

# Development of National LCA Database Roadmaps, including further Development of the Technical Helpdesk for National LCA Databases

Deliverable D 4.5a Final roadmap report for Ecuador

## Authors

Dr. Beatriz Rivela  
Dr. Ángel Ramírez

Escuela Superior Politécnica del Litoral  
Campus Gustavo Galindo, Km 30.5 Vía Perimetral, Guayaquil, EC090112  
Ecuador  
[beatrizrivela@gmail.com](mailto:beatrizrivela@gmail.com) / [aramire@espol.edu.ec](mailto:aramire@espol.edu.ec)

Financial support:



Commissioned by:



# Executive summary

The present project, "Development of National LCA Database Roadmaps", addresses the component of the "*Resource Efficiency through Application of Life cycle thinking*" (REAL) project, implemented by UN Environment and funded by the European Commission, aimed at supporting the development of life cycle databases, enhancing access to databases as well as furthering their interoperability.

In Ecuador, the national consortium established in order to support the implementation of the roadmap included government (Ministry of Environment), academia (Escuela Superior Politécnica del Litoral and Escuela Politécnica Nacional) and NGO sector (Conservación Internacional Ecuador). In recent months, University of Cuenca has contributed to the discussion of the roadmap implementation plan. Additionally, the project consortium has maintained a strong and active relationship with the Peruvian Life Cycle Assessment Network (PELCAN), which has been providing valuable support to this project.

The baseline assessment and the stakeholder mapping has been described in the deliverable D 2.5a "Report on baseline assessment and stakeholder mapping in Ecuador". This roadmap report for Ecuador strives to cover general aspects and outline specific activities that need to be considered to guide a successful process of national LCA database implementation in the country. Following on the vision and goals, the roadmap identifies concrete objectives and activities that will need to be undertaken towards realising the national LCA database.

A holistic approach to data governance for security, privacy, confidentiality and compliance has been discussed. To ensure implementation of the roadmap, the most critical aspect is about clarity on who has ownership or responsibility for progressing on implementation. The role of database manager has been assigned to the Ecuadorian Corporation for the Development of Research and Academia (CEDIA). The governance structure recommended includes a Steering Committee, representing relevant stakeholders (including government, industry and academia) to steer the overall direction of the database.

The potential costs related to the successful implementation of the roadmap have been analysed and discussed by participants of the National Database Working Group (NDWG), with the support of the Peruvian Life Cycle Assessment Network (PELCAN), considering capacity building, IT needs, human resources and dissemination activities. In previous experiences in other developing countries, funding for capacity building was provided by UN Environment, The Life Cycle Initiative, the European Commission or individual donor countries. National potential funding sources in Ecuador have been also identified.

A Two-Year Action Plan for the implementation has been defined, considering 18 activities according to the pathways to the attainment of the 7 specific goals. As local experts are not available to completely support technical development activities, such expertise needs to be built in order to avoid reliance on expensive expertise from other countries. Thus, the implementation of a national level capacity building programme must be prioritised, considering different types of target audiences.

## Table of Contents

Executive summary .....	i
Introduction .....	1
Background .....	1
Target audience and intended use of roadmap report .....	2
The roadmap establishment process .....	3
Baseline assessment and stakeholder mapping .....	3
Stakeholder consultations .....	4
National Database Working Group .....	6
Roadmap report writing process .....	6
Dissemination activities .....	6
Roadmap for developing a national LCA database .....	8
Vision and goals .....	8
Organisation and finances .....	9
Governance and management .....	9
Funds and financing .....	10
Data and database .....	12
Database hosting and access .....	12
Data needs and availability .....	12
Data quality requirements and review .....	14
Data format and database interoperability .....	14
Interoperability over the Global LCA Data Access (GLAD) network .....	15
Promotion of LCA uptake in policymaking .....	15
Roadmap implementation plan .....	16
Activities, roles and responsibilities for roadmap implementation .....	16
Budget and timeline for roadmap implementation .....	23
Risk management .....	25
Conclusions and recommendations .....	28
References and resources .....	29
Appendix A - Stakeholder consultation workshops .....	34
Appendix B - Stakeholder consultation process .....	45
Appendix C - Full paper CILCA 2009 .....	46

# Introduction

## Background

The availability of, and access to, life cycle assessment (LCA) data is a cornerstone of Sustainable Production and Consumption (SCP). However, in many countries the availability of LCA data is limited or non-existing and the assessment of impacts from policies and product choices are difficult to estimate by governments, businesses and individuals. The project [\*Resource Efficiency through Application of Life cycle thinking \(REAL\)\*](#), part of the UN Environment hosted [Life Cycle Initiative](#) and funded by the European Commission, faces the challenge of integrating resource efficiency in global value chains by using life cycle data on environmental impacts. The present project, "Development of National LCA Database Roadmaps", addresses the component of REAL aimed at supporting the development of life cycle databases, enhancing access to databases as well as furthering their interoperability.

From October 2018 to July 2019, the objective of the project has been to develop national LCA database roadmaps in different countries, as well as to move forward on the availability of current databases in those countries that already have a sufficient level of maturity. The project is led by theecoinvent Association in Switzerland, and includes project partners from Brazil, Ecuador, India, South Africa, Sri Lanka, and Uganda. This document outlines the roadmap for Ecuador, including specific activities for roadmap implementation.

In 2012, the Ecuadorian Government advised that Life Cycle Thinking should play a key role in the definition of sustainable policies on energy efficiency, which led to the approval of the project "LCA of Ecuadorian Electricity Generation", funded by the National Secretary of Planning and Development (SENPLADES). Two years later, efforts to disseminate Life Cycle Thinking and coordination among the different actors were crystallized in the creation of the Ecuadorian Life Cycle Network, with decisive support from the international community. The network was launched in April 2014, as a result of the International Seminar of Life Cycle in Ecuador "Life cycle approach for sustainability assessment: identifying crucial policies and methodological frameworks of implementation", with support provided by the Life Cycle Initiative and the Iberoamerican Network of Life Cycle (RICV). It is remarkable that, from the beginnings, all the activities developed (mainly discussion workshops and presentations) were very well-attended and received, demonstrating interest and appetite for life cycle approaches.

Nowadays, Ecuador has an active research community in LCA; the research activity of the network has been focused on the energy and construction sectors. However, the jump from academia to government and industry is yet to be fully achieved. There is a serious lack of Ecuadorian business case studies which could be used to spread the word. Government initiatives have not been consolidated, essentially due to the lack of coordination as well as the lack of funds to proceed.

After a process of consultation with key actors, a consortium was established in order to support the implementation of the roadmap for the national LCA database in Ecuador, including government (Ministry of Environment), academia (Escuela Superior Politécnica del Litoral and

Escuela Politécnica Nacional) and NGO sector (Conservación Internacional Ecuador). Angel Avadi, from the International Reference Centre for the Life Cycle of Products, Processes and Services (CIRAG) was actively involved in the definition of the Ecuadorian project plan.

The project consortium has maintained a strong and active relationship with the Peruvian Life Cycle Assessment Network (PELCAN), which has been providing valuable support to this project. Additionally, in recent months University of Cuenca has contributed to the discussion of the roadmap implementation plan.

## Target audience and intended use of roadmap report

This roadmap report for Ecuador strives to cover general aspects and outline specific activities that need to be considered to guide a successful process of national LCA database implementation in the country. Based on insights from previous national LCA database development efforts, it has been established following the guidance provided by deliverable D 3.1 "General guidelines and recommendations for establishing roadmaps aimed at national LCA database development" of the present project. Moreover, valuable feedback from stakeholder consultation has been considered to guarantee the appropriateness of the process in the national context.

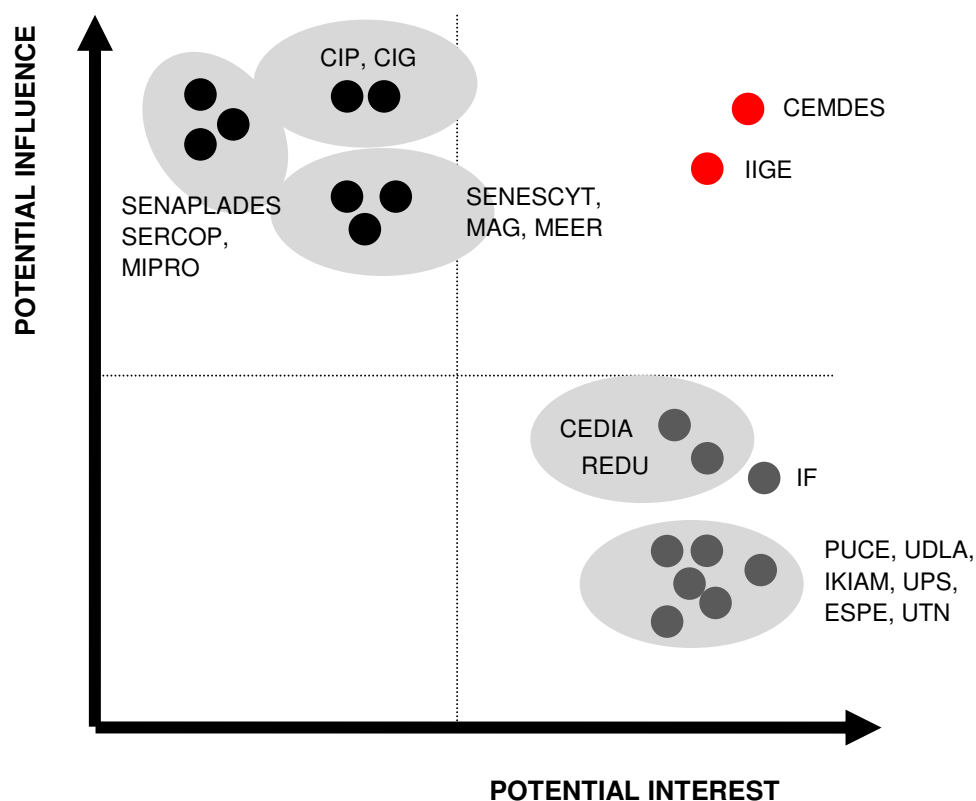
This document is intended for technical users with LCA knowledge who are guiding the national database development process. Following on the vision and goals, the roadmap identifies concrete objectives and activities that will need to be undertaken towards realising the national LCA database.

## The roadmap establishment process

Besides the project management, the project activities leading up to the roadmap establishment process and roadmap report are structured into: (i) baseline assessment and stakeholder mapping, (ii) stakeholder consultations, (iii) establishment of the National Database Working Group, (iv) roadmap report writing process, and (v) dissemination/launch of results. These project activities are summarized in the sections below.

### Baseline assessment and stakeholder mapping

The baseline assessment has been described in the deliverable D 2.5a "Report on baseline assessment and stakeholder mapping in Ecuador", considering LCA in industry and the private sector, LCA in regulations and public policy, LCA in research and academia and the status of LCA in international cooperation and NGOs. Potential stakeholders for the development of the national LCA database roadmap have been identified using the most common presentation style of stakeholder mapping: a matrix to represent two dimensions to capture and characterise the degree of influence and level of interests. The results of the mapping exercise are summarised in Figure 1 (see Table 1 in next page for the meaning of the acronyms), providing an overview of the stakeholder landscape.



**Figure 1.** Stakeholder analysis for development of national LCA database roadmap in Ecuador.

**Table 1.** List of stakeholders identified during first mapping exercise for development of national LCA database roadmap in Ecuador.

Sector	Stakeholder	Involvement
Public	Instituto de Investigación Geológica y Energética (IIGE)	direct
	Ministerio de Industrias y Productividad (MIPRO)	indirect
	Ministerio de Agricultura y Ganadería (MAG)	indirect
	Ministerio de Energía y Recursos Naturales No Renovables (MEER)	indirect
	Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT)	indirect
	Secretaría Nacional de Planificación y Desarrollo - (SENPLADES)	indirect
	Servicio Nacional de Contratación Pública - (SERCOP)	indirect
Industry and private sector	Consejo Empresarial para el Desarrollo Sostenible del Ecuador (CEMDES)	direct
	Cámara de Industrias y Producción (CIP)	indirect
	Cámara de Industrias de Guayaquil (CIG)	indirect
	Ingeniería Frugal (IF)	indirect
Academia	Pontificia Universidad Católica del Ecuador (PUCE)	direct
	Universidad Politécnica Salesiana (UPS)	direct
	Universidad Regional Amazónica (IKIAM)	direct
	Universidad de las Américas (UDLA)	direct
	Universidad Técnica del Norte (UTN)	direct
	Red Nacional de Investigación y Educación del Ecuador (CEDIA)	indirect
	Red Ecuatoriana de Universidades y Escuelas Politécnicas para Investigación y Posgrados - (REDU)	indirect
		indirect

It must be considered that actors build a dynamic and interdependent network of relations that can evolve quickly, so this mapping exercise has been updated during the project. The University of Cuenca, not identified as key stakeholder at the beginning of the project, has since played an important role in the discussion of the roadmap implementation plan.

## Stakeholder consultations

With the overall goal of getting stakeholders genuinely engaged in the roadmap process, two workshops were organized in Quito and Guayaquil on the 26th and 27th of February, respectively. These meetings also elicited the goals and aspirations of the project and ensured the key stakeholder views were captured. The participation of a representative from the process of development of national LCA database in Peru, Ian Vazquez-Rowe, provided the opportunity to discuss the lessons learnt from the process of our neighbour country, but it had also the main aspiration to show that the development of a national LCA database is not only meaningful but also already possible for a developing country such as Ecuador.

Details about both events are provided in Appendix A - Stakeholder consultation workshops, list of participants (signed) and photographs.

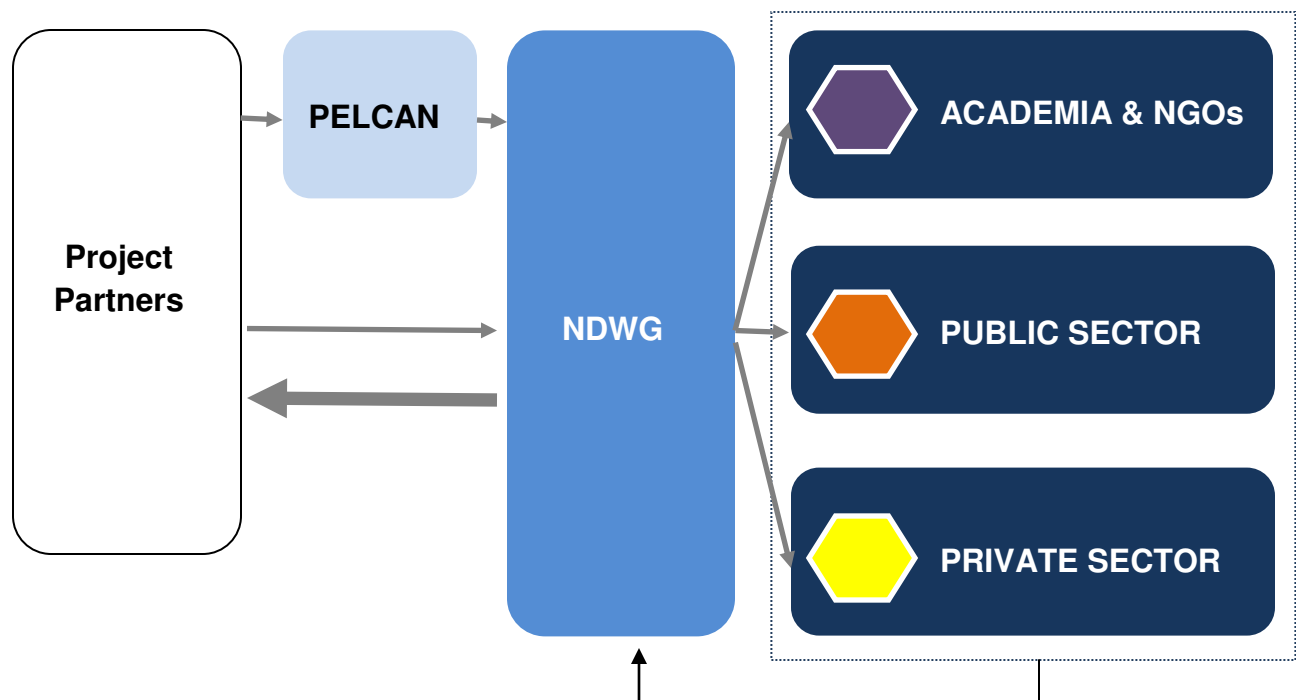
Following the recommendation of the Ministry of Environment, the Quito workshop's target audience was public sector and academia, whereas the workshop in Guayaquil focused on the

private sector. Notably, the Entrepreneurial Council for Sustainable Development of Ecuador (CEMDES) played a key role in attracting great representation from the private sector.

The workshops were structured in three main sections:

1. Providing a proper comprehension concerning life cycle approaches: How does LCA resonate with you?
2. Challenges and opportunities for Ecuador.
3. Making it real: lessons learnt from the Peruvian process.

After the development of the workshops, the National Database Working Group (NDWG) was formally established. Given the interest shown by most of the participants, a process of further stakeholder consultation was established (Figure 2) to maximise stakeholder involvement, recognising the need to be in tune with the needs, perceptions and attitudes of those who will shape and influence the roadmap success.



**Figure 2.** Stakeholder consultation for development of national LCA database roadmap in Ecuador.

Participants in the stakeholder consultation process are listed in Appendix B - Stakeholder consultation process.



## National Database Working Group

The National Database Working Group (NDWG) was formally established after the first round of stakeholder consultation workshops, considering not only the relevance in terms of influence but also the interest and commitment taken by the stakeholders. According to this analysis, below there is a list of the organizations that were committed to actively contributing to the NDWG (Table 2). One face-to-face meeting took place on Monday 13rd of May in Quito, whereas the other meetings took place online (Monday 15th April and Monday 3rd June, respectively).

**Table 2.** List of members of the National Database Working Group (NDWG) in Ecuador.

Sector	Member of the NDWG
Public	Ministry of Environment Instituto de Investigación Geológica y Energética (IIGE)
Private sector	Consejo Empresarial para el Desarrollo Sostenible del Ecuador (CEMDES)
Academia	Escuela Superior Politécnica del Litoral (ESPOL) Escuela Politécnica Nacional (EPN) Universidad Regional Amazónica (IKIAM)
NGO	Conservación Internacional Ecuador

## Roadmap report writing process

An project-internal review round resulted in feedback on the intermediate roadmap report, provided by representatives of the other countries participating in the present project in the form of a high-level SWOT (strength weaknesses opportunities threats) analysis, ensured the exchange of experiences and approaches, while it gave valuable insight to improve the implementation plan.

The following companies in Ecuador have participated in subsequent reviews: Holcim, San Carlos, Geocycle, Carbono Neutro, Adelca and Mexichem-Plastigama. Further discussion on key elements of the roadmap took place in the context of NDWG meetings. Finally, this roadmap report has been written by the technical coordinator of the project (Beatriz Rivela) and reviewed by the researchers from the University of Cuenca as well as by the national coordinator (Angel Ramírez).

## Dissemination activities

In the first stage of the project the goal of the dissemination activities was mostly focused on getting stakeholders genuinely engaged. As it has been mentioned, two workshops were organized in Quito and Guayaquil, 26th and 27th of February.

The main purpose of the second stage of the project was to ensure that the project research and practical outcome were widely disseminated to the appropriate target audiences. The dissemination plan was focused on digital strategies and targeted to the key stakeholders. This roadmap report will be made available to LCA stakeholders in Ecuador through suitable channels (e.g. mailing lists and social media).

A multidisciplinary round-table event was held as launch event on Tuesday 4th June, in the Universidad Andina Simón Bolívar (Quito), to disseminate and discuss the project's achievements.

In order to catalyse discussion and replication at international level, a contribution describing the roadmap process has been sent to the VIII International Conference of Life Cycle Assessment in Latin America. The International Conference of Life Cycle Assessment in Latin America, better known as CILCA, convenes professionals, researchers, decision makers, and the public in general from different countries to interact and exchange experiences under the umbrella of life cycle thinking and it is the most recognized event by the life cycle community in the region. CILCA 2019 will be the eighth edition of this international event, which has been rotating locations and this time will be happening on July 2019 in Cartago, Costa Rica. Our contribution, entitled "Life Cycle Assessment Database Roadmap: The Ecuadorian Experience" has been accepted as oral presentation (full paper in Appendix C). Moreover, UN Environment will host a side-event/special session where the roadmap process and outlook will be presented.

# Roadmap for developing a national LCA database

## Vision and goals

With the motivation of promoting access to life cycle knowledge as a public good, the vision of the Ecuadorian LCA database is to be the recognized source of national-based, high-quality, transparent life cycle inventory data which will become an integral part of the rapidly expanding use of life cycle approaches as an essential environmental and social analysis and decision-making tool.

The overall goal of the national database is to mainstream the use of Life Cycle Thinking by promoting publicly available, high-quality national-based life cycle inventory (LCI) data that are comprehensive, transparent, and critically reviewed. Providing a database that has transparent, quality-assured data is essential for supporting quality LCA activity and for building credibility and viability. Two of the most important features of the database are data quality and transparency. Users want confidence that the data are valid and demand a clear picture of what they represent, where they came from, and their uncertainty.

Following on from the vision and the overall goal, a set of concrete goals have been established:

1. Generate the necessary skills and capacity for the global application of life cycle approaches by training LCA practitioners, policymakers and business decision makers on the ways Life Cycle Knowledge can be best used in enhancing the effectiveness of decisions / policies towards sustainable development.
2. Create a data infrastructure that is interoperable, connected to Global LCA Data Access (GLAD) network, to promote the access to national-based life cycle inventories in Ecuador. This infrastructure will be the reference point to provide information to different actors (public and private sector as well as final consumers).
3. Collect and integrate data regarding social aspects to create unified databases. These databases will be the basis to perform social life cycle assessments (SLCA) and to complement the LCA methodology to measure sustainability.
4. Develop life cycle inventories following a unitary process perspective concerning prioritised sectors for national action.
5. Promote LCA uptake in policymaking and connect LCA application with UN's sustainable development goals (SDGs) as well as with on-going international programmes and projects.
6. Develop guidance, tools and mechanisms to support sustainable business development and national industry competitiveness. Promote awareness of the key role of sustainable business development to enhance environmental sustainability while contributing to economic viability and social inclusion.
7. Provide a repository of best practices, capitalizing experiences at different levels, from companies to governments, disseminating success stories, evidence and information on good practices to enable informed decision making.

## Organisation and finances

### Governance and management

A sound data governance programme must include the governance structure (i.e. a governing body or council), a defined set of procedures and a plan to execute those procedures. LCA data will need maintenance and updating over time. The management of the database should work towards the consistency among datasets, adherence to quality requirements and rules, defining the roles and responsibilities and planning for the database sustainability (UNEP, 2011).

The governance definition was the most controversial topic during the stakeholder discussion workshops. Concerns were raised by all the private sector participants about confidentiality; the main question, whose answer was considered critical to support the roadmap, was how to put the right controls in place to protect their data. Moreover, all the industry sector representatives (Table 3) expressed apprehensions on misuse of publicly available data: how can we ensure that their data are not going to be used as a basis to define and impose future taxes?

**Table 3.** Discussion participants from industry sectors - workshop in Guayaquil 27th February

Organisation	Sector	Participant	Role/Position
Ingenio San Carlos	Sugarcane	Coralia de la Cadena	Chief Sustainability Officer
Adelca	Steel	Andrés Alarcón	Chief Corporate Social Responsibility Officer
Plastigama	Plastics	Carlos Alaña	Chief Executive Officer (CEO)
Plastigama	Plastics	José Luis Cevallos	Chief Corporate Social Responsibility Officer
Novacero	Steel	Juan Carlos Andrade	Chief Executive Officer (CEO)
Holcim	Cement	Dorin Pepenel	Chief Executive Officer (CEO)
Holcim	Cement	Daniel Petroche	Chief Innovation Officer
Holcim	Cement	Carlos Ronquillo	Head of Cement Area
Cámara de Industria	Industry association	Leonard Quinde	Analyst

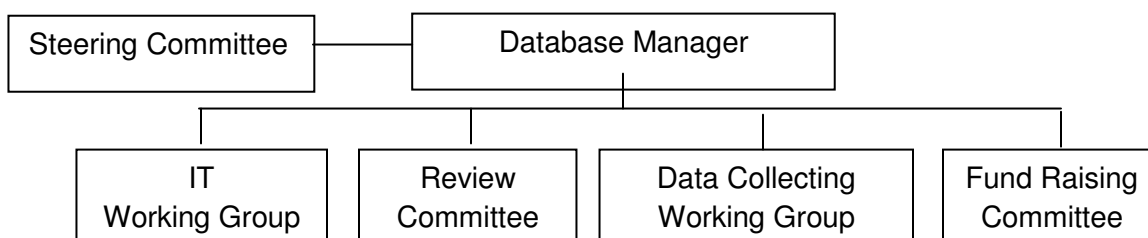
A holistic approach to data governance for security, privacy, confidentiality and compliance has been discussed. It is remarkable that all the stakeholders agreed that the academia is the best option to form governing body. Moreover, it is important to note that there are three main functions or activities concerning database management that need to be fulfilled: the IT, the review and fundraising management. The Peruvian LCA database experience showed that academia can be more agile and efficient in executing these functions.

Academia can be a great place to start because it is where most of the LCA data and expertise are concentrated. However, the day-to-day running of a database is appropriate to a not-for-profit organisation, consistent with other international life cycle databases. Thus, the role of database manager has been finally assigned to the [Ecuadorian Corporation for the Development of Research and Academia](#) (CEDIA). CEDIA's purpose is the development of scientific research and academia, as well as to offer services related to information technologies focused on scientific, technological, innovative, and educational development in Ecuador, through the Advanced Networks Project.

To ensure implementation of the roadmap, the most critical aspect is about clarity on who has ownership or responsibility for progressing on implementation. The governance structure recommended (Figure 3) includes a Steering Committee, representing relevant stakeholders (including government, industry and academia) to steer the overall direction of the database. This roadmap development exercise has included nomination of the Steering Committee (Table 4). The selection of members was made by the project team, based on their contribution to the NDWG and their commitment to the implementation process.

**Table 4.** List of members of the Steering Committee.

Sector	Member of the Steering Committee
Public	Ministry of Environment
Private sector	Entrepreneurial Council for Sustainable Development of Ecuador (CEMDES)
Academia	Escuela Superior Politécnica del Litoral (ESPOL) Escuela Politécnica Nacional (EPN) Universidad de Cuenca
NGO	Conservación Internacional Ecuador



**Figure 3.** Governance structure recommended

The governance structure should be reviewed by invited experts, for the board and disseminated to stakeholders every four years.

Moreover, it is crucial to clearly define and communicate the service level that stakeholders can expect from the database management. With the support of the Peruvian Life Cycle Assessment Network (PELCAN), key aspects related to service level (technical requirements, budget, time, etc.) have been discussed.

## Funds and financing

The potential costs related to the successful implementation of the roadmap have been analysed and discussed by participants of the National Database Working Group (NDWG), with the support of the Peruvian Life Cycle Assessment Network (PELCAN), considering human resources, IT needs, capacity building and dissemination activities. The needs assessment was

conducted according to the concrete goals established so it achieves the database project vision:

1. Capacity building programme designed for training LCA practitioners, policymakers and business decision makers to generate the necessary skills and capacity for the global application of life cycle approaches.
2. Infrastructure creation: development of an interoperable infrastructure, connected to Global LCA Data Access (GLAD) network.
3. Social Life Cycle framework: proposal of a context-specific SLCA framework, social indices and indicators.
4. Life cycle inventories: development of life cycle inventories, following a unitary process perspective, concerning prioritised sectors for national action.
5. LCA uptake in public policymaking: development of 3 pilot projects which promote the LCA uptake in public policymaking and/or connect LCA application with UN's sustainable development goals (SDGs) and on-going international programmes and projects
6. LCA uptake in sustainable business: development of guidelines to support sustainable business development, focused on national industry.
7. Dissemination: development of a dissemination plan, including a repository of success stories.

Financing required for this implementation was discussed with the support of PELCAN and it is described in section "Roadmap implementation plan".

In previous experiences in other developing countries, funding for capacity building was provided by UN Environment, The Life Cycle Initiative, the European Commission or individual donor countries. Financial support for the implementation of the Peruvian roadmap was provided by the International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) of Germany.

The Research and Academy Development Ecuadorian Corporation, CEDIA, could be one of the sources for funding. Their goal is to promote research and innovations projects that include Academia, Professionals and Entrepreneurs to support the development of the country. This organization provide funding through open calls for competition available for all member Universities. There are specific annual grants destined to Research Projects and Short Training Courses which could be used to develop a National LCA Database.

The National Secretariat of Higher Education, Science, Technology and Innovation of Ecuador (SENESCYT) is another stakeholder that impulse funding through the National Fund for Responsible Research Projects and Technological Development, which is managed by United Nations Development Program (UNDP). This fund is focused on projects regarding productivity innovation, environment, biodiversity, energy and materials, industrial development, social inclusion and Information and Communication Technology. Thus, the development of environmental and social databases is aligned to the goals of the aforementioned grant.

## Data and database

### Database hosting and access

The system must be freely accessible and easy to use, in line with the motivation of the database project of promoting access to Life Cycle Knowledge as a public good. A login system (assigning user IDs) will be used to identify and track users (welcome page). The requirements for hosting infrastructure will be defined according to the level of service intended to be offered (currently under discussion).

### Data needs and availability

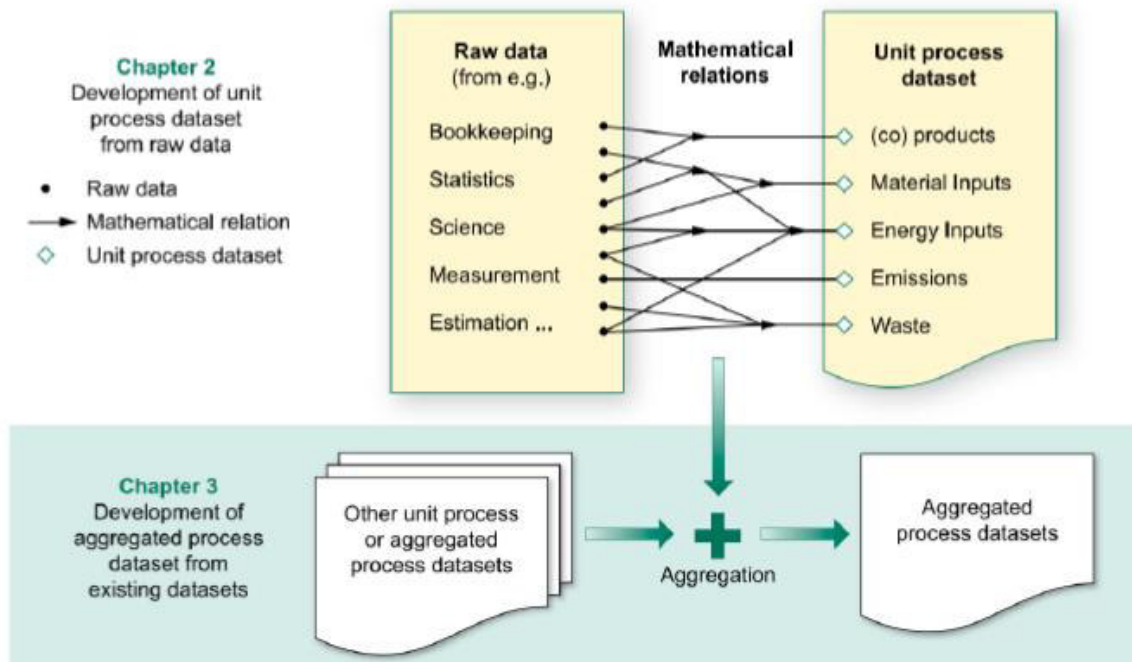
The process of identification of LCA data needs has been considered as a key action for stakeholder engagement in the roadmap development process. From the analysis of previous experiences, it can be concluded that most of the prioritisation exercises have had a very limited participation of the private sector. For example, the selection of priority sectors for PeruLCA, the recently created national LCA database for Peru, was established by the Peruvian Ministry of the Environment (MINAM) and agreed with the Peruvian Life Cycle Assessment Network (PELCAN). The selected sectors for Peru (hydropower, landfills and refinery products) also make sense for the Ecuadorian context. However, convinced of the advantages of a participatory process, it was decided to discuss national data needs during the workshops, in order to align everyone to the same vision and put all the stakeholders on the same page.

Drivers to address relevant sustainability issues were discussed during the workshops and special emphasis has been paid to the resolutions adopted at the Fourth session of the UN Environment Assembly (UNEA-4). A preliminary selection of datasets was proposed, considering relevant challenges related to processes or sectors in the economy as well as processes of particular concern or high environmental relevance:

- Environmentally sound management of waste: recognizing the international community's commitment to the sound management of waste and its significant contribution to the sustainable development goals (SDGs). There is a strong need to promote the availability of appropriate information in the value chain to favour sound and safe management of waste, including but not limited to a circular economy and other sustainable economic models.
- Innovative pathways to achieve sustainable consumption and production: acknowledging that the use of life-cycle approaches helps ensure that materials are used more productively throughout their life cycle, thereby reducing the generation of waste and environmental impacts, and can contribute significantly to the efforts for achieving sustainable consumption and production. It has been identified a great opportunity in applying Sustainable Public Procurement Practices (SPP) in Ecuador concerning some product categories.
- Sustainable energy planning: life cycle assessment allows to evaluate environmental impacts and find the best alternatives among various energy development plans and technologies.

- Application of LCA towards sustainable cities: cities are one of the top priorities of international organizations when it comes to setting sustainable development strategies, both in the economic, social and environmental areas sustainable cities, but decision-makers generally lack a life cycle perspective. Datasets concerning main issues involved in urban sustainability (buildings, energy, food, mobility, water and waste) are required to properly face this challenge.

Once this processes/data were preliminary selected, the next step was to identify the data availability. In the framework of the project "LCA of Ecuadorian Electricity Generation", LCIs have been created for hydroelectricity and fossil fuel, and thermal generation technologies. LCI of hydropower has considered on-site measurements for primary data related to operation and construction. Data were collected from design reports of 14 Ecuadorian power plants. LCI of fossil-based electricity generation technologies used in Ecuador include fuel oil in steam power plants, fuel oil in internal combustion engine power plants, natural gas in gas turbine power plants and diesel in gas turbine power plants. All the data related to the operation of the power plants were obtained by on-site measurements (average values for the year 2012), whereas background life cycle inventory data have been sourced from the ecoinvent database and adapted as far as possible to Ecuadorian conditions. LCI of hydroelectricity remains unpublished. LCI of fossil-based electricity has been recently published in Energy Policy (Ramirez et al., 2019). It is remarkable that these already available data demand more work in order to fulfil with the format requirements of the database. Thus, it is necessary to find strategies and funding for further work that guarantee that these data are incorporated in the database. For missing data, innovative approaches like the [LCA data machine](#) (LCADM) could be explored (Figure 4).



**Figure 4.** Creation of LCA datasets from raw data. Source: Ciroth and Srocka (2016), considering UNEP Shonan Guidance Principles (Wang et al. 2011).



## Data quality requirements and review

LCA researches of the Escuela Superior Politécnica del Litoral and Escuela Politécnica Nacional, based on the experience acquired as a result of their research work, are able to collect and review of LCA data, but they have not been involved with database management. It is noteworthy that there has not been any training activity concerning global guidance for databases creation and management in the country.

Data quality requirements of the LCDN (EC-JRC 2016),<sup>14</sup> ecoinvent version 3 (Weidema et al. 2013),<sup>15</sup> and QualiData (IBICT, 2016) have been analysed as a basis to discuss quality mandatory and optional guidelines, but external support is needed to define database quality and review principles and requirements.

## Data format and database interoperability

Throughout all project activities, data format and database neutrality are being respected, i.e., no particular format or system promoted nor favoured. Deliverable D 3.1 presents an overview of the most established/common data exchange formats. The ILCD and ecoSpold (v1 and v2) formats represent the two most established data exchange formats; both are compliant with ISO/TS 14048 and based on Extensible Markup Language (XML). This overview of formats also encompasses the relatively novel JSON-LD data exchange format:

- **ILCD**: according to Wolf et al. (2011), the development of the International Reference Life Cycle Data System (ILCD) started in 2005 (originally under the name ELCD data format). The ILCD format is supported by most major LCA softwares and it is used, besides the Life Cycle Data Network (LCDN), by national LCA databases such as SICV in Brazil, MYLCID in Malaysia, and the Thai National LCI database.
- **ecoSpold**: the ecoSpold format is the result of several iterative evolutions of XML-based data formats for LCA data, beginning in the 1990s. While sometimes associated primarily with the ecoinvent database, it is an open-source format, and its most recent version is the ecoSpold v2 format. The ecoSpold format is supported by most major LCA softwares, and it is used, besides for the ecoinvent database, by the AusLCI in Australia, PeruLCA in Peru, and the Quebec LCI database in Canada.
- **JSON-LD**: a format based on JavaScript Object Notation for Linked Data (JSON-LD) was developed and implemented by GreenDelta as an alternative to the established formats in XML. It aims at reducing the effort for implementation and inconsistencies between these formats, other advantages, such as being human-readable and the ease of integration into web-applications, were also put forward as motivation. JSON-LD was implemented as one of the formats in openLCA since 2015, but the support of this format in other LCA software is still limited. The JSON-LD data exchange format is directly created from the LCA Collaboration server and thus straightforward to use with GLAD.

Given the lack of expertise of the local team concerning data format implications as well as the absence of discussion about advantages/disadvantages of the different options, external support is strongly needed to discuss which data format must be chosen.

## Interoperability over the Global LCA Data Access (GLAD) network

This beginning database initiative acknowledges the value of being interoperable with other data sources, and the visibility that a platform such as the GLAD network can offer. The data infrastructure will be designed to be interoperable and connected to Global LCA Data Access (GLAD) network. This is complemented by considering the GLAD requirements for metadata descriptors during data collection and entry to the national LCA database.”

## Promotion of LCA uptake in policymaking

The development and expansion of national LCA databases ideally goes hand-in-hand with increased inclusion of LCA in public policies and regulations: an LCA database is as good as the decision making it can support and the number of users involved. Thus, the promotion of LCA uptake in policymaking has been established as an specific goal of the Ecuadorian roadmap implementation project.

The representatives of the Ministry of Environment have expressed their strong interest on the formulation and implementation of public policies related to two policy areas:

- Waste management: proposal supported by the team of the National Program for the Integral Management of Solid Waste (PNGIDS).
- Sustainable Public Procurement Practices (SPP): proposal supported by the team of the Sustainable Consumption and Production Unit.

Moreover, the municipality of Quito expressed its interest in policy action based on sustainability assessment at urban level and sustainable consumption and production indicators to analyse hotspots and provide information to consumers.

Concerning the connection of LCA application with UN’s sustainable development goals (SDGs) and on-going international programmes and projects, it has been observed that current UN programmes identified in Ecuador are focused on bioeconomy, circular economy and climate change. There is a challenging opportunity in these projects to introduce life cycle thinking. To this end, the Regional Office for Latin America and the Caribbean has been contacted and a creative brief workshop with the teams working on UN programmes has been proposed, to discuss how LCA resonates with their work.

# Roadmap implementation plan

## Activities, roles and responsibilities for roadmap implementation

The specific activities for first roadmap implementation have been discussed following the general guidelines and recommendations provided by deliverable D 3.1. A Two-Year Action Plan for the implementation has been defined, considering activities according to the pathways to the attainment of the 7 specific goals.

The Ecuadorian Corporation for the Development of Research and Academia (CEDIA) is responsible for the coordination of activities related to the creation of the infrastructure (Goal 2). Stakeholders recommended as members of the Steering Committee are responsible for progressing on implementation of the remaining activities, based on their specific competences. It is noteworthy that the geographical distribution of academia stakeholders (Figure 5) ensures national coverage.



**Figure 5.** Location of the academia stakeholders.

## GOAL 1

---

Coordinator: Escuela Politécnica Nacional

*Generate the necessary skills and capacity for the global application of life cycle approaches by training LCA practitioners, policymakers and business decision makers on the ways Life Cycle Knowledge can be best used in enhancing the effectiveness of decisions / policies towards sustainable development.*

The Life Cycle Capacity Development programme has been designed for training different target audiences to generate the necessary skills and capacity for the global application of life cycle approaches. The programme draws on existing materials from the Life Cycle Initiative and requires the completion of the Life Cycle Thinking e-learning modules as a prerequisite.

After a common introductory workshop, the capacity building programme focuses on the target audience specific needs.

### A1. Capacity building for academic institutions

Three workshops will be developed in each of the three universities' locations (Quito, Cuenca and Guayaquil) to assure the training of new experts in LCA as well as to reinforce current local capacities.

**Workshop 1.** Introduction -Overview of Life Cycle Approaches and basic understanding of Life Cycle Assessment (LCA) / 2 days

This workshop will provide attendees an overall view of the basic concepts in the fundamental principles of environmental life cycle analysis (LCA):

- Understand Life Cycle Thinking applications in public policies, businesses and by consumers.
- Learn about LCA stages of products or services
- Perform flow sheeting and develop a life cycle inventory as the basis for an LCA.
- Be able to conduct a life cycle assessment with LCA software.

**Workshop 2.** Become advanced / 2 days

This workshop will provide attendees practical recommendations for Life Cycle Thinking Application:

- Primary raw and secondary data acquisition
- Process modeling and creation of LCA datasets.
- Environmental life cycle impact assessment indicators and characterization factors used in Life Cycle Impact Assessments (LCIA).
- Guidelines for Social Life Cycle Assessment

**Workshop 3.** Database requirements and management / 1 day

This training is critical as national expertise needs to be built in order to avoid reliance on expensive expertise from other countries:

- Data quality and review requirements

- Goal and scope for the dataset
- Time related, geographical and technological conformance
- Service level
- Hosting infrastructure
- Data format and interoperability.

It is suggested that international experts provide support in workshops 2 and 3.

## **A2. Capacity building for public sector**

Workshops will be developed in Quito, Cuenca and Guayaquil to provide an introduction to life cycle approaches and their applications in public policies, businesses and by consumers.

**Workshop 1.** Introduction -Overview of Life Cycle Approaches and basic understanding of Life Cycle Assessment (LCA) / 2 days

This workshop will provide attendees an overall view of the basic concepts in the fundamental principles of environmental life cycle analysis (LCA):

- Understand Life Cycle Thinking applications in public policies, businesses and by consumers.
- Learn about LCA stages of products or services
- Perform flow sheeting and develop a life cycle inventory as the basis for an LCA.
- Be able to conduct a life cycle assessment with LCA software.

**Workshop 2.** Use of LCA software to assess environmental impacts

This workshop will provide skills and knowledge to perform Environmental Life Cycle Assessments (LCAs)

- Methodological framework of LCA according to international standards
- Relationship between LCA and Sustainable development
- Phases of LCA. Definition of goal and scope.
- Life Cycle Inventory (LCI). Data collection and analysis of results
- Impact evaluation methods. Normalization and weighting, general concepts.

**Workshop 3.** Environmental public policy and decision making through life cycle thinking

This workshop will provide insights about public policy development applying life cycle thinking

- Policy development in Ecuador
- Policy implementation based on life cycle thinking as a new approach to address sustainable development, cases studies of successful implementations.
- Roles and responsibilities
- Monitoring implementation of public policies.

## **A3. Capacity building for private sector**

Workshops will be developed in Quito, Cuenca and Guayaquil to provide an introduction to life cycle approaches and their applications in public policies, businesses and by consumers. Circular Economy and bioeconomy strategies are two topics relevant to the private sector

**Workshop 1.** Introduction -Overview of Life Cycle Approaches and basic understanding of Life Cycle Assessment (LCA) / 2 days

This workshop will provide attendees an overall view of the basic concepts in the fundamental principles of environmental life cycle analysis (LCA):

- Understand Life Cycle Thinking applications in public policies, businesses and by consumers.
- Learn about LCA stages of products or services
- Perform flow sheeting and develop a life cycle inventory as the basis for an LCA.
- Be able to conduct a life cycle assessment with LCA software.

**Workshop 2.** Social and environmental responsibility using life cycle thinking

This workshop will provide tools for guiding private sector to develop sustainability strategies

- Social responsibility: SLCA as a diagnostic tool
- Environmental responsibility: LCA as a diagnostic tool
- Benefits of life cycle thinking: LCA and SLCA.
- Why circular economy and bioeconomy business models need LCA

## GOAL 2

---

Coordinator: Ecuadorian Corporation for the Development of Research and Academia

*Create an infrastructure interoperable, connected to Global LCA Data Access (GLAD) network, to promote the access to national-based life cycle inventories in Ecuador. This infrastructure will be the reference point to provide information to different actors (public and private sector as well as final consumers).*

The development of an interoperable infrastructure, connected to Global LCA Data Access (GLAD) network, requires the definition from the design stage of practical issues such as the IT platform and metadata documentation and decision making during the implementation activities.

### A4. Kick off Workshop

A workshop will be developed in Cuenca to address practical issues:

- Data formats and protocols
- Data reviewer qualification plan
- Data quality review program
- Requirements for hosting infrastructure

### A5. Establishment of data collection and storage mechanisms

Decision will be based on the needs of data providers and data users identified in the initial baseline assessment and stakeholder analysis.

**A6. Establishment of customer service procedures/mechanisms**

The key tasks here will be define access criteria, define financial terms and marketing and communication to data providers and data users. Potential source of funding/to support financial viability will be defined by offering additional services, e.g., data basis for and generation of environmental product declarations (EPDs).

**A7. Selection and development of IT platform**

Based on the above requirements, the IT platform will be conceptualized and implemented.

**A8. Establishment of ongoing development/maintenance mechanism/procedures**

The launch of the IT platform needs to be accompanied by activity relating to its ongoing maintenance and evaluation to derive maximum benefit from the investments and effort going in.

**GOAL 3**


---

Coordinator: Universidad de Cuenca

*Collect and integrate data regarding social aspects to create unified databases. These databases will be the basis to perform social life cycle assessments (SLCA) and to complement the LCA methodology to measure sustainability.*

**A9. Propose a context-specific social life cycle assessment (SLCA) framework**

Propose a context-specific social life cycle assessment (SLCA) framework and establish a set of social indices and indicators to assess the social performance of prioritised sectors for national action.

**A10. Collect and integrate data regarding social aspects**

Two ongoing projects have been selected as pilot projects to assess social aspects:

- The project “Enhancing the Social Value of the Circular Economy in Latin America”, funded by the Flemish Interuniversity Council for University Development Cooperation (VLIR-UOS).

This project is carried out by University of Cuenca and Universidad Andina Simón Bolívar in Ecuador, and KU Leuven and University of Antwerp in Belgium. The project aims at proposing sustainable development strategies for solid waste management. The focus of the project is on three axes: economic, environmental and social, the latter being a new component in local research. For the three axes life cycle thinking will be used, special attention will be paid to Social Life Cycle Assessment (SLCA) the newest methodology and the one with more academic challenges. The project lasts four years and has two geographical case studies: Cuenca and Portoviejo. Cuenca is a national reference in the management of solid waste with the municipal company EMAC EP, but the involvement of groups of waste pickers is limited. In contrast, the city of Portoviejo has inadequate waste management, but there is an interesting experience of cooperation with waste picker groups. In these two geographical cases, two waste flows will be analyzed: Waste Electrical and Electronic Equipment (WEEE) and PET plastic bottles. WEEE is

studied for constituting a highly complex and dynamic stream; and PET bottles for being a simple one.

- The project “Deep Decarbonization Pathways in Latin America” (DDP-LAC), funded by the Inter-American Development Bank.

The DDP-LAC project builds capacity in Argentina, Colombia, Costa Rica, and Ecuador on long-term climate policy scenarios through a network of regional and international experts. The capacity building objective to enable the development of long term low emissions development strategies primarily aim at equipping in- country teams with specific tools and methodologies for the elaboration of country-driven 2050 pathways suited to inform the articulation between global climate goals and the relevant sets of country circumstances, including development priorities. Based on these expanded capacities, the secondary objective should be to initiate and facilitate exchange of knowledge between researchers and decision makers in countries, in order to support the internalization of the conclusions of long-term analysis into short-term policy, including in revised NDCs.

#### **A11. SLCA database creation**

Unified databases will be created to perform social life cycle assessments (SLCA).

### **GOAL 4**

---

Coordinator: Escuela Superior Politécnica del Litoral

*Develop life cycle inventories following a unitary process perspective concerning prioritised sectors for national action.*

#### **A12. Prioritize data needs**

Based on data needs previously described, 4 strategic sectors will be prioritized.

#### **A13. Fill data gaps**

Collect and critically evaluate the data quality of previous LCI studies and fill data gaps.

#### **A14. Develop life cycle inventories**

LCI data generation activities to create a common pool of freely available LCI data to serve as the backbone of life cycle-based metrics and assessments.

### **GOAL 5**

---

Coordinator: Ministry of Environment

*Promote LCA uptake in policymaking and connect LCA application with UN's sustainable development goals (SDGs) as well as with on-going international programmes and projects.*

#### **A15. Development of 3 pilot projects**

Development of 3 pilot projects which promote the LCA uptake in public policymaking and/or connect LCA application with UN's sustainable development goals (SDGs) and on-going international programmes and projects.



To meet the overall goal of engaging public institutions for policy making base in Life Cycle information, three ongoing/past projects have been selected as areas of work:

- Environmentally sound management of waste: ongoing project “Enhancing the Social Value of the Circular Economy in Latin America”.
- Sustainable energy planning: ongoing project Deep Decarbonization Pathways in Latin America
- Sustainable Public Procurement Practices: past project “Sustainable Public Procurement and Eco-Labeling project (SPPEL)”.

## GOAL 6

---

Coordinator: Entrepreneurial Council for Sustainable Development of Ecuador

*Develop guidance, tools and mechanisms to support sustainable business development and national industry competitiveness. Promote awareness of the key role of sustainable business development to enhance environmental sustainability while contributing to economic viability and social inclusion.*

### **A16. Development of guidelines to support sustainable business development**

Development of guidelines, drawn on existing materials from the Life Cycle Initiative, to support sustainable business development, focused on national industry, with the overall goal to promote awareness of the key role of sustainable business development to enhance environmental sustainability while contributing to economic viability and social inclusion.

Preliminary topics:

- Life cycle assessment – an SMEs perspective.
- How LCA can confer competitive advantage for companies in procurement.
- Life Cycle approaches for sustainable innovation.

## GOAL 7

---

Coordinator: Conservación Internacional Ecuador

*Provide a repository of best practices, capitalizing experiences at different levels, from companies to governments, disseminating success stories, evidence and information on good practices to enable informed decision making.*

### **A17. Develop and implement a communication plan**

Design and implementation of a communication plan truly tailored to the project.

### **A18. Repository of *Success stories***

Compilation of success stories for the promotion of the use of life cycle approaches and development of a repository of best practices.

## Budget and timeline for roadmap implementation

As it has been mentioned, local experts are not available to completely support technical development activities; such expertise needs to be built in order to avoid reliance on expensive expertise from other countries. A significant proportion of the database development budget has been allocated to developing local capacity. An overview of the timeline for the project activities is provided by the table below, including budget estimates.

Goal/Activity		Month																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Budget (in kUS\$)
G1	A1																									13.00
	A2																									3.00
	A3																									2.00
G2	A4																									6.00
	A5																									3.00
	A6																									7.50
	A7																									18.00
	A8																									3.00
G3	A9																									7.50
	A10																									9.00
	A11																									13.00
G4	A12																									1.50
	A13																									3.00
	A14																									60.00
G5	A15																									45.00
G6	A16																									11.00
G7	A17																									24.00
	A18																									8.00
		TOTAL																								237.50

## Budget description

A total of 5,000 USD has been considered in terms of daily allowances of the international experts in LCA, flying tickets, and accommodation (A2 and A4)

For each training (workshop or seminar) an amount of roughly 1,000 USD should be considered, including daily allowances for trainers, materials and venues.

Design and production of communication and awareness-raising materials is included in A16, A17 and A18.

## Risk management

Experience of database development in many countries indicates that there will be some difficulties along the way. Strategies to cope with negative risks will be discussed based on the framework described in Deliverable 3.1 for typical risks associated with LCA database development initiatives. These typical risks have been grouped in three categories: content and quality risks, stakeholder commitment, and resource constraints. Risk areas have been assigned to “risk owners”, who will be responsible for monitoring the risks and refining and triggering the risk responses:

- ESPOL: Escuela Superior Politécnica del Litoral
- EPN: Escuela Politécnica Nacional
- UCUENCA: Universidad de Cuenca
- MAE: Ministry of Environment
- CEDIA: Ecuadorian Corporation for the Development of Research and Academia

Table 5 summarizes typical risks and examples of suggested actions, which will be further discussed in the coming weeks.

**Table 5.** Typical risks and suggested actions to manage risk. Source: adapted from Deliverable 3.1 " General guidelines and recommendations for establishing roadmaps aimed at national LCA database development".

RISK		SUGGESTED ACTIONS	RESPONSIBLE
<b>Content and quality risks</b>			
1	Data quality may not be up to the mark (Incorrect, outdated)	Defining data quality goals and setting benchmarks to check whether the data meets the data quality requirements. Build data quality assessment and improvement into the data collection strategy, and establish appropriate review mechanism	CEDIA
2	Geographical coverage limitations	Start with most representative data possible and gradually improve data representativeness/ regionalization	MAE
3	Difficulties in collection of primary data	Include secondary data sources, (E.g. laboratory measurements, governmental and industrial documents, trade reports and databases, national databases, environmental inventories, consultancies, academic sources, engineering judgments).	EPN, ESPOL, UCUENCA
<b>Stakeholder commitment</b>			
4	Lack of contribution by stakeholders	Involve empowered and committed stakeholders right from the beginning of the road mapping exercise	EPN, ESPOL, UCUENCA
5	Insufficient support and participation from particular groups (e.g. government, industry, academia)	Promotional campaign at the outset to educate and motivate key stakeholders with clear messages on benefits to each group	MAE
6	Loss of stakeholder interest over time	Data updates and continuing engagement with stakeholders through periodic interactions/events	EPN, ESPOL, UCUENCA
7	Apprehensions on misuse of data	Address apprehensions at the outset and resolve open questions about who can access the data and for what purpose	CEDIA
8	Lack of stakeholder interest in using the data	Establish linkages with existing problems that are of concern to stakeholders and remove any bottlenecks in accessing the data (e.g. unduly high cost, cumbersome process)	EPN, ESPOL, UCUENCA

Resource constraints			
9	Financial constraints in developing and maintaining a National LCA Database	Establish business model at the outset and engage agencies that will fund the database development and those that will benefit from it. If the beneficiaries themselves are funding the development, financial commitments are more likely to be forthcoming	CEDIA
10	Insufficient expertise among national stakeholders	Establish linkages for inviting external experts to support and build local capacity	EPN, ESPOL, UCUENCA

## Conclusions and recommendations

The Peruvian Life Cycle Assessment Network (PELCAN) has been providing valuable support to this project. Lessons learnt from Peruvian process have been a source of inspiration and their experience provides very useful insights for some definitions under discussion, such as funds and financing issues. However, there is a strong need of external support to define some relevant technical aspects. In particular, capacity building is needed concerning two main aspects:

- Database quality and review principles and requirements.
- Data format and database interoperability.

This training is also critical for the sustainability of the project, as national expertise needs to be built in order to avoid reliance on expensive expertise from other countries.

Most of the workshop participants showed a great interest in the project. Thus, a process of further stakeholder consultation has been established to maximise stakeholder involvement, recognising the need to be in tune with the needs, perceptions and attitudes of those who will shape and influence the roadmap success.

Special attention has been paid to the definition of database governance, considering concerns raised by all the private sector participants about confidentiality and apprehensions on misuse of publicly available data.

The implementation of a national capacity building programme must be prioritised, considering different types of target audiences. Short-term strategies for financing this programme must be encouraged.

# References and resources

## POLICY FRAMEWORKS

### International framework

Draft Ministerial Declaration of the 2019 United Nations Environment Assembly “Innovative solutions for environmental challenges and sustainable consumption and production”.

UNEP/EA.4/L.2 Innovative Pathways to Achieve Sustainable Consumption and Production. Nairobi, 11–15 March 2019.

UNEP/EA.4/L.3 Promoting sustainable practices and innovative solutions for curbing food loss and waste. Nairobi, 11–15 March 2019.

UNEP/EA.4/L.4 Sustainable Mobility. Nairobi, 11–15 March 2019.

UNEP/EA.4/L.5 Addressing environmental challenges through sustainable business practices. Nairobi, 11–15 March 2019.

UNEP/EA.4/L.8 Environmentally Sound Management of Waste. Nairobi, 11–15 March 2019.

UNEP/EA.4/L.27 Keeping the World Environment under Review: Enhancing UNEP’s Science-Policy Interface and Endorsement of the Global Environment Outlook. Nairobi, 11–15 March 2019.

### Ecuadorian framework

Ministry of Environment & Ministry of Foreign Affairs. Comments to the Draft Outline Document for the Ministerial Outcome Document of the 2019 UN Environment Assembly. September 2018.

Noboa, E. Upham, P. Heinrichs, H. (2018) Collaborative energy visioning under conditions of illiberal democracy: results and recommendations from Ecuador. *Energy, Sustainability and Society* 8:31, pp. 1-17.

Vázquez-Rowe, I. Kahhat, R. Larrea-Gallegos, G., Ziegler-Rodriguez, K. (2019). Peru's road to climate action: Are we on the right path? The role of life cycle methods to improve Peruvian national contributions. *Science of the Total Environment* 659, pp. 249–266.

Vázquez-Rowe, I. Quispe, I., Gilardino, A. Regional Stakeholder Consultation on LCA Databases in Latin America. Report based on Session on ‘Regional Roadmap towards the Development of LCA Databases’. December 2015, Lima, Perú.

## SUCCESS STORIES AND OPPORTUNITIES

### LCA database roadmaps

MTEC (2017) Thai national LCI database. National Metal and Materials Technology Center, MTEC. Available at:



[http://spaces.oneplanetnetwork.org/system/files/8b\\_database\\_roadmapping\\_key\\_considerations\\_thailand\\_11-17.pdf](http://spaces.oneplanetnetwork.org/system/files/8b_database_roadmapping_key_considerations_thailand_11-17.pdf)

NREL (2009) U.S. life cycle inventory database roadmap. National Renewable Energy Laboratory, NREL. Available from: <https://www.nrel.gov/docs/fy09osti/45153.pdf>

Carlson, R. and A-C. Palsson (1998) Establishment of CPM's LCA database - project report. CPM report 1998:3. Chalmers University of Technology. Göteborg, Sweden. Available at: <http://cpmdatabase.cpm.chalmers.se/AboutDatabase.htm>

### **Database case studies and national/regional accounts**

Chomkham Sri, K. T. Mungcharoen, C. Yuvaniyama (2017) 10-year experience with the Thai national LCI database: case study of “refinery products. International Journal of Life Cycle Assessment, 22(11):1760–1770. DOI: 10.1007/s11367-016-1160-3

Harding, K., Basson, L., Brent, A., Freidlich, E., Mbohwa, C., Notten, P., Pineo, C., Ruiters, L.-H., von Blottnitz, H. and Janse van Vuuren, P. (2015) Status and prospects of life-cycle assessment in South Africa, LCM 2015. Available at: [https://www.researchgate.net/publication/281292750\\_Status\\_and\\_prospects\\_of\\_life-cycle\\_assessment\\_in\\_South\\_Africa](https://www.researchgate.net/publication/281292750_Status_and_prospects_of_life-cycle_assessment_in_South_Africa)

Lesage, P. and Samson, R. (2013). The Quebec Life Cycle Inventory Database Project. International Journal of Life Cycle Assessment, 21:1282–1289. DOI: 10.1007/s11367-013-0593-1

Valdivia, S., G. Sonnemann, L. Milà i Canals (2017) LCA mainstreaming conditions in Latin America—based on learnings from 2005 to 2014. International Journal of Life Cycle Assessment, 22:485–491. DOI: 10.1007/s11367-016-1142-5

### **Life Cycle Thinking opportunities**

Hellweg, S., Canals, L.M.I., 2014. Emerging approaches, challenges and opportunities in life cycle assessment. Science 344, 1109–1113. <https://doi.org/10.1126/science.1248361>

Seidel (2016). The application of life cycle assessment to public policy development. International Journal of Life Cycle Assessment 21 (3), pp. 337–348.

UNEP/SETAC Life Cycle Initiative (2014) Life Cycle Thinking in Latin America. Available at: <http://www.lifecycleinitiative.org/wp-content/uploads/2015/01/LCA-LCM-company-case-studies-in-Latin-America.pdf>

United Nations Environment Programme (2019). The Business Case For Life Cycle Thinking. p.20. Available at: [https://www.lifecycleinitiative.org/wp-content/uploads/2019/03/unep\\_nairobi\\_V7-LR.pdf](https://www.lifecycleinitiative.org/wp-content/uploads/2019/03/unep_nairobi_V7-LR.pdf)

United Nations Environment Programme (2019). The Business Case for Eco-innovation. Available at: <http://unep.ecoinnovation.org/>

## GUIDANCE ON DATA FORMAT AND DATABASE INTEROPERABILITY

Ciroth, A., Greve, S. (2018): Applying metadata descriptors for finding data and for building LCA models, ACLA LCA XVIII, Fort Collins, 25 September

Ciroth, A., Hildenbrand, J., Zamagni, A., Foster, C. Life Cycle Inventory Dataset Review Criteria. Technical report.

Ciroth, A., Srocka, M. Introducing the LCA data machine. SETAC Europe 2017, Brussels, May 8.

GLAD (2018) Supporting document for nodes interested to join GLAD. UN Environment/Global LCA Data Access Network, GLAD. Available at:  
<https://www.globalcadataaccess.org/uploads/Guidance%20for%20GLAD%20metadata%20descriptors.pdf>

Kuczenski, B., Davis, C.B., Rivela, B., Janowicz, K. (2016). Semantic catalogs for life cycle assessment data. *Journal of Cleaner Production* 137, pp. 1109-1117.

Meinshausen, I., P. Müller-Beilschmidt, T Viere (2016) The EcoSpold 2 format - why a new format? *International Journal of Life Cycle Assessment*, 21(9),1231–1235. DOI: 10.1007/s11367-014-0789-z

Oliveira Rodrigues, T., E. Toshio Sugawara, D.A. Lopes Silva, M. I. S. Folegatti Matsuura, T.E. Nunes Braga, C. M. Lie Ugaya (2016) Guia Qualidata - Requisitos de qualidade de conjuntos de dados para o Banco Nacional de Inventários do Ciclo de Vida (in Portuguese). Instituto Brasileiro de Informação em Ciência e Tecnologia, IBICT. Available from: <http://acv.ibict.br/wp-content/uploads/2017/05/Qualidata.pdf>

Simone, F., O. Kusche, L. Zampori (2016) Life Cycle Data Network — Handbook for data developers and providers. JRC Technical Reports, EUR 28251. Joint Research Centre of the European Commission. Available at: [http://eplca.jrc.ec.europa.eu/PERMALINK/JRC104371\\_lb-na-28251-en-c.pdf](http://eplca.jrc.ec.europa.eu/PERMALINK/JRC104371_lb-na-28251-en-c.pdf)

UNEP (2011) Global guidance principles for life cycle assessment databases - A basis for greener processes and products. United Nations Environment Programme, UNEP. Available at: <https://www.lifecycleinitiative.org/wp-content/uploads/2012/12/2011%20-%20Global%20Guidance%20Principles.pdf>

UNEP (2016) Opportunities for national life cycle network creation and expansion around the world. United Nations Environment Programme, UNEP. Available at: [http://www.oneplanetnetwork.org/sites/default/files/unep-lci\\_mapping-publication-9.10.16-web.pdf](http://www.oneplanetnetwork.org/sites/default/files/unep-lci_mapping-publication-9.10.16-web.pdf)

Vigon, B., Sonnemann, G., Asselin, A., Schrijvers, D. Ciroth, A., Chen, S.S., Braga, T. Poolsawad, N. Mungkalasiri, J. Boureima, F. Milà i Canals, L. (2017). Review of LCA datasets in three emerging economies: a summary of learnings. *International Journal of Life Cycle Assessment* 22 (11), pp. 1658-1665.

Wang, H., Ciroth, A., Gerber, P., Mbowha, Ch., Mungcharoen, T., Sahnoune, A., Tahara, K., Tikana, L., Suppen, N. (2011): Development of Unit Process Datasets, chapter 2 in the UNEP Shonan Guidance Principles.

Wolf, M.A. (2014) White paper: National LCA databases - Status and ways towards interoperability. maki Consulting. Berlin, Germany. Available at: [https://maki-consulting.com/wp-content/uploads/2013/05/2014\\_National-LCA-databases\\_White-paper\\_maki-Consulting\\_final\\_clean.pdf](https://maki-consulting.com/wp-content/uploads/2013/05/2014_National-LCA-databases_White-paper_maki-Consulting_final_clean.pdf)

Wolf, M.A., C. Döpmeier, O. Kusche (2011) The International Reference Life Cycle Data System (ILCD) Format – Basic Concepts and Implementation of Life Cycle Impact Assessment (LCIA) Method Data Sets in EnviroInfo 2011: Innovations in Sharing Environmental Observations and Information. Shaker Verlag Aachen, ISBN: 978-3-8440-0451-9.

## ECUADORIAN DATA

Avadí, A., Bolaños, C., Sandoval, I., Ycaza, C. (2015). Life cycle assessment of Ecuadorian processed tuna. The International Journal of Life Cycle Assessment 20 (10), pp. 1415–1428. <https://doi.org/10.1007/s11367-015-0943-2>

Pérez- Neira, D. (2016). Energy sustainability of Ecuadorian cacao export and its contribution to climate change. A case study through product life cycle assessment. Journal of Cleaner Production 112 (4), pp. 2560-2568. <https://doi.org/10.1016/j.jclepro.2015.11.003>.

Ramirez, A.D ., Rivela, B., Boero, A.J., Melendres, A.M. (2019) Lights and shadows of the environmental impacts of fossil-based electricity generation technologies: a contribution based on the Ecuadorian experience. Energy Policy 125, pp. 467-477.

Ramirez, A.D., Perez, E.F., Boero, A.J., Salas, D.A. (2017) Carbon Footprint of Energy Systems: Liquefied Petroleum Gas Based Cooking vs Electricity Based Cooking in Ecuador. ASME 2017 International Mechanical Engineering Congress and Exposition. DOI: 10.1115/IMECE2017-70351.

Ramirez, A.D., Torres, D., Peña, P. Duque-Rivera, J. (2014). Life cycle assessment of greenhouse gas emissions arising from the production of glued and pressed wall panels derived from Guadua Angustifolia Kunth (bamboo) in Ecuador. Eco-Architecture 2014 Conference. DOI: 10.2495/ARC140381

Salas, D.A., Ramirez, A.D., Rodriguez, C. R., Petroche, D.M., Boero, A.J., Duque-Rivera, J. (2016). Environmental impacts, life cycle assessment and potential improvement measures for cement production: a literature review. Journal of Cleaner Production 113, pp. 114-122. <https://doi.org/10.1016/j.jclepro.2015.11.078>.

Salas, D.A., Ramirez, A.D., Ulloa, N., Baykara, K., Boero, A.J. (2018). Life cycle assessment of geopolymers concrete. Construction and Building Materials 190 pp.170-177. <https://doi.org/10.1016/j.conbuildmat.2018.09.123>

Vaca D., Lobato A., Rivela B. (2014). Coupling multi-criteria analysis and life cycle approach for sustainability assessment of social housing in Ecuador. BauSIM -Human-centred building(s). Aachen, Germany.

Verán-Leigh, D. & Vázquez-Rowe, I. (2019) Life cycle assessment of run-of-river hydropower plants in the Peruvian Andes: a policy support perspective. *Int J Life Cycle Assess*, pp. 1-20.

## Appendix A - Stakeholder consultation workshops

This appendix provides an account of participants and some impressions from the workshops in Quito and Guayaquil on February 26<sup>th</sup> and 27<sup>th</sup>, respectively. The workshops were structured in three main sections:

1. Providing a proper comprehension concerning life cycle approaches: How does LCA resonate with you?
2. Challenges and opportunities for Ecuador.
3. Making it real: lessons learnt from the Peruvian process.

Details about both events are provided as follows:

- Workshop invitations
  - Quito 26th February
  - Guayaquil 27th February
- Workshop List of participants (signed) - Quito
- Workshop List of participants (signed) - Guayaquil
- Photographs

ESPOL



ESCUELA  
POLITÉCNICA  
NACIONAL

Medioambiente



EL  
GOBIERNO  
DE TODOS

CONSERVACIÓN  
INTERNACIONAL

Ecuador



Las instituciones organizadoras se complacen en extenderle una invitación a participar en el taller

# Hoja de ruta para una base de datos nacional de ciclo de vida: RETOS Y OPORTUNIDADES PARA EL ECUADOR

Fecha: 26 de febrero

Hora: 09h00 a 11h30

Lugar: Sala de convenciones 5to piso Edificio de Aulas y Relación con el Medio Externo

Escuela Politécnica Nacional

Avenida Toledo N23-55 y Madrid

En el marco del proyecto "Development of national LCA database roadmaps"

Financiado por:



UNIVERSITY OF CAPE TOWN  
iYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD



Life Cycle Initiative

ESPOL



ESCUELA  
POLITÉCNICA  
NACIONAL

Medioambiente



EL  
GOBIERNO  
DE TODOS

CONSERVACIÓN  
INTERNACIONAL  
Ecuador



Las instituciones organizadoras se complacen en extenderle una invitación a participar en el taller

# Hoja de ruta para una base de datos nacional de ciclo de vida: RETOS Y OPORTUNIDADES PARA EL ECUADOR

Fecha: 27 de febrero

Hora: 09h00 a 11h30

Lugar: Edificio STEM, ESPOL

KM 30.5 Vía Perimetral

En el marco del proyecto "Development of national LCA database roadmaps"

Financiado por:



UNIVERSITY OF CAPE TOWN  
YUNIBESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD



Life Cycle Initiative



# TALLER

## HOJA DE RUTA PARA UNA BASE DE DATOS NACIONAL DE CICLO DE VIDA: RETOS Y OPORTUNIDADES PARA EL ECUADOR

De mi consideración:

Me es grato dirigirme a usted para saludarle y llevar a su conocimiento que la Escuela Politécnica Nacional, conjuntamente con la Escuela Superior Politécnica del Litoral, el Ministerio del Ambiente y la ONG Conservación Internacional Ecuador, nos encontramos preparando el taller "Hoja de ruta para una base de datos nacional de ciclo de vida: Retos y oportunidades para el Ecuador".

El Análisis de Ciclo de Vida (ACV) constituye una piedra angular para proporcionar información veraz a los tomadores de decisiones, tanto en el ámbito de la política pública como del sector privado, pero debemos hacer frente al reto de disponibilidad y acceso a información de calidad que permita caracterizar con rigor los impactos ambientales, económicos y sociales de productos y procesos, para poder tomar decisiones adecuadas de cara a la sostenibilidad. En este sentido, el objetivo del taller es promover una hoja de ruta para la creación de una base de datos nacional, contando con el apoyo de la Iniciativa de Ciclo de Vida de ONU Medio Ambiente, en el marco del proyecto "Development of national Life Cycle Assessment (LCA) database roadmaps".

En este evento se realizará una breve introducción al papel clave de los enfoques de ciclo de vida para la evaluación de sostenibilidad, exponiendo los retos y oportunidades para el Ecuador. En el taller contaremos con la participación del Dr. Ian Vazquez-Rowe, cuya experiencia en el exitoso proceso de implementación de la base de datos nacional en Perú nos proporcionará interesantes lecciones aprendidas.

El taller se llevará a cabo el 26 de febrero 2019 en horario de 9:00 a 11:30h, en las instalaciones de la Escuela Politécnica Nacional, Sala de Convenciones - 5º piso, Edificio de Aulas y Relación con el Medio Externo, Av. Toledo N23-55 y Madrid, Quito. En tal virtud y conscientes de su compromiso con el desarrollo sostenible, nos complace extenderle una cordial invitación a usted o su delegado al mencionado taller.

Confianto en contar con su valiosa participación en este proceso, le rogamos su confirmación al correo [beatriz.rivela@epn.edu.ec](mailto:beatriz.rivela@epn.edu.ec) o vía telefónica al 0968935540.

Reciba un cordial saludo.

Atentamente,

Dra. Florinella Muñoz  
**Rectora de la Escuela Politécnica Nacional**

En el marco del proyecto "Development of national LCA database roadmaps"

Financiado por:



# ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL

Evento: TALLER HOJA DE RUTA PARA UNA BASE DE DATOS NACIONAL DE CICLO DE VIDA: RETOS Y OPORTUNIDADES PARA ECUADOR, Acuerdo ECOINVENT-ESPOL; lugar: Quito, predios de Escuela Politécnica Nacional; fecha: martes 26 de febrero de 2019; horario: 09H00 a 11H30; facilitador: Dr. Ian Vazquez Rowe

EMPRESA	NOMBRE Y APELLIDOS	TELÉFONOS	CORREO ELECTRÓNICO	FIRMA
Ministerio Ambiente	Irmu Suarez	0992777762	irmu.suarez@ambiente.gob.ec	
Ministerio del Ambiente	Liliana Figueroa	0988766380	lilian.figueroa@ambiente.gob.ec	
Adriana Avila	Adriana Avila	0999747853	adriana.avila@quito.gob.ec	
Jady Perez	Escuela Politécnica Nacional	0984259377	jady.perez@epn.edu.ec	
IKIAM	Cristian Urbina	0983763489	cristian.urbina@ikiam.edu.ec	
MAE/FICA-EPN	Ma. Cristina Torres	0995019082	maria.torres@apu.edu.ec	
FICA-EPN	Vanessa Fierro	0996052201	vanessa.fierro@epn.edu.ec	
CONSERVACION INTERNACIONAL	Christian Martinez	0984594420	cmartinez@conservation.org	
MAE-PNGIDS	Grace Collantes Morceno	0995595165	grace.collantes@ambiente.gob.ec	
MAE-PNGIDS	Yadira Mora Dután	0983471690	yadira.mora@ambiente.gob.ec	
MAE-PNGIDS	Lorena Gallardo	0999247991	lorena.gallardo@ambiente.gob.ec	
EPN-FIM	Rafael Soria	0987157499	rafael.soria@epn.edu.ec	
HERNAN	Sonia Jiménez	0995653255	sonia.jimenez@recursosyenergia.com	
PUCP (PERU)	IAN VÁZQUEZ ROWE	+51 94214811	ian.vazquez@pucp.pe	
Mar. Datalat	Margarita Yépez	099674727	margarita@datalat.org	
ESPOL	Angel Ramirez	0986985921	angel.ramirez@espol.edu.ec	
ESPOL	Beatriz Ravelo	0968935940	beatriz.ravelo@epn.edu.ec	

# BASE DE DATOS NACIONAL PARA CICLO DE VIDA

Fecha: 27 de Febrero del 2019 Facilitador: Dr. Ian Vázquez Rowe

CREA  
CRECE  
INNOVA  
ESPOL



	INSTITUCIÓN	NOMBRE	CARGO	FIRMA	CORREO
1	CEMDES	Jimmy Andrade	Director Ejecutivo		jandrade@cemdes.org jandrade@cemdes.org
2	San Carlos	Coralia de la Cadena Villacres	Jefe de Sostenibilidad y Gestion Ambiental.	cdela.cadena@ISC.com.ec	CDLACADENA@ISC.COM.EC
3	Agraria	Marilyn Muñoz	Docente		mammm35700@hotmail.com mammm35700@hotmail.com
4	Agraria	Karla Crespo	Docente		KARLACRESPOLEON@HOTMAIL.COM KARLACRESPOLEON@HOTMAIL.COM
5	Adelca	Andrés Alarcón	Jefe Responsabilidad Social		aalarcon@adelca.com aalarcon@adelca.com
6	Plastigama	Carlos Alaña	Gerente		
7	Plastigama	Jose Luis Cevallos	Dir de RSC		
8	Novacero	Juan Carlos Andrade	Gerente		andradejc@novacero.com andradejc@novacero.com

# BASE DE DATOS NACIONAL PARA CICLO DE VIDA

Fecha: 27 de Febrero del 2019

Facilitador: Dr. Ian Vázquez Rowe

CREA  
CRECE  
INNOVA  
ESPOL



9	ESPOL	Danilo Arcentales	Docente		daanarce@espol.edu.ec daanarce@espol.edu.ec
10	ESPOL	Andrea Boero	Docente		aboero@espol.edu.ec aboero@espol.edu.ec
11	ESPOL	Jorge Duque	Docente		jduque@espol.edu.ec
12	ESPOL	Paulina Criollo	Docente		pacrioll@espol.edu.ec
13	ESPOL	Dolores Astudillo	Docente		dastudil@espol.edu.ec dastudil@espol.edu.ec
14	ESPOL	Ana María Melendres	Docente		amelendr@espol.edu.ec
15	ESPOL	Daniel Avilés	Docente		deAviles@espol.edu.ec
16	ESPOL	Daniel Salas	Docente		DASALAS@ESPOL.EDU.EC
17	ESPOL	MSc. Rodolfo Paz	Docente		RPAZ@ESPOL.EDU.EC Rpaz@espol.edu.ec

# BASE DE DATOS NACIONAL PARA CICLO DE VIDA

Fecha: 27 de Febrero del 2019 Facilitador: Dr. Ian Vázquez Rowe

CREA  
CRECE  
INNOVA  
ESPOL



18	HOLCIM S.A.	Dorin Pepenel	Gerente General		dorin.pepenel@geocycle.com dorin.pepere@geocycle.com
19	HOLCIM S.A.	Ma. Auxiliadora Saa Eliza Fovar	Especialista Técnico Comercial		
20	HOLCIM S.A.	Daniel Petroche	Técnico de innovación		dann2592@gmail.com dann 25 92 @fusa.com
21	HOLCIM S.A.	Carlos Ronquillo	Jefe de Segmento Cemento		carlos.ronquillo@holcim.com
22	PRONACA				
23	PYCCA				
24	Cámara de industrias	Leonard Quinde	Analista del Departamento de Estudios Técnicos de la Cámara de Industrias de Guayaquil.		lquinde@industrias.ec lquinde@industrias.ec
25	ESFOL	Angel Rannio	DECANO FIMCP		

②6 PUCP (PERU) IAN VÁZQUEZ PROFESOR ASOCIADO ROWE

②7 CARBONO NEUTRAL KAREN NACIPH TÉCNICO AMBIENTAL

KARENnaciph@gmail.com  
karennaciph@gmail.com


BASE DE DATOS NACIONAL PARA CICLO DE VIDA

Fecha: 27 de Febrero del 2019 Facilitador: Dr. Ian Vázquez Rowe

CREA  
CRECE  
INNOVA  
ESPOL

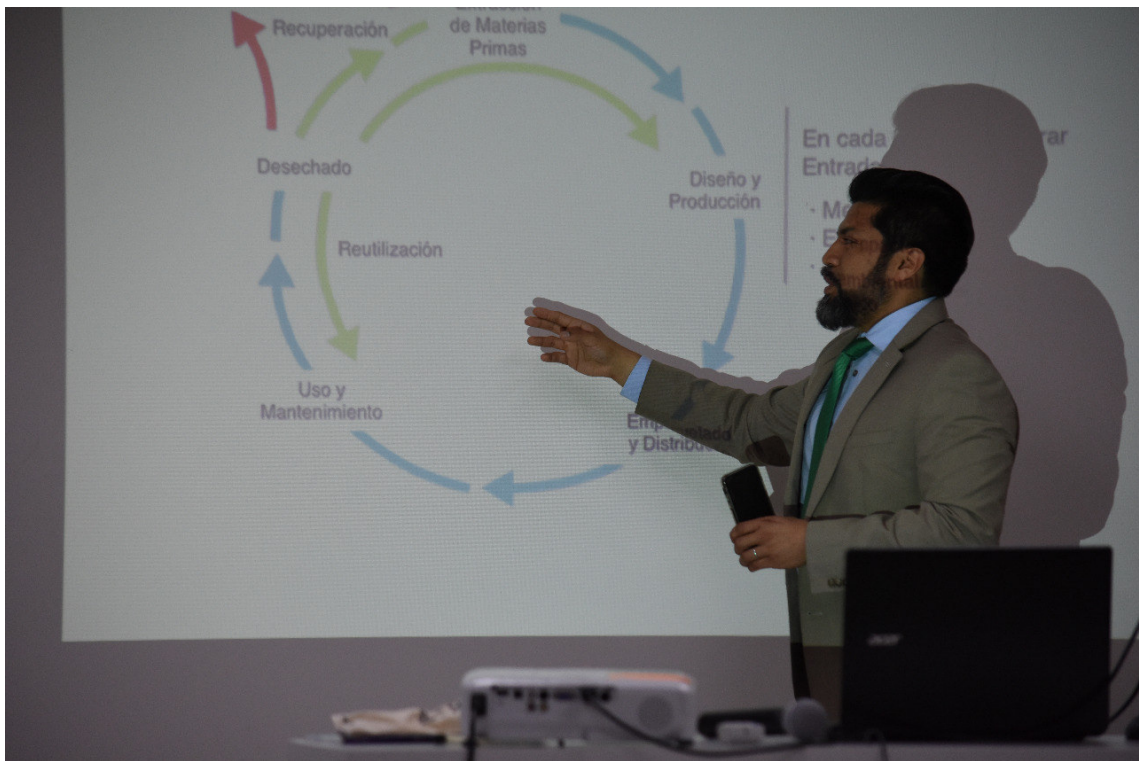


INSTITUCIÓN	NOMBRE	CARGO	FIRMA	CORREO
-------------	--------	-------	-------	--------

- (28) Universidad Santa María - Ma. Fernanda Chang Alvarado - Analista de Procesos Docente - mfeerchang@hotmail.com  
Campus Guayaquil - mfeerchang@hotmail.com
- (29) Escuela Superior Politécnica del Litoral - Vidor Junco - Coordinación Comunicación - vjunco@espol.edu.ec
- (30) ESPOL - Nathaly Pérez Rosales - Analista de Comunicación - nfperez@espol.edu.ec - 













## Appendix B - Stakeholder consultation process

A document explaining the information in this report to key stakeholders without technical LCA database knowledge in language that they are familiar with has been developed (in Spanish) in order to take on board their suggestions and concerns. The document is a “living document”, which will be updated regularly. The consultation is not conceived as a single conversation, but as a series of opportunities to create understanding about the project among those it will likely affect or interest, and to learn how these external parties view the project and its attendant risks, impacts, opportunities, and mitigation measures. Participants in the stakeholder consultation process are listed in the table.

<b>Sector</b>	<b>Stakeholder</b>
<b><i>Public</i></b>	Municipality of Quito Ministerio de Energía y Recursos Naturales No Renovables
<b><i>Industry/private</i></b>	Cámara de Industrias y Producción Carbono Neutral Holcim Ecuador S.A. Adelca Plastigama Ingenio San Carlos Novacero Ingeniería Frugal
<b><i>Academia and research</i></b>	Universidad Técnica del Norte Escuela Superior Politécnica de Chimborazo Universidad Agraria Universidad Santa María
<b><i>NGOs</i></b>	Datalat

## Appendix C - Full paper CILCA 2009



## CILCA 2019

VIII International Conference  
on Life Cycle Assessment in  
Latin America

[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

## HOJA DE RUTA PARA UNA BASE DE DATOS NACIONAL DE CICLO DE VIDA: LA EXPERIENCIA ECUATORIANA

### LIFE CYCLE ASSESSMENT DATABASE ROADMAP: THE ECUADORIAN EXPERIENCE

**Beatriz Rivela <sup>1\*</sup>, Ángel Ramírez <sup>2</sup>, Irma Suárez <sup>3</sup>, Cristina Torres <sup>4</sup>,  
Christian Martínez <sup>5</sup>, Ian Vázquez <sup>6</sup>, Carl Vadenbo <sup>7</sup>**

<sup>1</sup> PhD, inViable Life Cycle Thinking, Madrid, España

<sup>2</sup> PhD, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador

<sup>3</sup> MSc, Ministerio del Ambiente, Quito, Ecuador

<sup>4</sup> MSc, Escuela Politécnica Nacional, Quito, Ecuador

<sup>5</sup> MSc, Conservación Internacional Ecuador, Quito, Ecuador

<sup>6</sup> PhD, Pontificia Universidad Católica del Perú, Lima, Perú

<sup>7</sup> PhD, ecoinvent, Zurich, Suiza

\* [beatrizrivela@gmail.com](mailto:beatrizrivela@gmail.com)

## Resumen

*El Análisis de Ciclo de Vida constituye una piedra angular para proporcionar información veraz a los tomadores de decisiones, tanto en el ámbito de la política pública como del sector privado, pero la disponibilidad de datos de inventario continua siendo muy limitada y representa una barrera para la aplicación de los enfoques de ciclo de vida en el contexto internacional. En el marco del proyecto "Eficiencia de recursos a través de la aplicación del Pensamiento de Ciclo de Vida" (REAL, por sus siglas en inglés), financiado por la Comisión Europea, la Iniciativa de Ciclo de Vida de ONU Medio Ambiente realizó un llamado a realizar propuestas para el desarrollo de hojas de ruta de bases de datos nacionales. La propuesta ganadora, coordinada por ecoinvent, ha sido desarrollada por un consorcio integrado por representantes de Brasil, India, Sri Lanka y Sudáfrica, países que cuentan con bases de datos de ciclo de vida en diferentes niveles de madurez de implementación. Ecuador y Uganda fueron seleccionados para ser integrados al proyecto internacional como países que se encuentran tratando de dar los primeros pasos en la definición de una hoja de ruta para una base de datos nacional.*

*El presente trabajo se centra en la experiencia del equipo de Ecuador en el proceso de definición de la hoja de ruta, describiendo las fases en las que fue estructurado el proceso y sintetizando los resultados obtenidos, con la vocación de documentar un protocolo metodológico de trabajo replicable que contribuya a promover experiencias similares en otros países de la Región.*

*Palabras clave: hoja de ruta, base de datos, ciclo de vida, Ecuador.*



## CILCA 2019

VIII International Conference  
on Life Cycle Assessment in  
Latin America

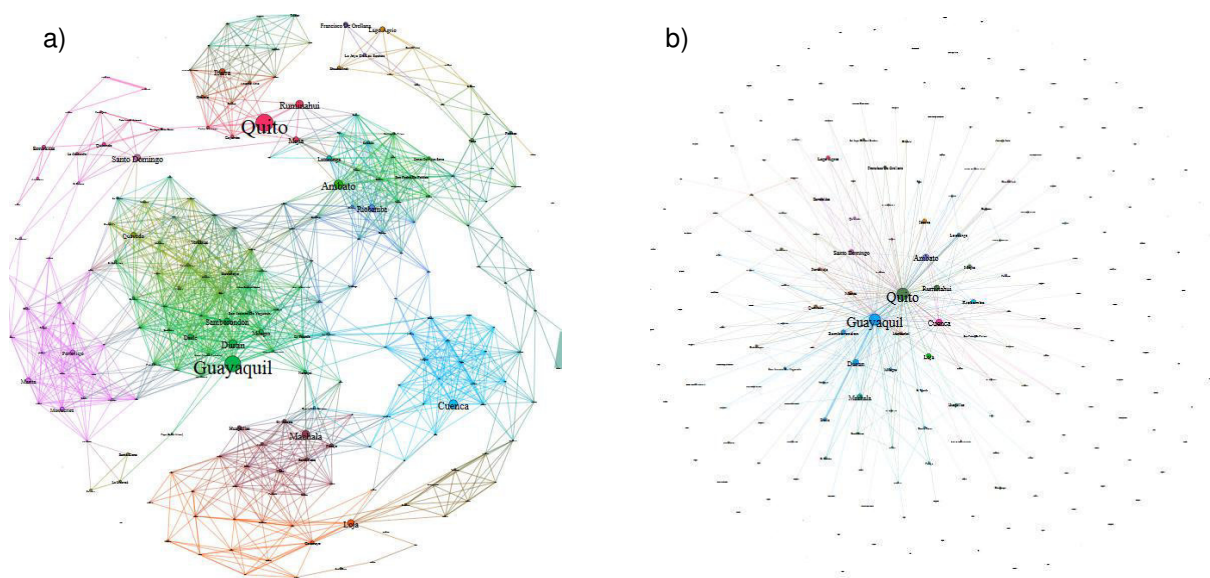
[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

## 1. Introducción

Ecuador es el más pequeño de los 17 países identificados por Programa de las Naciones Unidas para el Medio Ambiente como megadiversos, albergando una asombrosa cantidad de ecosistemas y especies en el Ecuador continental y mundialmente famoso por su fauna única en el remoto archipiélago de Galápagos (Cuesta et al, 2017). Desde un punto de vista socioeconómico, la representación gráfica de algoritmos para el análisis de redes posibilita observar las relaciones de las unidades administrativas del Ecuador (Figura 1). Resulta evidente que las dinámicas entre las ciudades Quito - Guayaquil son las más relevantes del país.

**Figura 1 – Representación gráfica de algoritmos de análisis de redes en Ecuador.**  
a) distancia vial; b) relaciones comerciales entre unidades administrativas (cantones).  
Fuente: adaptado de Astudillo (2018).



En marzo de 2014 se realizó el I Seminario Internacional de Ciclo de Vida en Ecuador, con la finalidad de conformar una red de profesionales que impulsase la investigación y abordase la evaluación de sostenibilidad de proyectos y actuaciones en los temas relevantes para el país. Fruto de este encuentro, en el que se contó con el apoyo de representantes de la Iniciativa de Ciclo de Vida de ONU Medio Ambiente y la Red Iberoamericana de Ciclo de Vida, se conformó la Red Ecuatoriana de Ciclo de Vida. En los 5 años transcurridos desde entonces, la ausencia de datos de inventario ha limitado significativamente las potenciales aplicaciones de las aproximaciones de ciclo de vida para proporcionar información veraz a los tomadores de decisiones, tanto en el ámbito de la política pública como del sector privado. La creación de una base de datos nacional de ciclo de vida, que posibilite disponer de datos que caractericen



## **CILCA 2019**

VIII International Conference  
on Life Cycle Assessment in  
Latin America

[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

con rigor los impactos ambientales de productos y procesos relevantes para el país, fue identificada como una actuación prioritaria por los actores involucrados en la Red.

En este contexto surge la oportunidad de presentar una propuesta de plan nacional para el desarrollo de una hoja de ruta al consorcio coordinado por ecoinvent e integrado por representantes de Brasil, India, Sri Lanka y Sudáfrica -países que cuentan con bases de datos de ciclo de vida en diferentes niveles de madurez de implementación-, con el objetivo de integrar la participación del Ecuador en el proyecto "Development of national LCA database roadmaps", financiado por la Comisión Europea a través del proyecto "Eficiencia de recursos a través de la aplicación del Pensamiento de Ciclo de Vida" (REAL, por sus siglas en inglés). El consorcio consideró de interés contar con la participación adicional de países que, si bien no cuentan con una base de datos nacional, están tratando de dar los primeros pasos; finalmente Ecuador y Uganda fueron seleccionados para ser integrados al proyecto internacional.

El presente trabajo describe la experiencia del equipo de Ecuador en el proceso de definición de la hoja de ruta para la puesta en marcha de una base de datos nacional, con el objetivo de reflejar el protocolo metodológico y las lecciones aprendidas en el camino.

## **2. Metodología**

El proceso de definición de la hoja de ruta fue planteado con el apoyo del Grupo Internacional de Trabajo (GIT) del proyecto y estructurado en las siguientes fases:

- Fase I: Conformación del equipo y planteamiento del plan de trabajo
- Fase II: Análisis de línea de base y mapeo de actores clave
- Fase III: Definición y discusión de la hoja de ruta
- Fase IV: Difusión de resultados

## **3. Resultados y discusión**

A continuación se describe brevemente el desarrollo y los resultados obtenidos en las diferentes fases de definición de la hoja de ruta:

### **Fase I. Conformación del equipo y planteamiento del plan de trabajo**

El equipo para la definición de la hoja de ruta de una base de datos nacional en Ecuador fue establecido contando con representantes de la academia, el gobierno y ONGs. En base a un análisis preliminar del estado de arte y las capacidades técnicas nacionales, el equipo fue finalmente conformado por la Escuela Superior Politécnica del Litoral (coordinador del equipo) y la Escuela Politécnica Nacional como entidades académicas, el Ministerio del Ambiente como representante gubernamental y la ONG Conservación Internacional Ecuador. El plan de trabajo, elaborado con la valiosa asesoría de la Red Peruana de Ciclo de Vida y Ecología Industrial, fue evaluado y aprobado por el consorcio del proyecto, incorporando las observaciones realizadas por la Iniciativa de Ciclo de Vida de ONU Medio Ambiente.

### **Fase II. Estudio de línea de base y mapeo de actores clave**



## CILCA 2019

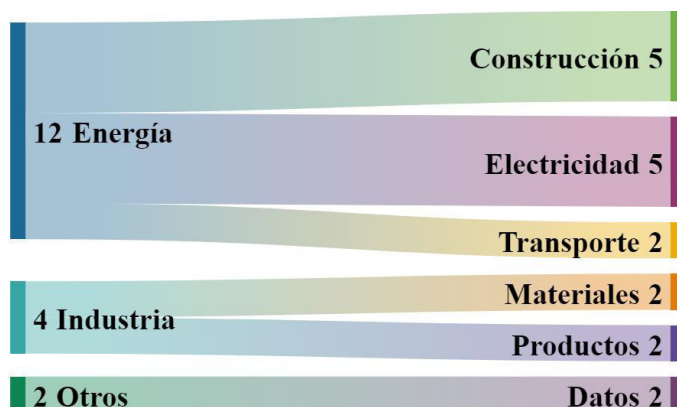
VIII International Conference  
on Life Cycle Assessment in  
Latin America

[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

Con el objetivo de abordar un adecuado diagnóstico, se realizó un estudio de línea base, recopilando la información relativa a las actividades previas de aplicación de Análisis de Ciclo de Vida (ACV) en las siguientes áreas: i) industria y sector privado; ii) legislación y política pública; iii) investigación y academia; iv) cooperación internacional y ONGs. De manera adicional, se analizaron las capacidades de recopilación y gestión de datos de ACV, la disponibilidad de datos de inventario y las necesidades de información identificadas por diferentes actores. Este primer diagnóstico evidenció que involucrar al sector privado sigue siendo uno de los mayores desafíos en Ecuador: el salto del mundo académico a la industria aún no se ha logrado. En la Figura 2 se muestran las áreas de investigación que han recibido una mayor atención por parte de la comunidad académica de ACV, identificadas en base a la producción científica en el periodo 2014-2018.

**Figura 2 – Áreas de investigación en Ecuador en base a las publicaciones Scopus del periodo 2014-2018.**



En la Tabla 1 se muestra el listado completo de actores relevantes evaluados para el desarrollo de la hoja de ruta de la base de datos nacional de ciclo de vida en Ecuador. Los actores clave potenciales se identificaron aplicando la técnica común de mapeo de partes interesadas: una matriz que representa dos dimensiones para capturar y caracterizar el grado de influencia y el nivel de intereses (Figura 3). Los actores de elevado interés y potencial influencia fueron invitados a formar parte del Grupo Nacional de Trabajo (GNT). Cabe señalar que el Consejo Empresarial para el Desarrollo Sostenible del Ecuador (CEMDES) desempeñó un papel clave para involucrar al sector privado en las discusiones mantenidas posteriormente en la Fase III.

### Fase III. Definición y discusión de la hoja de ruta

Tras una consulta previa a los actores clave, se consideró prioritaria como acción estratégica la realización de dos talleres de trabajo, diferenciando el planteamiento entre academia y sector público (celebrado en la ciudad de Quito) y el sector privado (ciudad de Guayaquil). En ambos espacios de discusión se abordó una breve introducción al papel clave de los enfoques de ciclo de vida para la evaluación de sostenibilidad, exponiendo los retos y oportunidades para el Ecuador, para posteriormente analizar las necesidades y puntos críticos de la hoja de ruta, tomando como referencia para el análisis la experiencia del proceso en Perú.



## CILCA 2019

VIII International Conference  
on Life Cycle Assessment in  
Latin America

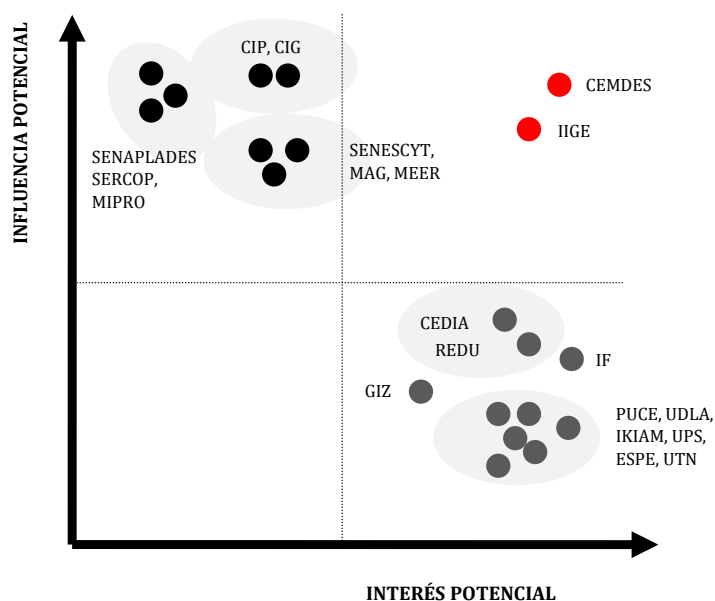
[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

**Tabla 1 – Actores clave potenciales para el desarrollo de la hoja de ruta de la base de datos nacional en Ecuador**

Sector	Actor	Implicación
Público	Instituto de Investigación Geológica y Energética (IIGE)	Directa
	Ministerio de Industrias y Productividad (MIPRO)	Indirecta
	Ministerio de Agricultura y Ganadería (MAG)	Indirecta
	Ministerio de Energía y Recursos Naturales No Renovables (MEER)	Indirecta
	Secretaría de Educación Superior, Ciencia y Tecnología (SENESCYT)	Indirecta
	Secretaría Nacional de Planificación y Desarrollo - (SENPLADES)	Indirecta
	Servicio Nacional de Contratación Pública - (SERCOP)	Indirecta
Industria	Consejo Empresarial para el Desarrollo Sostenible del Ecuador (CEMDES)	Directa
	Cámara de Industrias y Producción (CIP)	Indirecta
	Cámara de Industrias de Guayaquil (CIG)	Indirecta
	Ingeniería Frugal (IF)	Indirecta
Academia	Pontificia Universidad Católica del Ecuador (PUCE)	Directa
	Universidad Politécnica Salesiana (UPS)	Directa
	Universidad Regional Amazónica (IKIAM)	Directa
	Universidad de las Américas (UDLA)	Directa
	Universidad Técnica del Norte (UTN)	Directa
	Red Nacional de Investigación y Educación del Ecuador (CEDIA)	Indirecta
	Red Ecuatoriana de Universidades y Escuelas Politécnicas para Investigación y Posgrados - (REDU)	Indirecta
Cooperación Internacional	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Indirecta

**Figura 3 – Análisis de actores para el desarrollo de la hoja de ruta de una base de datos nacional de ciclo de vida en Ecuador.**







## **CILCA 2019**

VIII International Conference  
on Life Cycle Assessment in  
Latin America

[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

La estructura preliminar del documento de trabajo para la elaboración de la hoja de ruta fue definida en base a los lineamientos del GIT. Un primer borrador del documento, reflejando las observaciones realizadas por los participantes en los talleres -cuya discusión se centró en la gobernanza y modelo gestión de la base de datos y la priorización de inventarios- fue compartido con todos los asistentes. Posteriormente, el GNT elaboró un documento posterior, que fue sometido a evaluación por el consorcio del proyecto.

### **Fase IV. Difusión de resultados**

En el proceso se ha prestado especial atención a la difusión de resultados, generando un documento final descriptivo del proceso, que junto con la versión española de la guía elaborada en el marco del proyecto y las presentaciones empleadas en los talleres, conforman una herramienta que pretende estimular procesos similares en la Región.

## **4. Conclusiones**

Las lecciones aprendidas en el proceso de implementación de la hoja de ruta peruana han constituido un valioso insumo para la definición del proceso en Ecuador, con retos y oportunidades comunes en ambos contextos. La gobernanza y gestión de la base de datos son dos aspectos clave señalados por todos los actores para garantizar el éxito de la hoja de ruta; especialmente el sector privado ha expresado su preocupación sobre los elementos de confidencialidad y buen uso de la información generada de cara a participar activamente en su implementación. La priorización de datos ha señalado los sectores energético (electricidad e hidrocarburos), gestión de residuos, alimentación y sectores estratégicos en el ámbito de la compra pública, como ámbitos de mayor incidencia de cara a generar información relevante para los tomadores de decisiones.

Confiamos en que el protocolo de trabajo planteado y la descripción, reflejada en los documentos generados, de las actividades desarrolladas y las lecciones aprendidas en el proceso, constituya una fuente de inspiración y contribuya a promover experiencias similares en otros países de la Región.

## **Agradecimientos**

Los autores quieren agradecer el valioso apoyo prestado por el Grupo de Trabajo Internacional del proyecto "Development of national LCA database roadmaps", en cuyo marco se ha desarrollado esta experiencia, contando con el financiamiento de Comisión Europea a través del proyecto "Eficiencia de recursos a través de la aplicación del Pensamiento de Ciclo de Vida" (REAL, por sus siglas en inglés).

## **Referencias**

Astudillo, P., 2018. Evolution of the Ecuadorian economy: a complexity approach. University of Oxford. [Working Paper].

Cuesta, F., Peralvo, M., Merino-Viteri, A., Bustamante, M., Baquero, F. Freile, J.F., Muriel, P., Torres-Carvajal, O., 2017. Priority areas for biodiversity conservation in mainland Ecuador, Neotropical Biodiversity, 3:1, 93-106.





## CILCA 2019

VIII International Conference  
on Life Cycle Assessment in  
Latin America

[www.cilca2019.org](http://www.cilca2019.org)

July 15<sup>th</sup> – July 19<sup>th</sup> 2019  
Cartago, Costa Rica

La estructura preliminar del documento de trabajo para la elaboración de la hoja de ruta fue definida en base a los lineamientos del GIT. Un primer borrador del documento, reflejando las observaciones realizadas por los participantes en los talleres -cuya discusión se centró en la gobernanza y modelo gestión de la base de datos y la priorización de inventarios- fue compartido con todos los asistentes. Posteriormente, el GNT elaboró un documento posterior, que fue sometido a evaluación por el consorcio del proyecto.

### Fase IV. Difusión de resultados

En el proceso se ha prestado especial atención a la difusión de resultados, generando un documento final descriptivo del proceso, que junto con la versión española de la guía elaborada en el marco del proyecto y las presentaciones empleadas en los talleres, conforman una herramienta que pretende estimular procesos similares en la Región.

## 4. Conclusiones

Las lecciones aprendidas en el proceso de implementación de la hoja de ruta peruana han constituido un valioso insumo para la definición del proceso en Ecuador, con retos y oportunidades comunes en ambos contextos. La gobernanza y gestión de la base de datos son dos aspectos clave señalados por todos los actores para garantizar el éxito de la hoja de ruta; especialmente el sector privado ha expresado su preocupación sobre los elementos de confidencialidad y buen uso de la información generada de cara a participar activamente en su implementación. La priorización de datos ha señalado los sectores energético (electricidad e hidrocarburos), gestión de residuos, alimentación y sectores estratégicos en el ámbito de la compra pública, como ámbitos de mayor incidencia de cara a generar información relevante para los tomadores de decisiones.

Confiamos en que el protocolo de trabajo planteado y la descripción, reflejada en los documentos generados, de las actividades desarrolladas y las lecciones aprendidas en el proceso, constituya una fuente de inspiración y contribuya a promover experiencias similares en otros países de la Región.

## Agradecimientos

Los autores quieren agradecer el valioso apoyo prestado por el Grupo de Trabajo Internacional del proyecto "Development of national LCA database roadmaps", en cuyo marco se ha desarrollado esta experiencia, contando con el financiamiento de Comisión Europea a través del proyecto "Eficiencia de recursos a través de la aplicación del Pensamiento de Ciclo de Vida" (REAL, por sus siglas en inglés).

## Referencias

Astudillo, P., 2018. Evolution of the Ecuadorian economy: a complexity approach. University of Oxford. [Working Paper].

Cuesta, F., Peralvo, M., Merino-Viteri, A., Bustamante, M., Baquero, F. Freile, J.F., Muriel, P., Torres-Carvajal, O., 2017. Priority areas for biodiversity conservation in mainland Ecuador, Neotropical Biodiversity, 3:1, 93-106.