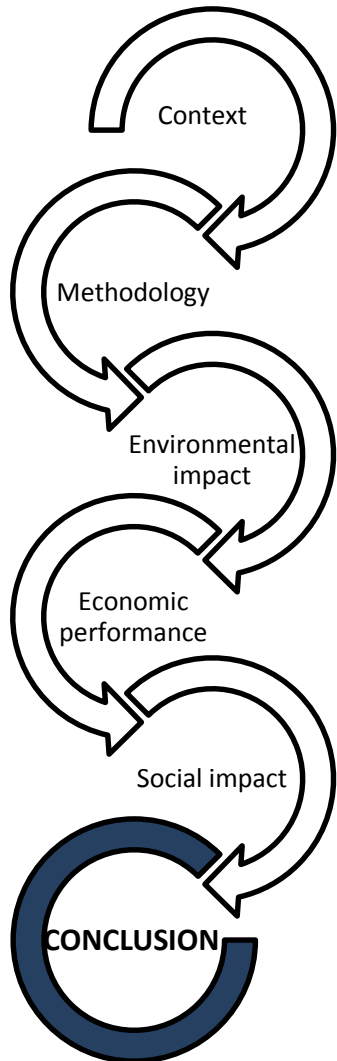
- Environmental assessment is the most discussed in order to mitigating the uncertainty about the potential reduction of the environmental pressure provided by PSS.
- The higher purchasing or rental cost is one of the barrier for the customers because they are often not aware about the *hidden* cost throughout the life cycle product.
- A link between Economic assessment and LCA is identify by some authors
- The social dimension suffers of a lack of studies surely due to its difficulty to assess including various stakeholders

Conclusion



- PSS has a potential to leverage sustainability
 - Benefits are not systematic
- Assessment methods and tools are required to guide stakeholders during the early step (e.g. design) of the life cycle of the PSS
- Multi-level assessment methods
- And still ...
- How can we integrate these dimensions into a holistic sustainability assessment

Research perspective



- Development of a methodology of evaluation and aid for decision-making for the *eco-design* of Product-Service system
 - A assessment method dedicated to PSS
 - The integration of this method into the design process

THANK YOU FOR YOU ATTENTION

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