NATALIA RUIZ-RODGERS

5. THE ROLE OF RESEARCH UNIVERSITY IN THE THIRD WORLD:

A Case Study of the National University of Colombia

The image of Colombia that is portrayed by the daily news is dire violence, kidnappings, and of course, drugs, are words that are conjured up at the mere mention of the country's name. Some of it is indeed true. For the last sixty years Colombia has been immersed in a civil war between rebels, drug traffickers and the government that has shed much blood and created great misery. What is less known is that Colombia is a nation of a great intellectual and scientific heritage. From the country's first days as a Spanish colony, when some of the earliest universities in the continent were established, to our present time as an independent republic, for centuries Colombia has had an extremely rich academic tradition. What are the perspectives for continuing that tradition into the 21st century? This essay presents a case study of the National University of Colombia, an institution that to maintain its leading role in the domestic arena, must become relevant in the international context. Even though the task of building of a world-class research university in Colombia offers unique -even daunting - challenges, the experience from the National University shows that, with long-term vision and support from the government, a way can be made.

The first part of this chapter offers some general background on Colombia and on the problems associated with developing science and technology in the country. The second part deals specifically with the question of building a world-class research university in a Third World country, and some of the institutional arrangements that could make it possible. The third section provides an overview of the National University, identifying its strengths and weaknesses in the context of Colombia. Finally, the fourth section describes the strategies used by the National University to achieve the goal of becoming a world-class research university.

COLOMBIA: THE BACKGROUND FOR UNDERSTANDING HIGHER EDUCATION

Situated in the northwestern corner of South America, Colombia is a land of great cultural and biological diversity. Traversed by the equator, dissected by the Andes, and with access to the Pacific Ocean, the Caribbean Sea and the Amazon River basin, the country has a unique wealth of environmental conditions and natural resources. Due to its tropical climate, most of the population centres are scattered

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throughout mountainous terrain (which is cooler) rather than in the flat, hot and humid lowlands. This geographic fragmentation of its population (and its land) has often been considered as a challenge to the development of infrastructure, as well as to the establishment of a strong, centralized state capable of enforcing the rule of law across the territory (DNP, 2005).

At nearly 45 million, Colombia has Latin America's third largest population after Brazil and Mexico, and its GDP of around USD 240 billion is the fourth in the region (World Bank, 2009). The per capita income is USD 4,724, but this average masks some stark regional and social disparities. The mean yearly income in and around the main cities of Bogotá (the capital), Medellín and Cali is close to USD 6,000 per person, but in some of the poorest regions in the Pacific lowlands it drops to USD 1,600. The population is not only separated by physical features, but also by deep social fractures. Colombia inherited an extremely unequal social structure from its colonial past, and modern society has not been able to shake off the profound disparities in wealth distribution. Today, nearly a fifth of the population lives below the poverty line and, despite recent gains in security and socio-political stability, the GINI index is 0.56, making it the one of the most unequal countries in Latin America.

A country with the level of poverty and security problems that Colombia has faces stark choices when it comes to tertiary education and research. This is not only due to matters of resource allocation, but because basic and applied research may not be within the radar of what society deems to be important tasks. This relation between science and technology and the context within which they exist may be examined from multiple perspectives. On the one hand, science and technology can be understood as part of the set of restrictions that countries face in order to advance to their desired future and in this sense, future scenarios are conditioned by current scientific and technological developments. On the other hand, societies may recognize their potential and build a vision of a nation based on their own desires and under this premise, science and technology are the vehicles that make the move in the desired direction possible.

In every historical time period, those societies that have been able to master strategically decisive technologies have forged their own destiny (Castells, 2002). These societies have been able to act, because their development has been based on knowledge. In today's society, this translates into having people with the ability to produce and reproduce knowledge, to have access to technologies that enable production, to have the norms and agreements that make these relations of production possible, and to make networks. The priority of universities thus becomes the development of capacities that allow the production and reproduction of knowledge.

In this context, scientific development adopts a key role because it produces institutionalized and legitimate knowledge for society. The relationship between society and science is established as the means to produce knowledge that is responsive to the market and the needs imposed by society. Moreover, in the global context, universities are precisely the main points of articulation between societies and the development of scientific knowledge. In accordance with this fact, scientific development and the strengthening of universities are consistently on the

political agendas of national governments and international organizations, such as UNESCO, the World Bank, the Inter-American Development Bank, and the OECD.

The relationship between economic and scientific development highlights the importance of scientific and technological knowledge for the building of strong societies. Latin America has been no stranger to scientific knowledge, but for most of its history it has performed a relatively passive role in the global arena. From the colonial era to the first half of the twentieth century, technological and scientific activities were largely subservient to - and lagging behind - the advances in the former European colonial powers. Even after these nations achieved formal independence, during the first half of the nineteenth century, Europe (and, later, the United States) continued to exert a very prominent economic and cultural influence. After the Second World War, there was a deliberate effort to spur national science and technology as necessary elements towards modernization and development. An example of this was the establishment of science and technology agencies throughout South America and in Colombia, the government established COLCIENCIAS, the National Administrative Department for Science and Technology, in 1963. In addition, this decade saw the arrival of funding agencies like the Johnson, Rockefeller, Ford and Kellogg Foundations, whose "missions" provided key support for research in agriculture and economics (Villaveces and Forero-Pineda, 2007).

These investments were accompanied by a series of reorganizations and restructuring of universities, so that by the end of the 1960s, all mayor public universities had undergone critical transformations. In this regard, the Universidad del Valle near Cali (1962–1978), the National University in Bogotá (1964–1966) and also the Universidad de Antioquia in Medellín all embarked on significant reforms of their academic programmes and organizational structures, a step seen as indispensable to promoting research (Villaveces and Forero-Pineda, 2007, p. 115).

The Colombian state considers universities to be strategic allies in the development of science, technology and innovation. Apart from generating knowledge, universities promote the formation of the human capital which enhances the country's competitiveness and productivity. That is, universities educate students at many different levels (from undergraduate to doctoral), generate knowledge through the rigorous work of research groups and doctoral programmes, disseminate knowledge through articles, books and academic conferences, and use this knowledge through the development of patents, specialized consulting and continuing education programmes. Recent evaluations made by the SNCyT found that universities have been the sector most strongly committed to the acquisition, creation and use of knowledge (COLCIENCIAS, 2009, p. 31), thus reinforcing the view that institutions of higher learning have the greatest ability to contribute to the consolidation of Colombia as a knowledge-driven society. In 2007, nearly 90% of the researchers and over 97% of the research groups that were active in the country belonged to universities; 84% of indexed journals were produced in universities; and over half of the resources used by COLCIENCIAS between 2000 and 2007 to fund research was given to universities (OCyT, 2008, p. 62, 70, 83, 118).

In sum, in Colombia there has been a significant change in the pursuit of building capacities to do research. The change is particularly noticeable in the increasing numbers of Ph.D. qualified faculty members in universities: in the National University, 27% of the faculty holds a doctorate; in the Universidad de los Andes, 53% (Bucheli et al., 2009); and in the Universidad de Antioquia, 20% (a 17 point increase from 1994).

WORLD-CLASS UNIVERSITIES: WHAT ARE THEY, AND WHY BUILD ONE IN COLOMBIA?

The term "world-class universities" has become, over the last decade, attractive and useful in relation to competing in a globalized market of higher education (Samil, 2009, p. 15), for they are recognized both by their academic peers and by their results. The two main sources of such recognition are two worldwide university rankings: the one produced by the Shanghai Jiao Tong University (SJTU), and the other that compiled for the Times Higher Education Supplement (THES)[1]. Thus, acceptance into this exclusive club of world-rank universities is not a result of self-proclamation, but rather, in the words of Samil, "the elite condition is bestowed by the external world based on international recognition" (2009, p. 15). This author suggests a more precise and manageable definition of world-class universities, claiming that the superior results of these institutions, such as highly sought-after graduates, cutting-edge research and technology transfer, are attributable to three main factors. First, a high concentration of human talent, both of professors and of students, second, a wealth of resources in order to offer advanced research and teaching opportunities and third, "appropriate governing characteristics that promote strategic vision, innovation and flexibility, and that enable institutions to make decisions and manage their resources without being hindered by bureaucracy" (2009, p. 19–20).

The international rankings are heavily based on academic output in refereed journals. With regards to SJTU, 60% of the score is related to publications indexed in the Science and Social Science Citation Index, whereas for the THES 20% is based on indexed publications and 40% is based on a peer review of research in different areas. In the short term, these scores can be affected by factors like 1) publications in the journals *Nature* or *Science*; 2) articles indexed by ISI or SCOPUS; and 3) the number of international students or faculty.

A different sort of classification, which is used primarily in the United States, is based on the guidelines set forth by the Carnegie Foundation. This classification "has been widely used in the study of higher education, both as a way to represent and control for institutional differences, and also in the design of research studies to ensure adequate representation of sampled institutions, students, or faculty"[2]. The emphasis of this classification is on the attributes that typify a research university. This category is defined by 1) the number of doctoral programmes in different disciplines; 2) the number of students who graduate within a given period; and 3) the research activities. According to the Carnegie Foundation, research universities can be either extensive (if they graduate 50 or more doctoral students per year in at least

15 disciplines) or intensive (if they graduate 10 or more doctoral students per year in at least three disciplines, or 20 doctoral students irrespective of the discipline).

In sum, the category "world-class" corresponds to the pursuit of a niche within the global market for tertiary education. It compels universities to develop capabilities to be competitive and internationally recognized as the best within that niche. The "research university" category is focused on the production and dissemination of knowledge, that is, on doctoral education and research.

Why and how would we build a world-class university in the Third World? Each country must be able to give meaning to what it understands as a world-class or research university, not just in the what, but also in the how it can be achieved. Some roads are well-trodden, but to follow others' footsteps without reflection might take us along unknown paths, away from the potential knowledge that might turn comparative advantages into competitive advantages for a nation. This requires a country to define the strategic lines, not the disciplines, which will take it along the desired path.

In Colombia, the trend or at least the intention has been towards the development of research universities. This has been, first of all, a state policy, for in the words of the Colombian Minister of Education:

> in research universities we seek the generation of knowledge that contributes to society at large through technical and social innovation through, for example, scientific publications and patents. At the same time, we should place the emphasis on doctoral education, mobilize external resources for scientific production and establish a great network of researchers. (Vélez, 2009)

Colombian universities have also shown signs of mobilizing and prioritizing resources towards the development of their institutions based on research. In this regard, the strategic development plans of all major universities, public and private, revolve around citing the promotion of research as the core of their mission. The National University's 2007–2009 plan states that "a fundamental step towards becoming a research university is to complete the full cycle of education, up to the highest degree" (Vicerrectoría de Investigaciones UNAL, 2007). Similarly, the Universidad de Antioquia (public) and the Universidad de los Andes (private), have incorporated research and the creation of knowledge as a key part of their institutional missions (Vicerrectoría de Investigaciones UNIANDES, 2008).

However, it is apparent that to achieve the status of research or world-class universities, Colombian universities need to increase the pace and scope of the structural changes that will allow them to produce and reproduce knowledge at the highest level.

THE NATIONAL UNIVERSITY OF COLOMBIA: ITS CONTEXT AND ITS CHALLENGES

The National University of Colombia has been at the undisputed centre of the academic tradition in Colombia. With a history spanning 140 years, a staff of nearly 3,000 professors, and over 43,000 students (38,000 undergraduate and

5,000 graduate), it is the largest and most important university in the country. It is truly national, being present in four of the country's main urban centres, as well as on three satellite campuses in some of the most remote areas of the country, ranging from the Caribbean to the Amazon. Created shortly after Colombia became an independent nation, it continues to offer high-quality education irrespective of social and economic backgrounds. Moreover, the university represents the largest and longest running effort of the Colombian people to build a nation through education and research, even under very difficult conditions.

Today, the National University stands as proof that the nation's dedication to the pursuit of knowledge, art and social service far outweighs the destructive power of a few. Even during periods of acute social strife, economic downturns and civil violence, it has remained open for the study of the widest range of academic disciplines, from classical studies to agronomy, from medicine to architecture. A melting pot of classes, diverse ideologies and regional origins, the university itself mirrors the country's deep struggles and is no stranger to political conflict. However, our campuses have been, and remain, bastions of free speech and dissent in a country in which political freedom cannot be taken for granted.

The university is also very closely monitored, being considered by many as the standard against which all higher learning in the country is measured. In other words, it sets the broader trends in higher education in the country, and at the same it carries the weight of great expectations. It is precisely because of this that it has to extend its mission as an engine of development and innovation, by setting higher targets so as to become an internationally recognized centre of research and teaching.

The following overview of the National University is focused on three issues a) the achievement and maintenance of quality of its academic programmes; b) research excellence; and c) financial support.

Quality Assurance

Colombia has 282 institutions of higher education (Figure 1), 81 public and 201 private, which offer 2,932 undergraduate and 1,934 graduate programmes (Figure 2). Among this very broad offering of tertiary education, the National University stands

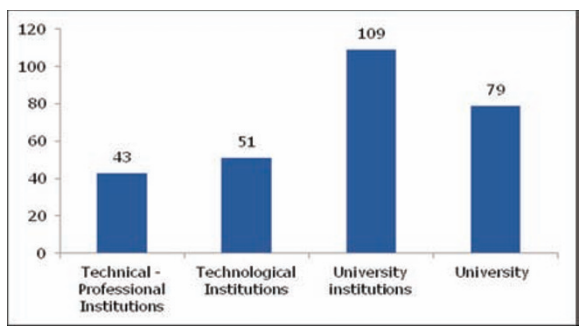

Figure 1. Number of institutions of higher education in Colombia, 2008.

Source: National System of Information of Higher Education in Colombia.

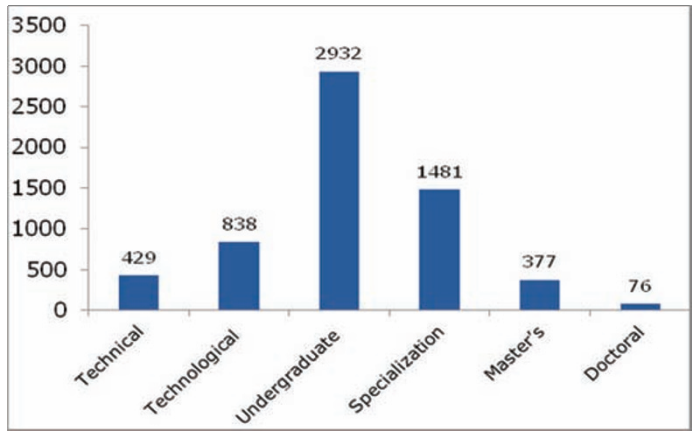

Figure 2. Number of educational programmes in institutions of higher education in Colombia, 2008.

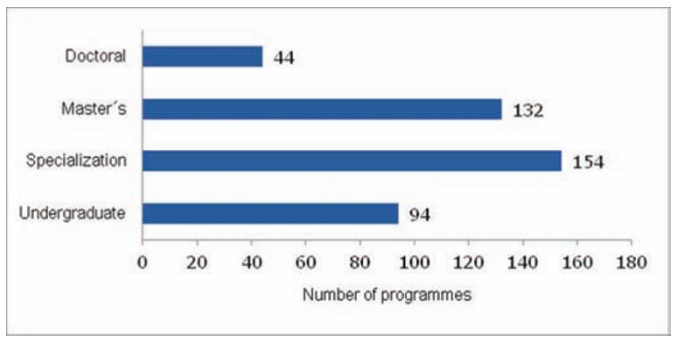

Figure 3. Number of academic programmes at the National University of Colombia, 2009.

out for its sustained effort to monitor and ensure the quality of its programmes and it is one of only 17 schools to have been certified by the Ministry of Education as high quality institutions (eleven are private and six are public). The parameters used by the National Accreditation Council (CNA) to assess the quality of undergraduate programmes are mission, students, professors, academic process, quality of life, administration, alumni, infrastructure and financial resources and this certification is given for a period of between four and eight years.

The university offers 352 academic programmes (Figure 3) and 75 of its 94 undergraduate programmes, across different fields, have been given the official quality recognition (Figure 4), which represents 80% of the total offer at this level over the last four years (Figure 5). According to this measure, our programmes represent 13% of the total number of programmes certified in the country (574).

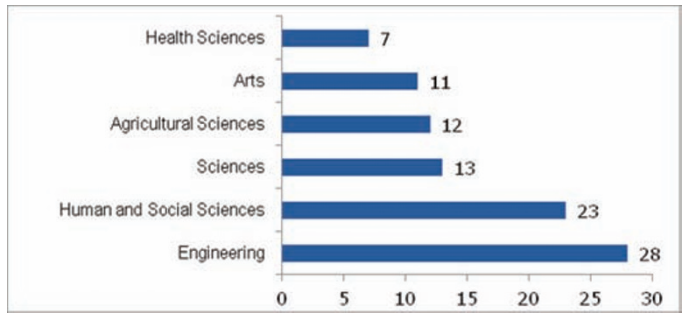

Figure 4. Number of undergraduate programmes by field at the National University of Colombia, 2009.

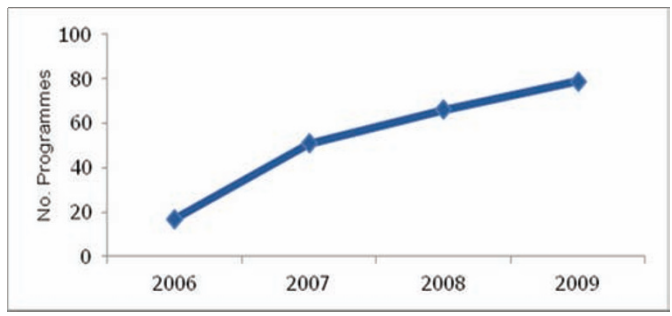

Figure 5. Number of undergraduate programmes at the National University of Colombia certified as high quality, 2006–2009.

In 2010, the university will embark on a process of evaluation and certification of 12 programmes based on the implementation of an ambitious improvement plan. An essential component of this plan, which was developed over the course of the last four years, is a curricular reform that establishes an academic credit system and increases the interdisciplinary and flexibility of the programmes concerned.

The university is also conducting an internal review of its graduate programmes, in tandem with the government establishing a national certification system. The evaluation model is based on the research activities and the graduation rate for each programme. In this regard, although the trend shows that there has been an improvement in the graduation rates in recent years (Figure 6), the number of doctorates granted is still very low for the National University (181) and for Colombia as a whole (489). The oldest Ph.D. programmes in the university are in philosophy, physics and chemistry (begun in 1989) and the fields with the highest number of Ph.D. awards are science and agricultural science (Figure 7). Finally, in an effort to increase the number of Ph.D. students in all fields, five years ago the university initiated a programme to support these students through scholarships and provided financial support for research projects (Figure 8).

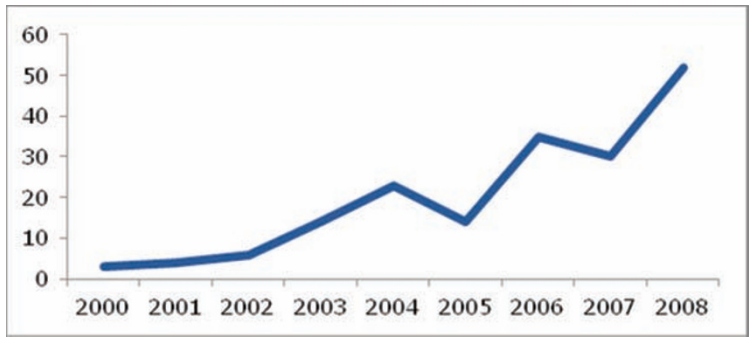

Figure 6. Doctoral degrees granted by the National University of Colombia, 2000–2008.

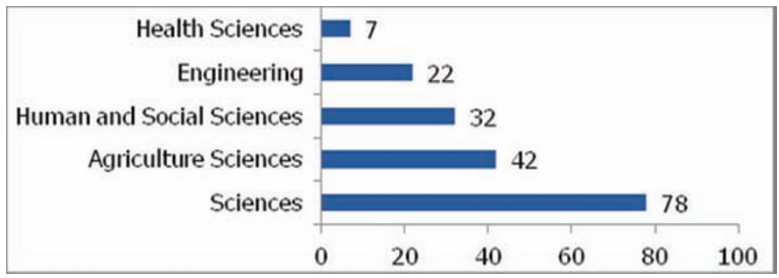

Figure 7. Doctoral degrees granted by the National University of Colombia, by field.

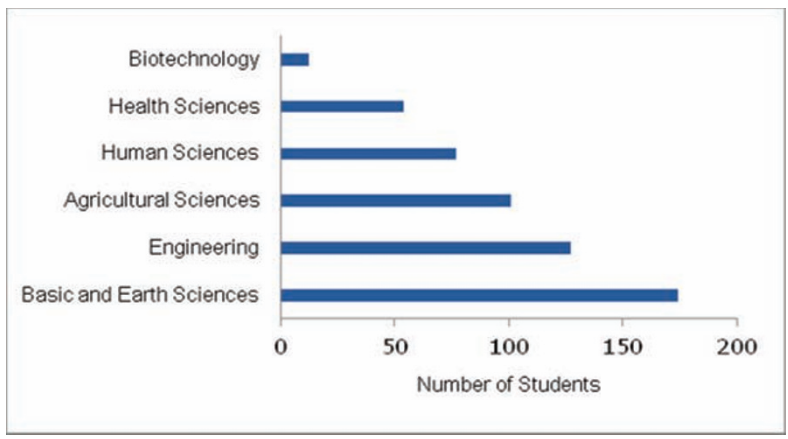

Figure 8. Doctoral students at the National University of Colombia, by field, 2008.

Research Excellence

The National University of Colombia is the major producer of original research in the country. According to the National System of Science, Technology and Innovation there are nearly 3500 recognized research groups, classified in four categories by research products (Figure 9) and of these, 479 belong to the National University, 91 of which have been classified in the highest quality levels (A_1, A), more than any other institution of higher learning in the country (Figure 10).

The quality of the faculty is another indicator of the university's research vocation. With respect to this, out of approximately 5,000 researchers with a Ph.D. working in Colombia, 855 are employed as full-time professors at the National University, mainly in the areas of natural sciences, engineering, and social sciences (Figure 11). In addition, of the university's 2325 full-time faculty 1,400 hold a master's degree as their highest qualification.

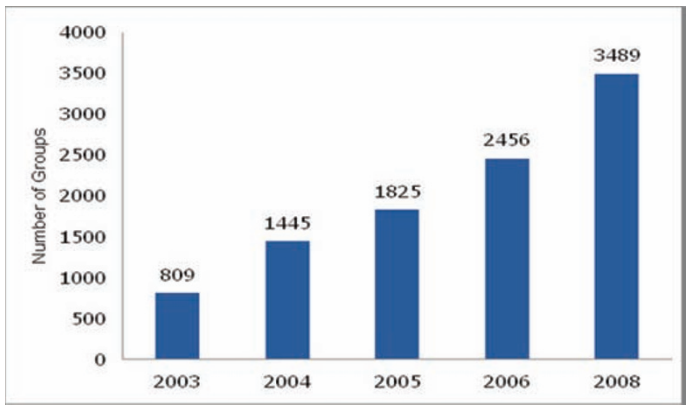

Figure 9. Number of research groups recognized by the national system of science, technology and innovation, 2003–2008.

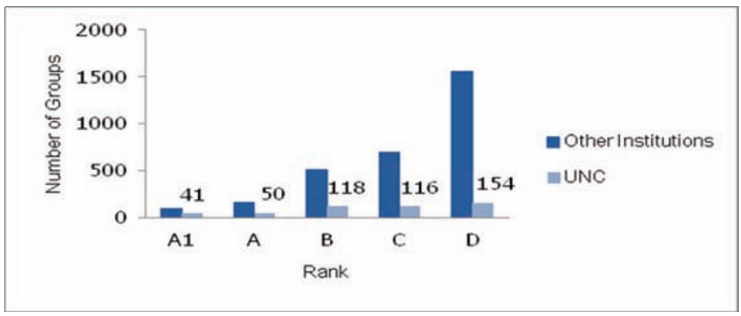

Figure 10. Number of research groups recognized by the national system of science, technology and innovation by category (A1 is the highest).

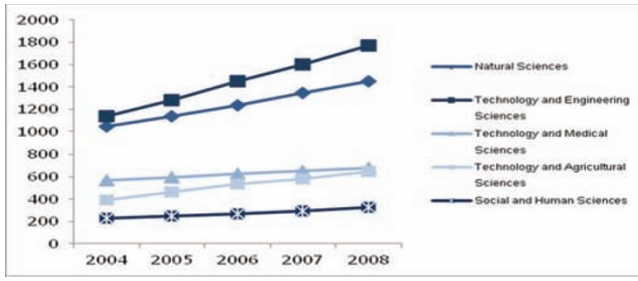

Figure 11. Number of researchers with a doctoral degree in Colombia by field of knowledge, between 2000 and 2008.

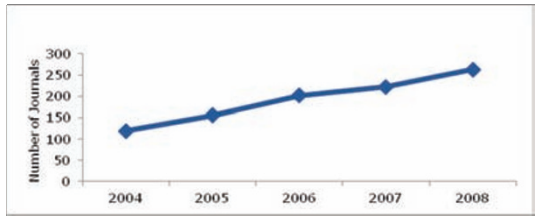

Figure 12. Number of Colombian scientific and technological journals in international indexes, between 2001 and 2008.

The National University has also played a key role within the recently created Research Centres of Excellence. In this regard, in 2005 the government opened a national competition to establish a network of research groups articulated around a common programme of work in scientific and technological fields considered strategic for the country. The basic criteria for establishing these centres are the national economic impact, the dynamism of the selected activities and scientific capacity, the ability to attract resources from international cooperation, the ability to train doctors and provide postdoctoral training and the relationship with international research peers. The university is actively involved in six of these ten centres, that is, CENM (Centre of Excellence in New Materials), CEIBA (Centre of Excellence in Modeling and Simulation of Phenomena and Complex Processes), GEBIX (Centre for Genomics and Bioinformatics of Extreme Environments), ARTICA (Research and Innovation Centre of Excellence "Regional Alliance of Applied Ticks"), CIIENN (Research and Innovation Centre of Excellence in Biotechnology and Biodiversity), and CIIEN (Centre for Research and Innovation in Energy).

Finally, the National University is one of the leading producers of publications in internationally indexed academic journals. Since 2003, the country started using a classification or indexing system for national journals that has stimulated the quality and the visibility of the products through international exposure (Figure 12). Although the majority of these journals are in the human and social sciences (Figure 13), the researchers with the greater number of cited documents comes from medicine, agriculture and the biological sciences (Figure 14).

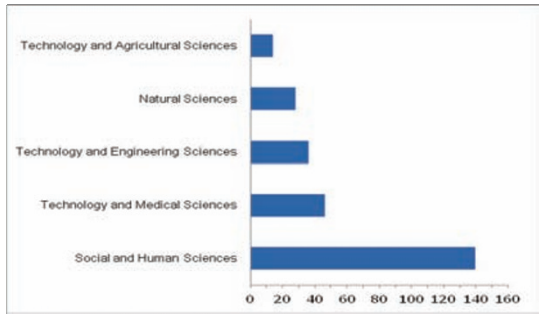

Figure 13. Number of Colombian Journals in international indexes (2008).

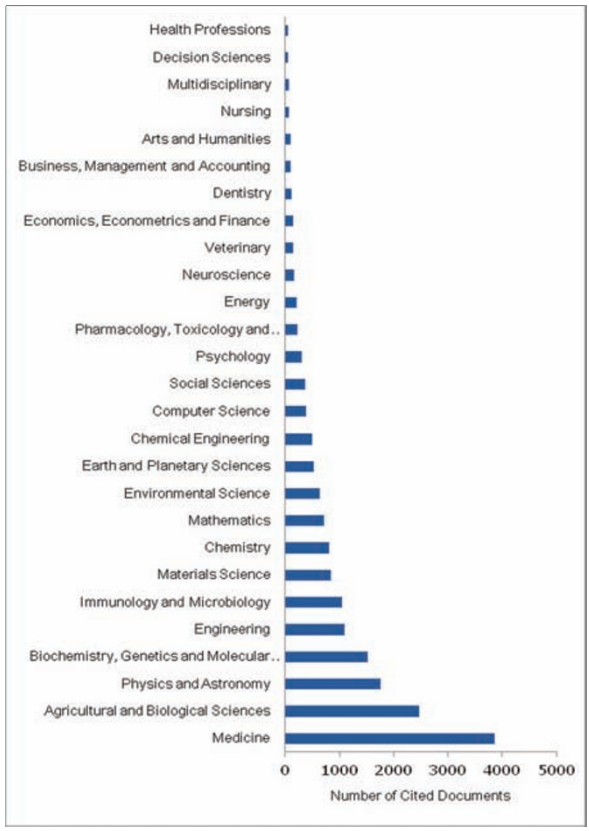

Figure 14. Number of cited documents of researchers in Colombia in international indexed journals, between 1996 and 2008.

Source: SCImago Research Group.

Financial Support

One of the greatest constraints to developing excellence in knowledge creation is limited budgets. In relation to this, the Colombian higher education system is not unique among developing (and developed) countries in that it faces financial difficulties and chief among the challenges confronting the National University is how to attain the goal of becoming a world-class university, in the context of dwindling state support and ever-increasing costs. The national budget allocated to education in Colombia corresponds to about 4.8 % of the GDP, with the net coverage rate for primary and secondary education being about 90% and that for higher education it is about 25%, although these trends are, as stated in the introduction, markedly different across regions. Additionally, the investment in research, as a percentage of the GDP, is 0.4% and the total budget of COLCIENCIAS now stands at about US$ 120 million, after substantial incremental increases in the last two years (Figure 15).

Although the National University of Colombia has the highest budget of any public university in the county, a mixed funding model has been applied to improve the development of the institution, which has enabled it to increase the total budget in the last three years (Figure 16A). In this regard, of the total current annual budget of the university (USD 500 million), 55% corresponds to government transfers, whilst 45% is mainly the result of external resources (Figure 16B), with tuition fees accounting for less than 4%.

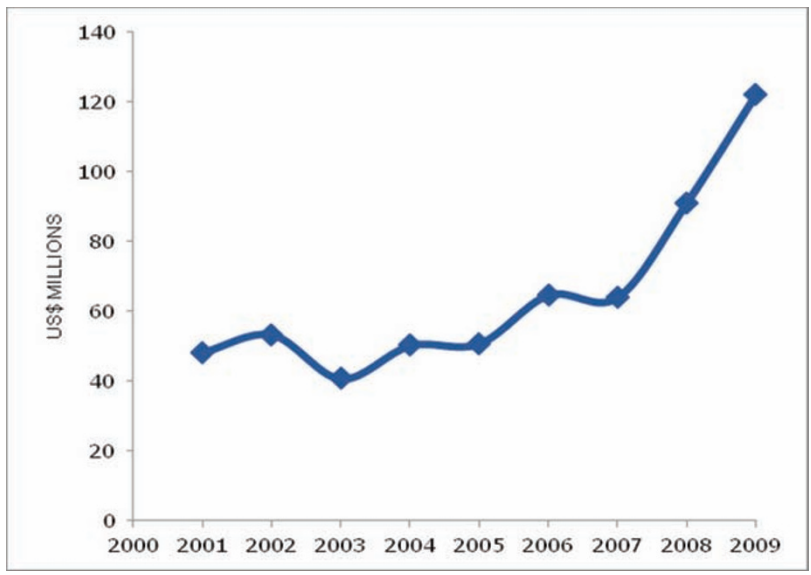

Figure 15. Budget of Colombian Administrative Department of Science, Technology and Innovation (COLCIENCIAS), between 2001 and 2009.

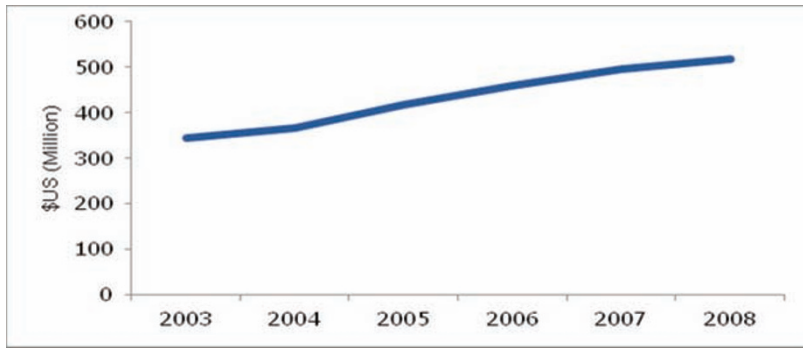

Figure 16A. Total budget of the National University of Colombia, between 2003 and 2008.

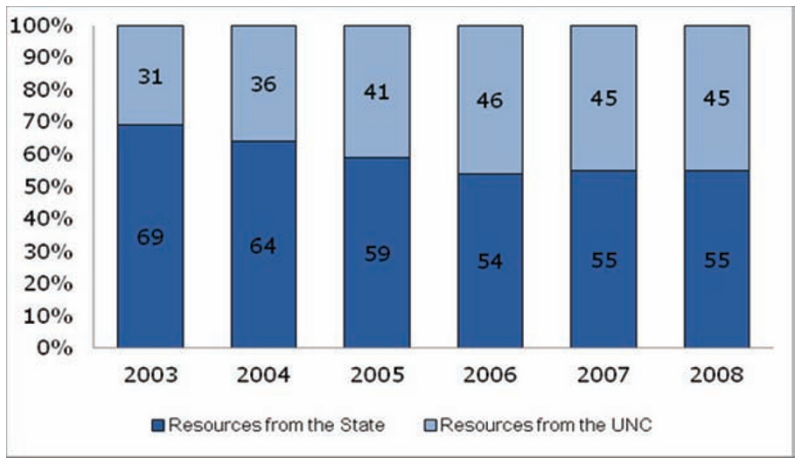

Figure 16B. Total budget of the National University of Colombia between 2003 and 2008: Percentage of resources provided by the state and resources produced by the university.

TOWARDS BECOMING A WORLD-CLASS UNIVERSITY: THE STRATEGY OF THE NATIONAL UNIVERSITY OF COLOMBIA

The institutional perspectives of building a university with international recognition, in the initial stage and in a complex environment, are based on international parameters. To this end, the National University is focusing on five broad strategies: a) internationalization, b) improving the qualifications of the faculty, c) funding for graduate study, d) increasing the number of international publications, and e) accreditation.

Internationalization has been built primarily through increasing the number of cooperation agreements with international universities, which has led to

improvements in the academic exchange of professors and graduate students (Figure 17). Traditionally, the university has made such arrangements with counterparts in Spain (59), France (41), the USA (33), Mexico (31) and Germany (29) and in 2008, it was able to increase financial support for academic interchange (122 visiting professors and 196 NUC professors at international events). As an institution, it participates in eighteen international networks, one being the Network of Macro-Universities in Latin America and the Caribbean (*Red de Macro-Universidades de América Latina y el Caribe*), which supports training grants for 23 UNC graduate students and joint research projects between several universities within the network.

Additionally, the university has a financial assistance programme with the DAAD (German Academic Exchange Service) to send professors to study for Ph.D.s in Germany. Moreover, this year the National University won an international competition of the DAAD for a Research Centre of Excellence in Marine Science in conjunction with the University Justus-Liebig of Giessen in Germany, being awarded € 1,479,488 that will be used to support a new Ph.D. programme to begin next year, in collaboration with another five universities in Colombia.

The second strategy has been to improve the qualification of the faculty through increasing the number of professors with a Ph.D. (Figure 18). With respect to this, in 2005 the university changed the academic regulations for professors, opening a national contest to recruit new professors with a doctoral degree and they also took action that led to an increase the number of foreign professors from to 135. In addition, this year 250 professors are studying for a Ph.D., mainly in universities abroad and by 2017, the university is expected to have 1500 Ph.D. professors, which will represent 65% of its academic staff.

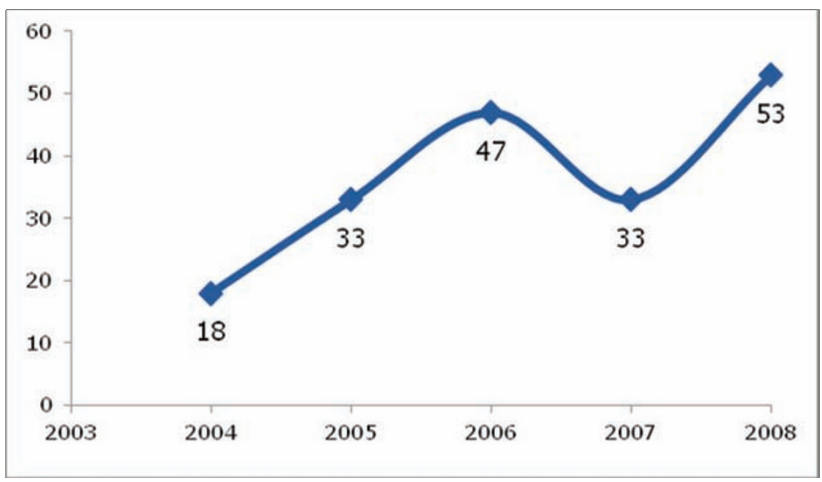

Figure 17. Number of new international agreements signed by the National University of Colombia, between 2004 and 2008.

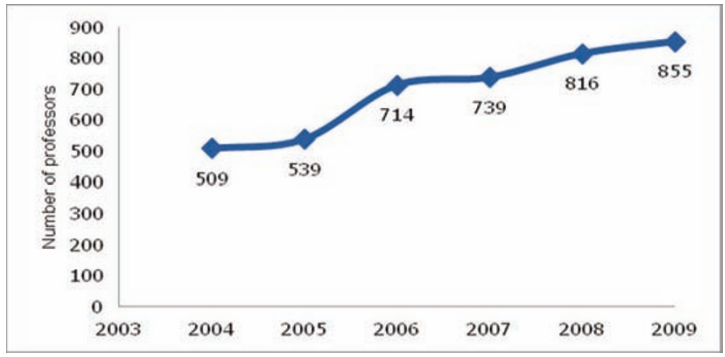

Figure 18. Number of professors with a doctoral degree at the National University of Colombia, between 2004 and 2009.

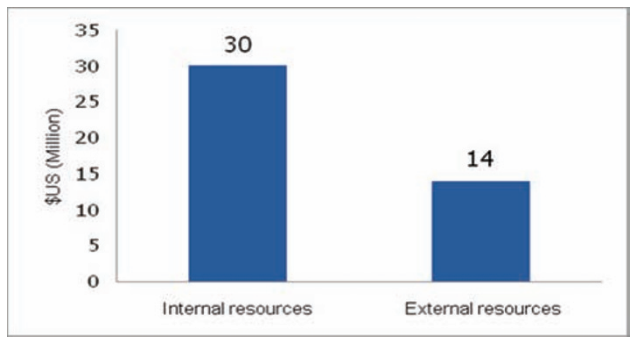

Figure 19. Financial support for research projects at the national university of Colombia (2007–2008).

A third strategy has been to increase the funding for research projects and scholarships for graduate students. In 2005, the university established a vice-rectory for research and a fund to ensure that 25% of the resources that are given by the government go to support research endeavours. In addition, this fund receives 6% of the external resources coming from extension activities. Moreover, the university encourages its researchers to send proposals to compete for national and international funding opportunities, so as further to increase the research activities (Figure 19).

In 2004, the National University established a scholarship programme for outstanding students on its Ph.D. and master's programmes, of which 70% are for the former and 30 for the latter (Figure 20). Furthermore, it is currently working to establish a scholarship system that will enable it to increase the number of scholarships with internal and external resources, with the goal of having, by 2010, at least 500 per year. In addition, COLCIENCIAS has a new financial programme to give 500 Ph.D. scholarships per year, for a period four years (2009–2012).

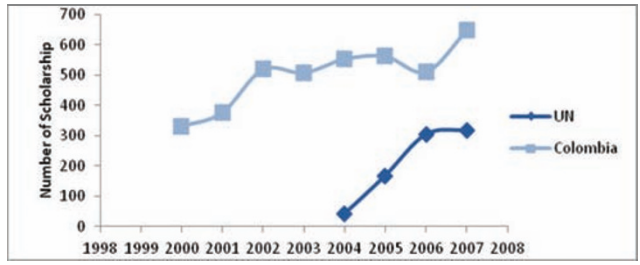

Figure 20. Number of scholarships provided to graduate students from a national agency (mainly COLCIENCIAS) and from the National University, between 2000 and 2007.

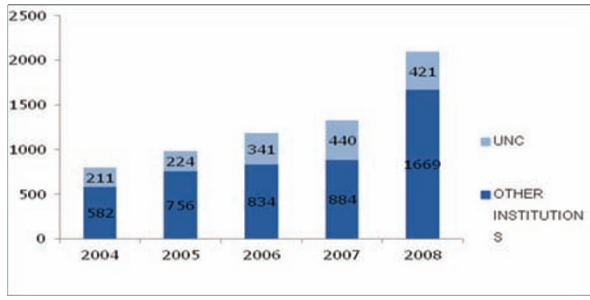

Figure 21. Number of papers in international indexed journals by researchers from Colombian institutions and from the National University.

The fourth strategy towards becoming a world-class university has been to increase the number of scientific papers in international and indexed journals. The salary of professors in a Colombian public university is established by law, and it increases in relation to academic production (books, papers, patents, etc.). Whilst this has had the positive effect of increasing the number of publications (Figure 21), the university recognizes that it still needs to improve the quality and the impact of its academic products. To this end, it is promoting a stronger evaluation process by academic peers for research proposals and unpublished books. Moreover, it is planning a special programme to improve the English language competencies of the faculty. Furthermore, in the last five years researchers from the university have received 90 international and 200 national awards and among their achievements are one publication in *Science* and four in *Nature* in the past six years.

The fifth strategy has been to achieve high quality international certification for all of the graduate programmes. With respect to this, architecture was the first programme certified by an international agency, The Royal Institute of British Architects (RIBA), a few years ago. This year, the university will submit its agronomy programme to the Iberoamerican Network for Quality Accreditation of Higher Education (RIACES), and it is planning a financial project to increase the number of international certifications for graduate and undergraduate programmes starting in 2010.

Finally, the university is carrying out strategic planning to develop the institution over the next ten years, in compliance with the government policy aimed at improving the quality of the universities throughout Colombia. In this regard, according to an institutional SWOT analysis, the National University still needs to improve its teaching and research labs, put in place a better administrative system, make longer strategic plans, develop the indicator system and connect more alumni to the university. Furthermore, although it is the largest university in Colombia, it needs to work hard to engage in more research, to attract a significant proportion of graduate students from different countries, and to generate more publications that have an impact upon the international academic community.

In conclusion, with suitable governance, better financial support and efficient management, the National University of Colombia expects to attract more resources and more academic talent to develop further and thus achieve international recognition in the near future.

NOTES

[1] Developed by QS Quacquarelli Symonds Ltd.
[2] http://www.carnegiefoundation.org/, retrieved 05/09/2009.

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