

# Preface

It is an old observation that ‘What gets measured gets managed’, and that what is not measured or measurable runs the risk of being neglected. It is therefore important that we have tools for assessing the sustainability of our choices when we develop the technologies and systems that shall help us determine and meet the needs of the present generations in a way that does not compromise the ability of our descendants to meet their needs in the future.

As you will learn from this book, we must take a life cycle perspective when we want to assess the sustainability of the solutions that lie in front of us. You will be presented with many examples of problem shifting where solutions that improve or solve a targeted problem unintentionally create other problems of environmental, economic or social nature somewhere else in the systems of processes and stakeholders affected by our choice. If we do not consider the totality of these systems in our analysis, we will fail to notice these unwanted consequences of our decision and we will not be able to take them into consideration. We also have to consider a broad range of potential impacts in our assessment, in fact all those is that the system can contribute to and that we consider relevant in the context of our decision-situation.

Life Cycle Assessment, LCA, offers this totality—it analyses the whole life cycle of the system or product that is the object of the study and it covers a broad range of impacts for which it attempts to perform a quantitative assessment. The focus of LCA has mainly been on the environmental impacts although both social and economic impacts can be included as well. It is an important assessment tool as demonstrated by the central role that it has been given in the environmental regulation in many parts of the world and certified by its ISO standardization and the strong increase in its use over the last decades by companies from all trades and all over the world.

Engineers and scientists who develop decision support, or make decisions where sustainability is a concern, should understand the need to view the solutions in a life cycle perspective and to consider possible trade-offs between environmental impacts and between the three sustainability dimensions. Designers and engineers who design and develop products and technical systems should be able to critically

read and evaluate life cycle assessment information about the alternatives that they are considering, and the environmental sustainability specialists among them should also be able to perform the LCA studies.

## **Why this Book?**

It is the purpose of this book to offer the reader the theory and practice of LCA in one volume comprising:

- A textbook, explaining the LCA methodology and the theory behind it in a pedagogical way with a meaningful balance between depth and accessibility
- A cookbook offering recipes with concrete actions needed to perform an LCA
- A repository of information about experience with the use and adaptation of LCA and LCA-based approaches within policy-making, decision support and life cycle engineering and management, and a collection of chapters presenting results and methodological challenges from the use of LCA in some of the central technological application areas of LCA

Focus is on environmental impacts but life cycle sustainability assessment is considered through introductory chapters on social LCA and on life cycle costing.

## **Who is the Target Audience?**

The book was written to support the LCA learning of

- University students, from undergraduate to Ph.D. level
- Researchers and (university) teachers
- Professionals looking to get started on LCA and quantitative (environmental) sustainability assessment
- LCA practitioners looking to deepen their knowledge of specific aspects of LCA methodology (e.g. uncertainty management) and LCA practice in specific areas (e.g. electro-mobility, buildings, biomaterials, etc.) and looking for relevant literature for further reading.

The structure of the book with separate and comprehensive parts on LCA methodology (theory), LCA cookbook (own practice) and LCA applications (practice of others) allows it to cater to the needs of this rather broad group of potential users.

## Who Wrote the Book?

A total of 68 authors contributed to the writing of this book (see short presentations of contributors at the end of each chapter). The core team consisted of researchers from the division for Quantitative Sustainability Assessment at the Department of Management Engineering at the Technical University of Denmark, where the three editors have or have had their employment (Ralph Rosenbaum now is an Industrial Chair for Environmental and Social Sustainability Assessment at the French National Research Institute of Science and Technology for Environment and Agriculture (Irstea) in Montpellier, France). Other contributions were solicited from leading experts within each field from the rest of the world, in particular for discussion of the different applications of LCA.

## Who made it Possible?

A book like this requires much work apart from the writing of the text before your eyes, and it had never reached your hands without the indispensable contributions from staff of the division for Quantitative Sustainability Assessment at the Department of Management Engineering at the Technical University of Denmark.

We also wish to thank all contributing authors for their timely and fine contributions, their constructive collaboration and not least their patience with a production process that lasted far beyond what was planned when we started.

We hope that this book will find a broad audience worldwide and strengthen the assessment of sustainability in the future, because what gets measured gets managed...

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