Life Cycle Assessment projects by process groups

Isabel Joaquina Niembro-García[1,*], Margarita González-Benítez[2], Xavier Carod[1]

[1]Universitat Politècnica de Catalunya, Department of Engineering Design, Barcelona, Spain

[2]Universitat Politècnica de Catalunya, Department of Engineering Design, SEAT-UPC Chair, Barcelona, Spain

* joaquina.niembro@gmail.com

Abstract The actual consequences analysis derived from the study of a system's life cycle, improving the simplistic approach of the decision making by partial aspects. The LCA has become a powerful and widely-used tool that allows the professionals to take action in a sustainable way. The work group carried out an LCA normally takes advantage of their knowledge and abilities to obtain a more or less reliable result. The working group's efforts haven't been until now systematically and normally guide themselves by experience, logic and intuition. It's pertinent that this effort is oriented by using Project Management. Project Management is the application of knowledge, ability, tools and techniques to the activities of the project to satisfy its requirements. An LCA study can be considered as a project, a temporal effort made for a unique result. With the Project Management vision, the elaboration of an LCA is faster, easier and successful. We have developed a guide for the elaboration of an LCA following the guidelines of ISO 14040 and Project Management, we have named it as: Life Cycle Assessment projects by process groups. Our point of view emerges from relating the matrix of the LCA phases (Goal and scope, Life cycle inventory, Life cycle impact assessment and Interpretation) and the process groups (initiating processes, planning processes, executing processes, controlling processes and closing processes). With that, we provide to the work group some guidelines to make an LCA as a project where we balance the scope, time, costs, quality, resources and risks.

1 Introduction

A study of LCA is in fact, a greater or lesser extent project and as such may be undertaken following the best practices of project professionals within the scope of knowledge of Project Management.
Until today, the LCA practitioner, could make use of general information about LCA and its principles, framework, requirements and general guidelines on methodology (ISO and others), however, had no functional and operational guidelines on how to undertake and develop an LCA study. We propose a methodology for contributing to make more effective the efforts of an LCA study. Best Project Management practices can be applied to "LCA studies projects" to increase the possibilities of obtaining better results. We do not propose to change the already validated LCA methodology, but implement it as a project perspective. That is why we have created a matrix to relate "LCA phases" and "Project Process Groups", respecting the rules and recommendations of both ISO 14 040 and Project Management. Below we present the objective of this work and then a brief introduction to LCA and Project methodologies, in order to unify the concepts used.

1.1 Objective

Our objective is to provide guidelines to manage any study of Life Cycle Assessment whit a Project perspective. Our methodology is intended for anyone who wants to make a LCA and implement a Project Management guidelines. Specifically for beginners in the LCA which, by their condition, seek and find references for LCA but have no experience of its implementation and therefore need support.

1.2 LCA

On the way towards sustainability, is engineering challenges: the efficiency of production systems and the development of technologies to minimize negative impacts on the environment and enhance economic efficiency, all without forgetting its social responsibility of the product system. A related problem is the tool to use to manage the actions that lead to sustainability. The international standard ISO 14001 (Environmental Management Systems) mentioned that organizations are increasingly looking to achieve and demonstrate sound

environmental performance [1], so it can serve a variety of tools, including Life Cycle Analysis (LCA) of proven effectiveness.
According to ISO 14 040 and ISO14 044, strokes are developed in four phases: Goal and Scope Definition, Analysis of Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA) and Interpretation [2] [3]. In Figure 1 shows the succession of phases of the LCA methodology and the direct application of each on the system.

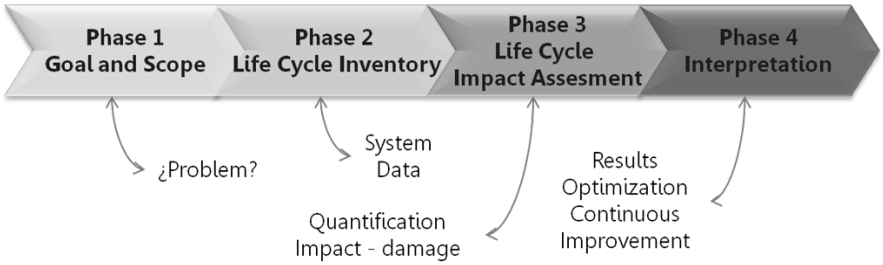

Fig.1: Phases of the LCA methodology

1.3 Proyect Management

Each day is considered over the project in a professional manner as evidenced by the growing number of projects that are generated and the diversity of projects that go beyond traditional construction and defense and get to ICT, marketing, research, social causes, legislation, etc. [4]. And that is why it is appropriate to speak a common language in the field and apply in their own land practices that are successful. There are many definitions of projects, including: "A project is a temporary endeavor undertaken to create a unique product, service or result" [5]. "Joint effort of many people (men and women) looking for maximum benefit in achieving a reasonable solution to a problem that is expected to be an ideal solution and economically beneficial for all" [6]. If we reformulate the above definition, from the perspective of today's world, proactive social and environmental issues, should be added that:"... ideal and beneficial solution from economic, social and environmental meant for all". And for this approach is to be applied tools like this methodology.
A project is different from the rest of the operations taking place in organizations, because every project has a defined end point (temporary feature) and is not equal to similar products or services (uniqueness property) [7]. Project management is achieved through "application and integration of project management processes of initiation, planning, implementation, monitoring and control, and closing" [5] (cf. Fig. 2). The knowledge to manage projects includes nine interrelated areas, viz.

Integration, Definition and Scope, Time, Cost, Quality, Human Resources, Communication, Risk and Procurement [5], which apply during the project life cycle (PLC). The PLC is defined to facilitate the management of a project. In Figure 2, outlines the time and effort invested in the PLC from the conception until the end of the project. It should be mentioned that when talking to the PLC, we refer directly to the Project, not the "methodological phases" of LCA, or stages of life cycle of a system (product or service) in the study.

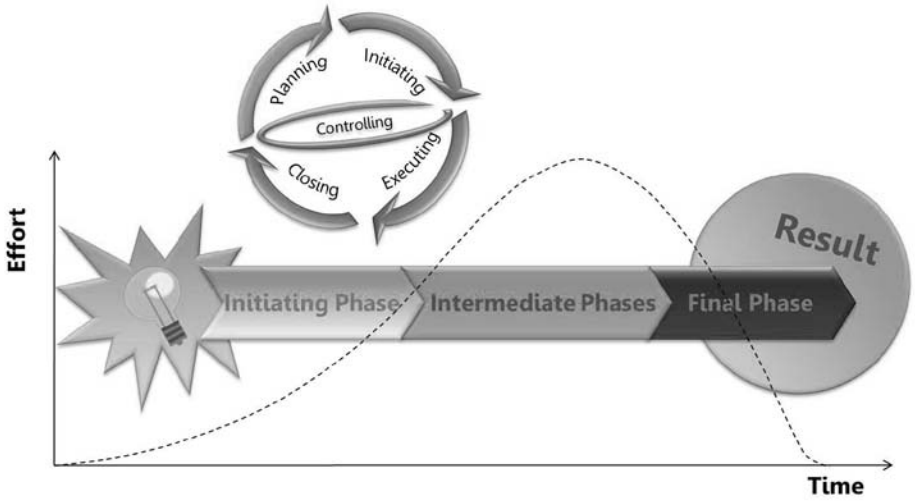

Fig.2: Project life cycle and Project Management Process Groups

Project Management Process Groups are related by the results they produce. The results of a process, usually becomes the starting point for another process or is a deliverable of the project. Process Groups are rarely discrete events, but overlapping activities that occur at different levels of intensity throughout the project, ie interaction between the phase of the project and may intersect (cf. Figure 2). Listed below are the Process Groups and briefly described:

- Initiating Process Group
  Defines and authorizes the project or a project phase
- Planning Process Groups
  Defines and refines objectives, and plan a course of action required to achieve the objectives and the intended scope of the project.
- Executing Process Group
  Integrates people and other resources to carry out the Management Plan.
- Group Process Monitoring and Control

Measure and regularly monitor progress, to identify variances from project management plan, so that corrective action when necessary to meet the objectives.

- Closing Process Group
  Formalizes acceptance of the product, service or result, and ends neatly the project or phase.

Those interested in the project (also known as stakeholders), belong to the institutions, companies, organizations, etc. that are involved in the project and have different levels of responsibility and authority. Among the key stakeholders of a project are: Project Manager, Designers (Proyect team conducting the research) and Client, usually the user of the results and often who finances, although it may be the same organization to which they belong the team.

2 Method

We have developed a methodology for LCA projects. The methodology incorporates part of the work and experience LCA within the Project Engineering Research Group (*Grupo de Investigación en Ingeniería de Proyectos - GIIP*) of the Universitat Politècnica de Catalunya. In Figure 3 shows a matrix to outline the transversal relationship between LCA Phases of an LCA study and Processes Group of any project. This paper describes the 12 items, with activities to be performed and characteristics of internal documents and / or deliverables.

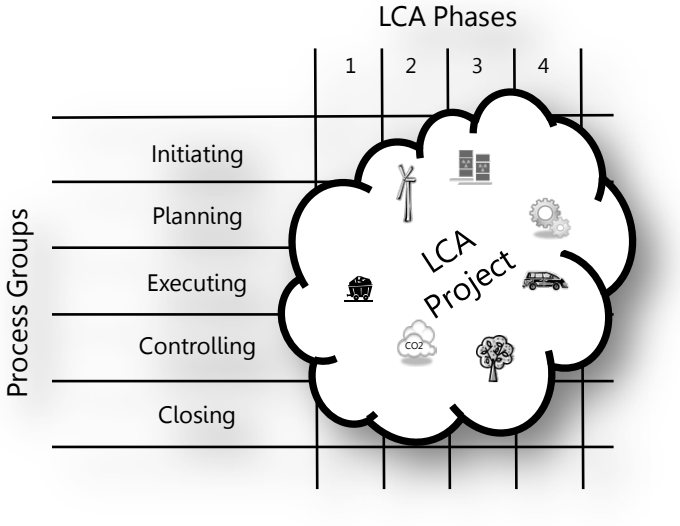

Fig.3: GIIP Methodology to LCA Proyects

3 Results

The result of this work is the Proyect Methodology for LCA (PMLCA, *MPACV* in Spanish). Here the 12 items, with activities to be performed and characteristics of internal documents and / or deliverables

- Initiating Process Group

A LCA Project comes from the idea or need for a LCA study by a company, organization or institution. The "generation of the idea" is the result of detecting a problem that requires expert solution. In this guide we start from the basic premise that the problem has been detected, the idea already exists and requires a response by the project. No purpose of this guide is to outline options for "find" a problem (commercial style, or solution selling, consulting, etc.), it would be a previous phase. Clearly shows a natural convergence between the first part of phase 1 of a LCA study (ISO 14040) and the Initiating Process Group: they both start with the contact with the problems we wish to study.

1) Approach the system

Working session between representatives of the stakeholders (designers, clients) with three objectives: 1) to express their interest in undertaking a study of stroke, 2) know the purpose of the study (what is sought?, why was will be used?) and 3) describe the system under study, may be necessary fieldwork (eg visit to a factory or industrial complex) or hold meetings with the responsible technical or logistical system.

2) Project Charter of the LCA Project

The signing of the Project Charter formalizes the proposed Project. Depending on the size of the project, the Project Charter can be an internal document of the performing organization or be shared with the Client. Contains the rationale for the project: a problem encountered by the organization that needs attention or needs an external client, the client's requirements (or the same organization), the name of Project Director and his level of authority, powers of project and budget summary.

- Planning Process Groups

The Planning Process Group requires considerable effort of staff, the experience of the project plays a fundamental role, vision and strategy form the basis for the operation of a project. The planning work should involve key project steakeholders and use their knowledge and skills. Planning can be iteratively throughout the PLC, feeding with the new information that is generated but can not continue indefinitely. he Planning Process generates the general plan called: Project Management Plan. Methodological Phase 1 Definition of Objectives and Scope of the LCA is symbiotic with the Planning Process Groups in a Project of LCA.

3) LCA Project Proposal

The "LCA Project Proposal" is a document prepared by the designers for the Client. With it, access to information on the study you requested and appreciated the designer's response to your request or opportunity to perform the LCA study. Generally include, among others: a) Requesting entity, b) Project title (acronym), c) Place, d) Area of intervention, e) Date of submission of the proposal, f) Details of the contact person, g) Background, context and relevance, h) Objective of the project, i) Limits and scope of the project, j) Deliverables of the project, k) Powers of the project (assumptions and constraints), l) Schedule of activities, m) Financial structure, n) Feasibility and sustainability, o) Processes of communication and availability of information, including the roles of the participants, p) Confidentiality in the handling of information.

4) Contract

The contract is a written agreement between designers and Clients where they buy has a commitment to the project. Usually made (or otherwise revised) by the organization's legal staff, under the premises of the LCA Project Proposal. The signing of the contract (legal representatives of the entities) marks the beginning of the project. A contract may be replaced by a partnership agreement or when the project is internal to the organization. While past activities already conducted an initial approach to the problem, until it has the security of the Contract is not advisable to begin the LCA study. The safety of the parties involved, provides security for the fulfillment of the requirements of the project. Common to include clauses on data protection and confidentiality, as well as actions to be taken for delays in access to information about the system, and the delivery of final results.

5) Objectives and Scope of LCA (1st Phase of LCA methodology)

The Methodological Framework of the ISO 14040 standard in the section Generals recommends the content of the "Objective and Scope" of LCA. Translating the "Objective and Scope" in a document written in a clear and consistent with the request, is an effort that always leads to satisfactory results at the end of the project. Information to develop "Objectives and Scope" can be obtained, including the "Project Proposal" and meeting planner-client work. "Objectives and Scope" will define the path forward in the LCA study. Include the definitions of "functional unit and reference flow", critical points in a LCA study.

6) Project Management Plan

Internal document of the Designers and the Proyect Manager, whose objective is to define, integrate and coordinate all information relating to management the LCA Project. The Project Management Plan use the information generated in the Planning Process including "Objectives and Scope" of LCA, should be emphasized: the activities for LCA, the flow of project resources and risks. Among the most likely risks in the LCA Projects is the lack of adequate data on

the system under study (despite the stated commitment to provide the information by the applicant). The Management Plan is a document that evolves according to the changes that occur during the LCA Project phases.

- Executing Process Group

In this Process Group interacting human and material resources to perform the work specified in the Project Management Plan, through the leadership of Project Manager. Most of the project budget will be invested in this process group. There may be variations in the time of project implementation, with respect to the original plan, which will require some re-planning activities such as requirements and resources. A significant change in the project must be approved by the customer.

7) Development Inventory (2 nd Phase of LCA methodology)

"It involves data collection and calculation procedures to quantify the inputs and outputs"of a system (4). Access to information (data, procedures, practices, etc.) can be a complex task that requires commitment and perseverance of the designers in the fieldwork or literature. The information collected should meet the quality criteria. It is advisable to use flow charts to graphically clarify the flow of materials and energy of the system under study. The data (numbers and parameters) must be provided to facilitate use in LCIA, for this we use algorithms that fit the data to the "functional unit" and "reference flows". Do not have a "Plan of Action Risk" can become a problem which causes phase delays in the project, in the frequent case of delay in obtaining the information. Analyzing information "real" system and compare them with those planned to obtain, may be necessary to reschedule the scope of the LCA, which causes changes in the Project Management Plan. Detect rapid changes in planning reduces the impact on the project budget.

8) Life Cycle Impact Assessment (3rd Phase of LCA methodology)

It is the application of the data prepared in the ICV to the elements defined in "Objectives and Scope (impact categories, category indicators and models of characterization, etc.) for the environmental assessment system. It is common to use software. The results are presented in graphical form for ease of interpretation.

9) Interpretation (4 th phase of the LCA methodology)

According to ISO 14 040, the interpretation involves the identification of significant issues arising from previous methodological stages, evaluation (reliability of data, verification of results and consistency) and conclusions, limitations and recommendations. Usually done a working session between planners to discuss results and formulate conclusions and recommendations. It is essential the support from experts and experienced analysts, although the evidence is emphatic, as their global vision offers a thorough interpretation of the impacts of the system.

- Group Process Monitoring and Control

Process Monitoring and Control are done to identify problems and implement timely solutions to carry out the project. Continuous monitoring gives a clear idea of the behavior of the project and shows any areas that need special attention or represent a danger to the project.

- Closing Process Group

The Closing Process formally ending the activities of a project or project phase.

10) LCA Study Report

Its aim is to provide the client with the results and conclusions of a LCA properly for the end user, specifying the data, methods and assumptions used in the study and the corresponding limitations [2] [3]. Assuming that the study meets the original objectives for LCA, it is essential that the results are exposed in accordance with the "Purpose and Scope", because this way the interpretation is favored by the customer. Develop a concise and complete Report, is itself a challenge and is usually well received by customers, the additional information appended to the end of the report. If done a Critical Review, the report must include the result of it. The LCA report generally contains, among others: a) Project title (acronym), b) Venue, c) Area of intervention, d) Date of filing of the report, e) Objectives and Scope of the Study, f) Brief methodological description, g) Results of the LCA study, h) Analysis of Results, i) Conclusions, j) Annex to the data representing the ICV, k) Annex to the justification of the LCIA methodology used and results in extensive, l) Annex to the Critical Review of LCA.

11) Critical Review

When you want to increase the credibility of a study of stroke or is to be used for comparison, is a critical review. It assesses, among others, the application of the methodology, data processing and consistency of the study. Review conditions are defined from the planning.

12) Contract Closure

Close the contract means to have fulfilled the requirements of the Contract to the conclusion of the LCA Project. You can close the contract before the end when there is agreement between the parties or breach of any of them and this has been established as a possibility in the Contract. The closing includes the backup file and because of the Project documentation, in addition to closing and settlement of administrative matters.

4 Discution

We have presented a methodology to Management LCA Proyects: the PMLCA, based on known and proven principles in the conduct of other projects.
In its application to LCA study performed in our group, we have demonstrated the efficiency gains of more junior Designers, measured as reduced development time and errors in the initial stages, even when the researchers were not specialists in LCA studies.
Similarly, we have managed to involve the Client in the evaluation of partial results, thereby facilitating the redefinition of objectives, scope and / or quality of the study in early stages of project, thereby reducing the cost and time compared to previous studies potential conflicts at the stage of completion.
This work is part of the International Cooperation Project "Development and Application of LCA Tools for Decision-making: Contribution to a Sustainable Society", sponsored by the Spanish Agency for International Development Cooperation (AECID A/027130/09) to whom we express our Acknowledgement.

5 References

[1] AENOR. UNE EN ISO 14 000 Gestión medioambiental. Evaluación del comportamiento medioambiental. Directrices generales. Madrid: Asociación Española de Normalización y Certificación; 2008.
[2] AENOR. UNE EN ISO 14 040 Gestión ambiental. Análisis de Ciclo de Vida. Principios y marco de referencia. Madrid: Asociación Española de Normalización y Certificación; 2006.
[3] AENOR. UNE EN ISO 14 044 Gestión ambiental. Análisis de Ciclo de Vida. Requisitos y Directrices. Madrid: Asociación Española de Normalización y Certificación; 2006.
[4] IPMA. NCB Bases para la competencia en dirección de proyectos. 3.1st ed. Valencia: Asociación Española de Ingeniería de Proyectos (AEIPRO), Asociación Española de Ingeniería de Proyectos (IPMA); 2006.
[5] Project Management Institute. Guía de los fundamentos de la dirección de proyectos : (Guía del PMBOK). 3ª ed. Newtown Square: Project Management Institute; 2004.
[6] Estay Niculcar Christian A. Rigor y relevancia, perspectivas filosóficas y gestión de Proyectos de Investigación-acción en Sistemas de Información. Universidad Politécnica de Cataluña; 2007.
[7] Capuz Rizo S, Gómez-Senent Martínez E, Torrealba López Á, Ferrer Gisbert P, Gómez Navarro T, Vivancos Bono JL. Dirección, Gestión y Organización de proyectos. Valencia: Universidad Politécnica, Servicio de Publicaciones; 2000.