



DIÁLOGOS SETORIAIS  
UNIÃO EUROPEIA  
BRASIL

# CRITICAL ANALYSIS OF THE MAIN INTERNATIONAL MANAGEMENT, USE AND MAINTENANCE LCI DATABASE POLICIES

**DIOGO A. LOPES SILVA**

*PhD candidate at University of São Paulo, Brazil*

**PAOLO MASONI**

*Research Director, ENEA – Sustainability Department, Italy*



# CONTENT

- ❑ INTRODUCTION
- ❑ METHODOLOGICAL FRAMEWORK
- ❑ RESULTS AND DISCUSSION
- ❑ LIST OF RECOMMENDATIONS FOR THE “SICV BRASIL”
- ❑ FINAL CONSIDERATIONS



DIÁLOGOS SETORIAIS UNIÃO EUROPEIA  
BRASIL

# INTRODUCTION



# INTRODUCTION

## □ GOAL AND MOTIVATION:

1) To analyze the current international policies of management, use and maintenance of LCI databases;

Others

2) To suggest a list of recommendations for the “SIV Brasil” DB.

Information to  
the DB users

Integration  
with the  
LCDN

Integration  
with Brazilian  
policies

International  
agreement

To assist IT  
infrastructure  
development

Documentation



DIÁLOGOS SETORIAIS UNIÃO EUROPEIA  
BRASIL

# METHODOLOGICAL FRAMEWORK



# METHODOLOGICAL FRAMEWORK

## 1. PRE-ASSESSMENT

*Analysis of international LCI DBs  
and survey of Brazilian  
companies needs and barriers*

## 2. IN-DEPTH ASSESSMENT

*Critical evaluation of the main  
DBs and of the results from  
the survey*

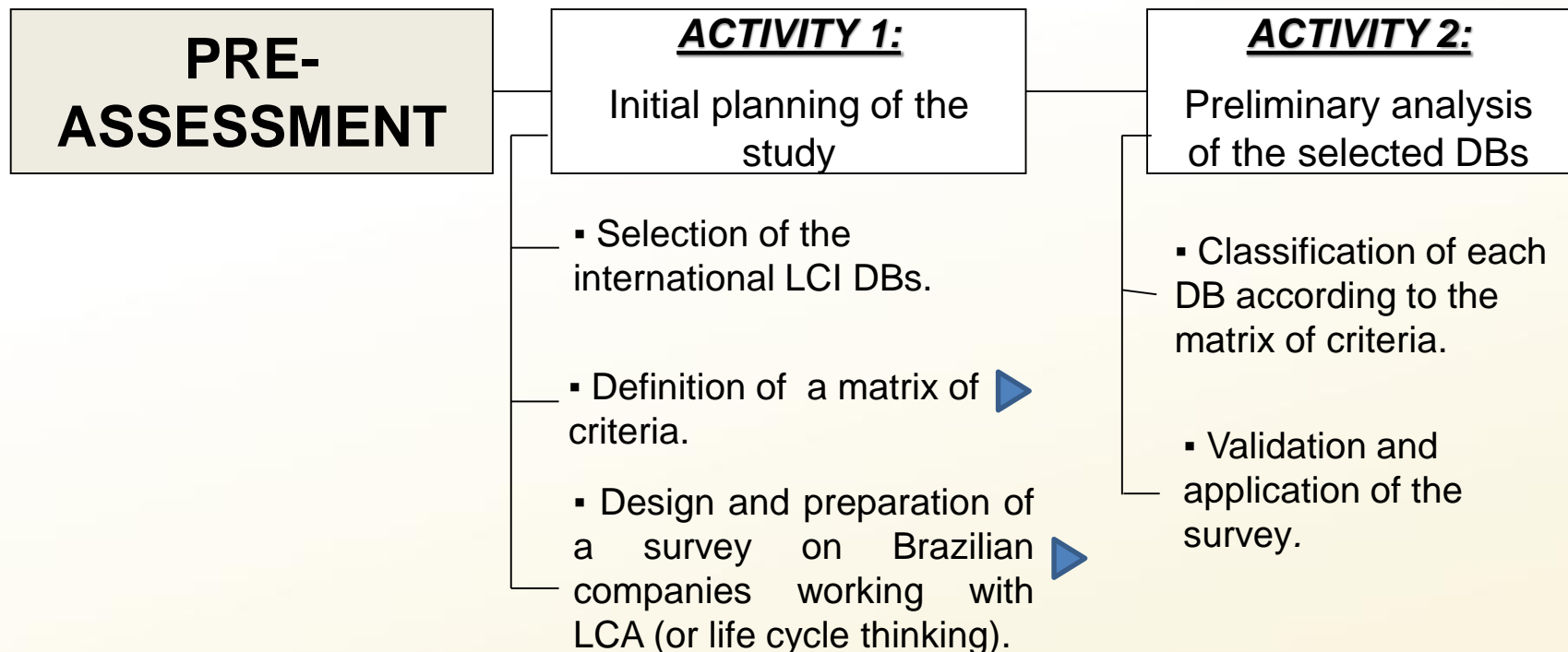
## 3. POST-ASSESSMENT

*Recommendations for the  
“SICV Brasil” DB*

**Figure 1:** Summary of the main  
methodological phases



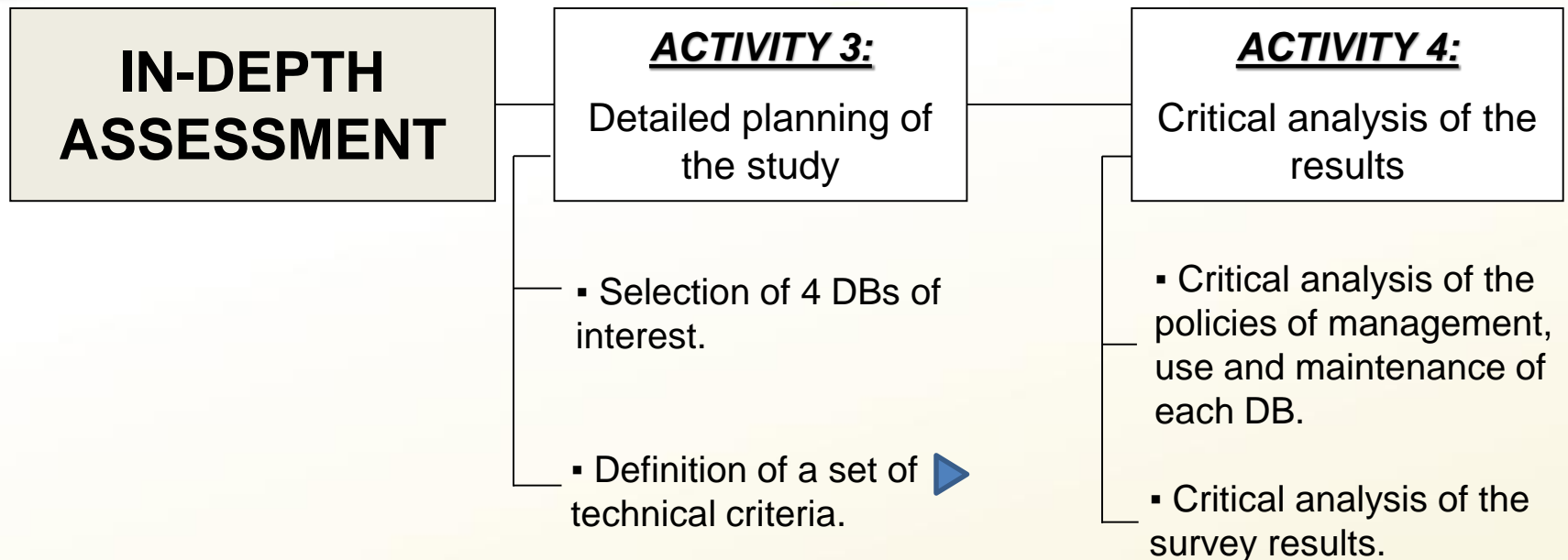
# METHODOLOGICAL FRAMEWORK



**Figure 2:** Set of activities during the pre-assessment phase



# METHODOLOGICAL FRAMEWORK

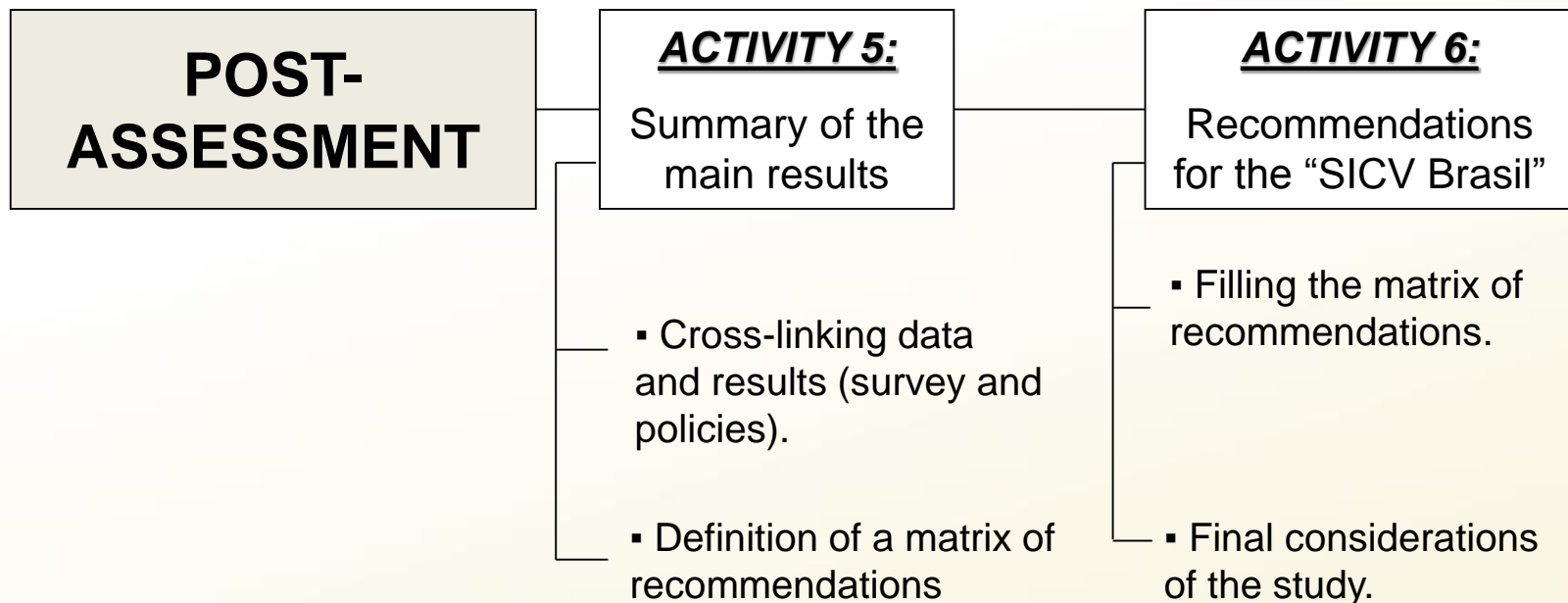


**Figure 3:** Set of activities during the in-depth assessment phase





# METHODOLOGICAL FRAMEWORK



**Figure 4:** Set of activities during the post-assessment phase

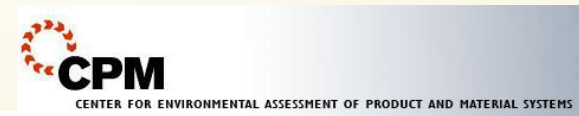


# RESULTS AND DISCUSSION



# RESULTS AND DISCUSSION

Country	Name
Germany	Ökobau.dat database
	GaBi database
Australia	AusLCI
Canada	CRMD
	LCI BD-Quebec
China	CLCD
USA	USLCI
Italy	Italian National Life Cycle Inventory Database
Japan	IDEA
Malaysia	MY-LCID
Thailand	ThaiLCI DB
European Union	ELCD
Sweden	CPM LCA Database
Switzerland	Ecoinvent
South of Europe	LCADB.sudoe





## PRE-ASSESSMENT OF THE 15 DBs

- ❑ General approach: most of DB adopt attributional modeling approach for G2G and C2G datasets.
- ❑ Actor's roles: it was pointed out the following basic structure: **steering committee**, **technical committee** and **project committee**.
- ❑ IT infrastructure: ecoSpold and ILCD formats are used. Most of DBs allow to download their datasets after a prior system registration process.



## PRE-ASSESSMENT OF THE 15 DBs

- Business model: it was identified that are free for use

ELCD  
**Database**

AusLCI (Australia)  
ELCD (Europe)  
ThaiLCI DB (Thailand)  
USLCI (USA)

**Inventory**

- Availability: free available documents, manuals, terms of use, policies, **USLCI, ELCD, LCADB.sudoe, ThaiLCI DB, and USLCI** were highlighted.

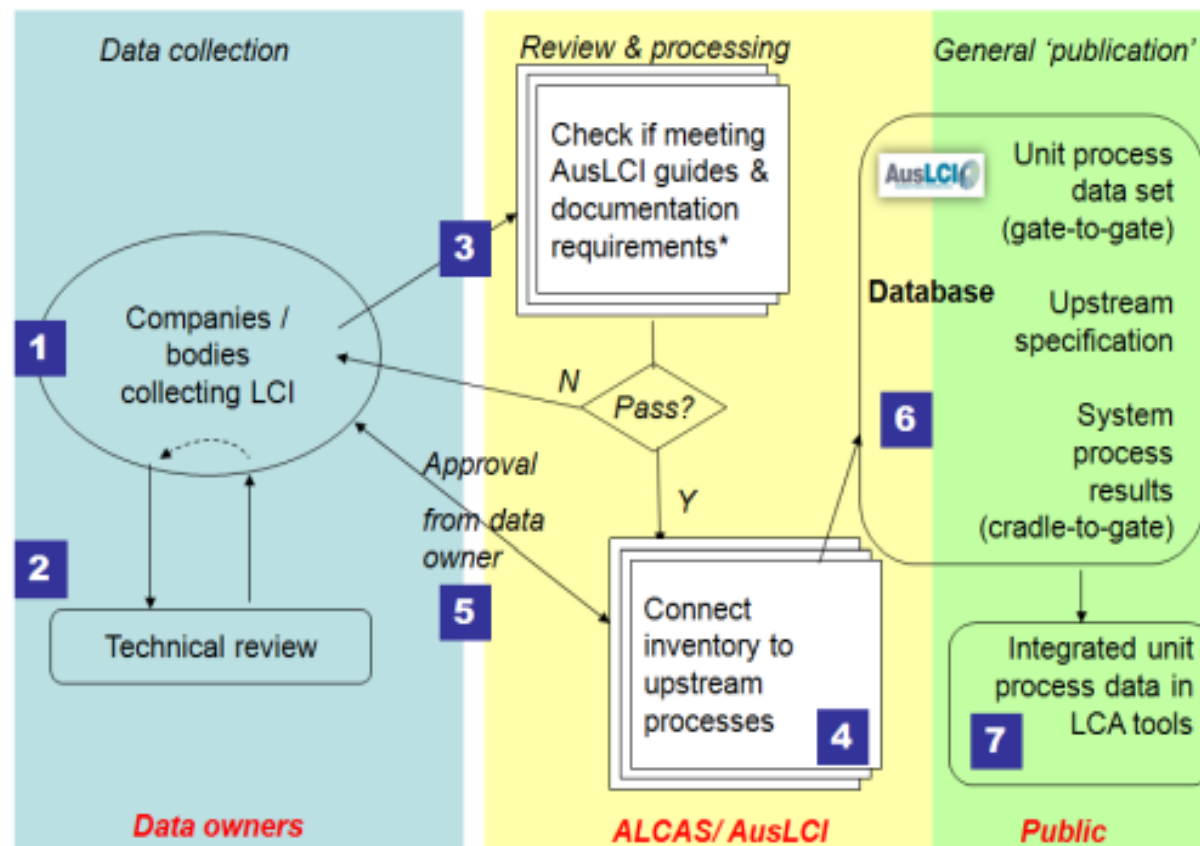


# AusLCI – The Australian Life Cycle Inventory Database Initiative





## IN-DEPTH ASSESSMENT OF THE 04 BDs



- ❑ G2G dataset submission in ecoSpold 1 or 2, or ILCD formats from any software tool.
- ❑ Technical review using a **checklist** (Excel file). ▶
- ❑ C2G aggregation with existent AusLCI and/or external DBs (**ecoinvent** and **USLCI**)

**Figure 5:** Flowchart for the AusLCI data publication



## IN-DEPTH ASSESSMENT OF THE 04 BDs



**ALCAS**  
AUSTRALIAN  
LIFE CYCLE ASSESSMENT  
SOCIETY

**Datasets Contributors AusLCI Use Publications Resources**

**Home page**

**Datasets**

Agriculture  
Bio based materials  
Chemicals  
Electricity  
Materials  
Transport  
Waste treatment

**Licence agreement**

**ALCAS website**

**Join ALCAS**

**Chemicals - Datasets List**

**Organic - Datasets List**

Ethylene dichloride-vinyl chloride monomer, at plant	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>
gluten, from wheat starch production	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>
starch plant operation, from wheat flour	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>
starch waste, from wheat starch production	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>
starch, from wheat	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>

**Inorganic - Datasets List**

zinc nitrate	<a href="#">View XML file</a>	<a href="#">Unit process (xls)</a>	<a href="#">System process (xls)</a>
--------------	-------------------------------	------------------------------------	--------------------------------------

- ☐ Confidentiality protocol: **C2G aggregation.**
- ☐ ISO/TS 14048 for nomenclature.
- ☐ Terms for use: **free access under prior system registration.**
- ☐ Online access or in Excel files

**Figure 6:** Screenshot of some G2G and C2G datasets



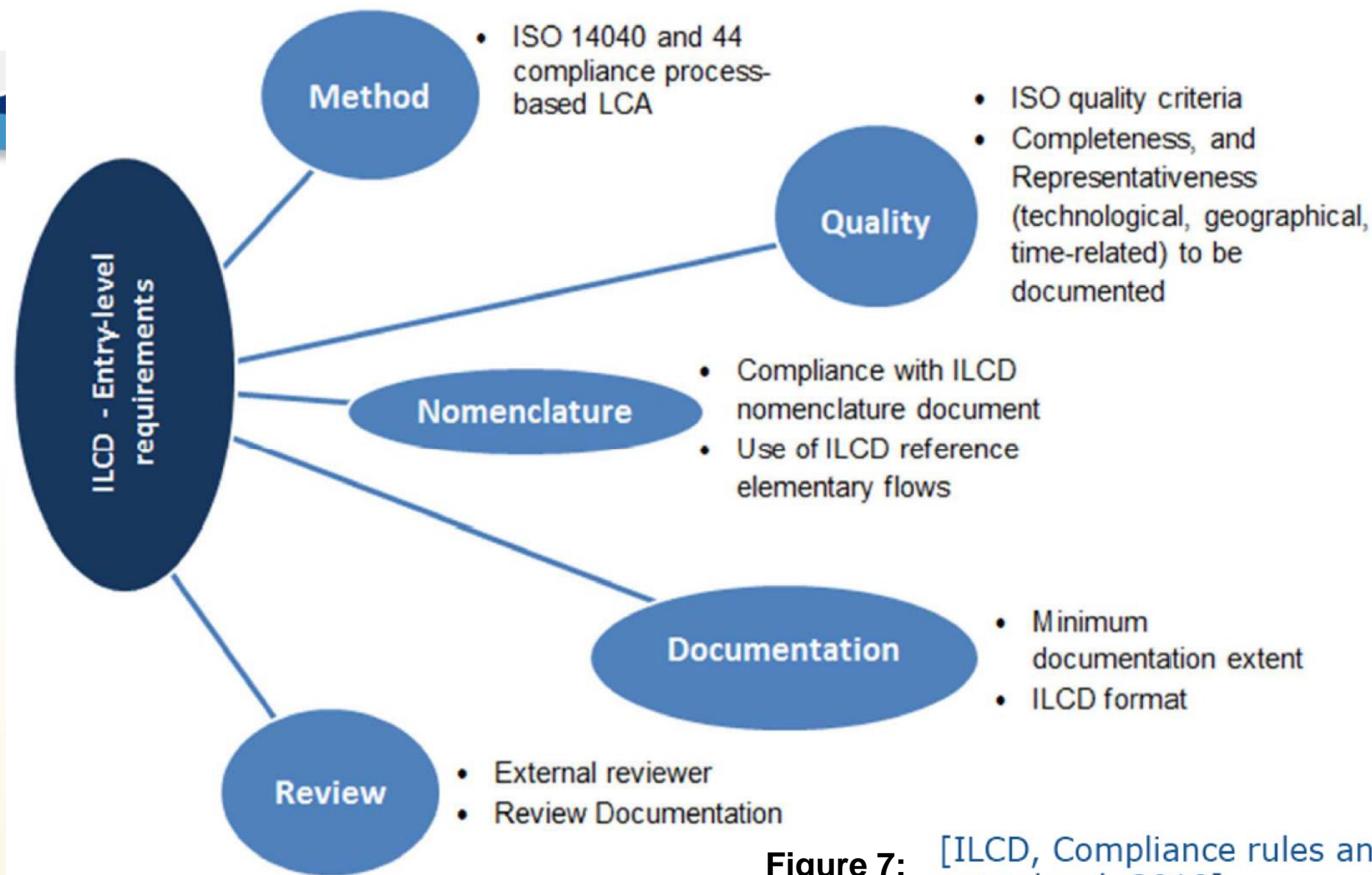


# ELCD – European Reference Life Cycle Database



## IN-DEPTH ASSESSMENT OF THE 04 BDs

- ❑ ELCD will be probably phased out, as result of a change in policy by the EC, in favour of the development of the LCDN
- ❑ Presently ELCD contains 503 datasets: 45 end-of-life treatments; 329 energy carriers and technologies; 89 Materials production; 243 Processes; 18 Systems; 33 Transports.
- ❑ Many ELCD 3.2 datasets have been reviewed against the ILCD entry-level and PEF data quality requirements.
- ❑ Datasets can be used free of charge and also distributed to third parties. A specific web page contains copyright and license conditions.



**Figure 7:**

[ILCD, Compliance rules and entry level, 2010]



## JOINT RESEARCH CENTRE

### EPLCA - European reference Life-Cycle Database

European Commission > JRC > IES > EPLCA > ELCD

Stock: Default root data stock

Home  
Dataset download  
Developer support

Browse Data Sets

Processes

LCIA Methods

Flows

Flow Properties

Unit Groups

Sources

Contacts

Search Data Sets

Search Processes

### ELCD3.2

Filter results

(1 of 51)										10 entries per page (503 total)									
Name		Location	Classification	Reference year	Valid until														
Graphic Paper; technology mix; production mix, at plant; 79% primary fibre, 21% recycled fibre		EU-25	Materials production / Paper and cardboards	2006	2015														
Acrylonitrile-Butadiene-Styrene granulate (ABS);production mix, at plant		RER	Materials production / Plastics	1996	2006														
Aerated concrete block;mix of P2 04 and P4 05;production mix, at plant;average density 433 kg/m3		RER	Systems / Construction	2004	2012														
Aerated concrete block;type P4 05 reinforced;production mix, at plant;average density 485 kg/m3		RER	Systems / Construction	2004	2012														
Aluminium extrusion profile;primary production;production mix, at plant;aluminium semi-finished extrusion product, including primary production, transformation and recycling		RER	Materials production / Metals and semimetals	2005	2011														
Aluminium sheet;primary production;production mix, at plant;aluminium semi-finished sheet product, including primary production, transformation and recycling		RER	Materials production / Metals and semimetals	2005	2011														
Anhydrite (CaSO4);technology mix of natural (33%), thermal (33%) and synthetic (33%) produced anhydrite;production mix, at plant;grinded and purified product		DE	Systems / Construction	2002	2010														
Articulated lorry transport;Euro 0, 1, 2, 3, 4 mix;40 t total weight, 27 t max payload		RER	Transport services / Road	2007	2010														
Articulated lorry transport;Euro 0, 1, 2, 3, 4 mix;40 t total weight, 27 t max payload		RER	Transport services / Road	2005	2010														
Barge;technology mix;1.228 t pay load capacity		RER	Transport services / Water	2005	2010														
(1 of 51)										10 entries per page (503 total)									

**Figure 8:** screenshot of datasets



DIÁLOGOS SETORIAIS  
UNIÃO EUROPEIA  
BRASIL



JOINT RESEARCH CENTRE

EPLCA - European reference Life-Cycle Database

European Commission > JRC > IES > EPLCA > ELCD

Stock: Default root data

Home

Dataset download

Developer support

**Browse Data Sets**

Processes

LCIA Methods

Flows

Flow Properties

Unit Groups

Sources

Contacts

**Search Data Sets**

**Search Processes**

### ELCD3.2

Search terms will be interpreted as additive search conditions. To include all options, just leave all possible entries unselected (default).

Search

Search across network ☐

#### Search in name and other description fields

Name:

Other description fields:

#### Geographical and time coverage

Geographical Coverage

Afghanistan  
Africa  
Albania  
Algeria  
American Samoa  
Andorra

Reference year  
between

Please select

and

Please select

Type of data set Please select

only parameterized ☐

#### Classification

##### Available Classes

Energy recycling  
Landfilling  
Waste water treatment  
Crude oil based fuels  
ELCD  
Electricity  
Hard coal based fuels  
Heat and steam  
Lignite based fuels  
Mechanical energy

##### Selected Classes

☐  
☐  
☐  
☐

Search

**Figure 9:** screenshot of datasets searching

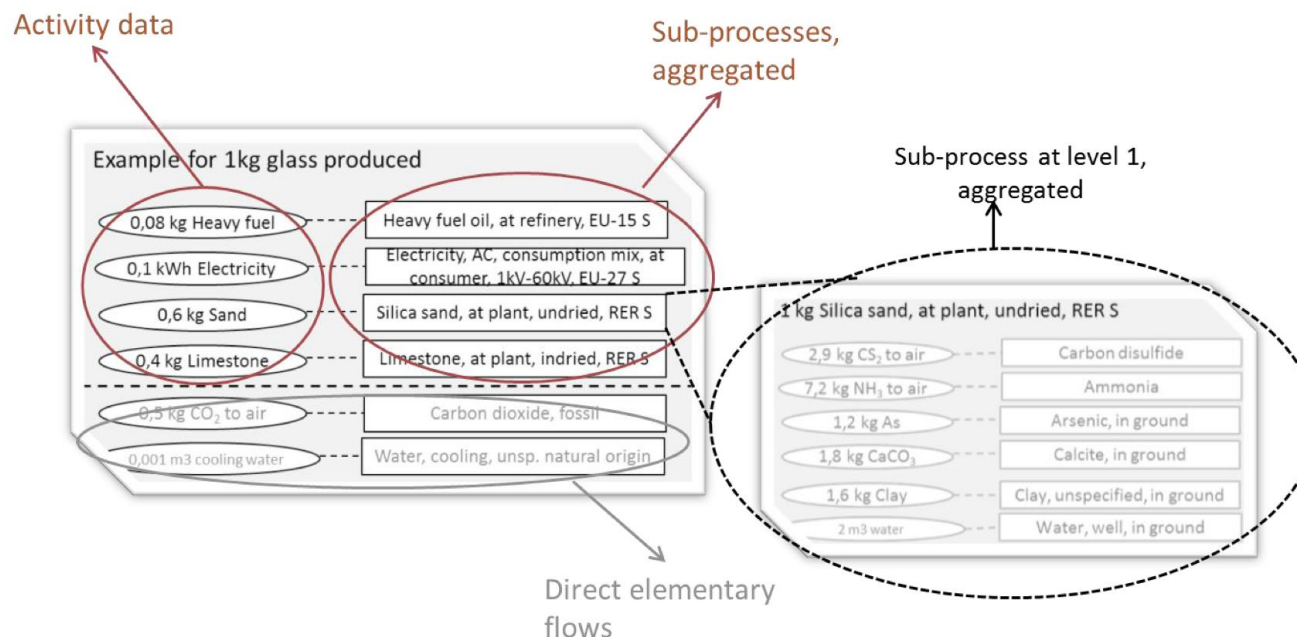
IN





- ❑ EC is presently commissioning PEF compliant, partially disaggregated datasets, at level 1.
- ❑ An important aspect of the PEF is the data quality scoring:

$$DQR = \frac{TiR + TeR + GR + C + P + EoL}{6}$$



**Figure 10:** Datasets disaggregation rules



# ThaiLCI DB – Thai National Life Cycle Inventory Database

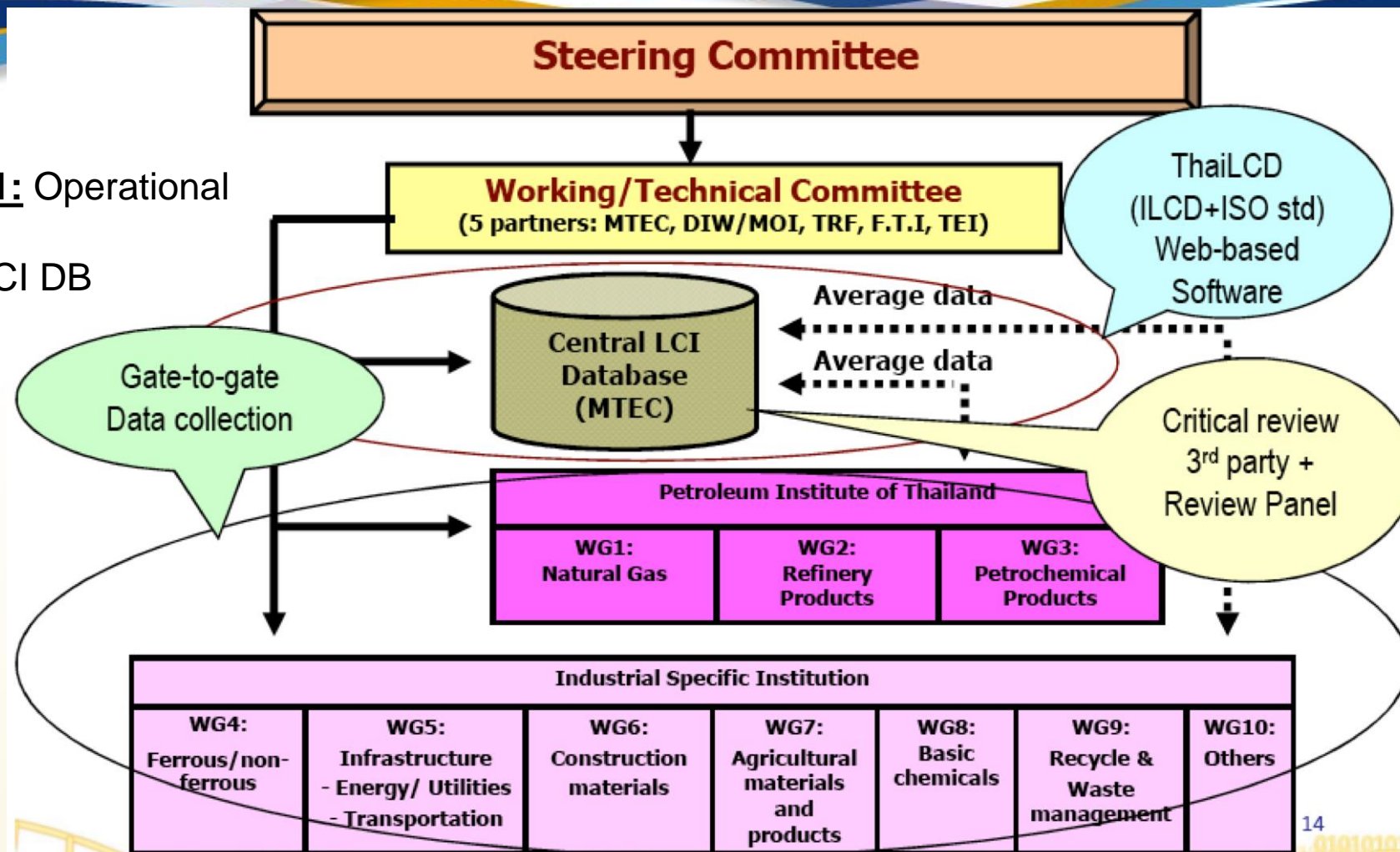


## IN-DEPTH ASSESSMENT OF THE 04 BDs

- ❑ ThaiLCI DB datasets are published in ILCD format and data can be exchanged as XML.
- ❑ Datasets are available as G2G (unit process datasets), both from specific manufacturing plants and from literature, and as C2G (aggregated datasets).
- ❑ In total 800 records are present.
- ❑ Major driver to convince the enterprise to provide their data is the overarching Sustainable Consumption and Production policy in place in Thailand that promotes the ecodesign, products with ecolabel and green purchasing.



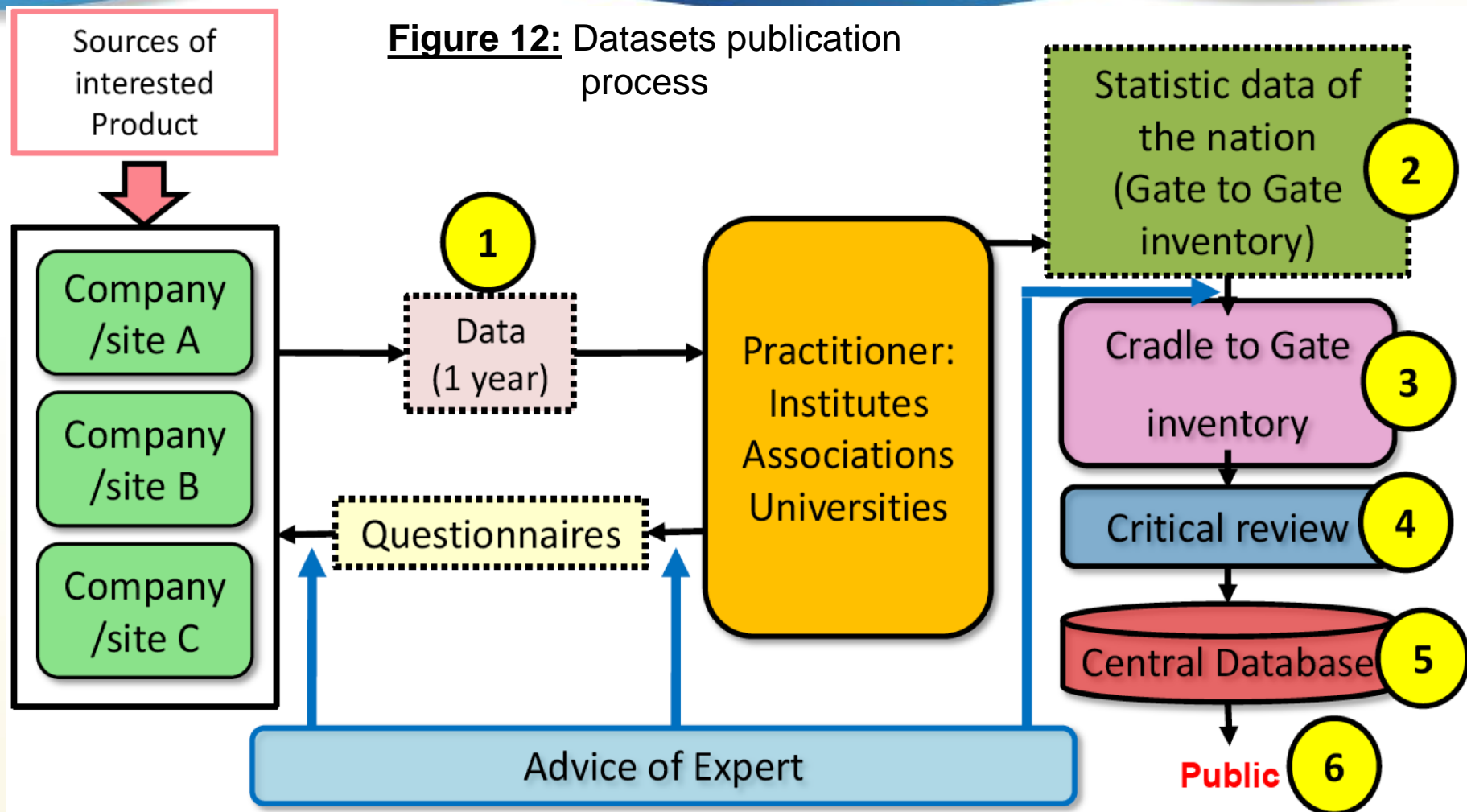
**Figure 11:** Operational structure of Thai LCI DB





# ThaiLCI DB development process

**Figure 12:** Datasets publication process





DIÁLOGOS SETORIAIS UNIÃO EUROPEIA BRASIL

# ThaiLCI DB search and browse interface

ฐานข้อมูลวัฏจักรชีวิตของประเทศไทย (Thai National Life Cycle Inventory Database)

: Thai National Life Cycle Inventory Database



## Thai National Life Cycle Inventory Database

ฐานข้อมูลวัฏจักรชีวิตของวัสดุพื้นฐานและพลังงานของประเทศ

▶ กลับหน้าเว็บหลัก

### ฐานข้อมูลวัฏจักรชีวิตของประเทศไทย

เงื่อนไขการค้นหา

Keyword :  กลุ่ม LCI :  ประเภท : ☐ G to G ☐ G to G Literature ☐ C to G (หากไม่ติ๊กเลยหมายถึงแสดงทั้งหมด)

แสดงหน้าละ :  รายการ

แสดง

เคลียร์

หมายเหตุสถานะฐานข้อมูล : ● = กำลังดำเนินการ ▲ = แก้ไข ■ = เสร็จสิ้น ✓ = สามารถขอฐานข้อมูลนี้ได้

กลุ่ม	ชื่อ	กลุ่มหลัก	กลุ่มย่อย	รายละเอียด	G to G	G to G Literature	C to G	Ref. Year
WG1 : NATURAL GAS	ก๊าซมีเทน (C1)			Methane (sale gas)	■		■ ✓	2551
WG1 : NATURAL GAS	ก๊าซอีเทน (C2)			Ethane	■		■ ✓	2551
WG1 : NATURAL GAS	ก๊าซโพรเพน (C3)			Propane	■		■ ✓	2551
WG1 : NATURAL GAS	ก๊าซปิโตรเลียมเหลว (LPG) จาก โรงแยกก๊าซ (C3-C4)			Liquefied petroleum gas from natural gas separation	■		■ ✓	2551
WG1 : NATURAL GAS	ก๊าซธรรมชาติเหลว (NGL)			Natural gas liquids (NGL)	■		■ ✓	2551
WG1 : NATURAL GAS	ก๊าซคาร์บอนไดออกไซด์			Carbon dioxide	■		■ ✓	2551
WG2 : REFINERY	ก๊าซปิโตรเลียมเหลว (LPG) จาก โรงกลั่นน้ำมัน			Liquefied petroleum gas from refinery	■ ✓		■ ✓	2548
WG2 : REFINERY	กำมะถัน			Sulfur	■ ✓		■ ✓	2548
WG2 : REFINERY	น้ำมันเบนซินไร้สารตะกั่ว 95			Gasoline oil	■ ✓		■ ✓	2548
WG2 : REFINERY	น้ำมันก๊าดหรือน้ำมันเครื่องบิน			Kerosene/Jet oil	■ ✓		■ ✓	2548
WG2 : REFINERY	น้ำมันแอฟทา			Naphtha oil	■ ✓		■ ✓	2548
WG2 : REFINERY	น้ำมันดีเซล			Fuel oil	■ ✓		■ ✓	2548



# USLCI – U. S. Life Cycle Inventory Database





## U.S. Life Cycle Inventory Database



## IN-DEPTH ASSESSMENT OF THE 04 BDs

Worksheet Name	Information contained in worksheet
Process Info	Properties of the process data, for example: <ul style="list-style-type: none"><li>• the region and time period</li><li>• representativeness</li><li>• sub-processes included</li><li>• general comments</li><li>• links to sources and people (detailed on the source and person info sheets described below)</li></ul>
Flow Info	The basic life cycle inventory (LCI) data: <ul style="list-style-type: none"><li>• flows into the process from nature and from other processes</li><li>• flows out of the process to nature and to other processes</li></ul> This sheet also allows for: <ul style="list-style-type: none"><li>• flow-specific comments</li><li>• specification of uncertainty data for each flow</li></ul>
Source Info	Bibliographic information for sources used to generate the unit process (“flow info”) data.
Person Info	Basic contact information for the person(s) involved in preparing the data spreadsheet.

- ☐ G2G, C2G and cradle-to-grave datasets in ecoSpold, ILCD or Excel formats.
- ☐ Streamlined ecoSpold template▶
- ☐ Aggregation process only with USLCI’s datasets
- ☐ Free access under user registration.

**Figure 13:** Basic dataset documentation



## IN-DEPTH ASSESSMENT OF THE 04 BDs

- ❑ Critical review: routine internal review and external review.
- ❑ **Internal review:** NREL revises each dataset according to its adherence with the guidelines, plausibility of the data, apparent completeness and mathematical correctness.
- ❑ **External review panel:** optional step in the critical review process.

Table 2. Two-Year Plan for the U.S. LCI Database

Action Item	Timeline
<b>Project Management</b>	
Fully develop annual operating plans. *	1-6 months
Formally establish advisory boards.	1-9 months
Prepare requests for proposals and hire subcontractors.	1-9 months
Develop and implement a business plan. *	3-12 months
Coordinate with national and international LCA/LCI efforts. *	1-24 months
<b>Data Management</b>	
Develop a data quality control protocol and plan.	1-12 months
Review and revise data formats and protocols.	1-12 months
Develop and implement a data reviewer qualification plan.	1-12 months
Implement a data quality review program. *	3-24 months
<b>Expansion/Revision of the Database</b>	
Prioritize data needs.	3-6 months
Fill data gaps.	3-24 months
Review and update or replace data sets. *	3-24 months
Incorporate new data from current LCA efforts. *	3-24 months
<b>Database Development</b>	
Revise database and data templates.	3-12 months
Develop a data reviewing and tracking application.	3-12 months
Develop applications for improved data accessibility.	6-24 months
Develop streamlined data entry tools.	12-24 months
<b>Communications</b>	
Develop and implement a communications plan. *	3-24 months
Revise and update the project Web site. *	3-24 months

\*Activities that will continue beyond two years

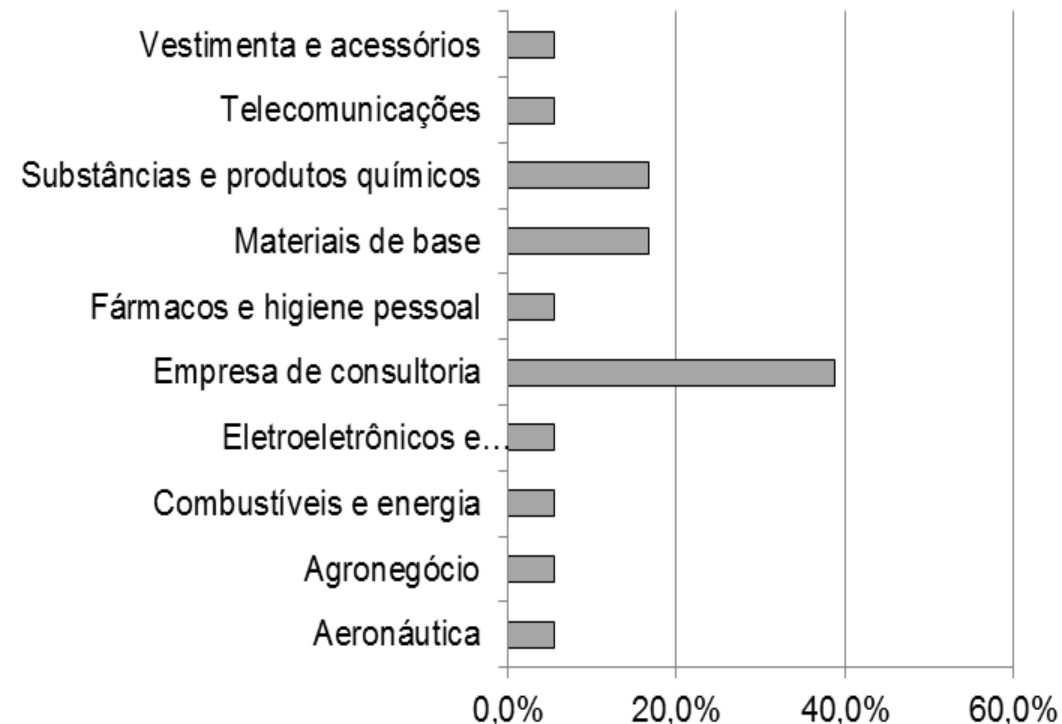
**Figure 14:** 2009 stakeholder roadmap meeting



# RESULTS OF THE SURVEY APPLICATION



## SURVEY HIGHLIGHTS



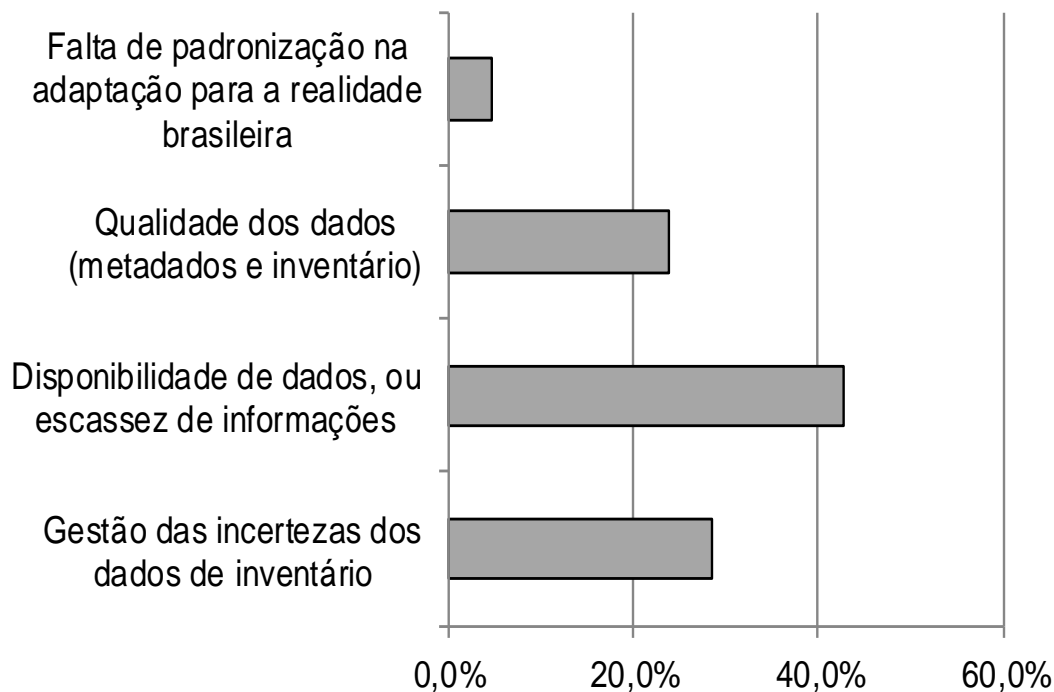
- ❑ The questionnaire was answered by **20 Brazilian companies**.
- ❑ As a **limitation** there were some important sectors not evaluated during the survey application (e.g., pulp and paper, packaging, machinery, automotive components, etc.).
- ❑ **Consultancy firms** were the main respondents.

**Figure 15:** The main sector activities





## SURVEY HIGHLIGHTS

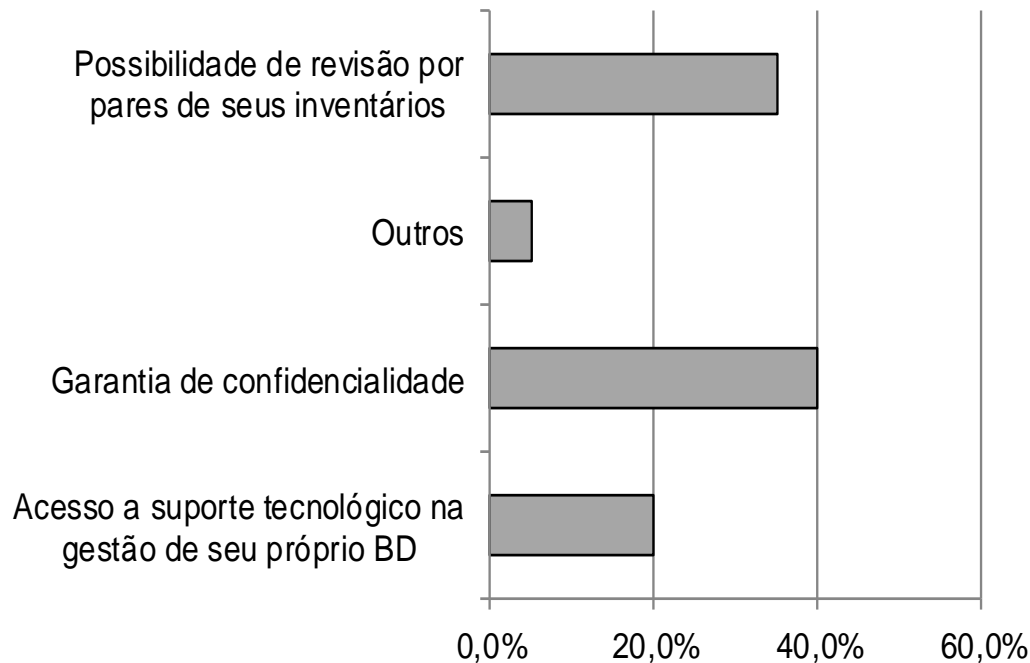


- ❑ **Ecoinvent, GaBi, ELCD and USLCI** were pointed out as the main international DBs adopted by the Brazilian companies.
- ❑ However, **availability of datasets** for the Brazilian context was the main problem (42.9%) when foreign DBs are used.

**Figure 16:** The main limitations due to use foreign DBs



## SURVEY HIGHLIGHTS



- ❑ **Confidentiality of data** was highlighted (40.0%) as the main positive key-factor.
- ❑ To have datasets revised by a **panel of specialists** was also an important factor (35.0%).

**Figure 17:** The main positive key-factors to motivate companies to submit datasets



## SURVEY HIGHLIGHTS

About the “SICV Brasil” DB development:

- ☐ 50.0% of respondents said “**no**” or “**maybe**” about to pay to have access to the Brazilian DB.
- ☐ Few number of published datasets (33.3%), and a limited number of covered sectors (25.0%) were pointed out as possible main problems to be avoided.



# RECOMMENDATIONS FOR THE “SICV BRASIL” DB



## DATABASE PLANNING

1. Consider the “SICV Brasil” as a tool for facilitating the implementation of SCP policy in Brasil
  - SCP is the context that shall provide drivers to use LCA
  - If shall be used in SCP, dataset shall be representative of the average Brazilian processes
2. Develop the “SICV Brasil” in steps: a first demonstrative database can be published with more relaxed requirements (such as on representativeness), starting from what is easily available.
3. Start the development of representative Brazilian datasets from the most used processes (energy, transport, end of life treatment, packaging, etc.) followed by the most relevant economic sectors and/or those that are identified as priority in SCP policy.



4. Develop a **business plan**, considering the short, mid and long term financial balance of the SICV Brazil
  - Business plan is a tool for assessing different scenarios (policy context, government funds, etc) and options



## DATABASE DEVELOPMENT

5. ISO 14040 and 14044 compliance is mandatory.
6. Develop a methodological guidance document to assure consistency and harmonization among datasets (this action is already in place)
  - PEF guide can be used as best reference for developing the methodological requirements.
  - The UNEP/SETAC Shonan principles can also provide excellent guidance.
  - On agricultural datasets, good guidance can be provided by the methodological guidance documents of Agribalyse and World Food LCA, in particular for estimating emissions from agricultural processes.
7. Continue your strong engagement within the Global Network of Interoperable LCI db.





8. Metadata is a crucial aspect in any DB. It is strongly recommended to specify the minimum requirements and adopt a common language in filling in the different metadata fields.
9. Define a procedure to assess the quality of a dataset
  - The PEF quality criteria has the main advantage to quantify the quality, but it requires a lot of expert judgment to be applied, therefore the consistency of its application by different experts is not fully assured. More guidance should be provided.
  - One important aspect not considered into the PEF quality requirements is the reliability of the data source (measured, estimated, from literature, etc.); moreover completeness is considered with respect to the LCIA indicators. This is a parameter very difficult to estimate.





## **DATASET REVIEW PROCESS**

10. Define a review procedure, including the definition of minimum criteria that the reviewers shall meet.
11. Internal review shall be conducted by the data provider, an independent external review before the dataset publication in the DB
  - External reviewer shall be expert in LCA and technology (it is easier to have a team of people with complementary expertise)
12. The internal and external review shall be documented, at least within the metadata



## **DATABASE MAINTENANCE**

- 13 Consider the cost of updating and maintain the database within the business plan
  - in order to reduce overheads costs of maintenance consider the possibility to have a small, not for profit organisation managing the database
- 14 Periodical update of the dataset
- 15 An old data is better than no data
- 16 Data provider should define the dataset validity (according to the specific rate of development of the technology)



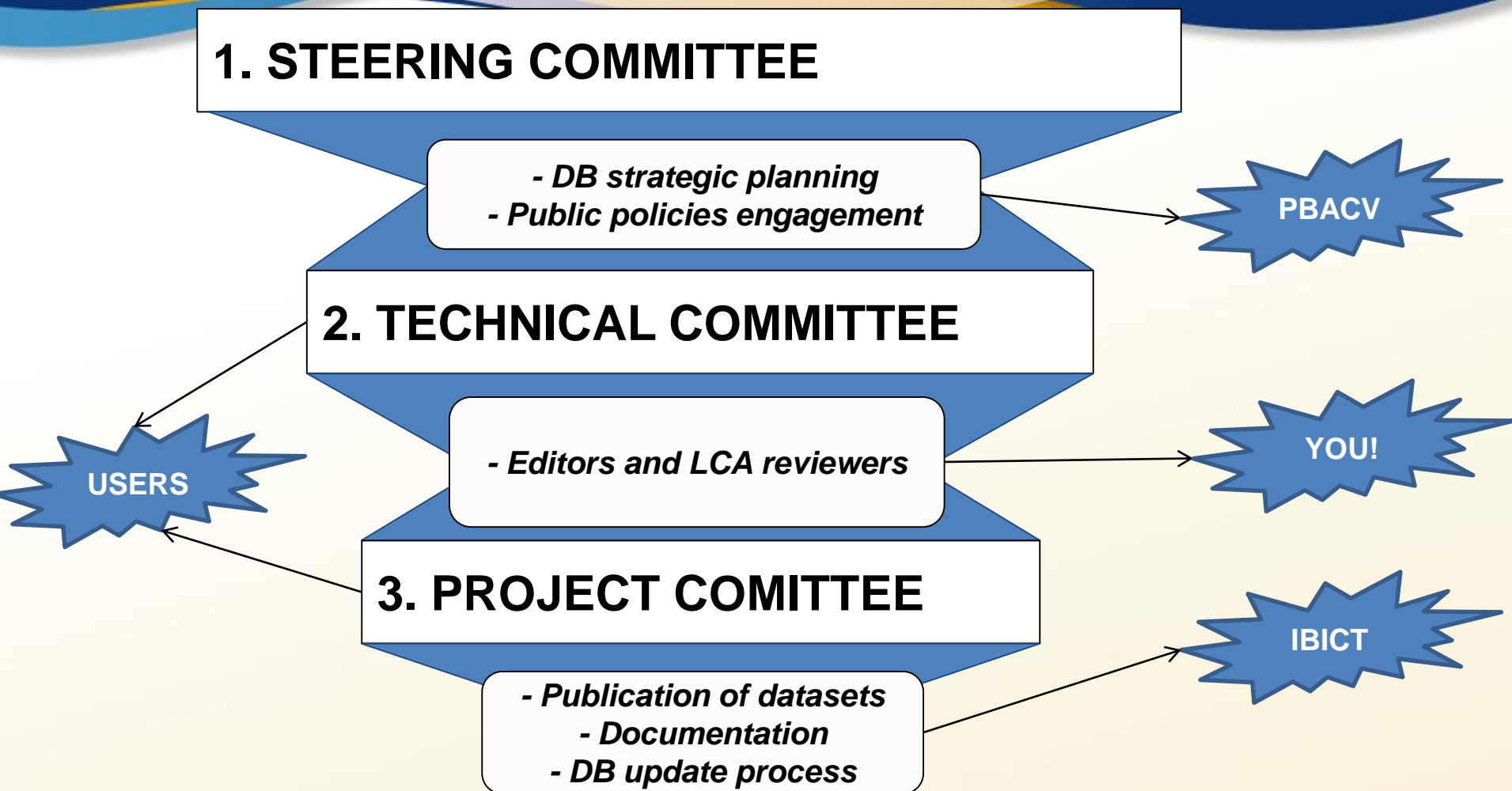
## USE POLICY

- 17 Free access to dataset can foster the use of the database (and of LCA)
- 18 G2G unallocated dataset are the most flexible
  - they can be aggregated (by the user or by the database managing software) with either attributional or consequential modeling.
  - Moreover they permit to perform a real contribution analysis.
  - But they are of more difficult use by LCA practitioners and they may have confidentiality problems if they are not averaged on a large number of firms
- 19 Aggregated C2G datasets are simpler to use
  - but they have an “a priori” choice of modeling (Attributional vs. consequential);
  - they have no confidentiality problem.
  - The contribution analysis cannot be performed.



## USE POLICY

- 20 The partially disaggregated (at level 1) dataset is an optimum compromise between the other two alternatives.
- 21 The DB might contain both C2G and G2G datasets
- 22 provide (downloadable) legal documents such as:
  - user license
  - disclaimer
  - confidential agreement
23. Before publication of dataset an administrative check shall assure that all the applicable procedure have been followed, including the (limited?) copyright transfer from data provider

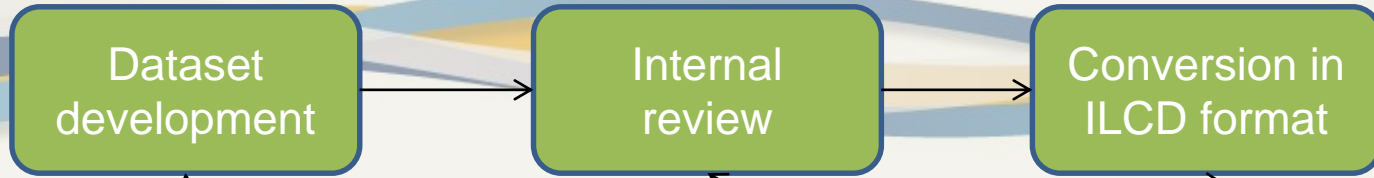


**Figure 11** – Suggestion of an organogram for the “SICV Brasil” DB

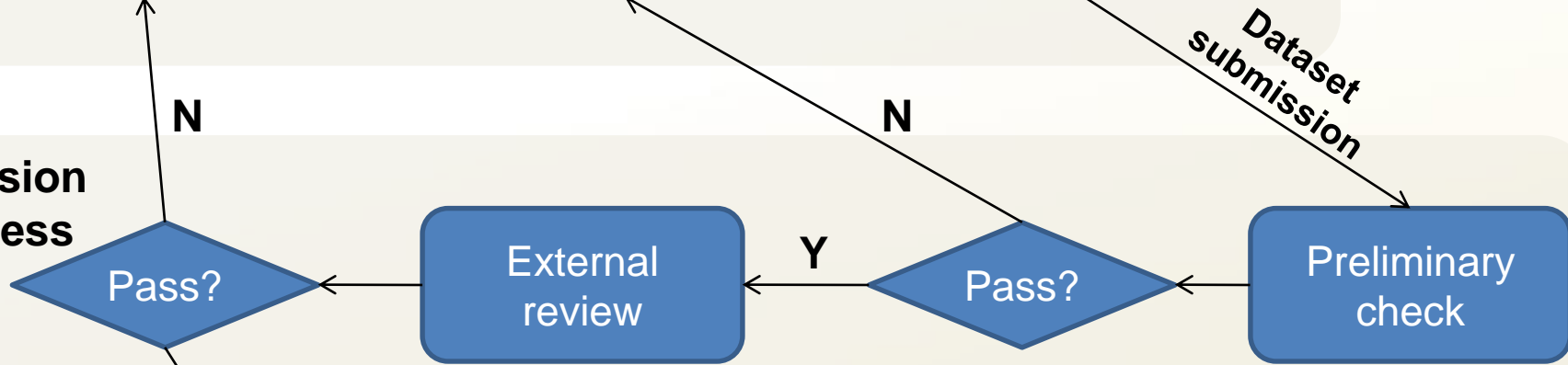


# RESULTS AND DISCUSSION

## Submission process



## Revision process



## Publication process



**Figure 12** – Suggestion of a general publication process for the “SICV Brasil” DB<sub>46</sub>





# FINAL CONSIDERATIONS



- ❑ An LCI database is not the goal, but it is:
  - ❑ a very powerful tool for enterprises willing to decrease the environmental impacts of their products and be competitive
  - ❑ a way for increasing the awareness of firms and public about the potentiality of LCA
  - ❑ an incredible source of information for public decision makers that want to support with scientific knowledge their commitment towards the sustainability



# FINAL CONSIDERATIONS

- ❑ Developing a national LCI database requires both a favorable policy context and sound technical competencies
- ❑ Indeed, the major difficulty is securing enough and long term funds: a strong national commitment to Sustainable Consumption and Production can provide the suitable context
- ❑ IBICT is working in exemplary way acting in parallel in promoting a suitable policy context and in developing sound technical basis



# FINAL CONSIDERATIONS

- ❑ IBICT is actively engaged in international governative forum for promoting use of LCA in public policies
- ❑ Is leading the work in the Global Network for delivering an international platform for sharing the LCI data in ready to use form
- ❑ Is participating to EU-Brasil cooperation project
- ❑ Co-operates with UNEP and UNEP-SETAC LC Initiative
- ❑ Brazilian LCA forum is the right way to promote capacity building and increase the awareness of relevant actors
- ❑ This is an example for all other countries



DIÁLOGOS SETORIAIS  
UNIÃO EUROPEIA  
BRASIL

# THANK YOU

**DIOGO APARECIDO LOPES SILVA**

*PhD student in Production Engineering – University of São Paulo*

*Msc. in Science and Materials Engineering*

*Wood Industrial Engineer*

[diogo.apls@gmail.com](mailto:diogo.apls@gmail.com) / [diogo@sc.usp.br](mailto:diogo@sc.usp.br)

+55 15 98112 7843

CV: <http://lattes.cnpq.br/1101747760784249>

[https://www.researchgate.net/profile/Diogo\\_Silva10/publications/](https://www.researchgate.net/profile/Diogo_Silva10/publications/)

**PAOLO MASONI**

*Research Director*

*ENEA, Territorial and Production Systems Sustainability  
Department*

[paolo.masoni@enea.it](mailto:paolo.masoni@enea.it) tel: +39 3289870609

twitter @PaoloMasoni

researchgate: [https://www.researchgate.net/profile/Paolo\\_Masoni](https://www.researchgate.net/profile/Paolo_Masoni)