

Researchers scientific production behavior in the Category Level III of the National Incentive Program for Researchers of Paraguay: Period 2010-2020

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ABSTRACT

Introduction: The measurement and characterization of scientific production allows to scope the degree and direction of science advancement. **Objective:** The objective of this study is to describe the researchers scientific production behavior categorized in the Level III of the National Research Incentive Program of Paraguay in the period 2010-2020. **Method:** A quantitative, descriptive, non-experimental, cross-sectional study was proposed. The scientific production data were taken from SCOPUS and SciELO. It was evident that about 80% of the scientific production studied corresponded to SCOPUS. The largest production was presented in 2015, 2017 and 2019. The publications were mostly written in English and they were mainly scientific articles. **Results:** The study revealed that publications made by male researchers corresponded to 75% concentrated within the age range of 55 to 59. Medical and Health Sciences was the most outstanding area of publications. **Conclusion:** Findings indicate that the researchers scientific production studied is channeled to attain themselves journals high-impact positions. They use English as the main language and the scientific article as the preferred medium for publication aiming towards an international visibility. However, there is a need to apply actions targeting equity for the participation of female researchers at the highest level of categorization and to increase the visibility of the least representative areas of science.

KEYWORDS

Scientific production – Paraguay. Information system – Scientific production. National Incentive Program for Researchers – Paraguay. Databases – Scientific production – Paraguay. Paraguay Researchers National System.

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Comportamento da produção científica de pesquisadores categorizados no Nível III do Programa Nacional de Incentivo a Pesquisadores do Paraguai: Período 2010-2020

RESUMO

Introdução: A mensuração e caracterização da produção científica permite medir o grau e a direção do avanço da ciência. **Objetivo:** Descrever o comportamento da produção científica de pesquisadores categorizados no Nível III do Programa Nacional de Incentivo a

Pesquisadores do Paraguai, no período 2010-2020. **Método:** Proposto um estudo quantitativo, descritivo, não experimental, transversal. Os dados de produção científica foram obtidos do SCOPUS e SciELO. Evidenciou-se que cerca de 80% da produção científica estudada correspondia ao SCOPUS. A maior produção foi apresentada nos anos de 2015, 2017 e 2019. As publicações foram em sua maioria escritas em inglês e foram principalmente artigos científicos. **Resultados:** Revelou-se que 75% das publicações correspondiam a pesquisadores do sexo masculino e que a faixa etária de 55 a 59 anos concentrava aproximadamente 35% das publicações. A área de publicações que mais se destacou foi a de Ciências Médicas e da Saúde. **Conclusão:** Os achados indicam que a produção científica dos pesquisadores estudados está canalizada para se posicionar em periódicos de alto impacto, utilizando o inglês como idioma principal e o artigo científico como meio preferencial de publicação, visando, assim, visibilidade internacional. No entanto, há a necessidade de implementar ações que visem a equidade na participação de mulheres pesquisadoras ao mais alto nível de categorização e a aumentar a visibilidade das áreas menos representativas da ciência.

PALAVRAS-CHAVE

Produção científica – Paraguai. Sistema de informação - Produção científica. Programa Nacional de Incentivo a Pesquisadores – Paraguai. Bases de dados - Produção científica – Paraguai. Sistema Nacional de Pesquisadores - Paraguai

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1 INTRODUCTION

Scientific production make up the expression of knowledge that has been generated from scientific research in a given field of knowledge, which can be quantified in terms of the number of publications produced (PIEDRA SALOMÓN, MARTÍNEZ RODRÍGUEZ, 2007; SPINAK, 1996). In this context, it is significant to point out that the researcher, according to the definition given in the Frascati Manual, "is a professional who conceives or creates new knowledge, through research, experiments, development of concepts, theories, models, operational methods, among others" (ORGANIZACIÓN PARA LA COOPERACIÓN Y EL DESARROLLO ECONÓMICOS, 2018).

Scientific production representation involves creating and implementing ways to allow evidence of the field of knowledge state in which the researcher is entering (PAZ-ENRIQUE, HERNÁNDEZ-ALFONSO, 2015).

The National Council of Science and Technology (CONACYT) in Paraguay, has carried out the National Incentive Program for Researchers (PRONII) since 2011 which establishes a system of economic incentives (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2021c). The funds granted are administered through contest procedures, which seek to foster science production dedication in all areas of knowledge. This program categorizes researchers according to the following three aspects: scientific production, international relevance, and the impact on other researcher development training, applying periodic evaluation processes by hierarchical levels. This categorization takes place into four levels. Level III is the highest requirements profile includes the Level II requirements, the creation of skills in research, the recognition of the international scientific community, as well as the participation and/or creation of collaboration networks at an international level are also considered (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2020).

A study is proposed in this context in order to look for describing the behavior of the scientific production of researchers categorized in the PRONII's Level III of Paraguay in the period 2010-2020. The knowledge of the researcher's scientific production characteristics in the highest categorization stratum will allow having a record of the scientific progress in Paraguay.

2 METHODOLOGY

A study with a quantitative approach was carried out, since it focused on numerical measurements and analysis of scientific production. The scope was descriptive considering that it sought to determine the characteristics of the phenomenon studied. The design adopted corresponded to the non-experimental one since the variables studied were not subjected to any manipulation.

The target population was made up of researchers categorized into the PRONII's Level III, who entered the Program in 2011 and were in the category of active or associated in 2020.

To identify the researchers as the target of the study, the CONACYT website was accessed to get the admission and evaluation resolutions of the PRONII researchers in order to establish a list of those belonging to Level III who were found categorized as active or associated with 2020. Then, the online Curriculum Vitae (CVPy) managed by the CONACYT was looked up allowing the entry and hosting of the researchers' resumes (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2022). Afterward the search was carried out by the researcher's names and surnames of interest for the study. To collate the data referring to their scientific production, demographic data, the name used in bibliographic citations, the area of performance, as well as other information necessary were compiled.

For the scientific production quantification of the target researchers, the SciELO and SCOPUS bibliographic databases were used as a search source. The publications search was carried out using the names and surnames of the researchers, also considering the name of the

citation issued in the curriculum vitae retrieved from the CVPy platform. The documentary typology considered was: scientific article, book chapter, case report, review article, and presentation in the period 2010-2020. The retrieved publications were validated with data reported in the curriculum vitae, finding no discrepancies between what was reported in the curriculum and the scientific production registered in the bibliographical databases considered in the study.

The variables behold by this study were gender, age, researchers' performance area, year, language, and the publication documentary typology.

Data loading and analysis were performed in Open Office and in a free statistical software called PSPP.

4 RESULTS AND DISCUSSION

The PRONII has a total of 16 active or associated researchers categorized in Level III as of 2020. The distribution of PRONII researchers according to the level of categorization shows that by 2020, Level III represents 3% of all categorized researchers (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2021b).

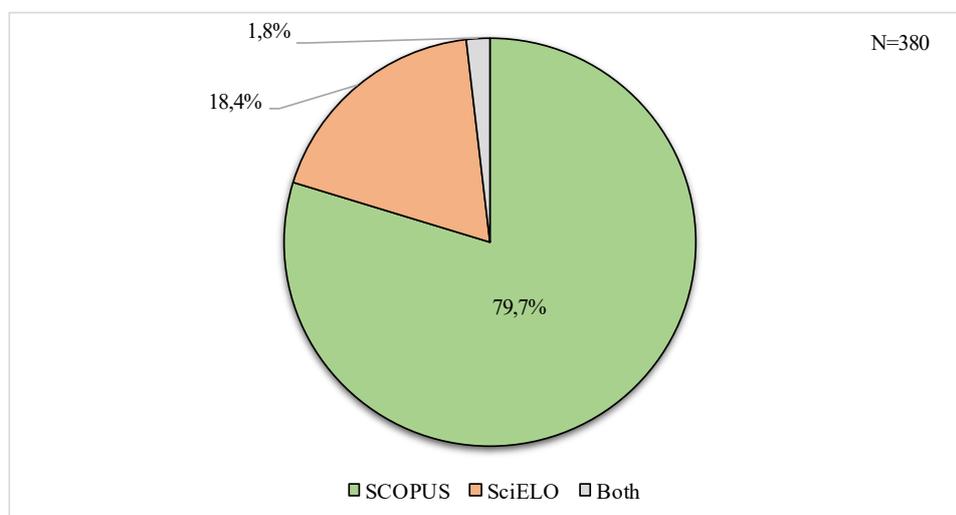
It is noteworthy that the results of this study correspond to the scientific productivity of 15 researchers, considering the specifications established in terms of the study period, the documentary typology, and the bibliographic databases considered. In the period 2010-2020, these 15 researchers generated a total of 380 publications under the established criteria.

About 80 out of 100 from the 380 total publications were observed in the SCOPUS bibliographic database, while about 18 out of 100 in SciELO. It is important to highlight that a small percentage of publications, that is less than 2%, was presented in both bibliographic databases (Graph 1).

It is relevant to mention that SciELO and SCOPUS agreed to integrate journals from the regional portal in 2007. This will meet the quality standards of the latter in order to increase visibility at the international level. Although SCOPUS and SciELO have different objectives and contents, they comprise as being comparable sources in terms of the journal covering and scientific production (MIGUEL, 2011).

Most of the studied publications belong to the SCOPUS bibliographic database, which tends to mark visibility. It is an expected fact on the view that the international scientific community recognition is a point of great relevance for the categorization in the PRONII's Level III.

Graph 1. Publications by the bibliographic database. Period 2010-2020.

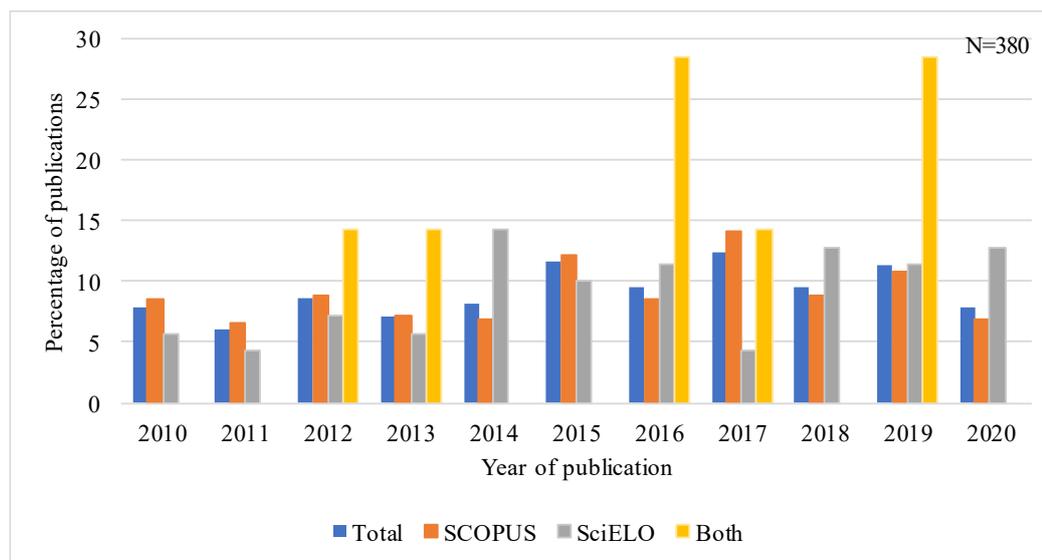


Source: own elaboration based on data collected in the study.

The yearly publication distribution highlighted that the production peaks occurred in 2015, 2017, and 2019. In this period about 35% of the total publications were accumulated. Similar behavior was presented in the SCOPUS database. On the contrary, SciELO had the highest publications concentration in 2014, 2018, and 2020, along which close to 40% were concentrated as a whole (Graph 2).

Peaks in publications number during 2015, 2017 and 2019 may be due to various factors, including the increasing number of researchers at Level III which started with 13 researchers in 2011 (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2012). This value raised to 18 in 2019 (CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA, 2021a).

Graph 2. Publications by bibliographic database expressed by year of publication. Period 2010-2020

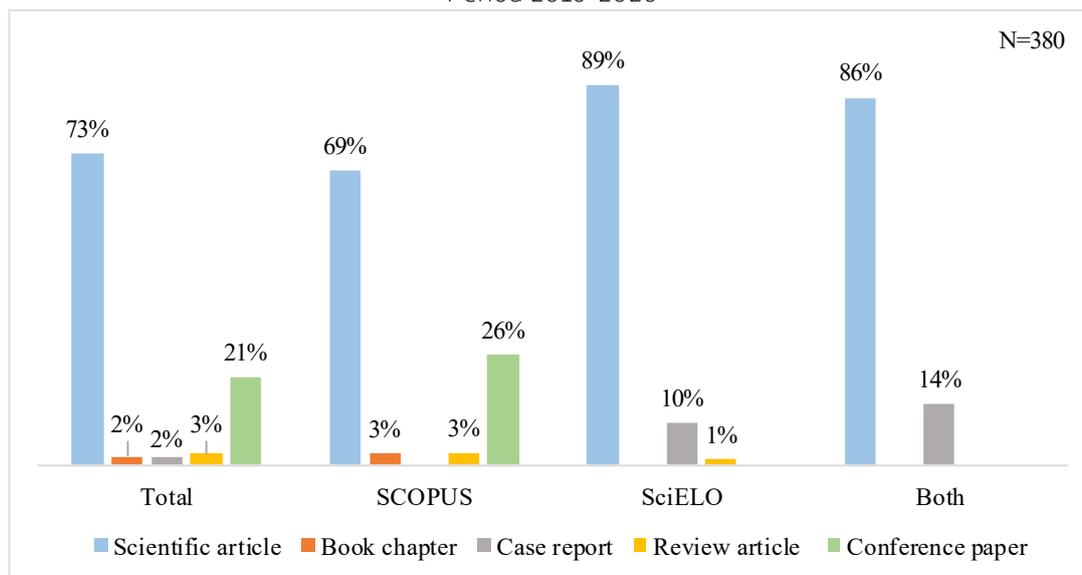


Source: own elaboration based on data collected in the study.

The total number of publications distributed by type of document showed that around 73 out of 100 corresponded to scientific articles, and around 20 out of 100 were papers. In SCOPUS, the behavior was similar to that of the total close to 69% and 26% for scientific articles and papers, respectively. Meanwhile, in SciELO, publications were concentrated in scientific articles and case reports, with around 89 out of 100 and approximately 10 out of 100 publications. A distribution similar to that presented in SciELO was observed for the publications that belonged to both bibliographic databases (Graph 3).

In this regard, it is worth noting what Lameda *et al.* (2015) mentioned in their study about the importance of scientific articles published, that the relevant factors include the following: to get prestige and credibility from the scientific community, the chance for accessing economic incentives for researchers, showing the scientific productivity of the institution to which the researcher belongs and the globalization of knowledge.

Graph 3. Publications by bibliographic database expressed by the type of document.
Period 2010-2020



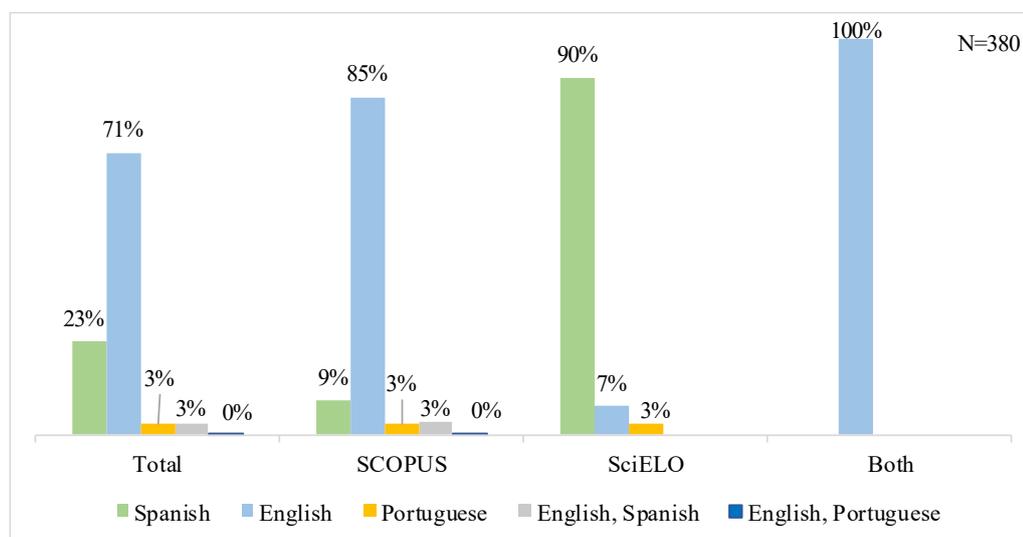
Source: Own elaboration based on data collected in the study.

Regarding the languages of publications, it was found that most of them were made in English, that is about 71% followed by Spanish with about 23%. In the SCOPUS database, these values were approximately 85% and 9% for the same languages, respectively. In SciELO a higher concentration of publications was found in Spanish, with approximately 9 out of 10, followed by English with about 7% (Graph 4). This is an inverse behavior observed in SCOPUS.

In a study carried out on the scientific production of researchers in Agricultural Sciences categorized in the PRONII's Level III of Paraguay during 2007-2019, Rodríguez-Del Valle and Dávalos-Dávalos (2019) found that the main language of publication is in English.

Likewise, Niño-Puello (2013) ratifies that the preferred language for the research publication is English and indicates that it is a language that promotes the advancement of science. This is the conclusion of his study on the relevance of English as an international language for scientific research.

Graph 4. Publications by bibliographic database expressed by the language of publication.
Period 2010-2020.



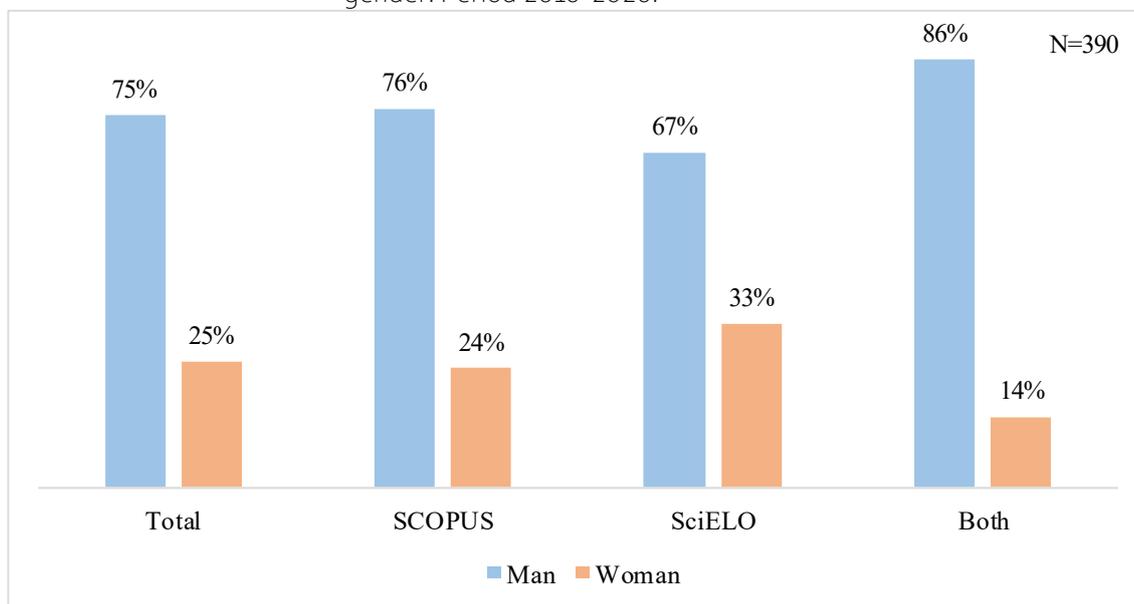
Source: Own elaboration based on data collected in the study.

It should be noted that besides a total of 380 publications 10 others were carried out in cooperation among the researchers contemplated in this study. Therefore, the examination of scientific productivity behavior per researcher was carried out on a total of 390 publications.

In this context, the categorized researcher distributed by gender showed that of the total of 390 publications, about 75 out of 100 were generated by male researchers. In this sense, it is of great importance to take into consideration that men's scientific production falls into 11 researchers, while the women's is concentrated in only 4. It is also significant to point out that a higher proportion of researchers' publications were appreciated in SciELO compared to SCOPUS, since about 9 percentage points were found in favor of the former. (Graph 5).

Regarding this, it is appropriate to bring up what was mentioned by Aboal *et al.* (2016), who refer that in the 2011 PRONII distribution of researchers there are more women than men. Thus, the disaggregation made by the level of categorization showed a particularity in Level III, which presents a prevalence of males. On the other hand, Dávalos (2019) considers that there is a relevant propensity to equate the participation of men and women in the Paraguayan research system.

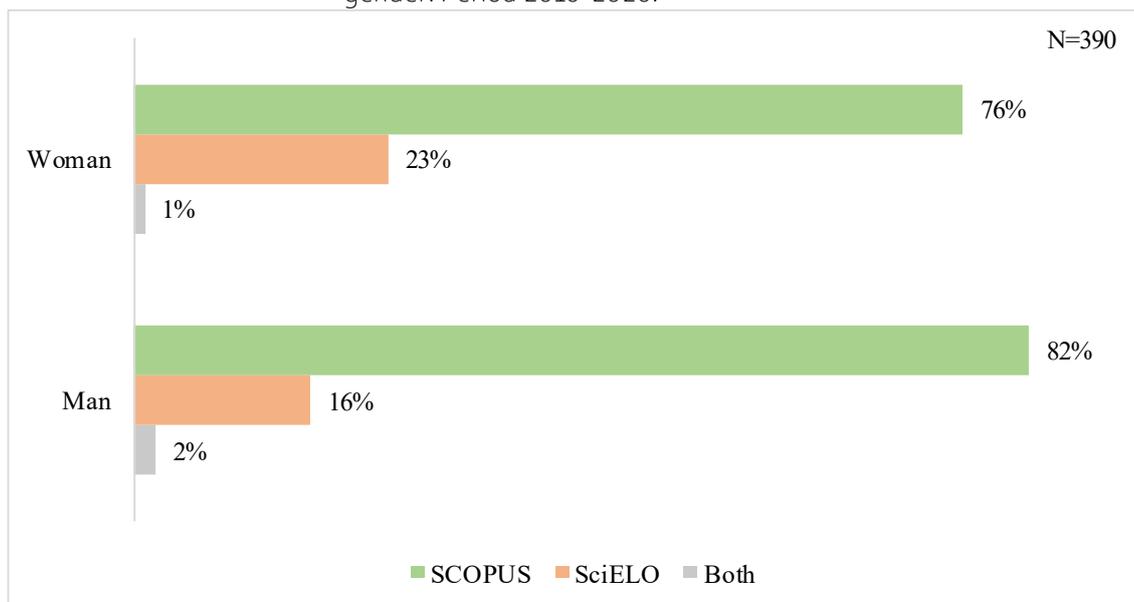
Graph 5. Publications by a bibliographic database of categorized researchers expressed by gender. Period 2010-2020.



Source: Own elaboration based on data collected in the study.

On the basis of the total number of publications generated by male researchers, around 82 out of 100 were observed in SCOPUS. Meanwhile, in the case of female researchers' publications, this value was reduced to 76 out of 100. On the other side, SciELO registered values of approximately 23% and 16% in relation to the total publications of women and men, respectively (Graph 6).

Graph 6. Publications by the bibliographic database of categorized researchers expressed by gender. Period 2010-2020.

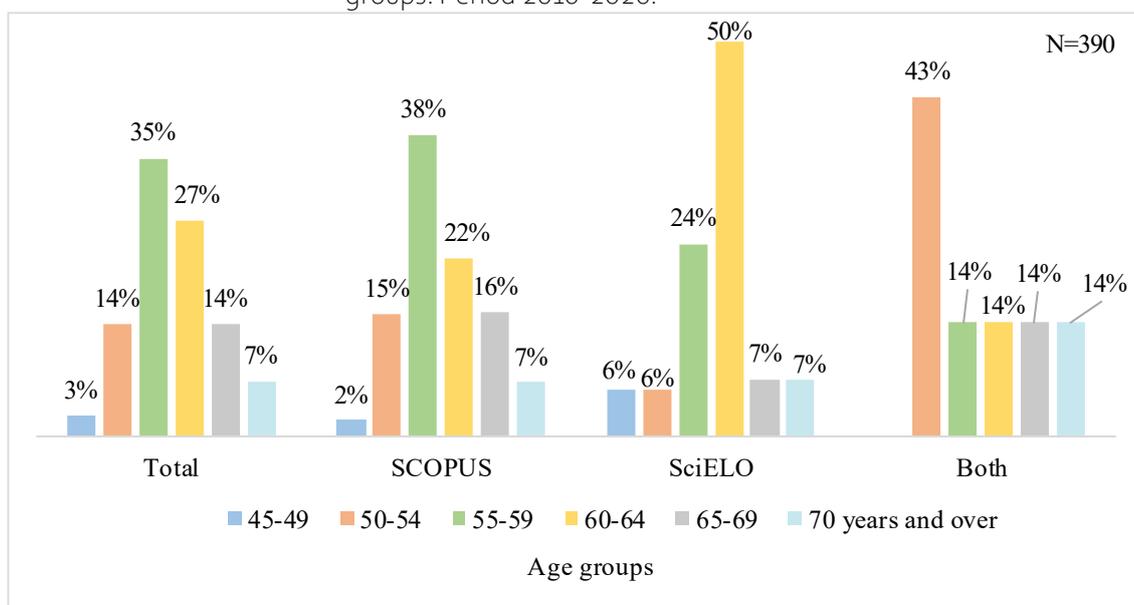


Source: Own elaboration based on data collected in the study.

Based on the total publications, researchers' productivity by age groups showed that the highest percentage was concentrated in the range of 55 to 59 years, followed by the group of 60 to 64 years with 35% and 27%, respectively. For the same age groups observed in SciELO, these values were around 38% and 22%. But an opposite behavior was observed in SCOPUS since approximately 50% of researchers were between 60 and 64 years of age and around 24% for those between 55 and 59 years old (Graph 7). At this point, it is important to mind the requirements for belonging to categorization Level III, as well as the time needed to generate research results and their publication afterward.

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Graph 7. Bibliographic database publications of categorized researchers expressed by age groups. Period 2010-2020.



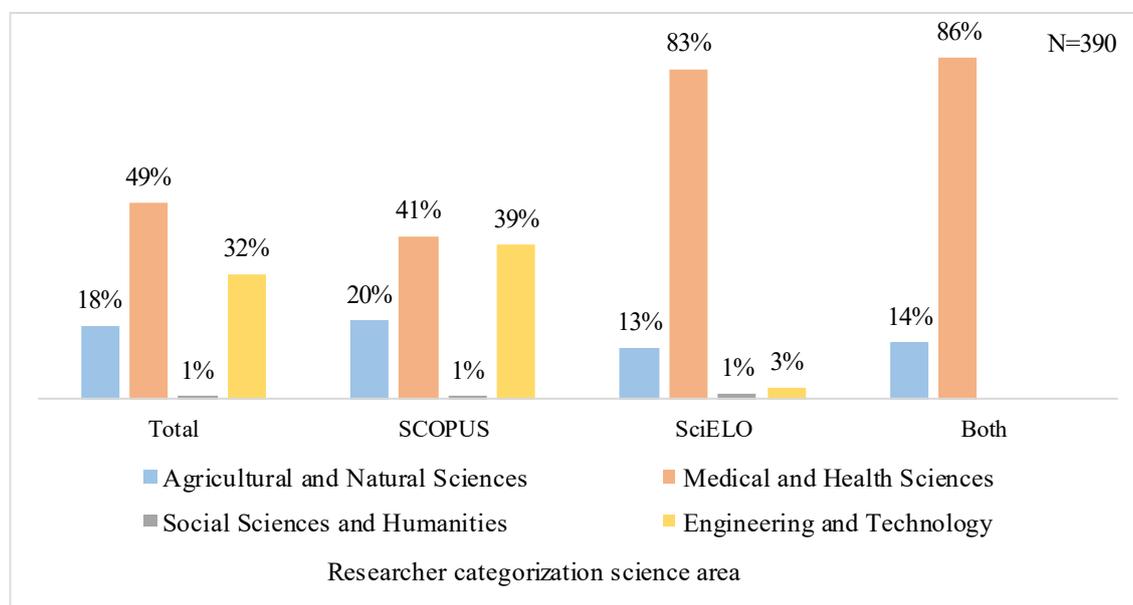
Source: Own elaboration based on data collected in the study.

According to the area of science to which the categorized researcher belongs, the publications' behavior showed that from 390 analyzed publications about 5 out of 10 corresponded to researchers in the Medical and Health Sciences fields, while about 3 out of

every 10 to those in Engineering and Technology. Disaggregation by bibliographic databases revealed that the most relevant concentrations of publications occurred in SCOPUS in the same areas as in the total, but with less disparate values for the two areas mentioned, with around only 2 percentage points in favor of the first one. On the other hand, the largest publications agglomeration in Medical and Health Sciences, as well as Agrarian and Natural Sciences, was found in SciELO, with approximately 83 and 13 out of 100 publications, respectively. Meanwhile, the Engineering and Technology field accumulated around 3% only (Graph 8).

According to Moreno-Fleitas' study results (2019) on the researchers' scientific production categorized in the PRONII's Level III of Paraguay between 2015 and 2020, the Health Sciences, Chemistry, and Animal Biology areas have the highest production. In turn, a study on Paraguay scientific production in the period 1973-2005 carried out by Duarte-Masi (2006) states that the largest proportion of publications is concentrated in Medical Sciences, Public Health, and Life Sciences. These results coincide with this study's findings and indicate that these fields of science remain the main focus for researchers.

Graph 8. Publications by bibliographic database expressed by categorized researchers' area of science. Period 2010-2020.



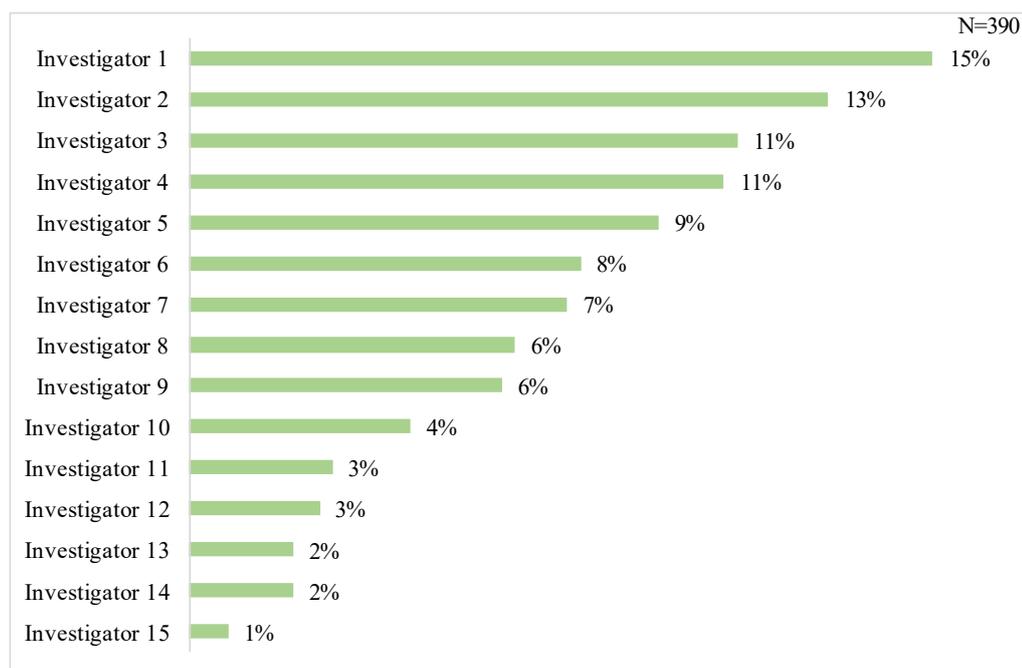
Source: own elaboration based on data collected in the study.

Sorting researchers according to the number of generated publications revealed that 4 researchers who represent approximately 27%, concentrate about 49% of the total publications. The researcher positioned as the best one agglomerated about 15 out of 100 publications, while the second is two percentage points below this, and the remaining two researchers accounted for approximately 11% each. This finding implies that the scientific production is mostly concentrated in a few researchers, as indicated by Rau (2011), that generally few authors agglomerate the largest proportion of scientific production.

It is worth mentioning that those who occupy the first position in the ranking of Level III categorized researchers, are also placed in the first positions of Paraguay scientists ranking, according to the number of citations in Google Scholar (2021), which supports the attained result.

It is also meant to add that according to the total scientific production studied, among the 4 best-positioned researchers there is only one woman. In agreement with what was pointed out by Borrell *et al.* (2015), the unequal distribution of power between men and women is represented by the institutions and structures related to scientific work, which consequently leads to an unequal distribution of scientific production to the detriment of female researchers.

Graph 9. Ranking of categorized researchers expressed by scientific production. Period 2010-2020.



Source: own elaboration based on data collected in the study.

It needs to be mentioned that the results of this study must be contextualized into the fact that Paraguay's R&D investment in relation to its GDP is below the Latin America and the Caribbean average, which is 0.56% in 2019. Making a concrete comparison with other countries in the region, Paraguay presents an R&D expenditure of 0.14% of its GDP in 2019, while in Argentina and Uruguay this value is represented by 0.46% and 0.53%, respectively in the same year, and 1.16% in Brazil in 2018. There are evident efforts toward science development at the national level, considering that since the PRONII was implemented in 2011, this value was only around 0.04% of GDP (RED DE INDICADORES DE CIENCIA Y TECNOLOGÍA - IBEROAMERICANA E INTERAMERICANA, 2021). There is still a long way to go over in order to close the current gaps in this context.

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5 CONCLUSIONS

In the light of the findings, the scientific production in the period 2010-2020 generated by the highest stratum of categorized researchers in Paraguay's PRONII is oriented towards seeking visibility, hence international recognition. Evidence of this is the fact that most of the scientific productions considered in this study are housed in the mainstream science bibliographic database, SCOPUS. Moreover, this is closely related to the requirements that researchers must meet to belong to Level III of categorization, with regard to their scientific production.

English makes up the main language used by researchers for communicating the results of the studies carried out and the type of preferred document for the publication is the scientific article.

Regarding the disaggregation of production per science fields, it is evident that researchers are mainly venturing into Medical and Health Sciences linked to renowned national institutes framed into thematic areas. On the other hand, there are areas that require greater stimulation so that their progress can be reflected in terms of scientific production.

Concerning publications distributed by gender, there is enough evidence of the need and urgency to implement strategies in order to reach equitable participation of men and women

at the highest level of researcher categorization. There are also collective efforts aiming to equalize the participation of women in science. Anyway, these are not yet reflected in the presence of female researchers at the highest hierarchical level of PRONII.

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