

# MEXICO. THE “LAW OF THE CONSERVATION OF CENTRALISM” IN RESEARCH. ITS MAIN CONSEQUENCES

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## Resumen

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**E**n este artículo se replantea el conocido fenómeno de centralización de las actividades de I+D en México. El aspecto novedoso es que se incluye el análisis de los efectos negativos que ya está acusando el sistema de I+D en términos de: “bloquear” las oportunidades de un desarrollo más racional del sistema nacional de investigación; promover la subsistencia de espacios territoriales sin capacidad de competencia; distorsionar el funcionamiento del mercado de trabajo de los investigadores y generar una falsa lógica de crecimiento y desarrollo en la definición de las políticas científicas de este país.

Palabras clave:

- Concentración de sistemas de investigación
- Mercado de trabajo de investigadores

## Abstract

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**T**his article revisits the known phenomena of the centralization of R+D activities in Mexico. The new approach being that the analysis includes the negative effects that are becoming evident in the research and development system in terms of: blocking opportunities for more balanced progress in the national research system, promoting the prevalence of territorial regions that lack the capacity to compete, distorting the research labor market, and the articulation of a false logic of growth and development in the defining of scientific policies in Mexico.

Key words:

- Research systems concentration
- Researchers labor market

## Introduction

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One of the characteristics of science, technology and innovation in Mexico is the enormous concentration of activities in Mexico City, which has thwarted all decentralization efforts that have thus been tried. While the structure of this concentration changes in relative terms, in absolute terms it is not only maintained but grows and diversifies the concentrating dynamics.

This inflexible return to the concentration has led us to believe in the existence of an “organizational law”, similar to the law of conservation of matter operating in natural science that explains how the substrate material can change shape but in the end, the overall content of material is maintained. The behavior of the concentration of research activities in Mexico is not exactly the same but quite similar, so the image as a metaphor helps to gauge the effect a centralizing behavior of activities and resources may have.

The “Law of Conservation of Centralism” in research in Mexico, consists of maintaining –at all times and spaces– a persistent phenomenon of geographical, institutional and budgetary centralization of scientific activities. If at a given moment the current composition loses strength at some point, it creates the tendency to rebuild itself –with the same characteristics– in another space, creating multi-concentrated processes that will, in the end, maintain a global structure with a centralizing behavior. Without changing the concentrating logic, efforts to decentralize turn into replicating mechanisms of the concentration itself.

By reviewing the experience of research system building in Latin American countries with the most scientific activity, we also find the fulfillment of the law of conservation of centralism, which has apparently been given a “natural character” and even been considered as a necessary phase and, in that sense, a condition that fosters its development and even, it has been granted features of being harmless.

The identification of the existence of a high degree of centralization of scientific activity in Mexico is not new, though there are scant analysis of its effects, so this article will try to use this space to address two of the most obvious consequences of centralization taking place in Mexico, and that show that it is far from harmless:

- The transformation of the concentration level to a new, higher level: that of “multi-concentration”
- The deformation caused by the concentration in the researchers’ labor market

We will resort to secondary type information from the National System of Researchers (SNI) of the National Council of Science and Technology (CONACYT) and first-hand information, obtained directly from a sample of researchers in the states of Puebla, Tlaxcala, Hidalgo and Mexico City. This information is part of the results of a research project funded by the Vice-Rectoría for Research and Graduate Studies of the Benemérita Universidad Autónoma de Puebla (BUAP).

## The process of concentration and multi-concentration

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By 1929 scientific activity in Mexico was at the formalization stage, although this was taking place only at one institution and in a single city: at the Universidad Nacional Autónoma de México (UNAM) in Mexico City. That same year the university was granted autonomy and already had three institutes: Biology, Geography and the National Astronomical Observatory, all based in Mexico City. In the rest of the country it can be said that scientific activity was non-existent (UNAM, 2002).

There are two very important moments in the development of science and technology in Mexico, significant not only for UNAM, but for the rest of the state universities. The first, in 1945, in the midst of the post-war period, when the institutionalization of this activity starts with the creation of UNAM’s Technical Council for Scientific Research, at that time the institution had, on top of the three institutes mentioned above, five others (Physics, Chemistry, Mathematics, Geography and Geophysics). At this phase, there were –or were in the process of being formed– some research centers in other states, but their activities were still incipient.

The second was the “consolidation” of scientific activity and dates from the decade spanning from 1970 to 1980. The starting point of this phase was the creation of CONACYT in 1970; then in 1974 the creation of the Universidad Autónoma Metropolitana (UAM), and although the Centro de Investigaciones y Estudios Avanzados from the Instituto Politécnico Nacional was established in 1961, it wasn’t until the early seventies that it strengthened its main lines of research. The first scientific development program in Mexico was issued in 1977: the National Science and Technology Program. It was also during the seventies that the number of UNAM’s research centers was expanded.

This consolidation phase of research at the national level took place mainly in higher education institutions based in Mexico City, while in the states of Mexico, Jalisco, Nuevo León, Puebla and Veracruz the phase of institutionalization had barely begun. Since then, a gap in activities related to R+D was instilled between the capital’s institutions and those of the states. (Virtually all research done in Mexico is conducted in universities).

In the nineties, the concentration of scientific activity in Mexico City was already accepted as natural, although the first efforts to decentralize were proposed. One of them –spurred in 1992– was to assign the coordination of the science and technology sub-sector to CONACYT, giving birth to the system SEP-CONACYT, composed of 29 research centers in the scientific, technological and social areas (currently 27 centers are still operating, of which 21 are in the states, and 6 in the capital). In 1996, the federal government created the Regional Research Systems, to promote research applied to regional needs with the involvement of end users of such projects.

Halfway through the nineties the Teacher Improvement Program (PRO-MEP) was launched to increase the training of human resources at state universities and to increase the number of full-time faculty devoting part of their time to research.<sup>1</sup> Also the creation of the states Science and Technology Councils began, establishing them in most states through the nineties. A very important process that is recorded in this period is the rise of scientific research in private institutions that, must be said, failed to break centralizing tendencies.

Attempts to decentralize both the higher education and research systems do not appear to have had an adequate orientation, focusing almost exclusively on productivity factors. Some authors consider decentralization "... as a discourse that gives origin to, expands and makes pluralism take root, leading to a crisis of meaning..." (Rogel, 2004). The loss of meaning in the strategies of consolidation and emergence of new areas for research in Mexico is exacerbated by the lack of infrastructure, regional development projects and the provision of sufficient human resources with adequate training, thereby causing the reproduction of a new concentration in each state where the imposed assessment criterion is again productivity. Within each state a dynamic similar to the existing concentration at the national level remains, the focus of which being the capital of each state. The general picture resulting is that of a research system concentrated in Mexico City and multi-concentrated in the capitals of each state.

The multi-concentration has occurred as a result of an unsuccessful decentralization, this result strengthens the interpretations that suggest that in Latin America decentralizations have been misunderstood as "mere transfers" of administrative responsibilities to structures that are not even capable of being the recipients of these new responsibilities (Feldfiber, 2003).

Science policy measures in the 2000's –such as the New Science and Technology Law–, strategies for the establishment of academic bodies and networks of knowledge, along with new budget allocation policies, such as the Fund for the Modernization of Higher Education (FOMES), the Institutional Strengthening Program (PIFI), etc., have only contributed to the centralization and multi-concentration, given their productivist mechanics of allocation, they have generated a "Matthew effect" as the institutions most benefited from these funds have been the strongest institutions in human resources and infrastructure, i.e. the institutions in Mexico City or in the capitals of each state.

By the late 2000's, CONACYT reports that nearly 45% of researchers recognized in the National System of Researchers (SNI) work in Mexico City. The spatial concentration is so startling that the states that come closest are 8 times below the number of researchers in Mexico City.

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<sup>1</sup> This program supported the recruitment of 6,679 new full-time professors by public universities in the period from 1996-2003.

The concentration levels of nationally recognized researchers can be grouped in three blocks, the first are those with higher levels of concentration, where Mexico City leads, followed by another seven states (see Table 1) not only with great educational traditions but with a significant degree of economic development.

**Table 1.**  
**Mexico. States with the greatest concentration of researchers**

State	Number of SNI members	%	State	Number of SNI members	%
Federal District	6,462	44.66	Baja California	511	3.53
México	860	5.94	Nuevo León	500	3.46
Jalisco	743	5.14	Morelos	481	3.32
Puebla	550	3.80	Guanajuato	436	3.01

Source: CONACYT (2008). SNI.

The next level of classification corresponds to the medium states in their efforts to attain research levels that could accompany a more sophisticated higher education system and graduate studies. This is the largest block as it includes 15 states (Table 2).

**Table 2**  
**Mexico. States with medium concentration of researchers**

State	Number of SNI members	%	State	Number of SNI members	%
Michoacán	363	2.51	Oaxaca	176	1.21
Veracruz	362	2.50	Coahuila	175	1.20
Querétaro	289	2.00	Hidalgo	172	1.18
Sn Luis Potosí	285	1.97	Zacatecas	126	0.87
Sonora	277	1.91	Chiapas	114	0.78
Yucatán	277	1.91	Tamaulipas	110	0.76
Sinaloa	188	1.30	Colima	108	0.74
Chihuahua	177	1.22			

Source: CONACYT (2008). SNI.

There are 9 states that do not even have 100 recognized researchers, which gives them a participation percentage of below 1% (Table 3). It is understandable that these states will be automatically out of the competition for obtaining research funds according to the funding management criteria currently being implemented that favors the dynamics of organization and the work of larger and more consolidated centers and universities.

**Table 3**  
**Mexico. States with a low concentration of researchers**

State	Number of SNI members	%	State	Number of SNI members	%
Baja California Sur	82	0.56	Quintana Roo	43	0.29
Campeche	77	0.53	Tlaxcala	35	0.24
Tabasco	75	0.51	Guerrero	34	0.23
Aguascalientes	69	0.47	Nayarit	20	0.13
Durango	64	0.44			

Source: CONACYT (2008). SNI.

But there is also centralization in terms of educational institutions, for there are three institutions that garner 38% of the workforce of all renowned researchers in Mexico<sup>2</sup> (UNAM, IPN and UAM, all three of them have their main campuses in Mexico City).

A cluster of the educational institutions that by themselves cover more than 1% of renowned researchers found that only 20 of them have a concentration of 70% of the total (Table 4). In this cluster there are institutions that are not only dedicated to teaching (such as IMSS), but there are also private HEIS as well as public HEIS from some states that are better poised for integrating into mainstream research (e.g. Michoacán).

The most serious problem is that the resource concentration level for research in 20 institutions is too strong, whereas in Mexico there are over a thousand HEIS both public and private, for undergraduate and graduate studies (ANUIES, 2007).

**Cuadro 4**  
**México. IES que cuentan con mayor número de investigadores**

Institution	Researchers	%	State
Universidad Nacional Autónoma de México	3,393	23.5	Mexico City
Instituto Politécnico Nacional	1,349	9.3	Mexico City
Universidad Autónoma Metropolitana	793	5.5	Mexico City
Universidad de Guadalajara	608	4.2	Jalisco
Benemérita Universidad Autónoma de Puebla	345	2.4	Puebla
Universidad Autónoma de Nuevo León	341	2.4	Nuevo León
Instituto Mexicano del Seguro Social	310	2.1	Mexico City
Universidad Michoacana de San Nicolás de Hidalgo	266	1.8	Michoacán
Inst. Tecnológico y de Estudios Superiores de Monterrey	261	1.8	Nuevo León
Universidad Autónoma del Estado de México	245	1.7	Edo. de México

Source: CONACYT (2008). SNI.

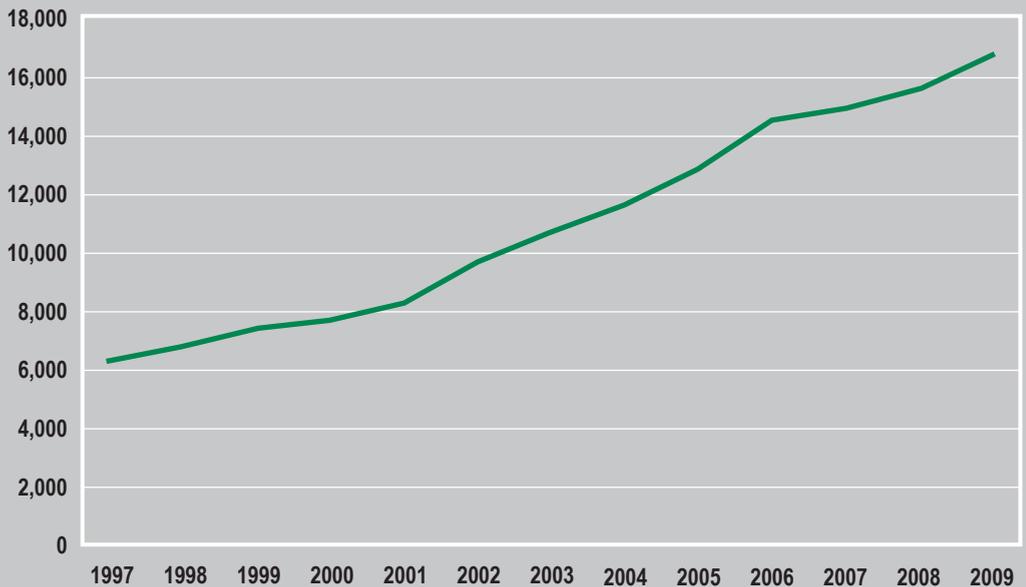
<sup>2</sup> 23.5 % works at UNAM; 9.3% works at IPN and 5.5% at UAM.

Mexico City has four very highly concentrated HEIS and Nuevo Leon also appears with two HEIS, of which one is private. The fact that only 20 educational institutions concentrate 70.4% of all nationally recognized researchers is why we can say that the centralization is not only spatial, but also institutional. UNAM is undoubtedly the institution that brings together a startling number of human resources dedicated to teaching and research.

Considering the phases of institutionalization and the consolidation of research activities in Mexico, the states present a delay, for it was not until the second half of the nineties that they registered very strong growth, such that their numbers doubled from 1997 to 2005 (Figure 1)

Figure 1

## Mexico. Growing number of researchers in the sni. 1997-2009



Source: CONACYT, 2009

One of the areas where research is done on a preferential basis is in graduate programs, research centers can be most frequently found in these activities. Graduate programs have also grown explosively since the 1990's and their dynamics of growth continue to date as shown in Table 6.

Clearly, the growth of graduate programs focuses on the stronger institutions and, again, this phenomenon supports the centralization and multi-concentration in Mexico's state capitals.

**Table 5.**  
**Mexico. Student enrollment in graduate programs**

School year	Specialization	Masters	Doctorate
2004-2005	31,314	106,457	13,081
2005-2006	31,727	108,722	13,458
2006-2007	34,898	111,970	15,135

Source: Statistical Year-Book ANUIES (2007).

According to CONACYT, in 2008 there were 328 registered research centers in Mexico, both public and private. 73.5% of these centers are public and 25.6% private (CONACYT, SNI, 2008). These centers vary in size which means they work in different capacities, from the “macro” centers of the largest universities to “micro” centers with only two or three members.

## Effects of centralization

To analyze the effects of centralization the information directly obtained from a sample of 98 male and female researchers belonging to SNI and working in public and private institutions will be used. In general, it was found that the extreme centralization of research in Mexico is creating distortions of various kinds which can be listed as follows:

- Preventing further growth.
- Obstructing a more rational growth.
- Creating a “block” for the development of areas with lower scientific activity.
- Warp-wage schemes in the labor market for researchers.

Let’s look closely at each of these points: It was mentioned that almost half of all renowned researchers in Mexico is now working in Mexico City and the three educational institutions with the largest number of researchers in the whole country are located in this same area.

This extraordinary centralization has been maintained on the grounds that it enables efficient resource consolidation, both material and human<sup>3</sup> however, a point which could be considered of spatial and institutional saturation has been reached, in which it will become increasingly difficult to obtain resources to hire a researcher while solving the paraphernalia that this implies, but especially related to their field of action and the infrastructure directly required.

<sup>3</sup> From the management techniques perspective centralization is perceived as a management system that is nor good nor bad in itself, and might be taken or left according to the will of the leaders or the influence of circumstances, but centralization is always there, in varying degrees (Carrillo, 2002).

Each institution, individually, faces greater difficulties annually with the approval of more resources, even if the Mexican government were to make higher investments in R&D, it is difficult to aim for a continued growth in institutions and territories already highly concentrated, especially those located in Mexico City, where the concentration of researchers coincides with the largest population density in Latin American with all the collateral problems that may derive from this situation.

The rationality of growth is also hampered by the concentration of resources in the country’s capital since the criteria for resource allocation is guided by “blind” productivity and quality standards which leave out certain states, that from the start are in no possibility of competing for resources.

Thus, in Mexico there are 10 states where research activity is so puny that it fails to reach even one hundred renowned researchers. We agree that this condition of weakness is not exclusively due to the concentration, but is influenced by a host of local governments’ mishaps and shortcomings.

The least developed states in terms of research suffer from a lack of quality human resources and the bare minimum to undertake development projects with the potential of improving their standing in this activity.

11 states could be carefully identified where it would be possible to promote a policy for strengthening research under a different criteria: 1) San Luis Potosi, 2) Durango, 3) Zacatecas, 4) Guerrero, 5) Campeche, 6) Oaxaca, 7) Tlaxcala, 8) Baja California Sur, 9) Quintana Roo, 10) Nayarit and 11) Colima.

If we now turn to the impact of concentration on the researchers salary structure, a greater benefit can be found for researchers working in institutions where there is a greater concentration and those that are located in Mexico City.

**Table 6**  
**Mexico. Researchers average monthly salaries from the entities under investigation according to location**

Researchers Average Monthly Salary, General	National	Mexico City	Other States
	36,789.3	46,837.8	28,878.7

Figures are in Mexican pesos. Source: UAM-FEBUAP Survey (2009).

Researchers working in Mexico City’s institutions earn incomes 27% higher than the national average and those working in the states earn on average \$18 thousand pesos less than their counterparts in Mexico City, and \$8 thousand pesos less than the national mean in approximate values, which in terms of the percentage compared to the national mean is 22% less.

**Table 7.**  
**Mexico. Researchers average monthly salaries from the entities under investigation according to gender**

Researchers Average Monthly Salary, General	Male	Female
	39,093.1	31,650

Figures are in Mexican pesos. Source: UAM-FEBUAP Survey (2009).

The gender variable also explains some income differences not necessarily related to the concentration effect. Through multiple mechanisms we found that women earn less than men. In absolute values female researchers earn 7,500 pesos a month less than male researchers. When comparing these results with the national average wage we found that male researchers –just for the sake of being men– earn 6% above the national average and their female counterparts –just for the sake of being women– earn 14% less than the national average.

**Table 8**  
**Mexico. Female researchers average monthly salaries from the entities under investigation according to location**

Female Researchers Average Monthly Salary	Mexico City	Other States
	41,410	25,550

Figures are in Mexican pesos. Source: UAM-FEBUAP Survey (2009).

The effects of the concentration on the salary structures for researchers are very clear, but collated with those are a number of effects derived from the uneven nature of the market that are inimical due to the cultural and structural matrix (Guadarrama, 2007), which affect female researchers twofold.

The condition of permanent income inequality for female researchers is exacerbated by the obstacles they face in joining equitable workplaces that are, essentially, public and private universities. Women hold only 32.5% of the seats in the labor market for researchers, but this is a situation that has remained unchanged for over two decades and has preserved those terms, despite an increasing feminization of research in all disciplines turning into what eventually becomes an apparent “acceptable” or “normal” distribution.

Assuming that the research system in Mexico has undergone a stage of institutionalization and consolidation, it could be assumed that a “second institutionalization” of research in Mexico could raise a new set of conditions for the territorial development, of institutions and stimulus policies, more equitable for all.

## Conclusions

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**G**iven the extreme level of centralization of R+D activities in Mexico, it can be asserted that it has become one of the main hindrances for a more rational research system.

In Mexico there is a territorial, institutional and financing centralization of activities, which favors Mexico City, to the detriment of the capacity development of institutions in other states.

Excessive concentration is not solely responsible, but contributes to the reproduction of inequalities that persist in the researchers labor market, some of which would not be expected of it, given its actors are those with the highest academic level of training in the country, where the most glaring of these inequalities affect female researchers.

A more rational development policy in this market should include less “blind” science policies which currently have a universal orientation based exclusively on productivity, but should instead be aimed at strengthening certain geographic regions and certain institutions, and also cultivating certain research areas of strategic importance for Mexico’s development.

The labor market for researchers could maintain a more virtuous growth by including generations of young male and female scientists and researchers, making more efficient use of existing facilities through operational restructuring to support its growth by applying the criteria and theme-oriented quality assurance existing frameworks more efficiently. There are 30% of research centers in numerical weakness and 11 states with great disadvantages in sufficiently trained human resources, this must be a niche to look at closely to define conditions for productivity improvement and clarification of the relevance.

The need for a second “institutionalization” of research in Mexico ought to be raised, which would seek new conditions for performance, productivity and relevance, but also new labor conditions for researchers, maintaining the appeal of this type of work but ensuring greater stability by eliminating the current income fragility.

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