Forum for Sustainability through Life Cycle Innovation

Workshop Report

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1st Stakeholder Meeting of the FSLCI's Academic Partnership Program

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Luxembourg

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Workshop Report

1st Stakeholder Meeting of the FSLCI's Academic Partnership Program

6.-7.9.2017 | Luxembourg

Workshop Participants

- Alexis Laurent (Technical University of Denmark)
- Guido Sonnemann (Université de Bordeaux)
- Miguel Fernandez Astudillo (LIRIDE-Université de Sherbrooke)
- Philip Strothmann (Forum for Sustainability through Life Cycle Innovation)
- Ralph Rosenbaum (Irstea Montpellier)
- Steffi Weyand (TU Darmstadt)
- Tobias Viere (Hochschule Pforzheim)

Introduction

The FSLCI recently launched its Academic Partnership Program. The Program is going to focus specifically on life cycle education in the context of higher education at universities and brings together academic groups from around the world which are interested in sharing their respective knowledge and collaborate on the subject. The Academic Partnership Program was launched during its 1st Stakeholder Meeting, which took place back-to-back LCM 2017 in Luxembourg. The workshop convened members of the following academic groups who recently joined the program:

- Analyse du Cycle de Vie et Chimie Durable (CyVi Group) | Université de Bordeaux
- Quantitative Sustainability Assessment (QSA) | Technical University of Denmark
- Material Flow Management and Resource Economy | TU Darmstadt
- Laboratoire Interdisciplinaire de Recherche en Ingénierie Durable et en Écoconception (LIRIDE) | Université de Sherbrooke
- Institute for Industrial Ecology (INEC) | Hochschule Pforzheim

The workshop focussed on an exchange of knowledge and practices and defined the scope and vision of the Academic Partnership Program. This report summarizes the discussions that took place during the workshop and provides an overview of agreed outcomes and future to-dos.

Scope

Initially, workshop participants discussed the scope and role of the Education Working Group. It was agreed that even though education in the sense of wider society learning and lifelong learning was important, this group should initially focus on education in the narrower sense of university education. It was also agreed that the group should not duplicate what others are already doing, with regards to trainings on LCA etc.

More specifically it was noted that the group should focus on linking up those that do teach LCA, whereas another group might be better positioned to focus on the communication and outreach side that is related, yet different. To this end it was suggested that the communication group could focus on an information package that the FSLCI could develop to help easier communicate about and advocate to the outside world on how to take a life cycle approach.

Participants noted that there is a broad range with regards to the quality of teaching LCA and that students who want to develop a deeper understanding of LCA are often faced with educators that lack the experience or understanding of LCA. This especially becomes an issue when students seek to write a Bachelor / Master thesis based on LCA and their supervisors lack the needed knowledge to guide them through the process. This understanding has been again reinforced and communicated by students who attended the recent FSLCI's recent Summer School on Life Cycle Approaches to advance Sustainable Regional Development.

Workshop participants agreed that there is both, a teaching as well as a supervision gap. Hence it was decided to keep the scope of the work focussed on the quality of LCA teaching and an exchange about the respective practices. Questions to be discussed by the group should concentrate on

- Ways to teach LCA
- Possible ways to integrate life cycle based approaches in curricula
- Ways to integrate life cycle thinking into product development processes
- linking with business schools to integrate life cycle based sustainability assessment into their programs

During a presentation of the different activities by the groups represented at the workshop (see annex) it became apparent that different levels of life cycle knowledge are taught. Workshop participants also noted that it was difficult to identify and differentiate programs that enable students to become actual life cycle practitioners from those who focus on providing a less comprehensive training.

Learning Objectives

As a result of this discussion, workshop participants decided to draft a common understanding of learning objectives for LCA students in terms of which areas a program should cover and thus what can be expected from which program. The group came up with four levels as described below:

	Level 1	Level 2	Level 3	Level 4
Setting	- less than 1 ECTS - Basic Awareness	- 1 - 6 ECTS - Minor / Intro Sustainability	- 6-10 ECTS - Master with a specialization in e.g. engineering or chemistry	- 10 - 30 ECTS - Core of Master / or PhD
Expected Learning Objectives	- Defining sustainability / environmental	- ISO Standard graphic (Goal and Scope etc.)	- Data calculation - Ability to do an LCA study	- Environmental Impact LCIA methods - Multiple software

	impact - Understanding Life Cycle Thinking / Resource Efficiency - Discussing the purpose of LCA - Highlighting standardization - LCA application	- Go through each phase - Functional unit exercise - Trade-offs / burden shifting across life cycle and impacts - Work through case example - Potential software example - Own calculations	- Advanced inventory modelling - System expansion - Sensitivity analysis - (basic understanding of consequential LCA) - Uncertainty / variability - Differences of impact assessment methods (Characterization Factors calculation) - Different types of LCA (O-LCA, IO LCA, LCSA, Social-LCA, LCC) - Being familiar with at least one software and databases - Has calculated / done one (ideally real life) study - Real data collection - Ability to structure / report & communicate an LCA study - Proficiency of reading of LCA data - LCA in policy	and databases - Structure of data (unit process vs system process) - Integration of LCA into other tools - Quantitative uncertainty analysis - Computational structure of data - Attributional vs consequential - Consequential modelling - Experience with other LCA applications (link to EPD etc.) - All different types of LCA tools

Book Presentation

Ralph Rosenbaum presented a new comprehensive LCA text book which has been developed based on the experiences of the editors and numerous authors in teaching LCA. The book “Life Cycle Assessment – Theory and Practice” covers throughout its more than 1000 pages a comprehensive state-of-the-art description of LCA-methodology and its specificities for a broad range of applications.

The five parts of the book provide: I) 40 pages of history and context of LCA; II) 340 pages on all there is to know about LCA methodology; III) 540 pages with a wealth of information on a broad range of LCA applications with 18 dedicated chapters on specific types and uses of LCA like policy development, organisational LCA, prospective LCA, life cycle management, ecodesign and LCA applications to specific domains like energy systems, mobility, buildings, food, bio-based products, chemicals, nanomaterials, water supply and treatment, waste treatment; IV) 80 pages with a cookbook giving the reader condensed recipes for all the concrete actions needed to perform an LCA; and V) 130 pages of appendix with an LCA report template, a full example LCA report serving as

inspiration for students who write their first LCA report, and a very detailed overview and qualitative comparison of all LCIA methods that can be found in LCA software.

Participants also mentioned various other LCA textbooks and outlined, which they have used so far. Throughout the discussion it was also mentioned that there was an open and free initiative to collaboratively create a LCA textbook. The textbook in its current version can be accessed via: www.lcatextbook.com

Ideas for future activities:

- Connect with the UnSchool of Disruptive Design
- Establish links to Business Schools
- Share insights on how to teach (structure) / use of which materials (level of exercises)
- Introduce a disclaimer in the learning objectives of curricula on how far the course goes
- Discuss possible starting points (basic understanding of climate change, global warming potential, IPCC, eutrophication etc.)
- Make a joint overview paper on the topic of LCA education

Agreed ToDos:

- Revise Learning Objective Level 3 to split into mandatory and voluntary objectives
    - Create a section with profiles of partner institutions on the FSLCI website,
    - E.g. number of students per course, which background, number of credits
    - full profile of what each group offers
- Share draft profile for comments with group members
    - Create a section where material could be shared
- Start with exercise materials and exams
- Agree on possible date for next group meeting
    - E.g. during LCE 2018 in Copenhagen, SETAC Europe 2018 in Rome or LCIC 2018 in Berlin
- Reach out to more groups to join the activity

Annex

Each of the groups present at the workshop briefly presented their approach and activities with regards to teaching life cycle approaches at their respective institutions.

TU Darmstadt

At TU Darmstadt, the Chair of Material Flow Management and Resource Economy (Head: Liselotte Schebek) provides Bachelor's and Master's courses for Civil and Environmental Engineering as well as for the Master's program Energy Science and Engineering. Within the Bachelor level, the Environmental Science course is mandatory for Environmental Engineering students. The class on LCA is an elective and is selected by students. The class aims to teach students a fundamental knowledge of the methodology and application of material flow analysis and life cycle assessment.

On the Master level, students can deepen their LCA knowledge by two courses. One course focuses on further approaches of LCA like consequential or hybrid modelling as well as on LCA case studies. In the other course, students work on an LCA project in teams to get familiar with the practical realisation of LCA case studies, the software tool openLCA and database ecoinvent.

The introductory level of LCA class usually has around 30 students, the follow up ones 5-10. If they attend three LCA classes, they have an advanced knowledge of LCA. Most of the students do not attend to both Master's courses and get a better insight and understanding of LCA during their Bachelor or Master thesis. At TU Darmstadt, LCA topics focus mainly on agricultural or energy systems and openLCA and Umberto are the applied softwares.

Pforzheim University (Hochschule Pforzheim)

The university has a Sustainability Board, of which Tobias Viere is the speaker. At Pforzheim University, which has in total 6000 students, every business student has to cover at least 6 ECTS on Business Ethics.

Pforzheim offers a Master (M.Sc.) on Life Cycle & Sustainability which is open for around 25 students p.a. Students mostly have a business (engineering) background and the majority comes from other universities.

During the Master, students work on project cases in cooperation with companies who pose specific questions. Students that have done this program can be considered LCA professionals / Industrial Ecology professionals and don't need to be trained that much more.

The Master is closely linked to the University's Institute for Industrial Ecology, which also runs a Resources & Energy PhD program together with Karlsruhe Institute for Technology (KIT) and Stuttgart's Technical University of Applied Sciences, which each send 3 students into the program.

Université de Bordeaux

At the Université de Bordeaux, Guido Sonnemann, LCA as a concept is taught mainly to chemistry and material science students. As part of a general introduction into sustainability, the concept of life cycle thinking is touched upon.

The professional Bachelor is 3 years long and as part of the module on recycling techniques some basic knowledge of LCA is taught. In the case of the general Bachelor, for 10-12 students that show a special interest and capacity a class on bio sourcing is offered, which includes introductions into the resource efficiency, material flow analysis and LCA.

The university also offers a Master in chemistry which includes in the quality management option a more specialized class on LCA. Yet students will still not be specialized in LCA, unless they decide to use LCA for their thesis.

Only in the case of the Master on Advanced Materials Innovative Recycling (AMIR), the course on LCA goes significantly more into detail and provides a more in-depth look at available software with a learning-by-doing project.

Apart from the university side of things Guido Sonnemann noted that a strategy committee on Circular Economy was formed in the region of Aquitaine with a subgroup on eco-design and life cycle assessment. The strategy developed seeks to integrate these concepts into curricula for engineering and natural science degrees. The region provides funding for a train the trainers programme and software for those interested.

LIRIDE-Université de Sherbrooke

The University of Sherbrooke has put the concept of Sustainable Development into the curriculum of its civil, electrical, chemical and building engineering faculty. The main idea behind this work is to provide a consistent and systematic integration framework of sustainable development (SD), life cycle thinking and tools in an engineering curriculum given the connection between the two.

Curriculum integration is a challenging project and requires the development of certain protocols to ensure success. To do so, a framework is proposed for the systematic integration of SD through the lenses of life cycle approach and associated tools to attain effective curriculum integration. The proposed framework suggests the following five steps: 1) Mapping the curriculum, 2) Setting learning targets, 3) Developing an action plan for the assessed program, 4) Implementing the action plan and 5) Assessing the final performance. The integration focuses on the application of life cycle approaches and tools such as environmental life cycle assessment and life cycle costing on engineering content from freshman to graduates.

Most of the MSc and PhD students do not come from Quebec but have been introduced to LCA as part of their studies at their previous university. They are also asked to take an advanced course on LCA modelling during their first year of studies (90h teaching with LCA lab for one semester)

Technical University of Denmark

At DTU, every engineering student leaving the university needs to have gone through at least one LCA course. Besides the introductory classes taught at Bachelor level, DTU offers a comprehensive Master program with more specialized courses. Here, classes on Life Cycle Management, System Modelling and Impact Assessment are offered. These more in-depth classes were developed 20 years ago and thus the faculty has a long history of teaching LCA. As part of these in-depth training, learning-by-doing projects in collaboration with industry are carried out by the students.