Commentaries

How to Improve Adoption of LCA

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Abstract

This article reviews efforts made by the United Nations Environment Programme to assess the progress in life cycle assessment (LCA) implementation worldwide. The effort was approached in two stages. First, research was carried out which included a document search and a survey of LCA practitioners. Secondly, an expert workshop of LCA practitioners was held to review the survey results and to develop recommendations for action. Results highlight that there is significant and growing interest in LCA and that its use is increasing. To foster better LCA adoption, industry, government and other societal groups will have to address barriers due to a lack of: a perceived need for LCA, of expertise or know how, of funding and a lack of data and methodology.

Keywords: Case studies; environmental management; implementation, LCA; LCA; Life Cycle Assessment; methodology, LCA; policy strategies; UNEP; United Nations Environment Programme

1 Introduction

The mission of the UNEP's Division of Technology, Industry and Economics is to help decision makers in government, local authorities and industry to develop and adopt policies, strategies and practices that are cleaner and safer, make efficient use of natural resources, ensure adequate management of chemicals; incorporate environmental costs; and reduce pollution risks to human beings and the environment. Within the Division, the Production and Consumption Unit aims at reducing the environmental consequences of industrial development and the pollution arising from an ever greater consumption of goods and services. In essence, societies must reorient their consumption patterns towards cleaner and safer production patterns. Production process-oriented or supply-side activities, such as Cleaner and Safer Production and Industrial Pollution Management, are being supplemented with consumption or demand-side activities. And addressing consumption patterns requires a better understanding of the driving forces behind increasing consumption trends.

The Unit carries out its work by working with industry to translate new and existing environmental management practices into practical tools and information that can enable them to improve their economic as well as environmental performance. The Unit informs and trains business decision-makers in small and medium sized enterprises and people working in developing countries to integrate these approaches into their work. The Unit also involves other stakeholders – government and non-governmental organizations (NGOs), for example.

Life cycle assessment (LCA) itself has proved to be a particularly valuable quantitative tool as well as a methodology or "way of thinking" that can be applied to production and consumption issues with fruitful results. In various forms, is has been applied to production processes, product design, and policy issues for several decades. In fact, the quantifying stage is never reached in many LCA applications. It is the qualitative use of LCA or LCA "thinking" which helps guide the decision making process. It makes sense that – in order to make good decisions – good information is necessary. As with all investment decisions, one wants to limit risks as far as possible and to maximize the market advantages. This is the thinking behind LCA. As an approach, it supports decision making and improves decision making.

Recognizing the potential of LCA to improve environmental management decisions, UNEP has initiated various activities to disseminate the state of the art experiences to promote further implementation. UNEP prepared the document "Life Cycle Assessment: what it is and how to do it" in 1996 to provide background information on the LCA concept and examples of current practice. The document also places LCA in the framework of other environmental analysis tools such as environmental impact assessment, risk analysis and technology assessment.

As a follow-up effort, UNEP, with the support of the governments of the United States, Switzerland and the Netherlands, initiated a project to determine the status of LCA implementation worldwide, barriers to better implementation and recommendations to overcome these barriers. This article briefly outlines this effort.

2 How was LCA Status Determined?

Determining LCA implementation worldwide was approached in two stages. First, a research effort, which included a document search and a survey of LCA practitioners was initiated and, secondly, an expert workshop of LCA practitioners was held to review the survey results and to develop recommendations for action for requisite stakeholders – government, industry, academia and non-governmental organizations (NGOs). This article presents the findings of these efforts.

To evaluate the current status of LCA, a limited though representative worldwide survey on the use of LCA was initiated. The goals of the survey were to obtain an indication of the level of application of LCA in industry and government,

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in developed, transitional and developing countries, as well as to get an idea about the barriers and success factors related to its wider use. More than 40 people from 31 countries were asked via email to fill in a questionnaire about LCA use in their respective countries. Twenty-four people from 20 different countries responded to the questionnaire. The countries represented were: Brazil, Canada, the Czech Republic, Germany, Italy, Japan, Korea, Lithuania, Malaysia, the Netherlands, New Zealand, the People's Republic of China, Singapore, Slovenia, South Africa, Switzerland, Thailand, United Kingdom, and the United States. (For more detailed information about the survey, contact UNEP TIE.)

In June 1998, UNEP hosted an expert meeting to review the survey results and to come up with a list of existing barriers to LCA implementation and a list of actions to overcome them. Fifty potential users and experts from 26 countries attended the workshop "Towards Global Use of LCA" which was held in San Francisco, California in the United States.

3 Who Uses LCA and Why?

As a first step in reviewing the results, an analysis was carried out on who uses LCA and why. The information from the survey was supplemented with document research and confirmed at the expert meeting. Overall LCA is used by industry, government, and NGOs to support decision making situations related to product development or comparison, the market situation, investments, and strategy development. The motivations for use differ amongst user groups. In industry, market forces and regulatory pressures are the main external factors, while internal forces come from company personnel. Industry is the main user of LCA for product-related decisions, using it primarily to improve existing products and redesign existing concepts. For government, the main motive is to shift environmental policy towards preventive measures, moving away from the generally less effective and more expensive, end-of-pipe measures. For government, the main application is in the area of product policy such as setting product requirements and product-related ecotaxes. For NGOs, including consumers and consumer organizations, more general motives are present, often involving how to make product purchasing decisions with an eye to personal health concerns. LCAs are usually performed by consumer organizations for the use of consumers and other NGOs. The purposes and reasons for LCA use by various groups are summarized below in more detail.

3.1 Industry

Ideally, LCA can be used to design or improve products, and to develop marketing and supply chain management strategies. Companies can also improve product environmental performance, (which can increase profits) and can use LCA as part of its environmental communications to provide more product information. At present, LCA is primarily used by companies internally to support their environmental decision making. The most frequent applications are related to:

- design, research and development,
- comparison of existing products with planned alternatives, and
- providing information and education to consumers and stakeholders.

Companies tend to use LCA for incremental product improvements and not for new product innovation. Surprisingly, the survey showed that LCA is rarely used for the identification of environmental bottlenecks or in the definition of marketing and advertising policies. The increasing trend towards chain management of a product – meaning that a company is held responsible for product use and disposal as well as design – has also led to an increased LCA use to meet these responsibilities and formulate company policies.

Industry Examples of LCA Use

Market Advantages ofToxic Free Carpets: After a stream-lined LCA of the carpet production process, Donau-Tufting GmbH in Germany phased-out heavy metal colors and vulcanization chemicals. The chemical-free carpet resulted in a 25% increase in annual turnover.

High Financial Savings: TransAlta Utilities undertakes "life-cycle management" on its purchasing and major projects. An LCA-inclusive costing effort helped them link the design, purchase, installation, use, maintenance and decommissioning of wood power poles. They have incurred significant savings given the one million plus poles in service.

Higher Materials and Transport Efficiency: In 1994 in Germany, Procter and Gamble compared conventional and compact detergents and was able to show that compact detergents could save 30% of raw materials yearly, 40,700 trips of truck, and 53 million MJ of energy. The chemical company Henkel analyzed the packaging of detergents, and reduced the amounts of energy used for package production. Smaller packages resulted in a savings of 74% of transportation space.

3.2 Government

At present, the main role of LCA is in environmental labeling and the formulation of regulations on product policy and waste management. However, there are high expectations of its future use in policy areas – such as green government purchasing, eco-management and auditing, green design guidelines and awards, and sector benchmarking.

The survey showed that most of the responding countries are moving towards integrating life cycle thinking in standard decision-making procedures, such as in eco-labeling criteria. Examples are the eco-labeling schemes in Germany, the UK, the Netherlands, Scandinavia and Thailand, and in the EU eco-labeling scheme.

The public sector is also using LCA in product and waste-policy development (UK and Germany); for procurement

Government Examples of LCA Use

The Dutch Packaging Covenant: A number of LCAs comparing one-way packaging systems with recycling systems have been carried out in the context of the Dutch Packaging Covenant, which involved different actors in the packaging chain. The results were different for different applications. Hybrid systems consisting of one-way packaging in combination with a durable container at home, for instance, scored relatively well. Moreover, LCAs identified environmentally weak points in packaging, which have led to product improvements in a number of cases. Overall, the LCAs provided useful input into the policy making decision process.

The United States Environmental Protection Agency carried out a number of LCAs and over time has gained experience in how to integrate them into policy decisions. One practitioner noted: "We came to realize that LCA should not be expected to be a 'black box' approach, and that the real usefulness of LCA is in identifying opportunities for product and process improvement. We have come a long way in just a few years in the better understanding of LCA methodology and applications."

of environmentally preferable products (USA); in directives for waste management (European Union Waste Directive) and cleaner production (European Union Integrated Product Policy). Furthermore, LCA has been used in sector covenants between the public and industrial sectors. The survey indicates that more countries will integrate LCA into sector covenants in the future.

3.3 NGOs and Consumers

LCAs supply consumers with information to help make product selection decisions and to influence related subjects. This, in turn, can influence enterprises and governments. NGOs can usually mobilize large groups of citizens via environmental groups, consumer organizations, and trade unions. Overall, the use of LCA by NGOs is not very widespread due to their limited resources and access to data. However, when LCAs are available, their results are used. Consumer purchasing decisions set the demand for products and services. With the LCA information, consumers who care about the environment can change their purchasing behavior, in turn sending a message to the industry to increase the environmental performance of products. This demand-side aspect is critical in the transition towards a sustainable society.

4 What is the Status of LCA Implementation Worldwide?

The survey and expert meeting revealed that Europe, North America and Asia are in the forefront of the development, adoption and application of LCA. However, most countries discussed, and those in the survey, are still at the beginning stage of LCA use, and there are clear differences in both application and expectations between countries with their experience in using LCA and with those without experience. The main results include:

- Eco-labeling schemes, government initiatives such as liabilities, product and waste management policies, and emerging green markets were identified as the most important factors that stimulate LCA.
- Countries experienced in the use of LCA highlight the importance of LCA as a quantitative scientific tool, while countries with less LCA experience tend to see it more as a way of thinking. However, the latter have high expectations of the future use of the LCA tool, provided clearer methodologies are developed, along with improved synergies with other tools.
- The use of LCA for validating market claims is indicated as an important application in countries with less LCA use, while countries with more LCA use place less significance on this aspect. They state that the most significant application is related to product development and measuring the performance of planned alternatives against existing products.
- Communicating LCA results to decision makers is sited more frequently as a problem in countries more experienced in LCA use. Whereas the costs of implementing LCA findings is cited as a major obstacle in countries with less LCA use.

Overall, there are high expectations about the future usefulness of LCA. Current LCA applications are primarily in product-oriented decisions, covering both the product itself and the technologies used. Increasingly, more general types of use such as market-oriented decisions, investment-oriented decisions and strategy-oriented decisions are establishing themselves.

LCA has been applied successfully in many cases, and there seems to be opportunities for further use. A broad community of scientists, policy makers, NGOs and companies have displayed interest. Furthermore, the growing interest in "chain" management implies that LCA can play an important role as a tool. Specific opportunities for improving widespread use lie in:

- Increasing the number of studies and users in the main areas related to product and market decisions, including integrating LCA into existing tools such as eco-labeling, education, and environmental management systems; and
- Extending the use of LCA to investment and strategy decisions, such as cost effective emission reduction strategies, legislation and eco-taxes – areas where LCAs are currently in limited use.

6 What are the Barriers to Better Implementation?

The potential of LCA as a decision-support tool is constrained by a number of barriers from inside and outside the LCA community of stakeholders. The study indicated that the costs of LCA, methodological issues, and communication were three of the main barriers. A further discussion of barriers took place at the UNEP workshop in San Francisco, resulting in a grouping of the barriers into the four categories discussed below. The relative importance of these barriers differs between countries, between different users and between different applications. Countries with less LCA practice are confronted with the first-mentioned type of barrier, the absence of any perceived need for LCA, while countries with more extensive LCA experience suffer more from the last-mentioned type, a shortage of data and methodologies.

To overcome these barriers, efforts are needed in education and communication, in setting public policies, and in the further scientific clarification and development of LCA and related tools. Specific recommendations and who should carry them out, are listed after the barriers.

Barrier 1: Absence of a perceived need for LCA. A general lack of environmental awareness and lack of chain management responsibility are basic barriers to LCA use. This differs among countries, organizations and companies. The lack of commitment to LCA or to the environment at the top management level, as well as a lack of integrated LCA procedures, are also significant barriers.

Barrier 2: Lack of LCA expertise or know-how. The lack of expertise to perform and understand LCAs is a particular problem in developing countries, for small and medium-sized enterprises (SMEs), and for policy-makers. The inability to communicate about LCA methodology and outcome is also a problem.

Barrier 3: Lack of LCA funding. There is an assumption that LCA is costly because of the extensive need for data and expertise. This is especially true for developing countries and SME's. In addition, the ISO requirements on review procedures could increase the LCA cost.

Barrier 4: Lack of data and methodologies. Data quality and availability are major practical bottlenecks in LCA studies. There is not one agreed upon manner to carry out an LCA, and ISO standardization does not solve the problem: in fact it may disqualify current methods. Furthermore, users are not always clear how LCA "fits in" as related to other available environmental management tools.

5 Recommendations: What can be done and who should take action?

A list of actions was drafted by the LCA experts at the San Francisco meeting. They highlight what can be done, by whom, to overcome the above listed barriers and improve the implementation of LCA use worldwide. They include:

What can intergovernmental organizations do?

- Continue developing and disseminating LCA information and set-up a global clearinghouse providing: training modules, methodology information, data, case studies, and success stories with detailed (economic) benefits. A clearinghouse could serve as an important mechanism to promote LCA in developing countries. A global interest group should be set up in connection with the clearing-house in order to monitor, collate, analyze and disseminate LCA results. This interest group could also play a role in connection with review activities.
- Support the development of LCA training programs and subsidy programs for developing countries.

What can governments do?

- Create incentives for the use of LCA, via promoting chain management responsibility; green procurement; and integrating LCA into environmental policy-making and decision-making procedures. However, the use of LCA in policies used as taxes and bans should be avoided for the time being in order not to conflict with international trade regulations.
- Support LCA capacity-building and method development. This may well involve international co-operation and agreements between governments, business and academia to reduce the costs and stimulate coherent developments.

What can industry do?

- Integrate LCA into product development, market-oriented and environmental management decisions.
- Make LCA data publicly available and, with governments, support a database for background data. To address the confidentiality issue, this may take place at a sector level rather than on a company level.

What can consultants do?

- Develop a market for LCA through awareness raised at the company level. LCA should be sold as a tool for environmental product management and not as a complicated universal tool.
- Promote the qualitative aspects of LCA studies.
- Develop user-friendly software.

Academia

- Develop LCA training programs and manuals to address general LCA issues as well as sector-specific and application-specific applications.
- Develop LCA methodologies at different levels of detail which are currently lacking, such as a simplified LCA method.

What can NGOs do?

- Set up environmental awareness campaigns for consumers to advocate green products and life-styles.
- Get involved in the LCA community and cooperate with governments and academia in order to influence future LCA developments.
- Use LCA-based information to advise consumers on product choice and life-style.

7 Conclusion

The results of the LCA global survey and expert meeting reveal a number of critical issues. LCA thinking can be effective in improving environmental decision making. Governments, companies, non-governmental organizations (like consumer associations) are becoming increasingly interested in and using LCA. The responses from LCA practitioners from over 20 countries reflect that the use of LCA is increasing due to eco-labeling schemes, government initiatives (e.g. liability), product and waste management policies, and emerging "green" markets. However, the lack of awareness, data, resources and expertise still pose problems. To overcome these, involved stakeholders need to take action, both individually and collectively. The proof exists that LCA works and benefits all involved, the challenge ahead is to continue moving forward with implementation.

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