UNEP/SETAC Life Cycle Initiative: Background, Aims and Scope

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Life Cycle
Initiative

1 History of the UNEP/SETAC Life-Cycle Initiative

The initiative has its origin in the SETAC-Europe Working Group on Life Cycle Impact Assessment and the Working Group on Data Availability and Data Quality. In 1999, the UNEP-DTIE office in Paris (United Nations Environmental Program, Division of Technology, Industry and Economics) was approached with the intent to give the work of the working groups a broader reach and to put it into a more authoritative framework. The first identified aim was to develop 'best practice for life cycle impact assessment (LCIA)' at a European scale. In the discussions with UNEP, the scope was extended in order to include also life cycle inventory (LCI) methods and data. The next step was to extend the initiative to a global scale, particularly also including developing countries. The last extension was to include also life cycle management (LCM) in the scope of the initiative.

During this process of scope extension, a number of questions arose, some of which have their history in SETAC and ISO discussions. With respect to LCI and LCIA, these were mainly the following four questions.

1. A first question in regarding LCI and LCIA was **how to deal with different levels of detail**. For some countries many data may be available, for others this is not the case; and also methods will generally have a focus at some parts of the world. In order to cope with this problem, the starting point was formulated that the initiative should start with the most easy, least detailed level, and then subsequently go into more detail in as far as data and methods will be available. For the LCIA program this for instance means that methods will first be developed and documented at world level and for infinite time, and that thereafter attention will be given to subsequent spatial differentiation and integration over shorter periods of time (for the LCI program, see section 3).

2. A second question was **how to deal with uncertainty**. A distinction was made between uncertainty in data and methods. As starting point it has been laid down that the initiative should aim at establishing the most likely data and preferable methods. It is further stated that: "When there is not sufficient data available to validate which of the available approaches is preferable (either in general of for a specific type of applications), still the co-operation should aim on more general grounds to establish best available practice amongst the alternatives. This may go in hand with information about non-preferred options for performing sensitivity analyses".

3. A third question was **how to deal with value choices**. In the ISO process, this point had given rise to intensive debate, particularly for public applications, i.e. the so-called comparative assertions. For the initiative, the starting point was formulated that it can indeed deal with value choices, like those underlying the establishment of a default list of impact categories, and the choice of periods of time or the establishment of an equivalency principle for aggregation in LCIA. This will be done under two conditions. (1) The first condition is that the distinction between scientific and value based information shall be fully transparent; and (2) the second that the final responsibility for possible choices will lie in the hands of the highest authority of the initiative, the International Life Cycle Panel (ILCP). It is further important to note that the establishment of best practice for the weighting step in LCIA has been excluded from the initiative. However, the following was added: "... the relationship between characterisation, normalisation and weighting methods will be analysed, because of the inherent interactions between these elements".

4. A fourth question regarding the LCI and LCIA programs dealt with the **application dependency of the methods and data**. Does best practice in the field of LCA exist, or does everything depend on the case at hand or on the place in the world? Like with the above questions, differing viewpoints were presented. The idea was developed that best methods or data may differ, not so much between different applications, but between different types of applications. For instance, there should best practice for product design, in contrast to strategic decision making; or best data in North America, in Japan, or in Europe; or preferred use of marginal methods for some types of applications (for instance short term optimisation), and average methods for other types of applications (for instance long term comparisons). For this approach the term 'generic application dependency' was coined.

The inclusion of aims related to LCM led to a further development of starting points for the initiative. A first important point was that also **qualitative methods** and life-cycle thinking came under the scope of the initiative, not only quantitative LCA. And, following this line, also other analytical tools were included in so far as these specifically contribute to the underpinning of **life cycle management**. Perhaps most fundamental was the question whether the initiative should be more modest and just aim at stimula-

tion of the exchange of information, and forget about best practice. This suggestion was not without ground. The aims of the initiative, the establishment of best practice, were seen as too top-down oriented. Instead, a bottom-up discussion with stakeholders and particularly with industry branches was recommended, probably leading to case dependent results and to education activities. Here a balance was found. Indeed, discussion with stakeholders was put in the front, starting with an identification of user needs. But still the aims relating to the enhancement of sound databases and methods, and general guidance on the use of data and methods remained a core part of the initiative.

In order to avoid the idea that just one method is to be identified as best practice for all types of applications, the term 'best practice' was replaced by 'recommended practice'.

2 Aims and Programs of the Initiative

At the launch of the initiative in Prague, 28 April 2002, the aims of the initiative are formulated as follows:

General aim 1: Exchange of information on the conditions for successful application of LCA and life cycle thinking

General aim 2: Exchange of information about the interface between LCA and other tools

General aim 3: Implementation of education activities related to the application of LCA and life cycle thinking

General aim 4: Development and enhancement of the availability of sound LCA data and methods

General aim 5: Provision of guidance on the use of LCA data and methods.

In order to reach these aims, three programs will constitute the initiative:

Program 1: The application of and education on LCA and life-cycle thinking (LCM program)

Program 2: Development and enhancement of sound LCI data and methods (LCI program)

Program 3: Development and enhancement of sound LCIA data and methods (LCIA program).

Each of these three programs will start with a definition study, to be completed in 2002.

By defining the aims and programs, the niche of the initiative in relation to other international organisations can also be indicated more precisely. SETAC primarily focuses on the development of the science underlying LCA; the International Society of Industrial Ecology (ISIE) focuses on the scientific developments underlying the toolbox for life cycle management; ISO focuses on the standardisation of LCA terminology, of technical frameworks, of general methodological requirements and of procedural guidelines; and the UNEP/SETAC Life Cycle Initiative focuses on the application of and education on LCA and life-cycle thinking and on the development of and guidance on sound and practical LCA data and methods.

In the framework of the aims of the initiative as a whole, aims have also been established for the three programs. These are given in the sections below.

3 Specific Aims of the LCI Program

The LCI program builds on the report of the SETAC-Europe Working Group on Data Availability and Data Quality (De Beaufort et al., in press). The general aims of the LCI program are the following:

LCI aim 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 use materials

LCI aim 2: A set of rules for LCI modelling, including rules for the setting of system boundaries and for allocation. More specific aims regard the LCI databases:

LCI aim 3: A survey and evaluation of current and coming activities to build LCI databases

LCI aim 4: Consideration of an exchange format between LCI databases

LCI aim 5: Definition and authorisation of requirements for a UNEP/SETAC LCI database or information system, including consensus-based allocation rules

LCI aim 6: On the basis of these requirements, the development and maintenance of a UNEP/SETAC LCI database or information system

In the above aims consistently the phrase 'LCI database or information system' is used. Originally, just the term 'LCI database' had been used. There is an important difference here. The term 'LCI database' implies that all data will be gathered at one location; the aim would be a real global UNEP/SETAC LCI database. This aim appeared to be unpractical and undesirable. Unpractical, because data owners may not be willing to hand over their data, and also because the updating of such a database would become an increasingly difficult task. Undesirable, because such a database would induce competition with existing activities in the field of LCI databases, such as in Sweden, Switzerland and Japan. The term 'information system' is more open, concerning the location where the data are stored and updated. Such an information system can include, or can even be fully composed of decentralised databases. Still it concerns a coherent activity. Global criteria can be defined to evaluate the quality of the data, a format van can be established for the exchange of data so that the data from the different databases are compatible with each other, and, last but not least, default methods can be developed for aggregating data of different unit processes into building blocks or subsystems. Although the focus is on decentralised databases with central co-ordination, it has not been excluded that for a number of important background processes with global reach a database at world level will be developed under the umbrella of the initiative. This is an important open point to be further discussed.

This focus on Decentralised Databases also implies that the first starting point, presented in section 1, involving a development from a global level to subsequent more detailed lev-

els, may need refinement for the LCI databases and information system. For the methodological questions this starting point may still be true. For instance, the focus should be on generally applicable allocation rules, to be further specified for different types of applications, or increasing levels of sophistication. But for the storage of data, the start will rather be decentralised; the development of a possible global database for some important background processes may start at a later stage.

A few more words can be said about the **methodology development**. Important topics will include rules on the definition of system boundaries, the developments of a consistent set of allocation rules, the establishment of recommended practice regarding marginal and average modelling, guidance on the use of input-output data as alternative for the cut-off of processes, and possibly others. It is envisaged that the 'generic application dependency' as described in section 1, may substantially help to solve existing school differences. For which applications should we use marginal modelling, and for which average modelling? When should we include forests or land fills in the product system, en when are these to be regarded as part of the environment? When is a substitution approach adequate for solving the problem of dealing with multiple processes, when should economic principles apply? Also the distinction between different levels of sophistication may help in this respect. Some methods may preferably apply for simple screening applications, whereas others may particularly be useful for more sophisticated analysis. It will also be clear that the establishment of recommended practice will imply value choices. These should be dealt with as described in section 1.

The focus in this article is on the content of the initiative. However, it should be borne in mind that the process aspects will be just as important. So it is one thing to define the aim that a coherent information system will be developed. It is another issue to bring this into practice. What mechanisms can be put in place so that it will be an advantage for a local database developer to join the process?

4   Specific Aims of the LCIA Program

The LCIA program builds particularly on the report from the first and second SETAC-Europe Working Groups on Life Cycle Impact Assessment (Udo de Haes et al. 1999, Udo de Haes et al., in press). The aims of the LCIA program are the following:

LCIA aim 1: A consistent conceptual structure of LCIA, including the relationship with the LCI processes on the one hand (the environmental stressors), and the Areas of Protection (the classes of issues to be protected by society) on the other hand
LCIA aim 2: An encompassing flow diagram of environmental processes, enabling a consistent choice of category indicators at midpoint level and at endpoint level
LCIA aim 3: A default list of impact categories, possibly consisting of two sets, on at midpoint and one at endpoint level (= physical damage level), including new ones for developing countries

LCIA aim 4: Recommended practice regarding a set (or two sets) of category indicators
LCIA aim 5: Recommended practice regarding methodologies for the calculation of characterisation factors for the different impact categories
LCIA aim 6: Recommended characterisation factors for the different impact categories, to be included in database on LCIA

With respect to the first two aims, I can also refer to the discussion which has been held in the Global LCA Village website (http://www.scientificjournals.com/ehs/globalvillage/welcome.htm) about the conceptual structure of LCIA (The Areas of Protection Debate; http://dx.doi.org/10.1065/ehs2002.03.014). What do we want to protect and why? How can we classify these endpoints in the so-called Areas of Protection? Can we indeed consistently distinguish between a midpoint and an endpoint level? These aims also involve possible proposals for a change in the LCIA terminology. An example concerns the choice between 'environmental intervention', 'environmental exchange', 'stressor' or 'elementary flow'. Other examples concern the term 'environmental mechanism', coined in ISO 14042 but hardly used by anybody; and the choice between the term 'Area of Protection' versus the term 'Safeguard Subject'. It should be clear that the establishment of new terminology is not an aim of the initiative. However, it is desirable that the initiative will give advise to the coming new round of ISO on LCA.

With respect to the third and fourth aim, a default list of impact categories and a discussion on category indicators has been included in the report of the first SETAC-Europe Working Group on LCIA (Udo de Haes et al. 1999) which has been further elaborated in the report of the second working group (Udo de Haes et al., in press). A new element here concerns the specific attention for new impact categories beyond the traditional set. On the one hand, this will concern categories which are particularly relevant for developing countries, such as soil erosion and salinisation; on the other hand, this will concern impact categories which represent regulation functions of the natural environment, also summarised under the term 'Life Support Functions' (see discussion in Udo de Haes et al., in press, chapter 8). A specific element in these two aims concerns the distinction between elements at midpoint and at endpoint level (cf. Bare et al. 2000), also known under the terms 'state' and 'impact' in the framework of the European Environmental Agency (1998).

Aim 5 and 6 deal with the final results: recommended practice regarding characterisation factors. Data on both fate and effect of the different substances (and on other types of stressors) have to be analysed in depth: what are the causes of existing differences between different authors? Also of crucial importance will be that the results will be peer reviewed by independent teams of experts. Another important aspect here is how to deal with the missing data on the vast majority of toxic substances. Particularly for the last issue the initiative is facing an interesting challenge: the need to bring together science and pragmatism, to obtain characterisation factors and data sets that are scientifically defendable, and yet relevant and practical for to the decision maker.

5 Specific Aims of the LCM Program

The LCM program is application-oriented. How can LCA and life-cycle thinking be brought into practice of business and policy decision making? The aims of the LCM program regard the following:

LCM aim 1: Identification of needs for LCA and life-cycle thinking
LCM aim 2: Discussion on the different applications of LCA and life-cycle thinking in business and policy decision making; identification of examples of successful applications; identification of success and failure factors; and provision of guidance for the use of LCA and life-cycle thinking
LCM aim 3: Discussion on and explanation of the role of different – detailed and simple – analytical and procedural tools in LCM
LCM aim 4: Inclusion of social and economic dimensions in LCA and life-cycle thinking
LCM aim 5: Discussion on and explanation of the position of the present initiative in relation to other programs or initiatives
LCM aim 6: Education regarding LCA and life-cycle thinking.

The first two aims are dealing with the application of LCA and life-cycle thinking. The first aim deals with the identification of the needs for the application of LCA and life-cycle thinking in business and policy-decision making. The second aim deals with an analysis of successful (or not successful) applications of LCA and life-cycle thinking, and the factors which play a role in determining the success. On the basis of an analysis of the needs and of the success and failure factors, guidance will be provided for the use of LCA and life-cycle thinking in business and policy-decision making. 'Business and policy-decision making' refer to a broad range of applications: including both business and government as stakeholders, and including the full range from operational management to strategic decision making. It may also include other stakeholders as users, such as consumer organisations.

In the aims 3 and 4, the scope of the program is extended in different ways. Firstly, other analytical tools which are relevant for LCM are examined. Examples include: Substance Flow Analysis (SFA), Material Flow Accounting (MFA), Environmental Risk Assessment (ERA), Life Cycle Costing (LCC), and Total Cost Accounting (TCA). The work on this aim particularly builds on the results of the EU-concerted action CHAINET (Wrisberg et al., in press). Also simplified tools are included under this aim. These will include tools for product design, for company benchmarking, for green accounting, or for sustainability reporting. Examples of such tools are: eco-design criteria, eco-indicators, sustainability indicators and eco-efficiency indexes. Finally, also procedural tools are a topic of aim 3. Examples include: Environmental Management Systems (EMS) according to ISO 14001; environmental audit, according to ISO 14010; different types of environmental labelling, amongst others according to the ISO 14020 series; green procurement; and supply chain management. Under aim 4, the other two dimensions of sustainability are dealt with, i.e. the social and economic dimensions.

Taking the full scope of the LCM program, under aim 5 the program is positioned in relation to connected programs or initiatives in the area of sustainable development. Examples concern the UNEP Cleaner Production Program, IPP and Product Stewardship. The final aim 6 concerns the education of stakeholders on basis of the results of the initiative, by providing training modules, by organising courses, and by promoting the use of LCM by industry, governments and consumer organisations.

6 Conclusions

The conclusions about the development of the content of the LC Initiative are the following:

* A specific niche for the Life Cycle Initiative has developed, compared with the role of SETAC, the International Society of Industrial Ecology (ISIE) and ISO.
* The aims of the initiative have step by step been extended, by bringing the initiative at a world level, by including both LCI and LCIA, and by including a program on Life Cycle Management (LCM).
* In the LCM program due attention is to be given to other tools and approaches than quantitative LCA which are relevant for life-cycle thinking in general, and also to the other two dimensions of sustainability, i.e. the social and economic dimensions.
* A number of important questions regarding the scope of the initiative and the methodological set-up have been in-depth discussed, thus resulting in a clear basis for the technical content of work to come.
* Three definition studies will now be implemented which will define the work program for the three programs of the initiative; these studies will be finalised by the end of 2002.

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