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Original Article

Panorama of Academy Research in Civil Engineering in Peru: A Bibliometric Analysis through Vosviewer, CONCYTEC Data, and SCImago Data

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Abstract *- This study presents a bibliometric analysis of academic research in civil engineering in Peru, with emphasis on scientific production, institutional visibility, thematic trends, and the profile of nationally recognized researchers. The novelty of the work lies in the integrated use of SCImago, Scopus, VOSviewer, and RENACYT–CONCYTEC data to provide a national and regional overview of civil engineering research. A quantitative, descriptive, and bibliometric approach is applied to examine publication trends, university participation, country rankings, impact indicators, thematic clusters, and the distribution of researchers by region, gender, academic degree, and RENACYT level. The results show that Peru has experienced a clear increase in scientific production, especially from 2020 onward, although its citation impact remains lower than that of leading Latin American countries such as Brazil, Mexico, Chile, and Colombia. The findings also reveal a limited institutional presence in regional rankings, a strong concentration of researchers in Lima, a predominance of male researchers, and greater participation of private universities in indexed production. VOSviewer maps show that the main research themes are associated with structural engineering, seismic response, construction, sustainability, and engineering education. These findings suggest that Peru is expanding its civil engineering research capacity, but still needs stronger institutional continuity, higher-impact publications, broader regional participation, and better integration between researcher databases.*

Keywords *- Bibliometric analysis, Civil Engineering, CONCYTEC, Peru, VOSviewer.*

1. Introduction

The civil engineer is a pillar of economic development and social stability in Peru, by supporting the planning, design, and implementation of critical infrastructure for connectivity, housing, water resource management, and the reduction of vulnerabilities to disasters. In a country with a complex geographic and high exposure to natural disasters, strengthening research in this discipline is essential to promote sustainable and resilient development. This importance is also evident in scientific publications shared internationally, such as the proceedings of the 9th International Conference on Architecture, Materials and Construction (ICAMC 2023) and the 8th International Conference on Civil Engineering and Materials Science (ICCEMS 2023), published as Conference Review in Advances in Science and Technology [1], which bring together studies on sustainable development, materials, and structural performance, including applications related to Peru (for example, the use of shapeless gabions in the event of possible undermining of the Continental–Peru bridge). There is no doubt that, despite its strategic importance, a comprehensive system is still needed to precisely determine which fields receive the most scientific attention and which areas remain underdeveloped. This makes it very difficult to set research priorities in line with the country's needs.

Bibliometric analysis has become a valuable tool for studying the evolution, trends, and structures of scientific production in civil engineering and related disciplines around the world. For example, [2] conducted a bibliometric analysis, which was performed, complemented by artificial intelligence techniques, to research environmentally sustainable concrete and determine the use of environmentally friendly additives, such as plastic fibers, extracted sediments, and plant materials. Thematic groupings, conceptual connections, and trends among various technical variables were identified using tools

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such as VOSviewer, providing a well-organized scientific overview. This methodology emphasizes the role of bibliometrics in defining scientific research, identifying areas that have not been studied extensively, discovering new lines of research, and orienting future studies. To complement this, several recent studies detail global trends in civil engineering, emphasizing both traditional fields (hydraulics, transportation, geotechnics, and structures) and emerging areas related to sustainability, technological innovation, and resilience.

On this line, [3] identified trends in scientific production linked to sustainable infrastructure, while [4] showed a growing integration of sustainability criteria in civil engineering education and research. Similarly, [5] emphasized the need to adapt infrastructure to the effects of climate change, reinforcing resilience and sustainability approaches in project design and management.

The paper also emphasizes important developments in methods and technologies that are significant for the field. [6] analyze academic impact metrics in civil engineering and [7] emphasize the ability of digital tools and artificial intelligence to optimize automation, project lifetime management, and decision-making. In the education and institutional sector, [8] and [9] highlight curriculum renovation, academic validation, and institutional excellence as essential elements for promoting scientific research in the field of civil engineering.

The investigation in civil engineering in Peru focuses primarily on geotechnical and structural, devoting less attention to transport, hydraulic, and water resources. The evolution of scientific production is in charge of CONCYTEC and RENACYT. International studies indicate that the production is concentrated in certain countries and institutions, leaving aside the emerging lines [10]. However, Peru still lacks an integral bibliometric analysis available that systematically compares the research thematic areas, authors, universities, and recognized investigators at the national level.

Although scientific production in civil engineering has increased in Peru, the available information remains fragmented across international bibliometric databases and national researcher registries. This situation hinders the development of an integrated perspective that relates publication growth to scientific impact, institutional participation, thematic development, and the characteristics of recognized researchers.

Recent bibliometric studies have demonstrated that integrating indicators of productivity, institutional participation, geographic distribution, thematic structure, and collaboration networks enables the identification of development patterns and research gaps within a scientific field [11]. Similarly, other studies have shown that increasing scientific output may coexist with fragmentation, making it difficult to identify clear trends, thematic gaps, and emerging research areas [12]. Furthermore, bibliometric analyses combining Scopus and VOSviewer have been used to characterize temporal, geographic, and disciplinary trends, as well as differences between the Global North and Global South [13]. In this context, a relevant research gap persists in the Peruvian case, as the absence of an integrated perspective limits the identification of strengths, disparities, and areas requiring further development within the civil engineering research system. To address this gap, the present study integrates data from Scopus, SCImago, VOSviewer, and RENACYT–CONCYTEC to analyze publication trends, institutional performance, thematic structure, scientific impact, and the distribution of recognized researchers in Peru within the Latin American context.

As a methodology reference [9] conducted a bibliometric study of the scientific activity in Nigerian universities in the field of engineering between 2010 and 2022, using Scopus, SCImago, as well as tools for bibliometric visualization. The study allows for identifying the engineering area with increased scientific activity, in particular, of the mechanical engineering and civil engineering, as well as institutions and countries with greater academic influence. Collaboration networks between authors, institutions, and countries were analyzed, highlighting the importance of international cooperation to strengthen the visibility and impact of university research. This approach is relevant for evaluating scientific production at a national level and in knowledge areas.

The bibliometric analysis permits the identification of scientific trends, institutional productivity and research areas. In civil engineering, Zhou et al. [14], Elkhayat et al. [3] analyzed the thematic evolution of researches related to sustainability and infrastructure. In Peru, Millones-Gómez et al. [15] evaluated the scientific production and its relationship with research policies and RENACYT in 94 different institutions, while Estrada-Araoz et al. [16] studied the productivity of six south-east Peruvian universities. Likewise, Arcila-Diaz et al. [17] examined the scientific trends of 93 Peruvian universities, while Ortiz-Mas et al. [18] and Carranza-Esteban et al. [19] addressed the scientific production of architecture school and university rectors, respectively.

Even though the studies provide information about Peruvian scientific research, they do not specifically integrate an analysis of scientific production in the field of Civil Engineering, the Latin American university location, the thematic trends and the characterization of RENACYT researchers. Hence, this current study aims to hold attention on this gap through a bibliometric analysis by using Scopus, Scimago, and VOSviewer, and complementing with information from RENACYT–CONCYTEC, with the purpose to characterize research in civil engineering in Peru within the Latin American context.

2. Materials and Methods

The study follows a quantitative, descriptive, and bibliometric approach to characterize the scientific production in civil engineering while indicating productivity, positioning, and impact, as well as patterns of scientific interaction through network analysis. This approach is consistent with recent applications of bibliometrics for examining knowledge evolution, identifying thematic trends, and evaluating academic performance in engineering areas [14, 17]. They joined bibliometrics (rankings, document volume, and impact indicators) with network analysis (co-authorship and bibliographic relations) to contextualize the regional performance in Latin America and describe the national performance in Peru.

2.1. Study design (Bibliometric Analysis)

This approach allows a three-pronged bibliometric analysis (regional, national, and international). To international level, countries, Latin American universities of civil engineering, and associated areas, using the available periods according to each source (recent windows in rankings and historic series when corresponding). This approach allows describing trends and identifying relevant actors; previous studies show that, even in specific themes such as the support methods of multi-criteria decision-making in civil engineering, the research focuses on applications of certain and methodology, while other topics receive less attention, influenced by individual decisions and the visibility of publications [20]. To national level, the analysis was completed with RENACYT data to characterize the critical mass of linked investigators to civil engineering in Peru.

2.2. Information Sources and Search Criteria

2.2.1. Bibliographic Bases

Indicators and records from SCImago (based on Scopus) and, when it was appropriate, consultations and thematic cuts from Scopus for associates' subareas (Construction Engineering and Structural Engineering). Scopus was considered a central source because of its coverage and extensive use in bibliometric studies in engineering [21]. The searches and extractions were delimited for period, region (Latin America), country (Peru), and institutional (universities), according to the available filter in every platform.

Table 1. Search strategy and bibliometric classification criteria used in Scopus and SCImago

Source	Analysis performed	Period	Subject Area / Category	ASJC code	Search query/filtering criteria	Boolean operators
Scopus	Construction Engineering in Latin America	2015–2025	Engineering – Building and Construction	2215	TITLE-ABS-KEY("Construction Engineering" AND "Latin America") AND PUBYEAR > 2014 AND PUBYEAR < 2026	AND
Scopus	Structural Engineering in Latin America	2015–2025	Engineering – Civil and Structural Engineering	2205	TITLE-ABS-KEY("Structural Engineering" AND "Latin America") AND PUBYEAR > 2014 AND PUBYEAR < 2026	AND
SCImago	Regional ranking of universities in Civil Engineering	2021–2025	Engineering – Civil and Structural Engineering	2205	Region: Latin America; category: Civil and Structural Engineering; institution type: Universities; period: 2021–2025	Filter combination
SCImago	Country comparison in Construction Engineering	1996–2024	Engineering – Building and Construction	2215	Region: Latin America; category: Building and Construction; country ranking; indicators: Documents and H-index; period: 1996–2024	Filter combination
SCImago	Country comparison in Structural Engineering	1996–2024	Engineering – Civil and Structural Engineering	2205	Region: Latin America; category: Civil and Structural Engineering; country ranking; indicators: Documents and H-index; period: 1996–2024	Filter combination

For the bibliometric analysis, two independent thematic consultations in Scopus, which were corresponded to the 2015-2025 period. The first one, oriented to building engineering, the following equation was employed: TITLE-ABS-KEY (Construction Engineering AND Latin America) AND PUBYEAR > 2014 AND PUBYEAR < 2026, and 68 documents were recovered. The second, correspondent to structural engineering, employed the following equation TITLE-ABS-KEY (Structural Engineering AND Latin America) AND PUBYEAR > 2014 AND PUBYEAR < 2026, obtaining 57 documents. The exact date of the performed consultations was 28th may of 2026. The documentary

counting process indicated correspond to the later consultations and should not be interpreted as historical verified quantities of the original search.

2.2.2. Registration RENACYT (CONCYTEC)

For the characterization of the researchers, the information from the National Registry of Scientific, Technological, and Technological Innovation Activities (RENACYT–CONCYTEC) was considered.

The set of presented data in this study includes 13,054 registered researchers, and from them, 2.515 belong to the area of Technology and Engineering. Within this área, 224 associated researchers with the Civil Engineering specialization were identified, who are the specific population of analysis.

For this group, variables related to regional distribution, gender, academic background, RENACYT classification level, institutional affiliation, and research lines were examined according to the presented information in this study records. The outcome were organized through frequencies and percentages for describing characteristics of the researchers linked to civil engineering. As background, Barboza-Palomino [22] examined the profile of women engineers qualified as researchers in Peru. This study brings a benchmark for the contextualization of the feminine participation in engineering research, without extrapolating the results directly to the civil engineering specialty. For ensure traceability and coherence in the source selection, Figure 1 schematically shows the consultation's sources and the search path used to get the bibliometric register (papers and magazines) in the study.

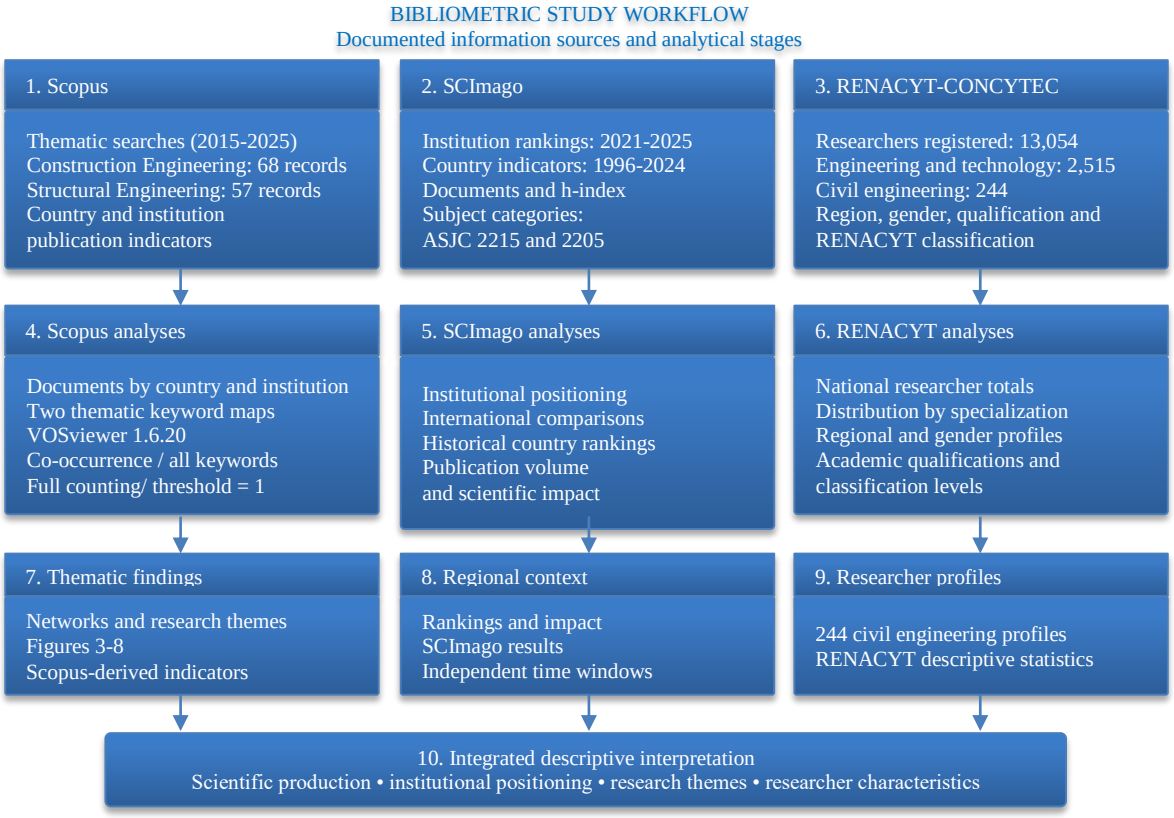


Fig. 1 PRISMA flowchart showing the bibliometric search strategy, screening, eligibility, and final inclusion process

2.3. Collection Data Procedure

The analysis periods were defined according to data availability and the specific objective of each source. Scopus was used for the recent thematic analysis of Construction Engineering and Structural Engineering during 2015–2025; SCImago was used to analyze institutional positioning during 2021–2025 and to perform the cumulative historical comparison between countries during 1996–2024. Consequently, these time windows correspond to independent analyses and were not combined into a single longitudinal series. Records corresponding to 2025 were considered within the analysis window available at the time of the query. The collection was developed on two fronts. First, bibliometric data were extracted from the selective platforms, recording the quantity of documents for the country and university, positions in rankings, and indicators of available impact (for example, H index). Second, a database was structured with RENACYT data for analysis for the distribution and characteristics of linked investigators to civil engineers. This source integration type allows a more complete vision of scientific performance [23].

2.4. Processing and Data Debugging

The data were cleaned through: (i) standardization of county names, institutions, and authors; (ii) duplicates were verified; (iii) homogenization of periods; and (iv) validation of the incomplete register.

Later, the information was organized in matrices and tables for the frequency calculation, percentages, temporal trends, and bibliometric network construction, following habitual practices in bibliometric analysis [21].

2.5. Data Analysis

The analysis included:

- Productivity: number of documents for country, university, and year.
- Positioning: comparative rankings for countries and universities.
- Impact: available metrics (for example, H index)

The statistical analysis was descriptive (frequencies, percentages, and temporal series) to identify growth patterns and institutional concentration. For the analysis of the bibliometric network, the VOSviewer 1.6.20 version was employed. Th co-occurrence analysis was applied (co-occurrence), considering all of the keywords as a unit analysis and the full counting approach. The minimum threshold was stablished from the occurrence per keyword. Through this configuration, the co-occurrence maps were generated that were corresponded to building and structural engineering, presented in Figures 7 and 8 [21].

2.6. Variables Analyzed

The following were analyzed: authors, universities, countries, subareas/themes of investigations (construction and structures), and scientific production for the year, metrics of available impact (H index), and RENACYT variables associate to gender, academic grade, RENACYT level, region, and institutional affiliation.

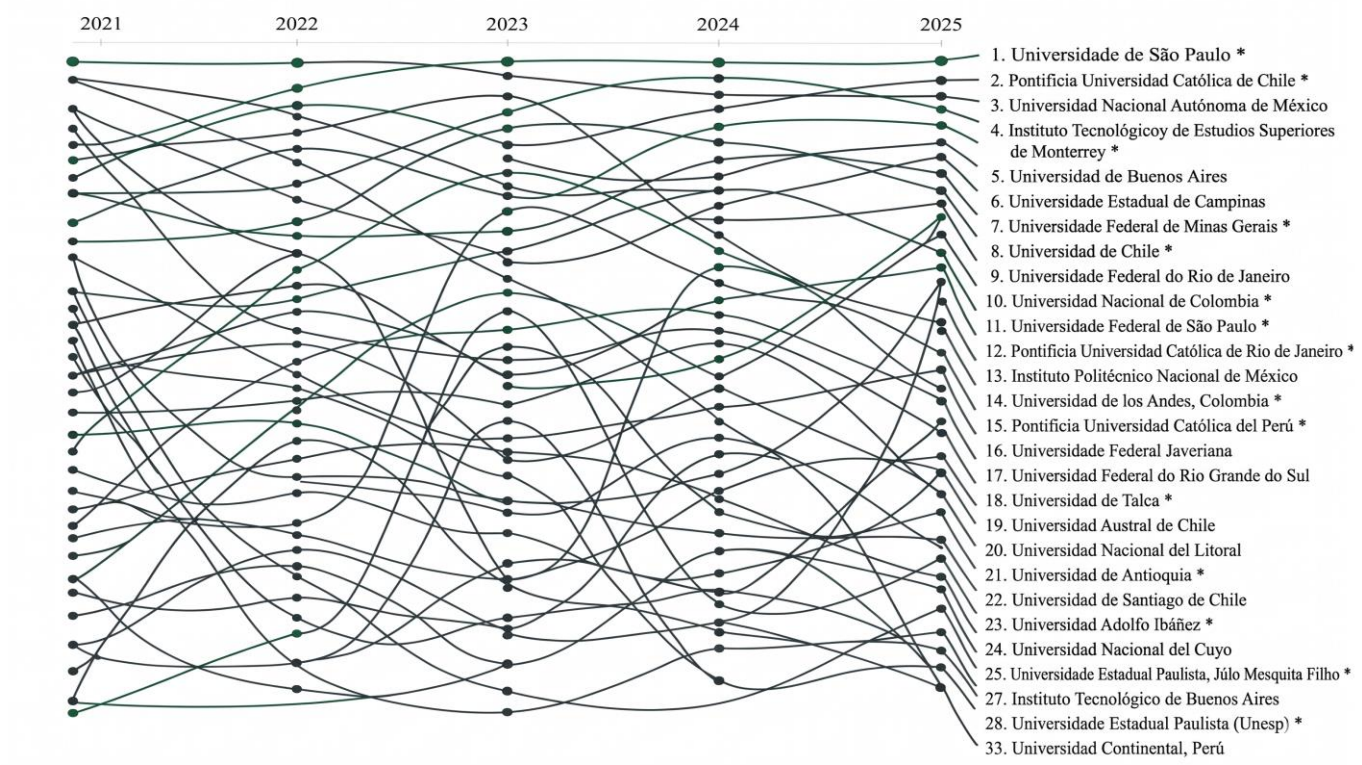


Fig. 2 Ranking of Latin American scientific production referred to civil engineering. Source: Adapted from SCImago data

3. Results

3.1. Panorama General of Investigation in Civil Engineering in Latin America (SCImago, 2021-2025)

Figure 2 shows the evolution of Latin American universities in the ranking based on scientific production in civil engineering in the 2021-2025 period. To this end, using a longitudinal graphic where every line represents a university and shows a position change over the years. In general terms, it is observed that the institutions of Brazil, Mexico, and Chile maintain a relatively stable regional leadership in the first positions. In contrast, there are more changes of position in the intermediate stages. The Continental University, which occupies the place 33 in the classification of 2025, is the only Peruvian institution included in the ranking, which demonstrates a scarce presence of Peru in the Latin American lists of scientific production in civil engineering.

In other areas, the bibliometric analysis indicates that the production tends to concentrate on a few leading institutions and that the visibility of the major part of the universities in global bases is scarce. So, the Continental University stands out as the main Peruvian reference in this regional mediation, which suggests a chance of improvement for the university system in terms of volume of publication, consolidation group, and international visibility.

3.1.1. Scientific Latin American Production (Scopus, 2015-2025)

Construction Engineering in Latin America (2015-2025)

It is observed that in Figure 3, the number of investigations in Construction Engineering is between the Latin American countries. It is observed that Peru registers the largest quantity of investigators (13), ranking in first place. In second and third place appear Colombia (12) and Brazil (8), forming the major block production inside the analyzed set. Peru's observed leadership in this specific query should not be interpreted as a general leadership in Latin American scientific production in Construction Engineering.

The 13 records identified correspond exclusively to the documentary collection retrieved through the thematic strategy applied in Scopus for the period 2015–2025. In contrast, the comparison presented later using SCImago considers the entire Building and Construction category and a much longer cumulative period, 1996–2024. Therefore, both results correspond to different bibliometric universes and are not directly comparable.

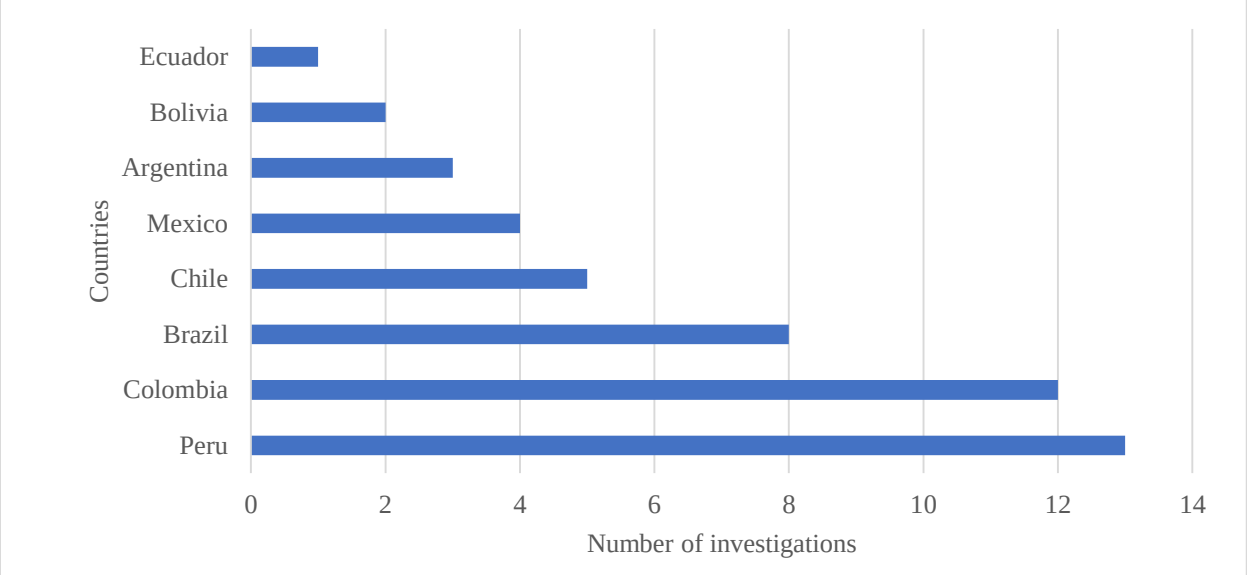


Fig. 3 Ranking of Latin American scientific production countries oriented to construction engineering. Source: Adapted from Scopus data

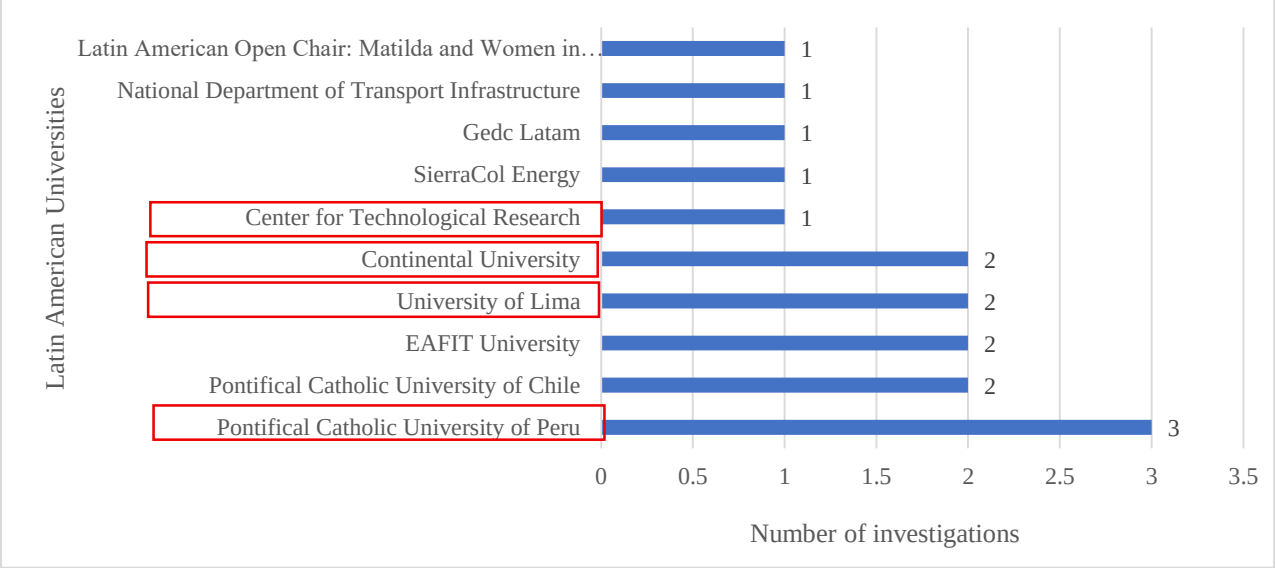


Fig. 4 Ranking universities of Latin America's scientific production oriented in construction engineering. Source: Adapted from Scopus data

Figure 4 presents the university ranking according to the number of investigators in Construction Engineering (Scopus). It is observed that Pontifical Catholic University of Peru (PUCP) leads with 3 investigations, positioning itself as an institution with major production within the set shown. In a second level, four investigation institutions with 2 investigators research each: Pontifical Catholic University of Chile, University EAFIT, Lima University, and University Continental.

Structural Engineering in Latin America (2015-2025)

Figure 5 is presented Latin American ranking according to the number of investigations in structural engineering for the period 2015-2025. It is observed that Mexico leads clearly with 9 investigations, ranking as the country with major production within the analyzed set. In a second block, Colombia (6) and Peru (6), show high performance and are comparable to each other.

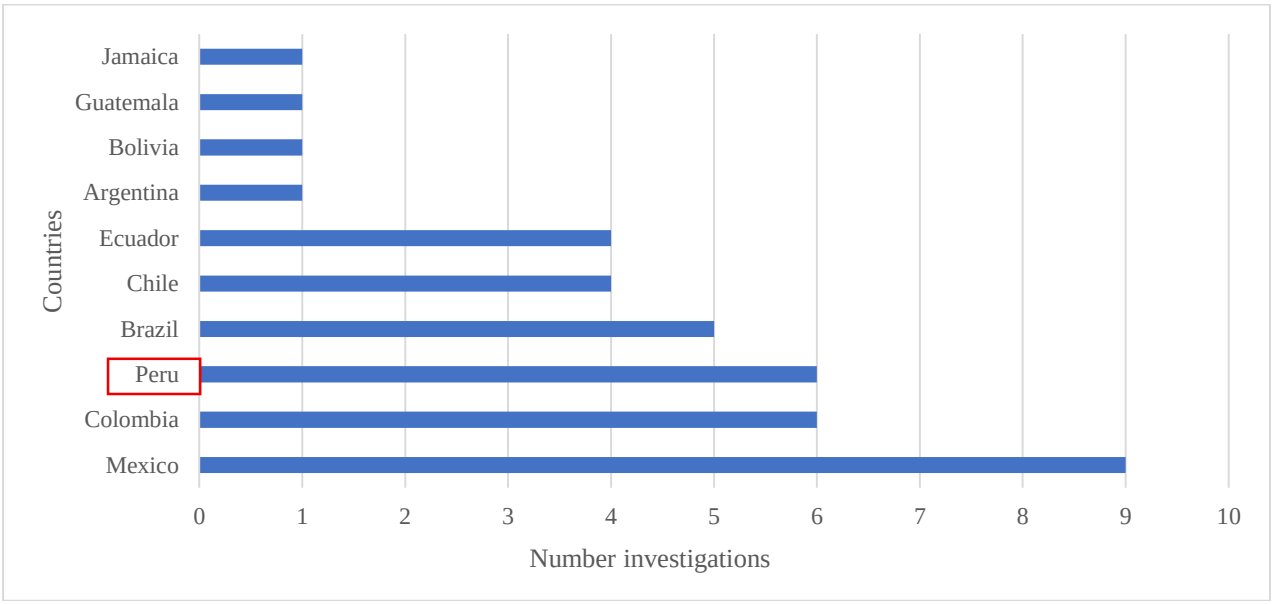


Fig. 5 Ranking of Latin American countries' scientific production oriented to structural engineering. Source: Adapted from Scopus data

Figure 6 presents the Latin American universities ranking according to the number of investigations in structural engineering (Scopus). It is observed that the Pontifical Catholic University of Peru (PUCP) leads the group with 3 investigations, positioning itself as an institution with major production inside the sample analyzed. In the second level, Tecnológico de Monterrey, Querétaro (2) and LLC appear, while the rest of the institutions register 1 investigation each, evidencing a punctual participation.

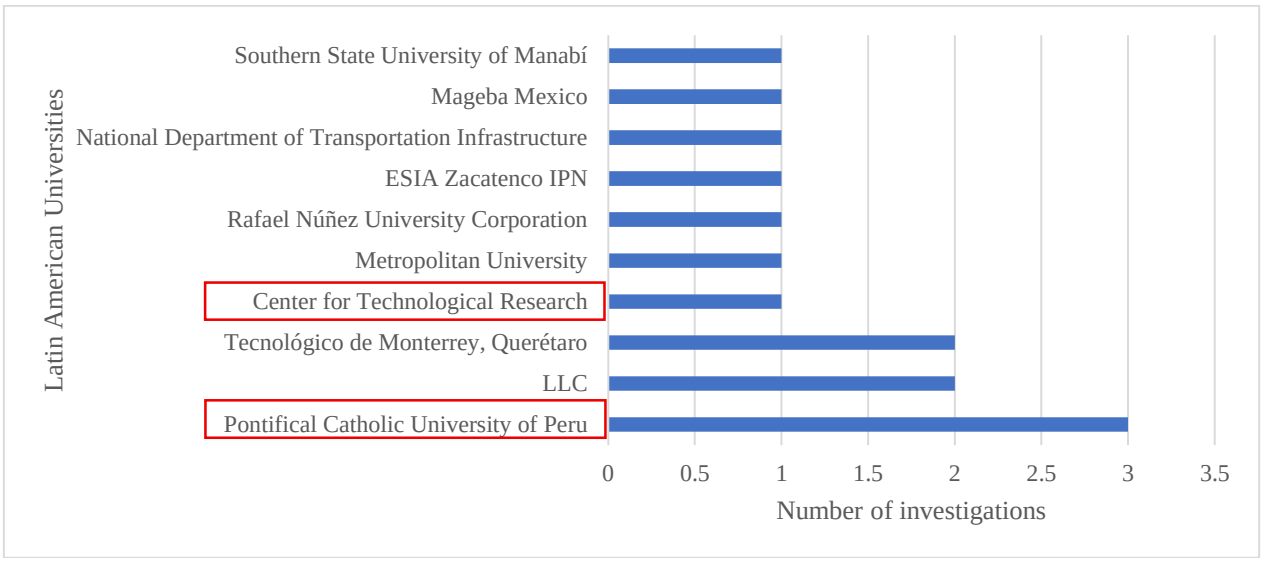


Fig. 6 Ranking of universities of Latin American scientific production oriented to structural engineering. Source: Adapted from Scopus data

3.1.2. Bibliometric Analysis through VOSviewer (Scopus, 2015–2025)

Maps and Thematic Clusters in Construction Engineering in Latin America

As seen in Figure 7, a highly networked, centralized system, where "Latin America" is the principal node and connects the themes more relevant (Sustainable development, Walls (structural partitions), Seismic response, Engineering / Latin American, Performance assessment, Optimization, Road construction / Contractors). This suggests that work like articulator nodes form the front of investigators; keywords are recurrently connected with the principal word, therefore, tend to present the referential nucleus.

Table 2 shows that research in Latin America focuses on sustainable development, seismic response, and structural performance, integrating optimization and infrastructure management.

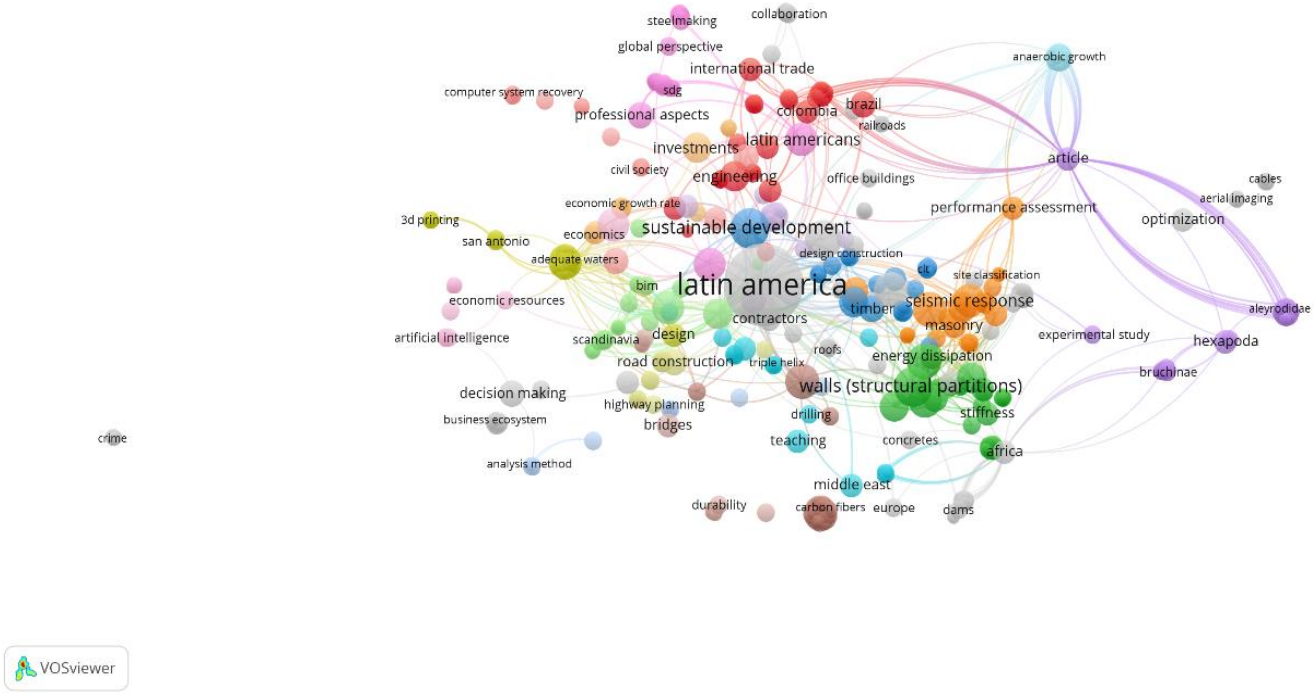


Fig. 7 Authors' maps of word analysis Construction Engineering" and "Latin American" with the highest interaction. Source: Obtained from VOSviewer

Table 2. Authors with major impact in "Construction Engineering" in "Latin America"

Keyword	Keyword Type	Co-occurrence strength (qualitative)	Interpretation / Relevance
Latin America	Descriptive / Geographic	Very high	Core focus of the field; concentrates the greatest connectivity.
Sustainable development	Thematic / Strategic	High	Main line of research: sustainability applied to infrastructure and construction.
Walls (structural partitions)	Technical/Structural	High	Dominant structural theme: related to stiffness, materials, and performance.
Seismic response	Technical/Structural	Medium– High	Extensive experience in seismic design and behavior.
Engineering / Latin American	Thematic / Contextual	Medium– High	Relationship between the technical perspective and the human and regional environment (scientific research).
Performance assessment	Methodological	Medium	Performance analysis: relates different aspects (materials, design, and seismicity).
Optimization	Methodological	Medium	Approaches to optimize costs, design, or structural performance.
Road construction / Contractors	Applied / Management	Medium	Management and execution of road infrastructure; practical approach to the sector.

Maps and Thematic Clusters in Structural Engineering in Latin America

As seen in Figure 8, a highly networked, centralized system, where "Latin America" is the principal node and connects the most relevant themes (Seismic response, earthquakes, masonry / confined masonry, seismology, engineering education, structural design, students, curricula/teaching, artificial intelligence, risk assessment, human engineering). This suggests that work like articulator nodes form the front of investigators; keywords are recurrently connected with the principal word, therefore, tend to present the referential nucleus. Table 3 highlights that research in Latin America mainly focuses on seismic engineering and structural resilience, while also incorporating engineering education and emerging technologies such as artificial intelligence.

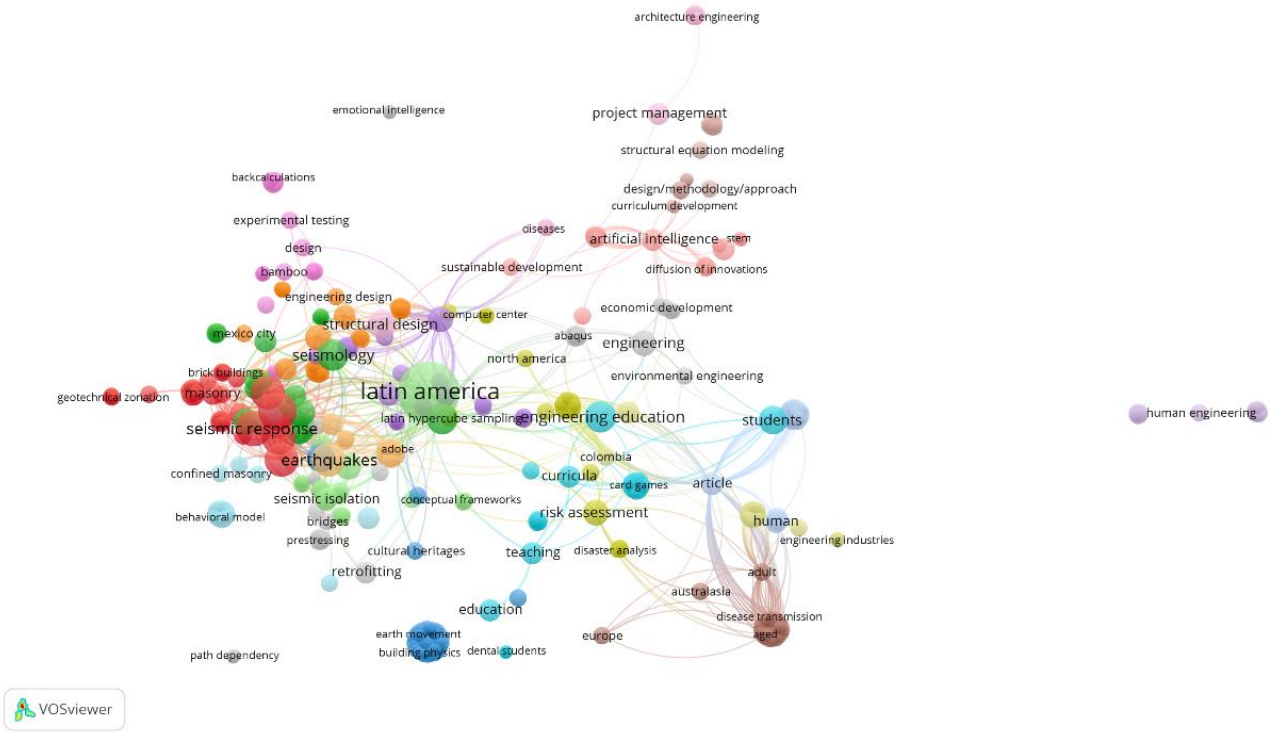


Fig. 8 Authors' maps of word analysis of " Structural Engineering" and "Latin American" with the highest interaction
Source: Obtained from VOSviewer

Table 3. Authors with major impact in "Structural Engineering" in "Latin America"

Keyword	Keyword Type	Co-occurrence Strength (Qualitative)	Interpretation / Relevance
Latin America	Descriptive/ Geographic	Very high	Central axis of the map; it articulates and connects the main subtopics of the field.
Seismic response	Operative/ Technical	High	Dominant line: structural performance under earthquakes and response assessment.
Earthquakes	Descriptive/ Technical	High	It reinforces the focus on seismic hazard as a recurring problem in the region.
Masonry / Confined masonry	Technical/ Constructive	Medium–High	Common categories in Latin America: fundamental for assessing vulnerability and promoting resilience.
Seismology	Technical/ Analytics	Medium – High	It supports the study of seismic phenomena and their relationship to structural engineering.
Engineering education	Thematic/ Academy	Medium – High	Second main line: training, curricula, and engineering education.
Structural design	Operative/ Technical	Medium	Methods, structural criteria, and design in relation to the seismic approach.

Students	Descriptive/ Academy	Medium	Direct relationship with education and the evaluation of training processes.
Curricula / Teaching	Operative/ Academy	Medium	Application of the model to curriculum design and teaching techniques.
Artificial intelligence	Technical/ Emergent	Medium	Cross-cutting theme: innovation, use of technology, and analytical tools.
Risk assessment	Methodological	Medium	Risk assessment and analysis associated with disasters/impacts.
Human engineering	Peripheral	Low	Isolated theme; low integration with the core of the map.

3.1.3. Comparison between Countries in Latin America (SCImago, 1996–2024)

Construction Engineering in Latin America (1996–2024)

Table 4. Ranking Latin American countries according to the number of investigations about Construction Engineering

Rank	Country	Region	Documents	H index
1	Brazil	Latin America	7762	144
2	Mexico	Latin America	2263	91
3	Colombia	Latin America	2197	82
4	Chile	Latin America	1974	73
5	Argentina	Latin America	1292	73
6	Ecuador	Latin America	608	43
7	Peru	Latin America	536	30
8	Cuba	Latin America	338	35
9	Venezuela	Latin America	184	28
10	Uruguay	Latin America	136	17

As seen in Table 4, the scientific production in Construction Engineering is very concentrated in Brazil, which leads with 7762 documents, and the H index is very high (144), which shows not only volume, but also sustained impact. In an analysis of production academy, the data show (2,263 documents; H = 91), Colombia (2,197; H=82), Chile (1,974; H=73) and Argentina (1,292; H=73), that show a similar impact to Chile despite having fewer jobs. Ecuador (608; H=43) and Perú (536; H=30) have lower production and H index, with Peru standing out in quantity, but not in comparative visibility.

Structural Engineering in Latin America (1996–2024)

As seen in Table 5, Structural Engineering, a similar pattern of leadership can be observed, with Brazil in first place (12,435 documents; H=149), consolidating its regional centrality. In second place, Mexico is found (4475 documents; H = 100), Chile (3359 documents; H = 102), Colombia (2997 documents; H = 92) y Argentina (1889 documents; H = 79). It should be noted that Chile, with fewer documents than Mexico, has a higher H index of 102, the suggest a quite high impact.

In this area, Peru occupies sixth place with 1048 documents, surpassing Ecuador, but its H index (39) is less than that of Ecuador (935, H=52) and also lower than that of Venezuela (421; H = 41), which means that the increase in quantity has not yet translated into the same level of accumulated citations. The lowest rankings correspond to Cuba (423; H=33) and Puerto Rico (236; H=32).

Table 5. Ranking Latin American countries according to the number of investigations about Structural Engineering

Rank	Country	Region	Documents	H index
1	Brazil	Latin America	12435	149
2	Mexico	Latin America	4475	100
3	Chile	Latin America	3359	102
4	Colombia	Latin America	2997	92
5	Argentina	Latin America	1889	79
6	Peru	Latin America	1048	39
7	Ecuador	Latin America	935	52
8	Cuba	Latin America	423	33
9	Venezuela	Latin America	421	41
10	Puerto Rico	Latin America	236	32

3.1.4. Scientific Production in Peru (Scopus, Last 20 Years)

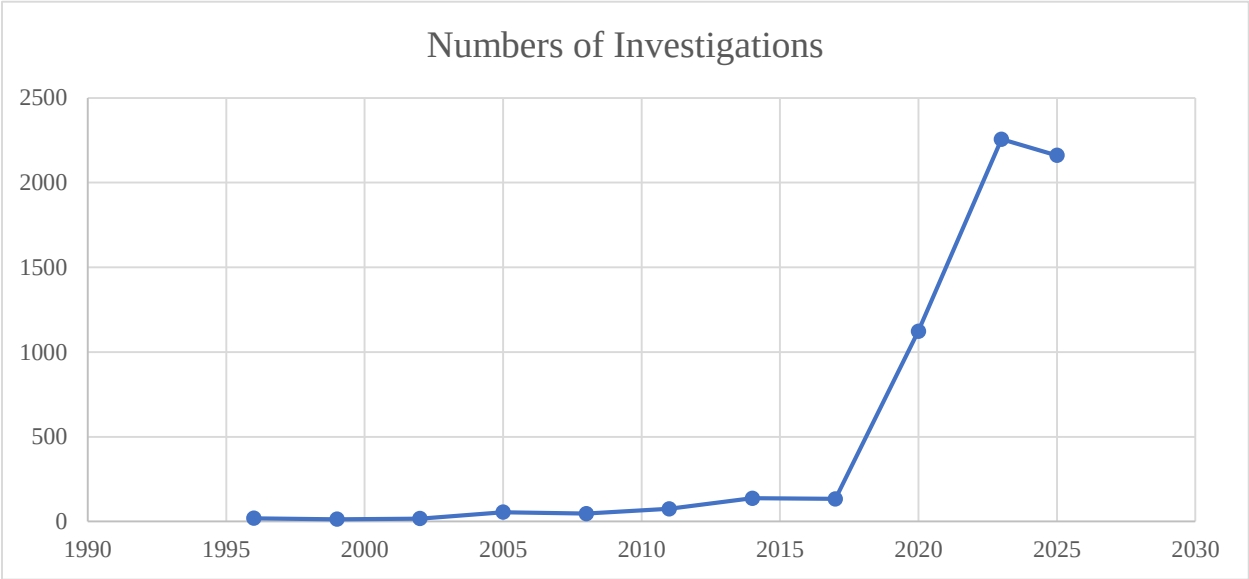


Fig. 9 Maps of the number of investigations of Peru in the last 20 years. Source: Adapted from Scopus SCImago

The scientific production in Peru has experienced significant growth, as the evidence to Figure 9. The volume is low and scattered in the first years, for example, between 1996 and 2002, with between 13 and 19 documents. Since 2005, has been occurring an increase (55 in 2005; 75 in 2011; 137 in 2014) has been observed, although with a little variation in 2017 (133). Since 2020, an important change has occurred an important change, with a structural jump: the numbers have increased from hundreds to more than a thousand documents (1123 in 2020), reaching a maximum in 2023 (2256). In 2025 (2161), the level follows being very high, although slightly lower than the maximum reached in 2023, which may be associated with the end of the year or with the stability after rapid growth.

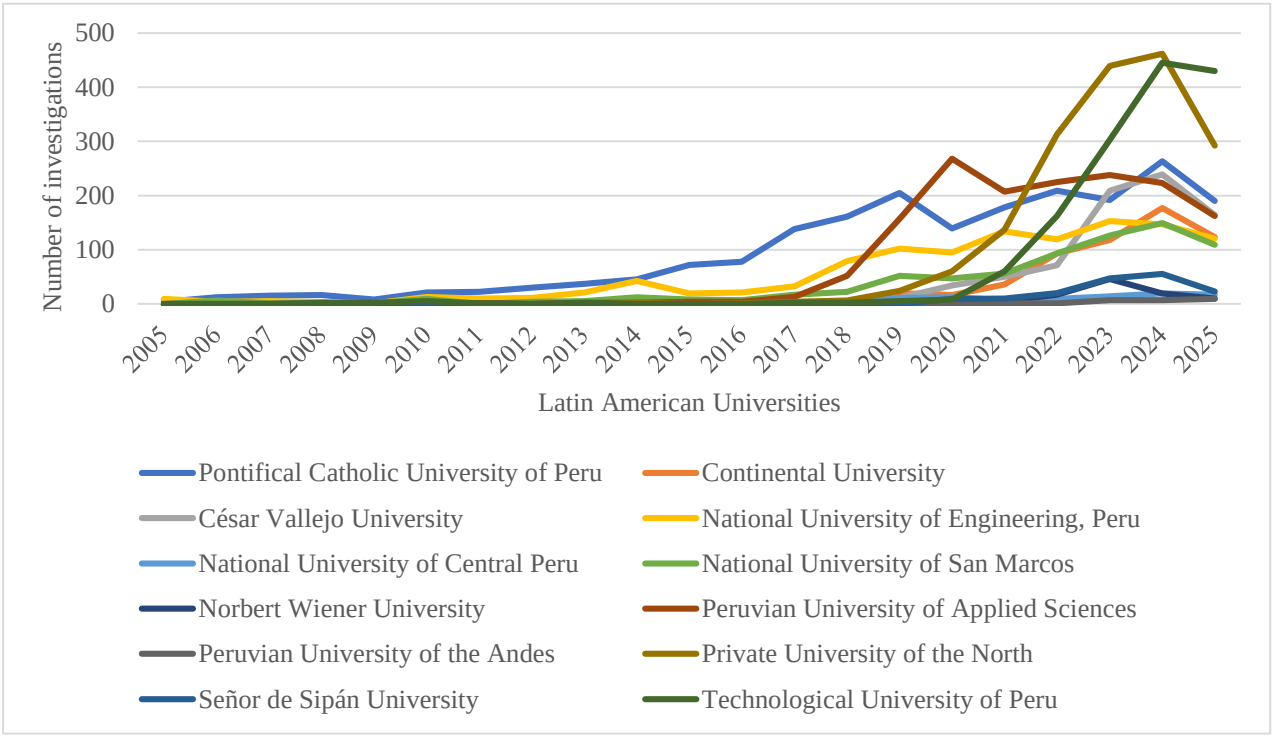


Fig. 10 Ranking of universities in Peru in terms of scientific production

Source: Adapted from Scopus data

Universities with a Large Number of Publications (Scopus)

As seen in Figure 10, the evolution 2005-2025 shows that in Peru, scientific production has increased with force since 2016-2018 and reaches its peak in 2020-2024. The decrease in 2025 is consistent with a year not yet consolidated by registration closure. The group of head the compose the Andes Peruvian University (with significant growth since 2018 and high levels since then), the UNI (with a good start since 2019), University Continental (with regular growth and high volume), and Señor de Sipán University (with faster growth, which will reach its peak in 2024). Norbert Wiener took the second level, with progressive increases and recent stability. Lastly, the UCV shows an expansion in width, while the UNMSM, the UPC, the UTP, and the Privada del Norte have a smaller presence or are more recent compared to the top positions.

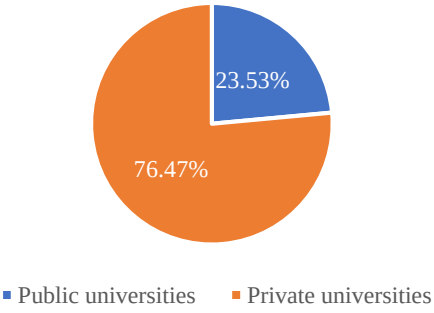


Fig. 11 Ranking of Peruvian universities by scientific output
Source: Adapted from Scopus data

Comparison between Universities Publics and Privates (Scopus)

Figure 11 presents the percetual distribution of 76.47 % for private universities and 23.53% for public ones, according to utilized data in this research. These outcomes display a difference in both categories within the analyzed set. Nonetheless, due to the descriptive character of this research, it is not possible to attribute this difference to institutional policies, economic incentives or specific management strategies

4. Overview of Research in Civil Engineering in Peru (RENACYT)

As shown in Table 6, of the total 13,054 researchers registered in RENACYT (100%), the Engineering and Technology area accounts for 2,515 researchers, representing 19.27% of the national total. Inside this wide field, civil engineer has 244 researchers, which represents 1.87% of all RENACYT researchers.

From the perspective of the internal structure of the system, these data show that the number of investigators in civil engineering is low in comparison with the total number of national investigators, as well as the group of engineers and technologists. This implies restricted participation of the sector in the national ecosystem of formally recognized research.

Table 6. Comparison of RENACYT researchers: Total, Engineering and Technology, and Civil Engineering

	Number of researchers	Percentage
Renacyt researchers	13054	100.00%
Engineering and technology	2515	19.27%
Civil engineering	244	1.87%

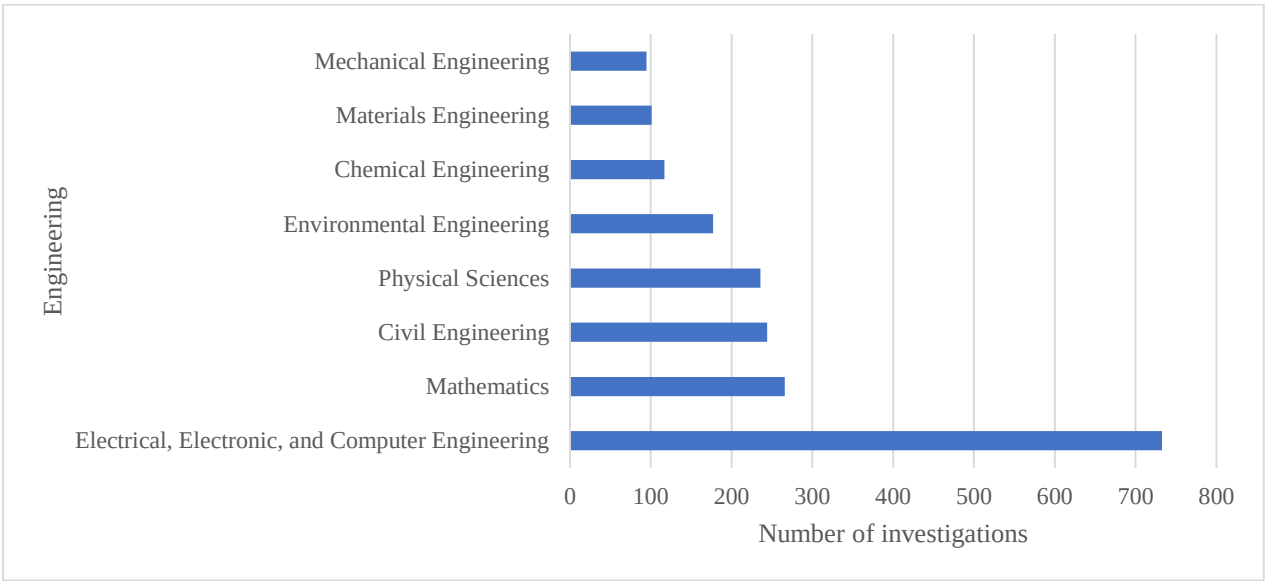


Fig. 12 Distribution of RENACYT researchers across selected fields of knowledge. Source: Authors' elaboration based on RENACYT–CONCYTEC data

4.1. Distribution of RENACYT Investigators to Known Areas (Perú)

Figure 12 presents the distribution of RENACYT researchers across the selected areas of knowledge. Electrical, Electronic, and Computer Engineering records the highest number, followed by Mathematics (266), Civil Engineering (244), and Physical Sciences (236).

These values correspond to different fields of knowledge and should not be interpreted as academic qualification levels of the 244 Civil Engineering researchers.

4.2. Specific Analysis of RENACYT Researchers in Civil Engineering (Peru)

4.2.1. Number of RENACYT Researchers Distributed by Regions of the Country

Figure 13 depicts the territorial distribution of the 244 RENACYT researchers linked to civil engineering. The city if Lima concentrates 92 of the researchers (37.70%), followed by the city of Puno with 18 (7.38%), and then Cajamarca and Junin, each with 15 (6.15%), and Arequipa with 15 (5.74%). Likewise, 19 researchers (7.79%) do not have regional information. These results put in evidence a heterogeneous territorial distribution, with a higher concentration of registered researchers in Lima

Number	Region	Amount
1	AMAZONAS	1
2	ANCASH	7
3	APURIMAC	1
4	AREQUIPA	14
5	AYACUCHO	3
6	CAJAMARCA	15
7	CUSCO	8
8	HUANCAVELICA	2
9	HUANUCO	3
10	ICA	1
11	JUNIN	15
12	LA LIBERTAD	10
13	LAMBAYEQUE	12
14	LIMA	92
15	MADRE DE DIOS	1
16	MOQUEGUA	3
17	NO REPORTADO	19
18	PASCO	1
19	PIURA	8
20	PROV. CONST. DEL CALLAO	5
21	PUNO	18
22	SAN MARTIN	2
23	TACNA	3
TOTAL		**244**

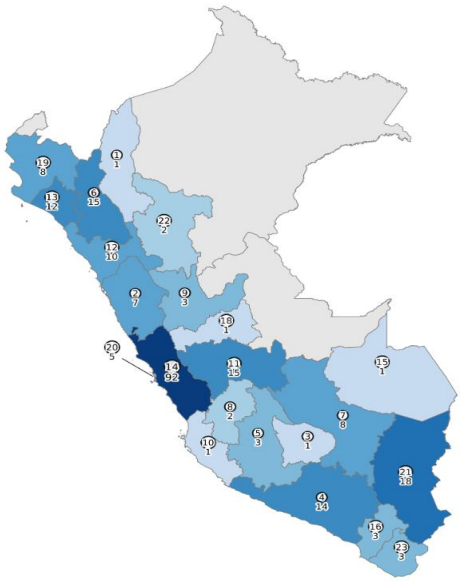


Fig. 13 Number of researchers according to their region. Source: Renacyt Data

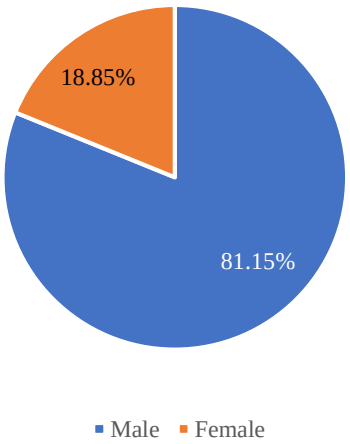


Fig. 14 Gender distribution of RENACYT researchers in Civil Engineering (n = 244). Data adapted from RENACYT database

4.2.2. Number of RENACYT Researchers in Civil Engineering by Gender

Figure 14 shows that among the 244 RENACYT researchers in Civil Engineering, males predominate (81.15%), while females represent 18.85%.

This demonstrates a markedly unequal composition in terms of gender participation within the field.

4.2.3. By Degree/Qualification

Figure 15 presents the distribution of the 244 RENACYT researchers of civil engineering according to their academic background. Researchers with a doctorate predominate (108; 44,26 %) and with a master's degree (107; 43,85 %), which together represent 88,11%. The remaining categories correspond to researchers with a professional title (6; 2,46 %), without an academic degree (2; 0,82 %) and students (1; 0,41 %).

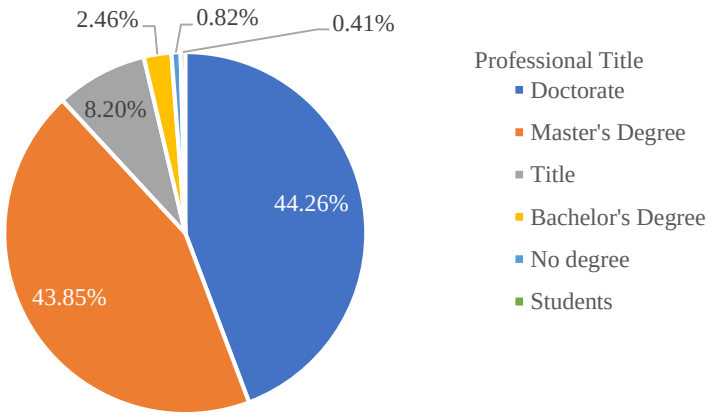


Fig. 15 Distribution of RENACYT civil engineering researchers by academic background (n = 244). Work based on RENACYT–CONCYTEC data used in the study

4.2.4. Distribution by RENACYT Level

Figure 16 shows evidence of a strong concentration at the upper levels of the system. The Level VII group 122 investigators, next to the Level VI (60) and Level V (28). In the first levels, intermediates and lows, much lower values are recorded: Level IV (14), Level III (12), Level II (4), and Level I (2). Additionally, identify 2 distinguished researchers. In total, the sum is 244 investigators.

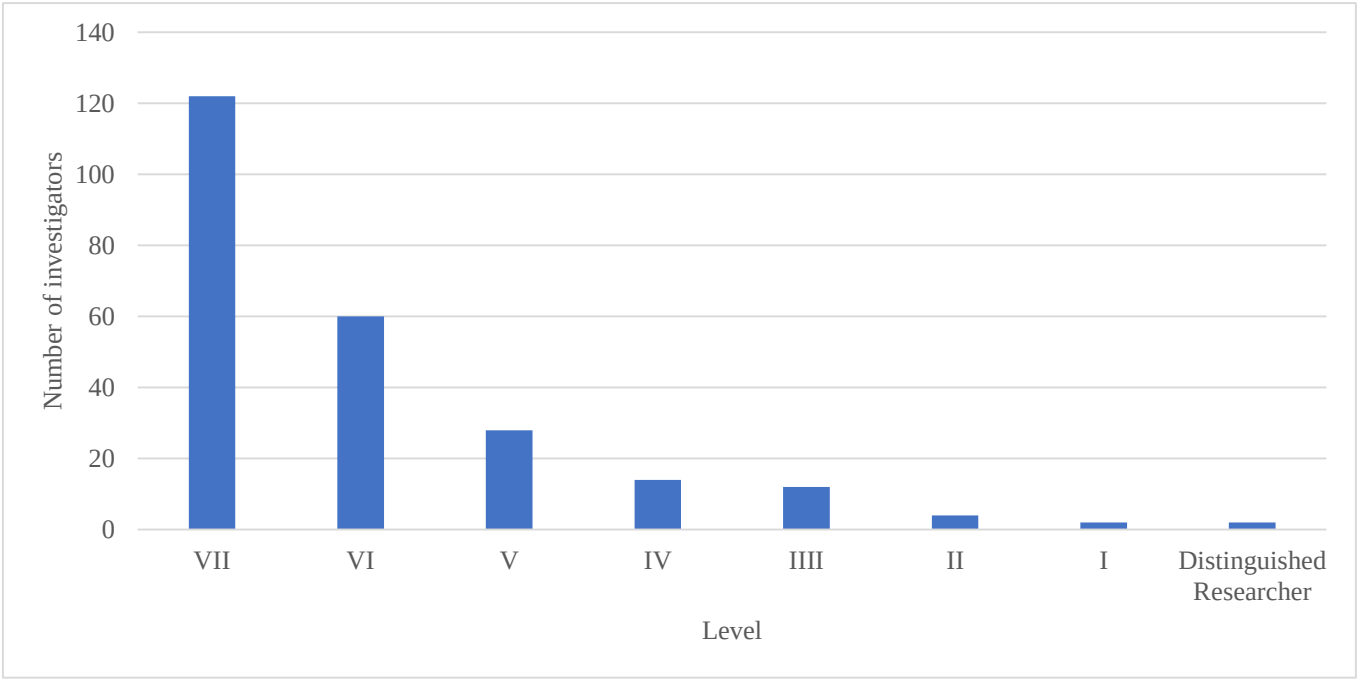


Fig. 16 Academic level of RENACYT researchers in Civil Engineering (n = 244). Data adapted from RENACYT database

4.2.5. Main RENACYT Researchers in Civil Engineering

Table 7 presents 10 profiles of linked researchers with civil engineering, organized according to the RENACYT classification levels mentioned in the analyzed records. Two distinguished researchers are included, two of level I, and four of level II, and two of level III. The table contains a descriptive purpose and does not constitute a productive or scientific impact classification. The original employed criterion for choosing the two level II profiles could not been verified with the available information.

Table 7. Characterization of RENACYT Civil Engineering researchers according to their classification level, institutional affiliation, and specialty.

N°	Researcher	RENACYT Level	Affiliated university	Academic degree	Main lines of research
1	Jose Luis Mantari Laureano	Distinguished Researcher	Technical University of Lisbon	Doctor of Naval and Maritime Engineering	Structural engineering and composite materials mechanics
2	Mas Samanez, Erick Arturo	Distinguished Researcher	Tohoku University (Japan)	Doctor of Civil Engineering	Hydraulic engineering, coastal engineering, and natural hazards
3	Tarque Ruiz, Sabino Nicola	I	Pontifical Catholic University of Peru	Doctor of Civil Engineering	Structural engineering
4	Muñoz Pérez, Sócrates Pedro	I	National University of Santa	Doctor of Civil Engineering	Materials and structures
5	Almeida del Savio, Alexandre	II	PUC-Rio (Brazil)	Doctor of Civil Engineering	Structural engineering, materials, and construction management
6	Santa Cruz Hidalgo, Sandra Cecilia	II	Pontifical Catholic University of Peru	Doctor of Civil Engineering	Seismic engineering, infrastructure risk, and resilience
7	Coll Pla, Sergio	II	Rovira i Virgili University (Spain)	Doctor of Civil Engineering	Engineering of built heritage, structural diagnostics
8	Palomino Tamayo, Jorge Luis	II	Federal University of Rio Grande do Sul (Brazil)	Doctor of Architecture, Urban Planning, and Building Construction	Computational mechanics of structures
9	Tupa Fernández, Néstor	III	University of Brasília (Brazil)	Doctor of Civil Engineering	Geotechnical materials engineering, fracture mechanics
10	Aguilar Bardales, Zenón	III	Kyoto University (Japan)	Doctor of Geotechnical Engineering	Seismic engineering and seismic geotechnics

4.2.6. Lines of Scientific Investigation and Production

Table 8 presents the descriptive characterization of the research lines and the types of scientific production for the 10 researchers linked to civil engineering. Between the identified specialties are structural engineering, seismic engineering, geotechnics, hydraulic engineering and life-cycle analysis. The present data does not permit to stablish a productivity order, nor compare, quantitatively, the impact of the researchers.

In the performed consultation, there were observed differences in the availability of the information regarding Rafael Aguilar Vélez and Ian Vázquez-Rowe between RENACYT and CTI Vitae.

These differences are presented as observations and do not constitute enough evidence to stablish record errors or to determine which of the platforms has more precise information.

Table 8. Research lines and types of scientific production of ten researchers linked to civil engineering

N°	Investigator	Investigation lines	Scientific production (type)
1	Aguilar Velez Rafael	Seismic engineering; heritage; structural monitoring; sustainable construction	Articles Q1–Q2 indexed, book caps, international conferences
2	Vázquez-Rowe, Ian	Life cycle analysis; ambient stability	Articles Q1–Q2 indexed, international reviews, book caps, scientific editorials
3	Mas Samanez, Erick Arturo	Hydraulic, costera, natural riesgos	Articles Q1–Q2, international projects
4	Tarque Ruiz, Sabino Nicola	Structural engineering	Indexed items, thesis direction
5	Muñoz Pérez, Sócrates Pedro	Materials and structures	Scientific articles and applied studies
6	Almeida del Savio, Alexandre	Structures, materials, management	International publications
7	Santa Cruz Hidalgo, Sandra Cecilia	Seismic engineering, riesgo, resilience	Scientific articles, research projects
8	Coll Pla, Sergio	Built heritage	Technical and scientific publications
9	Palomino Tamayo, Jorge Luis	Computer mechanics	Digital modeling, articles
10	Tupa Fernández, Néstor	Geotechnics and fracture	Specialized articles

5. Discussion

Figure 2 (SCImago, 2021–2025) shows that the regional leadership in scientific production in civil engineering concentrate of stable way in universities of Brazil, Chile, and Mexico, while the intermediate positions show major mobility. In the case of Peru, only the Continental University figure (position 33 in 2025), which shows a limited presence limit institutional and the difficulty of the national university system for positioning several universities simultaneously and consistently in rankings based on indexed databases. The institutional position should be interpreted by considering the indicators and utilized criteria in each classification. In the Peruvian context, Arcila-Diaz et al. [17] documented differences in production between universities, which permits to contextualize the observed institutional heterogeneity in this current study.

In Construction Engineering in Figure 2, Peru records 13 publications, placing it first among the compared group, followed by Colombia (12) and Brazil (8). However, the breakdown by university in Figure 3 shows that institutional counts are low: PUCP leads with 3, and a group of four universities records 2 (PUC-Chile, EAFIT, Universidad de Lima, and Universidad Continental). This suggests that the strong country-level performance from 2015 to 2025 does not translate into highly concentrated output at a few institutions, but rather into distributed production that is still small-scale per university—a pattern commonly observed when scientific productivity is disaggregated by institutional unit [21, 23].

In the field of structural engineering, Mexico stands out with nine research projects, while Peru and Colombia share second place with six. At the institutional level, the Pontifical Catholic University of Peru (PUCP) leads the list with three research projects, surpassing other institutions that contribute between one and two. Although Peru has recently become competitive in both sub-areas, its institutional contributions are limited, which affects their continuity and impact, as indicated by bibliometric studies [6, 21].

In Figures 7 and 8, the concentration on earthquake-resistant engineering and structural performance is due to the seismic context of Latin America [24]. In the VOSviewer maps, "Latin America" is a central node that connects subtopics such as seismic response and structural design, highlighting the importance of engineering education and the need to refine keywords.

According to Table 4, Brazil leads in publication and impact in construction engineering. Peru, although it publishes more than Ecuador and Cuba, has a lower H-index, indicating a mismatch between the quantity and quality of publications [25].

In Structural Engineering in Table 4, Peru ranks 6th in terms of publications, with 1,048 documents, but the quality of citations (h=39) is lower than that of Ecuador (h=52) and Venezuela (h=41). Despite the increase in the number of publications, influence does not grow proportionally, highlighting an inequality in bibliometric measurements. The objective of this study is to determine the research areas with the largest numbers of publications, the most influential researchers, and research trends in Peruvian Universities. Methodology: A bibliometric analysis was conducted from the Scopus database by retrieving a total of 29,935 documents between 2008 and 2021. Findings: The study analyzed the scientific production of 93 accredited universities in Peru

between 2008 and 2021, retrieved 29,935 documents, and observed an annual growth rate of 15% before Law 30,220, and 28% after. Medicine, social sciences, and engineering are the subject areas with the most publications. The study also found that Peruvian universities have contributed to 27 research areas. Peru, the United States, and Brazil were the top countries in collaboration. The study also illustrated the intellectual and conceptual structure of scientific production, with the greatest relevance in medicine and health [17]. The differences between the publication volume and the H-index depict that both indictors describe different dimensions of the bibliometric performance, Thus, they should be interpreted in a complementary manner and not as equivalent measures of productivity or scientific impact [26]. The scientific production of Peruvian universities have demonstrated a growing trend during the last decades, although there are differences among institutions and areas of knowledge. This behavior was also documented by Arcila-Diaz et al. [17], who analyzed the evolution of the researches in 93 Peruvian universities.

The observed differences between public and private universities should be interpreted by considering the characteristics and the limitations of the utilized indicators. Millones-Gómez et al. [15], examined the relationship between scientific production, institutional features and RENACYT researchers in 94 Peruvian institutions. In the same way, Arcila-Diaz et al. [17] identified differences in the scientific productivity among the universities of the country. These backgrounds permitted to contextualize the presented differences in Figure 11, although they do not explain their origin, nor permit to stablish cause-effect relationships from the available percentages.

The regional and gender disparities identified in this study represent two different dimensions of the national research system. The agglomeration of RENACYT researchers in Lima puts in evidence territorial differences in the analyzed set. Estrada-Araoz et al. [16] identified differences in the scientific production among universities in the Peruvian south-east, while Ortiz-Mas et al. [18] identified a heterogeneous distribution of research activity in the architecture school, according to their geographical location. These backgrounds permit to contextualize the results, although they do not explain the specific causes of agglomeration of civil engineers in Lima. In contrast, the gender analysis was conducted at the national level and shows that 81.15% of Civil Engineering researchers in Peru are male, while 18.85% are female. This imbalance highlights the need for policies that promote the participation and academic progression of women in Civil Engineering research, including mentoring, scholarships, research funding, and greater opportunities for leadership in scientific projects. These two findings should therefore be interpreted separately, as the available data do not establish the gender distribution of researchers within each individual region.

Civil Engineering brings together 244 researchers, of whom 81.15% are men. Most are based in Lima and have advanced postgraduate qualifications. There has been an increase in publications, indicating a growing system with limitations in terms of impact and specialized human capital, such as self-powered sensor networks for structural monitoring [27] and the implementation of BIM in construction projects [28].

In the performed search, differences in the availability of the information about Rafael Aguilar Vélez and Ian Vázquez-Rowe were observed between RENACYT and CTI Vitae. These differences are presented as descriptive observations and do not constitute enough evidence for establishing registration errors or to determine which of the platforms contains more precise information.

Unlike previous bibliometric studies focused on specific topics, particular technologies, or engineering disciplines analyzed in isolation, this study combines indicators of scientific output, institutional positioning, bibliometric impact, thematic maps, and characteristics of researchers recognized by RENACYT (National Registry of Science, Technology and Innovation). This integration does not imply a technically “superior” performance compared to other bibliometric methods, but rather a broader analytical scope for characterizing the Peruvian civil engineering research system. In this sense, the study's main contribution lies in relating internationally indexed output to the institutional structure and nationally recognized human capital, allowing for the simultaneous identification of growth, concentration, impact, thematic specialization, and territorial inequalities.

6. Conclusion

In summary, Peru is undergoing a clear phase of expansion in civil engineering research, with a turning point in 2020 that drove a sustained increase in production and visibility in Scopus during 2020–2024, remaining at high levels in 2025. This progress confirms a change of pace: the country is publishing more, participating more, and is more visible than in previous stages.

On a Latin American level, Peru is in the middle. Although the amount has grown and there is a regional presence, there is still a difference with respect to leading countries, above all when see the total impact (citations and H-index). It shows that the number of scientific publications has not yet translated proportionally into scientific influence.

Peru shows specific signs of competitiveness in subareas (2015-2025), especially in Construction Engineering, and maintains a relevant role in Structural Engineering. However, the level of institutionalization is still low, and the contributions of every university remain small, which limits consistency, specialization, and the development of strong lines over time.

Between 2021 and 2025 show that institutional positioning is changing and can vary year by year. Therefore, the Peruvian challenge is not only to grow over a given time period, but also keep productivity and impact with stability. In this scenario, production is concentrated in a few universities. Have cases of sustained growth, such as Universidad Continental, and cases of continued leadership by some key actors in specific areas.

The observed differences between the consulted information in RENACYT and CTI Vitae demonstrate the necessity to verify the consistency of the researchers' records. However, the available data does not permit to determine which of the platforms presents more precise information. Thus, it is suggested to contrast the records with official updated sources before establishing conclusions about their exactitude.

Finally, the analysis using VOSviewer allowed the identification of the thematic structure and co-occurrence relationships within the analyzed corpus.. The main themes were associated with seismic response, structural design, sustainability, engineering education, and emerging technologies. These visualizations should be interpreted as representations of the bibliometric relationships within the selected document set and not as indicators of the total scientific output of Latin America.

Recommendations

Universities are recommended to implement multi-year plans for each research area (structures, construction, geotechnical engineering, transportation, hydraulics, and materials), with production and impact targets (quartiles, citations, and co-authorships) to ensure continuity and reduce reliance on isolated efforts. To sustain them, it is crucial to strengthen research management through support offices that provide concrete services (scientific editing, translation, statistical support, ethics review, data management, and fund management), thereby elevating methodological quality and accelerating publication in indexed journals. Strategic internationalization is recommended, operations or influences more beyond its national borders and establishes connections whit Europe networks, the United States, and Asia, with a special interest in collaborations that give projects that can be published and formation programs of doctoral/postdoctoral (stays, joint management, shared laboratories). At the same time, quantity must be prioritized over the amount. For this, the production should refer to specific journals (preferably Q1–Q2, when possible), and good practices must be established: internal peer review before submission, reliable designs, and availability of data and procedures to increase impact and citations.

Furthermore, it is recommended to implement equality measures that include specific actions such as mentoring, initial funding, and promoting the role of women in supervising and writing theses and projects, as well as increasing the critical mass of women through doctoral and postdoctoral fellowships in civil engineering, with a focus on return to and inclusion in universities and regions. Regarding the implementation of these measures, it is suggested that research be maintained with stable funding, continuity of research groups, and a series of projects in development to avoid production spikes without structural support (postgraduate programs, laboratories, networks, and management) due to the changing nature of the 2021-2025 classification. It is recommended to strengthen the updating and verification procedures of the researchers' records, as well as improving the interoperability between RENACYT and CTI Vitae. These measures might permit to facilitate the comparison of information and reduce possible discrepancies between both platforms.

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