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Research as the Cornerstone of the University-Company-State Relationship

La investigación como eje articulador en la relación Universidad-Empresa-Estado

Carol Yovanna Rosero-Galindo and Juan Pablo García-López

Abstract

In Colombia, research is a dynamic process that involves various sectors. This chapter presents coordination between the Colombian state, the university, and the business sector in the field of research. Colombia's national research system is analyzed, along with how universities should be included and engaged with regards to state plans and policies, with the case of Universidad Cooperativa de Colombia highlighted. The involvement of young researchers in the Nariño region is then examined, along with the relevance of this as an indicator of research outcomes in the training of new human talent. Finally, the chapter looks at the involvement of the three entities previously mentioned in accordance with the Strategic Departmental Plan for Science, Technology, and Innovation in the Nariño region, arriving at the conclusion that the state system must implement actions to promote participation and facilitate communication between the sectors and stakeholders it is composed of.

Keywords: national research system, regional analysis, engagement, coordination, young researchers.

Resumen

En Colombia, la investigación es un proceso dinámico que comprende la participación de varios sectores. En este capítulo se expone la articulación en el campo investigativo entre el Estado colombiano, la universidad y el sector empresarial. Se desarrolla un análisis del sistema nacional de investigación en Colombia, y cómo debe darse en este la inclusión y vinculación de las universidades, en particular la Universidad Cooperativa de Colombia, en relación con los planes y las políticas estatales. Posteriormente, se analiza la participación de jóvenes investigadores en la región de Nariño, y su relevancia como indicador de productos de investigación en formación de nuevo talento humano. Finalmente, se relaciona la participación de los tres ejes mencionados en concordancia con el Plan Estratégico Departamental de ct+i en la región nariñense. Se concluye que el sistema estatal debe implementar una participación que facilite la comunicación entre los sectores y los actores de los cuales se compone.

Palabras clave: sistema nacional de investigación, análisis regional, vinculación, articulación, jóvenes investigadores.

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National research system in Colombia: Vision and inclusion of Universidad Cooperativa de Colombia

J. W. Best (1978) defines research as “the more formal, systematic, and intensive process of carrying on a scientific method of analysis” (p. 25). In Colombia, research is governed by Law 1286 of 2009 for Science, Technology, and Innovation (CTI), led by the National System of Science, Technology, and Innovation (SNCTI). These regulations seek to unite the efforts of the State, the university, the company, and civil society to build a development model in Colombia and its regions that is based on the generation and use of knowledge.

Since its inception as Administrative Department of Science, Technology, and Innovation, Colciencias has taken on the challenge of implementing development plans every four years, allocating the national research budget through the formulation of objectives such as consolidating the SNCTI, increasing and engaging human capital for research and innovation, and fomenting knowledge and innovation for the social and productive transformation of the country (Departamento Administrativo de Ciencia, Tecnología e Innovación, Colciencias, 2013).

To help achieve the first objective, and in order to define the steps that will boost regional capacity for innovation, the Departmental Government of Nariño, in conjunction with Colciencias and the Pasto Chamber of Commerce, and with the support of the Departmental Board of Science, Technology, and Innovation (Codecti) and different stakeholders in the Departmental System of Science, Technology, and Innovation (SDCTI), drove the formulation of the Strategic Departmental Plan for Science, Technology, and Innovation in Nariño (PEDCTI) (Gobernación de Nariño, 2012a).

While formulating the PEDCTI for Nariño (2010-2015), 21 higher education institutions (HEIs) were identified, consisting of 14 universities, 5 university institutions, and 2 professional technological and technical institutions (Gobernación de Nariño, 2012a). Likewise, it was established that Universidad de Nariño, Universidad Nacional a Distancia (UNAD), Universidad Mariana, Institución Universitaria Cesmag (I.U.Cesmag), and Universidad Cooperativa de Colombia represent, in that order, the five principal HEIs in the region. They also provide the greatest contribution in indicators of human resources, research groups, areas of research, and creation of research outcomes in national statistics. These statistics show that as of March 2011 Nariño had 72 research groups registered in Colciencias' GrupLAC (Salazar et al., 2011, p. 79).

Although more than 1,000 professional teachers are employed by HEIs in the Nariño department, only 3.73% have a doctoral degree, and this percentage is

principally made up of teaching staff at Universidad de Nariño (51 with doctoral degrees) and Universidad Cooperativa de Colombia (15 with doctoral degrees). While the inclusion of teachers with the highest professional qualifications is vital in different areas of knowledge, there is clearly a lack of departmental strategies for offering incentives to professionals with a doctoral degree. Such strategies are essential in encouraging these professionals to join the region's HIEs, or companies in the production sector.

It is therefore relevant for both HIEs and the private sector to study the goals proposed for achieving the second objective of Colciencias' Strategic Sectoral Plan for Science, Technology, and Innovation (2010-2019), in relation to the increase and engagement of human capital for research and innovation. Colciencias has set about the goals for 2014 in the following figures: 3,500 recipients of doctoral scholarships within the country and abroad; 4,000 recipients of scholarship-loans for Master's studies abroad with a research focus; 250 beneficiaries of the Young Engineers program, with international dual degrees in key areas; 50 post-doctoral positions for nationals or foreigners in the country undertaking research projects; and 50 individuals with doctoral degrees working with companies through the labor absorption program to develop research topics within the companies.

The participation of professionals from Nariño is thus facilitated with a view to increasing employment and strengthening HEIs' areas of research in the department. This is achieved by involving Master's and PhD students in the groups recognized by Colciencias until 2012 and mostly classified in categories C and D, 18.9% and 53.7% respectively, 3.2% in category B, and only 1.1% in category A. The glaring absence of groups categorized as A1 in Nariño highlights the commitment required by HEIs in the coming decade, combined with the efforts of researchers and students in training to increase the quantity and quality of outcomes generated by each research project.

The recognition of these research groups implies a long-term challenge, given that a continuous process of research and production is required with the aim of strengthening the 251 areas of research registered with Colciencias by groups in Nariño, and detailed in the Strategic Departmental Plan for Science, Technology, and Innovation in Nariño (2012-2015). These range across fields of knowledge such as social and human sciences (40.6%), basic sciences (34.3%), and applied sciences (24.7%) (Gobernación de Nariño, 2012b).

What is Universidad Cooperativa de Colombia's (UCC) contribution to the development of Science, Technology, and Innovation in the Nariño department? The inclusion of UCC in regional higher education indicators is the result of the rolling out of the Strategic National Plan-*Navegando Juntos* (Navigating Together)

(2013-2022). This plan establishes UCC as a higher education institution that forms part of the solidarity economy sector. It comprises 18 campuses throughout the country, and institutional indicators of 2012 showed the growth of the university with 50,039 students, 4,569 teachers, 2,165 employees, and 118,468 alumni. In response to the National Ministry of Education's recommendations for the country's HEIs in 2010 aimed at ensuring student retention, the university adopted academic, psychosocial, psychological, and financial measures, achieving a reduction in student drop-out rates from 21.59% in the second semester of 2006, to 10% in the same period of 2012.

The commitment established in UCC's Strategic National Plan incorporates the development of nine key programs (Universidad Cooperativa de Colombia, 2010), including strengthening research, an essential part of the university's mission and vision. Through agreement 025 of April 18, 2004, the Higher University Council established the General Statute and the Administrative Research Structure of Universidad Cooperativa de Colombia. The Statute creates the University Research System (SUI), which contains the basic definitions, institutional organization, the qualities and functions in the organic system, and the promotion, incentives, and financing of research in the Institution.

Since its inception, the SUI has integrated with the National System of Science and Technology led by Colciencias, through the creation of UCC research policies with the national system. In developing the Statute, the National Committee for Research Development (Conadi) was created, taking responsibility for the appraisal and approval of the institutional budget for financing research projects. The management of the Committee, together with the officials who direct the research centers on each campus, has allowed the university to conduct public calls for interest to obtain financing for research projects in different areas of knowledge, as well as the ability to support capstone projects, sustain groups classified by Colciencias, hire staff with doctorates, train teachers at the Master's and PhD levels, provide mobility and training for teachers and students, and adequately equip research spaces.

These calls for interest have facilitated the recognition of 118 research groups by Colciencias; the undertaking of 200 research projects, involving more than 600 researchers made up of students and professors; the hiring of 15 research teachers with doctoral degrees; a direct investment of more than COP\$11,000 million (approximately \$us5.73 million as of January 2014) in the Pasto campus, allocated to establishing state-of-the-art laboratories for conducting research, including the Molecular Biology Laboratory, the Cytogenetic Laboratory, the Clinical Simulation Laboratory, and the Odontology Clinic. The last of these has 50 units

for undergraduate and 17 units for postgraduate work, and is listed as the largest clinic in Nariño and among the four best in the country.

Finally, UCC's involvement in the call for proposals 566, Colciencias' National Call for Proposals for Young Researchers and Innovators 2012, also allowed the hiring of a staff member in the Interdisciplinary Health-Nursing Research Group (GIISE), a group recognized by Colciencias. This new hire will participate in development projects that are relevant to the needs of both the department and all of southwest Colombia.

It is also important to mention that the goal of UCC's Pasto campus is to gain entry into megaprojects that will allow it to form strategic alliances with other educational entities in the region's private and productive sectors. This is done with a view to securing external resources, within the country and abroad, and promoting research and innovation in the region and the country.

Young researchers and their relationship with the University-Company-State dynamic: Regional analysis in Nariño

Why do institutions involved in research in countries such as the U.S., France, and China, among others, appear at the top of the SCImago Institutions Rankings?¹ (SCImago Research Group, 2013). The answer to this question is that conventional research methodologies that have been implemented in first-world countries see scientific progress as the mission of a participating society with different stakeholders who perceive reality according to their own criteria (Shaw, Brady & Davey, 2011, p. 4).

This society, as an active participant in various research processes, consists of children, young people, and adults, with the final group being those who lead the research process (Shaw, Brady, & Davey, 2011). This simplistic distinction in the society raises another question: What makes it so special? In response, it should be mentioned that in the research models of international programs such as the Seventh Framework Programme, Erasmus, and Comenius, which belong to the European Union, the policies of participation that are applied emerge from a dynamic process of association and equality in the interaction of stakeholders who contribute to future solutions (European Commission, 2009). These policies consider young people to be a potential human resource for addressing issues that warrant a scientific method in order to find solutions. Cohesion is thus generated

¹ The SCImago research group's international listings that show countries' scientific development according to indicators such as the number of publications per year.

between the inclusion of youth and the research priorities that arise regionally, nationally, or globally (European Commission, 2009).

This model, which drives the development of research, has been replicated in Colombia, where policies for building and involving the young community in science have been implemented. This task has been taken on by Colciencias, which since the beginning of 1992 has presented research as a pedagogical strategy and a formative experience that can be addressed through policies such as *Programa Ondas* and Young Researchers and Innovators scholarships (Jaramillo, Piñeros, Lopera, & Álvarez, 2006). The objective of these programs has always been to train human resources in the three types of knowledge capital: social capital, human capital, and intellectual capital.

Nevertheless, national statistics show that the community participating in the programs mentioned above is concentrated in Colombia's main cities (Colciencias, 2006-2012). This picture of the situation suggests that there is little interaction between the State and the institutions that conduct research. One plausible explanation could be that which is put forward and demonstrated in Costa Rica, where government assistance is not coordinated with the internal policies of institutions, be they academic or business-oriented. Additionally, there is a lack of commitment from the stakeholders in charge of the research process to communicate with young people and motivate them to participate (Meoño, 2004, p. 4).

This situation can be seen in the Nariño department, where the involvement of young people in the research process is still in its early stages of development; this is reflected in the low participation rates in Colciencias' Young Researchers and Innovators category, which cumulatively has not passed 0.4% of total scholarships offered since the program's inception. This participation has only become noticeable in the past three years, and it is the result of the involvement of only two universities at the departmental level and one company (Colciencias, 2006-2012).

One explanation for this situation is put forward by Perdomo and Valera (2010), who state that the root of the problem lies in the university institutions, where the community of young people interested in the sciences is mostly made up of undergraduate students in their final semesters and recent graduates, the thesis and capstone project being their closest contact with research processes (p. 245). Although these academic practices are highly apt for training, it is wrong to consider them the only tools for teaching research.

Given the situation, Nariño's plan for 2015 is to become a setting for intervention and training offered to human resources, thereby increasing the social appropriation of knowledge by children and young people. In this way they can be included in processes for research learning in which they develop creative intelligence geared

towards transforming the adverse economic and social surroundings of the community in general (Delgado et al., 2012; Gobernación de Nariño, 2012a). When this requirement for research and innovation takes effect (Delgado et al., 2012), it will be vital to consider the guidelines for training the young people. On this topic, according to Jaramillo et al. (2006), a young researcher studying in a university should be shaped by reflecting on reality, with the aim of reexamining and evaluating what already exists, depending on national objectives. The Colombian university as an academic body has thus shown its commitment to the creation of the Research Incubators program, which has strengthened the training of young people as a research resource (Torres, 2012).

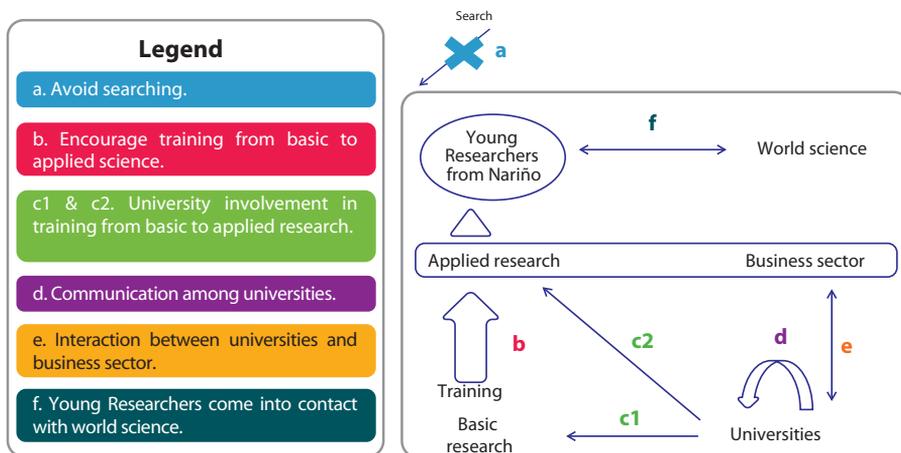
In accordance with the above, and based on the work of Vélez (1984)—who states that “we must explode the myth that research work is the privilege of a few out-of-touch geniuses and that only they can do it” (p. 50)—one effective solution to the problem in Nariño may be not to seek talented young people to bear the burden of research, but to train them following the premises of teaching how to learn and learning by doing (see Figure 5.1 a and b) (Jaramillo et al., 2006). This incorporates new perspectives of reality consistent with students’ own criteria, and changes the approach from a search for questions based on a research problem, to a search for questions based on existing solutions. This young research community should establish itself on qualities such as competence, relevance, and productivity in order to face the challenges posed by today’s changing world (Jaramillo et al., 2006).

Within the university, young researchers in Nariño tend to focus their work in the research areas of the research groups. Although the department has around 97 groups recognized by Colciencias, mainly in areas where knowledge is lacking with respect to local needs (Ciencia y Tecnología para Todos - ScienTI, 2013), the culture is significantly behind the times in terms of combining demand for scientific production with the inclusion of young researchers. As a result, there is a clear lack of coordination between the idea of “group” and the progress of the research groups mentioned. This model of individual and neutral research must be dismantled (Agudelo, 2004). It is necessary to seek new paths that make a case for the creation of strategic departmental research areas to aid communication among research groups in different universities, and thereby ensure interdisciplinary approaches as a resource inherent in the group where the young researcher is trained. Seeking internationalization is another approach that allows group thinking to develop.

In the dual benefit obtained by including young researchers to boost development of science in the Nariño department, the approach of seeking internationalization affords new perspectives for young minds, providing motivation and a greater sense

of belonging to the group. Gaete and Bratos (2012), however, argue that care must be taken when making contact with the global science community, as this may skew personal perception (see Figure 5.1 f).

Figure 5.1 Process for training young researchers



Source: Rosero and García, 2013.

Note: The diagram shows the training of young researchers linked to interaction between the global science community and Nariño. The formative process starts with basic research which is disseminated by the university and can be seen in the component of an applied research project jointly conducted with the business sector.

Likewise, internationalization and interdisciplinarity must be sought with both global universities and the business sector, even when the latter is only interested in the applied science component, a situation that has occurred in Colombia's major cities (Jaramillo et al., 2006) and in first-world countries (Shaw, Brady, & Davey, 2011).

Although Nariño is not considered a leading figure in the field of technology (Cámara de Comercio de Pasto, 2013), the business sector does to some degree represent a space for engaging young people in research processes, as for the most part it is the companies that offer their facilities for academic placements.

As only a minority of the business sector has visibly gotten involved with research, the Pasto Chamber of Commerce has proposed "Sectorial Nuclei" that promote competitiveness and the strengthening of business with an emphasis on an associative method (Cámara de Comercio de Pasto, 2013). This method

incorporates coordination with universities to conduct research (see Figure 5.1 d), but, as stated above, this period has only just begun.

Accordingly, the problem of coordination becomes identified as a quest for young people in training who have the capacity for entrepreneurialism, are always willing to assume and share responsibilities with a critical attitude, and develop abilities to solve problems in collaboration with others. Undertaking an internship is a good way of engaging with the business sector; however, greater commitment is required on the part of the department of Nariño to manage, develop, and support economic outcomes from research projects conducted within companies. At the same time, the companies must assume responsibility and understand that research is learned through practice by making mistakes and taking forward and backward steps. They must also accept that methods are meant as guides and not rigid constraints (Vélez, 1984).

Finally, this situation—although indefinite in the Nariño department due to the lack of programs that promote the training of young researchers, which then leads to the young population leaving to seek better opportunities—indicates that the training of young people in research processes should be addressed from an early stage through interaction among the department's universities, with an approach of interdisciplinarity and group communication.

University-Company-State engagement

Engagement between State-Company-University becomes a first step in motivating companies to coordinate with academia and help in the development of science and technology. Both parties benefit from this: the private company obtains a product that is the outcome of the research and development, while the universities generate scientific knowledge applied to the productive sector (Guerrero, 2009, p. 15).

Research thus becomes the cornerstone around which new knowledge is generated and then constantly transformed, leading to innovation. In Colombia, the government has added its efforts to define research policies; the majority of proposals implemented have harnessed the experience of researchers in the private and productive sectors, and in civil society. In Nariño, the Strategic Plan for Science, Technology, and Innovation analyzed the demand for research, knowledge, and technology based on 26 studies grouped into five areas of knowledge: Nariño achieving decent living, Nariño optimizing its differences, Nariño as a food powerhouse, Nariño making the rural economy viable, and Nariño green biodiversity (Gobernación de Nariño, 2012b, p. 64).

The analysis jointly undertaken by the different stakeholders in the Strategic Departmental Plan for Science, Technology, and Innovation in Nariño indicates the importance of training human resources across all five areas of demand. Emphasis is placed not only on the hiring of staff with doctoral degrees, but also on the HEIs creating new postgraduate programs in economic sciences, social and human sciences, exact sciences, and health sciences, among others, along with centers for research and regional development, and new research groups and areas.

It is assumed that the launch of the Nariño Plan for Science, Technology, and Innovation can initially be financed with public funds consisting of 10% of the General System of Royalties (SGR), which is forecast to reach 0.3% of GDP per annum. This would be followed by the involvement of other sources of finance such as the National Training Service (SENA); the Ministry of Commerce, Industry, and Tourism (MCIT); the Ministry of Agriculture and Rural Development (MADR); the Colombian Corporation of Agricultural Research (Corpoica); the Colombian Fund for Modernization and Technological Development of MSMEs (Fomipyme); and Banco de Comercio Exterior de Colombia (Bancóldex) (Gobernación de Nariño, 2012b, p. 228).

According to the projections of the Nariño Plan for Science, Technology, and Innovation, the main source of financing for conducting the region's research and innovation projects are funds from the SGR, estimated at COP\$509,912 million (approximately us\$263 million as of January 2012) for the period 2012-2020. This projection raises the issue of mechanisms that must be implemented by Company-University strategic partnerships with a view to the effective use of these funds, equivalent to COP\$190,603 million (approximately us\$98.4 million as of January 2012) between 2012 and 2015.

In the specific case of the involvement of UCC's Pasto campus, the combined efforts of the research committees and the technical committee for regional research are required to create interdisciplinary projects that facilitate the inclusion of professionals and officials from different university departments, directed towards identifying research priorities that are consistent with the University's mission and the Nariño Plan for Science, Technology, and Innovation.

Conclusions

Research in Colombia is governed by the national guidelines and policies defined by Colciencias. Including the regions in national policies is a responsibility of all stakeholders involved in research and innovation. This in turn requires active and associative involvement of the Company-University-State triad to generate innovative proposals that facilitate the creation of new products in line with the needs of

the region and, in the specific case of Nariño, consistent with the current Strategic Departmental Plan for Science, Technology, and Innovation.

For higher education institutions, such as UCC, active and associative involvement refers to making constant commitments towards the appropriation and generation of new knowledge. This includes the training of human resources, the consolidation and strengthening of research groups and areas, the hiring of researchers, and the adequate equipping of spaces suitable for carrying out short-, medium-, and long-term projects.

The training of young people in research processes must be addressed from the initial stages through the interaction of universities in the Department, using approaches of interdisciplinarity and group communication.

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