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Perspective

Science is strengthened by Mexico's researcher evaluation system: Factual errors and misleading claims by Neff

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Abstract

Neff alleges that evaluations of scientist performance by Mexico's National System of Researchers (SNI) undermine the utility of science in Mexico. Using information from interviews with Mexican ecologists, he suggests that evaluations that use journal impact factor (IF) as a proxy for quality is flawed and relinquish control of science policy to decisions made by editors of top-tier journals. We show that Neff's arguments, although well-intentioned, are based on factual errors and misinterpretations of the evaluation criteria used by the SNI. Specifically, evaluations focus on research quality and leadership across multiple activities including publications, citations, student training, project funding, and patents, among others. Evaluations do not focus on journal IF. Science in Mexico faces challenges due to the paucity of scientists and inadequate investment in R&D. The SNI, however, represents an outstanding success in strengthening the quality of science at the regional, national, and international levels.

Key words: researcher evaluation; impact factor; Mexico; SNI; ecology

1. Introduction

In an astonishing claim, Neff (2017) asserts that periodic evaluations of scientist performance by Mexico's National System of Researchers (*Sistema Nacional de Investigadores*), known as the SNI, *undermine* the utility of science in Mexico. Based on information gathered from a series of hour-long interviews with Mexican ecologists, he supports this claim with special reference to ecological studies. Neff also states that the SNI uses the journal impact factor (IF) and the citation record of each researcher to determine the category within the system (starting at candidate, and increasing from Levels I, II, and III, up to emeritus). Each of these categories comes with an economic bonus that is paid on a monthly basis. Positive evaluation by the SNI, carries with it several advantages, such as the likelihood of obtaining employment, obtaining funding, and may favor access to institutional salary bonuses. Given the direct economic and collateral benefits, membership of the SNI is highly sought after.

As Neff acknowledges, since its conception in 1986, the SNI, which is part of Mexico's National Council for Science & Technology (CONACyT), has been highly successful in putting Mexican science on the international map with regional, national, and international benefits.

To examine Neff's claim that science is subverted by SNI evaluations of researcher performance, we analyzed the basis for the main points on how SNI evaluations are performed, and their consequences on Mexican science, with emphasis on ecological studies. The following appraisal reflects our experience as members of the evaluation committee for Biology and Chemistry (T.W. 2009–11 and J.J.M. 2005–6), of the appeals committee (T.W. 2013 and J.J.M. 2014), and current Chair (J.J.M.) of the same committee. We obtained additional information from the current Director of the SNI (L.A. Godínez).

Neff's thesis is flawed for two main reasons: (1) it contains factual errors that undermine his principal arguments and (2) he reports opinions from a number of ecologists but appears not to have included individuals closely associated with the SNI among his sources, despite the fact that these individuals are listed on the SNI website. Mexico also enjoys freedom-of-information laws that make all information within government institutions freely available by sending an email request to the government oversight body (*Secretaría de la Función Pública*), also found on the SNI website.

2. Factual errors

Factual errors described by Neff fall into two categories: those related to the evaluation process, and those involving SNI function and procedures that could adversely affect the reliability of researcher evaluations.

(1) The first and most serious error is that related to the relevance of the journal IF. Neff states that IFs are used by the evaluation

committee as 'simplistic proxy measures' for quality, that researchers modify their research topics in order to publish in high-IF or even top-tier journals as a means to ascend in the SNI system and that, as a result, they avoid difficult areas of research that although worthy, may involve undue risk. At the national level, Neff argues that by using journal IF as an indicator of quality during researcher evaluation, Mexico has relinquished science policy to outside actors (journal editors) with no connection to Mexican science priorities.

Neff goes on to argue that Mexican ecologists respond to the SNI requirement for high-IF publications by opting for easy areas of study involving well-studied systems that are subjected to minimal disturbance by climatic conditions, that do not require continued sources of funding for long-term studies, that are accessible by graduate students, and for which baseline data are already available. As a result, topics and areas for studies that are deemed to be important but risks are avoided and nationally or locally important studies that might be valuable to rural communities, but are not of interest to editors of top-tier journals, are neglected.

This is not and has never been the case. Journal IF is not used as a criterion for assessing scientists who wish to enter or remain in the SNI. In the area of Biology and Chemistry, to which most ecologists belong, any journal with an IF greater than 0.5 is considered as valid, as journals with lower IF values are judged to be of poor quality; a position that is likely shared by most established researchers today. In addition, publication of articles in mainstream journals within each discipline and books and book chapters by international publishers (Elsevier, Springer, OUP, CRC, Taylor & Francis, etc.) is considered favorably for the upper levels (II, III, and emeritus) of the SNI as these researchers are expected to have international presence in the scientific community, whatever their area of interest. The evaluation committee may also suggest that researchers submit their work to higher impact journals, in order to increase the visibility of their research.

The requirements for Level I, involving authorship of three papers in a Journal Citation Reports (JCR)-indexed journal ($IF > 0.5$) in each 3-year period (in just one of which the researcher should be senior or corresponding author), are modest by today's standards. Scientists who fail to meet this level of production cannot enter, or are expelled from the system, but may reenter if their productivity improves in subsequent years. In addition, to attain Levels II or III, researchers have to demonstrate leadership and international presence in their discipline through higher rates of publication and citation, patents or other intellectual property, outreach activities, training of graduate students, and by obtaining external funding. In all cases, the quality, constancy, and importance of the research are judged rather than the IF of the journals in which publications appear. This point has been made previously (Williams and Aluja 2010).

(2) Neff states that new members of the evaluation committee are selected by the existing members, which leads to members from disciplines with faster publication rates being strongly represented in the committee. This is not true. Evaluation committee members are selected annually by voting on an extensive list of candidates that is sent to all SNI members by the Advisory Forum on Science and Technology (*Foro Consultivo Cientifico y Tecnológico*), a federal government advisory body that is independent of CONACyT. Occasionally, additional members may be invited directly by CONACyT to cover additional areas of expertise. A quick look at the list of evaluation committee members from 2017 (available on the SNI website https://www.conacyt.gob.mx/index.php/el-conacyt/sistema-nacional-de-investigadores/miembros-de-comisiones) reveals that ecologists are particularly well represented with a climate change marine ecologist and an evolutionary ecologist of fishes, as well as three additional experts in plant systematics and biogeography, evolutionary biogeography of insects and a plant ecologist/ecophysiologist. Given this, it is hard to accept Neff's assertion that Mexican ecologists suffer by being evaluated by scientists that are not experts in their discipline.

(3) Neff states that each committee applies uniform rules to all disciplines within its remit even though disciplines may differ widely in their rates of publication and citation. This is not true. As pointed out previously, in the Biology and Chemistry evaluation committee, the work of each discipline, from traditional taxonomists to molecular biologists, is considered within the context of their respective fields (Williams and Aluja 2010). There is invariably flexibility around the established guidelines for disciplines with markedly different rates of publication and citation, as is only fair. Not all citations have to be from the Web of Science (WoS)—those from the Scopus system (www.scopus.com) are also considered valid.

(4) The evaluation process is not 'points based' as Neff states. SNI evaluation is based on a range of criteria described on the SNI website, which is why numbers of publications or citations required for each level (category) within the system do not appear in the online guidelines for each area of the SNI.

3. Opinions and beliefs of Mexican ecologists

Neff reports a series of statements made by Mexican ecologists, researcher managers, and government users of ecological information. He highlights a number of ways in which publication-oriented evaluation of scientists affects the usefulness of their research to Mexican society. He also points out that some of these are beliefs, rather than facts- or evidence-based opinions. These issues can be broadly classified as follows: (1) types of research products required by funding agencies, (2) language issues involving publication in foreign journals, (3) international collaboration, and (4) special issues when working in areas with incomplete biological inventories. We will consider these in turn.

3.1 Research products required by funding agencies differ from those required by the SNI

Neff is correct in stating that funding provided by individual states or government ministries to address local (*Fondos Mixtos*) or national (*Fondos Sectoriales*) problems do indeed emphasize the need for solutions laid out in technical reports and manuals for decision-makers or presentations to local communities rather than scientific papers. We think that these forms of communication are not mutually exclusive and should not generate conflicts.

Neff further affirms that Mexico's National Council for Biodiversity (CONABIO) is frustrated because IF-centric SNI evaluations dissuade scientists from performing species distribution surveys and taxonomic studies. According to Neff, the slow pace of such work and the data sets that results from such surveys are incompatible with publication of articles in peer-reviewed journals required by the SNI.

To verify this assertion, we wrote to the CONABIO's General Director of Analysis and Priorities. She explained that she '... did not recognize that CONABIO was "frustrated" or that the SNI was responsible for the paucity of scientists that work on biological inventories ... this would be an oversimplified view of a complex problem'. She went on to state that:

> from the outset CONABIO has understood that collaboration with the academic community would be vital [to our mission] and the importance of publication of the results both for the

> researchers and for CONABIO . . . as publication and peer review of results is a relevant process. As such, at the end of a project CONABIO usually delays public access to the results for a two year period to give researchers time to publish'. (P. Koleff, personel communication).

On the contrary, she felt that SNI evaluations gave little weight to teaching, books, popular science articles (*artículos de divulgación*) and those evaluations should include a broader vision of applied scientific research and include products that informed the public and decision-makers. In fact, CONABIO is now involved actively with citizen-based science projects that are generating useful information on species distributions that is being validated by Master's and doctoral students.

3.2 Do language issues hinder access to information in foreign journals?

Neff asserts that publication in good quality international journals impedes access to information, and that to avoid this, Mexican ecologists should publish in Spanish in Latin American journals that are more accessible to students and local users of research. However, all universities and research centers in Mexico already produce outreach articles and popular magazines (*revistas de divulgación*), written in Spanish, to showcase their achievements. These types of publications are far more accessible to local end users of information than Neff's suggestion of technical papers published in Spanish in Latin American journals.

Neff's assertion that graduate students require written translations of English texts is also questionable. Master's and doctoral students in CONACyT-approved programs are required to have an understanding of written in English, usually verified by language school proficiency scores for entry into these programs. The need for translation of scientific papers for students should not be a major issue, except perhaps for low-quality programs that are outside of the CONACyT-approved system.

3.3 Are Mexican ecologists obliged to seek international collaborators?

Neff reports that in order to publish in 'top-tier' journals, Mexican ecologists are forced to collaborate with scientists in well-equipped laboratories in other countries. This is hardly unusual and applies to all scientists across the world. Moreover, articles in top-tier journals, such as *Nature*, *Science*, *Cell*, and *PNAS*, almost invariably involve international collaboration, wherever studies are conceived and across all fields of science and technology, including the life sciences (Shih 2016). There is a clear correlation between international collaboration and publication impact (Lancho-Barrantes et al. 2013), and we would suggest that most scientists favor international collaboration, rather than seeing it as a burden or hindrance. Considering international collaboration as a handicap is a curious claim.

3.4 Does research in areas with incomplete biological inventories deserve special treatment?

One of the complaints cited by Neff seems particularly far-fetched, such as ecologists that bemoan their requirement for a 3–5-year period of minimal productivity in order to establish new research sites in culturally and biologically diverse regions of the country. It is difficult to envisage a modern country in which scientists can avoid maintaining a baseline level of productivity for such an extended period. Ecologists in other countries may be envious to learn that this is quite possible in many academic institutions in Mexico, which often tolerate very low levels of research output but, as stated previously, productivity that averages less than one paper per year in a JCR-indexed journal is not sufficient if researchers wish to remain within the SNI system.

4. Science in Mexico faces major challenges

Science research in Mexico faces far greater problems than SNI evaluation of researcher productivity. With an annual investment of 0.55 per cent of gross domestic product (GDP), Mexico is in penultimate position in the ranking of investment in research and development (R&D) by Organization for Economic Co-operation and Development (OECD) countries, just above Chile and below Latvia (www.oecd.org/sti/rds). It also has the lowest number of people employed in R&D (0.61 per thousand) of any of the OECD countries. Standards of primary and secondary education are low; Mexico ranks last in educational achievement of 15-year-olds among the OECD countries (PISA 2015), so that few students can access master's and doctoral programs. The paucity of scientists is combined with marked geographical heterogeneity in their distribution with a dearth of active researchers in states that are farther away from Mexico City. Moreover, once contracted in the public sector, Mexico's labor laws make it almost impossible to dismiss non-productive scientists, who then occupy positions that young productive individuals, that have recently obtained their PhD degrees, could fill.

Of these issues, we think that funding is the most immediate and could involve the simplest solution. As science funding is scarce, funded projects tend to be small-scale and short-term (1–3 years). The achievements are accordingly modest and incremental in nature and continuity of funding is not assured.

Finally, of growing concern among the scientific community, notably ecologists, is the awareness that field work is fraught with danger, especially in sparsely populated areas. Over the past decade, public security has become a major issue in Mexico as drug cartel-related crime has exploded. Among the scientific community, this has disproportionately affected field ecologists, who are now at risk of assault at gunpoint, rape, and kidnapping for ransom during field work in areas controlled by cartels, which is effectively most of the country (Beittel 2015).

5. What is Mexico doing to promote science?

CONACyT is the main government body responsible for science, technology, and innovation in Mexico. As such it is fully aware of the challenges to promoting relevant and high-quality science across the country's academic institutions (AMC 2013). There are undoubtedly benefits to scientists working in Mexico. Most researchers in the SNI rapidly obtain a fixed position (tenure) with minimal additional requirements. Graduate students can enroll in CONACyT-approved programs for free and automatically receive a scholarship and access to medical services for the duration of their program.

Investment in R&D has increased. In the period between 1991 and 2009, Mexico's share in the world's investment in R&D grew by 3.2 per cent per year. Similarly, Mexico's share of the world's citation in indexed journals increased by 7.4 per cent per year during the same period, compared with 6.6 per cent for Brazil or 5.0 per cent for India (Gonzalez-Brambila et al. 2016). This reflects the steady rise in articles published in JCR-indexed journals by Mexican scientists in the area of life sciences and across all disciplines (Fig. 1), for which the annual growth rate has been 6.5 per cent in the period 2000–16. The impact

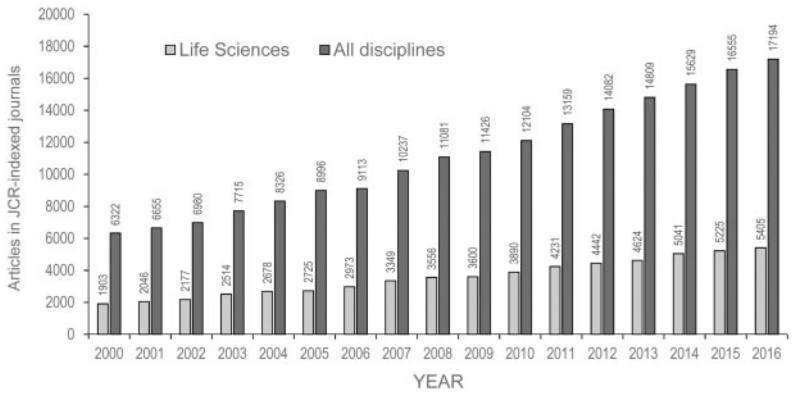

Figure 1. Publication of articles in life sciences (excluding medicine) and across all disciplines by Mexican scientists in JCR-indexed journals 2000–6. Numbers above columns indicate numbers of articles. *Source:* Web of Science Core Collection database (Clarivate Analytics).

of research increases through international collaboration (Wagner and Jonkers 2017), and Mexico has done well in this respect, with 46 per cent of Mexican-authored papers in JCR-indexed journals published in collaboration with scientists from other countries (Gonzalez-Brambila et al. 2016). CONACyT also funds bilateral and multilateral scientific exchanges, student enrollment in foreign graduate programs, and periods in foreign institutions for graduate students based in Mexico. Moreover, a thousand CONACyT-funded positions for young productive researchers have been also created over the past few years as part of the *Cátedras Conacyt* program. However, it is clear that the current government's aim to attain an investment in R&D of at least 1 per cent of GDP by 2018 (PND 2013) will not be met as major cutbacks in government spending have been implemented in 2016 and 2017 as a result of sluggish economic growth and reduced oil revenues.

With just 26,501 SNI members currently in Mexico across all scientific disciplines (L.A. Godínez, personel communication), for a country with an estimated population of 123.5 million persons (CONAPO 2017), the task of developing a strong scientific base is challenging. Nonetheless, the SNI is growing at an average rate of 8 per cent per year and is improving both in gender equality and in the uniformity of the distribution of scientists outside Mexico City (L.A. Godínez, personal communication).

Clearly, improved funding to meet the government's target of 1 per cent of GDP would increase the impact of science on local communities, help researchers address numerous pressing ecological and environmental problems on local and regional scales, and increase the international impact of Mexican science, which are among the issues raised by Neff's analysis. Unfortunately, marked changes in science funding are unlikely to happen soon given the country's current economic woes.

6. Conclusions

All institutions are imperfect—the SNI is not an exception. However, evaluations involve multiple criteria including publications, citations, scientific leadership, and training of graduate students, among others. Journal IF is not used as a proxy for quality and publication in top-tier journals is not required for promotion within the system. Science in Mexico faces many challenges including a deficit of scientists, low investment in R&D, short-term funding and major concerns around scientist safety when performing field studies. CONACyT is aware of these issues and works hard to address them with the limited resources available. The SNI is one of Mexico's clearest success stories in promoting high-quality science at regional, national, and international scales. We find that Neff's conclusion that the evaluation of researcher performance has undermined science in Mexico, though well-intentioned, is based on factual errors, urban legends, and misinterpretations.

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