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Mujeres científicas en la Universidad Autónoma de Zacatecas: retos y dificultades en el ingreso y permanencia al SNII

Women Scientists at the Autonomous University of Zacatecas: Challenges and Difficulties in Entering and Remaining in the SNII

Mulheres cientistas da Universidade Autônoma de Zacatecas: desafios e dificuldades para ingressar e permanecer no SNII

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Resumen

El Sistema Nacional de Investigadoras e Investigadores (SNII) reconoce e incentiva a investigadores, con el fin de estimular el desarrollo científico en México. Sin embargo, aún persiste una disparidad de género, en el que las mujeres son minoría, a pesar de que en los últimos años ha habido una mayor inclusión de mujeres en las diversas áreas de la ciencia. Nuestro estudio revisa la literatura que aborda esta disparidad para comprender por qué las mujeres aún son minorías en la labor científica en la Universidad Autónoma de Zacatecas. Encontramos que hay diversos factores culturales y sociales, tales como precariedades o

posibles beneficios en las Instituciones de Educación Superior (IES) que motivan su ingreso al SNII y el estímulo económico y el reconocimiento social de pertenecer al SNII. Además, se encontró que la pertenencia a dicho sistema provocó en algunos casos padecimientos mentales (crisis, ansiedad, angustia y estrés, entre otros). Para superar los problemas en las IES y las afectaciones causadas al pertenecer al SNII, científicos e investigadores han buscado y aplicado diversas estrategias, entre las que destacan el apoyo psicológico profesional, conversar con allegados, apegarse a la fe, buscar atención médica, organizar tiempos y ejercicio físico. En el caso de las investigadoras, se encontró que están afectadas por límites socialmente disimulados (el hogar, la crianza y ser madres).

Palabras clave: investigadoras, Sistema Nacional de Investigadores, mujeres, Universidad Autónoma de Zacatecas, Zacatecas.

Abstract

The National System of Researchers (SNII, by its initials in Spanish) recognizes and encourages researchers to stimulate scientific development in Mexico. However, a gender disparity persists, in which women are the minority, even though women inclusion in various scientific fields has increased. Our study reviews the literature that focuses on this disparity to understand why women remain a minority in scientific work at the Autonomous University of Zacatecas. We found that various cultural and social factors that influence on it, such as the precariousness or benefits in Higher Education Institutions (IES, by its initials in Spanish) which motivate their admission to SNII, and the economic incentive and social recognition for belonging to it. In addition, our study found that belonging to SNII caused mental health issues in some cases (such as crises, anxiety, distress, and stress), among various illnesses. To reduce health impacts due to problems related to IES and SNII, researchers have sought alternatives such as professional psychological and medical support, conversations with close ones, engagement with religion efficient time management, and physical activities. In the case of female researchers, it was found that they are affected by socially concealed limitations (household responsibilities, child- rearing, and motherhood).

Keywords: researchers, National System of Researchers, women, Autonomous University of Zacatecas, Zacatecas.

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Resumo

O Sistema Nacional de Pesquisadores (SNII) reconhece e incentiva os pesquisadores, a fim de estimular o desenvolvimento científico no México. No entanto, ainda persiste uma disparidade de género, em que as mulheres são uma minoria, apesar de nos últimos anos ter havido uma maior inclusão das mulheres em diversas áreas da ciência. Nosso estudo revisa a literatura que aborda essa disparidade para entender por que as mulheres ainda são minoria no trabalho científico na Universidade Autônoma de Zacatecas. Constatámos que existem vários factores culturais e sociais, como a precariedade ou possíveis benefícios nas Instituições de Ensino Superior (IES) que motivam a sua entrada no SNII e o estímulo económico e o reconhecimento social da pertença ao SNII. Além disso, constatou-se que pertencer a esse sistema causava doenças mentais em alguns casos (crise, ansiedade, angústia e estresse, entre outros). Para superar os problemas nas IES e os efeitos causados pela pertença ao SNII, cientistas e investigadores têm procurado e aplicado diversas estratégias, entre as quais estão o apoio psicológico profissional, o diálogo com os entes queridos, a adesão à fé, a procura de atendimento médico, a organização de horários e exercício físico. No caso das pesquisadoras, constatou-se que elas são afetadas por limites socialmente ocultos (lar, parentalidade e ser mãe).

Palavras-chave: pesquisadores, Sistema Nacional de Pesquisadores, mulheres, Universidade Autônoma de Zacatecas, Zacatecas.

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Introduction

The National System of Researchers (SNII) was created in 1984 with the aim of recognizing those who produce science and technology. This recognition is obtained through peer evaluation and grants the designation of national researcher, along with economic incentives that may vary according to the level. The latter are conditional on being affiliated with public institutions. The SNII has the following levels:

1) Candidates
2) Level I Researcher
3) Researcher Level II
4) Level III Researcher
5) Emeritus Researcher

Another fact to add is that the SNII depends on the budget of the National Council of Humanities, Sciences and Technologies (Conahcyt), formerly the National Council of Science and Technology (Conacyt) (Reyes and Surinach , 2015).

The requirements to enter the SNII are the following:

1) Being a teacher at Higher Education Institutions (HEIs).
2) Have a doctorate degree or, in the case of medical personnel, meet the equivalency requirement.
3) Have documented research products (articles, book chapters and books).
4) Participate in the dissemination of science through presentations at academic conferences.

The integrating areas of the SNII are the following:

- I. Mathematics, Physics and Earth Sciences
- II. Biology and Chemistry
- III. Medicine and Health Sciences
- IV. Behavioral Sciences and Education
- V. Humanities
- VI. Social Sciences
- VII. Agricultural, Livestock, Forestry and Ecosystem Sciences
- VIII. Engineering and Technological Development
- IX. Interdisciplinary.

By “women scientists” or “researchers” we mean all those who have postgraduate degrees, are dedicated to research and participate in academic and scientific programs, such as the Program for Professional Development of Teachers (PRODEP), the SNII or as Conahcyt scholarship holders . In addition, they disseminate and create knowledge through presentations or articles. In other words, they are those who focus on disseminating and producing knowledge regardless of whether or not they have institutional affiliation.

The objective of our work is to understand why there are fewer female researchers with SNII profiles, compared to males, at the Autonomous University of Zacatecas (UAZ). To do so, we analyzed the literature (such as articles, statistics, and reports) on gender disparity in scientific research, with special attention to the representation of women and men in various areas of the SNII. We employed a quantitative and descriptive design, using secondary data obtained from official databases and previous national studies on the SNII, and gender participation in scientific research.

At the time of writing this article, we found no research or materials that address the issue.

Method

The main data sources for our study are:

- National System of Researchers (SNII): official data on gender composition in the SNII since its creation until the most recent year available.
- Academic publications and previous studies: articles and reports that have analyzed gender disparity in scientific research in Mexico or studies that cover SNII issues.

Regarding data collection, we plan the following:

- Access to databases: obtaining data from the SNII through its online platform and requests for information regarding SNII data from the Zacatecan Council of Science, Technology and Innovation (Cozcyt) and the Autonomous University of Zacatecas. Also, access was gained to editorial and academic production databases, such as Google Scholar , Scopus , Scielo and Redalyc.
- Establishing a search strategy: search based on keywords that lead to specific studies ("gender", "participation" and "SNII"; "women", "men" and "science" or "innovation"; "gender equity" and "scientific research"; and "female participation", "IEES", "public universities", "Innovation systems" and "statistics").
- Process documentation: Each search was recorded indicating the date of the search, the database consulted, and the filters applied (publication date, Spanish language, geographic areas, universities, and IEES). Priority was given to studies conducted in the last five years (2019-2024) that address gender disparity in scientific research in Mexico.

The inclusion criteria for selecting literature are as follows:

- Studies and reports published between 2000 and 2024, although those published in the period 2019-2024 were prioritized.
- Studies that specifically address the representation of women and men in the SNII, within the nine integrative areas.
- Spanish Publications.
- Peer-reviewed studies (scientific articles and reports) and approved by Conahcyt .

Our exclusion criteria are as follows:

- Articles that do not address gender representation in the context of science or innovation in Mexico.
- Studies and reports published before 2000.
- Studies whose methodological quality does not meet minimum standards (evaluated in the next paragraphs).

The study selection and filtering process considers the following points:

- First phase of selection: titles and abstracts were reviewed. Studies that did not meet the inclusion criteria were discarded.
- Second phase of selection: the full texts of the studies preselected in the first phase were evaluated. Studies that did not provide sufficient information or did not meet quality standards were excluded.

Results

The United Nations Educational, Scientific and Cultural Organization (UNESCO) reported, based on 2016 data, that the global average of female researchers is 29.3%. In Latin America, the figure rises to 45.1%, while in North America it is 32.7%. In the case of Mexico, in 2016 female researchers represented 33% (UNESCO, 2019).

A study covering twelve countries found that Chile, Mexico and Japan had the lowest levels of gender parity in research, with only 38% of researchers being women (Allagnat *et al* ., 2017). This data reflects their total participation; however, when focusing on the STEM disciplines (*Science , Technology , Engineering and Mathematics)* (Science, Technology, Engineering and Mathematics), the outlook for women is even more limited. Although the proportion has improved in some areas, a significant gap persists, highlighting the lack of equity.

Studies on gender disparity in the SNII

The proportion of female researchers within the SNII in all areas has increased. In 2000, they represented 27.28%, while in 2018 they already made up 37.2% (Contreras-Gómez *et al.* , 2020), and in 2024 they make up 39.33% (Conahcyt , 2024). Various studies allow mapping the situation of female researchers at the micro level. For example, by 2020 in Yucatán, 34.9% were women, who were mostly in areas such as biology and chemistry,

humanities and behavioral sciences, biotechnology, and agricultural sciences (Carrillo Espadas and Flores, 2023) .

On the other hand, Contreras-Gómez *et al* (2020) found in their study, focused on area V, that they come mainly from the metropolitan area and represented the following percentages nationally: 33.6% in 2002, 32.8% in 2006, 35.1% in 2010, 36.5% in 2014 and 39.8% in 2018. An increase in female participation is observed over the years, at least in this area.

Díaz-Mejía (2021) demonstrated the gender disparity at the Autonomous University of Querétaro, where women represent 42% and men 58%. In addition, she identified that 70% of SNII members belong to areas of natural and exact sciences, and finally highlights that female scientists and researchers tend to have lower percentages in higher ranks of the SNII, compared to men. Therefore, it is important to reflect on gender equality among researchers and the occupation of spaces that have historically and culturally been dominated by men.

In Tlaxcala, women represented 38% in 2018 and 46% in 2020, distributed in the areas of 1) humanities, 2) social sciences, and 3) biology and chemistry (Cazarín -Martínez, 2022). Although some previous studies show an increase in the presence of female researchers, they are still a minority in several categories or levels of the SNII, representing approximately one third at the national level. With this previous data, we observe how institutional and cultural structures are getting closer to gender parity. However, micromachismos, gender discrimination, and certain dynamics of dominance or submission persist, which manifest themselves in subtle or covert ways (Requena Lara *et al.* , 2023; Tapia-Tovar and Orenday-Tapia, 2023). In 2024, at the national level (prior to the results of the SNII evaluation in July), there are 41,639 researchers, of which 39.33% are women and 60.66% are men.

In Zacatecas, in 2024, there are 492 researchers; men are the majority with 61.79% and women are the minority with 38.21%, which is similar at the national level.

The Autonomous University of Zacatecas concentrates the majority of researchers (407), of which 58.72% are men and 41.28% are women (Conahcyt , 2024). When breaking down the areas, it was found that for male researchers the predominant areas are VIII, II and I; while for female researchers they are III and IV (see Table 1). It is suggested to propose programs that allow the inclusion of women in traditionally masculinized areas and vice

versa, to achieve gender equality and access in almost all research areas (Reséndez-González, 2024).

In terms of levels, regardless of the area, it was observed that women predominate at the candidate level, but their presence decreases as one advances to higher levels (see Table 1). It is necessary to review why female researchers are not being promoted and to look for policies to promote gender equity, always seeking gender equality both in areas and at research levels.

Table 1. Representation of genders in the research areas in each gender of the UAZ

Area		Women					Man					Both
/Level		C	N.1	N. 2	N.3	Total	C	N.1	N. 2	N.3	Total	Total
I- PHYSICAL-MATHEMATICAL AND EARTH SCIENCES	Freq .	3	3	1	-	7	2	30	6	1	39	46
	%	6.52	6.52	2.17	-	15.22	4.35	65.22	13.04	2.17	84.78	100
II- BIOLOGY AND CHEMISTRY	Freq .	2	11	-	-	13	6	9	3	-	18	31
	%	6.45	35.48	-	-	41.94	19.35	29.03	9.68	-	58.06	100
III- MEDICINE AND HEALTH SCIENCES	Freq .	7	6	2	1	16	3	6	2	-	11	27
	%	25.93	22.22	7.41	3.70	59.26	11.11	22.22	7.41	-	40.74	100
IV- BEHAVIORAL AND EDUCATIONAL SCIENCES	Freq .	11	10	-	-	21	3	3	-	-	6	27
	%	40.74	37.04	-	-	77.78	11.11	11.11	-	-	22.22	100
V-HUMANITIES	Freq .	6	20	3	2	30	7	14	7	-	28	58
	%	10.34	34.48	5.17	3.45	51.72	12.07	24.14	12.07	-	48.28	100
VI- SOCIAL SCIENCES	Freq .	25	24	2	-	51	16	28	5	5	54	105
	%	23.81	22.86	1.90	-	48.57	15.24	26.67	4.76	4.76	51.43	100
VII- AGRICULTURAL, AGRICULTURAL, FORESTRY AND ECOSYSTEM SCIENCES	Freq .	6	4	-	-	10	6	24	-	-	30	40
	%	15	10	-	-	25	15	60	-	-	75	100
VIII- ENGINEERING AND	Freq .	4	10	-	-	14	16	25	5	-	46	60
	%	6.67	16.67	-	-	23.33	26.67	41.67	8.33	-	76.67	100

TECHNOLOGICAL DEVELOPMENT												
IX-INTERDISCIPLINARY	Freq .	3	3	-	-	6	2	4	-	-	7	13
	%	23.08	23.08	-	-	46.15	15.38	30.77	-	-	53.85	100
Total	Freq .	67	91	8	3	168	61	143	28	6	239	407
	%	16.46	22.36	1.97	0.74	41.28	14.99	35.14	6.88	1.47	58.72	100

Source: Prepared by the authors based on data from Conahcyt (2024).

Regarding this gender disparity in the SNII, we observe that in other studies (Cazarín -Martínez, 2022; Contreras-Gómez *et al., 2020; Díaz-Mejía, 2021) and* Conahcyt statistics , female researchers are increasingly gaining a greater presence in the field of research. Despite this, certain areas (such as I and VIII for scientists, while for women they are III and IV) seem to be more associated with a specific gender, although area VI shows a tendency towards gender equality. The areas where male researchers predominate are those usually called STEM and where at an international level the participation of women is lower (Venegas-García and Brito-Vega, 2023), which is a challenge for the UAZ, Zacatecas, Mexico and the world.

Some authors indicate that the SNII has allowed to improve the productivity of those who can be recognized as researchers due to their compliance with the requested criteria (Contreras-Gómez *et al.* , 2020; Ramón Santiago *et al.* , 2020). On the other hand, in the absence of decent salary and working conditions, people dedicated to research decide to join for the economic stimulus, social recognition, institutional requirements, opportunities for a position or to legitimize themselves as researchers (Camarillo Hinojoza, 2020; Cárdenas Novoa, 2015; Contreras-Gómez *et al.* , 2020). Other authors suggest that belonging to the SNII expands their employment bonuses or simplifies their job stability (Ocampo-Gómez *et al.* , 2020; Zúñiga Rodríguez and Vargas Merino, 2022).

Contradictorily, SNII evaluations appear to move away from strengthening academic research, although the discourse is the opposite, since priority is given to sole authorship and journals in recognized international indexes (Aguado-López and Becerril-García, 2021). It is also noted that the SNII represents a portion of the scientists who are dedicated to research in Mexico (Gil and Contreras, 2017). Belonging to the SNII does not facilitate job stability through part-time or full-time work in their HEIs (Acuña-Gamboa *et al.* , 2023).

Furthermore, there are high levels of burnout and demotivation among Mexican academics when trying to enter and remain in the SNII (Acuña-Gamboa *et al.* , 2023). The

high concentration of SNII researchers in few HEIs or research centers and the lack of a retirement system in most HEIs mean that they remain in their jobs until a very advanced age or until death, making it difficult for young researchers to enter these institutions and the SNII (Lloy , 2018). Likewise, most researchers are professors and one in two teachers suffers from *burnout* or chronic work stress (Jarrín-García *et al.* , 2022), which affects their daily and professional activities. In addition to the above, women were the most affected during the pandemic by academic work, possibly due to the need to combine their family and professional responsibilities (Santibáñez Cárcamo *et al.* , 2021).

In addition to this, Carrillo Espadas and Flores Galaz (2023) identified that the challenges of remaining in science are the following: 1) bureaucracy and excessive hierarchical administrative procedures; 2) the quantitative evaluation system over the qualitative (the products to be produced); 3) the lack of financing, whether institutional or external; 4) the lack of job security (there are no positions, no full-time contracts or retirements); 5) competition (envy, jealousy, disloyalty and rivalry); 6) excessive workload (several activities at the same time); 7) neglected mental and physical health (stress, pressure and illness); and 8) constant updating or new domains. As if the previous challenges were not enough, Vélez Bautista (2023) shows that female researchers in HEIs are subjected to harassment and intimidation, either because their male superiors try to get involved with them inappropriately or because the authorities impose research topics on them that are not necessarily related to their work.

In this same context, female scientists consider science to be androcentric because they perceive difficulties in functioning under patriarchal hierarchies where misogyny and machismo permeate, considering them to be of lesser stature than their male peers (Carrillo and Flores, 2023). In turn, they tend to present more stress, caused by salary, workload, pressure from superiors, lack of resources at the HEI, having large groups, lack of rest and taking work home, which prevents time for leisure, rest or family (Rodríguez and Oramas, 2021). Although the SNII was created to compensate for the low salaries of academic and research staff, it also implies a commitment and a high cost (Gutiérrez and Echeverría, 2023).

Similarly, Urrea Zazueta *et al.* (2022) analyze the gender role (practices of a gender) and stereotypes (preconceived ideas) of female scientists at the SNII. They found that the participants expressed experiencing discrimination and inequality in their work environments. They mentioned facing glass ceilings and labyrinths (unwritten actions that hinder, delay or limit the participation of women) and the Matilda effect (other academics

support men to achieve their goals, even if this puts them in subordinate positions or even displaces them). In other words, female researchers face a hostile context due to the heteropatriarchy that permeates Mexican society, which limits their academic and professional careers. The transition through training, access and permanence in the scientific field is marked by power dynamics within institutional structures. Added to this is the influence of a heteronormative matrix that prevails in the sociocultural context, perpetuating gender stereotypes and roles. In summary, female researchers perceive that their male colleagues are less questioned regarding their academic ability and authority (Sieglin *et al.* , 2014).

Likewise, they face the problem of age, since some tend to delay academic periods due to raising their children, while older women face the aging of their parents and the responsibilities derived from it (Hernández, 2020). Ramón Santiago *et al.* (2020) found that men spend less time than female researchers on household chores. It is also noted that women mention greater satisfaction with their families, while men differ slightly in this family satisfaction. In other words, for female researchers, it is their responsibility to take care of household activities, which affects their academic life and, therefore, their evaluations in the SNII (Acuña-Gamboa *et al.* , 2023). The fact that women have both work and domestic responsibilities causes crises, anxiety, anguish and stress (Vélez Bautista, 2023).

Although belonging to the SNII is a highly relevant distinction for them, it represents a high cost in terms of productivity and the time required to achieve it, which leads to facing dilemmas between work, personal situations such as couples or parenting, and the personal care they require (Gutiérrez and Echeverría, 2023). Some proposals to improve the conditions of women scientists are the following: 1) implement educational policies with a gender perspective, 2) establish institutional actions for child care, 3) combat sexism, and 4) support mixed research projects or those led by women (Gutiérrez and Echeverría, 2023; Vélez, 2023). Similarly, Cazarín -Martínez (2022) suggests developing infrastructure for child care during and outside of working hours, as well as granting leave for both mothers and fathers, recognizing that the home is a shared responsibility.

Similarly, Alonso Gómez *et al.* (2021) identified a series of attitudes and socio-emotions that promote resilience in researchers. Regarding attitudes, these include the ability to find solutions to problems, persistence, flexibility, reflection, and both intrinsic and extrinsic motivations. In the socio-emotions category, good relationships with family, the work team, and emotional intelligence stand out. On the other hand, female researchers often

seek psychological support or talk to their loved ones (family and friends) about their work difficulties. In other cases, they strengthen their spiritual development or seek medical attention, ultimately showing perseverance with their goals (Martínez-Rodríguez and Benítez-Corona, 2024).

Some researchers often apply resilient strategies to deal with job insecurity in HEIs, such as: 1) negotiating agreements on research schedules, 2) establishing collaboration networks to strengthen their work, 3) devoting time to taking care of their physical and psychological health, and 4) resorting to savings or loans due to salary uncertainty (Izquierdo *et al.* , 2022). Along the same lines, female scientists seek to balance work without quitting their jobs, sharing responsibilities with their partners and distributing tasks to avoid burnout, even hiring domestic help if necessary (Castañeda and Contreras, 2021).

Likewise, it is essential to implement institutional programs that promote gender parity in leadership positions, reduce the gender pay gap, promote the hiring and retention of women and minorities, establish support networks for female researchers both inside and outside HEIs, and develop mentoring mechanisms for experienced female researchers to guide new ones in administrative processes and in their preparation to enter and remain in the SNII (Cárdenas Pérez and Aguiar, 2023). In this way, female researchers have the possibility, depending on their environments and individual characteristics, to negotiate agreements for their well-being or be subordinated to stereotypes and power dynamics (López *et al.* , 2023).

Coinciding with this, the British Council launched a call for young female scientists with ongoing research to receive mentoring in the areas of science, technology, engineering and mathematics from established researchers from the SNII. The mentors will guide the young women on their projects using the SWOT analysis (Strengths, Opportunities, Weaknesses and Threats) and the SMART methodology (Specific, Measurable, Achievable, Realistic and Time-bound) (Venegas-García and Brito-Vega, 2023). The objective of this initiative is to increase opportunities for women to stand out and endure in the field of science.

Production criteria established by research area

In the study by Gil Antón and Contreras Gómez, (2017)the differences between area I (Physical-Mathematical and Earth Sciences) and area V (Social Sciences) are highlighted, where significant disparities in the evaluation are identified. In area V, the quantity and quality of research seem to be more relevant, while in area I greater importance is given to the significance of publications, which facilitates greater entry into this last area of the SNII. In line with this, the Conahcyt (2023)has established parameters based on the scientific production reported by researchers approved in different categories or levels of the SNII for the 2019, 2020, 2021 and 2022 calls (see Table 2).

Table 2. Production parameters by researchers approved for the SNII

Area	Level	Guy	Products and indicator
I. Mathematics, Physics and Earth Sciences	Candidates	Articles	Between 2 (Q1) and 4 (Q3)
		Books	0
		Chapters	0
	Level I Researcher	Articles	Between 4 (Q1) and 9 (Q3)
		Books	0
		Chapters	0
	Researcher Level II	Articles	Between 9 (Q1) and 20 (Q3)
		Books	0
		Chapters	0
	Level III Researcher	Articles	Between 14 (Q1) and 34 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 2 (Q3)
II. Biology and Chemistry	Candidates	Articles	Between 2 (Q1) and 4 (Q3)
		Books	0
		Chapters	0
	Level I Researcher	Articles	Between 5 (Q1) and 10 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 1 (Q3)
	Researcher Level II	Articles	Between 10 (Q1) and 19 (Q3)
		Books	0

		Chapters	Between 0 (Q1) and 2 (Q3)
	Level III Researcher	Articles	Between 20 (Q1) and 37 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 3 (Q3)
IIII. Medicine and Health Sciences	Candidates	Articles	Between 3 (Q1) and 6 (Q3)
		Books	0
		Chapters	0
	Level I Researcher	Articles	Between 6 (Q1) and 13 (Q3)
		Books	0
		Chapters	0
	Researcher Level II	Articles	Between 11 (Q1) and 25 (Q3)
		Books	0
		Chapters	Between 0(Q1) and 2(Q3)
	Level III Researcher	Articles	Between 20 (Q1) and 45 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 3 (Q3)
IV. Behavioral Sciences and Education	Candidates	Articles	Between 2 (Q1) and 5 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 4 (Q3)
	Level I Researcher	Articles	Between 5 (Q1) and 11 (Q3)
		Books	Between 0 (Q1) and 2 (Q3)
		Chapters	Between 2 (Q1) and 10 (Q3)
	Researcher Level II	Articles	Between 10 (Q1) and 22 (Q3)
		Books	Between 0 (Q1) and 5 (Q3)
		Chapters	Between 3 (Q1) and 15 (Q3)
	Level III Researcher	Articles	Between 15 (Q1) and 29 (Q3)
		Books	Between 0 (Q1) and 6 (Q3)
		Chapters	Between 2 (Q1) and 20 (Q3)

V. Humanities	Candidates	Articles	Between 1 (Q1) and 3 (Q3)
		Books	Between 0 (Q1) and 1 (Q3)
		Chapters	Between 0 (Q1) and 4 (Q3)
	Level I Researcher	Articles	Between 2 (Q1) and 6 (Q3)
		Books	Between 0 (Q1) and 4 (Q3)
		Chapters	Between 2 (Q1) and 8 (Q3)
	Researcher Level II	Articles	Between 3 (Q1) and 9 (Q3)
		Books	Between 2 (Q1) and 6 (Q3)
		Chapters	Between 5 (Q1) and 13 (Q3)
	Level III Researcher	Articles	Between 3 (Q1) and 1 (Q3)
		Books	Between 3 (Q1) and 8 (Q3)
		Chapters	Between 7 (Q1) and 20 (Q3)
VI. Social Sciences	Candidates	Articles	Between 1 (Q1) and 4 (Q3)
		Books	Between 0 (Q1) and 1 (Q3)
		Chapters	Between 0 (Q1) and 5 (Q3)
	Level I Researcher	Articles	Between 3 (Q1) and 8 (Q3)
		Books	Between 0 (Q1) and 3 (Q3)
		Chapters	Between 3 (Q1) and 10 (Q3)
	Researcher Level II	Articles	Between 4 (Q1) and 12 (Q3)
		Books	Between 1 (Q1) and 6 (Q3)
		Chapters	Between 5 (Q1) and 15 (Q3)
	Level III Researcher	Articles	Between 5 (Q1) and 15 (Q3)
		Books	Between 2 (Q1) and 8 (Q3)
		Chapters	Between 6 (Q1) and 20 (Q3)

VII. Agricultural Sciences, Agriculture, Forestry and Ecosystems	Candidates	Articles	Between 2 (Q1) and 4 (Q3)
		Books	0
		Chapters	0
	Level I Researcher	Articles	Between 5 (Q1) and 13 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 2 (Q3)
	Researcher Level II	Articles	Between 15 (Q1) and 28 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 4 (Q3)
	Level III Researcher	Articles	Between 23 (Q1) and 40 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 6 (Q3)
VIII. Engineering and Technological Development	Candidates	Articles	Between 2 (Q1) and 4 (Q3)
		Books	0
		Chapters	0
	Level I Researcher	Articles	Between 5 (Q1) and 11 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 1 (Q3)
	Researcher Level II	Articles	Between 13 (Q1) and 26 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 2 (Q3)
	Level III Researcher	Articles	Between 19 (Q1) and 40 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 4 (Q3)
IX. Interdisciplinary	Candidates	Articles	Between 2 (Q1) and 5 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 3 (Q3)
	Level I Researcher	Articles	Between 5 (Q1) and 11 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 6 (Q3)

	Researcher Level II	Articles	Between 9 (Q1) and 21 (Q3)
		Books	0
		Chapters	Between 0 (Q1) and 6 (Q3)
	Level III Researcher	Articles	Between 14 (Q1) and 55 (Q3)
		Books	Between 0 (Q1) and 1 (Q3)
		Chapters	Between 0 (Q1) and 6 (Q3)

Source: Own elaboration based on Conahcyt (2023).

The table shows the differences in the evaluation criteria between the different research areas, suggesting that the systematization can vary and be adapted according to the specific area. In addition, a problem is evident: there are more applications that are not approved than those that are approved, which indicates a possible budgetary limitation (Reyes and Suriñach, 2012). On the other hand, the lack of consideration of gender challenges and demands could be associated with the lower representation of female researchers in the review committees (Cárdenas and Aguiar, 2023). It is observed that the difference in the evaluation ranges between the nine areas of the SNII could lead to disparities in the number of accepted candidates in each of them. For example, when analyzing the requirements of areas I and VIII, where UAZ researchers predominate, it can be seen that they are less demanding in terms of the products necessary to advance to the next level, compared to areas V and IV, which have a greater representation of female researchers from the UAZ. Although women have increasingly entered different areas of study, there is still much work to be done to achieve gender equality in all areas of research. The SNII evaluates everyone based on meritocracy rather than considering particular aspects of life or inequalities. Mexico could aim for more inclusive policies.

In addition to the limitations mentioned in the article, it is identified that, at the macro level, although national policies have evolved in favor of women and have increased their opportunities, sexual and workplace harassment persist. Therefore, it is suggested to implement strict and effective regulations, instead of applying them poorly and at will (Gutiérrez-Martínez and Olivas-Luján, 2019). This does not mean that policies have achieved gender parity, but that they certainly point in a better direction than before, although there is still much work to be done in terms of policies, their application and their results.

Discussion

The Autonomous University of Zacatecas has proven to be a key player in the development of research at a regional level, consolidating itself as a reference in the generation of knowledge and in the promotion of academic excellence (Rochin, 2024). A notable aspect is the growth in the number of female researchers within the National System of Researchers (SNII), which reflects progress towards gender equity in the academic field. This increase has been accompanied by a growing interest in interdisciplinary collaboration, an approach that, according to Ríos *et al.* (2024), opens up new opportunities for the enrichment of scientific knowledge through transdisciplinarity. This research model not only encourages greater integration of diverse areas of study, but also allows complex problems to be addressed from more holistic perspectives, benefiting higher education institutions (HEIs) and society in general.

However, while the systematic review of the literature indicates progress towards gender parity in research, significant challenges remain. While public policies implemented over the past ten to fifteen years have contributed to gender equity in the SNII, the higher levels—particularly levels II and III—still show disproportionate representation. This gap suggests that, while women are making progress, achieving true parity at the highest levels of the system is a slow process that will require not only more time, but also a sustained effort in terms of institutional and cultural policies.

A critical point that deserves further attention is the disparity in research outputs by field of study, which could be influencing the decline in researchers in certain disciplines. This raises questions about the possible structural disadvantages faced by areas with fewer resources or less recognition, and how these differences affect the professional development opportunities of female researchers in particular.

Another worrying finding is the low participation rate of women in the SNII evaluation committees. This fact not only reflects a gender bias in key decision-making, but also underlines the need for greater female representation in academic power spaces. The scarce presence of women in these committees could perpetuate dynamics of exclusion and reinforce the barriers that female researchers face in advancing their careers. Furthermore, the prevalence of a heteropatriarchal culture, manifested in cases of workplace and sexual harassment, remains a worrying reality that limits the potential of many women in the academic field. To address these inequalities, it is imperative that institutions not only

implement anti-harassment policies, but actively promote an environment of respect and inclusion.

Taken together, the findings suggest that while progress has been made towards gender equity in research, there is still a long way to go to ensure that women, particularly in STEM disciplines and at higher levels of the SNII, can fully develop their careers without facing structural, cultural and gender barriers.

Conclusions

The data reviewed suggest that there are individual factors that facilitate the academic path, such as both extrinsic and intrinsic motivations. Even so, they face certain difficulties such as crisis, anxiety, distress, stress and other illnesses. In order to overcome these inconveniences, they usually: 1) seek psychological support, 2) talk to their loved ones, 3) work on their spiritual development, 4) seek medical care, 5) manage their time better and 6) do physical exercise. Along the same lines, different investigations indicate that HEIs are relevant because they could be a fundamental pillar for researchers if they provide them with institutional stimuli, facilities for motherhood, allow academic collaboration networks and offer support to improve their projects.

Conversely, HEIs can also be a constraint due to salary, workload, ease of access to HEI resources, large groups, excessive work at home, retirement and types of contract. Likewise, studies suggest that the work environment at HEIs can be affected by hierarchies that limit access to materials, unfair competition, envy, jealousy and rivalry between colleagues, which leads to actions that obstruct, delay or limit women's participation in a hidden way. We consider that possible constraints for the promotion of female researchers to higher levels include that they also take care of the home, raising and caring for parents. Women are considered to lack capacity, commitment, leadership and assertiveness due to emotional issues, causing them to be unable to access support or positions at HEIs.

The other authors asserted that, at a higher level, women were less represented than men, which is confirmed by the case of the UAZ. In addition, it was identified that, depending on gender, the predominance in a research area could vary. In a similar way to other studies, the UAZ shows a greater approach to gender equality. It is advisable to continue working on policies that lead the SNII towards gender equality and to look for ways to break the cultural stereotypes that some careers are for men and others for women.

Finally, the studies suggest that women join the SNII mainly for the economic incentive, followed by recognition and, in some cases, for the benefits of the HEIs. Although the difficulty of accessing positions in HEIs and insufficient salaries or benefits are not directly related to the SNII, they do have an impact on the interest in belonging to it. A fair redistribution of work and extra-work is necessary, since women are more vulnerable and at risk of suffering stress due to excessive activities, which takes away time for rest, recreation and self-care. Among the limitations of this work is that there were no interviews with the UAZ researchers that would allow for the information reviewed to be agreed upon or contrasted.

Future lines of research

There were limitations to the study, such as the lack of comparison of data with other universities or states; likewise, it lacks a qualitative approach that allows to delve into the needs of the researchers or their possible shortcomings; on the other hand, it does not focus on the growth in a research area over the years (longitudinal study), but the study itself considered data transversally and analyzed it. We consider that the majority of the literature and the data reviewed suggest that there is a greater approach to gender parity. Therefore, the possible lines of research on this topic are broad, the following are the most notable:

- Analyze the growth of researchers in each of the areas.
- Examine the predominance of researchers in a particular discipline or why there are more researchers in SNII level I, II or III, as the case may be.
- Describe collaborations for research considered interdisciplinary, either by the type of study carried out or the collaboration between faculties and sections of knowledge.
- Addressing why women have yet to achieve parity and how to maintain gender balance to influence public policy.
- Reflect on public policies that promote gender equality and equity among subgroups of researchers.
- Compare or look for similarities between different states and universities to understand what practical situations could benefit gender equality, always thinking about influencing Mexican public policies in favor of gender equality and the inclusion of minority groups in research.

Finally, we suggest that there be collaborations between HEIs to improve the results studied in the reviewed literature and proposals for public policies that benefit a greater number of female researchers.

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