

A stylized world map in shades of blue, overlaid with a network of thin white lines and small blue dots, suggesting digital connectivity. The map is centered on the Atlantic Ocean, with Latin America and Europe clearly visible.

BELLA 2030:

A Digital Alliance Between Latin America and Europe

Proposal

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Presentation of the Document

This proposal was prepared under the coordination of the Latin American Cooperation of Advanced Networks (RedCLARA), the regional Latin American research and education network, an international non-government organization based in Uruguay whose goal is to strengthen the development of science, education, culture and innovation through the use of advanced networks.

The purpose of this document is to obtain political and economic support from governments, development banks, telecommunications companies and other organizations in the region involved in these areas, in order to develop a regional infrastructure investment project that will allow expanding the Latin American and Caribbean digital ecosystem and its connectivity with the international digital ecosystem of science, technology, education and innovation. The leading actors of this proposal are the national research and education networks of Argentina, Belize, Bolivia, Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Trinidad and Tobago, and Uruguay, countries that still have very limited connectivity to RedCLARA and the digital education, research and innovation ecosystem it provides.

In 2021, RedCLARA is finalizing the *Building the Europe Link to Latin America* (BELLA) project. BELLA leaves us exceptional connectivity infrastructure, namely, a direct link between Europe and Latin America and a backbone that crosses South America, connecting Brazil, Chile, Colombia and Ecuador, two very high-capacity infrastructure developments for the use of educational and scientific institutions. This new infrastructure supports a significant increase in the potential for collaboration in science, education, technology and innovation.

BELLA has been developed with the contributions of Brazilian, Colombian, Chilean and Ecuadorean networks and the European Commission. After completing the first phase of the project, this infrastructure represents an investment of close to one hundred million dollars. Despite the positive impacts of BELLA, its benefits are limited to four of the countries in the region — Brazil, Chile, Colombia and Ecuador. With this new proposal, we will be expanding the backbone to incorporate fifteen additional countries, thus contributing to reduce the disparities that exist in the region and increasing opportunities for achieving greater economic and social development.

Throughout their existence, RedCLARA and its national research and education networks have deployed infrastructure worth more than two hundred million dollars. The continued support of the European Commission has been essential for these efforts, so we hope to continue to count on this support in this next investment phase and to add the participation of all the actors mentioned above in order to expand the positive impact that science, education and innovation have on the economic and social development of the region.

It is our desire that this proposal will help advance the priorities defined in the plans, strategies and digital agendas of the different subregional integration schemes such as SICA, CARICOM, CAN and MERCOSUR, as well as those of regional organizations such as ECLAC and development banks such as CAF, IDB, BCIE, BNDES and others. We hope that they will all join us in this effort to build the digital infrastructure that Latin America and the Caribbean need to strengthen education, science

and technology in the region, key pillars for economic and social development, and to accelerate digital transformation processes.

This proposal was prepared with the support and contribution of individuals and organizations both within and outside the region. RedCLARA member networks played a key role in its design. We would like to express our profound gratitude to everyone who contributed to its development.

Executive Summary

BELLA 2030: A Digital Alliance between Latin America and the Caribbean - Europe

This proposal has been prepared under the coordination of the Latin American Cooperation of Advanced Networks (RedCLARA), in its role as regional research and education network in Latin America, that brings together the national research and education networks (NREN) and in compliance with our goal to strengthen the development of science, education, culture and innovation through the use of the advanced networks.

Latin America faces great challenges and maintains significant levels of inequality that tend to perpetuate over time. The advances made in the last decade were destroyed by the COVID 19 pandemic. Recovering from its devastating effects requires an intelligent and skilful use of the new technologies of digital transformation, which requires the sum of efforts of the main national actors in the region, supported by international cooperation as fundamental pillars to implement appropriate recovery policies.

BELLA 2030 is a regional proposal that aims to support the development of the digital infrastructure to expand the digital ecosystem of science, technology, education and innovation of 16 countries in Latin America and the Caribbean: Argentina, Belize, Bolivia, Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Trinidad and Tobago and Uruguay. To make it a reality, the political and financial support of governments, development banks, telecommunications companies and organizations in the region linked to these areas is needed.

RedCLARA connects the region's national research and education networks (NREN) to the existing global capacity, allowing researchers, professors, and students to collaborate by sharing data, information and knowledge, which helps to integrate them into an international cooperation framework strengthened by technology, with the consequent impact on expanding access to research and education communities worldwide.

In 2021 RedCLARA will conclude the BELLA¹ (Building the Europe Link to Latin America) project, which will leave an exceptional connectivity infrastructure (45 optical channels with a capacity of 6.6 Tbps for the next 25 years), by inaugurating a direct link between Europe and Latin America, and a backbone that crosses South America, from the northeast coast of Brazil to the north of Colombia, both very high capacity links, for the use of educational and scientific institutions, supporting a significant increase for educational, scientific and technological collaboration potential.

BELLA was developed with the contributions of the NRENs of Brazil, Colombia, Chile, Ecuador and the European Commission. Today we can affirm that this infrastructure represents an investment of about one hundred million dollars; however, BELLA's impact is limited to these four countries and with this new proposal (BELLA 2030) we will be expanding the backbone to incorporate another 16 countries, thereby contributing to the reduction of disparities in the region.

¹ <https://bella-programme.redclara.net/index.php/es/>

Digital connectivity, collaboration and international cooperation are part of the strengths of RedCLARA and of the NREN that comprise it; since its creation, they have worked in cooperation with national research and education networks worldwide, highlighting the intensity of cooperation with Europe (GARR, REDIRIS, RENATER, DFN, FCCN, among others) and with its regional network GÉANT (see <https://www.geant.org>), carrying out more than eleven projects that have received funding and support from the European Commission.

These networks form a separate and distinct infrastructure from the commercial or public Internet. In this sense, it can be affirmed that these networks coexist in a parallel space reserved throughout the world solely and exclusively for the education and research communities.

BELLA 2030: Expanding the digital ecosystem of Latin America and the Caribbean

The general objective of the proposal is **to strengthen and expand the existing digital ecosystem of Latin America and the Caribbean, in order to contribute to the achievement of the strategic objectives of the region focused on strengthening education, science, technology and the innovation.**

The specific objectives are:

- Acquire and operate a digital optic fiber infrastructure capable of guaranteeing adequate connectivity with the rest of BELLA's infrastructure and, in particular, with the submarine cable that will connect Europe with Latin America in mid-2021 for the following Latin American and the Caribbean countries: the member countries of SICA (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and the Dominican Republic), Argentina, Bolivia, Jamaica, Mexico, Paraguay, Peru, Trinidad and Tobago and Uruguay.
- Act as a promoter and facilitator of innovation based on the application of digital transformation technologies to the development challenges of the region.
- Strengthen RedCLARA and the national research and education networks in their articulating capacity with the various social actors with whom they are linked.
- Intensify cooperative relations with European digital ecosystems from a double perspective: accessing good practices related to the operation of smart networks that promote science, technology and innovation relations; and to create spaces for the dialogue needed for the design, formulation and execution of accelerating projects for digital transformation processes in Latin America.

The implementation of this project will strengthen the long-term interconnectivity of the research and education communities of Latin America and the Caribbean and will promote collaboration between our region and Europe. Once all the services have been activated, an enormous potential for cooperation with Europe will open up, something that until now was limited by the lack of direct and of quality connectivity. An example of the advantages of this cooperation are the opportunities offered by the **Copernicus** Earth observation program of the European Union, whose data are useful for agriculture, the blue economy, climate change and environment, energy and renewable resources management, forests, health, disaster management, security and defence, tourism, transport and urban planning; **astronomical observatories in Chile, EU-LAC Resinfra**, which seeks to enable bi-regional collaboration, cooperation in high performance computing between **SCALAC and PRACE, EOSC**, the European cloud for open science, among others.

BELLA 2030 will allow to strengthen the capacities of the participating national networks and to increase the number of universities and research centers with access to infrastructure, as well as increase the linkage and coordination between the national networks and their governments.

To guarantee an equitable use of BELLA's capabilities, it is necessary to:

- Create national research and education networks in some of these countries: Belize, Bolivia, Jamaica, Panama, Paraguay, Peru, the Dominican Republic, and Trinidad and Tobago.
- Strengthen the existing NREN of: Argentina, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Uruguay.
- Expand the connection capacities of all of them to levels consistent with the capacity provided by the submarine cable.

The extraordinary developments that will take place as a consequence of the emerging technologies of digital transformation require the inclusion of collaboration and cooperation mechanisms that contribute to the acceleration of the processes of knowledge, technologies and innovation dissemination towards the less advanced nations. It is here where we visualize the important role that international cooperation plays. This initiative, strengthened with European cooperation, integrates the European heritage, with its large investments in research infrastructures, in digital technologies and in the strengthening of innovation, through digital technology, with the resources and capacities of Latin America.

The European Union has invested around € 137 billion in its most recent programs. The Horizon Europe Programme plans a total investment of 100 billion euros. This Programme is based on two main pillars, the green economy, and the transition to digital, recognizing the fundamental role of research and innovation for the future of Europe and the world in general, therefore it constitutes an opportunity for European and Latin American countries selectively take advantage of these opportunities, especially when there is a political framework for cooperation between the European Union and the Community of Latin American and Caribbean States (EU-CELAC).

In this context, we want to highlight that the European Commission has expressed to RedCLARA its interest in supporting the development of the BELLA 2030 project, which is why we consider that this proposal is a great opportunity for our countries. The support of the European Commission implies the contribution of two thirds of the investment, that is to say, that for every dollar contributed by the beneficiary countries, the European Commission will contribute two, making the investment of the participating countries more efficient. The implementation of the BELLA 2030 Project requires the political and financial commitment of the countries for which it is intended.

Introduction

We are living in times of extraordinary social and technological turbulence. Times in which populisms, authoritarian governments, migration and health crises are creating volatility and instability in societies where these were previously unthinkable, while also generating economic uncertainty, social complexity and ambiguity about the future. In March 2020, the pandemic unleashed by the COVID-19 virus added worrying levels of vulnerability in terms of economic and social stability across the globe [1][2][3].

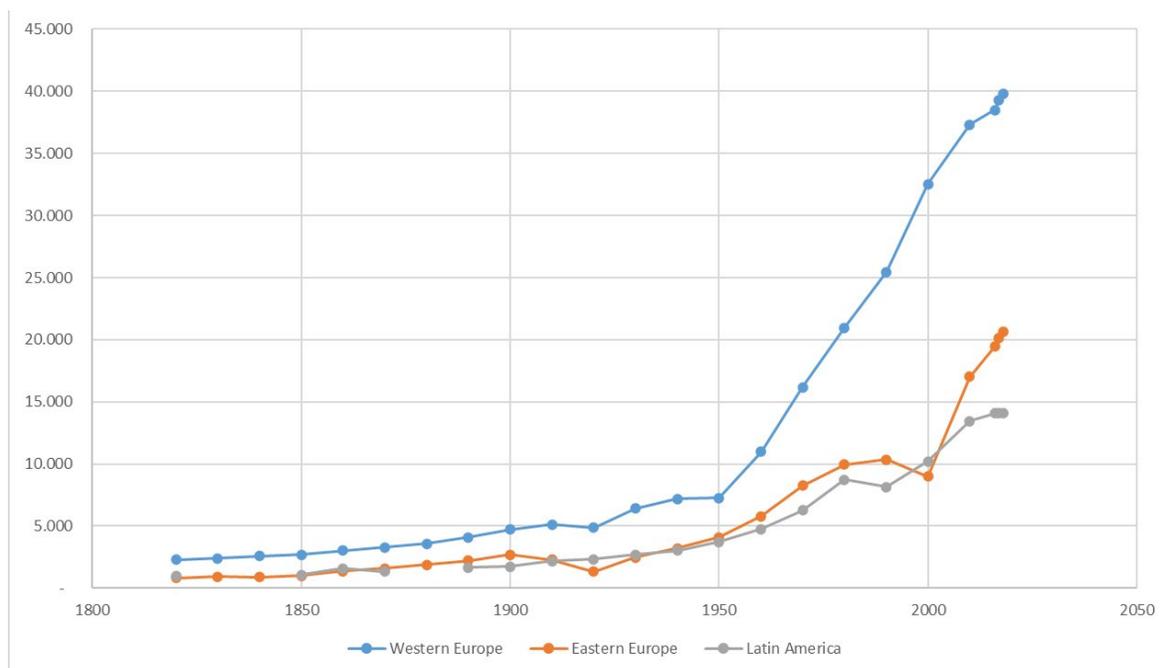
The pandemic has severely impacted Latin America, exacerbating inequality, increasing unemployment, rapidly debilitating most of the region's economies [4] and affecting the different sectors in very different ways [3]. Paradoxically, the pandemic has also accelerated digital transformation processes. To reduce infection rates, confinement strategies forced schools that had the capacity to do so to move their operation to a virtual format. Thus, a possibility that was barely considered an alternative to face-to-face classes became a necessity and, once again, exposed the fragility of our education systems [5].

Addressing the population's multiple economic and social difficulties which were exacerbated by the pandemic depends, to a large extent, on our being able to leverage digital technologies to reduce inequalities and promote sustained and sustainable economic development. In this context, educational, scientific and technological ecosystems are very important for us to adapt as best as possible to the new techno-economic paradigm represented by digital transformation. This paradigm is in its deployment phase in developed economies, and leverages the information and communication technology infrastructure that is already installed to develop new products and services [6]. It currently represents a market of 350 billion US dollars which could grow to 3.2 trillion in 2025 [7].

While in developed economies the digitization phase corresponding to the third industrial revolution has already been completed, in Latin America this phase is currently under deployment and at various levels of evolution [8][9]. Connectivity and access to Internet services is still deficient, as there is little access to broadband services and large disparities exist among the service penetration indicators of the different countries of the region as well as between urban and rural areas.

This low level of deployment compared to developed economies limits our development opportunities [10]. These difficulties are compounded by the shortcomings of our education systems and, in most cases, by the very limited development of science, technology and innovation ecosystems [11]. In addition, while successive waves of technology have continuously increased per capita income, they have also broadened the technological gap between central and periphery countries [7] (see Figure 1).

Figure 1: Impact of successive waves of technological change on inequality and income



Source: Based on information obtained from the 2020 version of the Maddison project database.

This proposal raises the possibility of contributing to the integration of the countries of the region to the deployment and use of digital infrastructure, taking advantage of the capacities developed and implemented by national research and education networks and by RedCLARA, an organization that groups and connects these networks through a dedicated digital platform for education, science, technology and innovation.

In a year marked by so many difficulties, RedCLARA is completing the initial phase of the BELLA Project² (*Building the Europe Link to Latin America*), which significantly contributes to the strengthening of the necessary digital infrastructure. The project was implemented in collaboration with five European networks (REDIRIS, DFN, FCN, GARR, RENATER), four Latin American networks (RNP, REUNA, RENATA, CEDIA) and GÉANT, the pan-European research and education network.

As a result of this initiative, a submarine cable directly connecting Europe with Latin America will be installed and operational this year for which ample capacity has been acquired (forty-five optical channels with a capacity of 8 Tbps with current technology) that will be available for the next twenty-five years. A high-capacity backbone comprised of terrestrial or submarine links has also been deployed connecting Brazil, Argentina, Chile, Ecuador and Colombia, an infrastructure that will be available for the next twelve years. These communication links and acquired capacities are essential infrastructures for increasing cooperation in education, science, technology and innovation between both continents and can be the main pillar of a regional strengthening and preparation strategy for the new technological wave that digital transformation is bringing about.

The BELLA Project has allowed deploying this infrastructure in which approximately one hundred million dollars have been invested. However, a good part of the countries in Latin America are still

² <https://bella-programme.redclara.net/index.php/es/>

not adequately connected to these capacities. This document explores the possibility of the next phase for the BELLA Project (BELLA 2030), which would include investments in the countries that make up the Central American Integration System (SICA), Mexico, Jamaica, Trinidad and Tobago, Peru, Bolivia, Paraguay and Uruguay.

Given that international cooperation is one of the essential pillars to support the implementation of adequate recovery policies, this initiative — which strengthens cooperation with Europe in education, science, technology and innovation — integrates European expertise with its major investments in research infrastructure, digital technologies and the strengthening of innovation through digital technology with the resources and capacities of Latin America and represents a great opportunity to promote development in both regions.

The digital transformation process in which we are already immersed is manifested in initiatives such as Industry 4.0 in Germany, Society 5.0 in Japan, superclusters in Canada and the development of gigantic projects in China, United States and France. All these initiatives have a common purpose, which is the fluid application of developments in science, technology and innovation to the generation of the resources, capacities and skills required by the new challenges of social and technological development in the different countries.

This purpose involves investments for training human resources in the use of emerging technologies, as well as the creation of spaces for exploring collegiate forms of co-production of value, co-creation of innovations and the construction of the R&D&i (research, development and innovation) infrastructures necessary to produce solutions to scientific and technological challenges.

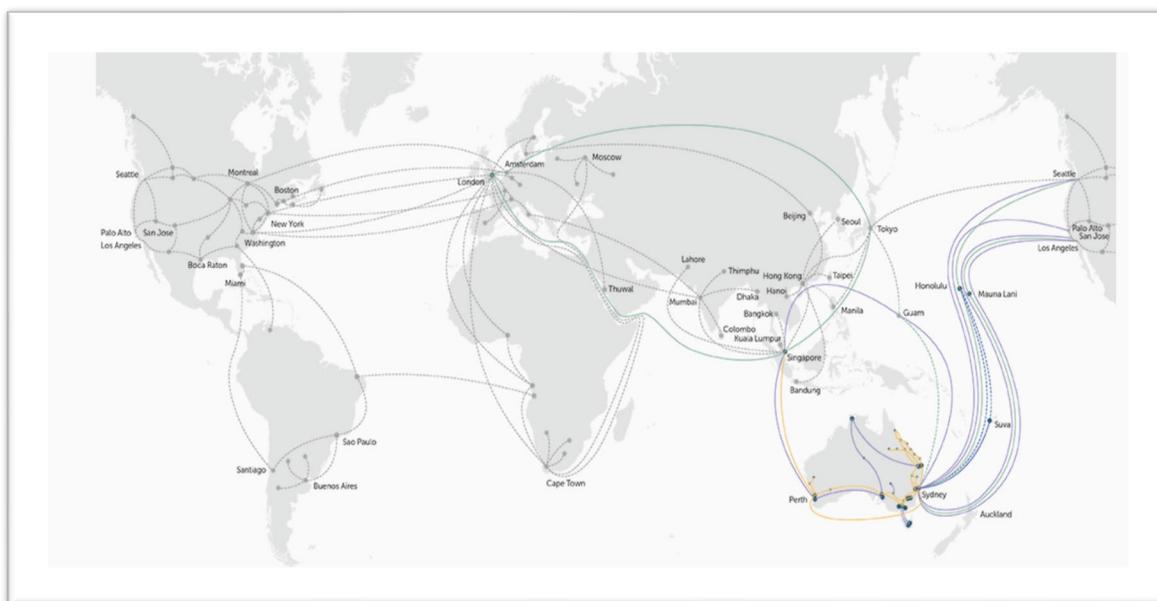
RedCLARA is a powerful space in the region, capable of serving as a testbed for most of the experiences in training and prototyping of solutions that the digital transformation demands.

The following sections describe the essence of this proposal, covering the cooperative role of research and education networks within the framework of digital transformation; the BELLA Project, its scope and impacts; the BELLA 2030 project as a proposal to expand the Latin American digital ecosystem and as a driver and support for innovation in digital transformation technologies; a roadmap for strengthening the articulating capacity of research and education networks in Latin America and, finally, some general conclusions.

Research and Education Networks and the Role of Cooperation within the Framework of Digital Transformation

The advanced Latin American network (RedCLARA) interconnects eleven national academic networks in the region. In turn, in each continent and/or subcontinent there are regional and national networks interconnecting universities and research centres. All these networks are interconnected and allow scientists, researchers, academics, teachers and students to collaborate by sharing data, information and knowledge. These networks form an infrastructure that is separate and distinct from the commercial or public Internet. In this sense, one might say that these networks coexist worldwide in a parallel space reserved solely and exclusively for education and research communities (see Figure 2 and <https://www.youtube.com/watch?v=HMuC-rceVBU>).

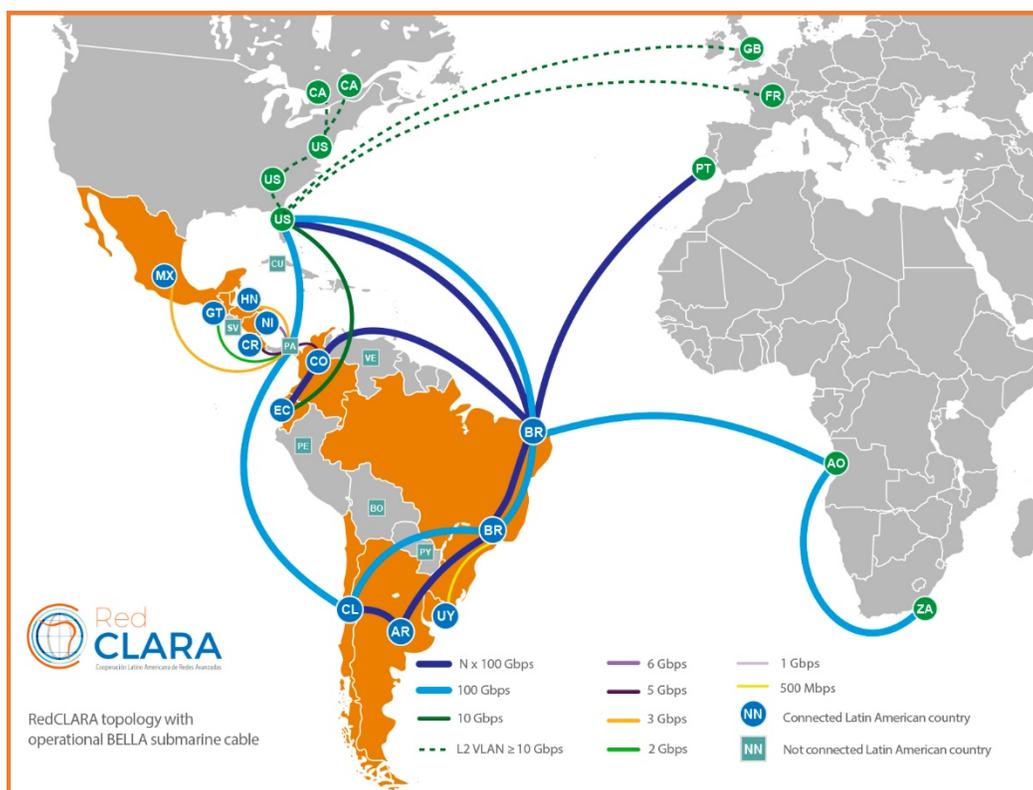
Figure 2: The global research and education network



Source: AARNET website, <https://www.aarnet.edu.au/>.

This global infrastructure is high performance in terms of speed and latency, which makes it suitable for transferring data between universities and research centres worldwide. RedCLARA's infrastructure connects national networks in the region to this global capacity (see Figures 3 and 4).

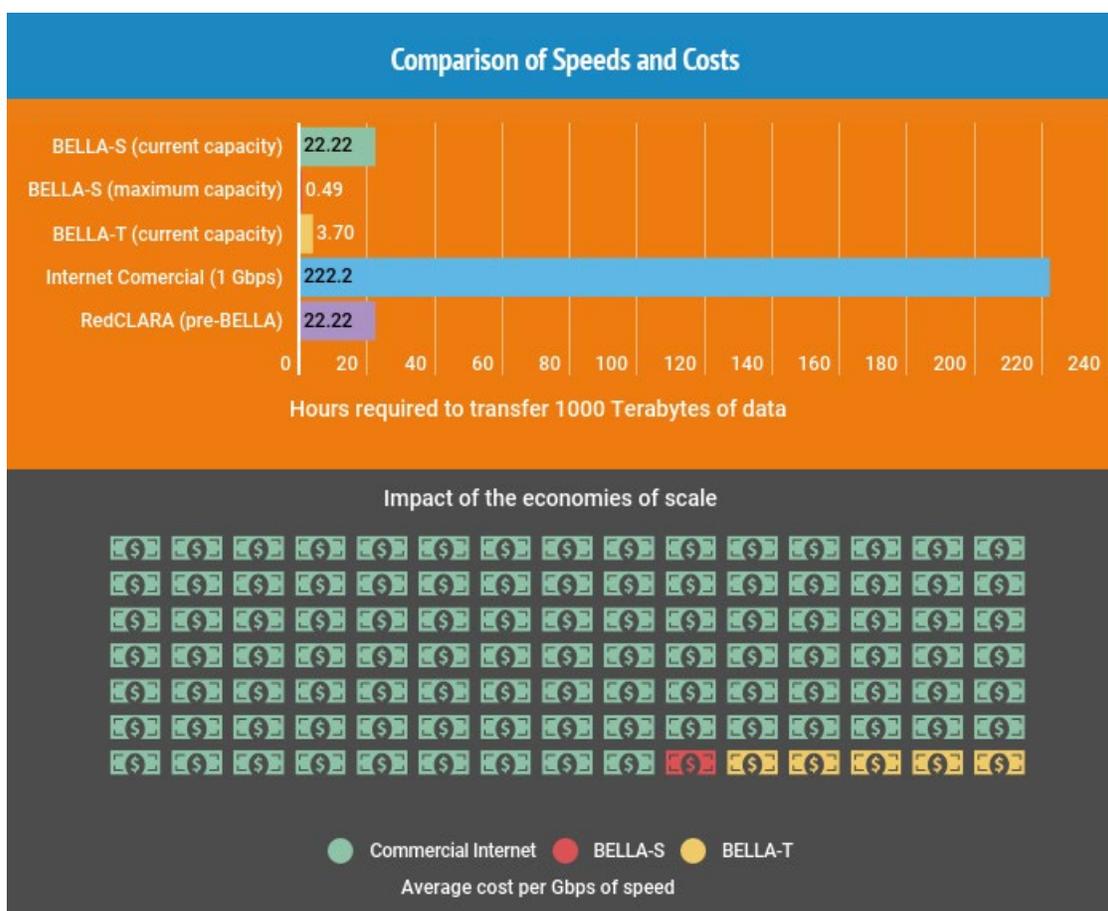
Figure 3: RedCLARA connectivity



Source: Prepared by the authors.

In addition to connectivity, research and education networks offer universities and research centres a series of tools and technologies. By integrating this series of resources, multiple other benefits are achieved. First, thanks to the expertise and specialization developed by the networks in the fields of science and education, the services provided are adapted to the requirements of each institution. Second, economies of scale are created that help optimize the use of resources (as shown in Figure 4). In addition, the space enabled by this series of services facilitates and promotes greater collaboration between researchers and teachers. This last aspect helps to integrate educators and researchers into a framework of international cooperation enhanced by technology, with the subsequent impact on the expansion of access among these research and education communities at a global level. Finally, the action of national networks produces innovations that are useful for the entire network ecosystem and which can lead to commercial applications.

Figure 4: Comparison of speeds and costs



Source: Prepared by the authors.

By using advanced networks, academics and researchers can collaborate across different countries and continents, regardless of distance or national borders. Thus, advanced networks serve two fundamental purposes:

- To support the work of researchers and academics by providing a conglomerate of products and services such as high-capacity data communication (which allows enormous amounts of data to be transferred in a short amount of time), cloud services, storage services, referencing, processing and dissemination of scientific data, high-performance federated computing capabilities, collaboration services and, generally speaking, all those that contribute to the effective development of education and research activities.
- To be a powerful research tool by providing a platform on which researchers and innovators can develop and test new network technologies and services.

The connectivity between RedCLARA and its international peers is a strength that can help find a solution of one of the paradoxes of our time, which is the coexistence of the most extraordinary technological advances that society has produced with major inequalities of all kinds, especially in our education systems, which has affected the inclusion targets expressed in Goal 4 of the 2030 United Nations Agenda for Sustainable Development: *“Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”* [12].

This inequality is reflected in the fact that a significant part of the Latin American population does not have access to the Internet, technological devices and/or the technical skills required to use them. Until 2019, only 66.7% of the population had an Internet connection and 46% of children between the ages of 5 and 12 lived in homes with no Internet access [13].

In this context, digital transformation threatens to widen the gap, increasing educational inequality and risk levels in the most vulnerable countries. Paradoxically, emerging digital technologies are a powerful tool to improve the conditions for people living in poverty. This requires the design of coordinated strategies for digitization and the formation of human capital that will contribute to strengthen the new industry and the education, science and technology ecosystems [7].

This formation of human capital requires international cooperation in education, science and technology. This can contribute to decrease existing deficits [14], in a way that will reduce the negative impacts on equality and on the economic and social well-being of the population of Latin America.

International cooperation plays a key role in achieving these objectives, as set out in Sustainable Development Goal 17: *“Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism.”*

Digital connectivity, collaboration and international cooperation are among the strengths of RedCLARA and of the national research and education networks it comprises. In this sense, these networks are key instruments to facilitate and expand the cooperation networks to which the countries of Latin America have access. In short, RedCLARA is part of a global conglomerate of networks that acts in coordination to support their communities and that has demonstrated its value and usefulness in strengthening the social processes that lead to the production and innovative use of knowledge.

It is recommended that the strategies to strengthen capacities should consider national research and education networks as essential actors. Their multiple links worldwide and their ability to insert themselves into the technological fabric of science and education will enhance and multiply any investment. It is important to promote the creation of these networks where they do not exist and to strengthen them in those countries that are already enjoying their benefits.

As a regional organization, RedCLARA fulfils several roles:

- To coordinate actions to increase the efficiency and effectiveness of the construction, deployment and strengthening of a regional digital ecosystem, connecting national networks with each other and with other continents.
- To facilitate technology-enabled collaboration.
- To orchestrate the actions of national networks to generate synergies and enhanced collective action.
- To promote the incorporation of technologies and practices developed globally by other networks.
- To function as a digital ecosystem for innovation in digital transformation technologies.
- To be a conduit for international action and cooperation.
- To support coordinated actions at the regional level with regional and global organizations.

The capabilities developed by these organizations, some of which have been in operation for more than thirty years, are unique. There are no comparable or direct substitutes capable of producing this myriad of positive results at the same level of cost. Both RedCLARA and its members are and should be considered public goods and, in this sense, they should be supported and their capacities leveraged to face the major challenges ahead of us as a society. With this project, we are directly expanding international cooperation opportunities, especially with Europe, which will allow the establishment of programmes and initiatives that will strengthen both parties within the framework of a close digital alliance.

Figure 5: Requirements of modern science



Source: Prepared by the authors.

RedCLARA and National Networks: An Experience in Educational, Scientific, Technological and Innovation Cooperation

Since its inception, RedCLARA and the Latin American research and education networks have worked in cooperation with national research and education networks worldwide, highlights of which include intense cooperation with the national research and education networks of Europe (GARR, REDIRIS, RENATER, DFN, among others) and with the European regional network (GÉANT, see <https://www.geant.org>). RedCLARA has implemented more than eleven projects that received funding and support from the European Commission.

Over the past eighteen years, cooperative relationships have contributed significantly to the development of capacities in various areas of scientific activity. Through the projects that have been implemented and in the process of seeking solutions to the challenges posed by the knowledge society, by applying digital transformation technologies to social and technological development, universities and R&D&i organizations have been playing an increasingly relevant role as institutions capable of contributing both to the design and experimentation, as well as to the conception and execution of projects that generate the knowledge and technologies demanded by the new realities.

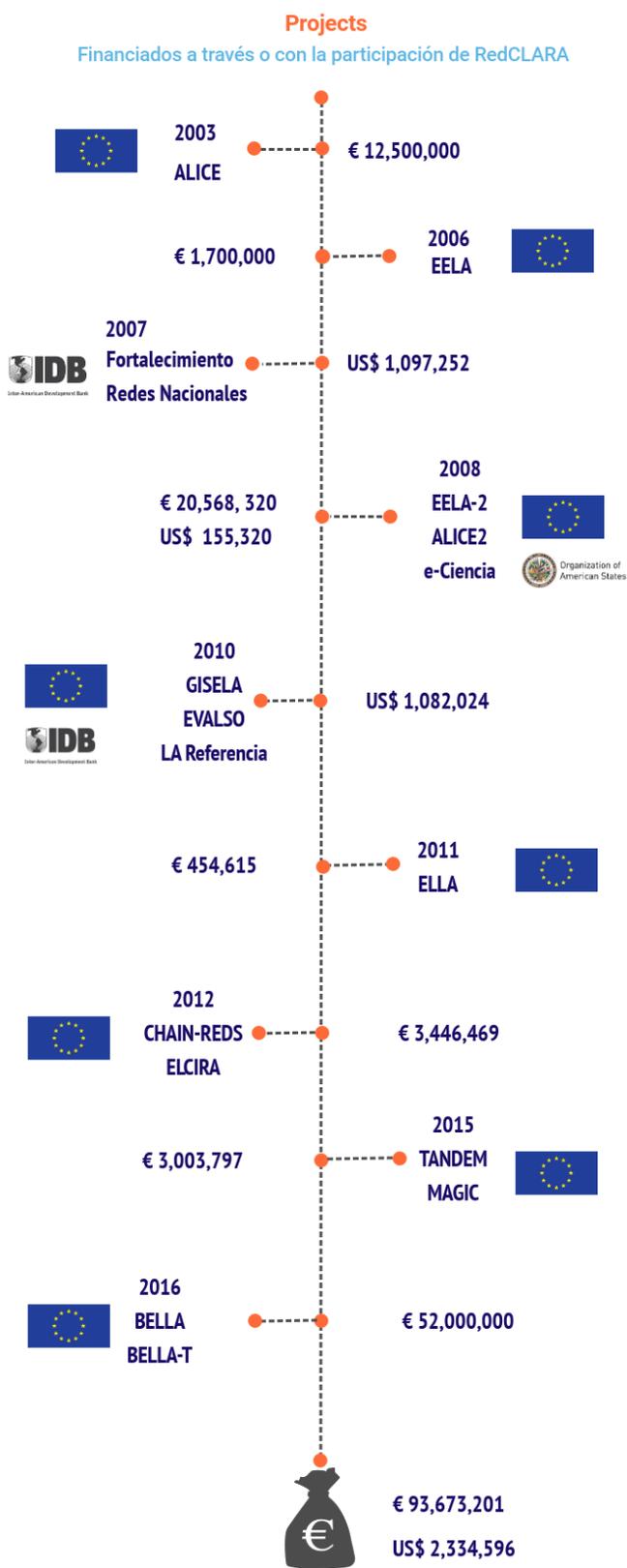
The areas in which cooperative relationships have been established include both the development of infrastructure for collaborative research and development, as well as the construction of infrastructure for connectivity.

From the point of view of infrastructure and connectivity, five projects have contributed the most to the evolution and growth of the network: **AUGER ACCESS, EVALSO, ALICE, ALICE2, LILA and BELLA.**

The ALICE (América Latina Interconectada Con Europa) and ALICE 2 projects represented investments of 12.5 million euros and 12 million euros, respectively, and allowed developing the initial infrastructure required to interconnect Latin American and European networks. BELLA is the most recent of these projects; it involves an investment of 65 million euros and is still in its deployment phase (see Figure 6).

The sustained action of RedCLARA in the region has given rise to multiple projects that have allowed, on the one hand, the deployment of powerful connectivity infrastructure and, on the other, meeting existing needs or initiating actions that have finally materialized in relevant organizations and infrastructure (see Figure 6).

Figure 6: Projects with RedCLARA participation



Source: Prepared by the authors.

The organizations that have been created as a result of these initiatives or with the participation of RedCLARA include:

SCALAC³, the Advanced Computing System for Latin America and the Caribbean (<https://scalac.redclara.net>), which organizes and integrates a strategic infrastructure in the field of high-performance computing in the region based on an advanced architecture that includes both high-performance and high-productivity computing (see Table 1).

Table 1: SCALAC supercomputing centres interconnected through RedCLARA

Computing Centre	Total Computing Capacity (TFLOPS)	Country	Website
Centro de Simulación Computacional para Aplicaciones Tecnológicas	48	Argentina	https://csc.conicet.gov.ar/
Sistema de Computação Petaflopica do SINAPAD	5100	Brazil	https://sdumont.lncc.br/
Núcleo de Atendimento a Computação de Alto Desempenho	226	Brazil	https://nacad.ufri.br/
Laboratorio Nacional de Computación de Alto Rendimiento	266	Chile	https://www.nlhpc.cl/
Super Computación y Cálculo Científico	105	Colombia	https://www.sc3.uis.edu.co/
Colaboratorio Nacional de Computación Avanzada	85	Costa Rica	https://kabre.cenat.ac.cr/
Abacus: Laboratorio de Matemática Aplicada y Cómputo de Alto Rendimiento	429	Mexico	https://www.abacus.cinvestav.mx

Source: Prepared by the authors.

LA Referencia⁴, the Latin American network of open access repositories with 10 national nodes and close to three million indexed documents, which was born as a project coordinated by RedCLARA and funded by the Inter-American Development Bank (IDB) Public Goods Fund between 2010 and 2013. It involves the participation of science and technology agencies as well as national research and education networks. Today, La Referencia receives administrative and organizational support from RedCLARA and is making a significant contribution to the goals of open science.

LaCoNGA⁵, the Latin American Alliance for Capacity-Building in Advanced Physics, is an ongoing Erasmus project that is supported by RedCLARA and brings together eleven Latin American and European universities for the purpose of building a virtual learning platform for Advanced Physics in

³ <https://scalac.redclara.net/index.php/es/>

⁴ <https://www.lareferencia.info/en/>

⁵ <https://laconga.redclara.net>

Colombia, Ecuador, Peru and Venezuela. The results of LaCoNGA will allow the creation of integrated tools for managing scientific data, videoconferencing, collaboration and the remote handling of scientific instruments that will serve as a model for the deployment of similar capacities in other areas of knowledge.

L-NET⁶, an organization in which RedCLARA participates as a founding member along with BID-LAB, is a neutral, non-commercial DLT (*blockchain*) infrastructure with ample spaces for stakeholder participation and a governance structure similar to that of the Internet. With its infrastructure and governance model, this organization will support projects that leverage blockchain technologies to promote topics such as identity, data protection, increased access to financial services, and public services such as the issuance of vaccination certificates, as well as other topics that are extremely important for equality and development.

RUTE-AL, the Latin American Telemedicine University Network, which has its origins in the experience of the Brazilian research and education network. This initiative extends this experience to an additional group of countries — Ecuador, Colombia, Chile and Mexico — allowing the specialized exchange of information and knowledge between health experts working with universities and research centres in Latin America.

These organizations or projects have been possible thanks to the support offered by digital network infrastructure and thanks to their capacity to articulate. This shows the value of continuing to invest and develop these capacities at the service of the Latin American community and society, in response to our regional realities and dynamics.

⁶ <https://www.lacchain.net/home>

The BELLA Project⁷

The BELLA Project strengthens the long-term interconnectivity of European and Latin American research and education communities. This is being achieved through two complementary and interdependent actions that will significantly enhance the ability of researchers and academics to collaborate across to two regions, namely, BELLA-S and BELLA-T.

BELLA-S guarantees rights to spectrum on a direct submarine cable between the two continents, meeting the transatlantic data-sharing needs of the European and Latin American research and education communities for the next quarter of a century. The capacity implemented by BELLA-S between the national networks that are part of the consortium is sufficient to satisfy immediate and long-term capacity requirements and can subsequently be upgraded up to forty-four times its initial capacity.

BELLA-T completes RedCLARA's terrestrial optical fibre network infrastructure, achieving a significant improvement of the Latin American research and education backbone. With this expansion, interconnection capacity reaches 100 Gbps, with the possibility of increasing up to 600 Gbps between the national research and education networks that are part of this first phase of the BELLA Project. This capacity has been secured for a period of twelve to fifteen years following its commissioning in 2021. This enhancement will ensure that the enormous step forward of the transcontinental capacity will be evenly distributed across the region and, through synergies with Latin American networks, will improve capillarity and equitable access to intercontinental services for all research and education end-users in Latin America.

Funding for BELLA is provided by the European Union through three European Commission Directorate-Generals (DG-CONNECT, DG-INTPA and DG-DEFIS) and by the networks in Brazil, Ecuador, Colombia and Chile. The total funding of the BELLA programme amounts to approximately 40 million euros, with 25 million euros provided by the European Union and 15 million euros provided by the Latin American academic network community. In addition, Latin American academic networks provide in-kind contributions through national infrastructure amounting to a value of approximately 25 million euros. Figure 5 shows the network topology and connection capacities of the BELLA infrastructure.

⁷ <https://bella-programme.redclara.net/index.php/en/>

Figure 7: Topology of the BELLA Project once completed.



Source: Prepared by the authors.

The BELLA Programme is led by a steering committee comprised of the national networks that have partnered with BELLA and representatives of RedCLARA and GÉANT.

Once all the services are in operation, a huge potential for cooperation with Europe will open up which until now has been limited by the lack of direct and quality connectivity.

An example of this expanded cooperation are the opportunities offered by Copernicus, the European Union's Earth Observation programme, which is based on the deployment of duly instrumented Sentinel satellites with complementary missions that allow continuously monitoring our planet. The data collected by the programme is useful in agriculture, the blue economy, managing the challenges of climate change and the environment, managing energy and renewable resources, forests, health care, disaster management, security and defence, tourism, transportation and urbanism.

With these capabilities, the research and education networks' infrastructure is in a position to guarantee the use of data in close to real time, which is extremely important when reacting to catastrophic events such as an earthquake, a tsunami or a hurricane. This capacity is available to Latin American governments, companies and society through the infrastructure of national research and education networks.

Other existing cooperation initiatives also benefit directly. The **astronomical observatories in Chile** and the high-energy physics experiments at CERN are concrete examples where infrastructure costs and the complexity of the experiments require special capabilities. **EU-LAC Resinfra**, which pursues

the construction of bi-regional collaboration between the European Union and Latin American countries, has developed four pilot projects, building on existing European research infrastructures, each in an area of knowledge identified as a priority within the framework of this cooperation: **INSTRUCT-ERIC**, in the field of Structural Biology; **E-RIHS**, in the field of Cultural heritage; **RICAP**, in the field of high-performance computation; and **LIFEWATCH-ERIC**, in the field of ecosystems and biodiversity

Bi-regional cooperation in high-performance computing is also very active between **SCALAC** and various European organizations such as **PRACE**, which has ten large high-performance computing centres located in five different countries, including Mare Nostrum 4 in Barcelona. Other initiatives such as **EOSC**, the European Open Science Cloud, can guide and complement the open science promotion strategies of many countries outside Europe.

These examples are only part of the enormous potential for cooperation with Europe. The European Union has invested approximately 137 billion euros in its most recent programmes (framework programmes 6, 7, and Horizon 2020). The Horizon 2020 framework programme affirms the view of European Union leaders on the value of research as an investment in the future and places this investment at the heart of a strategy for smart, sustainable and inclusive growth and jobs. By coupling research and innovation, the programme places its emphasis on developing excellent science, promoting industrial leadership and tackling the most pressing societal challenges (see <https://ec.europa.eu/programmes/horizon2020/what-horizon-2020>).

Horizon Europe, the European Commission's ninth framework programme, will run from 2021 to 2027 and is planning to invest a total of 100 billion euros. It is based on two main pillars — the green economy and the transition to digital — and recognizes the key role of research and innovation for the future of Europe and the world in general. With a political vision based on multilateralism, an intense international action is proposed to promote and achieve the sustainable development goals. This aggressive investment programme is a chance for the countries of Europe and Latin America to selectively take advantage of these opportunities and, based on the new infrastructure available through BELLA, build closer and more fruitful cooperation ties.

Especially when there is a political framework in place for cooperation between the European Union and the Community of Latin American and Caribbean States (UE-CELAC), expressed in its Action Plan and ratified by the ministers of foreign affairs of both regions in the declaration titled “EU-CELAC: Building bridges and strengthening our partnership to face global challenges” (2018)⁸.

With this proposal, we seek to take advantage of this opportunity which requires a set of actions to strengthen, assemble and orchestrate the capacity of Latin American countries and the social actors involved in these processes:

1. Expanding BELLA's connectivity to the countries that are not yet connected.
2. Strengthening the capacity of national networks to increase the number of universities and research centres with access to infrastructure.
3. Increasing the ties and coordination between national networks and their governments, mainly with the ministries of science, technology, innovation and education.

⁸ <https://www.consilium.europa.eu/media/36188/declaration-es.pdf>

4. Strengthening RedCLARA's ability to effectively coordinate this cooperation, serving as a link between national networks and the international organizations involved in these issues, both in Europe and in the rest of the world.
5. Developing or strengthening the infrastructure, services and processes required to facilitate cooperative action between researchers and educators.

BELLA 2030: Expanding the Latin American Digital Ecosystem

The initial phase of BELLA-T improves connectivity between the four current Latin American partner countries — Ecuador, Chile, Brazil and Colombia. We wish to increase the benefits of this new infrastructure by extending connectivity to several other Latin American countries, strengthen their capacity to promote innovation in digital transformation technologies, reinforce the ties between national and regional networks and other stakeholders (such as governments, the private sector and civil society), and intensify mutually beneficial cooperation actions with digital ecosystems and European capacity.

The general goal of this new phase is: **To strengthen and expand the existing Latin American digital ecosystem, an enabler of relationships and exchanges between Latin American academic networks, in order to contribute to the achievement of the region's strategic goals focused on strengthening education, science, technology and innovation.**

The specific goals are:

- To acquire and operate a digital fibre-optic infrastructure capable of guaranteeing adequate connectivity with the rest of BELLA's infrastructure, particularly with the submarine cable that will connect Europe with Latin America in mid-2021, for the following countries of Latin America and the Caribbean: Central American Integration System (SICA) member countries (Panama, Costa Rica, Nicaragua, El Salvador, Guatemala, Honduras, Belize, Dominican Republic), Mexico, Jamaica, Trinidad and Tobago, Peru, Bolivia, Paraguay and Uruguay.
- To act as a promoter and facilitator of innovation based on the application of digital transformation technologies to the region's development challenges.
- To strengthen the capacity of RedCLARA and of the national research and education networks to articulate with the various social actors with whom they are linked.
- To intensify cooperative relations with European digital ecosystems from a dual perspective: having access to good practices related to the operation of smart networks that promote science, technology and innovation relations; and creating dialogue spaces for the design, formulation and execution of projects that will accelerate the digital transformation processes in Latin America.

Implementing the expansion of the BELLA 2030 Project requires the political and financial commitment of the countries for which it is intended. The European Commission has expressed to RedCLARA its interest in supporting the development of the project, therefore we believe that the investment we propose represents a great opportunity for our countries. The European Commission's support involves the contribution of up to two-thirds of the investment, in other words, for every dollar contributed by the beneficiary countries, the EC will contribute two, thus increasing the efficiency of the participating countries' investment.

BELLA 2030: Expanding Digital Connectivity Infrastructure between the National Research and Education Networks of Latin America

The four Latin American countries that participated in this first phase of BELLA — Brazil, Colombia, Ecuador and Chile — significantly improved their connectivity infrastructure, and this has placed them in a privileged position to take advantage of the benefits of an alliance for digital cooperation with Europe. Other countries of the region lag far behind. Their connectivity to the BELLA digital ecosystem is very limited, with higher costs and connection speeds that are up to 600 times lower.

Guaranteeing an equitable use of BELLA's capacities requires:

- The creation of national research and education networks in some of these countries (Bolivia, Peru, Paraguay, Panama, Belize).
- Strengthening existing national networks (Costa Rica, Guatemala, El Salvador, Honduras, Nicaragua, Mexico, Uruguay, Argentina).
- Expanding the connection capacities of all these countries to levels that are consistent with the capacity provided by the submarine cable.

The proposed procurement and contractual model seeks to acquire irrevocable usage rights on fibre-optic cables for a minimum of fifteen years. This can be promoted through public tenders or through a co-investment model with private providers which will need to be defined later in the project.

Once this investment stage is complete, Latin American connectivity to BELLA infrastructure would be as shown in Figure 8.

Figure 8: Possible BELLA 2030 topology



Source: Prepared by the authors.

BELLA 2030 as a Promoter and Support for Innovation in Digital Transformation Technologies

During this century, the countries of the region will have to make extraordinary efforts to reduce the educational, scientific and technological gaps that have given rise to the market failures, systemic failures and infrastructure failures that separate us from the most advanced nations, limiting our socioeconomic development and preventing most of our companies from successfully competing in global markets.

Given that this is the reality not only of our countries but also of most nations worldwide, the situation is cause for concern and efforts are being made to find a collective or collegiate solution. The Sustainable Development Goals promoted by the United Nations and endorsed by Latin American countries are an example of this. One of these goals — **Build resilient infrastructure, promote sustainable industrialization and foster innovation** — proposes the intensive application of technology, science and innovation in the search for solutions to the major challenges faced by society.

Meeting this goal will be possible to the extent that investment levels in STI are significantly increased, R&D&i infrastructure is strengthened and companies are supported in their efforts to compete in global markets on a level playing field. In other words, to the extent that resources are generated that will allow developing the knowledge and technologies needed to produce innovations that respond to the challenges of social development and economic growth.

This goal is difficult to achieve, as we are in the midst of a profound process of technological change induced by emerging digital transformation technologies. Because it relates to capital- and knowledge-intensive technologies, this drastically increases the required levels of investment in STI, as well as the need for qualified human resources and creative thinking about the R+D+I spaces where new scientific and technological solutions will be developed. In addition, the development of these new capacities depends on the expertise of the organizations that will be responsible for the work, which tends to widen the gap between the most advanced countries and others that are not as advanced.

Faced with this situation, the extraordinary developments that will occur as a consequence of emerging digital transformation technologies must include an internationalization component based on collaboration and cooperation mechanisms that will help accelerate the processes for disseminating knowledge, technology and innovation to less advanced nations.

In the context of our countries, this would entail internal collaboration at a regional level with a focus on common goals related to digital transformation, as well as external collaboration with blocks of countries in different continents. This collaboration requires the existence of new spaces for experimenting and developing solutions that will make it easier for the countries of the region to acquire the capacities needed to exploit the benefits of digital transformation.

The capacities deployed by the national networks that are part of RedCLARA offer a unique opportunity for the construction of these new spaces for collaboration, exploration, experimentation and the continuous development of solutions to the challenges of today's society

based on digital transformation technologies. These spaces combine physical reality (R&D&i laboratories, classrooms, work rooms, servers, pilot plants, demo equipment in our universities and R&D&i organizations) with digital elements (information systems, business process management software, digital innovations, cloud computing, databases, cognitive technologies and virtual reality provided by BELLA and the advanced networks) and cognitive elements (mental models, thought experiments, ideation, knowledge management and the values associated with the co-production of value and the co-creation of innovations), to produce innovations that promote, support and accelerate the application of emerging digital transformation technologies to solve the challenges to the socio-economic development of our countries.

Together, the resources, capacities and competencies provided by RedCLARA and the national networks confer them many of the characteristics of a **Digital Ecosystem** capable of **strengthening the development of science, education, culture and innovation in Latin America through the innovative use of advanced networks**.

This **learning, knowledge and innovation ecosystem** is aligned with the goal of contributing, from our micro level, to the generation of the resources, capacities and competencies needed to achieve the goals set for sustainable global development.

RedCLARA already has experience in learning and knowledge ecosystems and smart universities. In this context, the possibility of developing digital learning ecosystems — an emerging concept that has the potential to become the new paradigm of educational processes supported by science, technology and innovation — is specifically proposed. In the cases of collaboration between national and European networks mentioned above, the network functions as a digital ecosystem of knowledge. The information box below contains a summary of the scope of the proposed initiatives.

REDCLARA AT THE CENTRE OF DIGITAL ECOSYSTEMS THAT WILL ENHANCE THE PROCESSES FOR IMPLEMENTING DIGITAL TRANSFORMATION TECHNOLOGIES TO THE ECONOMIC AND TECHNOLOGICAL DEVELOPMENT OF OUR COUNTRIES			
<p>GOAL: To update Latin American academic networks, turning them, with the support of digital transformation technologies, into a network of ecosystems that functions as a dynamic space, a facilitator of R&D&i processes carried out in a distributed manner for the purpose of supporting the educational, scientific and technological processes that enable the development of the solutions required to overcome the gaps in social, economic and technological development.</p>			
 LEARNING ECOSYSTEM	 KNOWLEDGE ECOSYSTEM	 DIGITAL ECOSYSTEM	 INNOVATION ECOSYSTEM
Based on the practices of what is known as Smart Universities and with a focus on the application of digital transformation technologies to teaching processes.	Geared towards the development of smart academic networks committed to the generation of technologies and knowledge that will contribute to the development of solutions to the region's challenges.	The digital space for the exploration, experimentation and development of forms of connectivity that will drive the processes of co-production of value and co-creation of innovations in the region.	Contribute to the generation of digital spaces for experimenting with digital innovations that support the application of science, technology and innovation to improve the competitiveness, productivity and innovation capacity of the companies in the region.

Source: Prepared by the authors.

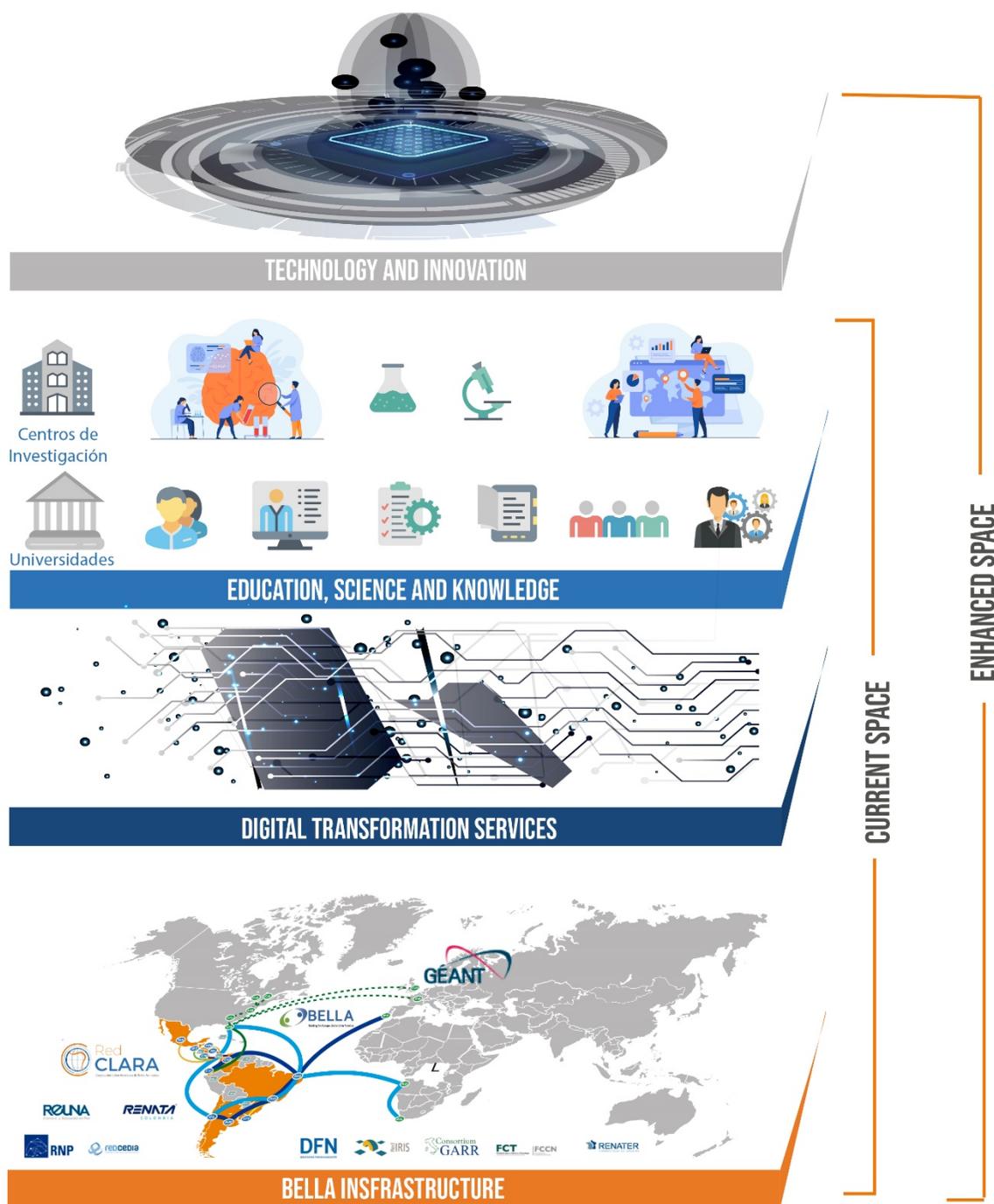
The role of RedCLARA and its member networks as an innovation ecosystem represents a very important contribution to the region, as it provides spaces to experiment and develop new technologies and applications in a limited, controlled, measurable and secure environment, separated by virtualization from the operational network or from servers and applications that are in production.

All of the communications infrastructure, data and computing centres of RedCLARA and of its member networks have performance requirements which are necessary for their use in both basic and advanced teaching, scientific and technological research applications, as well as for social businesses.

We are aware that there is a deficit of spaces in both South and Central America for exploring, experimenting with and developing the solutions demanded by digital transformation. The conditions are in place for RedCLARA to contribute from its level of competence to the search for and implementation of the solutions that our countries require.

These spaces for experimentation occur in the four-layer architecture shown in Figure 9:

Figure 9: Spaces for experimentation in a four-layer architecture



Source: Prepared by the authors.

Each of the layers above represents a domain or a space with specific functions where the various social systems formed by the networks interact in order to generate knowledge, technologies and

innovations that contribute to the achievement of the level of development and well-being that a region, a country or a community of countries wishes to attain.

The role of these domains is described below.

1. **Infrastructure and Enabling Technologies Domain:** This layer contains the infrastructure created by BELLA, which has been generated by non-profit organizations whose mission is to contribute to the development of digital structures capable of supporting the academic activity associated with the processes of generation, dissemination and application of knowledge. This domain comprises high-capacity connectivity networks, high-performance computing centres, datacentres, blockchain platforms, sensors, artificial intelligence, research infrastructures, laboratories, universities, wireless connection networks (5G and Wi-Fi 6), innovation hubs and technology centres.
2. **Digital Services Domain:** This layer includes the wide variety of services generated based on the digital infrastructure contributed by BELLA in order to provide applications, digital innovations, technological training, or to serve as a digital innovation hub to support the processes for incorporating organizations and companies to the digital transformation era.
3. **Education, Sciences and Knowledge Domain:** This layer is where the STI networks that are part of RedCLARA participate in knowledge generation and management processes which produce resources, capacities and competencies in strategic areas related to the digital knowledge, learning and innovation ecosystems.
4. **Technology and Innovation Domain:** This layer will be the space for the design, development, implementation and consolidation of technology- and knowledge-intensive innovations and digital services that will contribute to the processes for the systematic application of digital transformation technologies to the stakeholders in the various ecosystems that RedCLARA would support.

Systematic work in these four dimensions will allow RedCLARA and the national networks to contribute to the efforts that are being carried out in our regions to overcome the digital divide and create conditions that will contribute to economic and social development. In this sense, we wish to contribute with an innovative effort through which we can provide spaces for exploring and experimenting with the various forms of innovation that will be necessary to produce the desired transformations, including:

- Social innovation based on a territorial development approach.
- The digital innovation that drives most digital transformation processes.
- Innovation in design, which can be applied to the use of science and technology to generate solutions to social and technological problems.
- Innovation in teaching and learning processes that will lead to smart universities.
- Open innovation, the driver of alliances between companies and organizations capable of increasing the scope and impact of the initiatives undertaken by advanced networks.

Strengthening the Articulating Capacity of Research and Education Networks in Latin America

The 2021 Technology and Innovation Report prepared by UNCTAD urges developing nations to prepare for a period of rapid and radical technological change that will profoundly affect markets and societies. All countries will have to apply science, technology and innovation policies appropriate to their stage of development and their economic, social and environmental conditions. This requires strengthening and aligning science, technology and innovation systems and industrial policies, developing digital skills among students and the workforce, and closing the digital divides. Governments should also improve social protection and facilitate workforce transitions to cope with the potential negative consequences of frontier technologies on the labour market.

Many countries have been taking this call seriously for a long time and various intervention strategies are being configured to overcome the gaps that are limiting agile and effective progress in the construction of new forms of organization to produce the desired economic and technological developments.

Be it the information or the knowledge society, the fourth industrial revolution, society 5.0 or the digital transformation era, they all have two elements in common: (1) the use of science, technology and innovation as levers to enable the solutions demanded by future challenges; and (2) the fact that emerging digital transformation technologies will have the greatest impact on the processes for the generation and implementation of such solutions.

Universities and R&D&i organizations have a relevant role in both elements as institutions capable of contributing to the process of finding solutions to the challenges posed by the emerging society; to the design of and experimentation with the application of digital transformation technologies to social and technological development; and to the conception and execution of projects that will generate the knowledge and technologies that the new realities demand. An example of this is the role of universities as shelters for science, technology and innovation ecosystems, or their potential to act as smart organizations.

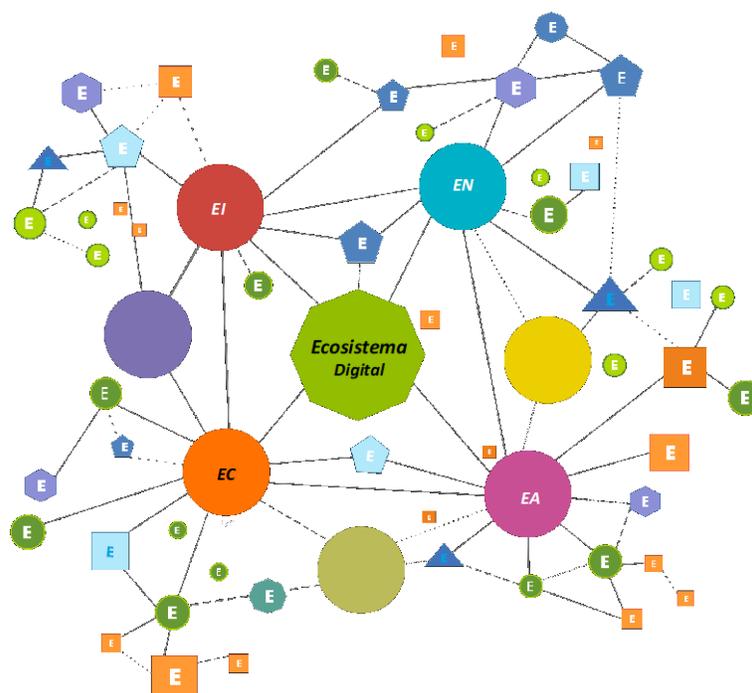
A **science, technology and innovation** ecosystem comprises a variety of actors or stakeholders, each with their different visions, missions, infrastructures, experiences, purposes and values, converging in a physical space, a social reality and a certain cultural reality with the intention to co-produce value and co-create innovations. All of this aimed at ensuring the sustainability of these agents and creating conditions that will allow them to harmoniously evolve and grow economically and technologically.

UNCTAD's report evidently reinforces the motivation and intentions pursued by our proposal. Adapting to new social challenges as the European Union has been doing demands a strategic vision to guide public policies that contribute to empowering, from a macro level, the actors who will design the programmes and execute the projects required at the meso and micro levels by the evolution of society.

At a micro level, thanks to the infrastructure provided by BELLA, RedCLARA already has a powerful network to provide connectivity to enable digital exploration spaces. The construction of the

additional digital infrastructure proposed by BELLA 2030 will dramatically increase the connectivity and diversity of services based on digital transformation technologies. The infographic below shows the expected evolution of RedCLARA towards a digital ecosystem that promotes processes for the generation of science, technology and innovation that the new realities demand.

Figure 10: Expected evolution of RedCLARA towards a digital ecosystem.



Source: Prepared by the authors.

As shown in Figure 10, the evolution is towards a digital ecosystem that will support the knowledge (EC), innovation (EI), learning (EA) and business ecosystems (EN) that are dynamically interrelated to produce, on the one hand, innovations in education and, on the other, the science and technology needed to support the management of innovation processes at a corporate level.

In order for this evolution to take place, it is necessary to promote a set of coordinated actions at the regional level. These include strengthening the articulating capacity of national networks and RedCLARA, establishing and deploying processes, developing the organizational capacities and the skills required to serve as integrators that will help to efficiently build an open space for cooperation and collaboration.

It will also be necessary to promote a closer link between national networks and social actors, actively incorporating not only national science, technology, innovation and education authorities and universities, but also the educators and researchers who are part of this system.

In short, it is a question of supporting the development of a decentralized but harmonious mode of operation, basing the entire system mainly on the capacities of national networks. In this sense, RedCLARA must strengthen itself primarily in its role as a facilitator and eventual orchestrator of

regional or international actions that will generate synergies and support the complementary use of national capacities.

The development levels of national networks in Latin America vary greatly. Several of the countries considered in this proposal (Panama, Belize, Dominican Republic, Bolivia, Peru) do not yet have a national network, so an essential first step would be the creation of these networks by actively integrating each country's universities and research centres. Many others have national networks with very few capabilities. The latter is particularly true in some Central American countries (Guatemala, Nicaragua, El Salvador and Honduras).

This consolidation of national networks as a common digital space where digital ecosystems are integrated is an absolutely necessary step if this action is to achieve the greatest possible benefits and impacts.

Conclusions

Latin America faces major challenges and maintains significant levels of inequality that tend to perpetuate over time. The progress achieved over the last decade was destroyed by the COVID 19 pandemic. Recovering from its devastating effects requires an intelligent and skilful use of new digital transformation technologies. These technologies promote a new techno-economic paradigm and have the potential to contribute to the region's economic and social development, yet they might also be sources of greater inequalities. The final effect will depend on the strengthening actions we can design and implement.

The digital divide creates additional challenges and difficulties for establishing and developing strengthening plans, and this situation is compounded by the shortcomings of our education systems and the science, technology and innovation ecosystems. These difficulties tend to widen the productivity and income gap between nations.

RedCLARA and the national networks have developed this platform that has a value of more than two hundred million dollars over the course of thirty years. This infrastructure has been deployed thanks to the contribution of universities, government agencies and multilateral cooperation sources. The European Commission has played a particularly important role in the development of this infrastructure, which is unique and unparalleled in the region. It is safe to say that there is no other initiative with the capacity to integrate a coordinated regional action of this magnitude.

RedCLARA has developed a strong capacity for managing international cooperation resources, with special emphasis on the European Union. Among other results, specialized regional organizations that respond to the needs and realities of Latin America and the Caribbean have been created.

International cooperation with Europe offers the possibility of mutual support in education, science, technology and innovation. This allows us to create opportunities for the more effective appropriation of digital transformation technologies, which can effectively boost agriculture, health, education and the rational use of energy, turning them into a powerful tool to improve the conditions of the population living in poverty.

The BELLA project has installed a submarine cable that is in operation and directly connects Europe with Latin America, as well as terrestrial capacity that provides high-capacity connections to four of the region's national networks. This project represents a contribution of more than one hundred million dollars for the purpose of reducing the digital divide that strongly affects our universities and research centres.

BELLA is an essential tool for increasing cooperation in education, science, technology and innovation between both continents and a pillar of a regional strengthening and preparation strategy for the new technological wave that the fourth industrial revolution is bringing about. Research and education networks will be in a position to guarantee that research projects can use data in close to real time.

Our proposal is the development of the BELLA 2030 project, which seeks **to strengthen and expand the existing Latin American digital ecosystem, enabler of relationships and exchanges between Latin American academic networks, in order to contribute to the achievement of the region's strategic goals focused on strengthening education, science, technology and innovation.**

BELLA 2030 will make it possible to strengthen the capacity of national networks and increase the number of universities and research centres with access to infrastructure; it will increase the ties and coordination between national networks and their governments, mainly with the ministries of science, technology, innovation and education; it will strengthen RedCLARA's ability to effectively coordinate this cooperation, serving as a link between national networks and the international organizations involved in these issues, both in Europe and in the rest of the world; and it will allow developing or strengthening the infrastructure, services and processes required to facilitate cooperative action between researchers and educators.

BELLA 2030 will help advance the priorities defined in the plans, strategies and digital agendas of the different subregional integration schemes such as SICA, CARICOM, CAN and MERCOSUR, as well as those of regional organizations such as ECLAC and development banks such as CAF and IDB. This project calls on the main stakeholders to contribute resources and join us in the effort to build the digital platform that Latin America and the Caribbean need to strengthen education, science and technology in the region — key pillars for economic and social development — and to accelerate digital transformation processes.

The European Commission has expressed to RedCLARA its interest in supporting the development of this initiative by contributing two-thirds of the investment. In other words, for every dollar contributed by the participating countries, the EC will contribute two, thus increasing the efficiency of the investment of the countries that join this project.

To support innovation processes, BELLA 2030 acts in four well-defined domains — the infrastructure and enabling technologies domain; the digital services domain; the education, science and knowledge domain; and the technology and innovation domain. In this sense, the role of NRENs as integrators of open thematic social systems in a continuous process of interaction provides them with the flexibility needed to participate, promote, share and disseminate knowledge-generating projects. In this sense, a decentralized and harmonious mode of operation based on the capacities of national networks is needed. We believe that the consolidation of national networks as a common digital space where digital ecosystems are integrated is a necessary step.

BELLA and BELLA 2030 will provide technology-based companies and start-ups the possibility of having the infrastructure needed to experiment and develop new technologies and applications in a limited, controlled, measurable and secure environment, separated by virtualization from the operational network or from servers and applications that are in production.

BELLA 2030 will facilitate the connection with European digital, educational and technological resources that can help the region to strengthen and level its capacities. We hope that this proposal will be received with interest and attention by the different relevant actors in the region, especially by governments, without whose contribution it is impossible to advance in its implementation.

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Acronyms

ALICE	<i>América Latina Interconectada Con Europa</i>
ALICE2	<i>América Latina Interconectada Con Europa 2</i>
AUGER ACCESS	Remote monitoring and controlling the Auger experiment
BCIE	<i>Banco Centroamericano de Integración Económica</i>
BELLA	Building the Europe Link to Latin America
BELLA-S	Building the European Link to Latin America - Submarine
BELLA-T	Building the European Link to Latin America - Terrestrial
BID - LAB	Innovation Laboratory of the Inter-American Development Bank
BNDES	<i>Banco Nacional de Desarrollo de Brasil</i>
CAF	<i>Banco de Desarrollo de América Latina</i>
CAN	<i>Comunidad Andina</i>
CARICOM	The Caribbean Community
CEDIA	<i>Corporación Ecuatoriana para el Desarrollo de la Investigación y la Academia – Ecuadorian NREN</i>
CERN	<i>Conseil Européen pour la Recherche Nucléaire</i> - European Council for Nuclear Research
DFN	German National Research and Education Network
DG-CONNECT	Directorate-General for Communications Networks, Content and Technology
DG-DEFIS	Directorate-General Defence Industry and Space
DG-INTPA	Directorate-General for International Partnerships
DLT	Distributed Ledger Technology
EC	European Commission
ECLAC	The United Nations Economic Commission for Latin America and the Caribbean
EOSC	European Open Science Cloud
E-RIHS	European Research infrastructure for Heritage Science
EU-LAC Resinfra	European, Latin American and the Caribbean Research Infrastructures
EVALSO	Enabling Virtual Access to Latin-America Southern Observatories
FCCN	Scientific Computing Unit of the FCT - Foundation for Science and Technology – Portugal (Portuguese NREN)
GARR	Italian NREN - Consortium
GÉANT	Pan-European research and education network
IDB	Inter-American Development Bank
INSTRUCT-ERIC	Pan-European research infrastructure in structural biology
LA Referencia	Network of repositories open access to science
LaCoNGA	Latin American alliance for Capacity building in Advanced physics
LIFEWATCH-ERIC	European Infrastructure Consortium providing e-Science research facilities for Biodiversity
LILA	Linking Latin America
L-NET	Lacchain Net
MERCOSUR	<i>Mercado Común del Sur</i> - Southern Common Market
NREN	National Research and Education Network
PRACE	Partnership for Advanced Computing in Europe

R+D+i	Research, development and innovation
RedCLARA	<i>Cooperación Latino Americana de Redes Avanzadas</i> - Latin American Cooperation of Advanced Networks
REDIRIS	<i>Red de Interconexión de los Recursos Informáticos de España</i> – Spanish NREN
RENATA	<i>Red Nacional de Tecnología Avanzada de Colombia</i> – Colombian NREN
RENATER	<i>Réseau National de télécommunications pour la Technologie l’Enseignement et la Recherche</i> - French NREN
REUNA	<i>Red Universitaria Nacional</i> – Chilean NREN
RICAP	Red Iberoamericana de Computación de Altas Prestaciones - <i>Ibero-American High Performance Computing Network</i>
RNP	<i>Rede Nacional de Ensino e Pesquisa</i> – Brazilian NREN
RUTE-AL	<i>Red Universitaria de Telemedicina de Latinoamérica</i> - Telemedicine University Network of Latin America
SCALAC	<i>Sistema de Cómputo Avanzado para América Latina y el Caribe</i> - Advanced Computing System for Latin America and the Caribbean
SDG	Sustainable Development Goals
SICA	<i>Sistema de la Integración Centroamericana</i> - Central American Integration System
STI	Science, Technology and Innovation
UE-CELAC	European Union - Latin American and Caribbean Community of States
UNCTAD	United Nations Conference on Trade and Development

