

# LCA mainstreaming conditions in Latin America—based on learnings from 2005 to 2014

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## Abstract

**Purpose** Based on the 2005–2014 developments in the Latin American and the Caribbean region (LAC), this paper aims to understand the conditions' levels for mainstreaming life cycle assessment/life cycle management (LCA/LCM) and map key next actions.

**Methods** Along the paper, four mainstreaming conditions are analyzed: expansion of LCM/LCA training activities, availability of LCA studies, national LCA database operating, and existence and activity of national life cycle network(s). Assuming that countries with better conditions are in a better position to develop national LCA based regulations, policies are also researched to complement this study.

**Results and discussion** With nine life cycle (LC) networks in 2014, the LAC region has positively developed its networking capacities since 2005 but not the databases area (only one LCA database, Mexicanaiah, is fully operational). It was found that countries with no networks, lack all LCA trainings, studies, and databases.

Local capacities are limited which in best case, Chile, does not exceed 18 practitioners per 10 million inhabitants. Based

on the total score on mainstreaming conditions, Mexico and Brazil are the most advanced countries, but their markets for LCA professionals are still small (Valdivia et al. 2015), which suggests that tailored made strategies are needed for stronger uptake of LCA by industrial sectors.

Argentina, Peru, Chile, and Colombia are in the second tier but still lack a critical mass of business cases and the political will to improve their mainstreaming conditions.

**Conclusions** LCA development in the LAC region since 2005 is overall positive but still insufficient to serve the growth of prosperous LCA markets. Well-functioning LC networks are essential to leapfrog LCA. In 2014, about 27 % of LAC countries counted on a LC network. A common language in the region (except for Portuguese in Brazil) has been instrumental for expanding LCA through regional cooperation. LCA-based policies are boosted when local capacities and databases are available following the cases of Mexico, Chile, and Brazil. More data and research are needed to understand the women role in advancing LCA and the causalities and motivations of LAC companies to decide for LCA implementation. The application of the methodology was possible thanks to good quality data available and delivered key findings to develop national road maps for advancing LCA. No indicator used is specific for the LAC region and similar exercises are encouraged in other regions such as Africa and Asia.

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The views and opinions expressed in this chapter are those of the authors and do not necessarily reflect the views of their organizations

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## 1 Introduction

Latin America and the Caribbean (LAC) consist of 33 countries. Most of them are developing and transition countries, characterized for their rapid development and increasing

“resource use (per capita/year)”<sup>1</sup> levels which are still lower than those of industrialized countries. As a consequence of this development, LAC countries risk mimicking industrialized countries’ “throw-away society” model (Valdivia et al. 2014) and their high metabolic rates for which governments are starting to design and introduce approaches to decouple economic growth from resource use and, hence, environmental impacts.

Life cycle assessment (LCA) is an emerging topic in Latin American and Caribbean (LAC) countries. A number of initiatives in the LAC region are promoting LCA based activities for more sustainable consumption and production such as The 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP) and national life cycle networks. In the following lines, a summary of the regional context for the promotion of life cycle approaches is presented together with the purpose of this study.

### 1.1 Sustainable consumption and production action plans in Latin America and the Caribbean region

According to the United Nations Environment Programme (UNEP 2015), the Latin America and the Caribbean (LAC) region is a pioneer on sustainable consumption and production (SCP) and has been actively developing SCP action plans since 2003. Notably, in 2014, the last Regional Forum of Ministers of the Environment endorsed its support to the 10-Year Framework of Programmes on SCP (10YFP 2015) adopted in Rio+20 (2012) which promotes a life cycle approach for national SCP plans, while in the LAC region, dedicated SCP policies exist in countries such as Barbados, Brazil, Colombia, Cuba, Chile, Dominica, Dominican Republic, Ecuador, Mexico, Peru, St. Lucia, and Uruguay; they usually lack a holistic approach and life cycle guiding principles.

### 1.2 Growing consumption of resources and generation of environmental impacts

The number of global class consumers<sup>2</sup> with common purchasing power is growing in this region. To illustrate the economic and consumption growth, a few indicators have been selected from a recent report of the World Bank (World Bank 2014), in the period 2005–2012: while population has slightly grown from 260 to 270 million and the gross national income per capita has gone from US\$ 3491 to US\$ 6664 and the number of individuals using internet nearly tripled from 16 to 43 %, with mobile cellular subscriptions following that trend and increasing from 42 to 108 per 100 people. Along

<sup>1</sup> Metabolic rate

<sup>2</sup> It comprises social groups that are not country-specific and tend to resemble one another in their behavior and lifestyle models. They can afford to have a high standard of living.

with the growing consumption, the energy and resources use as well as pollutants and waste generation rates are also increasing. While some industrial sectors in LAC are experiencing positive economic development, stakeholders (e.g., workers, consumers, and local communities) have not experienced substantive positive social and socio-economic changes.

In this context, a growing demand for strategies based on robust tools and approaches to support the developments of SCP policies and approaches is urged. A holistic perspective to address these challenges is essential to avoid trade-offs between the economic and social or environmental aspects, between product chains (local vs imported food) or resources used (fossil fuels vs biofuels), between life cycle stages in a product system (extraction vs the end-of-life phase as in the case of mobiles), and between impact categories.

### 1.3 First regional landmarks and events on LCA

The emergence of life cycle thinking (LCT) and LCA in the LAC region had a landmark in 2005 with the organization of the first International Conference on LCA (CILCA) held in Costa Rica. Since then, the CILCA has been organized bi-annually with growing participation from LAC and international participants (from about 100 in Costa Rica to 250 at the Fifth CILCA in Mendoza, Valdivia and Mila i Canals 2014). The sixth CILCA took place in Lima, Peru, in 2015 (Quispe et al. 2014) with about 170 participants. Another landmark was the first regional publication on “Life Cycle Assessment—ISO 14040 in Latin America” (Caldeiras et al. 2005).

### 1.4 Mainstreaming

According to the Oxford Dictionaries, 2015, “mainstream” means “ideas, attitudes, or activities that are shared by most people and regarded as normal or conventional.” Mainstreaming can be also understood as “products and services readily available and appealing to the general public, as opposed to being of interest only to a very specific subset of the public” (Business Dictionary 2015). In order to reach substantial socio-economic changes in societies, mainstreaming is a key instrument, but cultural diversity and different backgrounds need to be considered before designing and implementing measures; this learning is fundamental when designing the next steps to advance the LCA agenda in the LAC region.

### 1.5 Purpose

The purpose of this study is to present the evolution of the implementation of LCA in the LAC region since 2005, as well as to discuss the potentials for mainstreaming LCA in the region. Aspects such as regional distribution of users and practitioners, level of activity of the national networks, level

of implementation of LCA based approaches in organizations, and the existence of national databases and LCA-based legislation are covered in the discussion.

## 2 Methodology

### 2.1 Conditions for mainstreaming LCA in the LAC region

Following Valdivia's methodology (2015), four conditions for mainstreaming LCA are taken into account and will be analyzed (see Table 1) along the paper:

1. LCM/LCA training activities in place. 0 is equal to "not at all"; 1 to "only on LCA"; 2 to "multiple on LCM/LCA"; and 3 to "many good quality ones on LCM/LCA."
2. LCA studies available. Scores mean the following: 0: not at all; 1: few studies; 2: some, mainly by academics; and 3: many, by academics and big companies.
3. National LCA database operating. Three cases are considered: 0: there is no database; 1: a database is under development; and 2: local database is available for core sectors in the country.
4. Active national life cycle network(s), including information on size of the network and gender balance aspects. In general, these networks can function as a major multiplier for LCA applications by organizations. The first part (d.1) indicates the existence (1) or not (0) of a network in the country. The second part (d.2) refers to the size of the network and the last part (d.3) to the percentage of women.

Assuming that countries with better conditions are also in a better position to develop national policies or frameworks that

take into account life cycle approaches, to complement the analysis, policies are also researched.

There needs to be noted, that due to the very limited information available on the implementation of LC approaches in the private sector in the LAC region, the authors decided not to analyze the causalities and motivations of LAC companies to decide for the implementation of LCA and suggest considering this issue for future research.

## 3 Results

Based on information available through a global survey (Sonnemann et al. 2016) and a regional one (Valdivia and Mila i Canals 2014) as well as on data provided by IBICT (2016), the evolution of LCA thinking in LAC from 2005 through 2014 is presented for each of the criteria on mainstreaming conditions in Latin America and the Caribbean region.

### 3.1 Level of conditions for mainstreaming LCA

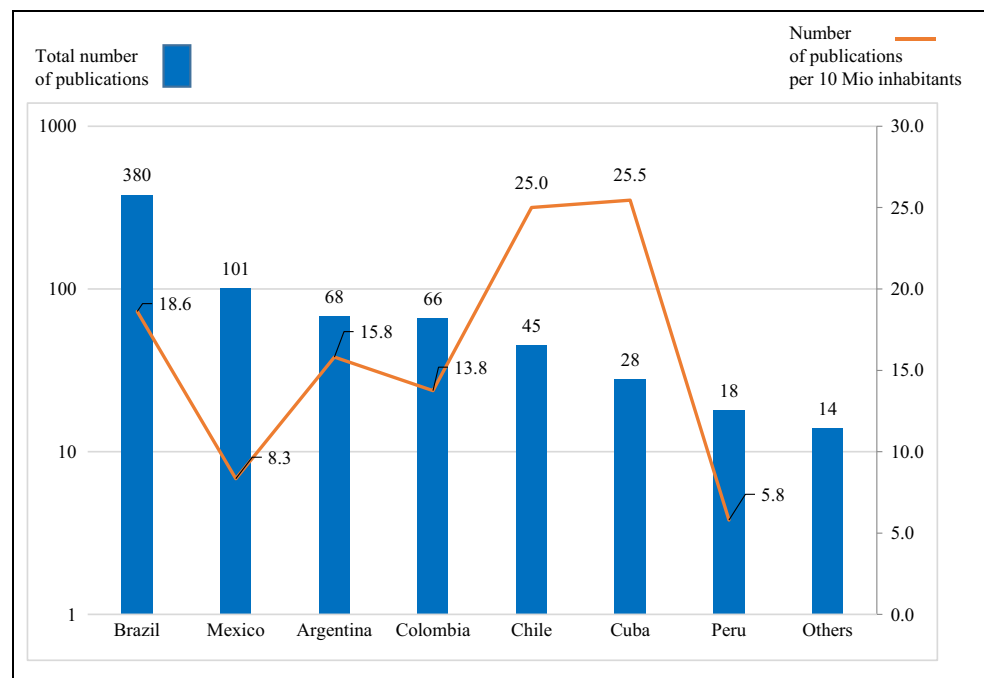
**LCA/LCM training activities** It is assumed that in countries with multiple training activities on LCA and LCM, such as Brazil, there is probably a critical mass of experts who can contribute to mainstreaming LCA. Capacities in Argentina, Chile, Cuba, Costa Rica, Mexico, Colombia, and Peru are under development with to the introduction of regular training events on LCA and LCM.

Based on the survey results, in Uruguay, the Dominican Republic, and Ecuador, only few training events were identified and more need to be organized. No evidence of training events were found for the remaining LAC countries not included in the results.

**Table 1** Mainstreaming conditions criteria in Latin American and Caribbean countries (a–d.3)

| Country               | (a) Training activities 2014 | (b) LCA studies 2014 | (c) LCA database 2005/2014 | (d.1) LC network 2005/2014 | (d.2) Size 2014 | (d.3) Gender 2014 |
|-----------------------|------------------------------|----------------------|----------------------------|----------------------------|-----------------|-------------------|
| 1. Argentina          | 2                            | 2                    | 0/0                        | 0/1                        | 10–50           | 73 %              |
| 2. Brazil             | 3                            | 2                    | 0/1                        | 1/1                        | 100–200         | 31 %              |
| 3. Chile              | 2                            | 2                    | 0/1                        | 0/1                        | 10–50           | 38 %              |
| 4. Colombia           | 2                            | 2                    | 0/0                        | 0/1                        | 50–100          | 44 %              |
| 5. Costa Rica         | 2                            | 1                    | 0/0                        | 1/1                        | 10–20           | No info           |
| 6. Cuba               | 2                            | 2                    | 0/0                        | 0/1                        | 10–20           | No info           |
| 7. Ecuador            | 1                            | 1                    | 0/0                        | 0/1                        | 0–10            | No info           |
| 8. Dominican Republic | 1                            | 1                    | 0/0                        | 0/0                        | 0–10            | No info           |
| 9. Mexico             | 2                            | 2                    | 0/2                        | 0/1                        | 100–250         | 37 %              |
| 10. Peru              | 2                            | 2                    | 0/0                        | 1/1                        | 10–50           | 39 %              |
| 11. Uruguay           | 1                            | 1                    | 0/0                        | 0/0                        | 0–10            | No info           |
| Totals                | –                            | –                    | 0/3                        | 3/9                        | About 500       |                   |

**Fig. 1** Total number of LCA studies published in indexed documents in 2014 and ratio of publications per 10 Mio inhabitants (Cadena 2015)



**LCA studies and LCA databases** The existence of LCA studies is a sign of the availability of life cycle experts and tools as well as the existence of minimum funding to cover the costs of carrying out these studies. It is also interpreted as the availability of some local foreground data, which can feed a national LCA database. Survey findings in the area of LCA studies and LCA are presented here:

- Respondents from all surveyed countries confirmed that local LCAs start to become available. This can be evidenced by analyzing the number of LCA publications in indexed international journals. In this regard, Brazil and Mexico stand out among the Latin American countries for their amount of LCA related publications in 2014 with 380 and 101 papers correspondingly. They are followed by Argentina (68), Colombia (66), Chile (45), Cuba (28), and Peru (18) (Cadena 2015). However, when looking at the ratio of publications per 10 Mio inhabitants, Cuba with 25.5, Chile with 25.0, and Brazil with 18.6 stand over the other countries (see Fig. 1).
- The LCA databases situation improved in 2014 as opposed to 2005 when no LCA databases existed. In 2014, one operational LCA database has been identified (Mexican is the Mexican LCA database, CADIS 2015) and clusters of datasets in Brazil (acv.ibict.br) and Chile. In the cases of Brazil and Chile, a breakthrough is expected, as international organizations (e.g., UNEP and the European Commission jointly) or projects (theecoinvent project on Internationalization ([www.sustainable-recycling.org](http://www.sustainable-recycling.org)) as well as national organizations (e.g., The Brazilian Institute of

Information Science and Technology (IBICT) and Fundación Chile) are making progress with international and local resources. In spite of this positive development, there are limitations to a broader local data use such as unclear access mechanisms or costs involved.

- Colombia, Peru, Argentina, and Costa Rica are at an early stage of discussions on how to generate data and establish LCA databases.
- There is very little or no evidence of local LCA studies and no records at all concerning the development of databases in the remaining countries.

**Networks and number of LCA professionals** In 2005, only three countries confirmed the existence of LC networks compared to nine<sup>3</sup> in 2014 (see Table 1, column d.1) which is a positive evolution in terms of networking and communication capacities in LAC. Furthermore, about 500 LCA professionals have been identified in 2014 with Brazil, Mexico, and Colombia having the highest number of professionals according to the surveys done. It is worth highlighting that the networking capacity analysis is based not only on the amount of the networks' members but also on their specific capacity measured by the estimated number of LCA professionals per 10 million inhabitants in the country. Two thousand fourteen population figures are used for these calculations

<sup>3</sup> Argentina ([redargentinadehuellahidrica.wordpress.com/](http://redargentinadehuellahidrica.wordpress.com/)); Brazil ([www.abcvbrasil.org.br/](http://www.abcvbrasil.org.br/)); Chile ([redacv.cl/](http://redacv.cl/)); Colombia ([www.redacvcolombia.blogspot.ch/](http://www.redacvcolombia.blogspot.ch/)); Costa Rica ([www.alcalacr.org/](http://www.alcalacr.org/)); Ecuador ([www.ciclodevida.iner.ec/en/](http://www.ciclodevida.iner.ec/en/)); Mexico ([sitios.iingen.unam.mx/CicloDeVida/Default.html](http://sitios.iingen.unam.mx/CicloDeVida/Default.html)); Peru ([www.red.pucp.edu.pe/ciclodevida/](http://www.red.pucp.edu.pe/ciclodevida/))

(Worldometer 2014). The values presented in Table 2 range from 4 in Brazil to 18 in Chile.

**Proportion of women** The proportion of women participating in the LCA community is 41 %, only slightly above the global percentage of women participation (37 %) (Valdivia et al. 2015). Argentina presents the highest women proportion (73 %) in LAC. This result suggests that while the gender balance in LAC looks positive, some efforts could be still done in certain countries.

### 3.2 LCA in policies

Mexico, Chile, Colombia, and Brazil confirmed the existence of the use of LCA in policies. In Mexico, a regulation for sustainable buildings (NMX 2013) requires the impact assessment of the whole LC of buildings as criteria and minimum environmental requirement. In case of the replacement of building materials, it is also demanded the use of third-party reviewed LCAs of alternative materials for comparative assertion purposes. As for Brazil, there is no mandatory use of LCA, but there are recommendations to use it, for example, in the Solid Wastes National Policy (Federal Law No. 12.305, 2010 and Decree No. 7.404, 2010, MMA 2010), which calls for shared responsibilities among relevant stakeholders along the life cycle of waste and the use of LCA to promote products with fewer environmental impacts. Similar is the situation in Chile where a law to promote recycling and extended producer responsibility (Chamber of Deputies, CdD 2016) has been issued which bases on life cycle thinking. In Colombia, its SCP action plan issued in 2010 explicitly incorporates LC thinking (MAVDT 2010) followed by a national public procurement policy (MinAm 2010) which updates and integrates the national plan on green markets and the SCP action plan. The national public procurement policy provides life cycle based criteria for sustainable purchasing by public offices and support their implementation. The cases presented above suggest an emerging awareness by politicians in emerging economies like Brazil, Mexico, Colombia, and Chile.

## 4 Discussion of results and recommendations

- With nine LC networks in 2014, the LAC region has demonstrated a positive evolution since 2005 in terms of networking capacities; however, the pace of LCA databases creation is still slow. Only one LCA database, Mexicaniuh from Mexico, is fully operational. A second one was recently launched in Brazil by IBICT and is at an early stage of consolidation. In countries with no LCA database, in order to leapfrog database

**Table 2** LCA in policies and # of LCA professionals per 10 Mio inhabitants vs mainstreaming status

| Country   | LCA in policies 2014 | # of LCA practitioners per 10 Mio Inhabitants 2014 | Mainstreaming conditions (total = a + b + c + d.1) (0–9) 2014 |
|-----------|----------------------|--|---|
| Mexico    | Yes                  | 11   | 7   |
| Brazil    | Yes                  | 8  | 7   |
| Chile     | No                   | 18   | 6   |
| Colombia  | No                   | 12   | 6   |
| Argentina | No                   | 10   | 5   |
| Peru      | No                   | 7  | 5   |

creation and development, political will is needed and national life cycle networks can be important catalyzers. Once these conditions are met, support from more advanced countries and international organizations and agencies for cooperation can be effective in moving the LCA databases development agenda forward.

- It was also found that countries with no LC networks also lack training events, LCA studies, and LCA databases. Following that, the authors infer that as a first step, it is essential to support the setting up of a functional and operational national LC initiative around a network and start its activities with the organization of training events on LCA.
- The conditions for mainstreaming in Mexico and Brazil are sufficient, but the fact that the market for LCA professionals is still relatively small (Sonnemann et al. 2016) suggests that more tailored made strategies are needed to boost a stronger uptake of LCA by industrial sectors and to support the development and/or enforcement of LCA-based legislations or regulations (e.g., beyond the sustainable buildings area—NMX 2013—sustainable energy could be also regulated in Mexico).
- Expanding the number of LCA professionals per 10 million inhabitants in these countries is a need for being able to grow with the markets. Argentina, Peru, Chile, and Colombia have certain conditions for mainstreaming LCA that are evolving in the right direction. However, they still lack of a critical mass of business cases for companies. Peru and Argentina lack an additional ingredient which is the political will through which progress can be acknowledged and financial resources made available.
- To better understand which the levels could be in countries where LCA has mainstreamed, e.g., in policies and in research and educational activities, Switzerland is considered as an example on which there is more

information available. With a population of 8.14 million inhabitants in 2014 (EUROSTAT), Switzerland, counts on an LCA network (Swiss LCA Forum) and LCA-based regulations as well as relevant LCA research hubs and projects at universities and research centers (ALCA<sup>4</sup>). According to the statistics of the 2014 UNEP/SETAC Life Cycle Initiative's mailing list (UNEP/SETAC 2015) and Sonnemann et al. (2016), there is between 55 and 250 LCA professionals which result in 68–307 identified LCA professionals per 10 Mio inhabitants. These numbers could be taken into account by countries when developing their roadmaps for mainstreaming LCA.

- The international community is especially called to support countries with no evidence of training events, LCA studies, or LCA databases, e.g., by providing basic training activities to raise awareness at all levels through most acknowledged universities and chambers of commerce.
- The influence of regional cooperation was not sufficiently researched, but it is assumed that the fact of countries speaking the same language, except for Brazil, has contributed to expanding the area at national levels. The fact of speaking a different language, Portuguese, was not an excluding criteria for cooperation efforts (e.g., at CILCAs events) which always provided translation into both Spanish and Portuguese.

## 5 Conclusions

- The positive development in most advanced LAC countries confirms the fact that well-functioning LC networks are essential. In 2014, about 27 % of LAC countries counted on a LC network and except for Brazil they were all in Spanish speaking countries.
- LCA-based policies are boosted when local capacities are available and databases in place. This can be confirmed in the cases of Brazil, Chile, Mexico, and Colombia which stand over other LAC countries in terms of both amounts of publications and LCA-based policies in place. Furthermore, LCA-based policies seem to be the precondition for a more prosperous market on LCA-related services and activities as it is the case now in Brazil and Mexico.
- More research is needed to understand the role of women participation in advancing LCA in LAC countries. Certainly, cultural and background differences in the LAC countries should play a role in this pending investigation.

- More data and analysis is needed to find the causalities and motivations of companies in LAC to decide or not for the implementation of LCA.
- There are several evidences of past experiences on regional cooperation in LAC which has played an important role in the LCA development in the region. More research is needed on drivers and conditions (e.g., perhaps the common language) that boosted cooperation in the past.
- The application of the methodology and criteria was possible thanks to the availability of good quality data obtained from global and regional surveys in 2013 and 2014. As this methodology can provide countries with elements to develop national road maps for advancing LCA, similar exercises are encouraged in other regions, if possible, by clustering per common language (e.g., English, French, or Arabic speaking African countries) or in individual countries in case of large size ones such as India or China.

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