



Science Diplomacy to Enhance Scientific Outputs in Ecuador



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Introduction

Ecuador is a small country with an annual GDP of US\$103 billion (National Institute of Statistics and Census, 2010). According to the National Population and Housing Census 2010, Ecuador's population amounts to about 16.5 million people. Ecuador is one of the most environmentally diverse countries in the world and it has contributed notably to the environmental sciences. The first scientific expedition to measure the circumference of the Earth, led by Charles-Marie de La Condamine of France, was based in Ecuador; and research in Ecuador by the renowned naturalists Alexander von Humboldt of Prussia and Charles Darwin of England helped establish basic theories of modern geography, ecology, and evolutionary biology. Even though Ecuador is been a place of interest for scientists around the world since the seventeenth century, it is well known that internally it has poor academic research and scientific outputs.

Science, Technology, and Innovation: Legal Framework

According to the "Organic Code of Social Economic Knowledge, Creativity and Innovation", known as the Code of Knowledge or "Código Ingenios" in Spanish, the Secretariat for Higher Education, Science, Technology and Innovation of Ecuador (Senescyt) is the Government Institution in charge of establishing the national policy in the matters of science, technology, innovation and ancestral knowledge.

This Code intends to modify the way in which knowledge is generated, used and distributed in Ecuador, by changing the ways in which universities and other institutes invest and manage their research and development departments, as well as their budgets.

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In Ecuador, scientific research is mostly carried out by universities but also in public research institutes; both of them, working under Senescyt's regulations. Although some public universities were created in the 19th and 20th centuries, they lack scientific tradition. Universities have focused mainly on teaching, leaving scientific production and quality behind. Few professors in universities hold PhD degrees in science, therefore research and publishing is reduced. These university staff has a high load of administrative work, their salaries are relatively low compared with other countries, and they are usually hired under contract rather than as full-time (Van Hoof, Eljuri, Estrella, & Torres, 2013).

As these staffs are a key component of quality research, the lack of adequately trained staff in Ecuador has negatively impacted outputs (Austin, 2002). However, problems are not only a function of the staff but also reflect the public system as a whole.

The public purchasing system (which controls all financial needs of research via the central government) is excessively bureaucratic and seriously inhibits research progress due to following reasons: people responsible for allocating funds are not familiar with science/research needs, the purchase system is very complex, designed to buy regular goods and not scientific supplies, and there is an annual gap in funding allocations, which occur because of the country's overall financial distribution regulations. This makes the purchase of materials and equipment very difficult and reduces the active time for research throughout the year (Castillo & Powell, 2018).

Although the legal conditions in Ecuador related to the matters of science, technology, and innovation are very complicated, due to specific programs and projects implemented by Senescyt, some of them involving international cooperation, several scientific outputs have increased.

Science Diplomacy in Ecuador

According to Ayala-Mora (2015), modern science in Ecuador started in the sixties, when "scientific knowledge was fundamentally foreign in Ecuador", since then, most of the Ecuadorian scientific publications were produced as a result of international collaboration, which played a crucial role in the advancement of science and technology.

According to the Research and Information System for Developing Countries of India - RIS, "Science Diplomacy aims at promoting scientific collaborations among different countries for addressing common challenges for mutual gains. Its role in shaping foreign policy of the nation has become prominent over a period of time..."

For small countries like Ecuador, or countries with low scientific productivity, collaboration with more experienced countries can generate research that would otherwise be impossible (Harris, 2004).

Since 2006, the Ecuadorian government has been working to improve scientific performance. Several new policies have been enacted to improve the standards of higher education, science, technology and innovation in the universities and technical institutions. For example, in recent years, Senescyt has encouraged scientific networking among national and international partners by funding multilateral projects under an arrangement known as "Virtual Common Pot", where each funding partner funded its national scientific teams. Ecuador has been participating in funding programs such as the Research Foundation Flanders (FWO; a Belgian organisation, whose main purpose is to support fundamental and strategic research) and with STIC & MATH AmSud Regional Program (French cooperation and counterparts in Latin America oriented to promote and strengthen collaboration and the creation of research-development networks in the fields of information, communication, science, technology, and mathematics, through the realisation of joint projects).

Although very few projects have been funded to Ecuadorian teams in these programs in recent years, every year more and more projects are presented during the annual calls and Senescyt has increased its budget for funding these projects (Medina et al., 2016).

Another case that is necessary to highlight is that Senescyt signed a protocol to the Technical Cooperation Framework Agreement (signed in 1999), between Ecuador and the European Center for Nuclear Research (CERN), focused to train Ecuadorian researchers in the areas of physics, materials science and ICT. As a result of this agreement, various stays have been made and some Ecuadorian scientists and students have participated

in the different experiments of CERN (Medina et al., 2016).

Other recent strategies promoted by the Ecuadorian government that directly increased international collaboration were the Prometheus Programme and the creation of four emblematic universities where almost all the PI (professor in-charge) are distinguished Professors from prestigious universities around the world.

The Prometheus programme succeeded in bringing international experts to Ecuador to conduct research at universities and public research institutes, to train Ecuadorian scientists in a variety of fields, and to transfer their knowledge to Ecuadorian professionals and students (SENESCYT, 2015; Van Hoof, 2015). From 2010 to 2015, Prometheus sponsored around 1000 visiting researchers in Ecuador, most contributing to the publication output of the country (SENESCYT, 2015). The new universities (known as “emblematic”) brought international professors to work on newly built university campuses in different areas. One of them, Yachay Tech University, has more than 100 foreign professors as faculty staff (74 percent of professors from 23 nationalities). These professors are actively publishing using data obtained mainly in their institutions of origin, which has increased both the number and impact of publications.

Another important aspect to consider is the fields of knowledge that international collaboration emphasizes. In general, agricultural/biological sciences and medicine account for 56.6 per cent of all publications in Ecuador (Castillo & Powell, 2018). At the country level, the United States and Spain are the largest collaborators in almost all fields of knowledge; this agrees with the results shown by Lemarchand (2015), and agricultural/biological sciences and medicine are in the top of the list of these countries (Castillo & Powell, 2018). This indicates the importance of collaboration with these countries in those particular fields.

Senescyt intends to improve scientific outputs to bring Ecuador to a knowledge economy and even though the number of scientific outputs has substantially increased in the last years due to the previously mentioned actions, for example, the number of publications, there are still many

problems to face to achieve the objectives established in the National Plan of Science, Technology, and Innovation and to fulfil the norms the Organic Code of Social Economic Knowledge, Creativity and Innovation demands.

The extreme bureaucracy and administrative hurdles that Ecuadorian researchers face have limited the achievement of better scientific outputs. Government and university administrations do not understand the demands of “research,” and faculty spend 70 to 90 per cent of their days teaching or doing administrative work; central government requirements for domestic and foreign researcher registration are daunting; permits and funding application approvals are delayed due to a lack of research-oriented administrators; and funding is slow and arrives late in the year (in some cases, resulting in the research stopping). University administrators must show experience in the scientific endeavour to understand the researchers’ needs to help solve these problems.

Conclusion

The future of Ecuadorian S&T should include an adequate policy on international collaboration to promote research in conjunction with at least two other regions while prioritizing North America and Europe. Government policies on research funding should continue for the top fields based on past work, but the government should also consider increasing funds in areas for which outputs impact is low if those areas are important to the future country framework. Higher education authorities should facilitate the exchange of faculty members and students with foreign institutions, provide easy travel, and allocate funds for shared research projects.

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