



HAL
open science

Life Cycle Assessment, why it lagged behind and how it will race forward

Rudy Patard, Guisela Patard, David Balloy, Anne-Lise Cristol, Ion-Cosmin Gruescu

► To cite this version:

Rudy Patard, Guisela Patard, David Balloy, Anne-Lise Cristol, Ion-Cosmin Gruescu. Life Cycle Assessment, why it lagged behind and how it will race forward. The 17th congress of the European Association of Work and Organizational Psychology (EAWOP2015), May 2015, Oslo, Norway. . hal-01150331

HAL Id: hal-01150331

<https://hal.science/hal-01150331v1>

Submitted on 21 May 2015

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

Why it lagged behind and how it will race forward

Rudy PATARD¹ PhD candidate, Guisela PATARD³ PhD candidate, Professor David BALLOY¹, Senior Lecturers Anne-Lise CRISTOL² and Ion-Cosmin GRUESCU²

Author contact: rudy.patard@ed.univ-lille1.fr | +33 (0)3 20 43 49 41
Cité scientifique Bât. C6 - Bureau 226 59655 Villeneuve d'Ascq FRANCE

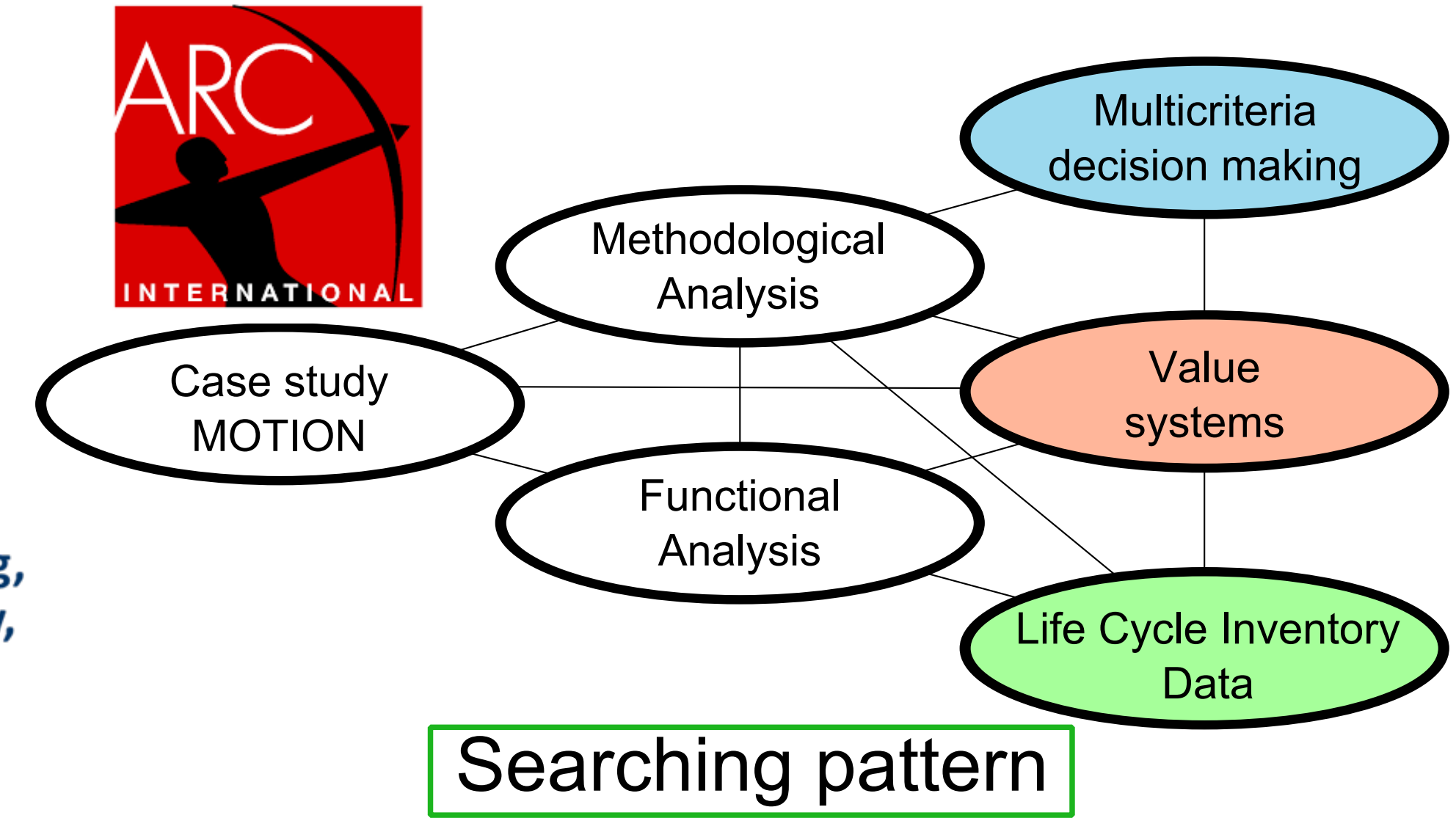
¹ Unité Matériaux et Transformations UMR CNRS 8207 Université de Lille 1 Sciences et Technologies.
² Laboratoire de Mécanique de Lille UMR CNRS 8107 École Centrale de Lille - Université de Lille 1 Sciences et Technologies.
³ Laboratoire PSITEC Université de Lille - 3 Sciences Humaines et Sociales.

Context

MOTION is a research project for ecodesign of glass making stainless steel tools.

Life Cycle Assessment (LCA) methodology is applied for evaluating environmental impacts. It is a leading methodology, but is criticised for being time-consuming and inconsistent due to numerous "modeling choices".

This study lies in field of ecodesign and has pre-existent framework, tools and sectorial rules. However, ADEME's requested to handle social, economical and environmental attributes combined to ILCD compliance. They put us in a position that we could not miss the present results.



Goals: & Method:

- Understand the causes of current LCA failure and identify solutions to overtake them.
- Analysis of LCA's function, reviewing current LCA methodology and criticisms.

Current state and critics

LCA.1.0

Approach:
By tools and applications

Framework:
ISO 14040
ISO 14044
ILCD guidance

Tools:
Simapro
GaBi
Umberto
etc.

Application:
Biofuels
Design
Metal
Building
etc.

Respectives sub-framework:
PCRs
Allocation rules
EPDs

John REAP 2008.
« A survey of unresolved problems in life cycle assessment ».
Table 1 LCA problems by phase

Phase	Problem
Goal and scope definition	Functional unit definition ^a Boundary selection ^a Social and economic impacts ^a Alternative scenario considerations ^a
Life cycle inventory analysis (LCI)	Allocation Negligible contribution ('cutoff') criteria Local technical uniqueness
Life cycle impact assessment	Impact category and methodology selection Spatial variation Local environmental uniqueness Dynamics of the environment Time horizons
Life cycle interpretation	Weighting and valuation ^a Uncertainty in the decision process
All	Data availability and quality

^a One might reasonably consider these problems to be pivotal decisions.

Main life cycle assessment framework issues

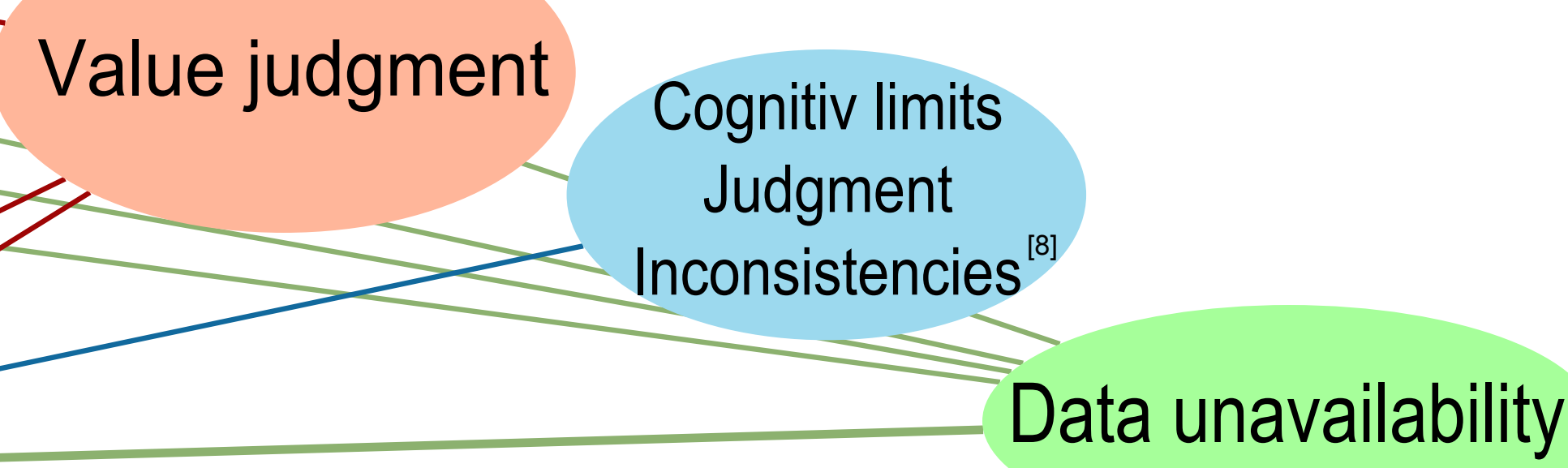
1 LCA : Always a decision support !

Decision support?	Kind of process-changes in background system / other systems	
	None or small-scale	Large-scale
Yes	Situation A "Micro-level decision support"	Situation B "Meso/macro-level decision support"
No	Situation C "Accounting" (with C1: including interactions with other systems, C2: excluding interactions with other systems)	

ILCD study types, Modified

2 Inconsistency and gaps in ILCD - ISO rules :

- Logical deadlock loop:
No interpretation for disclosed comparative study.
Interpretation needed in boundary definition.
- No guidance to handle the needed judgement.
Impossible ban against weighting.



Decision handling Multiple Incommensurable Attributs:



Multiple heterogeneous attributes evaluation:

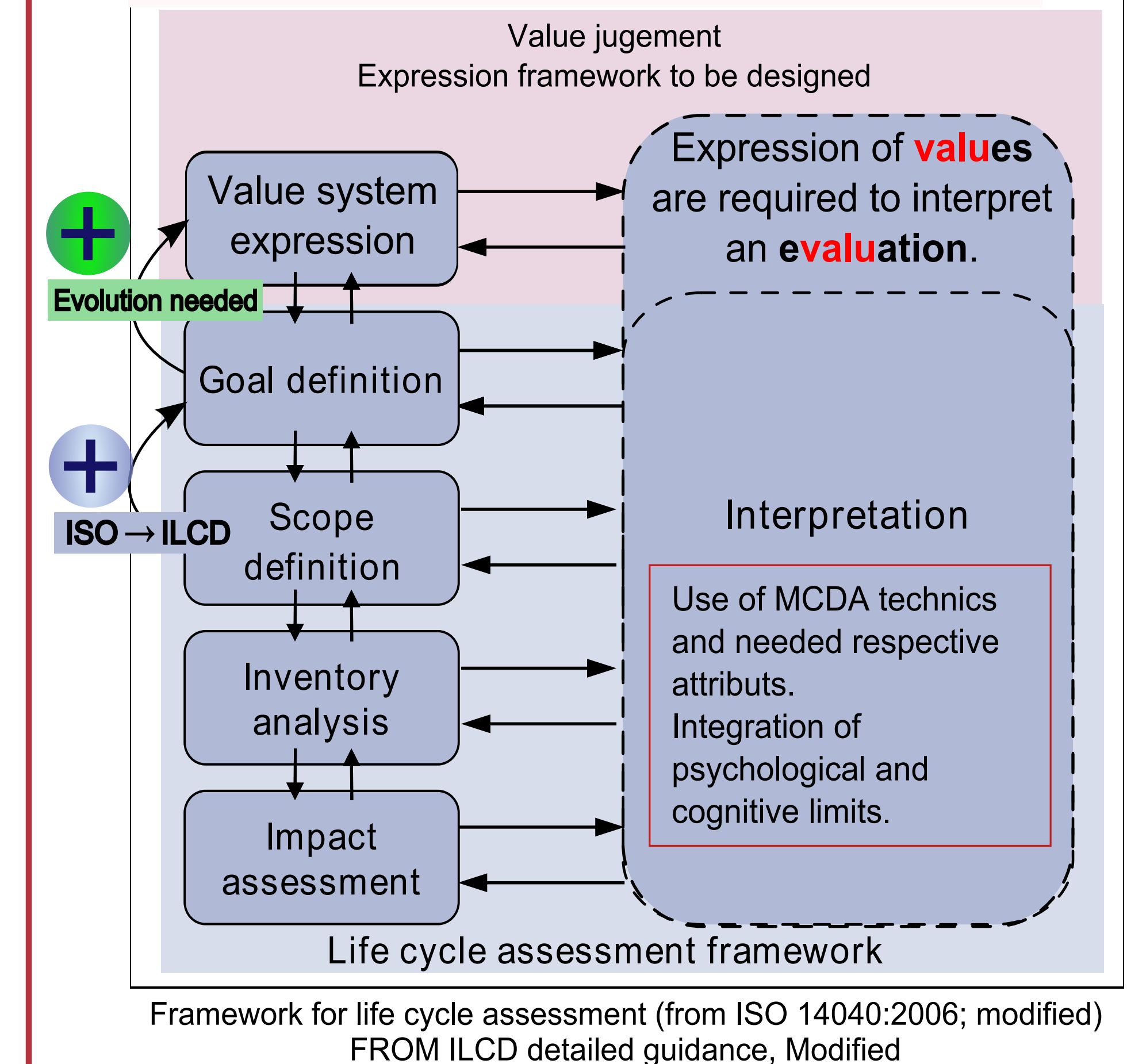
- Needs values and preferences expression^[7]
- Tends to reach cognition overload^[6]

So LCA requires:

- Multi-Criteria Decision Analysis tools (MCDA)^{[3][4]}

PROPOSITION

ISO/IEC 14040-4:2006/NP Amd 1, or its equivalent open standard, needs to start.



Framework for life cycle assessment (from ISO 14040:2006; modified) FROM ILCD detailed guidance, Modified

CONCLUSION: LCA NEEDS UPGRADING

LCA.1.0 is in a dead end !

LCA.1.1

Approach:
By goal and methodology

→ Judgment integration
→ ISO/IEC 14040-4:2006/NP Amd 1
→ One standard acknowledging multiple judgments.

LCA = MCDA

New development direction:
Psychology integration, the building of judgment
Piaget ; Kohlberg ; Gilligan ; Bègue ; Meyer

LCA.2.0 **LCA.3.0**

Approach:
For operationalisation of a corrected methodology

LCA aims at holism. It needs:
→ Interactivity (2.0)
→ Scalability (3.0)

LCA = ABM
Agent Based Modelling.

Development need: Scientific communities shall massively open and connect themselves, and develop open semantic web solutions for scalable knowledge production.

Remaining problem:
The way scientific communities produce and share knowledge.

PERSPECTIVE

- We are eager to see:
- Renewal of standards [ISO, ILCD, PEF]
 - Implementation of MCDA advanced tools
 - Semantic web as LCI resource
 - The societal debate about values

References

- [1] European Commission, Joint Research Centre, et Institute for Environment and Sustainability, ILCD Handbook: General guide for Life Cycle Assessment - Detailed guidance. Publications Office of the European Union, 2010.
- [2] J. Reap, F. Roman, S. Duncan, et B. Bras, « A survey of unresolved problems in life cycle assessment », The International Journal of Life Cycle Assessment, 14-mai-2008.
- [3] H. V. Rowley, G. M. Peters, S. Lundie, et S. J. Moore, « Aggregating sustainability indicators: Beyond the weighted sum », Journal of Environmental Management, p. 24-33, 2012.
- [4] T. Spengler, J. Geldermann, S. Hähre, A. Sieverdingbeck, et O. Rentz, « Development of a multiple criteria based decision support system for environmental assessment of recycling measures in the iron and steel making industry », J. Clean. Prod., vol. 6, no 1, p. 37-52, 1998.
- [5] C. B. Davis et M. P. C. Weijnen, « Making sense of open data: from raw data to actionable insight : Proefschrift », Next Generation Infrastructures Foundation, Delft, 2012.
- [6] J. Farrington, « Seven plus or minus two », Perform. Improv. Q., vol. 23, no 4, p. 113-116, 2011.
- [7] J.-M. Harribey, La richesse, la valeur et l'inestimable fondements d'une critique socio-écologique de l'économie capitaliste. [Paris]: les Liens qui libèrent, 2013.
- [8] T. Saaty, « Decision making — the Analytic Hierarchy and Network Processes (AHP/ANP) », J. Syst. Sci. Syst. Eng., vol. 13, no 1, p. 1-35, mars 2004.

Acknowledgement

I thank my director and supervisors for their trust as I evolved farther away from their fields. I thank the funders and partners of the project. I thank my colleagues, more particularly Dr. Hadrien ROUCHETTE, for the discussions and debate they took part in and that probably put me in the environment enabling my reflexions and results. I thank Coen VAN DER GIESEN MSc from CML for sending me DAVIS's work. I thank my sister Guisela PATARD, PhD researcher in PSITEC Lille 3 for her help and guidance in psychology fields. Finally I thank all the researchers for their work and the act of making it available as LCA, as collaborative discipline, would be nothing without them sharing.

Drawings taken from wikimedia's site <https://commons.wikimedia.org>