

Life-Cycle Assessment in North America

An Update on Capacity Building

James A. Fava and Joyce Smith Cooper

Businesses and governments are increasingly examining how environmental and social considerations can be incorporated into their decision making. Within this context, the understanding and use of life-cycle thinking and life-cycle assessment (LCA) has slowly spread within North America. A clear understanding of why this change is occurring, what challenges remain, and what knowledge, skills, and tools to address these challenges to further advance the use of life-cycle thinking and LCA is needed. In this column, we attempt to identify some of the challenges and provide insights for future efforts to build capacity for life-cycle thinking and LCA in both North American universities and the private sector.

Within the context of LCA, “capacity building” refers to development of the skills, datasets, tools, and knowledge needed to more fully incorporate life-cycle information into private and public decision-making processes. Although there may be a variety of ways this can be described, we believe that there are three major components to capacity building: (1) the promotion of life-cycle thinking and LCA, (2) adequacy and completeness of LCA data, and (3) tool development and dissemination.

North America has lagged behind Europe in the promotion and application of LCA. Over the

last few years, however, increased understanding, development, and use of LCA have emerged in North America. For example, life-cycle thinking and LCA are now promoted in North America through the following:

- The United Nations Environment Program/Society of Environmental Toxicology and Chemistry (UNEP/SETAC) Life-Cycle Initiative (www.unep.org/pc/sustain/lcinitiative/home.htm) and the activities of the American Center for Life-Cycle Assessment (www.lcacr.org)
- The activities of National Research Council Canada (http://dfe-sce.nrc-cnrc.gc.ca/overview/lifeCycle_e.html)
- The International Society for Industrial Ecology (www.is4ie.org/)
- The Interuniversity Reference Center for the Life-Cycle Assessment, Interpretation, and Management of Products, Processes, and Services at the École Polytechnique de Montréal (www.polymtl.ca/ciraig/ciraig_eng.html)
- The California Environmentally Preferable Product Database (www.eppbuildingproducts.org/), which has begun to incorporate LCA into product standards developed by the California Division of the State Architect as part of the California Sustainable Schools Program
- The U.S. Green Building Council

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(www.usgbc.org)), which is forming groups to address the value and use of LCA within its Leadership in Energy and Environmental Design Green Building Rating System[®]

Similarly, LCA data and tool-related efforts since 2000 in North America have included the following:

- The U.S. Environmental Protection Agency's LCAccess System (www.epa.gov/ORD/NRMRL/lcaccess/index.htm) for the identification of tools and available data
- The U.S. Department of Energy's Life-Cycle Inventory Data Project (www.nrel.gov/lci/)
- The Canadian Raw Materials Database (<http://crmd.uwaterloo.ca/eng.html>)
- Building for Environmental and Economic Sustainability (BEES), which measures the environmental performance of building products by using the LCA approach (www.bfrl.nist.gov/oe/software/nees.html)
- The ATHENA Institute's Environmental Impact Estimator, which uses data in a building systems context to capture the environmental dimensions of a project for conceptual building design (www.athenasmi.ca/ath_model/model_main.htm)
- A variety of private tools and databases, for example, software packages such as GaBi 4, TEAM, and Sima-Pro, developed by international consultancies that can be used in North American projects

These and similar efforts worldwide have substantially changed LCA capacity in North America; there is now more information on how to use LCA in decision making and an increased availability of inventory and impact assessment data.

Although increased guidance on how to integrate life-cycle approaches in decision making and improved data availability have increased LCA capacity both in the context of university research and in private decision making in North America, significant challenges remain. Thus, we attempt to identify these challenges and project the direction of future efforts to build LCA ca-

capacity in both North American university research institutions and the private sector.

First, in the past, university research and educational programs in LCA have been data poor: Inventory data have been held as proprietary, have been too expensive, and/or have been subject to publication restrictions. Similarly, impact assessment data have been held in unlinked and hard-to-find sources with little attention paid to regional specificity. This lack of data has hindered the development of (1) transparent and reproducible methodological advances and (2) classroom examples. Today, inventory and impact data are available and affordable through numerous database projects (including free national databases and notably through the Eco-Invent project described at www.ecoinvent.ch) as well as through impact assessment tools with global, regional, and local specificity, such as the U.S. Environmental Protection Agency's TRACI (see www.epa.gov/ORD/NRMRL/std/sab/iam_traci.htm) and the related articles in this journal by Bare and colleagues [2002] and Norris [2002]). Also, datasets conforming to the Eco-Spold format (see www.lcacenter.org/InLCA-LCM03/GRebitzer97/sld001.htm) provide a wealth of metadata. Clearly, future capacity-building activities at universities should focus on integration into the classroom and research in data quality (especially completeness), on transparent, reproducible methodological advances (e.g., impact assessment methods in eco-toxicity and human toxicity), and on better understanding of the environmental preferability of products.

Within the private sector, we are seeing a growing interest in better understanding the risks and opportunities associated with products from raw materials acquisition to end-of-life disposition. Businesses are recognizing that the life-cycle approach is a powerful systems framework for evaluating a product or technology from a cradle-to-grave or cradle-to-cradle perspective. A continuum of life-cycle approaches exists, from a qualitative approach on one side (i.e., life-cycle thinking) to increasingly more comprehensive quantitative assessment approaches at the other side (i.e., LCA). The realization of this distinction between life-cycle thinking and LCA is advancing, and companies are better able to use various life-cycle approaches to understand and

manage the risk and opportunities associated with their products and materials.

More training and awareness raising on the strengths and weakness of these life-cycle approaches, in what circumstances they are best applied, and how they can be successfully incorporated into decision making is needed. This awareness building will likely take three directions (simultaneously in some cases and subsequently in other cases): (1) ensuring in new product development and innovation that unexpected and unacceptable risks along the product's life cycle are identified and prevented, (2) piloting LCA studies to understand what life-cycle information might provide for more informed decision making, and (3) examining how the information can be used to create product branding or positioning with customers.

With respect to risk management applications, we foresee more efforts to conduct initial goal and scope definition that is used to ensure clarity on the intended purpose (e.g., marketing, product or technology evaluation, comparative assertion), audience (e.g., internal, external), and scope (e.g., functional unit, boundaries, data requirements, assumptions) of the LCA study. This goal and scope examination should occur with a cross-functional team (e.g., representatives from environment, sales, research and development [R&D], operations, and purchasing) to reach consensus on the purpose, audience, and scope. Such efforts build an understanding of LCA and its value.

Piloting of the LCA tool within companies is likely to occur with more frequency because of both the greater availability of data and models and the increased demand for life-cycle information from programs such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Rating System, the California Sustainable Schools Program, and end customers. Selection of the product for piloting may cover a high-profile product, a product that is perceived as being at risk, or a product for which an environmental preferability is perceived. The results will provide insights into whether and how life-cycle information and tools might be integrated into decision processes.

Application of life-cycle information for use in marketing may take a number of forms. One possible option is environmental product decla-

rations (EPDs). The intent of an EPD is to provide the basis of a fair comparison of products according to the products' environmental performance based upon the ISO 14040 series of standards. It can reflect the continuous environmental improvement of products over time and communicate relevant environmental information along a product's value chain. See www.environdec.com for more details and examples of EPDs.

We have observed that although over the past several years significant progress has been made in building LCA capacity in North America, there is still much work to be done. Our plan is to survey researchers in universities and colleges and practitioners in the government and the private sector to test our perception of the challenges to building capacity for improved understanding and application of life-cycle approaches in North America. If you are interested in participating and/or providing information, please contact one of us.

References

- Bare, J. C., G. A. Norris, D. W. Pennington, and T. McKone. 2002. TRACI: The tool for the reduction and assessment of chemical and other environmental impacts. *Journal of Industrial Ecology* 6(3): 49–78.
- Norris, G. A. 2002. Impact characterization in the tool for the reduction and assessment of chemical and other environmental impacts: Methods for acidification, eutrophication, and ozone formation. *Journal of Industrial Ecology* 6(3): 79–101.

About the Authors

James A. Fava is the managing director of Five Winds International, an international sustainability implementation consultancy based in the US, Canada, Germany, and the Netherlands. **Joyce Smith Cooper** teaches in the Department of Mechanical Engineering and directs the University of Washington Mechanical Engineering Design for Environment Laboratory at the University of Washington in Seattle, Washington, USA.

Address correspondence to:

Jim Fava
626 Meadow Drive
West Chester, PA 19380 USA
(j.fava@fivewinds.com)
(www.fivewinds.com)

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