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Turning Academics into Researchers

The Development of National Researcher Categorization Systems in Latin America

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Abstract

Evaluation procedures play a crucial role in science and technology systems, particularly within academic career structures. This paper focuses on an approach to evaluation that has gained prominence in Latin America over the past four decades. This scheme assesses the individual performance of academics based on their academic activities and outputs and assigns them a 'researcher category,' which carries prestige and, in many cases, additional monthly rewards. Initially implemented in higher education contexts with limited research focus, these systems aimed to bolster knowledge production by involving more academics in research. In this study, we define National Researcher Categorization Systems (NRCSs) and distinguish them from other evaluation systems. Subsequently, we present a comparative analysis of NRCSs in seven countries, identifying common trends. Additionally, we discuss categorization systems within the broader context of strategies employed to incentivize academic research, and we explore the potential structural effects that arise when NRCSs assume a central role in a science system. Through our research, we have identified a family of systems in five countries (Mexico, Argentina, Uruguay, Paraguay, and Panama) that share a common history and structure. Furthermore, we emphasize that NRCSs may reinforce a traditional model of the academic researcher, potentially impeding the development of professional profiles aligned with research directed towards social objectives. In summary, our study sheds light on NRCSs, providing insights into their nature, comparative analysis across countries, and implications within the broader academic research landscape.

Keywords: National Researcher Categorization Systems; Latin America; Academic careers systems

1. Introduction

The development of academic science in Latin America has been closely linked to the trajectory of its universities (Vessuri, 1994). In general terms, a ‘professionalist’ Napoleonic model of higher education was historically favored in the region, in which universities were primarily oriented towards the training of professionals for the social and political life of the country, and only belatedly and subsidiarily did they begin to develop scientific research activities (Arocena and Sutz 2005). Although the creation of universities in Latin America can be traced back to the 16th century, it was not until the 20th century that their participation in the generation of scientific knowledge was systematically debated. In the 1950s and 1960s, research councils were created in most of the countries of the region under the auspices of UNESCO (Finnemore 1993). This gave a strong impetus to the promotion of research activities, which succeeded in consolidating international-level research activities in a handful of elite institutions. However, the professionalization of academics overall has been slow and remains incomplete, with many professors still working part-time in teaching-only positions (Torres and Schugurensky 2002; Marquina 2020). In the Latin American context, research activities have traditionally been considered "an add-on" to the fundamental mission of the university dedicated to teaching. This is true even in a context in which research and development (R&D) budgets and the number of government agencies dedicated to science, technology, and innovation (STI) have grown over the years.

In the context of higher education systems with these characteristics, specific science policy instruments were designed by national governments in order to promote research activities and to create or consolidate a national scientific community (Galaz Fontes et al. 2009; Gil Antón 2013). In this paper, we will introduce the concept of ‘National Researcher Categorization Systems’ (NRCSs) to refer to a set of systems that serve this purpose. Originally, most of these instruments were conceived as a form of merit-based payment systems, in which academics who carried out quality research received a salary supplement (Galaz-Fontes and Gil-Antón 2013). However, over the years, their structure became more complex and they eventually contributed to the structuring and internal hierarchization of the scientific communities of their countries.

Our research was prompted by the realization that this type of system, which assigns individual researchers a category through a national assessment process, is common in Latin American countries, but not frequently encountered in other regions of the world. This article is concerned with describing the characteristics of this type of system and offering a definition that encompasses them. This will also help to differentiate them from other science policy and research evaluation instruments that are more prevalent in other regions of the world and highlight some specific challenges of Latin American science systems.

Individually, these systems have been the subject of numerous analyses from the field of higher education, STI policy, and research evaluation. These include studies on the

Mexican (Didou and Etienne 2010; Neff, 2018; Sandoval-Romero and Larivière 2020), the Argentinian (Sarhou, 2016a, 2016b; Beigel and Bekerman, 2019), the Colombian (Rodríguez Sánchez 2017; Piñeres Sus, Vélez Cuartas and Montes Sepúlveda 2017), the Brazilian (Wainer and Vieira 2013; Gonçalves 2020), the Panamanian (Murillo-González, Zapata and López 2023), the Paraguayan (Aboal and Tacsir 2017) and the Uruguayan case (Bianco, Goñi and Tomassini 2014; Vasen and Sierra 2022). Nevertheless, there are still no comparative studies that analyze this phenomenon jointly and systematically.

The objective of this paper is therefore to provide an overview and describe the structure of these systems and the characteristics of the recognition and rewards offered to the participating academics. In addition, we will discuss the effects that these programs may have on the structure of the science and technology systems of each country. We seek to answer the following questions: How is the evaluation of academics organized in Latin American countries? Is there an approach to researcher categorization that is distinctive to the region? What features do the systems analyzed have in common? What structural effects are they likely to induce?

After this brief introduction, we present some theoretical inspirations from the fields of higher education and science evaluation studies, which have informed the construction of the questions and the organization of our analysis. In the third section, we introduce a working definition of NRCSSs and explain how they differ from other types of research categorization and evaluation systems that have been described in the literature. We also discuss why it is important to analyze them in the context of research evaluation systems and practices, and not to consider them merely as merit-pay systems for academic careers. In the fourth section, we present the methodology and results of the analysis carried out on the seven main systems currently operating in the region. In this context, we present some shared characteristics and identify a family of systems with distinctive features. Finally, we introduce some additional issues for discussion regarding how these systems may shape academic careers and the STI systems in which they are embedded.

2. Perspectives on research evaluation systems

In the context of massive growth in enrolment and subsequent state policies that regulate the functioning of higher education systems and institutions, university researchers have been the primary focus in the analysis of recent changes (Marquina, 2000). Particularly, the introduction of new forms of research evaluation procedures has altered significantly the research evaluation agenda, expanding the diversity of policies analyzed (Thomas et. al. 2020).

The systems analyzed in this article should be understood as part of the new role assumed by the State in relation to university research and researchers globally. The rationale of 'new public management', has entailed the implementation of a series of performance measures to monitor and evaluate the performance of universities, departments, research units, study programs, and academics (Leišytė, 2022). In this context, since the 1980s,

states have implemented Research Evaluation Systems (RES), understood as “organized sets of procedures for assessing the merits of research undertaken in publicly-funded organizations that are implemented on a regular basis, usually by state or state-delegated agencies” (Whitley and Gläser, 2007: 6). However, although RES implemented in different countries share some characteristics, they also differ widely.

When designing RES, national governments were faced with multiple choices. One of the issues discussed was the introduction of centralized evaluation procedures. Some systems were created to reduce favoritism and inbreeding in universities and thus, include a centralized evaluation phase as a prerequisite for applying for tenured positions in universities. This is the case of accreditation systems in Spain (Sanz-Menéndez and Cruz-Castro, 2019) and habilitation in Italy (Abramo and D’Angelo, 2015).

Other research evaluation systems may differ in their unit of evaluation. For instance, there are schemes, like the *sexenios* in Spain, that assess research at the individual level. (Sanz Menéndez 1995; Cabezas Clavijo and Torres Salinas 2014), the National Research Foundation (NRF) Rating in South Africa (Callaghan 2018), and the classification of researchers in New Zealand (Middleton 2009; Cupples and Pawson 2012). Systems of accreditation (Sanz-Menéndez and Cruz-Castro, 2019) and of habilitation (Abramo and D’Angelo, 2015) also involve evaluations at the individual level. In addition, evaluations could be applied to a whole institution such as performance-based research funding systems (PBRFS) (Hicks, 2012; Zacharewicz et. al. 2019).

RES could also differ in the information they use as input, in their assessment procedures, and in the information they produce. RES can be classified based on whether they employ a formula, metrics-based peer review, or peer review exclusively (Gläser et. al. 2010). While most systems use peer review, some place greater emphasis on the use of indicators such as Australia, Germany (at the level of federal states), Ireland, Norway, Belgium (the Flemish region), and Italy (Gläser et. al. 2010). The use of metrics is not only related to reducing costs and time. Metrics are regarded by scholars as a legitimate and integral component of research assessment across various review contexts and fields of study (Langfeldt et al. 2021). In the context of recruitment, the use of peer review and metrics is also affected by the structure of the process and disciplinary cultures (Reymert 2021).

Systems may also differ regarding the use made of the evaluation results. Molas-Gallart (2012) identifies three main possibilities. The first one is connected to the distribution of resources among the potential beneficiaries of a specific policy or program. The second one has an improvement role. In this case, the system seeks to provide information on past activities to make modifications to certain aspects in future implementations. The third one has a controlling function. Here the aim is to control how organizations and individuals use public resources to carry out their activities and thus achieve public policy objectives. It focuses on direct auditing of how resources are employed.

RES have also been classified between weak and strong, according to two dimensions (Whitley and Gläser 2007). On the one hand, they are classified according to certain characteristics: (i) structure and governance, (ii) frequency of calls, and (iii) level of

formalization, standardization, and transparency. On the other hand, they analyze each RES based on its consequences for the financing of research in public sciences, both due to its direct impact on the allocation of resources and the share of funding that is affected by them. According to the combination of characteristics and impact, RES are labeled as either weak or strong. Weak RESs have a low degree of transparency as they are organized informally by funding agencies and/or university consortia with little standardization of the procedures or criteria used. They rarely publish their results, which are usually intended to promote organizational improvement and thus be formative, rather than judgmental for summative evaluation. Strong RES, on the other hand, are implemented regularly, with a high degree of institutionalization, and according to highly formalized rules and procedures. In general, the evaluations in strong RES present a high level of standardization, and the results are published immediately and publicly so that the position of the universities, departments, groups, and researchers can be easily determined.

What all these different systems have in common is multiple-level competition. This means that individual and collective actors are simultaneously engaged in various nested and interdependent competitions, in which they strive for material and symbolic resources that they perceive as scarce. As a result, the interplay of these individual competitions gives rise to a complex system of demands and rewards, shaping both the actors within higher education and the higher education system itself (Krücken 2021).

Competition also takes place globally between countries and world regions in the global science system (Beigel, 2014). Although the different research evaluation systems are governed by their own principles and rules, in recent years there has been a global convergence towards a single way of assessing and measuring the quality of academic activities or products (Vessuri, Guédon and Cetto 2014). The negative consequences of a naïve use of academic productivity and impact metrics based on global citation databases such as Scopus or Web of Science have been widely documented (Larivière and Sugimoto 2019). In turn, in the human and social sciences, the effects of the use of standardized metrics are especially problematic (Vasen and Lujano-Vilchis 2017; Giménez-Toledo 2018).

Another challenge generated by standardizing tendencies is their impact on the ability of science policies to direct knowledge production toward issues of national relevance. The evaluation guidelines used within standardized evaluation schemes can have performative effects and function as "signals". They indicate what a researcher is expected to do in order to be promoted and advance in their academic career (Bianco, Goñi Mazzitelli and Tomassini 2014). Each system includes national and regional specificities, creating national evaluation cultures, and even differentiated recognition circuits within the same country (Beigel 2014; Beigel, Gallardo, and Bekerman, 2018; Reymert, Jungblut, and Borlaug 2021; Reymert 2021; Kulczycki 2023). But even in this context, evaluation criteria and forms of measurement have become increasingly homogeneous and could push research agendas that follow the topics most likely to be published in journals indexed in major databases. This could result in the neglect of topics of local relevance

and lead to inconsistencies within the national or global research system (Bianco, Gras, and Sutz 2016; Krawczyk and Kulczycki 2021; Kreimer 2011).

In this section, we have reviewed many different aspects that can be employed to describe evaluation systems, such as the level of centralization, the unit of evaluation, the type of information used as input and that is produced by the process, or the impact that can be appreciated from the implementation of global and standardizing practices. In the following section, building on these insights, we will characterize the approach to researcher categorization that has been developed in Latin American countries.

3. National Researcher Categorization Systems

As mentioned in the introduction, this paper aims to survey the different researcher categorization systems that have emerged in the Latin American region in recent decades. In this section, we first present a working definition of the concept and then distinguish this instrument from others that share some similar characteristics.

We define National Researcher Categorization Systems (NRCSs) as policy instruments that aim to classify and recognize the individuals who conduct scientific research in a given national context¹. They intend to identify the academics who are actually involved in research activities, as opposed to those who do it half-heartedly or only pretend to engage in them.

The following six characteristics are shared, to a greater or lesser extent, by the different systems on which this study focuses.

- (1) **Complementarity.** The system does not offer a primary source of employment. It is a complement for someone who already holds a position in a university or research institution.
- (2) **Hierarchy.** There are different levels within the system, according to the degree of experience and professional development of the researcher.
- (3) **Centralization.** The evaluation of applications is carried out in a unified way at the national level and organized according to disciplinary areas.
- (4) **Focus on research.** Although other activities such as university teaching, extension, knowledge transfer, or leadership may also be considered, the evaluation is focused on research activities and outputs.
- (5) **Recognition.** The system provides its members with both symbolic and/or financial recognition.
- (6) **Transitory nature.** Membership has limited temporal validity, and there is no long-term stability associated with them.

¹ Categorization can be considered a basic step in all evaluation practices. It involves determining in what group the entity under consideration belongs (Lamont 2012). This aspect is particularly explicit in the systems analyzed in this article, in which researchers are classified into different levels or categories.

We believe that it is necessary to introduce the concept of NRCSs since they have significant differences from other approaches to evaluating academics that have already been described in the literature. To further understand their distinctiveness, NRCSs can be distinguished from: (a) academic career systems, (b) habilitation/accreditation systems, (c) competitive project funding, and (d) cash-for-publication schemes.

It should be noted first that NRCSs do not constitute standalone forms of employment, but rather are an "add-on" to the traditional academic career (Teichler et. al, 2013). Unlike career systems, NRCSs operate at a national scale and focus almost exclusively on research activities.

Secondly, NRCSs should be distinguished from the accreditation/habilitation schemes found in Spain and Italy (Sanz-Menéndez and Cruz-Castro 2019; Abramo and D'Angelo 2015). In those countries, all academics applying for a position as tenured professors need to obtain a credential from a centralized national assessment agency. Although both NRCSs and accreditation schemes evaluate the individual performance of academics in a nationwide centralized fashion, there are substantial differences between them. While accreditation systems apply only to hiring and promotion, NRCSs provide regular monitoring of the careers of academics. Finally, most NRCSs provide financial incentives to beneficiaries, whereas accreditation does not offer monetary rewards but rather grants the applicant eligibility to participate in a competitive selection process.

Similarly, NRCSs should not be confused with project funding (Spinello et. al. 2021). Although in some cases, NRCS categorization may be associated with the execution of a specific project, funding provided by these systems is fundamentally intended as a professional stimulus or "salary bonus" rather than as funds to carry out research.

Finally, it is also necessary to distinguish NRCSs from other instruments that give rewards to individual researchers based on their research achievements, such as publication awards. These cash-for-publication schemes are common in countries such as China, where they predominate at the institutional level (Quan, Chen and Yu 2017; Xu, Rose and Oancea 2019), or Turkey, where there is a national program (Yuret 2017, Tonta 2018). The fundamental difference between NRCSs and these incentive schemes lies in the object and scope of the support. While NRCSs evaluate the past track record of researchers and their future research potential and award a category for a certain period of time, cash-for-publication schemes are linked to specific publications.

A last point we would like to highlight is that there are a few systems that could be regarded as NRCS in other regions of the world outside of Latin America. The most similar systems, that perform a centralized classification of researchers can be found in South Africa, Spain, and New Zealand. The National Research Foundation (NRF) Rating in South Africa classifies researchers into five categories based on a centralized procedure, and then universities can choose to award those scholars categorized by the NRF with financial or symbolic recognition (Callaghan 2018). In Spain, the *sexenios* system centrally grants recognition to academics who have met certain minimum research goals in the six years before the postulation. It is a distinction that is either awarded or not, rather than a system with different levels (Sanz Menéndez 1995; Cabezas Clavijo

and Torres Salinas 2014)². In the case of New Zealand, through the Performance Based Research Funding (PBRF) system, academics are classified into four categories based on their past performance in research. The results of this categorization have an important weight in defining the funding universities receive from the Ministry of Education, but it does not impact the personal income of academics directly (Middleton 2009, Cupples and Pawson 2012).

Out of these three, the South African NRF Rating is probably the closest to the definition of NRCSs since its main objective is not the competitive financing of institutions and aims rather at individual recognition. The Spanish *sexenios* program departs from our definition of NRCSs in the sense that it does not have levels or categories and is rather a binary system. Finally, in the New Zealand PBRF, the individual classification of researchers is carried out as a mechanism for the competitive allocation of budgets to universities. It can be better understood as a performance-based research funding system, closer to the European cases described by Hicks (2012) and others.

4. National Researcher Categorization Systems in Latin America: mapping and analysis

The realization that there are systems of categorization of researchers with strong similarities in many Latin American countries led us to carry out a systematic review of the characteristics of these systems and their distribution in the region. In the previous section, we provided a preliminary definition and distinguished NRCSs from other types of research evaluation. In this section, we present the results of the empirical analysis conducted.

4.1. Materials and methods

The authors conducted a detailed review of the academic literature on science policy in the region, as well as national and international information portals, such as *poiticascti.net* run by the Organization of Ibero-American States (OEI) or UNESCO's *GO-SPIN* platform.

The first stage of the work resulted in the identification of 10 systems that aim to classify researchers at a national level, located in Argentina, Brazil, Colombia, Mexico, Panama, Paraguay, Peru, Dominican Republic, Venezuela, and Uruguay. Except for Ecuador³,

² *Sexenios* should not be confused with the accreditation scheme that also exists in Spain and was commented earlier in this section.

³ In Ecuador, the Secretariat of Higher Education, Science, Technology and Ancestral Knowledge (SENESCYT) establishes general requirements for hiring and promotion within university academic careers, which include criteria for assessing research. This is closer to the accreditation/habilitation schemes described in the previous section and therefore, we decided not to include it in our analysis. In Chile and Costa Rica, researchers are assessed primarily through their own institutions, without the intermediation of

Chile, and Costa Rica, researcher categorization schemes are present in all the countries of the region with a functioning science system.

After a more detailed review, we decided to exclude from our analysis the systems of Peru, Venezuela, and the Dominican Republic, and focus on the other seven⁴. In the case of the Dominican National Researcher Career and the Peruvian National STI Register, systems are very recent and not sufficiently consolidated. In the case of the Venezuelan Researcher Promotion Program (PPI), the system has not been updated in recent years and is severely underfunded, and almost non-functional.

Based on the literature on research evaluation and our previous knowledge of the administrative procedures in Latin American science systems, we identified nine characteristics that could help us understand the structure and the variations that can be found within researcher categorization systems: (a) Name of the system, (b) Managing institution, (c) Year of creation, (d) Frequency of calls, (e) Level or categories of researchers, (f) Benefits provided (economic and symbolic) (g) Size, (h) Disciplinary organization, (i) Quotas. Table 1 provides a comparative summary of the main features.

The first three characteristics are essential for placing any system in a historical and institutional context and identifying policy transfer processes. The remaining six characteristics are related to the structure and governance of evaluation systems (Whitley and Gläser, 2007; Hicks, 2012). The frequency of calls, the number of levels or categories, and size can help explain features related to the structure, while the benefits provided, disciplinary organization, and quotas enable us to analyze governance. Additionally, the nature and magnitude of the benefits provided, along with the implementation of quotas, can serve as indicators of the growing competition that can be observed at multiple levels within higher education systems (Krücken, 2021).

Data was collected in two stages during 2021. First, official documents were compiled through official web pages. Freedom of Information requests were filed in Mexico, Brazil, and Argentina with the agencies responsible for the management of the systems. This information was complemented by other data that was available in the secondary literature.

In the second stage, in each country, a key informant was identified who could confirm the information found or expand on it if necessary. Through them, we were also able to access additional documents, especially in countries in which Freedom of Information procedures are not in place or not easily accessible. This interaction took different forms (videoconference, email, instant messaging), according to the preference of the informant.

The results were systematized in the form of factsheets, which were then made available to the public on the project's website. The official documents of each system and selected

a centralized national system. Regardless of this, other standardized assessment procedures might be in place at other levels, for example, to receive funding for prestigious projects (e.g., FONDECYT in Chile) or cash-for-publication incentives (Ramos Zincke 2021). In the case of Chile, there is also a powerful institutional-level accreditation system for universities.

⁴ We are aware of the methodological limitations of a study where cases have been selected according to the dependent variable. Our present work is primarily exploratory. In contrast, a study that aims to identify the causal effects of the existence of NRCSs should include countries that do not have these systems in its sample.

secondary literature selected that illustrate each case can also be accessed through the website⁵. Based on the factsheets, we performed a comparative analysis, which sought to identify common trends and system-specific characteristics.

Table 1. Main characteristics of the NRCs analyzed

Source: Prepared by the authors based on data from national STI councils.

	Brazil	Mexico	Colombia	Argentina	Panama	Uruguay	Paraguay
Program	Productivity scholarships	National Researchers System (SNI)	Research group and researcher measurement model	Teacher-Researcher Incentive Program (PROINCE)	National Research System (SNI)	National Researchers System (SNI)	National Incentive Program for Researchers (PRONII)
Managing Institution	CNPq	CONACYT	MINCIENCIAS	SPU-ME	SENACYT	ANII	CONACYT
Year of creation	1976	1984	1990	1993	2007	2007	2011
Frequency of calls	Annual	Annual	Biennial	Quadrennial	Annual	Annual	Annual
Number of levels (including emeriti)	6	5	4	5	5	5	5
Monthly economic benefit (USD)	210-288	425-1990	None	1.5-6	900-2000	182-365	258-1330
Size	16,759	33,165	21,094	59,663	202	2,034	566
Disciplinary areas	39	10	6	19	5	8	4
Quotas	Yes	No	No	No	No	No	No

⁵ The website address is : <https://impactoabierto.org/mapa/> [Materials available in Spanish]. Documents used as sources included:

- Argentina: Decree of creation, Manual of Procedures, Evaluation criteria document (2014), and data provided as result of the FOI request
- Brazil: Terms of national scholarships, description of productivity grants (rn-016-anexo 1), benefit table for CNPq scholarships, call for research productivity grants (2020), call for technological development productivity grants (2020), division of disciplinary areas in CNPq, compiled assessment criteria document for research productivity grants, and data provided as a result of FOI request.
- Colombia: Call for Applications Measurement Model 2021, and Annex of the Call for Applications (includes criteria and formulae for assessment of groups and individuals).
- Mexico: official website, SNI regulations, official comment on 2021 modification of SNI rules, criteria document (one for each of the 5 thematic áreas, and one for the technology commission), and information provided as a result of FOI request.
- Panama: official website, current rules, evaluation criteria, call for applications 2020, and information provided through interaction with SENACYT officials.
- Paraguay: official website, PRONII rules and procedures, and criteria documents (4 in total, one for each area).
- Uruguay: official website, law of creation, SNI rules and procedures, criteria document, and ANII monitoring report.

4.2. Goals and objectives

The objectives for the creation of the systems mentioned in official documents have many similarities. All of them refer to the importance of consolidating research activities in the national territory. In many cases, the need for greater dedication to research by faculty members of higher education institutions was also behind the creation of the system. It should be recalled that in Latin America there is a strong professionalist tradition in universities, and a great share of the academic staff is devoted to teaching undergraduate courses on a part-time basis. The idea of consolidating an integrated career of teaching, research, and service was evident in the creation of PROINCE in Argentina. This initiative introduced the term *docente-investigador* [teacher-researcher] in its official documents to describe academic personnel who were previously referred to as *docente* [teacher, instructor], likely drawing inspiration from the French term *enseignant-chercheur* (Vaccarezza, 2000).

In most cases, the discussions on the need to increase academics' dedication to research were linked to salary issues. In the 1980s in Mexico, in a context of high inflation and brain drain, the creation of SNI was a means of supplementing university wages and simultaneously demanding greater dedication to research.

Colombia was an exception in this respect since there was never an economic dimension directly attached to the system. The systematization of information on R&D activities carried out in the country appears as one of the most important objectives of this system. Originally, it was aimed only at classifying research groups and centers, and only later did it include the categorization of individual researchers.

In countries with smaller scientific communities such as Paraguay and Panama, systems are oriented toward the generation of a critical mass of individuals involved in research. Universities in these countries do not provide enough salaries and academics need additional incentives to dedicate time to research. In these countries, NRCSs have offered significant economic rewards. In the case of Uruguay, although its size is comparable with Paraguay or Panama, the scientific community has a greater degree of maturity (Davyt 2011). Even there, the creation of SNI was based on the need to find ways of incentivizing research activities within the framework of the academic career.

4.3. Structure and operational procedures

In general terms, the systems operate according to the following model. A scholar first obtains a teaching position at a university or research institute and then applies to join the NRCS of his or her country. For this purpose, they are evaluated by national review panels organized on a disciplinary basis. Based on the academic past performance of the applicants, they may be admitted into the system and granted a certain category. Assessment criteria value research outputs over teaching, extension, dissemination, or

technology transfer activities. If admitted, membership granted is valid for a period of three to ten years, depending on seniority and the rules of each system. Once the term has expired, it is necessary to submit a new application to ensure permanence or request promotion. If the application is denied, the researcher loses the monthly reward and all the strategic perks associated with membership. In this sense, there is no tenure or job stability within the system.

In what follows we analyze the variations on this basic model that we found in our study. The information is organized according to the six characteristics presented in the definition of NRCSs in the previous section: complementarity, hierarchy, centralization, focus on research, recognition, and transitory nature.

Complementarity

NRCSs are not standalone career systems, i.e., they do not directly employ researchers. Their structure is rather complementary since they offer rewards that are added to the base salary of each academic. Rewards are paid as a tax-free bonus by a national institution and not by their direct employer.

Each national system has differential minimum requirements to fully access the economic benefits. In Mexico, only those who have a permanent or semi-permanent position in a public research institution can receive the salary supplement. Professors from private universities were first excluded and later included, only to be excluded again in 2021. They have taken legal action against CONACYT and justice has ruled in their favor in 2022, and have recently regained access to the benefit.

In Argentina, in order to receive the financial reward, the member must also be involved in a research project that meets certain requirements. In addition, only those who have been categorized and work at least 20 hours weekly in a national university receive the economic reward (in 2021 only 36% of the 59,663 categorized academics received the benefit).

In Panama and Brazil, the applicant must be affiliated with a public or private institution that conducts research. In Panama, the applicant must also commit to dedicating 26 hours per week to R&D tasks. In the case of Uruguay and Paraguay, the requirement is to demonstrate participation in research activities in the country, without further details regarding the contractual relationship with the main institutional affiliation. In Colombia, an institutional endorsement is needed to be evaluated as a group, or as an independent researcher. Universities verify the link between the researcher and the institution and do not generally endorse applicants that do not have a contract.

The relative importance of NRCSs within the science and technology system of each country is also variable. In absolute terms, the Argentine is the largest system with 59,663 members, followed by the Mexican SNI with 33,065 members, the Colombian with 21,094, and the Brazilian with 15,551. Among the smallest systems, we find the Uruguayan with 2034 members, the Paraguayan with 566, and the Panamanian with 202. Although the size of the NRCS is somewhat proportionate to the size of the scientific system in each country, some particularities can be recognized. For instance, the Brazilian

system is particularly selective and comprises a smaller percentage of the country's researchers than, for example, the Uruguayan or Argentinean systems. The lack of reliable and comparable statistical information on the total number of full-time academics in each country prevents more accurate comparisons.

Hierarchy

Depending on their academic background, applicants may be admitted into the system and granted a certain category. NRCSs have established between four and six levels. Except for the systems implemented in Argentina and Brazil, the other structures include the category of emeritus researcher. In some countries, such as Uruguay, Colombia, Argentina, Uruguay, and Paraguay, the initial categories can accommodate academics who are still pursuing postgraduate studies, while in Mexico and Brazil, a doctorate is a requirement for entry into the lowest category. In the case of Panama, there is a program of postgraduate scholarships that maintains a direct link with the SNI. In other countries such as Argentina, Brazil, or Mexico, there are postgraduate scholarship systems, but with a less direct connection to the country's NRCS.

Four of the seven systems analyzed (Mexico, Colombia, Uruguay, and Paraguay) incorporate forms of participation for researchers who have left the country and live abroad, in an attempt to take advantage of scientific diasporas and brain circulation. In no case does this participation give the right to an economic reward, but it does allow more fluid participation in the country's scientific activities for those residing overseas.

Some systems incorporate other levels of evaluation in addition to the individual. In the case of Colombia, its NRCS was oriented at first to research groups and only later began to categorize individuals. In the case of Panama, the system's regulations also contemplate the classification of research groups and centers, but currently, only the categorization of individuals is operative. It is worth clarifying that in many countries there are institutional evaluation and accreditation systems for universities and graduate degree programs (Mexico, Argentina, Brazil, Chile, etc.) that operate separately from the NRCSs.

Centralization

Unlike academic career systems, whose management and regulations are administered at the institutional level, NRCSs carry out evaluations on a national scale. In federal countries with very extensive and heterogeneous scientific systems such as Brazil or Mexico, centralization may be perceived as an attempt to homogenize and impose uniform criteria emanating from the national government. In smaller countries with a centralist tendency, such as Paraguay or Uruguay, this element may be less disruptive.

The only system that adds a subnational level of review is Argentina's PROINCE, in which the 19 disciplinary commissions are replicated in each of the seven geographic regions into which the university planning system is divided. Although there are unified

criteria documents at the national level, the categorization process is carried out by regional commissions.

The evaluation process is organized based on disciplinary divisions. The subdivision of areas can be linked to the size and complexity of each country's scientific system. At one end is Brazil's system with 39 areas and at the other end Paraguay's with only 4. In between are Argentina's (19), Mexico's (10), and Panama's (5) NRCs. In the case of Colombia, the evaluation is not carried out by peers but in an automated way, and there are no specific criteria by area. However, the ranking of researchers and their groups is made with reference to the disciplinary area in which they registered (there are 6 in total).

Focus on research

Although evaluation criteria in NRCs tend to cover all types of academic activities (research, teaching, mentoring, extension, dissemination, technology transfer, service...), research outputs are the most highly valued.

Criteria documents contain many specific guidelines on how to evaluate research outputs. In 5 out of the 7, there are mentions of bibliometric indicators, mainly the journal impact factor, Scimago SJR, and Google Scholar h5 index. Brazil and Colombia also have national journal ranking systems (*Qualis* and *Publindex* respectively), which are also used to establish a hierarchy among publications. In the case of Colombia, there is also considerable detail regarding the evaluation of books.

Except for the Colombian system, which carries out an automated evaluation, the rest of the countries employ peer committees, made up of distinguished scientists, who are themselves members of the system. In Uruguay, in addition to the evaluations by each disciplinary committee, the applications are reviewed later by a multidisciplinary panel that seeks to establish general criteria across disciplines and prevent major divergences between areas.

Regarding the evaluation of academics oriented to applied research and technological development, the Brazilian system has a specific call for applicants oriented to “technological development and innovative extension”, who undergo an evaluation with differential criteria and by specialized peers. They represent approximately 5% of the current total active recipients of CNPq productivity scholarships. In the Mexican SNI, there is also a differential mechanism for considering technological activities, which are evaluated by a cross-cutting commission. The applicants, however, still need to be attached to a specific disciplinary area. In the Uruguayan system, there is no similar mechanism, and this poses challenges to evaluators in some disciplinary contexts (Vasen and Sierra 2022).

Recognition

Recognition and rewards offered to academics are a central component of NRCs. The economic aspect is inextricably linked to the identity of some systems, while in other

cases, it plays only a minor one or none. Symbolic recognition, both in terms of prestige and access to strategic positions, is another major attraction of these systems for researchers.

The economic aspect is central to the Mexican SNI. The amount of the reward is updated annually in line with inflation. In 2021, the monthly values are USD 425 for the candidate level, USD 850 for level I, USD 1135 for level II, and USD 1990 for level III and emeriti. In addition, members can also take out private health insurance under very favorable conditions.

Other systems in which the weight of the economic stimulus is strong can be found in Panama and Paraguay. Unlike Mexico, where the reward was originally aimed at preventing brain drain, in these countries the objective was to support the consolidation of a local scientific community. In the case of Panama, rewards start at USD 900 per month for the first category, USD 1200 per month for the second, and USD 2000 per month for the most distinguished. The Paraguayan PRONII grants 258 USD per month in the candidate category, 444 USD in level I, 887 USD in level II, and 1330 USD in the most distinguished level. In these three countries, the economic reward represents a very high percentage of the researchers' monthly income, at least 20%, and may even reach 40%.

The Brazilian system grants 210 USD per month in the lowest category and 288 USD in the highest. Members also receive a monthly payment of approximately USD 200 for research expenses. The system has a much less pyramidal structure than those described in the previous paragraph. While the highest category in Brazil receives 1.4 times what the lowest receives, in Mexico a level III researcher receives 4.7 times what a junior researcher receives. In Uruguay, in 2021 members received USD 182 per month at the initiation level, USD 243 at level I, USD 305 at level II, and USD 365 at level III. In this second group of countries, the proportion of the researcher's monthly income that corresponds to the NRCS is much lower (about 10%).

In Colombia and Argentina, the economic weight is negligible. In the case of Colombia, no economic stimulus was ever established. In the case of Argentina, the situation changed over time. In the early days, the reward had a significant value, but over the years its weight declined sharply. Payments also suffer large delays and devaluations. Today, the economic benefits of belonging to the system are irrelevant. In 2019, the last year for which data is available, a researcher with the highest category received 70 USD annually and the lowest category only 20 USD, that is, between 1.5 USD and 6 USD per month. Payments are made in three installments with little predictability and are also subject to the country's inflationary dynamics.

The symbolic benefits offered by all these systems are an attraction for academics. Prestige is associated with centralized evaluation processes. The applicant's production is assessed in a broader and more competitive milieu than that of their home institutions. In this sense, centralized assessments contribute to a less endogamic culture of evaluation. In many cases, scholars include their membership and category in their e-mail signature and as one of the highlights of their CVs. Moreover, in some countries, membership has strategic privileges, such as access to leadership roles in scientific institutions.

Transitory nature

Membership in these systems is always transitory and must be renewed at regular intervals, ranging from three to ten years. Once the term has expired, it is necessary to re-apply to ensure permanence or request promotion. In this sense, there is no tenure or permanent job stability. As a researcher climbs within the NRCS, the period of validity of the categories is longer and some systems even include emeritus members that must no longer undergo the evaluation process.

The Brazilian system is the only one that has fixed quotas in each category and disciplinary area, so admission and promotion are limited by the availability of a vacancy in the next category.

Another characteristic of most of these systems is their reliability. Calls are opened according to schedule, and payments are made on time. This stands in contrast to many other policy instruments in the region where such reliability is not the norm, making it particularly appreciated by researchers. The implicit message conveyed to researchers can be summarized as follows: *If you meet productivity targets, you will receive prompt rewards, but failing to do so may result in a swift loss of benefits.*

5. Discussion

In this discussion section, we return to the research questions outlined in the introduction. First, we examine whether there is a single NRCS model or whether countries have implemented very diverse systems within the same general framework. Secondly, we examine the complementary relationship between universities, on the one hand, and national councils, agencies, or ministries, on the other hand, and compare this relationship to other strategies aimed at strengthening university research. Finally, we draw attention to potential structural effects that may arise from the establishment of NRCSs.

5.1. Variations within National Researcher Categorization Systems: Is there a common model?

The creation of research evaluation systems around the world can be related to the rise of New Public Management (Leišytė 2022). However, its impact has not been uniform across different countries and regions. In particular, regarding the individual assessment of academics in Latin America, we identified a subgroup of systems with many similarities in five out of the seven countries discussed in this article (Argentina, Mexico, Uruguay, Panama, and Paraguay). On the other hand, even though they provide a centralized individual categorization scheme for academics, the structure of the Brazilian and Colombian systems presents significant differences (Figure 1).

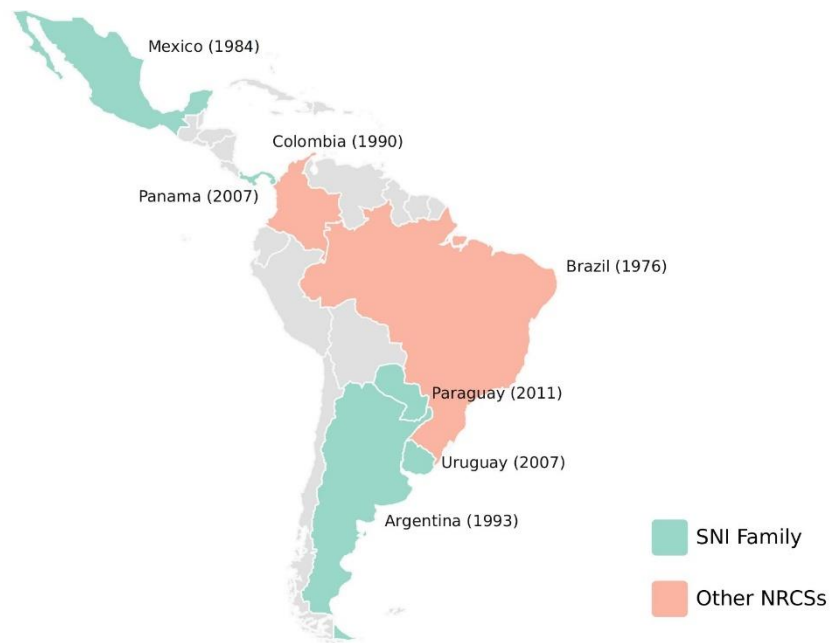


Figure 1. NRCSSs analyzed in the article and their year of creation. Source: own elaboration.

Regarding the first group, the inspiration model was the Mexican SNI, created in 1984. This system influenced the creation of PROINCE in Argentina (1993), the SNIs in Uruguay and Panama (both in 2007), and PRONII in Paraguay (2011). Although we excluded it from our analysis due to the lack of reliable updated information, the Venezuelan PPI program, created in 1990, could also be considered part of this family (Marcano and Phélan 2009). This "SNI model" emphasizes the construction of a hierarchy of academics based on research outputs that runs parallel to that of institutional academic careers. Economic incentives played a central role in the original structure of all these systems, although in some cases their importance has diminished over time.

A process of policy transfer can be recognized among the systems in this first group. National bureaucracies observed and sought advice in neighboring countries, without imposition or coercion exercised from international lending agencies or harmonization strategies implemented through regional integration organizations, as has been the case with other STI policy instruments (Bagattolli et. al. 2015). Hence, this case may be understood as a process of policy dissemination based on learning from experiences developed in other countries (Aguar, Davyt and Nupia 2017).

The cases of Colombia and Brazil differ greatly from each other and from those of the first group. In the case of Brazil, the program was created in 1976 before the Mexican SNI. It was conceived as a scholarship or grant associated with the execution of a specific research project and aimed at increasing academic productivity. However, the ranking element that the program includes is more important than the aspect of project funding. It is not a one-time grant, but rather a system in which researchers participate on a sustained basis, are ranked and can move up or down in the internal hierarchy. On the other hand, the Brazilian system is the only one that incorporates quotas at each level. In this case, it is not enough to have fulfilled certain criteria to access a certain category, but promotion is also dependent on the availability of positions and on the performance of

other applicants. This brings its operation closer to the logic of competitive funding than to that of accreditation.

On the other hand, the Colombian system, created in 1990, is probably the most dissimilar. Its origin was linked to benchmarking of research groups and the mapping of the country's scientific production. Only later did it incorporate the recognition of individual researchers. Unlike all of the other systems, there is no economic reward directly associated with membership. Moreover, evaluation in the Colombian system does not employ peer review panels like the other systems. A mathematical model is applied instead to curricular data to assess the applicant's production.

5.2. Integration, externalization, or complementation

Research activities in university systems with a strong professionalist tradition appear to be something that “can wait” when compared to the immediate demand for instructors to fill courses (Marquina, 2020). Different approaches can be developed to encourage research in these contexts.

The first alternative is the one adopted in countries such as Costa Rica and Chile, consisting of an academic career that integrates research, teaching, and service. This strategy could be regarded as an *integration* model. Research incentives are integrated into the evaluation criteria for hiring, tenure, and promotion or other institutional schemes. This option is also predominant in other regions of the world, such as North America, through the research university model and its tenure system. Also in Europe, institutional career systems play a significant role at the individual level and are complemented by comprehensive performance-based evaluations at the institutional level.

A second approach is the creation of academic research careers not directly linked to university teaching. This strategy could be named *externalization*. This alternative has been the one that prevailed in Argentina through CONICET. This research council offers permanent positions under a civil service regime. Members work in various universities or CONICET's own centers, are evaluated on the basis of their research outputs and have no formal obligation to be involved in teaching or service activities beyond mentoring graduate students (D'Onofrio and Rogers 2021)⁶. With nuances, analogous structures can be found in the CNRS in France and the FNRS in the French Community of Belgium. Academic research conducted entirely in non-university settings, as may be the case with the Max Planck institutes in Germany, could also be considered a form of externalization.

NRCs described in this paper offer a third alternative -*complementation*- that constitutes a middle ground between integration and externalization. Academics are still members of

⁶ At the time of its creation in 1960, the career of the scientific researcher at CONICET provided only a tax-free bonus, complementary to the salary. However, in 1971 a new regulation was passed that transformed researchers into full-time public employees regardless of their link with the university. The creation of PROINCE in 1993 sought to re-edit the pre-1971 complementation model, but was only moderately successful, as CONICET career model continued to expand and continued to expand in the last decades.

an institutional career, but their universities do not provide the conditions and incentives for them to seriously engage in research activities. NRCSs fulfill this complementation role. They offer a horizon of economic and symbolic growth that may not be adequately provided to academics by their own institutions. The reliance of centralized research assessment procedures on international standards of quality and productivity can also help mitigate the risk of academic inbreeding.

Accreditation systems, such as those in Spain and Italy, although structurally different from NRCSs, can also be regarded as complementation strategies, since their assessments are complementary to the evaluations carried out by the higher education institutions themselves. They are based on the assumption that the predominant academic culture may be a barrier to the development of research with international quality standards and integrated into global agendas. Such complementation strategies could also be indicators of higher education systems with a strong university autonomy that may hinder other more direct forms of state intervention in internal aspects of the institutions.

5.3. Potential systemic effects of introducing National Researcher Categorization Systems

In this section, we discuss five issues that could arise from the relationship of complementarity between NRCSs and universities. Even though we have found some signs of these effects in our study and in previous work, we are aware that the causal relationship between these issues and NRCSs can only be established through controlled studies.

Firstly, NRCSs may potentially weaken academic career structures within universities and could contribute to a further decline in the already low prestige of the teaching function. In the modern university, research activities are far more important than teaching for the construction of prestige and reputation. NRCSs, by focusing their evaluation process on research, reinforce the undervaluation of teaching and with it, of the academic career in Latin American universities (Vaccarezza 2000).

Secondly, NRCSs may also contribute indirectly to the precarization of scientific work. Economic rewards take the form of transitory tax-free bonuses. In this context, an important part of the academics' monthly income is tied to productivity and does not compute for medical insurance, retirement, and social security contributions. (Galaz-Fontes and Gil-Antón 2013). This element of precariousness is linked to the transitory nature of the rewards and is part of the identity of the system.

Third, given the centralization of the assessment process and the heavy workload placed on the evaluators, a detailed and in-depth analysis of each application is difficult. The tasks become highly bureaucratized and the formative aspects of evaluation are kept to a minimum (Molas-Gallart, 2012). Buendía et al. (2017) have pointed out that in Mexico they had originally intended to evaluate, but have ended up just "counting beans".

Fourth, NRCSs have promoted a standardized approach to research evaluation, and have based their criteria on comparable international indicators. In most cases, this has

translated into the use of productivity and academic impact metrics based on citation databases such as Scopus or Web of Science. Some disciplinary communities have welcomed these changes as driving progress towards higher quality research, while in others, particularly in the social sciences, it has generated heated debates.

Lastly, the adoption of internationally standardized evaluation criteria may hinder the ability of local science policies to influence scientific practices. The metrics-heavy standardized approach rewards primarily researchers that work on mainstream topics and build a traditional career path. Academic trajectories more closely engaged with the social and economic impact of R&D may end up being less aspirational (cf. Neff 2008 for an analysis of ecological research in Mexico). Thus, NRCSs may be generating a lock-in in career paths and research agendas that only make a limited contribution to national STI strategic priorities.

6. Final remarks

Although there are broad global trends in STI policies, each region or country develops programs and instruments adapted to local needs and realities. In this paper, we have described an approach to evaluating academics that has been developed in Latin America since the 1970s. However, until now, this trend has not been addressed systematically and comparatively in the specialized literature. We hope that our research can contribute to making this regional pattern more visible.

One of the main findings of our work refers to the fact that there is a group of systems that belong to the same ‘family’, whose origins lie with the Mexican SNI. Future work could delve deeper into the policy transfer processes that led to the diffusion of this model first to Argentina and Venezuela, then to Panama and Uruguay, and, more recently, to Paraguay. Also, it might be relevant to examine whether the science systems of the countries that have *not* established this type of scheme have any distinctive characteristics. This will help to establish a dialogue between the national case studies, which already exist in some countries and the more global vision that we wish to convey in this study. It could also advance knowledge of the different roles that NRCSs may acquire in the political and institutional ecology of each country.

A second contribution of this study is related to the characterization of the complementation strategy represented by NRCSs. These systems not only serve the function of promoting research activities, but also constitute a form of indirect intervention by research councils, agencies, or ministries in the regulation of academic careers of university institutions. Through economic and symbolic incentives offered directly to individuals, national institutions shape desirable professional profiles and the structure of disciplinary communities.

Lastly, we would like to connect our analysis of NRCSs with the global trends in research evaluation. The development of large-scale centralized evaluation mechanisms creates a favorable scenario for the introduction of metrics in research assessment. In bureaucratized systems such as NRCSs, the requirements for admission or promotion can

swiftly be defined in terms of a specific number of publications or citations or a certain h-index. This may lead to a complete outsourcing of the assessment of scientific quality and relevance and may limit the ability of policymakers to include evaluation criteria that prioritize regional or thematic research agendas. In this context, we emphasize the need for evaluation systems that are responsive to local contexts and knowledge demands.

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