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Academic training and its impact on scientific production among university teachers in Ecuador

Formação acadêmica e seu impacto na produção científica entre professores universitários do Equador

La formación académica y su impacto en la producción científica de los docentes universitarios de Ecuador

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Ana María Aveiga Ortiz
ORCID: https://orcid.org/0000-0003-0603-6269
Escuela Superior Politécnica Agropecuaria de Manabí Manuel Félix López, Ecuador
E-mail: aaveiga@espam.edu.ec
Carmita Leonor Álvarez Santana
ORCID: https://orcid.org/0000-0001-5508-924X
Escuela Superior Politécnica Agropecuaria de Manabí Manuel Félix López, Ecuador
E-mail: clalvarez@espam.edu.ec
Miryam Elizabeth Félix López
ORCID: https://orcid.org/0000-0002-2201-2147
Higher Education Professional, Ecuador
E-mail: mefelixlopez@hotmail.com
María Piedad Ormaza Murillo
ORCID: https://orcid.org/0000-0001-5642-6754
Higher Education Professional, Ecuador
E-mail: mapiedad@hotmail.com

Abstract
The aim of this study was to analyzed the correlation between academic training (PhD, master's degree, specialty) and the scientific production of Ecuadorian university professors in public universities between 2015 and 2019. A bibliometric research was carried out, in a study of the quantitative and statistical analysis of scientific production using the support of the PRISMA systematic review methodology. The number of professors fluctuated between 18 811 and 20 491 during the period analyzed. Results indicated a generally positive, though not uniform, relationship between academic qualifications and research output. The strongest and most significant correlation was found between the number of scientific articles and book chapters (r = 0.983). While professors with PhDs tend to have higher publication rates, the relationship is not always consistent. The study concludes that, although advanced degrees are typically associated with increased scientific production, factors such as the quality of training, institutional support, and available resources are crucial in maximizing high-quality research outcomes in Ecuador.
Keywords: Higher Education; Teachers; Public Universities; Research.

Resumo
O objetivo deste estudo foi analisar a correlação entre a formação acadêmica (doutorado, mestrado, especialidade) e a produção científica de professores universitários equatorianos em universidades públicas entre 2015 e 2019. Foi realizada uma pesquisa bibliométrica, em um estudo de análise quantitativa e estatística da produção científica com o apoio da metodologia de revisão sistemática PRISMA. O número de professores oscilou entre 18.811 e 20.491 durante o período analisado. Os resultados indicaram uma relação geralmente positiva, embora não uniforme, entre as qualificações acadêmicas e a produção de pesquisas. A correlação mais forte e mais significativa foi encontrada entre o número de artigos científicos e capítulos de livros (r = 0,983). Embora os professores com doutorado tendam a ter taxas de publicação mais altas, a relação nem sempre é consistente. O estudo conclui que, embora os diplomas avançados estejam frequentemente associados a uma maior produção científica, fatores como a qualidade do treinamento, o apoio institucional e os recursos disponíveis são cruciais para maximizar a produção de pesquisas de alta qualidade no Equador.
Palavras-chave: Ensino Superior; Professores; Universidades Públicas; Pesquisa.

Resumen
El objetivo de este estudio fue analizar la correlación entre la formación académica (doctorado, maestría, especialidad) y la producción científica de los profesores universitarios ecuatorianos de las universidades públicas entre 2015 y 2019. Se realizó una investigación bibliométrica, en un estudio de análisis cuantitativo y estadístico de la producción científica utilizando el soporte de la metodología de revisión sistemática PRISMA. El número de profesores fluctuó entre 18 811 y 20 491 durante el periodo analizado. Los resultados indicaron una relación generalmente positiva, aunque no uniforme, entre las cualificaciones académicas y la producción investigadora. La correlación más fuerte y significativa se encontró entre el número de artículos científicos y capítulos de libros (r = 0,983). Aunque los profesores con doctorado tienden a tener tasas de publicación más elevadas, la relación no siempre es coherente. El estudio concluye que, aunque los títulos avanzados suelen asociarse a una mayor producción científica, factores como la calidad de la formación, el apoyo institucional y los recursos disponibles son cruciales para maximizar los resultados de la investigación de alta calidad en Ecuador.
Palabras clave: Educación Superior; Profesorado; Universidades Públicas; Investigación.

1. Introduction

Education, recognized as a fundamental human right (Guerrero & Posso, 2023), is crucial for sustainable development. Quality higher education plays a key role in preparing competent professionals and engaged citizens, thereby contributing to the achievement of the Sustainable Development Goals (SDGs) and promoting equity and human development (Orozco et al., 2020; Barrutia et al., 2019). As a driver of social and economic progress (Barbón et al., 2018; Rojas & Soria, 2016), higher education is essential for building fair and prosperous societies.

The quality of teaching, which is critical for student achievement and global competitiveness, has been extensively studied (Guerrero & Posso, 2023; Barros & Turpo, 2020). Recent research indicates that effective teaching goes beyond content delivery and includes cultivating skills such as critical thinking, collaboration, and autonomous learning (Kawuryan et al., 2021). Additionally, challenges in higher education are shaped by historical evolution and the need for continuous innovation (Castro et al., 2021).

In Ecuador, scientific production has seen significant growth, with over 29,000 articles indexed in Scopus since 2011. This increase reflects the dynamism of the national research system and has propelled three Ecuadorian universities into the top 1,000 globally according to the QS University Rankings. This rise in research output has enhanced the country's academic prestige, driven innovation, and contributed to the development of highly skilled human capital (Herrera et al., 2021).

Nevertheless, disparities in the academic training of university faculty raise questions about its impact on scientific productivity. The aim of this study was to analyzed the correlation between academic training (PhD, master's degree, specialty) and the scientific production of Ecuadorian university professors in public universities between 2015 and 2019.

2. Methodology

A quantitative bibliometric research was carried out (Pereira et al., 2018) using simple descriptive statistics using data classes, absolute frequency, mean values, standard deviation, Std. Error of Mean (Shitsuka et al., 2014) and statistical analysis of kurtosis, correlation and significance (Costa Neto & Bekman, 2009).

This study aimed at analyzing the relationship between academic training and scientific production among university professors. The review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines established by Moher et al. (2010).

The analysis included empirical studies (both quantitative and qualitative) published in scientific journals indexed in databases such as Scopus, Web of Science, Latindex, DOAJ, SCIELO, EBSCO, Redalyc, LILACS, and OAJI, among others. Only data from publicly funded higher education institutions were considered, and the reviewed documents included scientific articles, books, and book chapters written in English or Spanish and published between 2015 and 2019, according to the

Comprehensive Information System of Higher Education of Ecuador (SIIES).

The data were processed using JASP 0.19.0.0 software. The analysis began with a normality test, followed by the application of the Pearson correlation test to examine the relationships between academic degrees (PhD, master's, and specialist) and various types of academic production (scientific articles, books, and book chapters).

3. Results and Discussion

The analysis of data from Ecuador's public universities reveals significant fluctuations in the number of faculty members over the years: 18,811 in 2015, 20,491 in 2016, 19,108 in 2017, 20,452 in 2018, and 19,034 in 2019. As the total number of professors increased, the production of scientific articles, books, and book chapters generally followed a similar upward trend, suggesting a positive correlation between faculty size and research output.

However, this overall pattern is marked by considerable variability, indicating that not all institutions with a larger faculty produce higher levels of academic output. The presence of negative kurtosis in most variables suggests that the data distributions are slightly flatter than a normal distribution. This may reflect the presence of some institutions with significantly higher or lower levels of academic production compared to the average (Table 1).

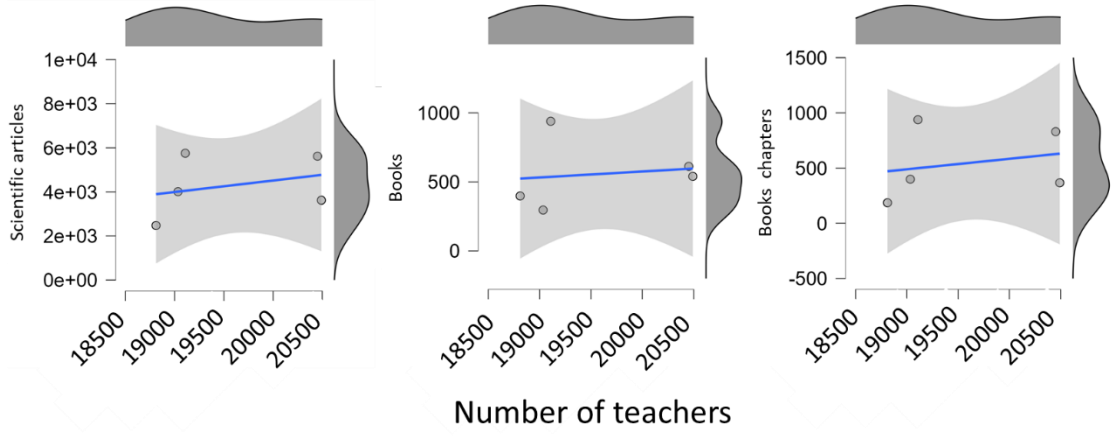
Table 1. Descriptive statistics of the study variables (2015-2019).

	Total teachers	**Scientific articles**	**Books**	**Book chapters**
N	5	5	5	5
Mean	19 579.20	4 295.20	557.00	544.00
Std. Error of Mean	367.60	621.08	110.15	144.49
Std. Deviation	821.97	1 388.78	246.29	323.09
Kurtosis	-3.19	-1.71	1.03	-2.42
Minimum	18 811.00	2 476.00	296.00	186.00
Maximum	20 491.00	5 752.00	939.00	938.00

N = data for five years (2015, 2016, 2017, 2018 and 2019) .
Source: Research data (2025).

The scatter plot in Figure 1 illustrates a positive relationship between the total number of faculty and academic output. As the number of faculty members in an institution increases, there is a corresponding rise in the production of scientific articles, books, and book chapters. This trend aligns with the expectation that a larger faculty typically enhances an institution's research capacity and overall academic productivity.

Figure 1. *Scatter graphs of scientific production and the number of teachers.*

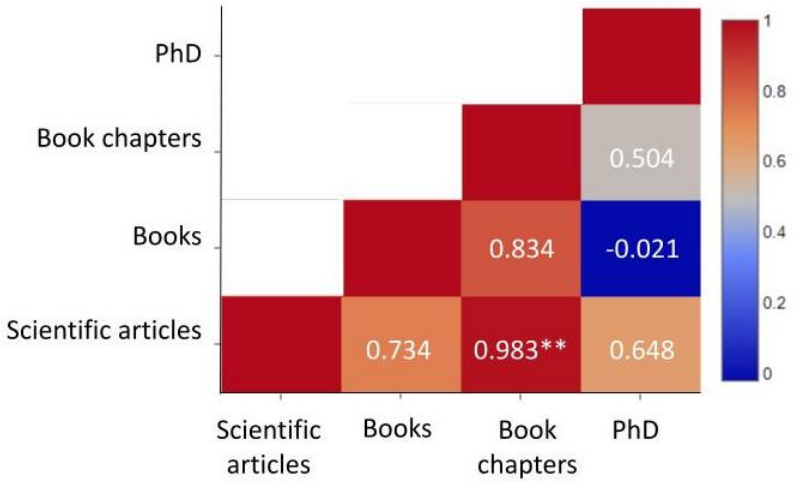


Source: Research data (2025).

However, this relationship is not consistent across all institutions. The variability observed suggests that the number of faculty alone does not ensure high academic output. Other factors, such as the quality of graduate programs, availability of resources, institutional culture, and research orientation, are equally important in shaping the level of academic productivity.

When analyzing the relationship between the number of PhDs and scientific output (Figure 2), a moderate positive correlation is observed with the number of scientific articles (r = 0.648), although it is not statistically significant (p = 0.237). Conversely, a weak negative correlation is found between the number of PhDs and book publications (r = -0.021), likely due to random variation. In contrast, a moderate positive correlation is seen between the number of PhDs and book chapters (r = 0.504). Interestingly, the number of books published does not show a significant correlation with other variables. However, there is a very strong and statistically significant positive correlation between the number of scientific articles and book chapters (r = 0.983, p < 0.003), suggesting that researchers who produce many scientific articles are also likely to contribute significantly to book chapters, and vice versa.

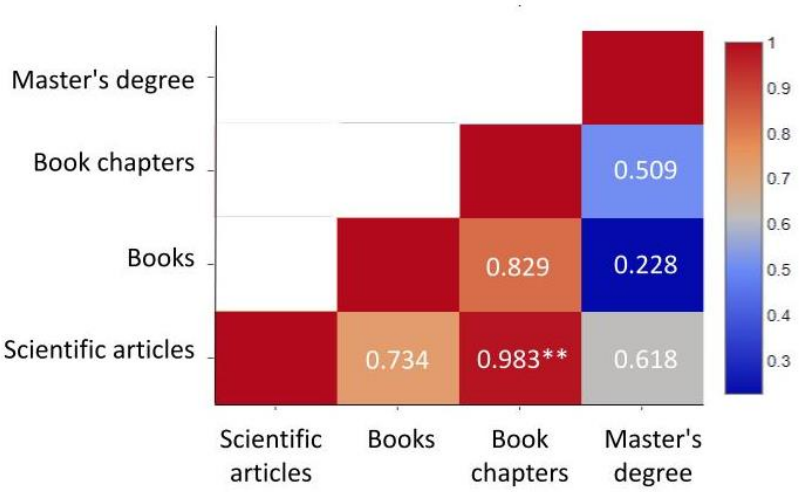
Figure 2. *Correlation and significance between PhD degree and scientific production (**p < 0.01).*



Source: Research data (2025).

For master's degree holders, a moderate positive correlation is observed with the production of scientific articles (r = 0.618). The relationship with book publications is positive but weaker (r = 0.228), while the correlation with book chapters is moderate (r = 0.509). Additionally, a very strong and statistically significant positive correlation is confirmed between the number of scientific articles and book chapters (r = 0.983, p < 0.003), as shown in Figure 3.

Figure 3. *Correlation and significance between master's degree and scientific production (**p < 0.01).*

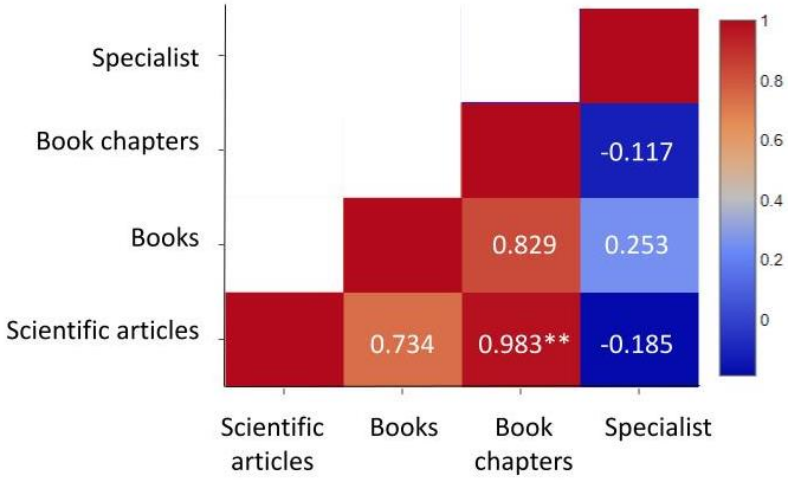


Source: Research data (2025).

For the specialist degree, a weak negative correlation is observed with the publication of scientific articles (r = -0.185), suggesting that holding a specialization may be slightly associated with lower scientific output. However, this relationship is very weak and could be influenced by unexamined factors. Similarly, the correlation between the specialist degree and book publications is negative but even weaker (r = -0.117). In contrast, a positive but very weak correlation is found between the specialist degree and book chapters (r = 0.253).

Additionally, a very strong and statistically significant positive correlation is again confirmed between the number of scientific articles and book chapters (r = 0.983, p < 0.003), as shown in Figure 4.

Figure 4. *Correlation and significance between specialist degree and scientific production (**p < 0.01).*



Source: Research data (2025).

The results of this research underscore several key aspects. While positive trends in scientific production are evident, they do not achieve statistical significance. Among the 19,034 faculty members in 2019, only 4,705 documents related to scientific production were reported, including scientific articles, books, and book chapters. The correlations identified follow the hierarchy: PhD > Master's > Specialty. Additionally, a strong and significant correlation was found between the number of scientific articles and the number of book chapters.

Research on the relationship between academic training and scientific production reveals important nuances. Barros & Turpo (2018) argue that the scientific output of university professors is significantly influenced by institutional, educational, and personal factors. They suggest that higher levels of academic training, particularly advanced degrees such as the PhD, generally correlate positively with increased scientific production. This trend is evident in the Ecuadorian context, where professors holding advanced degrees tend to produce more scientific articles compared to their counterparts with less advanced qualifications.

However, the results of this research in Ecuador indicate that while there is a positive correlation between academic training and scientific production, this relationship is not consistently strong or significant. For instance, although professors with PhDs tend to publish more scientific articles, the correlation with the production of books and book chapters is not as robust. This suggests that factors beyond academic qualifications significantly influence scientific output.

However, the results of this research in Ecuador indicate that while there is a positive correlation between academic training and scientific production, this relationship is not consistently strong or significant. For instance, although professors with PhDs tend to publish more scientific articles, the correlation with the production of books and book chapters is not as robust. This suggests that factors beyond academic qualifications significantly influence scientific output (Barros & Turpo, 2018).

In Cuba, Urbay et al. (2022) emphasize that doctoral training is vital for maintaining the country's scientific potential, particularly within universities. Their study highlights that enhancing doctoral training not only fosters the individual academic development of faculty members but is also essential for advancing research and scientific production at the institutional level.

At the regional level, data indicate a growing research competency in higher education, with a significant emphasis on health, education, and engineering, particularly in Cuba, Colombia, and Ecuador (Arzuaga et al., 2023). In Peru, Delgado et al. (2021) concluded that academic degrees, thesis advisory services, and participation in research projects are key determinants of scientific article publication. This finding aligns with the situation in Ecuador, where studies by Imán et al. (2021) and Balladares et al. (2020) demonstrate continuous growth in scientific production at public universities, with increases noted between 2012 and 2017 and since 2003, respectively.

An analysis of a university in Manabí, Ecuador, revealed a significant interrelation between doctoral and master's training and scientific production, particularly at the regional level (López et al., 2021). This increase in production has been consistently observed over the years. Furthermore, another study in Ecuador (Escobar, 2022) found a strong correlation between the number of professors holding a doctorate and the volume of publications in both international and regional indexes.

Building on these observations, previous studies indicate that the quality of graduate programs and the availability of institutional resources are critical factors influencing faculty members' ability to conduct high-quality research (Casimiro et al., 2020). In Ecuador, the variability in scientific production among institutions may be attributed to differences in research support infrastructure, institutional culture, and overall research orientation.

4. Final Considerations

The results of this research on the relationship between academic training and scientific production among university professors in Ecuador present a complex and multifaceted picture. While the trend confirms that professors with more advanced

degrees, such as a PhD, generally exhibit greater scientific output, this relationship is neither linear nor universal. The study indicates that, although academic training is essential, it does not guarantee high levels of scientific production on its own.

It is evident that various institutional, personal, and contextual factors significantly influence faculty members' ability to generate new knowledge. These factors include the quality of academic programs, the availability of institutional resources, research support, and the academic environment in which faculty operate. Thus, while academic training provides a strong foundation, the institutional context and available resources are equally crucial for fostering significant scientific production.

Despite the sustained growth in scientific output observed in recent years, the findings highlight a critical need to enhance research incentive and support policies. Universities must implement strategies that create a more conducive environment for research, such as improving access to resources, fostering collaboration, and providing adequate incentives for scientific production. In conclusion, a comprehensive approach that combines strong academic training with robust institutional support is essential to maximizing the potential of university faculty in Ecuador to generate high-quality research.

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