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Overview of Research and Higher Education Systems in Argentina, Brazil, and Chile

This Outlook report provides a comprehensive overview of the current state of higher education and research in Argentina, Brazil, and Chile, highlighting the significant transformations these countries have undergone in recent years. It discusses the historical context of higher education policy development, the political landscape, and the strong research areas and infrastructures that have emerged.

The report highlights the strong research areas in these countries, such as Argentina's focus on nuclear science, agriculture and space activities, Brazil's leadership in material science (using SIRIUS, a Synchrotron Light Source) and biomedical research, and Chile's advancements in astronomy and climate sciences. Additionally, it discusses formalised scientific collaborations with Sweden, which have enriched the research landscape in these nations.

In summary, Argentina, Brazil, and Chile, besides facing distinct challenges shaped by their political contexts, have made significant strides in higher education and research.

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In **Argentina**, the higher education system is facing a severe crisis due to the recent election of an ultra-conservative government led by President Javier Milei. His administration has implemented drastic budget cuts and austerity measures, which have led to widespread protests and discontent among students and educators. The Ministry of Education has been downgraded to a secretariat, and significant reductions in funding for public universities and research institutions have raised concerns about the future of education and scientific research in the country.

Conversely, **Brazil** has experienced a resurgence in its commitment to research and education following the return of President Lula in January 2023. The new government is focused on reversing the policies of the previous administration that deprioritised science and education. Increased funding for key ministries, such as the Ministry of Education and the Ministry of Science, Technology, and Innovation, has been allocated to enhance research infrastructure and support innovation. Brazil's strong emphasis on sustainability and inclusiveness is evident in its investments in research and development, particularly in the context of its leadership roles in international forums.

In **Chile**, President Gabriel Boric has prioritised science, technology, and innovation as essential drivers for sustainable development. His government is investing in various initiatives, including the promotion of artificial intelligence and the establishment of a national data centre plan focused on sustainability. Chile's commitment to strengthening its research ecosystem is further demonstrated by its membership in CERN and the development of the International Antarctic Center.

Research and higher education in Latin America – an introduction

Introduction

Higher education in Latin America has undergone significant transformations over the past few decades, with Argentina, Brazil, and Chile emerging as key players in the region's educational landscape. These countries have implemented diverse policies and initiatives to enhance the quality, accessibility, and international competitiveness of their higher education systems. They have also established robust research infrastructures, fostered international collaborations, and made significant investments in science and innovation. This report gives a summary of the historical policy development for higher education as well as an update on the current political administrations' attitudes to research and higher education, to facilitate better understanding of the present conditions and prerequisites for Latin American universities.

Further, a brief overview is provided of the most important public actors in the different countries' ecosystems for science and research, innovation systems (mostly related to universities), and strong research areas and infrastructures. Formalised scientific collaborations with Sweden are also presented as well as a look at the ranking of the best universities in the three countries.

Political context

The current political situations in these three countries show movements in different directions.

Chile appointed their youngest president ever when Gabriel Boric was installed at the age of 36 on the 11th of March 2022. He recently proclaimed that "without Science and Innovation, there is no sustainable development".[1] Boric is prioritising research and education and has an extensive agenda to promote both. In Brazil, Lula returned as president in January 2023, and he is now fighting to reverse many decisions by the previous ultra-conservative government to again promote sustainability, better education, and the valorisation of science. However, he is working in a fiscally difficult and polarised political environment. Argentina has moved in the other direction with a new ultra-conservative government and radical president. Javier Milei was elected on promises of public spending cuts, with severe consequences for higher education and the scientific community.

Argentina

Argentina is currently grappling with a severe education crisis. The country's political landscape has been marked by protests, budget cuts, and widespread discontent among students, educators, and citizens.

President Javier Milei, who assumed office in December 2023, has implemented radical austerity measures as part of his economic reform agenda. These measures aim to reduce public spending, stabilise the economy, and address Argentina's high inflation rate (nearly 290%). However, the impact on education has been particularly harsh. During his election campaign, President Milei symbolically brandished a chainsaw, emphasising his intention to reduce public spending and shrink the government.[2] The government has maintained the budget from 2023 but with an inflation rate of almost 300%, this means an effective budget cut of almost 70%. To further manifest his priorities, the president has dissolved the Ministry of Education and degraded it to a secretariat within the Ministry of Human Capital. The former prestigious National Science and Technical Research Council (CONICET) has been moved to a sub secretariat within the presidential cabinet. The longer-term consequences of these acts remain to be seen.

Brazil

After a four-year period of governance that severely deprioritised research and science, the new government has since 2023 reversed this under the motto: "science has come back". This is especially evident in the new financial investments in the two key ministries in this area, the Ministry of Education (MEC; focus on research and education) and the Ministry of Science, Technology and Innovation (MCTI;

focus on research and innovation). The new administration also prioritises sustainability, climate change, and green transition.

Compared to 2022, the MEC has had a budget increase of 31%, with a large part of these resources earmarked for upgrading the research infrastructure at federal universities and research institutes (research labs, etc.). The budget of the Coordination for the Improvement of Higher Education Personnel (CAPES), a research funding agency under the MEC that uses about 80% of its budget for research grants, has increased by about 70% in 2023. The 2023 budget of the National Council for Scientific and Technological Development (CNPq), which awards grants to researchers, has increased by 44% compared to 2022. The Financing Authority for Studies and Projects (FINEP), which supports scientific research in companies, universities, technical institutes, and other public and private institutions, had its budget increased to a new record level of USD 2.2 billion in 2023, thereby more than doubling its 2022 budget of USD 900 million.

The MCTI and the FINEP, in partnership with the Ministry of Development, Industry, Commerce and Services (MDIC) and the National Bank for Economic and Social Development (BNDES), last year launched the *Mais Inovação Brasil* programme, which amounts to USD 13 billion in investments in business innovation projects until 2026.

However, strong polarisation and fiscal containments, combined with not having a majority in the congress, hamper the government's progress on its intended agenda. Worth mentioning is also the strong commitment to sustainability and inclusiveness that Brazil has shown as 2024 chair of the G20 and in hosting COP 30 next year.

Chile

The Chilean government, led by President Gabriel Boric, is heavily investing in science, technology, and innovation as key drivers for sustainable development. This investment is evident in various initiatives, including the allocation of lithium resources to research and development (R&D) projects, the development of a national data centre plan focused on sustainability, and the promotion of artificial intelligence with regulatory measures and certification programmes for specialists. The government also emphasises the importance of strengthening the national research ecosystem and has initiated Chile's membership in the European Council for Nuclear Research (CERN), alongside supporting the construction of the International Antarctic Center. These are some of the key points stated by the president in his public statement in June, and more detailed information can be found on MinCiencia.[3]

Key figures

In the table below some key figures are presented to compare some of these three countries' metrics.

Key data for Argentina, Brazil and Chile vs OECD and the World

Metric	Argentina	Brazil	Chile	OECD	World
Size (km²)	2.78 million	8.51 million	0.76 million		
Population	45 million	214 million	19.5 million		
GDP per capita (USD)	13,730	10,044	17,093	46,280	13,138
Total GDP (USD trillion)	0.48	1.89	0.293		
% GDP for education	5.8%	6.1%	5.3%	4.9%	4.2%
% GDP for R&D	0.53%	1.26%	0.36%	2.70%	2.30%

Private and Public Universities

Country	Total	Public	Private
Argentina	115	57	58
Brazil	2,458	296	2,162
Chile	61	30	31

Source: Ministry of Education, Argentina (2023); Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP), Ministry of Education, Brazil (2023); Consejo Nacional de Educación (CNED), Ministry of Education, Chile (2023)

Higher education policy development in Argentina, Brazil, and Chile

From colonialism into the 20th century

Argentina's higher education system began under Spanish rule, with the establishment of the University of Córdoba in 1613, which focused on religious and classical studies. After independence in 1816, Argentina expanded its higher education system, establishing secular institutions like the University of Buenos Aires in 1821, which emphasised liberal arts, law, and medicine.

Higher education in **Chile** likewise began under Spanish rule, with the founding of the University of San Felipe in 1738. Its focus was on theology, law, and humanities. After gaining independence in 1818, Chile restructured its higher education system, establishing the University of Chile in 1842.

Higher education in **Brazil** started later than in Argentina and Chile. The first higher education institutions (HEIs) were established in 1792, with medical and law schools in Bahia and Rio de Janeiro. Following independence in 1822, Brazil gradually developed its higher education system. The founding of the University of São Paulo in 1934 marked a significant milestone.

A persistent challenge continues to plague these three countries' higher education systems: unequal access. This disparity can be traced back to the colonial era, when educational opportunities were primarily reserved for the elite. This historical inequality laid the groundwork for the socioeconomic and regional disparities in educational attainment that persist today. Indigenous populations and lower social classes were largely excluded from this system, hindering the development of a more inclusive educational landscape.

The legacy of colonialism continues to manifest in several ways. The cost of higher education remains a significant barrier, particularly for students from low-

income backgrounds. While financial aid programmes exist, they often fall short of covering full costs, resulting in a burden of student debt. Furthermore, inadequate preparation from primary and secondary education disadvantages students from less privileged backgrounds, making it harder for them to compete for admission and succeed in higher education. Many students from lower socioeconomic classes also face the additional challenge of balancing work with their studies, which can hinder academic performance and delay graduation. Finally, the concentration of HEIs in urban areas creates a geographical disadvantage for students from rural or remote regions who lack the resources to relocate for their studies.

The effects of dictatorship

The higher education policies in Argentina, Brazil, and Chile underwent significant changes during their respective dictatorships. These policies were shaped by the ideological and economic agendas of the regimes, leading to varying impacts on public and private institutions, access, and equity.

Argentina

During the military dictatorship in Argentina (1976–1983), the regime's higher education policies were characterised by repression and control. Universities were seen as potential hotbeds of dissent, leading to strict government oversight and intervention. The regime implemented policies that limited academic freedom, purged faculty members perceived as subversive, and curtailed student activism. The emphasis was on aligning higher education with the regime's ideological and economic goals, which included a shift towards technical and vocational education to support industrial growth.[4]

Despite these efforts, public universities in Argentina remained relatively robust, as the state continued to play a significant role in funding and managing higher education. However, the quality and equity of education suffered due to political interference and reduced academic autonomy.

Brazil

In Brazil, the military dictatorship (1964–1985) also sought to control and reform higher education. The regime introduced the University Reform of 1968, which aimed to modernise and expand higher education to support economic development. This reform led to the establishment of new federal universities and the expansion of existing ones, thereby increasing access to higher education.[5]

However, similar to Argentina, the Brazilian regime emphasised technical and vocational education over liberal arts and social sciences, reflecting its focus on economic growth and development. Academic freedom was curtailed, with strict censorship and surveillance of faculty and students. Private higher education also expanded during this period, partly due to government incentives and a growing middle class seeking higher education opportunities.

Chile

In Chile, the military dictatorship of Augusto Pinochet (1973–1990) implemented some of the most radical market-oriented reforms in higher education of these three countries. The 1981 General Law on Universities deregulated the sector, allowing the establishment of private universities and reducing state control over public institutions.[6] This led to a significant increase in the number of private universities and introduced high tuition fees as these institutions sought to be financially self-sufficient.

The reforms in Chile created a highly privatised and market-driven higher education system. While this expanded access to higher education, it also exacerbated socioeconomic segregation, as students from affluent backgrounds were more likely to attend prestigious private universities. Public universities, meanwhile, faced financial constraints and struggled to compete with their private counterparts.

Policy development after dictatorship

In the post-dictatorship era, all three countries have made efforts to increase the poorer part of the population's access to higher education and minimise the effect of historical socioeconomic segregation. Some of the most significant policies implemented are mentioned below.

Reserved places

Brazil is the only of the three countries which reserves places for university students based on race (indigenous, black, mixed-race) and disabilities. The Quotas Act was approved in 2012, reserving 50% of all university places for candidates who have completed high school in public schools. In addition, places are reserved for self-declared black, mixed-race, indigenous students as well as students with disabilities, in proportion to the population of the state in which the institution is located.

Tuition fees and reductions

In **Argentina**, public universities traditionally do not charge tuition fees for undergraduate programmes. This policy reflects the country's commitment to providing accessible higher education to all citizens, particularly those from low-income backgrounds. The government funds public universities through general taxation, allowing students to enrol without paying tuition fees. However, students may incur some indirect costs, such as administrative fees and for materials.[7]

Postgraduate programmes, however, often do charge tuition fees, and these can vary significantly depending on the university and the programme. Private universities in Argentina charge tuition fees for both undergraduate and postgraduate programmes, and these fees can be quite high compared to the average income of Argentine families.

Brazil's higher education system includes both public and private institutions, with a significant difference in tuition policies between them. Public universities, which are funded by the federal or state governments, do not charge tuition fees for undergraduate programmes. Private universities, on the other hand, charge tuition fees for both undergraduate and postgraduate programmes. These fees may vary widely depending on the institution and the programme. To support students in private institutions, the government offers several financial aid programmes, such as ProUni (University for All Program)[8] which was created in 2004. ProUni is a public–private partnership where places are offered (with full or partial scholarship) at private HEIs in exchange for tax exemptions.[9, 10] It should be noted that 88% of Brazilian universities are private, accommodating 72% of all university students. Although public universities are free, limited places are available, thus leading to severe competition. Ironically, the privileged part of the population is overrepresented due to their ability to pay for private primary and secondary schooling and therefore being better prepared for the difficult entrance test ENEM.

In **Chile,** the tuition fee system is quite different from that of Argentina and Brazil. Both public and private universities charge tuition fees for undergraduate and postgraduate programmes. The cost of tuition varies significantly between institutions and programmes, often making higher education expensive for many families.

To address issues of affordability and access, the Chilean government introduced the gratuidad policy[11] in 2016. This policy aims to provide free tuition to students from the lowest-income households, covering up to 60% of the student population in participating institutions. Despite this, a significant portion of students still pay tuition fees, and the high cost of education remains a major issue. Various scholarship programmes and student loan options, such as Crédito con Aval del Estado (CAE), are also available to help students manage these costs.[12, 13]

New universities

Overcoming the territorial inequity of the educational system was one of the pillars of the higher education reform implemented in 2016 in **Chile**. The main thrust of this policy was to strengthen public institutions by establishing a network of institutions that had a presence in all the country's regions. Therefore, two new state universities were created, Universidad de Aysén and Universidad de O'Higgins, responding to the historical demand of the communities, as these were the only regions without their own state universities.

Argentina's higher education system has evolved significantly, starting with five public universities in 1918 and expanding in the 1970s, through the 1990s. Between 2007 and 2015, 15 new universities were created with the specific purpose of bringing education closer to vulnerable populations and traditionally excluded groups.[14]

Impacts of the policies

Argentina: In 2005, 1.5 million students were enrolled in higher education, a number which grew to 2.5 million in 2022, an increase of 67%. The shares of public and private universities have remained steady, with 70% studying at public and 30% at private universities. In 2019, the newly created universities (2007–2015) absorbed nearly 9% of all new enrolments, thereby providing access to students from more remote parts of the country.

Brazil: In 2022, more than 9.4 million undergraduate students were enrolled in Brazilian universities, up from 4.6 million students in 2005, an increase of over 100%. The private sector doubled their student numbers, while public HEIs increased theirs by 50%. In general, the implemented policies have contributed significantly to the democratisation of access, permanence, and completion rates of students from social groups in situations of vulnerability and discrimination in Brazilian higher education. However, this development is limited, for instance by barriers hindering students from lower socioeconomic levels from entering undergraduate courses with greater social prestige and which provide greater earning prospects for graduates.

Chile: The number of enrolled students increased from 600.000 in 2005 to 1.2 million in 2022, an increase of 100%. In 2022, 33% of enrolled students benefitted from free tuition. Both the two newly created universities, Universidad de Aysén and Universidad O'Higgins, have managed to consolidate a quality educational offering, showing sustained institutional growth that is reflected in increasing enrolment, with over 90% of students coming from the same region.

All countries: In all three cases, there has been a significant increase of 67–100% in

new higher education enrolments. Relative to population size, new enrolments are quite similar: 4.4% for Brazil, 5.6% for Argentina and 6.2% for Chile. Generally, the inclusion of low-income and other excluded groups has increased in all countries.

Important public actors in the R&D system

All three countries have extensive ecosystems for research, innovation, and higher education in the academic, public, and private sectors. Below an overview of the most significant public actors is presented.

Argentina

As mentioned earlier, the new administration in Argentina (since January 2024) has reduced the number of ministries down to eight and thereby incorporated some of them as secretariats in other ministries, although their functions remain similar. Below the budgets of ministries and agencies are given in USD to facilitate comparison with Brazil and Chile; however, as the Argentinian Pesos has lost value against the American Dollar by a factor of 5 between January 2023 and January 2024 (from 0.0055 to 0.0011), these values are only approximate.

Ministry of Science, Technology, and Innovation (MINCyT)

MINCyT is responsible for formulating and implementing policies related to scientific research, technological development, and innovation. It aims to strengthen the national science and technology system and promote the transfer of knowledge to the productive sector. The ministry's budget for 2023 was approximately USD 331 million. It has now been incorporated into the cabinet of the president and is no longer a standalone ministry.

Ministry of Education

The Ministry of Education oversees the entire Argentine education system, including higher education. It develops policies and programmes to enhance educational quality and accessibility. The budget of the Ministry of Education in 2023 was approximately USD 9.3 billion. This ministry has also been downgraded to a secretariat under the Ministry of Human Development.

National Scientific and Technical Research Council (CONICET)

CONICET[15] is the main agency for the promotion of science and technology in Argentina. It supports research through funding, grants, and the management of research centres and institutes across the country. In 2023, CONICET had a budget of approximately USD 217 million. CONICET is also the leading research organisation in Argentina. It employs approximately 12,000 researchers and oversees a network of research institutes and centres across the country, often in collaboration with universities. These institutes focus on a wide range of disciplines, including natural sciences, social sciences, engineering, and medical research.

National Agency for the Promotion of Research, Technological Development, and Innovation (Agencia I+D+i)

This agency[16] is responsible for managing and allocating funds to research projects, technological development, and innovation. It operates various programmes to support scientific and technological advancements. In 2023 the budget of Agencia I+D+i was approximately USD 93 million.

Brazil

The institutions and ministries for research and higher education have remained the same under the new administration (January 2023) but with higher budgets and a clear prioritisation as a very important area for Brazil's development.

Ministry of Science, Technology, and Innovation (MCTI)

The MCTI[17] is responsible for formulating and coordinating national policies for scientific research, technological development, and innovation. It aims to promote scientific and technological advancements to boost Brazil's socioeconomic development. Its 2023 budget was approximately USD 2.1 billion.

Ministry of Education (MEC)
The Brazilian MEC[18] is responsible for formulating and implementing national education policies and managing the federal education system. It plays a crucial role in ensuring access to quality education at all levels, from early childhood education to higher education and vocational training. The MEC provides scholarships and financial aid through programmes like the University for All Program (Programa Universidade para Todos – ProUni). Its 2023 budget was around USD 30 billion.

National Council for Scientific and Technological Development (CNPq)
CNPq[19] is a key funding agency that supports research projects, grants scholarships, and promotes scientific and technological research across various fields. Its budget for 2023 was approximately USD 320 million.

Coordination for the Improvement of Higher Education Personnel (CAPES)
CAPES[20] focuses on the development of higher education personnel through funding scholarships, supporting postgraduate programmes, and promoting international academic cooperation. Its 2023 budget was approximately USD 1.1 billion.

Financier of Studies and Projects (FINEP)
FINEP[21] supports technological and scientific development through funding research projects, innovation initiatives, and providing resources for the commercialisation of research results. Its budget for 2023 was approximately USD 2.2 billion

Chile

Under the new administration (since January 2022), Chile is also prioritising research, science and higher education as important factors in the country's sustainable development. Another recent significant change in structure is that the National Research and Development Agency (ANID) was established as the successor to CONICYT (the institution which was responsible for promoting science and technology for over 52 years) on the 6th of January 2020.

Ministry of Science, Technology, Knowledge, and Innovation
This ministry[22] is responsible for designing and implementing policies related to science, technology, knowledge, and innovation. It aims to enhance the country's scientific and technological development and to integrate science and innovation into the public and private sectors. Its budget for 2023 was approximately USD 545 million.

Ministry of Education
This ministry oversees the entire educational system in Chile, including higher education. It develops policies, programmes, and reforms to improve the quality and accessibility of education at all levels. Its 2023 budget was approximately USD 15.4 billion.

National Council of Science, Technology, Knowledge and Innovation for Development (CTCI)
The CTCI[23] formulates and implements policies to advance scientific research, technological development, and innovation, ensuring alignment with national development goals. It manages public funding for research and innovation projects, supports the development of research centres and innovation hubs, and promotes collaboration between universities, research institutions, and the private sector. The council also focuses on fostering human capital by enhancing the training and education of scientists, researchers, and technologists, and by providing scholarships for postgraduate studies. Additionally, it encourages international cooperation in science and technology, facilitating knowledge and technology exchange. Key institutions like ANID and the Chilean Economic Development Agency (CORFO) play significant roles in supporting research and innovation. The 2023 budget for CTCI was approximately USD 567 million.

National Agency for Research and Development (ANID)
ANID[24] supports the development of scientific and technological research through funding, scholarships, and grants. It promotes the training of researchers and the dissemination of scientific knowledge. The 2023 budget for ANID was approximately USD 512 million.

National Fund for Scientific and Technological Development (FONDECYT)
FONDECYT[25] is managed by ANID and supports high-quality scientific research across various disciplines. It provides financial aid to individual and collaborative research projects, fostering the development of researchers at all career stages and promoting scientific excellence and innovation. FONDECYT also encourages international collaboration by funding projects involving foreign researchers and institutions. In 2023, FONDECYT had a budget of approximately USD 186 million to support its mission of advancing scientific research in Chile.

Collaboration between universities and industry

Awareness of the importance of innovation for development, economic growth, and sustainability has grown significantly in recent years in Latin America. It is a focus in most sectors, with the support of several national policies and programmes.

Some policies give incentives to R&D. The innovation budget is mostly directed towards public sector institutions and programmes as briefly described below. Two of the most important initiatives directly connected to universities – technology transfer offices and science parks – are also described.

Incentives and direction of innovation budget

Argentina

In Argentina, the innovation budget is distributed across both the public and private sectors, with a significant portion allocated to public institutions and programmes. However, mechanisms are in place to promote private sector involvement in R&D activities.

Some examples of subsidies are tax deductions of up to 100% of the expenses related to innovation projects. In certain cases, particularly for companies involved in biotechnology and software, income

generated from R&D activities may be partially or fully exempt from income tax. Sectors like agriculture, energy, healthcare, and information technology see significant investment in both public and private innovation. Programmes are often designed to solve national challenges (e.g., energy sustainability, food security) and stimulate technological advancement.

Brazil

In Brazil, the innovation budget is distributed between the public and private sectors, with a strong emphasis on public investment in science, technology, and innovation.However, there are significant incentives to promote private sector participation as well.

One example is Lei do Bem (the Good Law). This law provides tax incentives to private companies that invest in R&D, allowing them to deduct a portion of their R&D expenditure from taxable income, thereby promoting private sector innovation.

Brazil focuses its innovation efforts on sectors like agriculture, energy, aerospace, and healthcare. The government prioritises projects with high potential for technological advancement and socioeconomic development.

Chile

Like in Argentina and Brazil, a large portion of Chile's innovation budget is directed toward public institutions, universities, and research centres. The private sector benefits from government incentives, grants, and public–private partnerships.

One example is tax incentives, which allow companies to deduct a significant portion of their R&D expenses from their taxable income. Also, the CORFO Programs for Private Companies directly fund innovation in private companies by providing grants for business innovation projects.

Mining, energy, agriculture, and technology are key sectors for Chile's innovation funding. The government focuses on projects that promote sustainable development, technology transfer, and international competitiveness.

Technology transfer offices

Before the establishment of Innovation and Technology Transfer Offices (OTTs), collaboration between universities and industry faced several significant challenges that hindered the effective commercialisation of research and limited the potential for impactful partnerships. One of the most prominent problems was a lack of structured communication channels.[26]

There was often neither any formal framework nor a dedicated office to facilitate interactions between universities and industry, leading to miscommunications and missed opportunities. Researchers and industry professionals often operated in silos, without an effective platform to share knowledge, needs, and capabilities. Universities further often lacked the expertise and resources to manage intellectual property (IP) rights effectively. This included difficulties in patenting inventions and negotiating licensing agreements. Innovations therefore frequently remained within the academic sphere without being protected or commercialised, leading to a loss of potential economic benefits and technological advancement. Cultural differences also created a gap between academia and industry, with differing motivations, timelines, and success metrics. Academics often prioritised publications and theoretical advancements, while industry focused on market-ready solutions and profitability. This cultural mismatch led to difficulties in aligning goals and expectations, making collaborations less effective and more challenging to sustain. Legal and regulatory barriers also had a negative impact. Complex legal and regulatory frameworks made it difficult for universities and industry to navigate collaborations, particularly concerning IP rights, funding arrangements, and contractual obligations.

The creation of OTTs aimed to address these issues by providing a structured and professional approach to managing university–industry collaborations. OTTs serve as dedicated units within universities that focus on:

– Facilitating communication and partnerships between researchers and industry.

– Managing intellectual property and helping to secure patents and licenses.
– Bridging cultural gaps by aligning academic and industry goals.
– Navigating legal and regulatory challenges to smooth collaboration processes.

By addressing these pre-existing problems, OTTs have significantly improved the effectiveness and impact of university–industry collaborations in Argentina, Brazil, and Chile.

Science parks

Science and innovation parks (SIPs), also known as technology parks, have played a significant role in fostering research, development, and economic growth in various countries, including Argentina, Brazil, and Chile. These parks serve as hubs for technological innovation, collaboration between universities and industry, and startup support.

SIPs provide a platform for networking and collaboration among universities, research institutions, and private companies. This collaboration is crucial for knowledge exchange and the commercialisation of research. Many SIPs include business incubators and accelerators that support startups and small enterprises by providing mentorship, funding opportunities, and business development services. SIPs often facilitate access to funding and investment by connecting researchers and entrepreneurs with venture capitalists, angel investors, and government grants. They offer regulatory and administrative support to navigate the complexities of patenting, licensing, and other legal processes related to innovation and technology transfer.

Brazil was an early mover when its first park was established in Campinas in 1989, inspired by Silicon Valley and similar initiatives worldwide. Argentina's Polo Tecnológico Rosario was established in 2000 and in Chile the Valparaiso Science and Technology Park came in 2001.

Below follows an overview of the most significant SIPs in these three countries.

Argentina

Polo Científico Tecnológico

The Scientific–Technological Hub is a set of buildings that functions as the headquarters of different institutions related to science and technology and also houses the Ministry of Science, Technology and Productive Innovation, the National Agency for the Promotion of Science and Technology, and the new headquarters of CONICET. The University of Buenos Aires is one of the principal partners, providing research expertise and facilitating academic collaborations.

Parque Tecnológico Litoral Centro (PTLC)

Located in Santa Fe, the PTLC[27] serves as both an institution and a complex of buildings. It connects leading and emerging companies, public and private sector organisations, and the academic, scientific, and technological potential of Santa Fe. The PTLC promotes the incubation and establishment of environmentally friendly technology-based companies. It aims to create a supportive ecosystem for startups and innovative enterprises. The park facilitates the flow of knowledge and technology between universities, research institutions, businesses, and markets. The PTLC leverages existing infrastructure, including applied research laboratories, centralised technical services, pilot plants, incubators, and business containers.

Polo Tecnológico Rosario (PTR)

The PTR Group[28] in Rosario, Santa Fe, is an institution focused on the public–private articulation of innovative platforms. It is integrated with the national and international technology ecosystems, including companies, governments and the science–technology sectors, and the group has more than 110 partner companies from the software, telecommunications, bioengineering, biotechnology, and engineering sectors, among others. Other partners include both the city and province governments as well as educational institutions such as the National University of Rosario and the National Technology University.

Brazil

Parque Tecnológico São José dos Campos

The São José dos Campos Technology Park[29] is one of the largest and most advanced in Latin America, focusing on the aerospace, defence, energy, and information technology sectors. It hosts research centres from major companies like Embraer and Petrobras, as well as numerous startups and academic institutions.

Inova Unicamp

Located in Campinas, São Paulo, this park[30] is known as a major technology hub in Brazil. It supports companies and research institutions in sectors such as telecommunications, IT, and biotechnology. The park project started in 2008 and has since evolved and consolidated itself as an ecosystem specialised in the transfer of knowledge and innovation. The park's environment allows students and researchers to work together with incubated companies, startups, and R&D laboratories. They also generate knowledge applied to emerging technology practices in several segments and industries. This talent network works as a catalyst for new ideas and businesses, creating an important link between the academic environment and the market, and facilitating collaboration with Unicamp.

TecnoPuc

Associated with the Pontifical Catholic University of Rio Grande do Sul (PUCRS),[31] TecnoPuc focuses on information technology, biotechnology, and energy. It fosters collaboration between academia, businesses, and government. The park supports over 120 companies and startups and is known for its vibrant ecosystem that promotes innovation and entrepreneurship.

Chile

OpenBeauchef

OpenBeauchef,[32] located at the Faculty of Physical and Mathematical Sciences (FCFM) at the University of Chile, serves as a centre for scientific and technological innovation and entrepreneurship. Their mission involves promoting, managing, and enhancing innovation and entrepre-

neurship within the R&D ecosystem. Some aspects of OpenBeauchef include innovation and entrepreneurship training with the aim of building capabilities within the community to transfer scientific and technological knowledge to society. Through startup incubation and acceleration technology-based startups are supported through resources, mentorship, and networking, while prototyping and digital fabrication for sustainability encourage sustainable practices. The Technology Transfer and Industry Collaboration division helps to bridge academia and industry and the Beauchef Investment Network connects investors with promising startups. OpenBeauchef has created over 56 startups, generated more than 340 jobs in 2022, and transferred over 2,500 products and services to society, benefiting over 3,000 students.

Centro de Innovación UC Anacleto Angelini
The Centro de Innovación UC Anacleto Angelini[33] is an innovation centre and science park at the Pontifical Catholic University of Chile. Its mission transcends traditional academic boundaries, aiming to bridge the gap between theory and practice, academia and industry. The centre serves as a catalyst for creativity, collaboration, and transformation. The centre hosts 19 organisations, thereby providing them with a collaborative environment. Over 500 companies have benefited from the centre's expertise by tapping into its resources and networks and approximately 35,000 entrepreneurs from 14 countries have received guidance and mentorship. Beyond Chile's borders, the centre actively engages with international partners and participates in joint research projects.

Fundación Chile (FCh)
FCh,[34] a non-profit organisation, actively fosters innovation through local and international networks. Their focus areas include sustainability, human capital development, education, aquaculture, entrepreneurship, and food systems. During its existence, FCh has created more than 65 companies across diverse productive sectors within the country. These ventures promote new industries and innovative products, particularly in Chile's key natural resource domains. The organisation collaborates extensively with over 160 international entities, including companies, governments, and technological centres, spanning 35 countries. Their shared mission involves delivering high-impact technological solutions through knowledge transfer, adaptation, research, and development.

Strong research areas and infrastructure

These three countries conduct a lot of interesting research and some of the facilities and infrastructures are world class in global comparison. In the following section, brief descriptions of some of the strongest areas are presented. Follow the links in the notes for more information.

Argentina
Argentina stands out when it comes to research on nuclear topics, space and agriculture with some institutes mentioned below.

National Atomic Energy Commission (CNEA)
CNEA[35] conducts research on nuclear energy, radiation, and applications. It operates research reactors for medical isotopes and materials testing.

National Space Activities Commission (CONAE)
CONAE[36] focuses on space research, satellite development, and earth observations and launches satellites for environmental monitoring, agriculture, and climate studies. It provides valuable data for disaster management and resource monitoring.

National Institute for Agricultural Technology (INTA)
INTA[37] is Argentina's primary agricultural research institute, focusing on improving crop yields, animal production, and sustainable agricultural practices. INTA's research helps to ensure Argentina's agricultural productivity and food security. They develop new crop varieties, improve livestock management techniques, and contribute to sustainable agricultural practices.

Argentine Institute for Snow, Ice and Environmental Sciences (IANIGLA)
IANIGLA[38] is a leading institute dedicated to research on the cryosphere (snow, ice, and frozen ground) and its impact on the environment and climate. IANIGLA's research on the Patagonian Ice Fields and Andean glaciers provides crucial data on climate change and water resources management in Argentina and the region.

Brazil
Brazil has one of the latest generations of synchrotron light sources as well as strong research institutes within agriculture, health, and space.

National Center for Research in Energy and Materials (CNPEM)
CNPEM[39] is a leading research institution specialising in energy, materials, and biotechnology. It is home to state-of-the-art facilities, including the Brazilian Synchrotron Light Laboratory (LNLS) and the new BSL-4 lab. CNPEM performs research on renewable energy, advanced materials, biotechnological innovations, and handling of high-risk pathogens.

Brazilian Agricultural Research Corporation (Embrapa)
Embrapa[40] is a government agency that conducts research on agriculture, livestock production, and forestry. It has a network of research centres across Brazil with expertise in various agricultural domains. Embrapa plays a vital role in ensuring Brazil's food security and agricultural competitiveness. Their research leads to new crop varieties, improved farming techniques, and sustainable agricultural practices that benefit Brazilian agriculture.

National Institute for Space Research (INPE)
INPE[41] leads space research and satellite monitoring in Brazil. It conducts research in meteorology, environmental monitoring, and space sciences, providing valuable data for national and international research efforts.

Oswaldo Cruz Foundation (Fiocruz)
Fiocruz[42] is a prominent biomedical research institution, leading research in public health, tropical diseases, and biotechnology. It has a substantial impact on health policies and practices in Brazil and collaborates extensively with international health organisations.

Chile
Due to its unique geographical location, Chile has strong observatories in the Atacama desert as well as research stations near the Antarctic.

European Southern Observatory (ESO)
ESO[43] operates several of the most advanced astronomical observatories in the world, located in the Atacama Desert, which provides ideal conditions for astronomical observations. ESO's facilities, including the Very Large Telescope (VLT) and the Atacama Large Millimeter/submillimeter Array (ALMA; see below), have led to significant discoveries in astronomy, such as imaging black holes, studying star formation, and understanding cosmic phenomena.

Atacama Large Millimeter/submillimeter Array (ALMA)
ALMA[44] is one of the world's largest and most powerful telescopes for observing the universe in millimetre and submillimetre wavelengths. It is a collaborative project involving countries from North America, Europe, and East Asia. ALMA has made significant contributions to our understanding of the universe, including insights into the formation of stars and planets, the structure of galaxies, and the properties of cosmic dust and gas.

Instituto Antártico Chileno (INACH)
INACH[45] specialises in Antarctic research and environmental conservation. INACH conducts scientific expeditions to Antarctica and also contributes to preserving the fragile Antarctic ecosystem.

Center for Climate and Resilience Science (CR2)
CR2[46] is a leading research centre focused on climate change and its impact in Chile and South America. It brings together researchers from various disciplines. CR2 provides crucial scientific data and analysis to inform policy decisions related to climate change adaptation and mitigation strategies in the region.

Collaboration with Sweden

All three Latin American countries have extensive international cooperation in a broad variety of areas. There is of course also strong scientific collaboration between these three countries. Some of the most significant partners for all three countries are the USA, EU and the Netherlands in agricultural science, and the USA and Germany in health and biotechnology. All three collaborate with Israel in information and communication technologies. The primary partners in research on energy are the USA and Germany whereas environment and climate change are areas with a growing concern especially in Brazil, which has been severely impacted by droughts, wildfires, and inundations. This research area may be expected to grow further in the near future, with Sweden as an interesting collaboration partner.

Ongoing collaborations between Sweden and these three countries are summarised below.

Collaboration and bilateral contact between Sweden and Argentina usually take place between individual researchers and institutions. The Argentinian network of researchers in Sweden managed by the Argentinian embassy in Sweden should also be mentioned.[47]

Collaboration between Sweden and Brazil in science, innovation, research, and higher education has been developing robustly over the past decades. With an innovation partnership from 2009 initially based on collaboration on aeronautics, the High Level Group (HGL) on Aeronautics was created but later expanded with the Steering Group of Innovation (SGI), which included four thematical areas (life sciences, sustainable cities, sustainable mining, and bioeconomy). More information can be found on the Sweden Brazil Innovation Initiative (SBII) platform.[48]

The Swedish – Brazilian Research and Innovation Centre (CISB)[49] facilitates col-

laborations between universities, research institutes, and companies from both countries, focusing on areas such as aerospace, sustainable cities, and bioeconomy. The CISB has established innovation and research hubs in Brazil to facilitate collaborative projects, involving key Swedish companies like Saab and Ericsson, alongside Brazilian universities and research centres.

The Academic Collaboration Chile Sweden (ACCESS)[50] is a platform designed to enhance academic relations between Chile and Sweden. This initiative is a collaborative effort involving eight Swedish and seven Chilean universities, aimed at facilitating and deepening connections among researchers, staff, and students from both countries. In collaboration with the Swedish Foundation for International Cooperation in Research and Higher Education (STINT),[51] ACCESS provides funding for joint courses and research projects. These funding opportunities are particularly aimed at PhD students and postdoctoral researchers. The goal is to develop joint courses that promote sustainable societies in both Chile and Sweden. Funding opportunities are available through yearly calls for proposals. For more information, see https://accesschilesweden.org.

University rankings

Looking at the Times Higher Education (THE) and QS World University Rankings for Latin America from 2024, Universidade de Sao Paulo (USP) and Pontificia Universidad Católica de Chile (PUC) take the two first places, with USP ranked first this year while PUC was ranked first last year.

In the table below, the rankings from these two top-ten lists for Latin America are compared. Only universities from Argentina, Brazil and Chile are shown (Colombia and Mexico also have universities ranked in the top ten). As can be seen, Brazil and Chile dominate the rankings. Internationally, the USP is found in the top 250 of the THE, Universidade Estadual de Campinas (Unicamp) in the top 400 and PUC in the top 500. Most other top Latin America universities may be found between 600 and 1000 in the world rankings.

Ranking of Universities 2024 from QS and THE

2024 Ranking	2024 Ranking	Institution	Country
QS	THE		
1	1	Universidade de São Paulo (USP)	Brazil
2	3	Pontificia Universidad Católica de Chile (PUC)	Chile
3	2	Universidade Estadual de Campinas (Unicamp)	Brazil
5	9	Universidad de Chile (UCH)	Chile
8	5	Universidade Federal do Rio de Janeiro (UFRJ)	Brazil
9	Not listed	Universidad de Buenos Aires (UBA)	Argentina
10	4	Universidade Estadual Paulista “Júlio de Mesquita Filho” (UNESP)	Brazil
11	13	Universidad de Concepción (UdeC)	Chile
14	10	Universidade Federal de Minas Gerais (UFMG)	Brazil
15	17	Universidad de Santiago de Chile (USACH)	Chile

From Argentina, the University of Buenos Aires (UBA)[52] is renowned for its research in sociology, philosophy, history, and literature. Its Faculty of Social Sciences is highly influential in Latin American studies. Further, UBA’s Faculty of Medicine is a leader in clinical research and public health studies. The university excels in areas such as physics, chemistry, and mathematics, contributing significantly to scientific research in Argentina.

From Brazil, USP[53] is a global leader in biomedical research, particularly in areas such as tropical diseases, immunology, and genetics. USP is particularly strong regarding research related to aerospace, civil, and electrical engineering, and often collaborates with international institutions. The university conducts extensive research in biodiversity, conservation, and climate change, contributing to global environmental studies.

Unicamp,[54] also in Brazil, is known for its research in computer science, artificial intelligence, and information technology. The university has a strong focus on chemical engineering, materials science, and nanotechnology.

From Chile, PUC[55] is highly regarded for its research in economics, business administration, and public policy. The university is also involved in significant research projects in astronomy, leveraging Chile's geographic advantage with some of the world's leading observatories. PUC also excels in educational research, psychology, and sociology.

The University of Chile[56] is strong in civil, electrical, and mechanical engineering research, with a focus on innovation and applied sciences. It is also known for its research in medical and health sciences, including epidemiology and public health.

Overall conclusion

The higher education systems in Argentina, Brazil, and Chile have evolved significantly, with each country establishing strong research areas that contribute to their global standing in various fields. These nations have invested in research infrastructure and fostered environments conducive to innovation, which are critical for addressing both local and global challenges.

In **Argentina**, key research areas include astrophysics, environmental science, and social sciences. Institutions such as CONICET play a pivotal role in advancing research in these fields, particularly in climate change and biodiversity studies. The country's universities, such as UBA, are also renowned for their contributions to the social sciences and humanities.

Brazil stands out with its robust research in agricultural sciences, biomedical research, and engineering. Embrapa is a leader in agricultural innovation, while institutions such as Fiocruz are at the forefront of public health research. The recent increase in funding for research and development under the new administration has further strengthened Brazil's research capabilities, particularly in sustainability and climate change.

Chile has gained international recognition for its research in astronomy and earth sciences, bolstered by its unique geographical advantages. The country hosts some of the world's leading observatories, such as ESO, and is actively involved in significant projects like ALMA. Chile's commitment to advancing research in renewable energy and environmental sustainability is evident through government initiatives and collaborations with international research organisations.

In summary, while the higher education systems in Argentina, Brazil, and Chile face challenges, their strong research areas and collaborative efforts, particularly with countries like Sweden, position them as key players in the global research landscape. By continuing to invest in research infrastructure and fostering partnerships, these nations can drive innovation and contribute to sustainable development both regionally and globally.

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About the author:
Dr Jacob Silva Paulsen has over 13 years of experience working in Brazil, including a four-year tenure as a visiting scientist at the University of Brasília. He has also taught courses and delivered lectures on sustainability at various Brazilian universities. With a background in civil engineering from the Danish Technical University and KTH Royal Institute of Technology, where he completed his PhD, Dr Paulsen later contributed his expertise at FORMAS, a Swedish research council for sustainable development. He also has gained extensive experience in research, innovation, and higher education through his role as Science and Innovation Counsellor at the Swedish Embassy in Brazil.

STINT, The Swedish Foundation for International Cooperation in Research and Higher Education, was set up by the Swedish Government in 1994 with the mission to internationalise Swedish higher education and research.

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Address: STINT, Wallingatan 2,
SE-111 60 Stockholm, Sweden

Telephone: +46 8 671 19 90

info@stint.se www.stint.se

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