Working paper on capacity building needs and gaps of the Private Sector for implementing the Paris Agreement goals in the Latin American and the Caribbean region

Christian Patrickson and Carla Seguel

February, 2020

Abstract:

The significant role of the private sector has been recurrently pointed out as key to support climate-related capacitybuilding activities and can also benefit from enhanced capacities to contribute to foster the global climate change agenda. This is particularly relevant in developing countries in which climate change will affect and most likely play a relevant role in the development of their economies in the coming years. This working paper is aimed at developing a preliminary global map of capacity-building needs of the private sector participation in the LAC region, in order to better understand the actions already taken and provide an evidence-based grounding for further analysis of the region's needs and gaps. The research is also meant to enhance the role of research centers and the academia to support capacity-building efforts in the context of increased climate action and ambition, particularly regarding adaptation and resilience to climate change. The methodology used in this research consisted of a desk review of the latest documents and reports related to capacity building needs in the LAC region available on the web, an online survey addressed to private sector organizations and an online data search of the current capacity building offerings by research centers, universities and the academia in the region. The main findings show that private sector is not necessarily present in the main economic sectors in the LAC region and/or those that are most vulnerable to the effects of climate change. This can cause a potential misalignment in the setting of adaptation priorities between the private sector and the governments. As the effects of climate change have become more apparent, private companies have increased their efforts to become more resilient. However, unlike mitigation, adaptation actions have been less evident, mainly due to the lack of standardized mechanisms that allow to clearly identify, categorize and measure them. This has also compromised the proper communication and coordination of climate change adaptation actions among the different stakeholders in the region. Private sector survey results indicate a high sensitivity to extreme events related to climate change, particularly to the ones related to infrastructure damage, insurance costs increase, forest fires and water scarcity. This calls for better climate change risk management, the further development of climate change financial instruments and the creation of robust and transparent climate change policies and governance in LAC countries. Current educational programs in the LAC region still relegate the sustainability and climate change concepts to specialized courses and environmental careers and there is a lot to do in terms of leveraging partnerships between the private sectors and research centers on the main identified climate change sensitive topics. The presence of regulations and incentives would clearly foster cooperation and engagement among the governments, private sector actors and the academia, which would positively contribute with the advancement of the climate goals established in the Paris Agreement. The preliminary mapping carried out in this working paper can be further enhanced by deepening and focusing the research in the most relevant sectors of LAC countries in which the private sector is present. The same recommendation can be raised for the current offering of the academia and research centers, of which few of them currently focus on factors that are considered key for the implementation of future adaptation programs in the region.

Keywords: Climate change, Capacity building needs, Latin America and the Caribbean, Private sector, Academia, Research Centers.

1 Introduction

1.1 Background

During the last years, climate change has become more relevant as its impacts have become more apparent. This has been particularly the case with developing countries, as they are less prepared to dealing with climate change impacts. People's way of life is increasingly being affected by the effects of climate change and societies are beginning to understand that adaptation and resilience actions cannot be postponed any longer. This requires to clearly identify the most vulnerable economic sectors in order to determine and assess the potential impacts that must be addressed, clearly establishing the options and risks so that priorities can be established and efforts optimized.

In this context, the Latin America and the Caribbean region (LAC) stands out for its diversity of resources, high levels of social inequality and environmental vulnerabilities, all of which makes the region particularly vulnerable to the effects of climate change. The United Nations has promoted structural changes¹ to achieve equality and environmental sustainability by proposing the creation of new social pacts and by strengthening communication among governments, the private sector and social actors. Among all sectors, the private sector plays a key role in this process, as it is the one that ultimately will have to develop capacities and implement technologies that will enable the transition to a low carbon and resilient economy in the coming years.

This paper presents a preliminary view of the knowledge gaps and capacity building needs required by the private sector in order to advance in a development path that is consistent with the goals and objectives established by the Paris Agreement. It also reviews the current offering of the academia and research centers in the region, identifying the gaps that would have to be overcome in order to better respond to the current (and future) needs of the private sector and increase its involvement and effectiveness in the climatic agenda of the LAC region.

1.2 Methodology

The methodology used in this research contemplated three main activities aimed at gathering the most current information as possible for the analysis:

- 1. Perform a desk review of the latest documents and reports related to capacity building needs in the LAC region with a focus on climate change adaptation and resilience. This review was mostly done online, through internet publications of NGOs, Development Banks and other multilateral organizations.
- 2. Carry out an online survey aimed at identifying climate change adaptation awareness, knowledge, sensitivity and proactivity of the private sector in the LAC region.
- 3. Carry out an online search about the current capacity building offering of research centers, universities and the academia in general. This information was structured as a database.

¹ Bárcena, Alicia. Master class at National Autonomous University of Mexico, UNAM. October 30th, 2019.

1.3 Capacity building and capacity development

UNDP (2009) defines "Capacity development" as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. Although there are some differences between "Capacity-building" and "Capacity development", both concepts include elements that are useful and/or necessary when dealing with the challenges of climate change. For example:

- Fostering a cohesive vision and operating framework (laws, policies, protocols) in dealing with climate change;
- Leveraging human capacities by providing training, sharing of experiences and transfer of skills and knowledge;
- Facilitating partnerships in order to optimize the international support and the use of resources;
- Developing knowledge-based and continuous learning processes, following and monitoring their results;
- Increasing technical and financial resources.

2 Private sector climate change gaps

2.1 Regional context

The LAC region is a vast and diverse territory, comprised of countries with different levels of economic development and greenhouse gas (GHG) emissions. According to the Emissions Database for Global Atmospheric Research² (EDGAR, 2019 Booklet), 82% of the 2018 fossil-based CO₂ emissions were concentrated in Brazil, Mexico, Argentina, Venezuela, Chile and Colombia (19% Power industry, 7% Buildings, 26% Transport, 19% Other industrial combustion and 11% Other sectors). Likewise, 83% of 2015 GHG emissions were concentrated in the same countries, as can be seen in the following graph below:

² <u>https://edgar.jrc.ec.europa.eu/overview.php?v=booklet2019&dst=GHGpc</u>. Consulted on November 14th, 2019.





Sources: Last GDP per capita (Dec/2018) from webpage tradingeconomic.com. EDGAR fossil GHG 2019Booklet Reference: https://edgar.jrc.ec.europa.eu/overview.php?v=booklet2019&dst=GHGpc

The participation of the private sector in the main economic activities of the countries in the LAC region was established using the World Bank economic sectors³ classification:

- Primary sector: Extracts or harvests products from the earth, such as raw materials and basic foods. Includes agriculture (both subsistence and commercial), mining, forestry, grazing, hunting and gathering, fishing, and quarrying. The packaging and processing of raw materials are also considered to be part of this sector.
- Secondary sector: Produces finished goods from raw materials, extracted by the primary sector. Includes manufacturing, processing, construction, metalworking and smelting, automobile production, textile production, the chemical and engineering industries, aerospace manufacturing, energy utilities, breweries and shipbuilding.
- **Tertiary sector:** Also known as the service sector. Sells the goods produced by the secondary sector and provides commercial services to both the general population and businesses economy wide. Includes retail and wholesale sales, transportation and distribution, restaurants, clerical services, media, tourism, insurance, banking, health care and law.

The main economic sector in the LAC region is the **primary sector**: the extraction of natural resources (mining and oil industries), manufacturing and agriculture. However, the main presence of the private sector in the region is located in the **secondary and tertiary sectors**, capable of using more specialized know-how and technologies to produce higher added-value goods.

³ The World Bank classification for the economic sectors in the last years consider five sectors. The fourth and fifth sector have been considered the intellectual activities and the highest levels of decision-making in a society or economy, respectively.

The following tables illustrates the above by showing the presence of the private sector through the participation of approximately 500 private companies in different sectors in the main LAC countries⁴.

| Country | GDP 2019 (Billions USD) | Main economic sectors | | Main private sector presence |
|-----------|----------------------------|-----------------------|---|---|
| | | Primary sector | Agriculture Livestock Mining | Agroindustry Oil/Gas Forestry |
| Brazil | 1,930 | Secondary sector | Energy Manufacturing | Energy Automotive Food Manufacture Steel/Metal |
| | | Tertiary sector | Business and finances Tourism | Retail Logistic Health services Water & Wastewater |
| | | Primary sector | Agriculture Mining | Multisectoral |
| Mexico | 1,242 | Secondary sector | Manufacturing | Automotive Food |
| | | Tertiary sector | Tourism | Retail Telecommunication Transport |
| | | Primary sector | Agriculture Livestock Fishing Mining | Agroindustry Oil/Gas |
| Argentina | 408 | Secondary sector | Manufacturing Energy | Automotive Steel/Metal |
| | | Tertiary sector | Tourism | Retail Telecommunication |
| | | Primary sector | Agriculture Forestry Fishing | Oil/Gas Energy Mining |
| Colombia | 355 | Secondary sector | Energy Manufacturing | Cement |
| | | Tertiary sector | Business and finances | Retail Telecommunication |
| | | Primary sector | Agriculture Livestock Fishing Mining | Mining |
| Chile | 306 | Secondary sector | Energy Business and finance | Energy Food Celulose/Paper |
| | | Tertiary sector | Tourism | Retail Telecommunication Water & Wastewater |

Table 1: Private sector presence in the LAC region, (part 1)

 $^{^{\}rm 4}$ The countries GDP's was used in the selection of the chosen countries in the LAC region.

(Table 1, part 2)

| Country | GDP 2019 (Billions USD) | Main economic sectors | | Main private sector presence |
|--------------------|----------------------------|-----------------------|---|--|
| | | Primary sector | Livestock Mining Forestry Fishing | Mining Oil/Gas Multisectoral (i.e. conglomerates) |
| Peru | 239 | Secondary sector | Energy Manufacturing | Food |
| | | Tertiary sector | | Retail Telecommunication |
| | | Primary sector | Agriculture Forestry | Oil/Gas |
| Ecuador | 108 | Secondary sector | Energy Manufacturing | Energy |
| | | Tertiary sector | Tourism | Retail Telecommunication |
| | | Primary sector | Agriculture Fishing | Agroindustry |
| Puerto Rico | 105 | Secondary sector | Manufacturing | Infrastructure Retail |
| | | Tertiary sector | Tourism | Transport |
| | 86 | Primary sector | Agriculture Livestock Mining | |
| | | Secondary sector | Manufacturing | Multisectoral |
| Dominican Republic | | Tertiary sector | Tourism | Finance Insurance Telecommunication Retail |
| | 83 | Primary sector | Agriculture Livestock Mining Forestry Fishing | |
| Guatemala | | Secondary sector | Manufacturing | Multisectoral (i.e. conglomerates) Automotive Cement |
| | | | | Tertiary sector |
| | 64 | Primary sector | Agriculture Livestock Forestry | Agroindustry Oil/Gas |
| Costa Rica | | Secondary sector | Manufacturing Energy | Energy Food Infrastructure |
| | | Tertiary sector | Tourism | Finance Insurance Water & Wastewater |

| Economia | N° of companies | Accumulated (%) | |
|--------------------|--------------------|--------------------|------------------|
| Retail | Tertiary sector | 77 | 16% |
| Energy | Secondary sector | 56 | 27% |
| Food | Secondary sector | 43 | 36% |
| Automotive | Secondary sector | 40 | 44% |
| Mining | Primary sector | 36 | 51% |
| Oil/Gas | Primary sector | 34 | 58% |
| Telecommunications | Tertiary sector | 26 | 63% |
| Steel/Metal | Secondary sector | 21 | 67% |
| Agroindustry | Primary sector | 20 | 71% |
| Manufacture | Secondary sector | 20 | 76% |
| Multisector | Secondary sector | 19 | 79% |
| Health | Tertiary sector | 14 | 82% |
| Transport | Tertiary sector | 14 | 85% |
| Electronics | Secondary sector | 10 | 87% |
| Logistic | Tertiary sector | 9 | <mark>89%</mark> |
| Celulose/Paper | Secondary sector | 8 | 90% |
| Consumer goods | Secondary sector | 7 | 92% |
| Cement | Secondary sector | 6 | 93% |
| Entertainment | Tertiary sector | 6 | 94% |
| Infrastructure | Secondary sector | 6 | 96% |
| Petrochem. | Secondary sector | 6 | 97% |
| Software/TI | Fourth sector | 5 | <mark>98%</mark> |
| Chemistry | Secondary sector | 4 | 99% |
| Services | Tertiary sector | 3 | 99% |
| Water & Wastewater | Secondary sector | 3 | 100% |
| Education | Fourth sector | 1 | 100% |
| Total | | 494 | |

Table 2: Number of LAC private companies by economic sectors

Source: World Bank database, information of LAC countries webpages, America Economía ranking of 500 main companies in Latin America.

According to CEPAL (Comisión Europea 2019 "Avances en la Acción Climática de América Latina: Contribuciones Nacionalmente Determinadas al 2019"⁵), it is possible to identify economic sectors in LAC region that have been defined as highly vulnerable to climate change and therefore, require a stronger adaptation action. Such is the case of the agriculture, water resources and health sectors. Nevertheless, as is possible to observe in the preceding tables, the private sector does not appear to have a predominant presence in primary sector activities⁶, considered as the most vulnerable to climate change impacts.

Considering the above, the analysis was mainly focused on the following sectors:

- Agriculture and forestry;
- Mining;
- Infrastructure;
- Financial services.

2.2 Survey on private sector capacity building gaps

The role of the private sector is fundamental to supporting higher ambition on climate change, but this requires the development of new skills, capacities and knowledge. In order to directly assess and evaluate the current status of the private sector relative to these dimensions, this research carried out an online survey contemplating the following questions:

Identification questions:

- **Question 1:** Which sector/sectors do you represent?
- **Question 7:** Please, indicate your country.

Identification of climate change knowledge and skills among private sector participants:

• **Question 2:** Do you know the meaning and implications of "climate change adaptation" and "climate change mitigation" in your respective sector/sectors?

⁵ Comisión Europea (2019). Avances en la Acción Climática de América Latina: Contribuciones Nacionalmente Determinadas al 2019. Programa EUROCLIMA+, Dirección General de Desarrollo y Cooperación – EuropeAid, Comisión Europea, Bruselas, Bélgica. 171p.

⁶ In the LAC region it is possible to identify countries with open economies (market economies: Chile, Mexico, Colombia, Peru); social democracies or mixed economies (protectionist models: Argentina, Uruguay, Brazil, Ecuador, Bolivia, Paraguay and Costa Rica) and closed economies (very little free market economy relationships and/or maintain economic relationships with countries with similar economic models: Cuba, Venezuela and Nicaragua).

Identification of climate change skills/knowledge/capacities that the private sector participant considers need to be strengthened in their sectors:

- **Question 3:** If your preceding answer was affirmative, which of the following subjects do you consider that need to be strengthened through better information/capacitation/learning in your respective sector/company/association?
- **Question 4:** The following climate change consequences (18 consequences were mentioned) are potential impacts that could affect economic sectors. Please, mark those you consider are not being properly addressed within your sector, due to lack of skills/knowledge/capacities.
- **Question 5:** Do you think that there are still some climate change-related effects that have not been properly addressed in your sector due to lack of capacities/knowledge? Which one(s)?

Identification of climate change capacities/supports/regulation that need to be strengthened in their countries:

• **Question 6:** What actions do you consider are necessary to be developed in your country in order to properly address the climate change effects identified in the preceding question?

The questions were designed to identify the actions the private sector is taking, the aspects that needed strengthening, the impacts not currently or properly addressed and the institutional arrangements that would have to be developed or improved in order to better deal with the impacts of climate change. To maximize the reach and rate of response, the survey was carried out in English, Spanish and Portuguese and was kept available on-line for approximately two months⁷. The survey was sent to private sector organizations such as companies and industrial or guild associations. A total of 44 responses were received. The following section shows and briefly comments on the answers.

Answers to questions N° 1 and N° 7 were aimed at identifying participants' sectors (74,4% represent secondary and tertiary sectors) and their countries:

| Selected options | Total | (%) |
|---|-------|------|
| Agriculture (Agriculture, Cattle, Fishing and Forestry) | 6 | 14% |
| Mining | 4 | 9% |
| Infrastructure (Construction, IT) | 5 | 11% |
| Finance and Business | 11 | 25% |
| Others | 18 | 41% |
| Participant who answered | 44 | 100% |
| Participants who did not answer | 0 | 0% |

| Countries | N° of participants | (%) |
|------------|--------------------|------|
| Chile | 21 | 48% |
| Brazil | 4 | 9% |
| Costa Rica | 7 | 16% |
| Colombia | 2 | 5% |
| Argentina | 4 | 9% |
| México | 3 | 7% |
| Peru | 2 | 5% |
| Grenada | 1 | 2% |
| Total | 44 | 100% |

Table 3: Identification of participants: sectors and countries

⁷ The total available time to carry out this working paper was four months.





The most active participants in the survey belonged to the "Finance and Business sectors" and "Others" (comprised by Energy, Guild organizations and Chilean Water utilities)⁸.

Answers to question N° 2 indicated that 90,9% of the respondents understand the concepts of GHG emission mitigation and adaptation to climate change.

⁸ Water Utilities in Chile are regulated private companies.



Figure 3: Private sector awareness of climate change "adaptation" and "mitigation" concepts

Question N° 3 was aimed at determining the aspects of climate change the private sector considered that needed further development through better information, capacity-development or knowledge in their respective sectors. The first part of this question was designed as a multiple-choice question, while the second part offered participants the possibility to freely comment on any initiative that their organizations had implemented in the past designed to strengthening these capacities. The summary of the answers received is shown in the following table:

Table 4: Subjects that private sector participants consider that need to be strengthened.

| Selected options | Total | (%) |
|---|-------|-----|
| Climate change strategies integrated to daily company actions. | 28 | 64% |
| Adaptation climate change actions. | 26 | 59% |
| Climate change Plans/Politics (Carbon footprint, Energy Efficiency, Water footprint). | 25 | 57% |
| Mitigation regulatory compliance of GHG (for example CO ₂ , CH ₄ , N ₂ O). | 13 | 30% |
| Participant who answered | | |
| Participants who did not answer | 0 | |

Considering mitigation, adaptation and resilience actions (Table 4), survey participants highlighted the need to reinforce capacities required for integrating the climate variable into business planning. This starts with strategies that take into account all climate factors that can affect or compromise

business operations. More than half of the answers showed the need to integrate climate change actions to companies' everyday activities. Adaptation and long-term strategies (such as carbon and water foot-printing and energy efficiency) need to be reinforced, though these last ones were described as activities that were already being addressed by some companies as part of their climate change action plans. Some of the specific climate-related capacities and climate-related know-how that were explicitly mentioned by survey participants were the following:

- 1. Energy efficiency, automation and digitalization;
- 2. Agricultural innovation techniques (improvement in plantations, irrigation, soils);
- 3. Carbon and water foot printing;
- 4. Water management;
- 5. Energy reconversion.

According to the above, there is clearly a need to develop these new capacities (and the supporting know-how, technologies, industries, regulatory framework, etc.) in the LAC countries. Proper management of climate change variables is key to business sustainability and therefore should be permanently incorporated in the business strategy, with emphasis on dynamic adaptation actions and mitigation plans for the medium and long-term (carbon and water footprint and energy efficiency).

The least selected option had to do with strengthening the knowledge of regulatory GHG emission mitigation. This could be explained due to the experience in GHG mitigation gained through the CDM during the past two decades and to the recent development of local GHG-related standards and policies in the region.

Answers to question N° 4 pointed at impacts that are currently not being properly addressed within the corresponding sectors due to lack of skills, knowledge or capacities. The answers are summarized in the following table and graph:

| Selected options | | sponses | |
|--|-----|---------|------------------------------------|
| | | Total | |
| Scarcity/hydric stress in water basins. | 45% | 20 | |
| Decrease in crops production and quality. | 41% | 18 | |
| Changes in water salinity in basins and estuaries. | 36% | 16 | Decrease in |
| Increase in sediment dragging. | | 13 | precipitations |
| Increase in safety standards in the construction industry (higher costs). | 27% | 12 | |
| Reduction of hydraulic energy generation. | 25% | 11 | |
| Illness increase, man-hours losses. | 43% | 19 | 1 |
| Heat waves that affect crops quality and cattle productivity. | 39% | 17 | |
| Increase in electric energy demand due to higher cooling and heating devises. | 32% | 14 | Temperature |
| Decrease in the useful lifespan of electric and mechanical equipment. | 30% | 13 | increase |
| Crop yield modifications. | | 12 | |
| Land quality modification due to frost and heat waves. | 27% | 12 | |
| Infrastructure damage to installations due to extreme natural events (i.e. floods, hurricanes, typhoons, etc.) | 50% | 22 |] |
| Economic losses due to damage and increase in insurance policies. | 50% | 22 | |
| Forest fire prevalence. | 45% | 20 | Eutomatic and |
| Impacts over public/private infrastructure, transport, energy, water, communications and IT. | 43% | 19 | Extreme events |
| Drought intensification. | 39% | 17 | |
| Intensified contamination episodes due to thermic inversion in the athmosphere. | | 10 | |
| Participant who answered | | 43 | |
| Participants who did not answer | | 1 | |

Table 5: Potential climate change impact indicated as not properly addressed by the private sector



Figure 4: Climate change impacts that according to participant's perspective, are not being properly addressed in their sectors.

Private sector's need to strengthen its climate risk management capacity is reinforced by the results of the following survey's answer, in which participants identified eighteen potential climate change-related impacts that could severely affect them. Four of the most selected impacts are associated to extreme events. While all the outlined impacts demand a greater planning capacity by businesses, those related with extreme events imply a higher risk exposure due to their less predictable nature and possibly more adverse economic impacts.

As previously mentioned from question N° 1, the "Finance and Business" sector was one of the most participative sectors in the survey. This could explain why "Extreme events" was the most selected category type in the survey, and most likely indicates the need to develop new financial instruments and tools that allow to better identify, measure and manage financial risk associated with extreme events related to climate change.

Other impacts that were also widely chosen by survey participants was Scarcity/Hydric stress in water basins and Illness increase (translated into man-hour losses). This can be explained by the fact that these impacts have a high level of awareness as they have been (and currently are) severely affecting the LAC region in the last years⁹.

The purpose of question N° 5 was to identify other climate change-related effects that have not been properly addressed in various economic sectors, due to lack of local capacities/knowledge. Since this was an open question, the answers were broad and diverse. Some of them related to climate change management in businesses, while others were related to fostering cross-sectoral collaboration, the generation of new scientific evidence and studies and the development of local institutions and regulatory frameworks in the LAC countries. The following tables show a compilation of all the answers received, grouped according to the classification below:

GHG emissions control, climate related risk management and climate action in companies:

- 1. Carbon pricing.
- 2. Carbon markets uncertainty management.
- 3. Water statistics improvement.
- 4. Business opportunities that climate change adaptation represents for private sector.
- 5. Payment capacity indicators of debtors who are vulnerable to climate change impacts.
- 6. Further development of environmental and climate change indicators for loan evaluation and businesses.
- 7. Bio economy, circular economy.
- 8. Embodied carbon (i.e. in the construction sector).

⁹ For example, review the latest studies about current water scarcity in Chile and Brazil. Reports available at: <u>https://www.opia.cl/static/website/601/articles-91835_archivo_01.pdf</u> and <u>https://www.mdpi.com/2073-4433/10/11/642</u>

Cross-sectoral collaboration:

- 1. Leveraging technology transfer.
- 2. Climate change capacity building in rural sectors.
- 3. Promotion of more active social involvement in climate change matters.
- 4. Water rights and education.
- 5. Development of climate change scenarios to promote private investment and funding.
- 6. Agricultural technique innovation.
- 7. Wastewater use, aquifers recharge, water supply.

Scientific local data and studies; institutional and regulatory framework:

- 1. Some utility service fees still do not factor in climate change costs and investment.
- 2. Regulations for industrial water use.
- 3. Biodiversity loss.
- 4. Impacts on power transmission and distribution due to heat waves, storms and floods.
- 5. Solid waste contamination due to lack of management.

Question N° 6 was designed as a multiple-choice question, so that the respondents could select, according to their criteria/judgement, which of the proposed actions could be developed in their country in order to properly/better address the climate change effects and impacts identified under questions N° 4 and N° 5. The answers are shown in the table below:

Table 6: Most Relevant capacities to be developed in LAC countries, according to survey participants criteria.

| Selected options | Total | (%) |
|--|-------|-----|
| Financial support for innovation projects aimed at adaptation and mitigation | 33 | 75% |
| Generation of cross-cutting climate change knowhow in professional careers: social, healthcare, finance, administration, engineering, etc. | 32 | 73% |
| Higher diffusion of climate change-related impacts in the economy sectors | 30 | 68% |
| Higher degree of collaboration between the private sector and research centers on climate change matters | 29 | 66% |
| Higher incentives to the private sector through national climate change policy | 29 | 66% |
| Higher private intersectorial collaboration | 24 | 55% |
| Capacity-building supply from the academia | 11 | 25% |
| Others (please specify) | 5 | 11% |



Figure 5: Actions to be developed in order to properly address the climate change effects in the survey participant's sectors

Table 6 presents the resources/capabilities survey participants consider most relevant to be developed in their countries, for addressing climate change challenges that their organizations will most likely have to face. According to the responses, the most relevant capacities are the following:

- 1. The development of financial instruments and mechanisms for the implementation of adaptation and mitigation projects.
- 2. The development of multi-disciplinary professional knowledge on climate change.
- 3. Fostering collaboration and synergies between private sectors and research centers.
- 4. The development of incentives to the private sector through clear institutional frameworks.

2.3 Role of the Academia: Educational and Research Centers.

In the changing context imposed by climate change, the generation of new knowledge becomes a crucial factor to develop solutions. Here is where the role of the academia and research centers plays a decisive role, as education can facilitate the adaptation process of individuals and societies to changing circumstances. In this case, good quality training can enable the successful deployment of the new low-carbon and resilient technologies that will be required to transition to a low carbon economy that is consistent with the Paris Agreement goals.

From undergraduate to postgraduate programs, climate change represents a significant educational challenge. These programs should consider both the causes as well as the consequences of climate change in order to enable the deployment of long-term effective educational strategies. On the one side, such strategies should consider the long-run and tackle the causes of the climate change problem through climate change mitigation. However, they should not neglect the impacts of nearer climate change impacts which require the development of new adaptation options.

Many universities have implemented actions aimed at mitigating their own GHG emissions; they perform climate change-related communicational activities involving the civil society, collaborative work with public and private sectors and have postgraduate programs on climate change, as this topic is now present in almost every environmental career worldwide. Nevertheless, from the research carried out in this paper, very few universities in the LAC region¹⁰ provide or are currently developing undergraduate programs that incorporate the concepts of sustainability and climate change, in which the skills and knowledge required to develop sustainable and climate friendly solutions are part of every careers' curricula. Such approach would help to support and complement private sector efforts towards pursuing sustainable goals, encouraging new research initiatives on sustainable development and establishing intersectoral networks and synergies which are key to generate more effective and optimized results on climate action.

A good example of an educational initiative that has successfully incorporated sustainability goals is the one supported by the International Association of Universities (IAU), which currently has more than 582 members worldwide and supports sustainable development in higher education. This initiative provides useful sustainable development resources and currently counts with more than 800 initiatives implemented by higher education institutions and organizations that consider compliance with SDGs as part of their programs.

¹⁰ Monterrey Institute of Technology (Mexico), Los Andes University (Colombia) and Pontifical Catholic University of Chile.

Table 7: Number of Training centers in LAC

| Countries | Training centers | LAC universities with Environmental Training programs (Examples) |
|-----------|------------------|---|
| Argentina | 139 | Universidad de Cordoba, Universidad de Buenos Aires, Universidad de la Defensa Nacional. |
| Brasil | 244 | University of Sao Paulo, University of Campinas, Federal University of Sao Paulo (UNIFESP), Federal University of Minas Gerais, Sao Paulo State University (UNESP), Federal University of Rio Grande do Sul, Federal University of Santa Catarina, Federal University of Rio de Janeiro, University of Brasilia, Federal University of Sao Carlos, Federal University of Viscosa, Federal University of Ceara, Pontifical Catholic University of Rio Grande do Sul (PUCRS), Federal University of Parana, Federal University of Pernambuco, Rio de Janeiro State University (UERJ), Federal University of Bahia, Fluminense Federal University, Federal University of Lavras, Federal University of Goias, Federal University of Santa Maria, Federal University of Pelotas, Federal University of Rio Grande do Norte (UFRN), Federal University of Para, University of the Sinos Valley, Federal University of Ouro Preto, Federal University of Technology-Parana, Nove de Julho University, University of Vale do Itajai, Vila Velha University. |
| Chile | 63 | Pontificia Universidad Católica de Chile, Universidad de Chile, Pontificia Universidad Católica de Valparaíso, Universidad de Santiago, Universidad de la Frontera, Universidad de Valparaíso, Universidad de Concepción, Universidad Austral de Chile, Universidad Técnica Federico Santa María, Universidad Católica del Norte, Universidad Andrés Bello, Universidad de Antofagasta, Universidad del Desarrollo, Universidad Católica de la Santísima Concepción, Universidad Mayor, Universidad Católica de Temuco. |
| Colombia | 242 | Universidad Nacional de Colombia, Pontificia Universidad Javeriana, Universidad de Antioquía, Universidad del Norte Colombia, Universidad Industrial de Santander, Universidad Antonio Narino, Universidad Distrital Francisco José de Caldas, Universidad EAFIT, Universidad La Salle, Universidad de Medellín, Universidad Tecnológica de Pereira. |
| Mexico | 2,398 | Instituto Tecnológico de Monterrey, Universidad Autónoma Nacional de México, Universidad Autónoma Metropolitana, Universidad Nacional Politécnica, Universidad Autónoma de Puebla, Universidad Autónoma del Estado de México, Universidad de Guanajuato, Universidad de San Nicolás de Hidalgo Michoacán, Universidad Autónoma de Baja California, Universidad Autónoma del Estado de Hidalgo, Universidad Autónoma de Yucatán, Universidad de Colima, Universidad de Sonora. |
| Peru | 343 | Universidad Nacional de San Antonio Abad de Cusco, Pontificia Universidad Católica del Perú, Universidad Científica del Sur, Universidad San Martín de Porres. |



Though the current supply of climate change specialization programs is highly concentrated in environmental careers, there are a great variety of short programs aimed at professionals of different areas and sectors. For example, FLACSO offers a leadership, city, law and economy program on climate change and the Center for Climate and Resilience Research (CR²) from Universidad de Chile offers short programs on low-carbon carbon development. Research centers affiliated to universities, governmental or non-profit organizations are currently including a broader range of climate change-related sub-areas in their research activities.

Table 8 below shows a compilation of research centers located in the LAC region, which consider climate change-related sub-areas that are relevant for the implementation of adaptation and mitigation in the region.

| N° of sub- areas | Climate change-related sub-areas | N° of research centers that incorporate the sub-area |
|---------------------|--|---|
| 1 | Sustainable development | 151 |
| 2 | Management/conservation/Sustainable use of natural resources | 135 |
| 3 | Water use (rights/management) | 41 |
| 4 | Waste management | 5 |
| 5 | Bioenergy | 3 |
| 6 | Climate change impacts in the ocean | 1 |
| 7 | Carbon emission and cycles | 7 |
| 8 | Socioeconomic climate change impacts | 10 |
| 9 | Adaptation and Mitigation | 59 |
| 10 | Disaster risk reduction and response | 13 |
| 11 | Sustainable agriculture | 32 |
| 12 | Agro and biotechnology | 5 |
| 13 | Agriculture and the environment | 26 |
| 14 | Food security | 13 |
| 15 | Biodiversity | 74 |
| 16 | Biofuels | 7 |
| 17 | Fossil fuels | 4 |
| 18 | Renewables | 6 |
| 19 | Forest and deforestation | 27 |
| 20 | Climate finance and green economy | 5 |
| 21 | Environmental law | 8 |
| 22 | Energy (efficiency, economy, reform) | 34 |
| 23 | Land use | 58 |
| 24 | Environment and migration | 2 |

Table 8: Research centers in LAC, that incorporate climate change-related sub-areas

Source: onthinktanks.org

Considering the extension and complexity of the LAC region, the current offering of climate changerelated sub-areas in the region is not plentiful. From the table above it is possible to observe that there are specific climate change areas that have not been properly addressed. Climate change finance, environmental law and disaster management have been insufficiently covered by research centers and the academia in the LAC region. From the program review of all academic and research centers in the LAC region, only 5 out of 245 (2%) are currently working on climate finance. All of them are non-profit organizations located in Brazil, Chile, Argentina and Nicaragua.

An interesting example that illustrates the existence of unattended areas related to climate change refers to the poor development of communicational skills that are necessary to communicate the implications of climate change to audiences with heterogeneous educational levels and information needs (both in breadth and depth). Such is the case of the agriculture sector, which includes the farmer, who basically produces for local markets, to big corporations that are primarily oriented towards international markets.

The following table describes the main challenges associated to communicating climate change across different audiences.

| Complexity of the climate change message | Due to their wide scope, climate change-related messages may confuse audiences or not be fully understood. |
|--|--|
| Variety of themes | Many themes fall under the umbrella of "climate change": CO_2 emissions, droughts, extreme events, transport, energy production and use, etc. This makes the understanding of climate change challenging to some audiences. |
| Lack of specializad reporting | Whereas newsmedia have reporters who specialize in social affairs, economics or sports, very few have staff trainning on matters related to climate change. |
| Competing theme | Since it is not absolutely certain that some impacts are specifically caused by climate change, it is not rated as highly as political, wars, conflicts, or other themes. |

Table 9: Challenges associated to communicating climate change to audiences

Source: Addressing the Challenges in Communicating Climate Change Across Various Audiences, Springer, 2019.

Effective climate change action (both in mitigation and adaptation) requires educating audiences. That explains the need for good communicating skills to devise well-designed messages. Along these lines and considering the information obtained from the survey, the elements public and private sectors could further develop and/or consider in order to better communicate a more coherent and effective message about climate change could be the following:

- 1. The connection between climate change local and global impacts and events.
- 2. A clearer explanation of climate change impacts on local, regional and global communities.
- 3. Better ways of defining global, regional and local actions to combat climate change.
- 4. The relevance of government policies in the climate change problem solving process.
- 5. The need of a robust and transparent climate change governance.
- 6. The relevance of adaptation and mitigation in creating and maintaining business resilience.
- 7. The benefits associated to climate change finance and green investments.

According to the survey results, climate finance support and disaster risk mitigation are relevant actions that participants clearly identified as needed to properly address climate change impacts in their respective sectors and countries. From the LAC research center database compiled during this research, it is possible to conclude that there is an important number of institutions that can develop and propose mitigation and adaptation actions, but few of them deal with climate change-related disaster risks and climate finance adequately. This is shown in the figures below.



Figure 6: LAC Location of climate change adaptation and mitigation research centers



Figure 7: LAC Location of climate change disaster risk and response research centers

Figure 8: LAC Location of climate finance and green-economy research centers



Despite many research centers that focus on climate change and sustainability do engage in collaborative actions with the private sector, this information is not publicly available. Therefore, in

order to have a more accurate and detailed picture of type of collaboration in the LAC region, this information would have to be assessed country by country.

Good examples of collaboration between research centers and the private sector are the projects developed by the "Centro de Cambio Global de la Pontificia Universidad Católica de Chile (PUC)¹¹" which study and evaluate climate change impacts and policies for the private sector. Another research center that works with the private sector in Chile is the "Instituto de Ecología y Biodiversidad (IEB)¹²", which has carried out studies such as "Ecological knowledge in the wine industry¹³" aimed at identifying climate change adaptation strategies that would benefit Chilean wine producers.

3 Conclusions

- In the last years, the severity of climate change in the LAC region has become more apparent, making private companies to increase their efforts in becoming more resilient. Unlike climate change mitigation, adaptation actions have been less evident, mainly due to the lack of standardized mechanisms that allow to clearly identify, categorize and measure them. This has also prevented a better communication with stakeholders, making them less known in the LAC community.
- The most relevant economic activities in the LAC region correspond to the primary sector. However, the private sector presence is more intense in the secondary and tertiary sectors. This may cause a potential misalignment of the adaptation priorities between the private sector and the corresponding governments. To prevent this, it might be necessary for governments to pursue a higher private sector engagement in the development of national climate change plans, in order to align interests and secure a more active participation of the private sector.
- From the open-question answers obtained in the survey, it is evident that the opportunities that climate change represents for the private sector are not necessarily clearly and/or sufficiently identified. Examples of this are the poor relationship established by some survey participants between innovation and the development of new low-carbon products and services, as well as the relation that exists between efficient management processes and climate change mitigation.
- The survey participants clearly indicated the need for more financing options for climate change
 initiatives. It is possible that the existing financing instruments such as the Green Climate Fund
 (GCF)¹⁴ and CAF's Green Bond Program¹⁵ among others are not sufficiently well-known or
 perceived as too complex, financially constrained and of limited scope. If that were the case,
 this would probably explain this perception in the LAC region.

¹¹ https://cambioglobal.uc.cl/

¹² https://ieb-chile.cl/

¹³ For further information, please refer to: https://ieb-chile.cl/en/proyectos/ecological-knowledge-in-the-wine-industry/

¹⁴ https://www.greenclimate.fund/

¹⁵ https://www.caf.com/en/investors/green-bonds-program/

- Education is a crucial factor for leveraging climate change ambition. So far, the academia has focused mainly on providing specific specialization courses on climate change, however considering the cross-cutting nature of climate change (and of sustainability), in order to spread climate action in the LAC region it is necessary to teach climate change skills, capacities, knowledge, etc. in more careers and not just in the ones specifically related to the environment.
- The survey results also indicated the need for better interaction between the public and private sectors in order to foster sustainable development and climate change action in the region. This better interaction translates into the promotion of climate change science by governments, the generation of high quality data required for the new adaptation plans and in making information more transparent and accessible to the private sector and social actors in general.
- Partnerships among the government, the academia and the private sector can significantly contribute to bridge the existing capacity needs and knowledge gaps on climate change. The government can engage with the private sector and establish climate change vulnerabilities and priorities at a national level. The academia can develop the science associated to climate change impacts and the private sector can use this information to develop technologies and strategies for climate change adaptation that are consistent with the national climate change priorities and action plans.
- The lack of long-term environmental planning in the LAC region has important implications to the private sector's relation with climate change. In the absence of clear and well-defined government guidelines and policies, the private sector has a high chance of miss-coordinating its climate actions at a broader and more effective level, particularly when it comes to adaptation actions and increasing climate resilience.
- Without a strong institutional framework (e.g. incentives and guidelines, which involve a greater knowledge and information on climate change) it is more difficult for countries to achieve their national environmental goals and more so, honor their Paris Agreement pledges. A concrete, well-founded and clear climate change policy can provide the support level and incentives required by the private sector to take proper action on adaptation, resilience and mitigation.

4 Recommendations

Based on the results and conclusions obtained in this paper, it is possible to make the following recommendations:

1. Private sector risk exposure to climate change impacts depends on a variety of factors. The most obvious is related to the physical impacts in the sectors in which the private sector operates. However, the context and local circumstances in which such physical impacts occur are also relevant when evaluating risks. As climate change impacts become more apparent and the associated risks more relevant, the private sector will have to perform a more careful risk assessment and consider all the local variables and particular circumstances in order to adapt effectively and accordingly¹⁶. This generates a unique opportunity for the academia and research centers in the region, which should engage with the private sector in order to develop the studies and the required skills, technologies and tools that will be required by private companies to mitigate the risks associated to the transition towards more resilient business models.

¹⁶ A good example of this is the TCFD (Task Force on Climate Change Financial Disclosure). https://www.fsb-tcfd.org/

- 2. The climate change challenge demands the development of widespread and cross-cutting knowledge, skills and capacities in the LAC region. This requirement should be properly and/or better attended by academic centers in the region, by incorporating climate change (and ideally sustainability) elements in the curricula of all careers that can contribute directly or indirectly with the development of climate change or sustainability goals (i.e. SDGs).
- 3. The development of clear public climate change policies would facilitate and enhance the collaboration among research centers and the public and private sectors. For example, the presence of adaptation and mitigation incentives would likely motivate research centers to engage with the private sector in the creation of new adaptation and mitigation technologies in the region, which would positively contribute with the regional climate change objectives and goals.
- 4. An accurate and effective identification of the capacity building needs for dealing with the impacts of climate change (i.e. adaptation) requires a more detailed mapping and characterization of the private sector presence in the LAC region than the one performed for this research. This would allow to answer questions such as: How are the economic sectors structured in the LAC countries?, Do the main climate change vulnerabilities affect the public or the private sectors?, What is the private sector participation/role in the productive, manufacturing and service sectors?, Are specific climate change vulnerabilities well known/established, properly communicated and addressed?, Are there other factors (i.e. social, cultural, political) that should be taken into consideration when dealing with climate change impacts?, among others. The answers to these questions could be extremely useful (or even necessary) for a successful design and deployment of capacity building programs in the region.
- 5. At a more specific level, this research identified the following climate change areas that need further development in the LAC region:
 - Improve climate change understanding at different levels: local, regional and global.
 - Climate change communication plans.
 - Climate change governance and policies: institutional arrangements.
 - Design of mitigation/adaptation/resilience plans for businesses (private sector).
 - Climate change finance: The creation of new and more efficient and effective instruments as well as better mechanisms to promote a more widespread use of them in the region.
- 6. The information gathered in the LAC region showed a total of 245 climate change research centers. Their areas of expertise can be divided into 24 sub-areas, which are related to climate change, but need to be strengthened both in depth and geographical scope. The main sub-areas identified were:
 - a) Bioenergy,
 - b) Climate change impacts in the ocean,
 - c) Fossil fuels optimization,
 - d) Renewable energies,
 - e) Forestation and deforestation,
 - f) Climate finance and green economy,
 - g) Environmental law and public policies,
 - h) Environment and migration,
 - i) Gender equity,
 - j) Sustainable communities and cities.

- 7. It would be advisable to more actively promote university seminars or conventions in the LAC region in order to facilitate and accelerate the creation and diffusion of multidisciplinary skills and knowledge that are relevant for facing climate change. This could be led –for example- by academic institutions that have already adopted a cross-cutting approach about climate change (or sustainable development) in their programs. The seminars could facilitate the sharing of technologies, experience and useful knowhow in the implementation of climate change solutions and/or other sustainable initiatives. Such instances would encourage the participation academic institutions, governmental organizations, representatives of the private sector and other relevant stakeholders.
- 8. This working paper showed the private sector presence in the main economic sectors of the LAC region, the main private sector needs and gaps for climate change adaptation as well as a global assessment of the current supply (and possibly some deficiencies) of the academia and research centers on that matter. This information could be useful to deepen this research in the region through the following next steps:
 - a) Conduct a targeted and detailed assessment of the private sector adaptation needs for each sector and country. A starting point for this could be the information provided in Table 1 of this working paper.
 - b) Perform a detailed assessment of the current capacity building programs supplied by the academia and research centers in each country of the LAC region. This will allow for a more precise diagnostic of the specific gaps and capacities that are currently missing, signaling the type of capacity building programs that would be required.
 - c) Engage with some specific (i.e. main/strategic) academic and research centers in the LAC region that would be willing to create, use or leverage multi sectoral collaboration on climate change adaptation. The information provided in this working paper could be useful to prioritize and map such possibilities in the region.
 - d) Engage with some specific (i.e. main/strategic) academic centers in order to explore the possibility of introducing/incorporating concepts such as climate change and sustainability in their academic programs. The information provided in this working paper could be useful to prioritize and map such possibilities in the region.
 - e) Engage with LAC governments in order to assess the viability/willingness to structuring collaborative adaptation plans among actors in the government, private sector and the academia/research centers. The mapping of this in the LAC region would be useful in the deployment capacity building programs in the future.

A more detailed analysis of the capacity needs and gaps of the private sector in the LAC region would allow to deploy capacity building plans aimed at addressing the main gaps and deficiencies on climate change adaptation currently observed, as well as implementing educational programs that in the long-run would consider sustainability and climate change concepts from the onset. This would positively help with a better understanding of the climate change problem, facilitating the compliance with the Paris Agreement goals.

References:

Comisión Europea (2019). Avances en la Acción Climática de América Latina: Contribuciones Nacionalmente Determinadas al 2019. Programa EUROCLIMA+, Dirección General de Desarrollo y Cooperación – EuropeAid, Comisión Europea, Bruselas, Bélgica. 171p.

Maria Cecilia Acevedo, Eduardo Borensztein, and Joaquin Lennon (2018). Development Gaps: Methodological Innovations and Inclusion of Private Sector Indicators, IDB Invest. 80p.

CEPAL (2011). La economía del cambio climático en Centroamérica: Reporte técnico 2011, Mexico. 437p.

ECLAC (2015). The economics of climate change in Latin America and the Caribbean: Paradoxes and challenges of sustainable development, Santiago, Chile. 96p.

Christopher P.O. Reyer (2015). Climate change impacts in Latin America and the Caribbean and their implications for development. International Bank for Reconstruction and Development, Springer. 24p.

Editor-Walter Leal Filho (2016). Innovation in Climate Change Adaptation. Springer, Hamburg, Germany. 388p.

CEPAL (2016-2014). Evaluaciones de desempeño Ambiental en América Latina y el Caribe. Perú, Chile, Colombia, Brazil.

Barry Sadler (Editor) et al. (2015). Handbook of strategic environmental assessment. Earthscan, Oxfordshire, UK. 621p.

Tobias Schmidtke, Koch H., Camarero García V. (2018). Los sectores económicos en América Latina y su participación en los perfiles exportadores. Proyecto Regional Transformación Social-Ecológica. Friedrich-Ebert-Stiftung.

Walter Leal Filho, Lackner B. McGhie H. (2019). Addressing the challenges in communicating climate change across various audiences (climate change management). Springer. Hamburg, Germany. 673 p.

Walther Leal Filho (2010). Universities and climate change. Springer. Hamburg, Germany. 269 p.

Virginie Fayolle, Fouvet C. Soundarajan V. (2019) Engaging the private sector in financing adaptation to climate change: Learning from practice. Action on Climate Today. 36 p.

The UNDP adaptation programme (2018) UNDP Climate change Adaptation: Impacts. https://www.adaptation-undp.org/privatesector/.

GIZ (2015) Supporting SMEs in adapting to climate change. https://www.giz.de/en/worldwide/33477.html.

Trading Economics (2020) Economic Indicators | List By Country. https:tradingeconomic.com/countries.

EDGAR-Emissions Database for Global Atmospheric Research (2019) EDGAR-Fossil CO₂ and GHG emissions of all world countries.

https://edgar.jrc.ec.europa.eu/overview.php?v=booklet2019&dst=GHGpc.

ODEPA Chile (2016) El cambio climático y los recursos hídricos de Chile. https://www.opia.cl/static/website/601/articles-91835_archivo_01.pdf.

On Think Tanks (2019) On Think Tanks | Independent research, Ideas and advice. https://onthinktanks.org/.

Altillo.com (2019) Guía de Universidades en España, Argentina, Mexico, Perú. https://www.altillo.com/universidades/index.asp.

América economía (2020) Estas son las 500 empresas más grandes de Latinoamérica. https://www.americaeconomia.com/negocios-industrias/estas-son-las-500-empresas-mas-grandes-de-latinoamerica-2019.