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Making an impact through joint efforts - values, outcomes and lessons learned from 25 years of collaboration

Sara Palander^{1*}, Anna Wikström¹, and Maria Rydberg¹

¹ Swedish Life Cycle Center, Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden

Abstract. The Swedish Life Cycle Center brings together Swedish life cycle competence and front-running companies. It has been instrumental in developing and adopting life cycle approaches in the Swedish society, whilst making important contributions to international initiatives. This paper describes results from the Centre's 25-year long history and presents its core values and principles, which have been crucial for collaboration and development over the years.

1 Introduction

Founded in 1996 and hosted by Chalmers University of Technology, the Swedish Life Cycle Center is a centre of excellence and collaboration platform for academia, research institutes, industry and government agencies. It fosters competence-building and knowledge exchange in advancing and applying the life cycle field. With its multidisciplinary methodology and collaboration between researchers, practitioners and decision-makers, the Centre is a recognised player in the field. By bringing together Swedish life cycle competence and front-running companies, it has been instrumental in developing and adopting life cycle approaches within Swedish society and making important contributions to international initiatives. The Centre's vision is "credible and applied life cycle thinking globally" and the mission is to work for the integration of the life cycle perspective into processes and decision-making in industry, government policy and other parts of society. It is a partner-driven collaboration, with the partners setting the agenda and managing all the activities. Today, the Centre consists of a network of some 500 people (between the various partners) involved in research projects, working groups (for learning) and expert groups (for impact and influence), training (professionals and higher education) and in networking and communication activities (internal conferences, webinars etc.).

1.1 From 1996 to 2021

The Centre grew out of mutual interest between industries, with the goal of decreasing and preventing the environmental impact associated with products. Aided by support for a centre

* Corresponding author: sara.palander@chalmers.se

of excellence programme from Sweden's innovation agency (Vinnova, formerly NUTEK) and allied with a group of researchers at Chalmers University of Technology, the first 10-year collaboration took off. The name of the Centre at the time was the Center for Environmental Assessment of Product and Material Systems (CPM). The overall mission with the government support was to strengthen the Swedish national innovation system's crucial link between academic research groups and industrial R&D [1]. At its inception in 1996, the collaboration was about building up a common language and agreeing on definitions of life cycle approaches, nomenclatures, terminologies etc. Data, databases and life cycle assessment software were important aspects at the outset and such things as the Sustainable Product Information Network for the Environment (SPINE) data format were developed [2]. Early on, it was important to work on global harmonisation processes and the International Organization for Standardization (ISO) framework was identified as a good basis. The capacity-building of the first ten years was invaluable to Swedish companies; they still are working with these practices developed in the Nineties and have built up strategies based on results and outcomes [3, 4]. During this period, 24 companies were connected to the Centre's consortia via research projects and through financing. Twenty academic achievements were realised and eight EU projects were implemented [1].

In 2006, the governmental funding ended and only a handful of companies stayed in the collaboration alongside the researchers at Chalmers University of Technology. LCA colleagues were still needed to handle this complex approach and new companies identified the Centre, with its opportunities to learn from a well-known and recognised joint effort. Two EU Life + projects were managed, to further improve the implementation and practical perspective and to communicate what was learned from the collaboration. One of them won an accolade as one of the best EU Life + projects of 2012 [5].

The starting point for re-forming the Centre was the common goal of working towards hosting the 6th International Conference on Life Cycle Management 2013, where also the new name, the Swedish Life Cycle Center, was launched. New partnerships were set up with other universities and new research institutes, industrial players and new ways of working were identified. Since 2016, the Centre has hosted a formalised dialogue, now consisting of nine Swedish governmental agencies. The aim is to build capacity and mutual learning between the agencies themselves and between the agencies and the wider Centre.

1.2 Ways of working

The expert group and working-group format were set up and new ways of networking were established, such as webinar series and the annual network conference which gathers Swedish life cycle professionals for mutual learning in round-table format and joint business and research intelligence. Lately, the communication activities with the Centre's internal and public network have been improved to foster outreach and channel expertise. Another important part of the development has been training sessions for professionals, with the overall aim of increasing understanding and the use of the life cycle approaches in decision-making activities, plus educating advocates of life cycle thinking. The university partners have jointly initiated, developed and run the PhD course, *Advances in Life cycle Assessment*. The latest development was made possible by financial support from the Swedish Energy Agency throughout the projects *Swedish Platform for the Life cycle Perspective* [6] and the *Innovation Cluster for the Life cycle Perspective*. This year, a scientific director has joined with the aim of increasing the scientific quality of the Centre. Formerly run by the Scientific Advisory Group, this role complements the Centre's director, who is responsible for its operations and for running a technical secretariat that manages the Centre's activities.

2 Method

To ensure the Centre's relevance to society, an external review by two reviewers (one in academia and one in industry) is conducted every three years, as commissioned by the Centre's host university. An annual self-assessment of the Centre is carried out by the Board, with all partners asked to compile benefits and effects from collaborating. They also conduct a critical review and highlight potential improvements that the technical secretariat further develops in dialogue with the Board. Results and outcomes are summarised, with some examples highlighted in this article to provide some diversity in the results and activities to which the Centre has contributed over the years.

3 Results

Throughout the years the partners involved have varied, but an applied life cycle approach has been the basis of all research and projects carried out. The common denominators of this journey are the Centre's core values and principles (described in Discussion) and hosting an environment with the best conditions aimed at mutual learning and co-creation. The Centre's main contributions to the partnership over the years are summarised under the following four headings.

3.1 Capacity-building

With almost 500 professionals across our formal network of partners and with its government agency dialogue, the Centre has been invaluable to Sweden's capacity-building in the life cycle field, within companies, among government agencies and at universities [7, 8]. In recent years, the Centre has also created the conditions to include external partners in research and other activities. The education of professionals and collaboration on life cycle assessment in higher education are important results from the collaboration which further contribute to capacity-building. To better respond to an increased demand for knowledge, in 2021 the Centre launched its collaboration agreement to small- and medium-sized companies, which was possible by the previously mentioned funding support from the Swedish Energy Agency.

3.2 Methods, tools and working practices

The Centre is developing methods, tools and working practices via collaborative research projects, through case studies, in working groups and in round-table discussions. Some of these have resulted in the integration of life cycle assessment into product development processes [9, 10], supply-chain management in purchasing [11], logistics planning [12], better understanding of recycling [13, 14], and decision support being adopted for different business functions [15]. It has also resulted in better knowledge on life cycle thinking in environmental management systems [16], better understanding of policy initiatives and how they will affect various organisations such as the Product Environmental Footprint (an initiative of the European Commission) [17, 18]. Outcomes of the working groups are highlighted in terms of their opportunities for arranging dialogues around business case studies, new research results and business intelligence.

3.3 Harmonisation processes

The Centre has a long history of working within the framework of ISO and took an active role in the Swedish Institute for Standards with its aim to develop and impact the global

harmonisation of LCA standards (14040- and 14020-series). Latest contribution has been to ISO 14008 on monetary valuation. An important part of this work was the research behind this standards [9, 10, 19, 20]. Since 2013, it has also been important to be part of the development of the European Commission Environmental Footprint process, supporting the Swedish representatives in the European Commission's Environmental Footprint Steering Committee and Technical Advisory Board [17]. In 2015, a partnership was signed with the United Nations Environmental Programme to run a pre-study for the Global LCA Data Network (GLAD) and the Centre's expert group *Data Strategy* was set up for this purpose. Also Society of Environmental Toxicology and Chemistry (SETAC) has been a valuable platform for cooperation.

3.4 Collaborations & networking

The Centre is a meeting place for networking and collaborations. Meetings and networking activities are occasions coordinated by the technical secretariat, in which ideas arise and are developed. However, the research projects have also resulted in spin-off projects managed outside the Centre, due to such things as specific interest among a smaller group of people. This short take-off for new projects and collaborations has also been highlighted as important in the annual self-assessment. The PhD courses and ability to host international scientific conferences are important outcomes for researchers. These include the International Conference on Life Cycle Management in 2013 and the 2020 Social LCA conference.

The advantages for partners are summarised as follows; i) staying at the forefront and managing long-term sustainability innovations; ii) being part of the development of tools, strategies, business models, working processes and common practices for implementation in operations; iii) access to a global expert network of industrial and academic bodies and public authorities; iv) mutual learning process and acceleration of knowledge – high-level research discussions and case studies; v) benchmarking and strategic business intelligence (from policy-business-research perspectives); vi) driving the life cycle field forward globally.

4 Discussion

By bringing together Swedish life cycle competence and front-running companies, the Centre has been instrumental in developing and adopting life cycle approaches in Swedish society, in industry and among government agencies. Over the years, the Centre has involved many individuals and organisations, taken part in the development of methods, tools and working practices. This has brought about learning processes and fostered competence. Furthermore, the Centre has made important contributions to international initiatives and global harmonisation. New collaborations have been possible and the ripples are spreading.

Over time, the Centre has put major effort into its core values and principles; something which might be seen as a success factor. Operating as a *neutral arena* (in which all parties are equal) allows a common agenda to be set and projects to be developed mutually. Projects are co-created by researchers, practitioners and decision-makers. This neutral arena has also been made possible by a strong university base, in which the *scientific base* is secured. This lends credibility to decision-making processes and is also important in terms of transparency issues. The focus on *cross-sector solutions* provides a meeting place in which colleagues in the life cycle field meet across sectors (industry-academia-authority or between different industry sectors) to manage common projects or hold dialogues on specific tasks which share a common interest. Two of the most important core values for the technical secretariat to work on with the Centre's board are *transparency and trust*. A formal consortium agreement is used. This is signed by all partners and deals with confidentiality, the use of results,

ownership and so on. Transparency is also one of the most important aspects when dealing with sustainability is an invaluable source of learning. A *global perspective* is essential when managing resources that move around the globe. Thus, global collaboration is needed. Moreover, collaborations with other life cycle communities and international initiatives are of utmost importance. In addition to these core values and principles, engagement between partners and government agency collaboration is invaluable. All individuals are crucial in achieving successful results and outcomes and individuals form the Centre's resource and competence base in all its activities. Furthermore, the engagement of individuals is essential if partners are to get the most value from the cooperation.

4.1 Challenges

Over its 25 years, the Centre has dealt with a variety of challenges. Today, its challenges are mostly internal. The partners have differing interests which must be dealt with. The competitive situation between the groups (industry, academia, research institutes and government agencies) and the competitive situation among these groups. Since 2006, the Centre has been without long-term governmental funding and therefore depends on a stable number of partners and attracting external funding for joint research projects and activities. This gives rise to a lot of administration. This poses also a challenge to the Centre when dealing with long-term strategic sustainability efforts, such as open and accessible life cycle data on a national level and building national capacity. The Centre could have a dedicated role or function and be a natural home for the above issues (which might otherwise fall between domains). Today, given that the life cycle community is experiencing increasing demand for life cycle skills, there is a need to develop these skills. How do we contribute to build life cycle skills? In addition, there is a need to support small- and medium-sized enterprises, other business sectors, the public sector, start-ups and individuals with life cycle competence. How do we respond to society's heightened need for life cycle competence?

5 Conclusion

Major added value is afforded to organisations when they can participate in a common network or organism within the life cycle field. The opportunities for mutual learning and capacity-building impact upon society and drive the life cycle field forward. The annual self-assessment sheds light on the importance of participating in the dialogue and case studies and for researchers, practitioners and decision-makers to have the ability for mutual learning. The Centre needs to find ways to respond to this heightened interest and demand. Collaborations between life cycle communities and networks will be important and the Centre's board and technical secretariat have identified our partnership with United Nations Life Cycle Initiative, SETAC and the Forum for Sustainability through Life Cycle Innovation as a good start in the journey towards greater responsibility in society. Thanks to the previously mentioned project with funding from the Swedish Energy Agency and the Centre's partners, the Centre has opportunities to expand this field. The Centre's partners find this collaboration fundamental to succeed in implementing life cycle perspective into processes and decision-making, plus its development within the life cycle field; these results would not have been achieved if the Centre partners had been acting alone.

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