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Overview of the Research and Higher Education System in Colombia

The article provides a comprehensive overview of the current state of higher education and research in Colombia, highlighting key changes and events in recent years. It discusses the socio-economic and political context of higher education policy as well as the institutional ecosystem for research areas and infrastructure, especially in the field of biodiversity and environmental sciences. As Sweden and Colombia signed a partnership agreement in 2024, the information in this article could spark interest in Swedish academia to further explore possible areas for scientific collaboration and intercultural dialogue.

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Context

Geography and Natural Capital

Colombia is the only country in South America with coastlines (and islands) on both the Atlantic and Pacific oceans. The country covers an area about 2.5 times the size of Sweden. The population is around 52 million people (2024), making it the second most populous country in South America after Brazil. Colombia is also an ethnically diverse country with 87% self-reported mestizos (people of mixed European and indigenous ancestry), afrodescendants (6.7%) and indigenous peoples (4.4%).[1] The country is also one of the world's megadiversity hotspots with the Amazon rainforest, Andes highlands, Caribbean coasts and Orinoco grasslands. It is the second most biodiverse country in the world after Brazil, which is approximately seven times larger.

About 10% of the species on earth live in Colombia, including over 1,900 bird species – more than those of Europe and North America combined. Colombia is also home to 10% of the mammal, 14% of the amphibian and 18% of the bird species of the world. The country has between 40,000 and 45,000 plant species, equivalent to 10–20% of the total number of global species. Yet, over the past 30 years, Colombia has lost more than 6.7 million hectares of forest due to deforestation, affecting tropical rainforests of the Amazon and Pacific regions. Consequently, Colombia is one of the countries that advocated early on for the creation of the Sustainable Development Goals (SDGs) during the Rio+20 summit. In 2019, Colombia launched a flagship policy to plant 180 million trees as part of its broader environmental and climate strategy. In 2024, Colombia hosted the UN Biodiversity conference (COP16)[2] in Cali, and showed its commitment and efforts to integrate biodiversity goals into the National Development Plan. It also ratified the Escazu Agreement on environmental rights and public participation in 2024.

Socio-Economic and Political Context

During the 20th century, Colombia's income per capita grew at 2% on average per year. Coffee constituted over two-thirds of exports. The country received the first delegation of the World Bank in 1949 to guide its industrialisation process, but high levels of income and wealth inequality led to a period called La Violencia during the 1950s. The 1960s marked the rise of guerrilla movements like the Revolutionary Armed Forces of Colombia (FARC) and the National Liberation Army (ELN), inspired by Marxist ideologies. These groups sought to address social inequalities and land distribution issues. The 1980s saw a surge in narcotics trade, leading to the rise of powerful drug cartels. The government's crackdown on these cartels led to further internal conflict. The 1990s involved attempts at peace processes with limited success and the unilateral opening of the economy to the world economy. Likewise, a new constitution was adopted in 1991, aiming to decentralise political and fiscal power and improve human rights protection, yet the violence persisted.

Colombia has transitioned from a volatile economy in the late 1990s to a more stable, upper-middle income country by 2024. In the 2010s, peace negotiations led to the 2016 peace agreement with FARC. The oldest guerrilla force in the world became a political party, although some dissident factions remain active. After that, gross domestic product (GDP) grew on average by 4% annually. Yet, the pandemic triggered the fall of GDP by 7% in the first two quarters of 2020 and unemployment surged to above 20%. Over 83% of the population had received at least one vaccine dose by mid-2021. GDP then grew by a significant 10.8% in 2021, 7.3% in 2022, 3.3% in 2023 and around 1.6% in 2024. This ability to bounce back underscores substantial institutional and financial resilience despite falling commodity prices and global uncertainties.

The 19th of June 2022 election run-off vote ended in a win for former guerrilla, Gustavo Petro, who became the country's first leftist president. The president was elected with strong support from the student and peasant movements, labour unions, and ethnic groups. The government promised to increase public funding for universities, make higher education more

accessible through tuition-free schemes and grants instead of loans, and enhance the quality of research and innovation. Despite these ambitions, fiscal deficits have put those commitments on hold.

Higher Education Policy Development in Colombia

As of 2021, Colombia has 298 Higher Education Institutions (HEIs): 89 universities, 134 university institutions, and 75 technical and technological institutions. While 28% of the HEIs are public, enrolment is split with around 1.2 million students in public HEIs and 1.15 million in private institutions. 62% of the 89 universities are private. Students must pay tuition fees at public and private institutions, yet private universities are more expensive despite being non-profit institutions. The Colombian Association of Universities (ASCUN)[3] plays a key role in fostering inter-university collaboration, policy advocacy, and the internationalisation of Colombian higher education.

As in most Latin American countries, some of the greatest challenges faced by the Colombian higher education system include socio-economic inequality and geographic concentration. Most HEIs are in urban centres, thereby limiting access for rural populations. The Colombian Institute of Educational Credit and Technical Studies Abroad (ICETEX)[4] is a government agency created in 1950 to reduce this inequality by providing student loans and scholarships to help finance higher education, both within Colombia and abroad. Similarly, the Colombian state has implemented various higher education policies and programmes in the last decade:

Ser pilo paga, or Hard work pays off (2014–2018)
This programme targeted low-income students with high scores on the "Saber" national standardised tests and a specific score on the Identification System of Social Programs (SISBEN). It provided tuition and living aid to students entering private universities. Only around 10,000 students were approved annually 2014–2018, compared to the approximately 2 million enrolled students per year.

Key Economic Statistics

Indicator	Value	Year	Source
GDP (current US$)	USD 418.54 Billions	2024	World Bank
GDP per capita (current US$)	USD 7914.00	2024	World Bank
Inflation, consumer prices (annual %)	9.20%	2023	DANE
Internet usage (% of population)	77,00%	2023	World Bank
Government expenditure on education (% of GDP)	4.40%	2022	Colombia Reports
Government expenditure on higher education (% of total education spending)	1.00%	2022	OECD
Gross domestic expenditure on R&D (% of GDP)	0.23%	2022	World Bank, OECD iLibrary

Generation Excellence (2018–2022)
This programme expanded support with three tiers: Excellence (high performers), Equity (socioeconomic vulnerable) and Team (institutional support). Data from 2021 showed that the Excellence group continued to be around 10,000 students but the Equity group comprised 218,000 students, showing that the programme reached a significant proportion of enrolled students.[5]

Yet both programmes have ceased during the current administration. Efforts were instead made to implement tuition-free programmes for low- and middle-income students according to SISBEN. Yet, insufficient funding has become the main challenge to this policy.

Key Public Actors in the R&D Ecosystem

Colombia has an extensive ecosystem for research, innovation and higher education. The public sector plays a substantial role through the Ministry of Education, the Ministry of Science, Technology and Innovation, the Ministry of Environment and the National Planning Department, and affiliated research institutes such as Agrosavia, CIAT, INS, INVEMAR, and CIF, among others. These research institutes are positioned as leaders in their respective fields at an international level. They do not only significantly contribute to scientific and technological development within Colombia but also actively participate in global collaborations, thereby enhancing their impact and international recognition.

– **National Planning Department (DNP):**[6] DNP ranks as a ministry and plays a vital role in coordinating national public policies across all economic and social sectors, including those related to science, technology, and innovation. It ensures alignment with national development goals.

– **Ministry of Education:**[7] The ministry supports research by funding higher education institutions and promoting scientific education.

– **Ministry of Science, Technology and Innovation (Minciencias):**[8] Formed in 2019, Minciencias absorbed Colciencias and centralised the governance and execution of science, technology, and innovation policy. It also manages research funding and certifies science and innovation parks.

– **Ministry of Environment and Sustainable Development:**[9] Established in 1993 within the framework of the National Environmental System (SINA), the ministry coordinates environmental management across governmental, regional, and scientific entities and research institutes. SINA provides the foundation for Colombia's robust biodiversity governance structure and supports collaboration among public, mixed and private agencies.

Instituto de Hidrología, Meteorología y Estudios Ambientales, (IDEAM):[10] Located in Bogotá, the national Institute of Hydrology, Meteorology and Environmental Studies manages scientific data on water resources, weather, climate, and environmental monitoring across Colombia.

Instituto de Investigaciones de Recursos Biológicos Alexander von Humboldt:[11]

Located in Bogotá, the Alexander von Humboldt Institute of Biological Resources focuses on biodiversity science and genetic resources, and coordinates Colombia's national biodiversity information system.
Instituto de Investigaciones Marinas y Costeras José Benito Vives de Andréis (INVEMAR):[12] Located in Santa Marta, Magdalena, the José Benito Vives de Andreis Institute of Marine and Coastal Research is one of the leading marine research centres in Latin America and conducts basic and applied research on marine and coastal ecosystems of national interest.
Instituto Amazónico de Investigaciones Científicas (SINCHI):[13] Located in Leticia, Amazonia, the Amazonian Scientific Research Institute concentrates on ecological, social, and biological research in the Colombian Amazon. It supports sustainable resource use and colonisation studies.
Instituto de Investigación Ambiental del Pacífico "John von Neumann" (IIAP):[14] Located in Quibdó, Chocó, the Pacific Institute of Environmental Research is dedicated to environmental research in the Pacific region.

– **Colombian Corporation for Agricultural Research (Agrosavia):**[15] Located in Mosquera, Cundinamarca, Agrosavia is a public agency for agricultural research and biotechnology. Key areas are genetic improvement, agricultural biotechnology and sustainable crop management.

– **International Center for Tropical Agriculture (CIAT):**[16] Located in Palmira, Valle del Cauca, CIAT is globally recognised for its research in sustainable agriculture and food security. It is part of the CGIAR system, a global network of agricultural research centres. CIAT collaborates with numerous international organisations to develop innovative solutions that enhance agricultural productivity and climate resilience. Key areas are food security, climate change and agricultural biotechnology.

– **National Institute of Health (INS):**[17] Located in Bogotá, INS is a cornerstone of public health and epidemiological research in Latin America. Its research on infectious diseases, epidemic control, and public health is internationally recognised. It collaborates with the Pan American Health Organization (PAHO) and the World Health Organization (WHO). Key areas are epidemiology, virology and public health.

– **International Center of Physics (CIF):**[18] Located in Bogotá, CIF excels in applied physics research and clean technologies. Its projects in renewable energy and clean technologies are part of international collaborations seeking sustainable solutions to global energy problems. Key areas are solar energy, wind energy and clean technologies.

R&D Funding

Colombia's gross domestic expenditure on R&D is 0.23% (2022). It is one third of the Latin American average and ten times lower than the OECD average. The Ministry of Science, Technology, and Innovation (Minciencias) is the primary public entity responsible for funding research in Colombia. A significant source of public research funding is the General System of Royalties (Sistema General de Regalías).[19] This system allocates a portion of oil and mining royalties to regional and national research projects. Around 10% of the royalties go toward science, technology, and innovation, with a focus on regional development.

Public funding is often directed toward strategic sectors such as health, agriculture, biodiversity, environmental science, and education. Public universities are key beneficiaries of this funding, and they conduct much of the country's basic and applied research. The private sector's role in research funding is significantly smaller than that of the public sector. In 2020, private R&D investment was estimated to be less than 0.1% of GDP. Some private companies, especially in sectors like agriculture, biotechnology, and ICT, do invest in research, often in collaboration with universities or research institutes. However, the scale of these investments remains modest compared to other countries in Latin America.

Science and Innovation Parks

Science and innovation parks are central places for the academic world to meet and interact with the private sector to create new products and innovations. The innovation ecosystem of Colombia involves many more actors which fall beyond the scope of this article. Here a short overview is provided of some of the central science and innovation parks in Colombia, with links to further information.

– **Parque Tecnológico de Innovación (TECNNOVA)**[20] is a leading science and technology park that fosters innovation and collaboration between universities, businesses, and research institutions. It is closely associated with universities such as the University of Antioquia and EAFIT University in Medellín. TECNNOVA focuses on various sectors, including ICT, biotechnology, and renewable energy. The park provides facilities for research and development, incubator programmes, and funding opportunities for startups and innovative projects.

– **Parque Científico y Tecnológico de la Universidad del Valle (PCyTUnivalle):** The Science and Technology Park of the University of Valle in Cali[21] supports research and innovation in areas such as health, agriculture, and environmental sciences. The park aims to promote the transfer of knowledge and technology from the university to the industry, facilitating partnerships that drive regional development.

– **Ruta N Medellín**[22] is an innovation and business centre in Medellín, known for its vibrant ecosystem that encourages technological innovation and entrepreneurship. It collaborates with universities like EAFIT, the National University of Colombia, and the University of Antioquia. Ruta N supports sectors such as ICT, health tech, and clean energy through various programmes, including incubators, accelerators, and funding initiatives.

Collaboration with Sweden

Besides individual collaboration between researchers in Sweden and Colombia, there is no official collaboration between the countries on research and innovation. However, since 2021 there has been a strategy for development cooperation between Sweden and Colombia. The strategy applies 2021–2025[23] and provides the Swedish International Development Cooperation Agency (Sida) with a total of SEK 1.11 billion and the Folke Bernadotte Academy (FBA) with SEK 45 million.

Sida's activities aim at contributing to peace and transitional justice, human rights, democracy, the rule of law and gender equality, as well as the environment, climate and sustainable use of natural resources. The FBA's activities contribute to peaceful and inclusive societies. In June 2024, Sweden and Colombia celebrated 150 years of bilateral relations. Swedish Prime Minister Ulf Kristersson and Colombian President Gustavo Petro signed a bilateral partnership agreement[24] to strengthen the countries' cooperation in four main areas:

– Political dialogue and multilateral cooperation
– Trade and development cooperation
– Climate, environment, green and digital transitions
– Peace and security

University Rankings

According to the QS World University Ranking for 2025, Colombia has three universities in the top-500 ranking: Universidad de los Andes is ranked 179th, Universidad Nacional de Colombia 219th and Pontificia Universidad Javeriana 377th. For Latin America, these universities are at the 6th, 8th and 12th place. The top-1000 ranking include other Colombian universities, for example Universidad del Rosario and Universidad EAFIT.

1. **Universidad de los Andes (Uniandes)**
   Universidad de los Andes[25] in Bogotá is often regarded as the best university in Colombia. It is known for its high academic standards, cutting-edge research, and significant contributions to innovation and development. The university offers a wide range of undergraduate and graduate programs and is highly respected both nationally and internationally.
2. **Universidad Nacional de Colombia (UNAL)**
   UNAL has its main campus in Bogotá[26] with additional campuses in Medellín, Manizales, and Palmira, and is the largest and most prestigious public university in Colombia. It offers a wide variety of programmes and is renowned for its research output and academic excellence. The university plays a significant role in the country's scientific and cultural development.
3. **Pontificia Universidad Javeriana (PUJ)**
   Pontificia Universidad Javeriana[27] in Bogotá and Cali is a leading private university known for its academic excellence, research capacity, and strong Jesuit educational traditions. It offers a broad range of programmes and has a robust reputation in the fields of law, medicine, and business.
4. **Universidad del Rosario**
   Universidad del Rosario[28] in Bogotá is one of the oldest universities in Colombia, known for its rich history and tradition of providing high-quality education. It offers a variety of undergraduate and graduate programmes with a particular emphasis on social sciences, law, and health sciences.
5. **Universidad EAFIT**
   Universidad EAFIT[29] in Medellín is renowned for its business and engineering programmes. It is a modern university that focuses on fostering entrepreneurship and innovation. EAFIT has strong ties with industry, which help in providing practical experience and opportunities to its students.

Overall Conclusion

Colombia's higher education and research landscape has experienced substantial transformations in recent years, reflecting a commitment to enhancing accessibility and addressing the persistent socio-economic and geographical inequalities that have historically plagued the system. Public programmes like "Ser Pilo Pago" and "Generation E", the most recent policies

to support low-income students and promote academic excellence, have been replaced with tuition-free programmes. However, their coverage has been affected by budgetary constraints.

The country's diverse research institutions, such as the International Center for Tropical Agriculture (CIAT), the Institute of Marine and Coastal Research (INVEMAR) and the National Institute of Health (INS) are making significant contributions to global challenges, particularly in areas like biodiversity, agriculture, and public health. These institutions advance scientific knowledge and foster international collaborations that enhance Colombia's reputation on the global stage. Hence, the newly signed agreement between Colombia and Sweden is an interesting vehicle to explore the potential for scientific collaboration and intercultural dialogue.

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