

Life Cycle Inventory Program of The Life Cycle Initiative



Draft Final Report of the LCI Definition Study

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1. Introduction

1.1 General aims of the Life Cycle Inventory Program

The Life Cycle Inventory Program is one of the programs of the UNEP/SETAC Life Cycle Initiative. Another program addresses Life Cycle Impact Assessment (LCIA), and a third addresses Life Cycle Management (LCM). The background document to the UNEP/SETAC Life Cycle Initiative sets out five general objectives¹:

1. Exchange of information on the conditions for successful application of LCA and Life Cycle Thinking;
2. Exchange of information about the interface between LCA and other tools;
3. Implementation of educational activities related to the application of LCA and Life Cycle Thinking;
4. Enhancement of the availability of sound LCA data and methods;
5. Provision of guidance on the use of LCA data and methods.

The last three objectives are applicable to the LCI program, and are expanded in the Terms of Reference for the LCI program definition study to include the following aims²:

- To facilitate life cycle inventory analysis and improve the reliability of its results, by promoting the development of and access to reviewed, publicly accessible LCI databases and/or information systems;
- To harmonise existing bodies of LCA knowledge, and develop consistency in recommended practice;
- To stimulate multidisciplinary scientific work in the fields of LCI and LCIA and possibly other LCA areas, under the leadership of UNEP and SETAC;
- To ensure continuity of the presently ongoing scientific work, in the fields of LCI and LCIA and possibly other LCA areas;
- To ensure that LCA is applicable on a global level (including developing countries); and
- To present demonstration studies showing the successful application of the developed recommended practice.

To these ends, LCI Program deliverables initially identified included³:

1. A peer reviewed and regularly updated database or information system for the Life Cycle Inventory for a wide range of unit processes or subsystems (“building blocks”), like electricity, transportation or commonly used materials;
2. Identify the LCI modelling methods most appropriate for different needs, and develop situation dependent rules of recommended practice, including rules for the setting of system boundaries and for allocation.

¹ See <http://www.uneptie.org/pc/sustain/lcinitiative/objectives.htm>

² See http://www.uneptie.org/pc/sustain/reports/lcini/LCI_DS_ToR_draft3_.pdf

³ Udo de Haes, H.A., Jolliet, O., Norris, G., Saur, K. “Background, Aims and Scope”, *Int J LCA* 7(4) 192-195 (2002)

Related to the formation of a database or information system, four steps were identified:

3. A survey and evaluation of current and coming activities to build LCI databases;
4. Consideration of an exchange format between LCI databases;
5. Definition and authorisation of requirements for a UNEP/SETAC LCI database or information system, including consensus based allocation-rules;
6. On the basis of these requirements, the development and maintenance of a UNEP/SETAC LCI database or information system.

These tentatively proposed deliverables and originally perceived needs provided a basis for the user needs assessment and a starting point for the definition study. This report provides the outcome of this process, with the work plan and revised set of deliverables presented in chapter 4 informed by the results of the user needs assessment (chapter 2) and a thorough exploration of the needs and possible strategies to address them (chapter 3).

1.2 Context: existing efforts and realities

Complimentary to the LCI Program, a number of national and some multi-national projects are presently at various stages of progress around the world, each intended to address the needs for increased consistency, credibility, and availability of LCI data. These include, but are not limited to:

- National LCI database projects in many countries including Switzerland, Italy, Japan, Australia, Germany, USA, Canada
- Multi-national LCI database projects by private industry, public interests, and partnerships between industry;
- The ISO 14048 Technical Specification “LCA Data Documentation Format” which incorporates elements and input from SPOLD and SPINE;
- Results of the SETAC International Working Group on Data Quality & Data Availability.

The LCI Program is being designed to complement, strengthen, and augment these important initiatives, and to avoid duplicating their deliverables. It is designed expressly to address the needs that remain assuming that each is successful, and indeed to promote their success in various ways.

Other realities that are also guiding the design of the LCI Program include the following:

- Creation of LCI data is highly resource-intensive.
- Real practice in LCA will continue to rely on a mixture of pooled existing data and newly developed data.
- The quality of LCI results arises in part from three properties of the LCI data used:
 - how the data was developed, including methods used at building block level (its quality);
 - how it is documented, described, and reviewed (its transparency); and
 - its relevance to a given application (its applicability).

The quality of LCI results is also influenced by the ways in which the data building blocks are combined methodologically in the LCI (e.g., selection and consistency of allocation methods).

- The LCI Program should facilitate continuous improvement in LCI data, and provide guidance to users of existing data, rather than defining an idealized target.

1.3 Process

This draft Final Report of the LCI Definition Study has been prepared based on four complimentary threads of activity:

- a) A user need survey was widely published to enable worldwide participants to make proposals, and give suggestions and constructive criticism.
- b) Two workshops were organised in May and December 2002 to ensure input and feedback at the launch and finalization of this definition study.
- c) A draft author team has collaborated via email, teleconferences and partial meeting to draft this report and its background documents;
- d) A peer review group received earlier copies of the definition study and was invited to provide written comments.

The present document will now be submitted for review to an external panel. It will also be widely published for comments through an Internet Forum.

2. User needs

The field of life cycle assessment is facilitated and carried out by a wide array of different parties. The LCI Program Definition Study began with a focused user needs assessment. Specifically, the LCI Program definition study is designing the LCI program by collaboratively involving representatives of, and inviting and reviewing widespread input from, all parties involved in LCA about their needs and concerns. “LCA stakeholders” include:

- Those who *use the results of LCA to make decisions* by industry, government (policy), NGOs and consumers;
- Those who use LCA data and software tools to *conduct LCAs*;
- Those who *provide LCA data and software tools*, both for-profit and not-for-profit;

The views, needs, and concerns can vary within each of these stakeholder groups: geographically, between large versus small companies, and between sectors. Therefore, outreach to and involvement of stakeholders has been designed to encourage comprehensive representation geographically, economically, and organizationally.

The surveys received were compiled into an MS Access database that is available from the contact author of this report, upon request. Whilst all data are retained in a master table, a number of edits were made to some responses to facilitate the analysis. For the results presented in this chapter, the following edits have been made:

- Surveys with only Part A completed (user profile) are not included. This is because the user profile is only there to complement and provide background to Part B (the user needs). It is therefore of no value when no user need information has been provided.
- Following similar reasoning, surveys with identical Part Bs are combined into a single survey. This is also done for consistency, as in some cases, a group of users compiled a single survey (i.e. provided a few contact names and emails but sent a single submission), whilst in a few other cases, a group of users sent identical information (other than name and email), but sent in separate submissions.
- Non-analysable data is removed, e.g. comments where numerical responses are requested.
- For the needs importance ratings, where users entered a range (e.g. 2-3), the highest number is taken.
- All attempts are made to avoid the use of the “other” category in questions where specific categories were asked to be checked. In many cases, where a respondent had checked the “other” category, it was possible to infer an approximate fit into one of the specified categories from their comments (this often seemed to be more of a language/understanding problem than a genuine non-fit into any category, or sometimes was due to users wishing to specify their input more precisely).

The survey was sent to thousands of “sustainable consumption and cleaner production” contacts provided by UNEP, as well as to all persons who had attended prior meetings related to the Life Cycle Initiative and all available current addresses for persons who had been active in SETAC working groups related to LCA in the past. The first set of responses provided excellent coverage of the different LCA using sectors; however, geographically it was dominated by European responses, with very low representation from Asia, Africa, and Latin America. The LCI user

needs survey was translated into Spanish, and this translation was posted at the UNEP website. UNEP also issued a second call for survey responses, and specifically asked Asian members of the ILCP for assistance in outreach to the community of LCA users in Asia. Unfortunately, this second round of appeals yielded only modest increases in the number of responses from outside of Europe.

The overall final response rate was between 10 and 15% , and spanned 28 countries. 122 surveys were received in all, with 107 individual surveys analysed after the provisions listed in the first two points above had been applied.

The survey responses contained three types of information:

- Categorical (generally identifying attributes of the respondent from a list)
- Numerical scores of importance rating on different issues
- Free text comment (in relation to each potential need/concern area, and in relation to additional write-in need/concern areas).

The first type of response has provided a helpful characterization of the population of survey respondents. It shows, for example, excellent variety along some user dimensions (e.g., LCA usage type, as summarized in the next section), while there unfortunately remain some important gaps in terms of geography. Although the survey was sent to a host of UNEP-provided contacts in Asia and the non-OECD countries, and several follow-up requests for response were sent to contacts in Asia, the response rates from these regions remained very low. The questionnaire was fully translated into a Spanish version that was also posted on the UNEP website, but unfortunately this did not serve to raise the response rate from Latin America. *Future outreach/feedback solicitation steps within the Initiative must employ a combination of translation (especially of the survey announcements, response request/reminders, and web content) and the involvement of regional LCA “opinion leaders,” as means to help increase the global coverage of responses.*

The numerical scores of importance ratings helped identify a few topics or concerns of high importance, and a few others of low importance, as summarized below.

Finally, the free text input proved to be very valuable, in giving a “voice” and detailed content to the user input. These responses are summarized and interpreted in a companion document, “Textual Input LCI User Need Survey.” This input was highly useful in stimulating the generation of additional project ideas which had not appeared in the first round of draft author team documents, and which were summarized and subjected to discussion and voting at the Barcelona meeting.

2.1 User Profiles

Surveys were received from 28 different countries, with the breakdown given in Figure 1. Europe dominates considerably, accounting for 69% of the responses, with North America next well represented, at 14% (see Figure 1).

The breakdown according to primary work sector is given in Figure 2. Academia dominates considerably, with 45% of respondents indicating they are active in research, increasing to 53% if users active in both research and consulting are included. Large industry is next well represented, with 27% of respondents indicating activity in this area. Consulting is also well represented, with 9% of respondents specifying this activity, increasing to 18% if combined with those users indicating activity in both academia/research and consulting.

Use of LCA

The following breakdown was obtained as to how respondents primarily use LCA (excluding the 6% of respondents that indicated no reply to this question):

Decision making	61%
Conduct LCAs	20%
Provide data and/or software	9%
Decision making & provide data/software	9%
Other	1%

In analysing the responses to this question, some edits were necessary because many respondents indicated more than one category, thereby confusing the analysis. Since most of the respondents specifying “decision making” and/or “providing data” also specified “conducting LCAs”, it was decided that these activities are essentially special cases of conducting LCAs. Thus as reported above, “Conduct LCAs” indicates only those respondents who specified this category alone, thereby setting apart those users that as yet only conduct LCAs. Also, it was decided to report as a separate category those users that specified all three of the activities. When not counted separately, those using LCA for decision making increases to 65%, and those providing data and/or software increases to 16%.

Stage of LCA on which respondents base decisions

The following breakdown was found as to the stage at which respondents base their decisions (excluding the 8% of respondents that indicated no reply to this question):

Always/usually LCI	9%
A combination of LCI and LCIA	72%
Always/usually LCIA	18%

14% of respondents indicated a positive response to the question “If your work currently does not make any use of LCA, do you plan to use LCA in future?”. However, this level of response appears inconsistent with earlier responses in the survey (i.e. only 6% of respondents specify no answer for “stage of LCA” and “Use of LCA”). It thus appears that this question was not well understood, since specifying the stage or use of LCA does indicate some current level of activity in LCA. Of the 6 respondents that do consistently indicate no use of LCA, 3 do plan to use LCA in the future, whilst 1 does not (2 indicate no response).

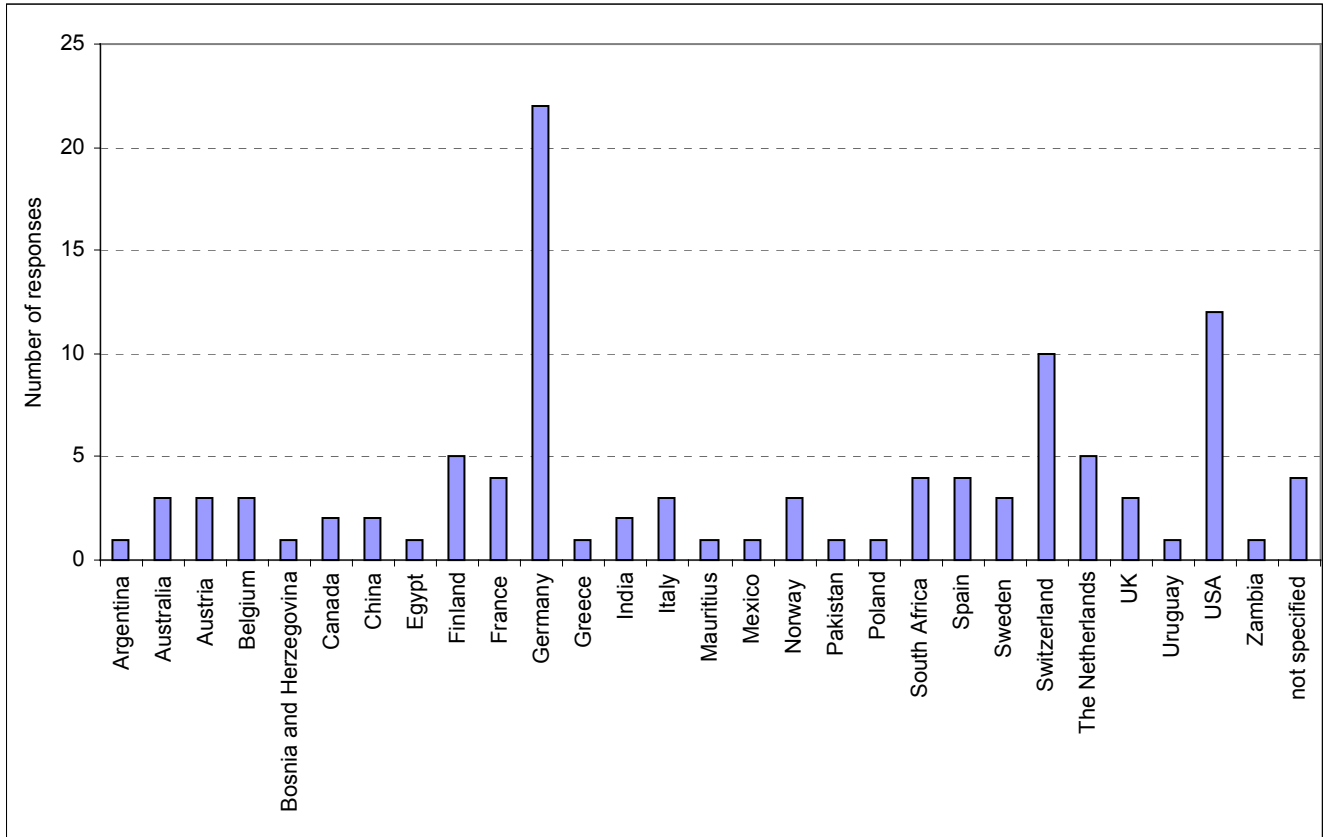


Figure 1 Breakdown of surveys received according to home country.

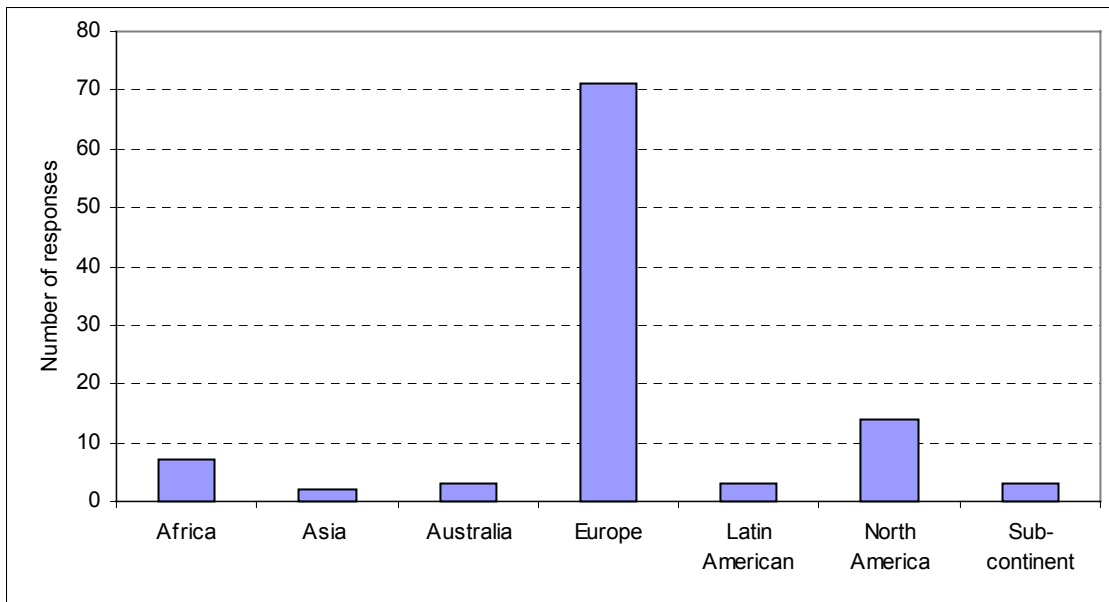


Figure 2 Breakdown of responses according to world geographical region.

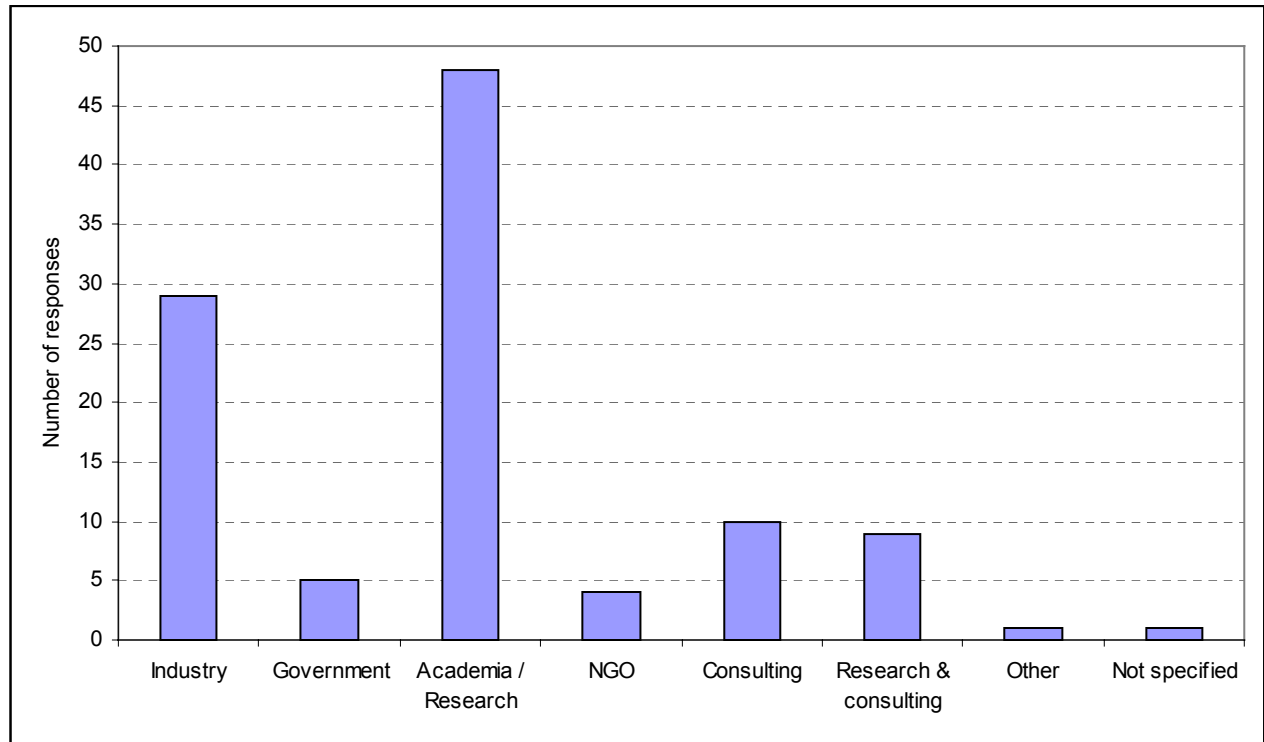


Figure 3 Breakdown of surveys received according to primary work sector.

Industry Use of LCA

Of the respondents working in industry, the only departments indicated in appreciable numbers are environment, health and safety (59%) and research and development (24%). An additional 7% indicate they work in both these departments.

2.2 User Need Importance Rankings

The second section of the survey identified a set of candidate needs, requested numerical scoring of their importance, and invited free text reactions to the needs as well. The candidate needs are summarized below:

A) Needs related to life cycle inventory data;

for example, including (but not limited to) issues such as:

- a. Needed data characteristics, e.g. documentation, verification, inclusion of statistical and data quality information (reliability of source, completeness, representativeness), improved quality, etc.;
- b. Measures to address data gaps and data uncertainty;
- c. The need for more representative data sets, e.g. country or region specific data sets, data to address new materials or processes etc.;

B) Needs for further LCI methodological guidance and consistency in practice;

for example, including (but not limited to) issues such as:

- a. Allocation methods, e.g. further specification of the current ISO 14041 hierarchy, regarding which allocation methods should be used when;
- b. System boundary issues, such as:
 - i. Scope of types of economic processes to include (such as production of capital goods, provision of services), and methods to employ when available data are incomplete in this sense;
 - ii. Scope of types of flows or environmental interventions to include;
 - iii. Cut-off rules;
- c. The dependence of the LCI model structure and data content upon the question posed, e.g. descriptive versus change-oriented applications (allocation of burdens and credits in an existing system versus the identification of expected environmental consequences of choices);
- d. Simplification of methodology and screening methods;
- e. Guidance on scenario development, e.g. modeling future waste management practices, future consumer attitudes etc.

C) The need to increase the capacity for performing LCIs globally;

for example, to provide skills and training, better access to data etc.

D) The need to be able to judge or validate LCIs.

The following table summarise the importance attached to these needs, given by the percentage of respondents assigning a particular score to the need.

Table 1 Overall ratings given to identified user needs (percentage of respondents assigning particular score).

Importance (0 least, 3 highest)	Needs (numbered as in Part 2 of survey)									
	Aa	Ab	Ac	Ba	Bb	Bc	Bd	Be	C	D
0	0%	1%	4%	7%	4%	7%	7%	6%	1%	8%

1	11%	22%	8%	26%	26%	33%	29%	34%	10%	20%
2	30%	43%	31%	34%	31%	41%	28%	30%	31%	37%
3	58%	30%	53%	26%	33%	14%	32%	24%	52%	30%
not rated	1%	4%	4%	7%	7%	5%	5%	7%	6%	5%

The importance attached to the need is fairly strongly associated with the sector in which the user works. There are also significant regional differences in the perceived importance of the needs. The most significant of these differences are outlined below, based on the figures in Appendix B. Although interesting, these figures are rather uncertain and can only be taken as an indication of the needs differences because of the low sample sizes (academics/researchers (57 respondents), industry (29), Europe (69), North America (14) and developing countries (17)). The percentages given in the figures exclude non-rated responses (i.e. the responses are normalised to 100%).

The following main features can be distinguished:

- Overall, the need to address data characteristics (e.g. documentation, quality etc.) is identified as the most important need, with 58% of respondents indicating they thought this very important. Next most important are the somewhat related needs of more representative data sets (53%) and the need to increase the capacity for performing LCIs globally (52%).
- The highest priority need changes somewhat according to sector. Academics/researchers identify the same three needs with the highest priority, but give the need to increase the capacity for performing LCIs globally the highest priority (63%). Surprisingly, industry respondents give this a low priority. They do however recognise the need for data characteristics and more representative data, but much less emphatically than academics/researchers (with only 41% and 52% of industry respondents indicating these needs respectively as very important, compared with 58% and 60% of academics).
- Some startling differences are evident according to home country. The same three needs are identified with the highest priority for Europe, since the European respondents considerably dominate the overall ratings (they are by far the highest respondent group). North American respondents also recognise the same three needs but recognise the need for measures to consider data gaps and uncertainty as of equally high priority. Unlike the other groupings, developing countries indicate one need with far greater consensus than any other, with 82% of respondents indicating the need to increase global capacity as very important. Considerable consensus was also evident on the need for data characteristics (64%). Rather unexpectedly, the next highest priority need for developing country respondents is for methodological guidance on system boundary issues (59%), a need given low priority by the other groupings.
- Overall, greater importance is attached to the needs related to inventory data, with less importance attached to methodological guidance and consistency needs. The second data related need (i.e. the need for measures to address data gaps and uncertainty) is given a lower priority than the other two data related needs, with only a majority of North American respondents indicating this as very important (all other groupings rate it as somewhat important).
- Overall, the need to consider the dependence of the LCI model structure and data content upon the question posed is given the lowest priority, with only 14% of respondents indicating they thought this very important. The need for guidance on scenario development is also given a low priority, with 34% of respondents indicating they think this of low importance. For the

other methodology-related needs the priority ratings were fairly evenly spread across the range (e.g. 34% indicating that further guidance on allocation methods is somewhat important).

- The same general trend is evident for academics/researchers (i.e. greater importance attached to needs related to inventory data than methodological guidance), with the need for guidance on system boundaries and allocation indicated with the lowest importance. Industry respondents place even less emphasis on the need for methodological guidance, with the majority indicating these needs of low importance for all but the need for guidance on allocation (which 34% specify as somewhat important).
- Although the same general trend is also evident for European and North American respondents, the North American respondents place a higher priority on the need for methodological guidance than the Europeans, with a slim majority (36%) placing a high priority on 3 of the 5 identified needs (compared to none of these needs identified as high priority by the majority of Europeans).
- Some surprisingly reversals are evident when considering developing country respondents alone. The majority of respondents from developing countries place a high priority on the need for methodological guidance on system boundary issues (59%), whilst the majority of those from Europe and North America see this as only somewhat/moderately important. Even more conflicting, the majority of developing country respondents (41%) think that guidance on scenario development is very important, whilst those from Europe and North America rate this of low importance. Also rather surprising is the very low importance given by developing country respondents to the need for the LCI model structure to be dependent on the question posed.
- Overall, the need for validation is given similar priority ratings to the methodological needs, with 37% of respondents indicating that they think this somewhat important. Little deviation is seen across the different groupings, with all majorities rating the need for validation as somewhat important, other than developing country respondents, of which 47% rate it as very important.

In summary:

- A high priority is identified across all user groups for the need for data characteristics, e.g. documentation, inclusion of statistical and data quality information etc., as well as for more representative data sets.
- An equally high priority is identified across all groups other than industry for the need to increase the capacity for performing LCAs globally. Academics/researchers and developing country respondents identify the high priority of this need with a high degree of consensus.
- Needs relating to achieving methodological guidance and consistency, as well as for validating LCIs, are given lower priority.

2.3 Summary of key user themes and LCI program design principles

The following themes stand out as consistent or majority opinions and suggestions from the extensive (36-page) summary of written comments from users. This summary, “Textual Input LCI User Need Survey”, is available from the contact author.

- LCI data is a key need of users, but users advise that UNEP should not develop such databases except perhaps in rare instances where existing data development projects will not address such a data topic.
- There is a strong need to increase the involvement of participants from developing countries, in the use of LCA, in the development of methods and tools relevant to their needs, and in the initiative.
- While users cite a desire for methodological guidance and consistency, they also suggest (in some cases quite strongly) that the Initiative not develop new methods, new standards, nor that it (by doing so) inadvertently bound ongoing advances in LCI methodology.
- Capacity-building is identified as a very high need, and an appropriate focus for the Initiative. Such outreach efforts will need to make the case for LCA value to potential users.
- Case study illustrative examples of LCA and its application to decision making in industry and government policy were cited as a strong need.
- There was widespread concern that the initiative not simply produce “more paper”; instead, users stressed the importance of *practice-oriented* activities.
- Finally, there were calls for linking to life cycle impact assessment (LCIA) and life cycle management (LCM) issues during LCI data review.

From these distilled inputs, two central design principles for the LCI Program are stimulated.

First, we note the natural constellation of calls for capacity-building, for a practice orientation, for outreach/involvement of developing countries, and for increased availability of such resources as LCI data and compilations of case study examples. In response to this cluster of identified needs, and in light of the well-known principal of building capacity through tutored involvement on real-world problems of relevance to the learner, we suggest a practice-oriented approach that links teams of experts in countries with extensive LCA experience with teams in less experience countries. Through capacity-building collaborative case studies the calls for increased information resources and case study examples are addressed simultaneously with capacity building needs.

Second, we note that user input is well-aligned with UNEP’s standard method of engagement, in that both call for stressing *facilitation of dialogue and exploration which may lead to consensus* on recommended practice, rather than directly developing standards. Organizations such as ISO are the proper vehicles for development of LCI method standards. The initiative can compliment such efforts and help address the needs that remain (e.g., on topic areas such as allocation which are left flexible by the ISO standards) by sponsoring method illustration studies and convening workshops to compare and explore the pros and cons of different methods, and in so doing build consensus on recommended practice.

In conclusion, the user needs prompt the following design principles:

- ***Needs for resources, such as a compilation of case studies, and perhaps basic LCI data in non-OECD countries, can be addressed through structured processes that link teams (of experts and students) in “LCA-mature” countries with teams in “LCA-new” countries.***

- *In this practice-and-product-oriented capacity-building approach, the needs for capacity development is addressed through international activities that address common information resource needs of the global LCI community.*
- *The Initiative should promote explorations that may lead to consensus on recommended methodology practice, by convening method illustration studies and practical methodological workshops.*

2.4 Outcome of the 1 December 2002 Workshop in Barcelona, Spain

Following a presentation of the content of the draft definition study as of December 2002, discussion generated a subset of the near-term project ideas for submission to an informal voting phase of the final plenary session of the workshop. These near-term project ideas were also stimulated by the review of text-based input from the user needs survey. Near term project ideas were required as input to the January 2003 meeting of the Initiative's governing body, the International Life Cycle Panel (ILCP). The results of this process are summarized in Table 2.

Table 2: Summary of Responses from Informal Voting Session during Barcelona Workshop

Votes	Near Term Project Concept
20	LCA case study library
16	Peer review process to support database evaluation
15	Survey available data and identify gaps
12	www-based portal and cooperation
8	LCI/LCIA nomenclature agreement facilitation forum
7	Data documentation agreement facilitation forum: practical implementation of ISO 14048
7	Network of projects developing data on electricity and/or other environmentally important supply chains for countries new to LCA (capacity-building network)
5	Network of projects working on I/O LCA databases for countries new to LCA (capacity-building network)
3	Dialog on product specific requirements (PSRs) and Type III Ecolabel phased sophistication
3	Dialog on how to address impacts relevant to less developed countries

The following conclusions can be drawn from the workshop:

- A high priority is attached to data-related needs, including identifying current data gaps, and developing mechanisms for database evaluation.
- A high degree of support is evident for the development of a case study library, with the possibility of a web-based portal also well supported.
- Moderate support was given on the need to facilitate agreement on LCI/LCIA nomenclature, and to facilitate agreement on data documentation.
- Whilst the case study library was well supported, less support was given to other capacity and data building suggestions, such as networks of projects developing data on important supply chains for “new” LCA countries or I/O databases for these countries. We note that there were no participants from developing countries in the LCI breakout session of the Barcelona workshop, so this prioritisation simply reflects the Europe/North America sense of priority also found in the user needs survey (section 2.2)
- Needs related to product specific requirements (PSRs) and Type III Ecolabel were given low priority, as were measures to address impacts relevant to less developed countries (which should be strongly qualified by the absence of developing country participants in Barcelona!).

2.5 Overview of User Needs

An indication of user needs have been gathered from the ratings given to the candidate needs in the user needs survey, the comments received in the survey, and the voting on potential tasks at the Barcelona workshop. The following key points can be made:

- All forums give a high priority to data-related needs. The need for more representative data sets is identified as a high priority in the user needs survey, although this is qualified to some degree by the comments, many of which stress that UNEP should not be getting into the database development business. However, a conclusion of the workshop is that a survey of available databases to identify data gaps would be a valuable contribution by the Initiative.
- The high importance given to the need for data characteristics by the user needs survey is echoed only moderately by the workshop participants, with only moderate support given for agreement facilitation of database documentation and nomenclature.
- A very high importance is attached to capacity building in the user needs survey. This high importance is repeated in many of the comments received in the survey, which particularly stress the need to increase the involvement of developing countries. However, capacity building initiatives are given relatively low support in the workshop. This dichotomy of support can be understood to some degree by looking at the survey results, where developing country respondents overwhelmingly put this as a high priority, whilst a lower percentage of European respondents do so. A higher level of support is also given by academic than by industry respondents. The lower level of support at the workshop is therefore not that surprising given that there were no participants from developing countries.
- The workshop participants did however overwhelmingly support the initiative to develop of a case studies library, which does have capacity building elements, in addition to addressing information-related needs.
- The generally low support in the user needs survey for needs related to methodological guidance and consistency is better understood in light of the comments received with the survey. Many of these stress that the Initiative should not be about developing new standards or prescriptive methodological “guidance”, but rather about achieving consensus and demonstration of recommended methodology through case studies.
- A relatively low priority is given in the user needs survey to needs related to peer review and validation, whilst a peer review process to support database evaluation is the second highest supported task at the workshop. This is fairly puzzling, since validation is given relatively low support across all groups in the survey, and may perhaps be explained by a higher representation of a particular focus group (e.g. those with database interests) at the workshop.

In summary, we conclude the following:

- There is good agreement across the high priority needs, particularly those related to inventory data.
- Deviations between the user needs survey and the workshop conclusions can be understood in light of the workshop participants representing a smaller, less diverse and more focussed sample of LCI users.
- The comments received in the survey reinforce and provide insight into the user needs ratings

- The low representation from developing countries in the survey, and their absence from Barcelona, together with the UNEP-driven goal of addressing user needs in developing countries and the global support for capacity building, leads us to re-affirm the centrality of this need in the final, interpreted results. It also leads us to suggest more attention to the need for measures to address impacts relevant to less developed countries, which was considered in Barcelona but had not been explicitly mentioned in the user needs questionnaire.

3. LCI Project Topics

3.1 Overview

This section provides background and motivation to the specific tasks identified for each of the three program areas:

- LCI capacity-building globally
- Data availability and validation
- Method guidance and consistency

The second topic was initially conceived as two separate topics (Data availability and database characterisation, and Ability to validate LCIs), but the high degree of overlap meant that these were combined into a single topic area.

Although these three topics are clearly distinct whilst discussing their needs and the motivation for the identified tasks, the activities designed to address these tasks are likely to have a high degree of overlap (e.g. a single activity and its deliverable may address needs related both to data availability and methods guidance). As far as possible, the following two chapters present the tasks, activities and deliverables according to the project topics, although some degree of overlap is unavoidable. This chapter presents the tasks, whilst chapter 4 presents the activities and deliverables.

3.2 Capacity Building

The meaning and content of capacity building is defined or understood variously by many different fields. For purposes of this document we use LCI capacity-building to indicate the strengthening of abilities and capabilities for undertaking life cycle inventory analyses, where capabilities are supported by factors including the availability of tools and data resources, the widespread ability to use such tools, and the existence of effective networks among data providers, LCI practitioners, and LCI users.

Problem Identification / Issues

There are different stakeholders with different needs for capacity building:

- those who use the results of LCI/LCA to make decisions
- those who use LCI data and software tools to conduct LCIs
- those involved in LCA education / start teaching LCA in universities
- those who provide LCI data and software tools

Training needs and strategies need to be identified for:

- Trainers (champions of the LCI/LCA concept who can deliver training)
- Industrial managers
- Product designers, engineers

- Purchasing department employees and others, who should consider life cycle aspects within their daily decisions
- Consultants
- Public policy makers and NGO's
- Those responsible for environment, health and safety (EHS) in industry
- Tertiary institutions (universities and colleges)

In addition, the following points apply:

- We need to distinguish the needs of large companies, who can conduct their own LCA studies and establish their own teams for this purpose, from branch organisations and other companies who buy external studies without having the capacity to judge their quality and reliability.
- Approaches for promotion of LCA tend to be supply driven. The tool is still confined to a limited group. There is an urgent need to expand and broaden the base of LCA so that approaches become more demand-driven. There is thus a need for support factors on the demand side.
- Multi-national companies are initiating LCA activities and training their R&D staff in the technique. Adoption of LCI/LCA within government is lagging behind industry. There is thus a need for more public-private sector partnership in LCI work.
- LCA is a complex method, and learning it is aided by expertise – and ideally, practical experience -- in a variety of fields. This is a significant obstacle which cannot simply be overcome by the use of hybrid-LCA or similar approaches, as these should not be applied without fully understanding the implications of using such abbreviated methods (since the overall precision and reliability of the results are affected). Technical expertise and understanding is the main problem for many consultants and universities performing studies for different industries. Similarly, LCA-method know-how is the main obstacle for industrial LCA-practitioners, especially if performing LCAs on an occasional basis or as a beginner.
- Lack of expertise for performing and conducting LCIs is a particular problem in developing countries.
- Inaccessibility and/or lack of transparency of appropriate LCA data hinders LCI capacity building (e.g. lack of transparency results when data is presented at building block level (subsystems), without specification of the methods used for aggregating the unit process data). Data quality and availability is one of the major practical bottlenecks in LCI studies. For developing countries the cost of high quality LCI data is also a barrier. Besides databases, there is also a need for documented experiences of the use of LCA, detailing its successes and failures.
- Harmonisation in wording and LCI-methods is another obstacle in practice. The use of LCI-datasets from various sources pose a problem to LCA studies if they contain different nomenclature, since they cannot be properly calculated if flows used in one database cannot be aggregated with another etc.
- The wide array of available options for allocating burdens among co-products is a barrier for capacity building, although sensitivity analyses on the influence of allocation choices can reduce problems in the majority of cases. Sufficient guidelines developed and approved in practice are not available.

Recall from our working definition that capacity building is much more than simply training and includes human resources, organizational and institutional development. The following phases of the capacity building process are distinguished:

- Initiation
- Skills transfer
- Institutionalization, and

- Self-sufficiency

Capacity Building Activities need to be sequenced as follows:

- Needs assessment
- Identification of target groups and institutions
- Training (local and regional basis)
- Strengthening institutional capacities

LCI Training

The “educate-the-educator” and “Train the Trainer” approach is a far-reaching training strategy because of its potential multiplying effect for rapidly building national capacity. However, this approach has not been widely applied in a systematic manner for LCA. There may be value in developing a standard LCI training programme (leading to a recognized certificate).

Building Capacity in LCI at Universities

University graduates bring the LCI concept to either the workforce or to research activities. Integration of LCI into the curriculum will therefore enhance the application of LCI in the workforce and the research community. Opportunities include, for example, greening of engineering and business management curricula, improved teaching resources, fellowships in LCA, creating chairs in Cleaner Production, Green Design Engineering etc. The initiative should explore working with an engineering education organization to see if the topic could be incorporated into a suitable conference in the short to medium term.

It is easier to modify the curriculum (or to create a new one) within postgraduate studies (i.e. MSc and PhD level studies) than to modify the curriculum of undergraduate studies. In the short term it could be more effective to include LCA or to “green” the curriculum of postgraduate studies. Greening of undergraduate studies will be effective in the medium to long term. New teaching resources are needed to achieve this curriculum development, including case studies, impact information, homework exercises, textbooks, and software. Currently available resources are insufficient for teaching LCA. A network of educational institutions providing LCA education is thus required.

There are at least 3 areas of opportunities to which the Initiative could contribute to building capacity in LCI in universities:

- improvements in teaching resources (including providing textbooks, case studies, courses etc.)
- funding of classroom activities
- development of public-private sector partnerships, and networks of educational institutions.

Capacity Building in Developing Countries

There is a need to raise awareness of LCA and its usefulness at all levels (industry, government and academia). There needs to be more involvement of Sustainable Production and Consumption Centers, of which there is currently a global network of more than 100 centers operating across 40 odd countries. Especially in developing countries, Sustainable Production and Consumption Centers can be an effective means for promoting LCA activities and should play a more important

role in LCA awareness raising. They have the core functions of disseminating information, education and training.

In addition the following particular needs are identified:

- Lack of specific local or regional data availability is closely connected with capacity building. If there are no suitable databases, it will be hard to educate people on conducting LCIs.
- There is a lack of local LCA trainers. Joint projects with universities or consultants with practical experience provide a good starting point. Incentives are needed for such international projects. Distance Learning Courses could be a first training method.
- There are a lack of interlocutors for the few LCA practitioners in a given country. The establishment of regional forums is advisable when the problems to be discussed are similar. Train-the-Trainer Activities need to be organized regionally. Train-the-Trainers will be an effective approach but it is important that the means and incentives for implementing LCA projects are also available.

Additional creative ways to increase capacity also need to be explored, for example:

- By exploiting synergies between LCI and other environmental tools, which may be better established in developing countries; an example is to use information from environmental impact assessments (EIAs) for LCI purposes. In addition to EIA, there are possibilities for LCI to learn from other tools, including environmental risk assessment, sustainable land use, substance-flow analysis, input/output analysis, etc.
- There are regional capacity building initiatives for the adoption of ISO 14000. Ways to disseminate LCA through these initiatives need to be investigated.

The objective is to achieve a Basic Capacity Level (BCL) in LCI in every country - a level which is needed for further dissemination of the LCA concept and principles throughout society. Specifically it involves creating:

- an active and continuing core of LCA advisers and trainers
- a set of LCI case studies and demonstration projects
- a functioning sustainable production and consumption center locally or in the region
- training materials
- LCI principles included in university curricula

3.3 Data Availability and Validation

Problem Identification / Issues

As can be seen from the aims listed in section 1.1, the topic area “data availability, database characteristics and validation” addresses an important part of the set goals and suggested activities of the LCI Programme.

The "Data availability, database characteristics and validation" topic area addresses users of LCA data and software, and educators. In accordance with the goals of the initiative, the main focus has to be on the users with the greatest influence and relevance for LCA practice in decision making, i.e. for the feasibility and reliability of non-theoretical LCA studies. The focus is therefore on those users of LCA data and software that carry out LCA studies for decision making in industry, government and NGOs, as well as on the providers of LCI databases and software used widely by the LCA practitioners.

The following main needs regarding LCI data availability and database characteristics exist in LCA practice:

- **Data availability** (i.e. where to obtain the required LCI data, at what price?)
- **Data use practicability** (i.e. how fast can I make use of the LCI data, e.g. do I have to transform flow names, quantities and units to those I use in my system? Do I have to build up upstream processes around the LCI dataset if it is a unit process?)
- **Ease and cost of providing data** (i.e., how costly in personnel time and attention and any other required resources, to provide the raw data to LCA practitioners, in the form of completed questionnaires, etc.? Do questionnaires and other data queries focus on important or necessary “need to know” data, minimizing requests for “nice to know” information, providing maximum quality for least effort?)
- **Data consistency** (i.e. is the data - if it is made available as an aggregated cradle-to-gate process, as typically in practice - consistent with my background LCI data system? This has two main sub-aspects, the first addresses the LCI-data of the background system, e.g. are the same energy-models and data used? The second, which is also important for unit processes, addresses the question whether the methodology used (including goal and scope aspects, such as system boundaries etc.) is the same),
- **Data appropriateness and representativity** (i.e. is the data the right data for my actual application in terms of technology(-mix), country/region/location(-mix) and time/age of data),
- **Data quality** (i.e. how high is the overall quality of the dataset both regarding stochastic and systematic errors), and finally the
- **Data source reliability** (i.e. how reliable is the information given regarding the above listed data aspects, since this can not be judged by myself in the desired degree).

Existing realities and efforts and consequences for the deliverables

A number of national and multi-national LCA projects are at various stages of progress around the world. The effort undertaken here has to be co-ordinated with the effort of these projects. For

example, some of the questions being tackled by UNEP/SETAC Initiative are the same as those being tackled by the German national LCI-database network project. The outcomes and conclusions of this and other projects will significantly minimise the required effort of the Initiative, and serve as building blocks, argumentation and consideration chains to be integrated under the umbrella of the initiative.

Also, LCA practitioners in industry, government and research institutions, and consultants currently rely mainly on databases provided by private or academic database developers for their LCA work and decision making (see Table 3). The Initiative must be designed to complement, strengthen, and augment all these important initiatives and databases, and avoid duplicating their deliverables. It is indispensable that the Initiative's activities support the continued use of presently existing databases, be it in companies, at database providers or in academic institutions etc.

The ToR states one of the Initiative's primary aims to be to facilitate and provide guidance for the use and improvement of existing LCI data, rather than to set up idealised aims of a rather theoretical value. Considering the depth and quality of the practice-relevant LCI databases available worldwide, and their relevance in today's LCA practice, and considering also the extreme cost of building up new LCI databases, the *"peer reviewed and regularly updated database or information system"* can only be realised as an information system providing LCA practitioners with the desired transparent, reviewed and structured information on available LCI databases and datasets. The main existing LCI databases and actual projects are listed in Table 3.

Thus in order for the initiative to become part of the solution rather than obstacle to the urgently needed harmonisation in practice, the following need to be observed:

- The Initiative's aim should be to provide an information system, which can provide a platform to join and harmonise existing efforts, rather than develop a database duplicating results available elsewhere.
- The Initiative should not be concerned with developing new methods, but rather with facilitating methods development underway.
- The Initiative should not develop new standards and requirements, e.g. data reporting formats, extensive documentation etc., but instead be concerned with promoting recommended practice.

Table 3: Rough overview over existing types of projects and databases with relationship towards LCI data issues (selection). See also preliminary LCI databases overview prepared as outcome of this definition study.

Established LCI databases widely used in LCA practice in industry etc.	GaBi, SimaPro, TEAM, SPINE, Umberto, LCAit, KCL-Eco etc.
Actual national LCI database projects	Switzerland, Italy, Japan, Australia, Germany, USA, Canada etc.
Multi-national LCI database projects	Cost Action 530, eLCA etc.
LCI databases that are made publicly available, but were developed within or for industry associations	Corrugated board database from FEFCO, Groupement Ondulé and the Kraft Institute; plastic resin database from Association of Plastics Manufacturers in Europe, etc.

3.4 Movement Towards Methodological Consistency

Recall from the summary of key user input themes and project design principles that both the user input and UNEP's standard method of engagement are aligned in calling for *facilitation of dialogue and exploration which may lead to consensus*, rather than directly developing standards. Organizations such as ISO are the proper vehicles for development of LCI method standards. The initiative can compliment such efforts and help address the needs that remain (e.g., on topic areas such as allocation which are left flexible by the ISO standards) by sponsoring method illustration studies and convening workshops to compare and explore the pros and cons of different methods, thereby promoting recommended practice.

Problem Identification/Issues

The international standards on LCA have provided a framework for undertaking Life Cycle Assessment. These standards have set guiding principles, and in some cases application specific guidance and rules to be used when undertaking an LCA. Within this broad framework however, there is a extensive range of LCA methods, approaches and applications. Within this diversity of applications there are many issues and decisions to be made on which the standards are either silent, ambiguous, or self referencing (referring the user back to the goal and scope of their study).

There are a substantial range of guidance documents available, some of which are of very high quality and provide detailed information, however most guidance documents are based around individual groups, or countries or regions and their applicability, particularly across developing countries and countries with vastly different environmental conditions is unclear. Also, across different methodology and guidance documents, there are still many differing and conflicting approaches. Finally, the development of most guidance material has not had involvement from a broad cross section of regions, or stakeholders, and therefore do not address situation dependency issues, which limits usefulness and ownership of such documents.

With many of the advanced LCA practitioners looking at different modelling perspectives and situation dependent methodology, integration of LCA with other tools, and increasing geographic information in life cycle inventories – the newcomer to LCA may find it difficult to navigate the ever shifting methodology and to understand where their application fits into the broader scheme of LCA and decision support.

There are many resources already developed to help users undertake LCA. An overview of such resources are listed in Table 4. In an effort to avoid duplication and reinvention, this task will:

- Identify and provide a guide to available information on undertaking LCI.
- Identify gaps in existing guidance information and develop information to fill these gaps.
- Identify where differences between methods exist, and explore ways to build consensus on recommended practice, e.g. through recognising situation dependent methods.
- Determine what level of localisation is required for guidance information such as descriptions of terminology and/or language translations

Table 4: Existing resources

Resource	Cost	Positives	Negatives
International Standards 14040-14043	cheap	The agreed standard we are generally working to.	Very hazy on many methodological issues
International Standards “how to” reports (ISO14047&14049)	cheap	Good example	All very project specific (may not be useful for generic LCI)
ISO 14048 for documentation and CPM’s guide to using 14048	Free?	Detailed documentation standard	Very heavy to understand – better incorporated into software exchange documentation package
CML Guide to International Standards	Free on web – expensive to buy	Recent – detailed and based around 3 levels of sophistication: -simplified - detailed - extended	Not sure how much relates to generic data development
Many papers and conference presentations	Mixed	Great diversity of work	Difficult to locate, keep track of. Will have a lot of contradiction.
LCI related theses	Mixed	Diversity of work	
UN Guide to Input Output analysis	Not cheap	Good basic text	Still a complex task for the uninitiated
National Guides?			
Industry sector specific guidelines			
Web-based guides to basic LCA, such as, e.g. US EPA LCA Access.	Free	Easily accessible source of information	Not all are reliable. Also, there are so many it is difficult to categorise or keep track of
SETAC Code of Life-Cycle Inventory Practice			

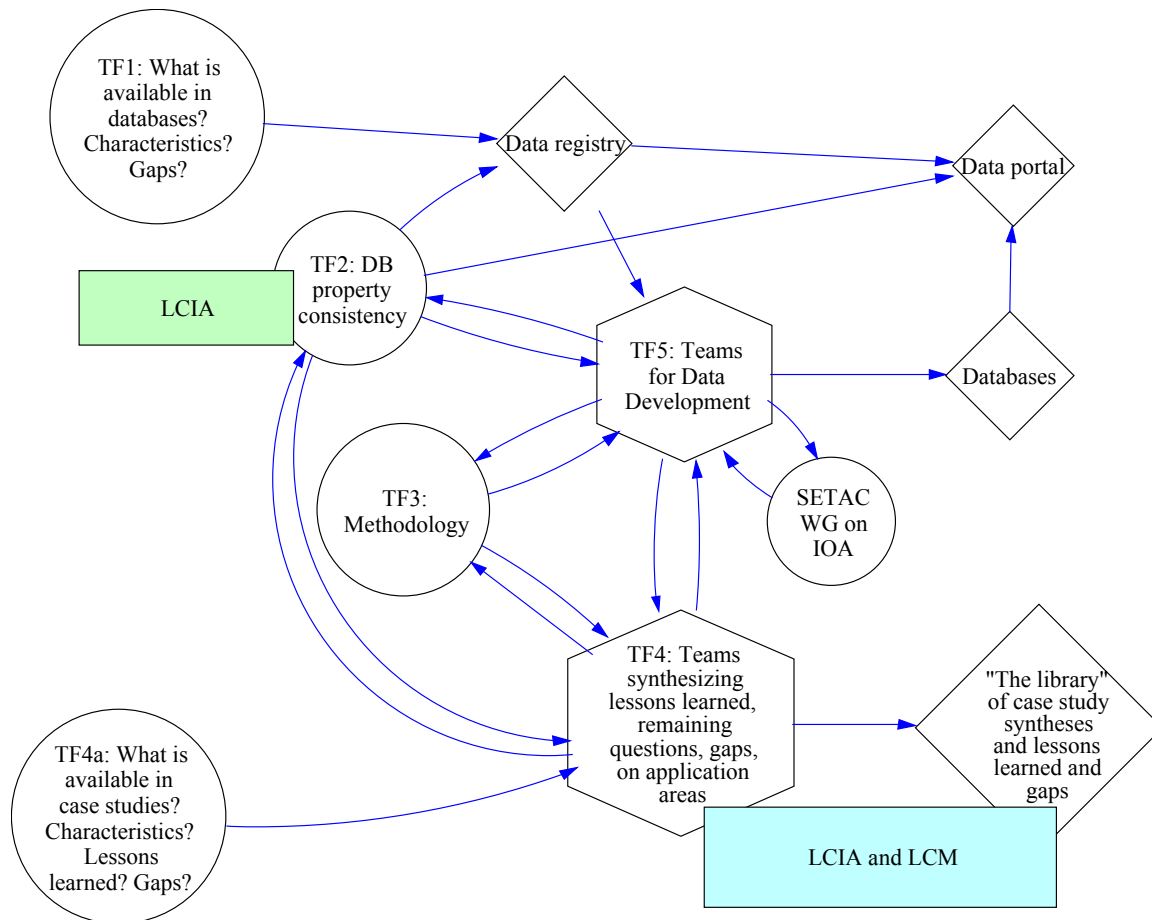
4. Terms of Reference for LCI Task Forces

Overview

Five Task Forces (TFs) are proposed for development and initiation under the Life Cycle Inventory (LCI) Program:

1. Overview of LCI databases
2. Database property consistency
3. Methodology
4. Case Studies Library with Meta-Analyses
5. Database Development Capacity Development/Utilization

The relationships among these five task forces (and the LCIA and LCM programs, and SETAC WG on IOA) are illustrated in the figure below.



A central aspect of the LCI Task Force (TF) design is to undertake capacity building as coached or facilitated “on-the-job-training” among teams which include both experts and novices, rather than adopt a more limited and traditional, one-way, top-down “training” approach to capacity building. The learn-by-doing approach to capacity-building pairs experienced teams with novice teams, into a larger team that works jointly to develop useful deliverables:

TF 4 delivering case study compilations and meta-analyses for use by governments, policy-makers, and decision makers; and

TF 5 developing key data elements (such as, but not necessarily limited to, electricity generation) that are driven by user needs in countries lacking data infrastructures.

There is still guidance and training involved in this method of capacity building, but it is offered and made available on an as-needed basis in the context of a practical application, rather than “force-fed” as the single focus of a “training” exercise. The information flow and learning in this practice-oriented capacity-building is *two-way*, flowing from not only from experts to novices, but from novices to experts and their guidance materials as well, since the projects represent practical test implementations of the guidance (e.g., from TFs 1, 2 and 3, and from the SETAC WG on IOA, and of the ISO standards).

There are three “guidance” TFs: database survey (TF1), database characteristic (TF2), and LCI methodology (TF 3). There are also two “practice” TFs (4 and 5), denoted by hexagons in the figure. The practice TFs make use of deliverables from the guidance TFs, as described in each of the TF TORs below. Linkage from the “guidance” task forces to the “practice” task forces will be strengthened by establishing persons who are members of both a guidance and a practice TF. Diamonds in the figure represent output deliverables that have value in the real world: a database registry, databases, and the library of case study syntheses and lessons learned. The guidance task forces are producing usable deliverables as well, in forms including handbooks on best practice for LCI methodologies, and voluntary consensus on data documentation format implementations.

Modes of working

The working mode is quite different between the *guidance* TFs and the *practice* TFs. TFs 1, 2, and 3 will be composed of no more than 10 members, with a chair and co-chair. Their membership will be as expert and global in scope as possible. These TFs will solicit input at all major information gathering and decision points with the membership of the LCI WG. They will conduct working meetings open to public auditing in conjunction with major international meetings such as SETAC and ISIE events, scheduled and publicized by UNEP and SETAC well in advance.

The main function of the two *practice* TFs will be to structure, guide, oversee and manage the formation and work of international teams that in turn undertake practice projects in each of the areas. These international teams will combine members from at least one expert institute, university, or company, together with members from at least one novice institute, university, agency or company. These teams will work together to produce a deliverable, such as a meta-analysis of LCA case studies on a particular product group, or to develop electricity LCI databases for countries in a given region such as Southeast Asia, South America, etc.

The TF membership will consist of no more than 12 members, with fully global scope and with expert representation from both experienced and novice LCA countries. As with the guidance TFs, they will conduct working meetings open to public auditing in conjunction with major international meetings such as SETAC and ISIE (International Society for Industrial Ecology) events, scheduled and publicized by UNEP and SETAC well in advance. The role of these TFs will be to set up the international teams, assist in finding funding for their work, develop their draft work plans, and provide technical guidance and support to them throughout their practice projects.

The remainder of this document is organized as follows. First, the table below summarizes the relationships between the work elements of the definition study, and the task forces. Then, draft terms of reference for each TF are provided, which incorporate two rounds of input from members of the LCI draft author team, peer review group, and other participants in the SETAC meetings in Hamburg in April 2003.

Relationship of the Task Forces to the Work Elements in the LCI Definition Study

Work Element From LCI Draft Definition Study (DS)	Corresponding Task Force
DATA	
The DS called for the following tasks/deliverables. It also called for eventual development of an interpretive portal, (the “filter” concept); this would take place after the elements below had been achieved, so a TF for designing the filter is premature to propose at this stage.	
1. Web-based summary of available databases	1
2. Identify requirements and obstacles to LCI database harmonization	2
3 Peer-review procedure for LCI database characteristics	1 (key characteristics); 2
4. Data documentation guidance	2
5. Validation guidance	2
6. LC chain stochastic error calculation guidance	3
METHODOLOGY	
Address the following topics via a 3 step process: 1. Commissioned white papers, web-published; 2. Virtual (asynchronous forum) 3. Workshops to identify harmonization opportunities	
Data documentation and exchange formats (see D4 above)	2
LCI nomenclature	2
Develop peer-review process (see D3 above)	2
(The Peer Review Group included a call to address other methodology issues in the DS and TFs)	3
CAPACITY BUILDING	
The DS specifies objective of achieving basic and self-sustaining capacity level in as many countries as possible. The Peer Review stressed the need to structure such capacity-building efforts as mutual engagements rather than 1-way flows. The DS, User Needs Summary, and Peer Review all stressed the need to engage non-using countries in addressing the relevance and value of LCA to their particular needs and context.	
Training (which has evolved into learning-while-doing)	4, 5
Building capacity at universities	4, 5

Task Force 1: LCI Database Registry

Aims

This task force will update and expand the working summary of available LCI databases (produced during the definition study), including both public/national databases as well as LCI databases being made available by industry associations. The results will be used to create a web-based, UNEP LCI Data Registry, which provides basic meta-data and web links to the appropriate sites.

Motivation

A growing number of nations are investing resources in projects to make LCI data publicly available. These databases are as of yet poorly networked, if at all. At the same time, a growing number of industry associations and private sector interests have invested in developing LCI databases, which they make available for wider use to differing degrees and with a variety of levels of restriction or qualification. A growing number of researchers are developing process LCI databases, while others develop Input/Output-based LCI databases; some are for sale while others are (at least in principle) freely available for use by others. Finally, LCA software providers continue to expand and update the proprietary databases which are bundled in their software.

This growing wealth of data resources has not yet been comprehensively surveyed. Some LCA researchers are familiar with significant subsets of the available databases, but this knowledge tends to be focused on an industrial or geographic or methodological subset of the whole. The same is true of the few, highly valuable, efforts to develop web-based portals to LCA data. The world LCA community needs a comprehensive summary of available databases. It further needs for such a summary to be self-updating, since the world of LCI data continues to evolve and to grow.

Organizational aspects

Task Force 1 will be comprised of fewer than 10 LCI database experts from around the world, whose work is supported by a wider group of members of the LCI Working Group (LCI WG). Members will include a native Spanish speaker to assist outreach to Latin American countries, an expert with excellent access to database projects across Asia, and at least one representative of industry data providers and LCA software providers.

The work by this task force will also build upon and integrate results from other projects including the German LCA project and the US EPA's LCAccess website.

Work program and work process

The work under TF1 is planned for a period 26 weeks in duration. There are two main steps: (1) outreach and gathering of meta-information about the widest possible set of available LCI databases; and (2) creating the registry. For a database to be listed in the Registry, the data providers will need to successfully complete a simple questionnaire documenting a set of key database characteristics, which will be developed during the work of the TF. The high visibility and non-automatic status of inclusion in the Registry should motivate data-providing organizations to freely and proactively keep UNEP informed of database development and updates.

These work steps will be undertaken through the following five, more detailed steps:

Step 1: Survey of LCI databases (update draft survey document to include industry sector databases, commercial/proprietary databases as long as they are available to potential users; and also I/O-based LCA databases)

- Web-search, and solicit information from database developers
- Follow up with respondents and compile data availability query
- Write updated / expanded summary report

Step 2: Determine “key” database characteristics for database overview matrix

- Review work to date - May 2002 Database Workshop, definition study, and initial suggestions from TF2 (especially key outcomes of the data quality workshop)
- Create draft set of characteristics
- Invite feedback from working group and from TFs 2 and 3
- Review draft set / incorporate feedback

Step 3: Summary report of LCI databases and their key characteristics

- Create matrix of database characteristics
- Locate each available database within the matrix
- Compile draft report, combining survey completed in 1 and key characteristics matrix in B.
- Invite feedback on database overview matrix and overall report.
- Review feedback / update report.

Step 4: Web-site content and plan of implementation

- Adapt summary report content for website.
- Draft a plan for updating and maintaining the document and registry (including strategy, parties responsible, budget etc.)
- Send out registry applications to all known providers of databases from steps 1-3
- Invite feedback on maintenance plan

Step 5: Create Database Registry

- Upload summary report and database overview matrix onto web-site.
- Create links to information sources.
- Check information content / operability of web-portal
- Finalize and implement plan for updating and maintaining the Registry.

Deliverables

The specific deliverables of this task force are:

- A summary document that is as comprehensive and up to date as possible, which names and briefly describes LCI databases which are available to external users in the world. The document will include a basic comparison of databases, using a set of key characteristics that will be constructed during the work of the task force.
- Content for a web-based registry of LCI databases, with links to the information sources (where possible);
- Plan for updating and maintaining the document and data registry, including identification of the parties responsible, and estimation of the required budget.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26
Web-based Life Cycle Inventory databases overview																										
Outreach (tasks 1 and 2)																										
Draft overview (task 3)																										
Final overview and draft plan of implementation (task 4)																										
Implementation of website (task 4 cntd.)																										
Upload at UNEP website (task 5)																										

Task Force 2:LCI Database Characteristics and Quality

Aims

In keeping with the aims of the LC Initiative and responding to input received during the LCI User Needs Survey, the aim of this task force is to facilitate voluntary and practice-oriented movement towards consistency and commonality of database properties, while avoiding the role of drafting “standards” per se.

The TF will pursue consistency on four core characteristics of databases:

- 1) data quality
- 2) documentation format
- 3) data exchange format
- 4) nomenclature

Characteristics 1-3 are interdependent. Characteristic 4 will be addressed jointly with participants and task forces of the LCIA program.

Motivation

A number of Life Cycle Inventory (LCI) database development projects are underway, with more being launched in the near term. Each such project will develop and make available LCI data to a wide community of users. The databases are being developed according to their own individual *protocols*, which specify aspects such as:

- Elementary flow nomenclature
- Elementary flow inclusiveness and speciation
- Documentation contents, format, and publishing method
- Treatment of data quality and uncertainty

The ISO 14040 series of standards provide guidance on some aspects of the above issues, but leave room for important variation on many issues. Also, full adherence to ISO standards is not necessarily a current property of all of the ongoing national and industrial database projects. Meanwhile, and in the near future, LCI databases are being built according to the protocols now in place. All database projects, and all users of LCI data, will benefit from consistency, comparability, and practicality of exchange among these databases.

Organizational aspects

TF 2 will be composed of no more than 10 members, with a chair and co-chair. Its membership will be as expert and global in scope as possible, and will include representation from data users as well as data developers, and experienced as well as novice countries. It will solicit input at all major information gathering and decision points with the membership of the LCI WG. It will conduct working meetings open to public auditing in conjunction with major international meetings such as SETAC and ISIE events, scheduled and publicized by UNEP and SETAC well in advance.

This TF will use the work of TF1 as partial input during its early stages, and will provide output to especially TF5, which is practice-based capacity development on databases. It will also provide output to strengthen and refine the characteristics of the web-based LCI Data Registry.

Work program and work process

During the next 2 years, the following steps will be undertaken by this Task Force.

- Finalize the terms of reference for the TF.
- Identify in detail the principal needs for increased consistency on each of the four dimensions: quality documentation, documentation format, exchange format, and nomenclature; liaise with the appropriate LCIA TF on the last point.
- Work with TF 1 to ensure that the databases identified and contacted during TF1's work are characterized as thoroughly as possible concerning their approach to the four dimensions.
- Augment the results of this survey, if and as necessary, by commissioning short documents from experts and users, including database providers, which identify the current variety of practice on each of the four dimensions, and which suggest practical means for achieving greater consistency. The results of the consistency needs assessment, survey, and any commissioned documents will be published at the UNEP website and advertised as widely as possible. These results should be translated into major languages.
- Conduct an internet-based virtual (asynchronous) discussion forum focusing on reaction to the results of the step above, perhaps with multiple language tracks,
- Conduct an international workshop involving providers as well as users of databases, at which the results of the documents and the internet forum are summarized, and then a process is facilitated to identify ways that practice can move towards greater consistency in each of the subject database property areas. The main outcome sought from this meeting if possible will be formal or informal agreement among database developers regarding consistent approaches to each of the database property areas, and publication of these approaches for access by other database developers. On database property areas where this is not achieved, a second-best solution will be agreement on a follow-up path of action to achieve greater consistency.
- Communicate the findings and conclusions in the form of a best/consistent practices handbook, and provide training on the results to the practice teams working under TF5.

Deliverables

Deliverables to be produced by this TF are, at a minimum, summary reports on each of the four topic areas above, which characterize the state of consistency (or lack thereof) among major databases and database development projects, and which recommend consistent practices towards which these databases and projects should move, and also recommend processes by which this consistency can best be achieved. A more ambitious outcome which should be attempted is for the process outlined below to actually facilitate movement by database developers towards global consistency on issues of data quality, documentation, exchange, and nomenclature.

Task Force 3: LCI Methodological Consistency

Aims

The aim of this task force is to initiate and stimulate processes, studies, and forums that facilitate voluntary and practice-oriented movement towards transparency, ultimately contributing to improved consistency and commonality of LCI methodological practice.

Motivation

There are several core methodological issues on which greater transparency in method would provide benefits in terms comparability and hence improved consistency in LCI. There is a central role here for criteria for classifying and comparing methods, to be determined and agreed to in this Task Force. This classification relates to methods choices in modeling, such as on the mechanisms taken into account (e.g. substitution and broader economic mechanisms), the solutions to the multi-functionality problem (e.g. allocation in co-production, combined waste handling and recycling), and to the cut-off problem (e.g. through comparable cut-off between options or avoiding cut-offs by estimating procedures such as hybrid methods involving IOA).

Clarity in such matters will bring benefits that go beyond simple comparability; it may ultimately lead to development of better, more consistent modeling practices, e.g., with greater expected accuracy for predicting the consequences of product-related decisions. It should be clear however, that LCI modeling cannot predict full reality and that there may be legitimate differences in approaches to modeling. Also, moving towards improved modeling quality has the risk of increasing the complexity and cost of LCI studies. A trade-off between easy practicability and richness of modeling seems unavoidable. Such a trade-off should be visible, allowing practitioners to make the appropriate choices at a practical case level. What is needed is to bring the various methodological choices and proposed or possible methodological extensions together into a consistent framework for consideration, evaluation, and representation.

Organizational aspects

As for the other guidance TFs, TF3 will be composed of no more than 10 members, with a chair and co-chair. The membership will be as expert and global in scope as possible. This TF will solicit input at all major information gathering and decision points with the membership of the LCI WG. They will conduct working meetings open to public auditing in conjunction with major international meetings such as SETAC and ISIE events, scheduled and publicized by UNEP and SETAC well in advance.

Probably more so for TF3 than for any of the other TFs, in the subject area of LCI methodology, the LCI field currently contains a wide range of different and sometimes opposing positions. Since the membership on the TF must capture this range of viewpoints, there is a real need for the members of this TF to express and to hear the full set of views. People need to get used to each other's language and terminology to understand diverging positions and lines of reasoning. This takes time but at the same time helps to better identify differences in methodological approaches, and if structured properly may well lead to surmounting of these differences. In the end, the process and deliverables must also allow for consensus/ dissent statements because differences of opinion may well remain after the deliberations and search for common ground.

Work program and work process

During the next 2 years, the following steps will be undertaken by this Task Force.

Step 1: Identify major methodological topic areas, and for each, describe whether consensus has already been reached or not. Then identify major existing contributions (scientific papers) on these issues, and request further specific contributions where necessary. Contributions should be published on the web⁴ well in advance of a following meeting, which should be held in conjunction with an international LCA-related event if possible. TF members may at this stage prioritize the areas of divergence.

Step 2: Develop criteria for comparing LCI methods in a comprehensive framework. TF will begin to address this issue by identifying major existing contributions (scientific papers) on this topic, from within and possibly also from beyond the confines of the traditional LCI field, and request further specific contributions where necessary. Contributions should be published on the web well in advance of a following meeting, which should be held in conjunction with an international LCA-related event if possible.

Step 3: After the areas of methodological divergence have been identified, and a framework for comparing methods has been agreed upon, the following six procedural steps are next.

- Gather existing leading papers on a linked group of methodological issues.
- Commission new synthesis white papers, with as one central deliverable a draft decision tree, to guide practitioners towards the most appropriate choice of LCI methods for application in their case studies. If necessary, several alternative decision trees may result from this step.
- Produce one or more worked out examples on the set-up of studies and the results coming out of them when following different paths in the decision tree in parallel. The white paper should include a practical example application of any proposed method. The white papers and examples will be published at the UNEP website and advertised as widely as possible.⁵ The purpose of the synthesis white papers will be to
 - ❖ Identify the current variety of methodological practice and the consequences of this variety in the framework developed;
 - ❖ Summarize pros and cons of different methods in relation to their applications at hand
 - ❖ Produce a draft decision tree for stepwise guidance in the choice by practitioners of a most appropriate method for the application at hand.
- An internet-based virtual (asynchronous) discussion forum focusing on reaction to the white papers, perhaps with multiple language tracks.
- A possible workshop involving leading practitioners as well as major users of LCA from all sectors and regions, at which the results of the white papers and the forums would be summarized, leading to a final version of the decision tree (if necessary, the earliest branch(es) in this tree will depend upon methodological or perspective choices about which there remain differences of opinion). The workshop will also generate a plan for disseminating the results.
- A plan for a dissemination process helping practitioners to move towards improved methods use in LCI.

⁴ Translation into several major languages would be desirable if resources make it possible. The TF members should work with UNEP to identify sponsors for such translations at the outset of their work.

⁵ Again, translation of these white papers into a set of widely-used languages is a high priority.

Deliverables

From Step 1: Status summary of methodological issues, areas of consensus, areas of divergence, and expressions of the major current positions on these areas.

From Step 2: An agreed upon framework for classifying and comparing LCI methods.

From Step 3: A guidance document on methods choice in relation to application, and a plan of dissemination.

Task Force 4: LCA Library for Meta-analyses

Aims

As one of the *Practice* Task Forces, TF4 has the aim of delivering products (deliverables) through a process that is also specially organized to maximize capacity-building among participants.

The product-oriented aims of TF4 are to create an “LCA Library” which contains two types of information:

- a) Compilations of LCAs on specific topic areas; and
- b) Meta-analyses of the LCAs in these topic area compilations.

This information will provide a practical input to efforts at the identification of hotspots and product design. In addition, generating this information is a task that provides an excellent opportunity to provide guidance and build capacity in the critical assessment and comparison of LCA studies and in making use of their results in drafting summaries for decision support.

Motivation

Much knowledge has been acquired on environmental impacts along the production and consumption chain of products and materials, and for some product groups LCA results now indicate the parts of the product life cycle on which designers, purchasers, and policy makers need to focus. However, this information is fragmented and is often not provided in a form that can be easily used by business or in administration. It would therefore be helpful to compile the relevant case studies into synthesis reports for different materials and groups of products. The information should be provided in a simple way so that it is understandable to a wide range of non-specialists in government, business, marketing and public affairs.

The need is thus for more than simply a compilation or list of existing studies on a set of product categories. Such a compilation is a necessary first step, but it needs to be followed by meta-analyses of the case studies to characterize uncertainty/robustness of the results and conclusions, areas of agreement and disagreement, and the major sources of disagreement where it exists. For instance, for cars it is clear that the use phase is the life-cycle stage with the highest potential impact on climate change. Conclusions extracted from the meta-analyses, based on the best available life-cycle information, should be made available to decision-makers in business, governments and NGOs. In addition, some users will desire access to the underlying studies themselves; this will be true for researchers and for individual region decision makers when the findings are strongly dependent on location or on subsets of the product groups.

A compilation of LCA case studies could also be usefully augmented by a review of high-value supporting data sources on the supply chains of the product groups of interest.

Finally, we note that one of the best ways to learn about LCA, especially in the early stages of the learning curve, is to perform critical review and comparisons of existing LCAs on a given topic. Thus, the task of gathering, reviewing, and comparatively analyzing LCA studies on specific topic areas provides an ideal practice area for capacity development. There must be experienced LCA practitioners on the review team, but not all team members must be LCA experts at the outset of the review. We further note that the meta-studies should address all facets of the LCAs, from goal and scope definition, through inventory and impact assessment (where relevant) to importance analysis and the actual decision/policy/market consequences of

the LCAs. Thus, it is imperative that this task be undertaken jointly with participation from the LCIA and LCM programs.

In summary, we recognize the strong need for an annotated and publicly available “library” of LCA case studies, *and* for efficiently communicated “meta-studies” of LCA cases on product group topics. The compilation of case studies is a necessary precursor to the meta-analyses, and by rendering it this compilation in the form of a globally accessible, annotated digital library, the compilation will provide a valuable follow-up resource to some users of the meta-analysis.

Building a comprehensive “library” of case studies is a very large undertaking; it will require many person-hours, and it will need to be maintained. At the same time, conducting the reviews and analyses that contribute to meta-analyses will be excellent learning experiences for those involved. Thus, it is proposed that international working teams be formed to address individual topic areas, and that these teams involve mixed levels of experience, mixed geographic participation, and a mix of academic, consulting, industry and government involvement.

Organizational aspects

As one of the “Practice-oriented” task forces, the TF members themselves do not conduct the work directly. Rather, the members of the TF structure and oversee the process, provide guidance and assistance and problem-solving to the meta-teams, assist with fund-raising for the individual meta-studies and for the TF work as a whole, and facilitate the gathering and widest possible dissemination of the results of each meta-teams’ work. The TF also helps provide the necessary continuity and integration across the work of the individual meta-teams.

Work program and work process

Fortunately, the work on this TF does not need to start “from scratch.” In recent years, expert teams at several universities have undertaken meta-studies of existing LCAs on several different product groups or life cycle states. For example, at least one research institute has compared LCAs of recycling of major post-consumer material streams.

This TF will begin its work by identifying and then enlisting the collaboration of, and building on the work of, members of these expert teams. The work will be carried out in 2 phases. The first phase will be roughly 1 year in duration, while Phase 2 will consist of multiple team projects and span several years. The elements of the work plan for Phase 1 of TF4 are thus as follows:

- Review and finalize the ToR for Phase 1 and the first year of Phase 2.
- Identify expert institutes around the world that have conducted meta-analyses of LCAs of product groups, or of process systems such as municipal solid waste management. Select 2-3 such groups to provide the anchors for the first round of meta-teams.
- TF4 members and leaders from the expert institutes jointly set the design of the first round of meta-studies, which should build on the results from the prior studies by the expert institutes. Begin recruiting partner institutes for each meta-study.
- Conduct meta-studies, which will be streamlined and relatively low-risk since they build on prior studies. Provide assistance and guidance as necessary.

- Consider the feasibility and value of generating a summary of key data sources for the product groups of interest.
- At the completion of the first round of studies, convene a full meeting of all the pilot study teams plus a wider cross-section of LCA providers and users, at which the lessons learned will be reviewed, and a final process for the meta-studies and for the ongoing build-up and maintenance of the library will be established.

Phase 1 (the steps described above) will set the specifics of the follow-on process. However, at this stage it is possible to illustrate the kind of follow-on process that is envisioned, as a vehicle for visioning and understanding the potential of this TF.

Phase 2 product topic teams would be formed on separate product group topics. These topics might helpfully correspond to product groups addressed by “product-specific requirements” (PSRs) in the development of major type-III ecolabels (EPDs).

Each product topic team would include at least 2 different regional academic teams, each directed by faculty at a university and including at least 1 (preferably several) graduate (and possibly undergraduate) students. The universities will need to compete for the privilege to participate, since there will be a modest level of funding provided to the university teams. Each product topic team will include participation from at least one LCA-experienced university, and from at least one LCA-novice university, preferably one in an LCA-novice country. In addition, it may prove very valuable to include in each product topic team one or more representatives from industry, government, and consulting, especially including persons with technological and economic backgrounds in the industries of interest.

Deliverables

Phase 1 will generate conclusions on each of the following:

- Budgets for studies;
- Funding sources;
- Project team meetings;
- Size and general structure/composition of teams;
- Levels of funding to universities and other participants;
- System for reviewing proposals and forming teams;
- System for meta-analyses in the ongoing case study library development;
- Systems for establishing topic “caretaker” point of contact or team which would maintain and update the topic area page over time, so that it serves as a magnet for future case studies that are done on the topic areas.

The deliverables from each product topic team (from Phase 2 onward) will be two-fold:

- a) A compilation of studies: a web page with links to the studies or their source organizations, which allows downloading of PDF documents for as many as possible of the case studies
- b) The group meta-analysis report, which summarizes the findings and the studies that were reviewed.

Together the web sites, PDF documents, and meta-analyses will come to comprise the UNEP/SETAC LCA Library.

These two types of project output will serve as primary inputs to other efforts that occur either within the Life Cycle Initiative or outside the Initiative dealing with *meta-analyses* for the identification of hotspots. Specifically, the meta-studies will shed light on:

- Which portions of the life cycles of different types of products provide the greatest potential for making improvements in the total life cycle environmental burdens; and
- Which product groups offer significant potential for life cycle environmental improvements based on product selection or design.

Task Force 5: LCI Databases and Capacity-Building

Aims

As one of the *Practice* Task Forces, TF5 has the aim of delivering products (deliverables) through a process that is also specially organized to maximize capacity-building among participants.

The product-oriented aims of TF4 are to create an “Starter” LCI databases within countries that do not now have them, making maximum possible practical use of the guidance on database consistency and methodological consistency coming out of TFs 2 and 3, respectively.

The process-oriented aim is to build, through “on the job training” involving teams that include both experts and novices, the capacity to develop LCI databases.

There is really a third aim of the activities of TF5: to provide operational “field tests” of the strengths, weaknesses, applicability and practicability of the results of TFs 2 and 3, and, where applicable, of the guidance on I/O and hybrid LCI database development coming out of the SETAC Working Group on IOA methods for LCA.

Motivation

The need for capacity building tasks was clearly expressed in the user needs surveys. Also, the capacity-building section of the LCI Definition Study calls for build-up of capacities at universities, and launching train-the-trainer activities.

A particular need expressed in inputs to the program so far – and in the definition study approach -- is to make the capacity building efforts practical and not theoretical, and (as strongly expressed by the peer review group’s initial peer review ahead of the Hamburg meeting) not a top-down approach or a North → South approach but a collaborative effort among peers, designed from inside the application context, rather than imposed upon the application context.

Subsequent rounds of input to the draft TF ToRs have confirmed the need for the work of TF5 in particular to be guided in part by user demands for data. The needs assessment stressed the critical importance of data availability, while at the same time advising the initiative itself not to attempt to become a database provider itself.

The result of considering the input above is the concept for a task force with a strong learn-by-doing component, linked with peer-support structures among experienced and early-on teams of practitioners and researchers, analogous to the peer-support structure of TF 4 (the LCA Library).

Organizational aspects

The TF5 membership will consist of no more than 12 members, with global scope and with expert representation from both experienced and novice LCA countries. As with the guidance TFs, they will conduct working meetings open to public auditing in conjunction with major international meetings such as SETAC and ISIE events, scheduled and publicized by UNEP and SETAC well in advance. The roles of TF5 will include the following:

- Set up regional teams devoted to database development and capacity development
- Assist in finding funding for their work
- Facilitate and guide the development of each regional teams' draft work plan
- Provide technical guidance and support to the regional teams throughout their data development projects, ensuring the maximum possible transfer of outcomes from TFs 2 and 3 so that data development and capacity building reflects the state-of-practice guidance being developed within the LCI program.

TF5 will structure, guide, oversee and manage the formation and work of *regional teams* that in turn undertake database development projects in countries that currently lack adequate LCI data. Each regional team will include participants from at least one expert institute, university, or company, and sets of partners from institutes, universities, agencies or companies in LCA-novice countries from across the region.

Note also that through TF5, the Initiative is striking a creative balance of four types of input received during the user needs survey which appeared at first to contradict one another:

- On the one hand, LCI data was identified as a pressing need, and yet the Initiative was counseled *not* to try to get into the business of creating databases itself;
- On the one hand, the need for capacity-building was strongly expressed, but so was the aversion to top-down, "paternalistic" imposition or importing without adaptation of methods from Europe or North America into very different application contexts.

Work program and work process

As with the other practice-oriented TF (TF4 on the LCA Library), the work of TF5 will proceed through two phases: a planning and design phase, followed by an implementation phase. The planning phase (Phase 1) will be 1 year in duration, while Phase 2 will span multiple years. During Phase 2, each regional team will include a survey of the key or core LCI data needs perceived by actual or potential users in their country, and will then develop databases that meet these needs. This may involve, for example, linkage to the findings of other initiative task forces that are addressing topics such as inclusion of social or other development-related impacts within LCA models, since there may be special LCI data needs related to these impact categories.

In addition to providing for transfer of findings from TFs 2 and 3 to the regional project teams, members of TF5 will also facilitate knowledge- and guidance-transfer from the SETAC working group on IO/hybrid LCA methods to the working teams if and where appropriate. The initiative and TF5 members will not impose its views on whether process, I/O, both, or hybrid databases should be the focus of each participant country's work. Instead, these decisions will be demand-driven, and will emerge from research that takes place during the scoping phase of each meta-team's work. To properly enable this bottom-up, demand-driven decision making, TF5 will include a diverse mix of practitioners who are familiar and capable with

respect to process, IO, and hybrid methods. The project teams may thus need to make use of software tools that can work practically with process, I/O, and hybrid models.⁶

Through TF5, the Life Cycle Initiative will not itself be getting into the database development business, nor will it be providing “capacity building training” in a simply abstract way, nor will it impose data development goals from the outside. Rather, it will facilitate and enable teams of practitioners within LCA-novice countries on a regional basis to take charge of determining and then beginning to meet their own data needs, developing in-country and in-region support and capability networks in the process.

Deliverables

Phase 1 will generate budgets, team composition, and work plans for each of a set of regional teams. Design of the teams will attempt to identify and link to partner agencies or institutes which are involved in related data collection or model development, such as teams working with the World Bank to develop integrated IO-pollution emission models, or institutes which have been adapting process-style databases from other regions such as Europe to local conditions.

The deliverables from each product topic team (from Phase 2 onward) will be two-fold: The product-oriented deliverables are “Starter” LCI databases within countries that do not now have them. These databases will provide

The process-oriented “deliverable” will be wider capacity to develop LCI databases.

⁶ We note here in passing that widespread availability of low-or-no-cost LCA software may be another important need. It was not raised as an issue during the user needs survey, nor is it now addressed by any LCI task forces. Instead, TF5 can be seen as potentially expanding the need or market for such tools, which in turn are probably best supplied by creative entrepreneurs and/or research institutes rather than by the Initiative. If the need goes un-met as TF5’s work proceeds, this fact should be raised to the attention of the Initiative for reconsideration.

Appendix A: Work Plan As Proposed in April 2003 Draft Definition Study

This Appendix contains the work plan elements as proposed in the April 2003 draft Definition Study. That document was sent to peer review; on the basis of the peer review comments, an initial set of LCI task forces were proposed at the SETAC meeting in Hamburg in late April, where a round of input was received. Following the Hamburg meeting, three separate rounds of input were received and synthesized to generate the final LCI TF ToRs that appear in section 4 of this report. This Appendix retains the language of section 4 of the April Definition Study, for purposes of retaining a comprehensive record of the ideas and planning that have led to the TF ToRs.

This section presents LCI Program activities under the three headings of capacity building, data availability and validation, and methodological guidance. An additional section of the April draft workplan pertained to the LCA case studies library, which has matured into TF4; that text has been dropped from this Appendix to avoid confusion.

A.1 Capacity Building

Train-the-Trainers Activities

Activities

- Explore how the Initiative can exploit the institutional and technical capacity of Sustainable Production and Consumption Centers and similar LCA Societies and Centers to carry out training in LCI.
- Organize train-the-trainer activities on a regional basis for LCA (UNEP has a long experience in these type of activities). The initiative can consider running 4 regional train the trainers workshops (in Africa, South America, Eastern Europe and Asia).
- Organize local and regional symposiums/forums, which should enhance the exchange of data and information on LCI developments and projects in the region, as well as providing information on different issues like: boundaries; cut off rules; allocation procedures; sensitivity analysis.

Deliverable

The setting up of an active core of LCA advisors and trainers in all countries.

Building capacity at University level

Activities

- This should start with an assessment of the current situation of university education concerning LCA and identification of factors that can lead to successful recognition and implementation of LCA education modules.
- A working group comprising university and industry people needs to be constituted to consider the needs of employers, the teaching of LCA, teaching tools and support materials and the building of curricula at undergraduate and professional level (with a possible focus on incorporation with Industrial Ecology curricula). This group should organize a joint conference on LCA education and training. Such a conference must be organized by UNEP, SETAC, and together with an engineering organization and an association of universities around the world.

Deliverable

A workshop/conference with the following key objectives:

- to define the essential knowledge and skills of the LCA-literate,
- to reach agreement on the fundamental principles of teaching,
- to assist educators to develop curricula at undergraduate and professional level, as well as for continuing professional development,
- to provide examples of initiatives and establish a network for a continuing exchange of information and experience.

The key findings of the conference must then be widely disseminated to all universities.

Tools for Training (distance learning, expert systems, software etc.)

Activities

- Support education and outreach through on-line educational opportunities, information exchange and other media. General specifications for a web-site structure need to be worked out which will take into account how to make the tool appropriate for different users and how to apply a multilingual approach.
- Development of user-friendly software as well as “expert systems” providing specific guidelines for dealing with data gaps, choices and methodological choices as well as error-calculation indicators and methods, will reduce the time to get started with LCA, costs of the studies and lower the stochastic and some of the systematic errors required for carrying out an LCI. There is a need for low-cost softwares for academic institutions in developing countries. The initiative should look into ways to sponsor institutions in developing countries for buying software, books, journals etc.
- Development of user-oriented didactic concepts for LCI knowledge dissemination and availability of didactically prepared best-practice examples for LCI (both hard copy as well as web-based). These materials should be condensed and intuitive as possible, otherwise LCA-practitioners in industry and consultants will not read them. These materials need to be available in the local language if not yet provided by local consultants and software distributors.
- Organize low cost distance learning training courses on LCI, using the development of distance learning courses at different levels as a strategy for reaching as many potential users as possible. This will support the cooperation of experienced consultants with new LCA-practitioners and LCA-training centers in non-OECD countries. The initiative should work with an open university to develop this low cost distance learning training course.

Deliverables

- A prototype of a web site to support on-line education and outreach.
- Options to sponsor institutions in developing countries for buying software, books, journals etc.
- Report or web-based best-practice examples for LCI, possibly in a number of different languages.
- Low-cost distance learning training courses.

Public /Private Sector Partnerships

Activities

- To develop LCA information networks that move from information to knowledge, and support field-based counselling units, especially to meet the needs of policy makers and SMEs.
- To investigate the potential for Sustainable Production and Consumption Centers to help in creating information networks and enhancing public/private sector partnerships.

Deliverables

- Prototype of information network, including public/private sector partnerships.

Strengthening the demand side for LCA-services

Activities

- Identify the factors that promote LCA-application in industry and government in Europe and North America and transfer these as far as possible to other countries. Typical success stories need to be compiled. Identify and show the potential of utilization of LCA in developing countries.
- Develop “LCA-lobbying” information and introduce these into international policy and to governments and industry associations. The initiative has to find ways to mainstream and harmonize formats of LCI/LCA in environmental governance and national economic development policies and programmes.

Deliverables

- A number of LCA awareness-raising campaigns and workshops in developing countries, targeting industry, government, NGO's and academia and showing success stories.
- The development / dissemination of case studies where LCA studies have been shown to be of direct relevance to decision making in developing countries.

A.2 Data Availability and Validation

Web-based Summary of Available LCA databases

Activities

Two-level tabular LCI-database characteristics overview:

Document available data in terms of: industries, countries, technologies; degree of aggregation (cradle-to-gate, unit process, other) and methodological and model assumptions. Also document data availability status, under which confidentiality restrictions, under which format, using which methodology, nomenclatures, and standards, for which costs and other conditions for access; and how the data are applicable in practice, how far are the datasets consistent among each other, how is the data documented, in which languages is the data available, which links and support to standard and upcoming LCIA-methods are provided, who are users of the database? Make use of existing efforts and output of other initiatives; closely co-operate with all relevant database developers.

Meta-information system on LCI databases and datasets

Develop and implement a web-based user-friendly information platform for world-wide access to information on availability issues of LCI databases and datasets. Keep the information up-to-date by establishing a self-financing mechanism of the hosting and updating of this web-portal. Make use of experience gained by other activities aiming at this or similar goals (also in other areas than LCA); report on integration of these experiences.

Deliverables

Double peer-reviewed two-level LCI-database matrix overview of all world-wide available LCI-datasets: First level only with basic information without need for review (e.g. not including information on data quality or quantity, but on general scope and the contact details); second level with reviewed quantitative and qualitative information with the above named characteristics. Short documentation and guidance report on usability of information.

Meta-information system on LCI databases:

Web-based information portal as described above. Established mechanism to keep the information up-to-date continuously also after end of this project.

Database harmonisation - requirements and obstacles

Activities

Identify main requirements and obstacles for a broad harmonisation of the most practice-relevant existing LCI databases - whether of methodology, format, technical, financial, confidentiality, strategic, national priority setting, or other quality. Evaluate required effort in terms of finance, experts-resources, and project duration for establishing both a practice-oriented format and an accepted format implementation procedure for improved compatibility of existing LCI-databases. In the working progress, make use of past and actual achievements of public and private, national and international activities dealing with this topic. Give highest priority to ensure and support continuity of existing LCI databases be it those of database providers of public or private origin or those build-up in-house in industry, research institutions etc. Small case-study on applicability of harmonisation draft approach focussing on required effort to transform existing databases of high practice-relevancy. This subtask is strongly linked to the LCIA project activities (e.g. due to direct link of flow names, initial emission compartment and emission place and time).

Deliverable

Report on requirements and obstacles to LCI database harmonisation and means to overcome these. Detailed draft of harmonisation concept including its implementation. Report on applicability-test.

Double peer-review procedure for LCI database characteristics

Activities

Develop and implement an internationally harmonised and widely accepted, objective, and independent double peer-review procedure for LCI database characteristics and LCI dataset quality (in terms of process-specific technical quality, LCI methodology, stochastic overall standard error of aggregated process-chains, and documentation issues). To be linked to required similar review on impact assessment methods which will flow from the LCIA project.

Deliverable

Report on LCI database and dataset quality double-peer-review system (and first experience gained from its application) including a procedure for selection of reviewers and financing of the review.

Life Cycle Chain stochastic error calculation

Activities

Develop a guidance-document on how to calculate and report overall stochastic errors of the LCI-data (or characterised results) along life cycle chains. Link/harmonise work to the related effort undertaken in LCIA project. Provide error-documentation format.

Deliverable

Report on stochastic error calculation and reporting for aggregated LCI process-chains.

Data documentation

Activities

Provide or select a harmonised, practice-oriented LCI-data documentation format and subformats in orientation to the ISO 14048 standard. Provide guidance to database developers how to ease exchange of dataset-documentation information separated from and in addition to exchange of dataset-input-/outputflow information.

Deliverable

LCI-dataset documentation format and ISO 14048-subformat guidance scheme, in report.

Validation Guidance Documents

Activities

The objective of this set of tasks would be to transform the outcome of the other projects, namely of the "Data availability and characteristics" project and the "Methodological guidance" project to documents feasible for fast and easy use for LCI data validation by LCA practitioners, that directly deal with LCI datasets.

A second task would prepare a well structured check-list type handbook listing typical input- and output flows of most important types of processes. The structure should orient to industry type and/or process-type and have also explicit reference to material-flows and products processed in the process (e.g. giving typical ranges of percentage of reaction-intermediate or product substance lost to the primary emission media) and list (and probably quantify ranges) of typical emissions and wastes encountered.

Deliverables

Guidance document and check-list for validating general and methodological aspects of LCI datasets.
Guidance document and check-list for typical emission and waste flows of processes.

Long Term Concept: Application-specific LCI dataset-filter

Actions

The purpose of this task would be to develop a web-based expert-knowledge-based filter system for allowing LCA practitioners to identify the degree of appropriateness (representativeness, completeness, quality, and so on) of an LCI-database or dataset for his or her specific needs and intended use in the LCI-model (e.g. goal & scope depending, foreground / background-system, material-related politics support etc.).

Deliverable

Web-based expert-knowledge-based filter tool as described above. Documentation of (technical) use and limitations of validity of the output.

A.3 Movement Towards Methodological Consistency

As stressed by Guido Sonneman at the Barcelona meeting, UNEP's role is not to direct "top-down harmonization efforts." Rather, its role is to facilitate and convene processes from which voluntary movement towards consistency emerges in a bottom-up fashion. Albeit with the recognition that some top-down guidance (e.g. a top-down discussion paper) will be required to guide the process.

Activities

For each of the three topics below, a three-part process is proposed for facilitating such movement towards consistency at a global level. The processes would consist of:

- a) Two to four brief white papers would be commissioned on the topic, which would be posted on a website for the purpose;
- b) A web-mediated comment/discussion period would follow, during which all interested parties would have an ability to post and read comments on the topic; these comments would then be summarized by a peer review group formed for that purpose; and

- c) A workshop would be held, with global participation, including sponsored participation from emerging economies; the purpose of the workshop would be to identify opportunities for movement towards consistency on the topic.

The three methodological topic areas (that have been recognised of high priority in the user needs assessment) are as follows:

- A. LCI data documentation and publishing formats
- B. LCI flow scope and nomenclature
- C. Peer review process

The fourth topic for a white paper / web forum / workshop process is:

D. Identification of LCA method changes/advances required to better address needs of users in non-LCA-active countries, especially the needs of developing countries. Electronic discussion forum with brief white papers, followed by an international meeting intended to identify which key developments of LCA (beyond mere capacity-building in business-as-usual-LCA; for example, method/scope advancement to address social and/or economic issues; application revisions such as allowing phased sophistication of LCAs that support Environmental Product Declarations (“type III ecolabels”); etc.) that would make LCA more valuable and responsive to the needs of users (companies, government, NGOs, researchers and consumers) in those countries which are not now actively engaged with LCA.

Deliverables

For each of the topic areas:

- Brief white papers summarising topic
- Report summarizing web-mediated discussion
- Workshop to identify opportunities for movement towards consistency on topic
- Report summarizing workshop findings.

Appendix B: Detailed Results from LCI User Needs Survey

The labelling of the user needs is as in section 2.2.

B.1. Breakdown of user needs importance according to sector

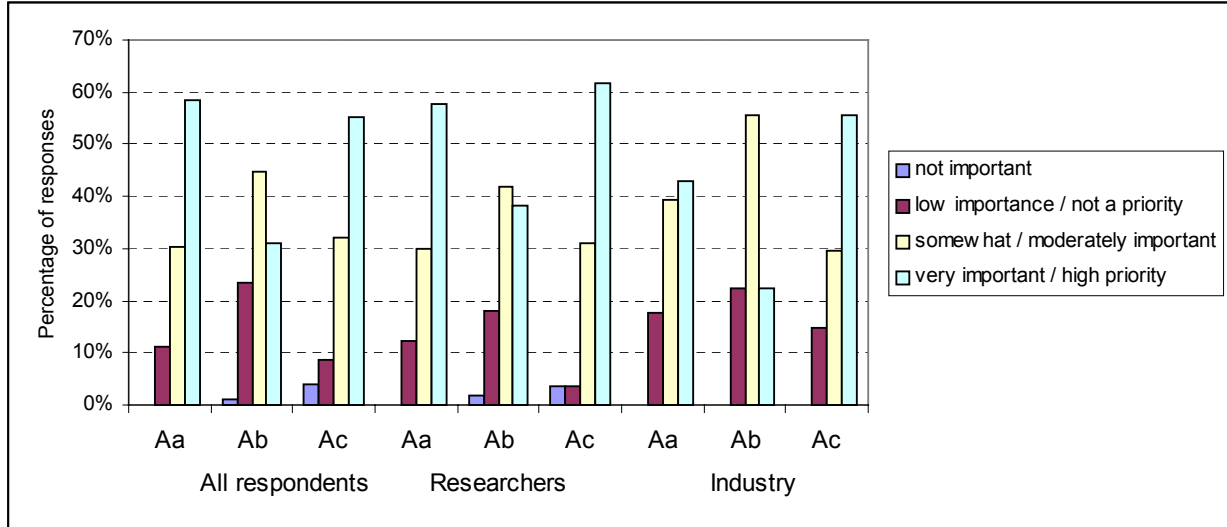


Figure 4 Importance attached to needs related to inventory data (needed data characteristics, data uncertainty and more representative data sets).

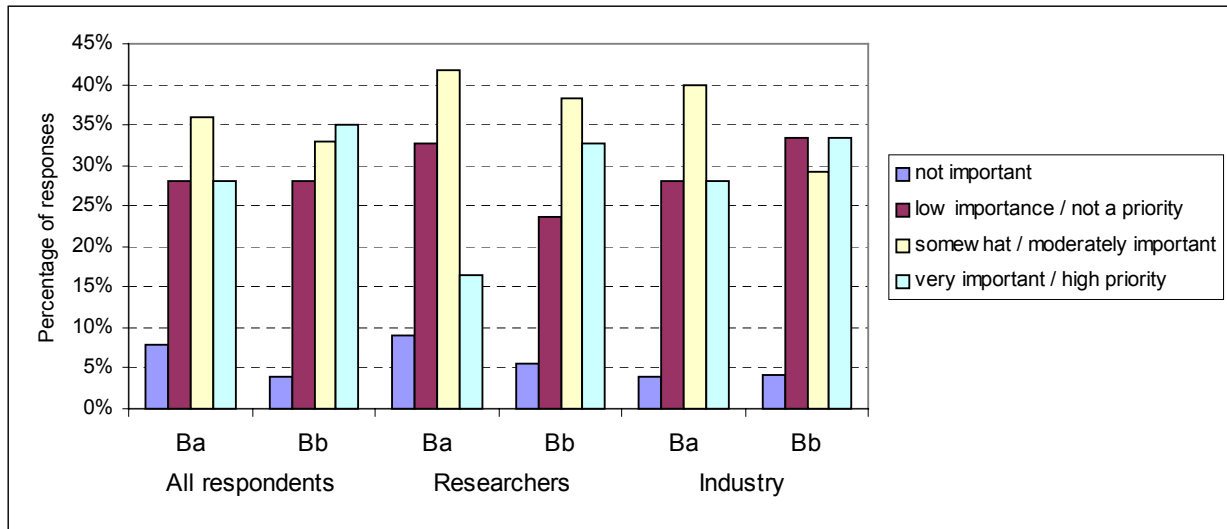


Figure 5 Importance attached to need for methodological guidance and consistency in allocation and system boundaries.

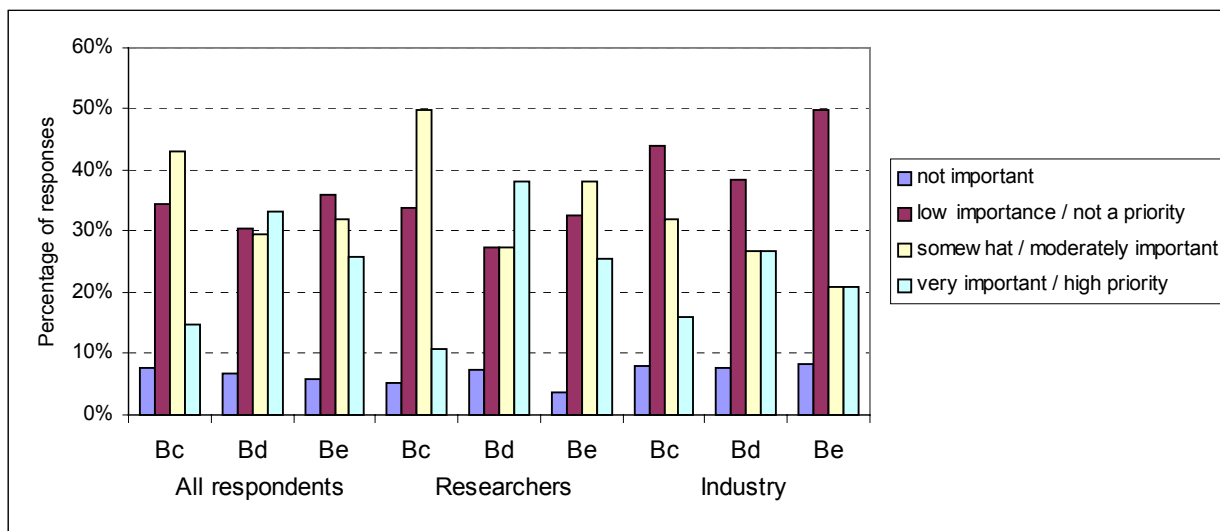


Figure 6 Importance attached to further needs related to methods guidance and consistency (model structure dependence, simplification and scenario development).

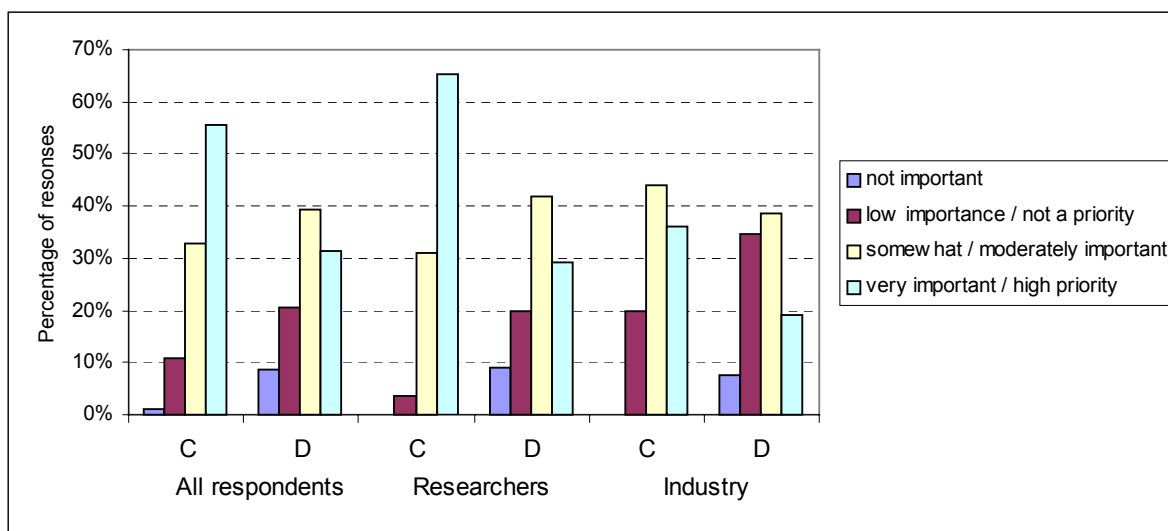


Figure 7 Importance attached to need for increasing the capacity for performing LCIs globally and for validating LCIs.

B.2. Breakdown of user needs importance according to home country

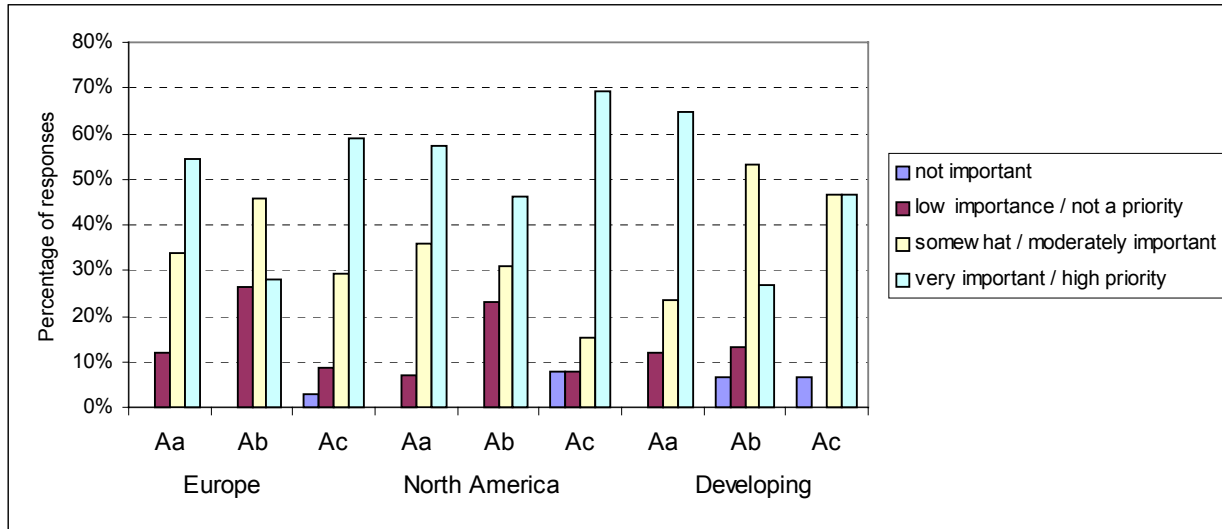


Figure 8 Importance attached to needs related to inventory data (needed data characteristics, data uncertainty and more representative data sets).

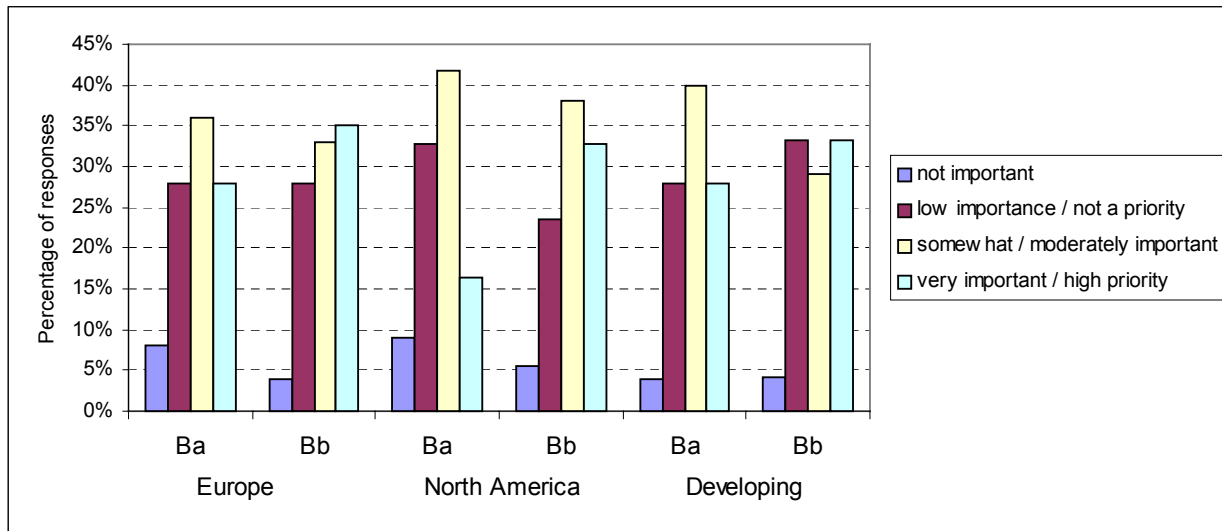


Figure 9 Importance attached to need for methodological guidance and consistency in allocation and system boundaries.

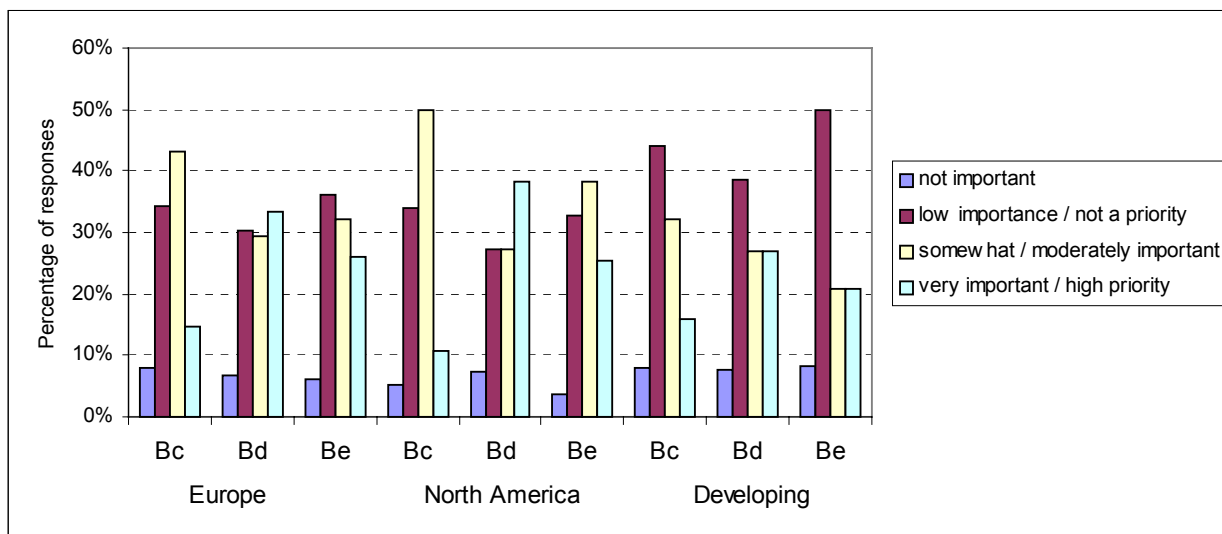


Figure 10 Importance attached to further needs related to methods guidance and consistency (model structure dependence, simplification and scenario development).

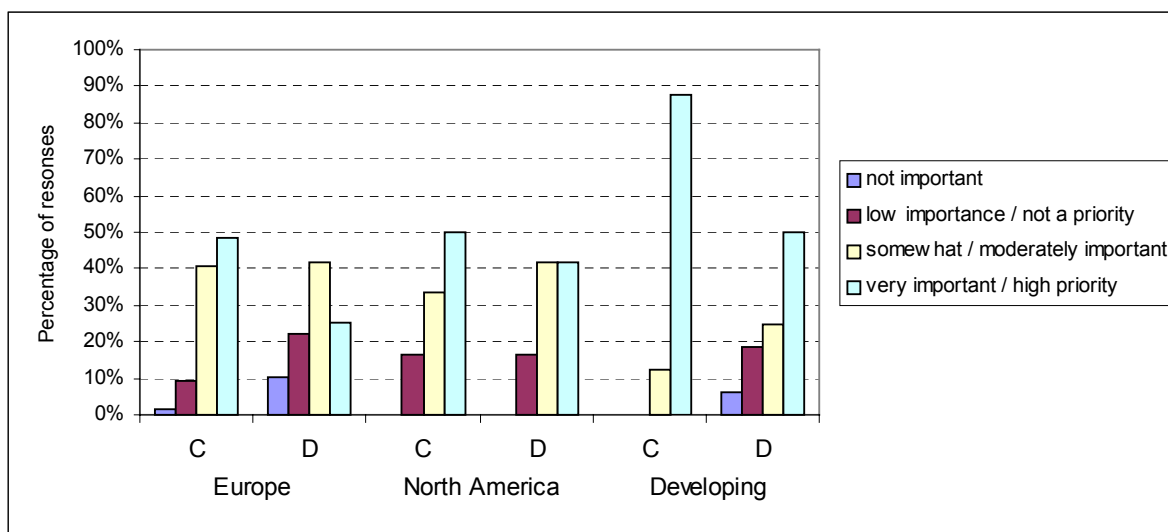


Figure 11 Importance attached to need for increasing the capacity for performing LCIs globally and for validating LCIs.