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INTRODUCCION

En 1976 México fue sede del 38 Congreso Mundial de la Federación Internacional de Documentación (FID). Este congreso tuvo como tema central "La Información y el Desarrollo".

Para entonces, el CICH tenía cinco años de creado y tres de compilar los datos para su "Bibliografía Latinoamericana". El material acumulado en 1974-1975 se prestaba para el estudio preliminar de algunos aspectos importantes de la investigación en nuestra región.

El personal del CICH inició ese estudio, lo que dio como resultado una serie de trabajos que fueron propuestos al Comité Organizador del Congreso; al aceptarlos, uno de los miembros del Comité de Selección opinó: "Estoy muy impresionado por la calidad e importancia del trabajo presentado en estos artículos".

Sin embargo, estos artículos, al no haber sido impresos y puestos en circulación por los organizadores del Congreso, no contaron con la difusión adecuada y oportuna. Aún así, las solicitudes de copias de los mismos no han sido infrecuentes, y el Dr. F. W. Lancaster de la Graduate School of Library Science de la Universidad de Illinois, los ha citado más de una vez.*

En una de estas citas (1979), Lancaster dice: "Apart from the impressive compilation of data for the

FOREWORD

In 1976 the 38 World Congress of the International Federation of Documentation (FID) was held in Mexico City. The Congress centralized its interest on the slogan "Information and Development".

By then, CICH had turned its 5th year of activities and had, during the last three, compiled the data for its "Bibliografía Latinoamericana". The material accumulated in 1974-1975 was ideal for a preliminary study of some important aspects of research in our region.

CICH's staff initiated this study, resulting in a series of papers that where proposed to the Congress Organizing Committee and, being accepted, one member of the Selection Committee expressed the following opinion: "I am very impressed by the quality and importance of the work represented in these papers."

However, the papers were not printed and circulated by the Congress organizers and, consequently, did not receive the proper and timely dissemination. Nevertheless, request for copies of the same papers have been frequent, and Dr. F. W. Lancaster of the Graduate School of Library Science, University of Illinois, has cited them more than once.*

In one of these citations (1979) Lancaster writes: "Apart from the impressive compilation of data for

United States by King et al. (1976), some of the most relevant studies toward the development of statistical indicators of the type outlined have been conducted in México at the Centro de Información Científica y Humanística, Universidad Nacional Autónoma de México. This work is summarized in four papers by Sandoval et al., Buttenklepper et al. and Pérez-Guinjoan et al. The bibliometric studies conducted in México examine the quantity and distribution of articles on Latin America published in non-Latin American journals, including the proportion of the total contributed by Latin American authors, and the extent to which scientific and humanistic research conducted in Latin American is reported in journals of world prestige published outside Latin America. The contribution of individual countries to this literature, the contribution of individual institutions in these countries, and the distribution of the literature over about 4000 journals is also examined. The studies conducted in México can be regarded as useful models of what can be done in the development of indicators of communication, in science, technology, and other fields, that may be of direct concern to policy makers at national levels."

Al contar con un nuevo órgano de circulación, el CICH ha creído

the United States by King et al., some of the most relevant studies toward the development of statistical indicators of the type outlined have been conducted in México at the Centro de Información Científica y Humanística, Universidad Nacional Autónoma de México. This work is summarized on four papers by Sandoval et al., Buttenklepper et al. and Pérez-Guinjoan et al. The bibliometric studies conducted in México examine the quantity and distribution of articles on Latin America published in non Latin American journals, including the proportion of the total contributed by Latin American authors, and the extent to which scientific and humanistic research conducted in Latin America is reported in journals of world prestige published outside Latin America. The contribution of individual countries to this literature, the contribution of individual institutions in these countries, and the distribution of the literature over about 4000 journals is also examined. The studies conducted in México can be regarded as useful models of what can be done in the development of indicators of communication, in science, technology, and other fields, that may be of direct concern to policy makers at national levels."

Now that CICH has this new tool of circulation, it was considered convenient to give these papers the long delayed and needed

conveniente darles la difusión que merecen. Por eso se presentan ahora como Número 3 de INFORUM. Se conservan en inglés, por haber sido la lengua oficial del Congreso.

dissemination. This is the reason to publish them as Number 3 of INFORUM. They are written in English, the official language of the Congress.

* Lancaster, F.W. "Toward paperless Information Systems", Academic Press, 1978 (Chapter 5. Some problems of formal communication in Science and Technology").

* Lancaster, F.W. "Information retrieval systems: characteristics, testing and evaluation". 2nd. ed. John Wiley & Sons, 1979 (Chapter 17, Evaluation of a National Information System).

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RESEARCH IN LATIN AMERICA. A BIBLIOMETRIC APPROACH

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ABSTRACT

Report of the analysis of the scientific and humanistic Latin-American research through its production of articles published in non-Latin-American journals of world prestige, during a two-year period (august 1973 to july 1975). The analysis includes the volume, the disciplines covered, the journals in which they are published, as well as the inter-relationships of these factors.

Twenty countries published at least an average of 2328 articles per year. The contribution (in decreasing order of importance) from Brazil, Argentina, Mexico, Chile and Venezuela, amounted to 90% of the total. Biomedicine, Chemistry and Physics-Mathematics are the disciplines better covered. The contributions from

each country to each discipline are discussed. The large dispersion of the papers published in 1162 journals is pointed out.

INTRODUCTION

The proper planning of research within the socioeconomic framework is fundamental to development; in its turn, for a proper planning the knowledge of the status and trends of research is fundamental also.

The bibliometric study of the results of the highest level research may be of great help as one of the measurable parameters for the obtainment of this knowledge. There is an important gap between the quality of research in Latin American and the quality that its natural vehicles of dissemination, the

Latin American Journals, have.

The largest part of the production of the original research is published in journals of world prestige, the majority non-Latin-American. The drain of Latin America manuscripts to foreign journals has been measured in those two disciplines which appear as the most attractive to Latin American researchers: Biomedicine (1) and Chemistry (2).

Since its creation the Scientific and Humanistic Information Center (CICH) of the National University of Mexico (UNAM) (3) has been particularly interested in compiling, on a current basis, the material published by Latin Americans in foreign journal, material which by its volume and dispersion makes this an urgent task recommended more than once by international organisms (4,5). Such material is listed in the sections "Bibliografía Mexicana" and "Bibliografía Latinoamericana" of the bi-weekly "information package": **ALERTA (Información Multidisciplinaria en la Universidad)**, published by the CICH since 1974. The mentioned bibliographies, which are unique by their contents and current compilation, have accumulated a valuable multidisciplinary material which lends itself to interesting bibliometric studies.

A report is made here of the 4656 bibliographic references accumula-

ted by **ALERTA** during the years of 1974 and 1975, which correspond in **Current Contents**, from which they are compiled, to the period between August 1973 and July 1975, inclusive. The two reports, that on Biomedicine from 1968 to 1970, and this multidisciplinary one of 1974 and 1975, with a three-year interval in between, show an eight-year range of bibliographic production resulting from Latin American research.

RESULTS

The Volume:

The two-year production shows that, at least (since the material is compiled from **Current Contents**, a selective and non-comprehensive tool) 4656 Latin-American articles have been published in non-Latin American journals, with an annual average of 2328. By itself, this figure should call the attention of the national and regional organisms interested and/or responsible of research in Latin America. If, as demonstrated in another paper (6), the universities are the institutions contributing the majority of this material, the governments and the universities themselves should give a special attention to the channeling and circulation of this important intellectual resource one of the aspects of which, its dispersion, needs a separate mention.

The countries:

The 4656 detected papers during the analysed two-year period, are originated in 20 Latin American countries (Figure 1). One of them alone, Brazil, produces 30.5% of the total. Two, Brazil and Argentina, produces 57% of the total. And five, Brazil, Argentina, México, Chile and Venezuela, produce 90% of the total.

Six more countries, Colombia, Perú, Uruguay, Cuba, Costa Rica and Guatemala, produce 7.8% of the total. The other nine countries: Ecuador, Bolivia, Panamá, El Salvador, Honduras, Nicaragua, Paraguay, República Dominicana and Haití, produce the rest: 2.2%. Among the five more productive countries, the three with smallest population, Argentina, Chile and Venezuela; show the highest rates of papers per year as per million of population (26.0, 21.0 and 14.1, respectively). Brazil and México show 6.9 and 7.2 (Table 1).

México shows the highest productivity of papers per year as per individual researcher: 0.1, in contrast with its low rate of individual researchers per million population: 75.

At the other end of the scale, Chile and Colombia show a productivity of papers per year as per individual researcher of 0.04, and rates of individual researchers per million population of 479 and 49, respectively.

Considering researchers salaries only, the cost per article (in US dollars) is lowest for México: 9537 and much higher for the rest of the countries, specially for Chile: 18293 US dollars per article.

The journals:

Once more the Bradford's Law has to be mentioned. The number of journals which in the two-year period have published the 4656 Latin American articles is 1162, although only 39% of them (108) include 39% (1829) of the total articles.

This great dispersion needs to be particularly pointed out. The knowledge, even approximate, of the volume of manuscripts exported from Latin America for their circulation in foreign journals has been considered (5) as a necessity, not only because of the impact it has on the quality of the regional journals, which unquestionably are thus expropriated, but also learning which are the fields of knowledge to which Latin American researchers give their priorities, as well as which are the regional nuclei which show the greatest research. The great dispersion of the original manuscripts, has interfered with their identification.

Once more it is found that the US journals take the first place between those attracting Latin American manuscripts, though the first two

places of the long list are taken by one Dutch journal (**Biochimica et Biophysica Acta**) with 66 papers, and one Swiss journal (**Experientia**) with 63 Latin American papers published during the studied period (7).

The Disciplines:

Based on the title of the papers, the material was classified in eight main areas of interest which, in decreasing number of articles, are (Figure 2): 1) BIOMEDICINE; 2) CHEMISTRY; 3) PHYSICS AND MATHEMATICS; 4) BIOLOGY; 5) AGRICULTURE; 6) SOCIAL SCIENCE AND THE HUMANITIES; 7) ENGINEERING; 8) GEOSCIENCES.

It is necessary to point out that Biomedicine includes both its clinical and experimental aspects; Chemistry includes all its branches; Physics and Mathematics includes Astronomy and Astrophysics; Biology includes all its branches, like Botany, Zoology and Entomology; Agriculture includes Veterinary, Animal Husbandry, Silviculture, Foods, Fisheries, Soils, etc.; Social Science and the Humanities include Education, Economics, Anthropology, Archeology, History, Art, etc.; Engineering includes all its branches; and Geosciences include the three recognized branches: Geography, Geology and

Geophysics.

I. The priority of Biomedicine in Latin American research confirms previous findings (1). A little more than one third (34.04%) of the 4656 papers covers this field.

In this respect, it is important to point out the following: of the two periods studied, the first one (1), covering from 1968 to 1970, showed an annual average of 969 papers; and this one, which is the second, covering 1974 and 1975, shows an annual average of 1973. If 208, mainly General Chemistry and Biochemistry, papers are deducted from the first study, the result is 761. It may be concluded that during the last eight years (1968-1975) the Latin American biomedical research has offered to foreign journals a contribution of about 775 manuscripts per year.

The largest contribution in the field comes from Argentina, with 32.11%.

II. Almost one fifth (19.88%) of the total volume covers the different branches of Chemistry, with an annual average of 463 papers. These figures are quite compatible with those obtained in a previous study (2) in which an annual average of 644 papers was found (including Chemical Engineering with 62 papers, which is here included in Engineering, and Physicochemistry and Biochemis-

try, which are here included in Physics and Mathematics, and Biomedicine, respectively).

The largest contribution on the field comes from Argentina, with 37.25%.

III. Almost another fifth of articles covers Physics and Mathematics, with 19.67% (annual average: 458 papers). The major contribution comes from Brazil, with an important 40.5%.

IV. Research in the many branches of Biology produces an annual average of 217.5 papers (9.34% of the total). The major contribution comes from Brazil, with 34.71%.

V. The relatively small contribution in Agriculture (7.2%) with an annual average of 163.5 papers, is rather unexpected, although it is shown that Agriculture takes the first place among disciplines covered by papers on Latin America published by foreign and Latin American researchers on non-Latin American journals.

The major contribution comes from Brazil, with 24.15%.

VI. If, as it seems evident (9), the Latin American sociologists and humanists publish the majority of their bibliographic contribution in their own national and regional journals, it is an interesting finding

that in the field of Sociology and the Humanities the annual average of 98 papers (4.2% of the total) is a contribution even larger than that coming from the Engineers and Geoscientists.

The major contribution comes from México, with 27.04%.

VII. The annual averages of 83 papers in Engineering and 52.5 papers in Geosciences (3.57% and 2.25% of the total, respectively) point to the fact that in Latin America there may not be many specialists making research in these disciplines; or perhaps, that there are no many opportunities for this type of research.

The major contribution in both disciplines comes from Brazil, with 45.18% for the former and 35.23% for the latter.

It is worth calling the attention to the fact that it is Engineering the discipline in which the country that covers it best (Brazil) affords the highest percentage of all separate country-discipline contributions (45.18%). To which should be added that the next figure in decreasing order of importance (40.50%) corresponds to Physics and Mathematics, so closely linked to Engineering, and that here again Brazil is the leader.

The origin by country and per discipline of the major contributions is illustrated in Table 1.

It shows that Argentina takes the

first place in Biomedicine and Chemistry, whereas México is first in Social Science and the Humanities. In all the other disciplines, Brazil takes the first place, with a remarkable contribution in Engineering and Physics and Mathematics.

The second place is taken by Brazil in Biomedicine, Chemistry and Social Science and the Humanities; México in Agriculture, Engineering and Geo Sciences; and Argentina in Physics and Mathematics and Biology.

The third place is taken by Argentina in Agriculture and Engineering; Chile in Geosciences and in Social Science and the Humanities; México in Biomedicine, Chemistry, Physics and Mathematics, and Biology.

The low Chilean contribution and the relatively high Peruvian contribution in Engineering, is worth pointing out.

As to the distribution of disciplines in each of the major countries (Table 2) it is observed that Biomedicine is basic for all. A second priority is given to Physics and Mathematics in Brazil, México and Chile; to Chemistry in Argentina and Venezuela, and to Agriculture in Perú and Colombia.

The Geosciences have a minimum priority in almost all countries, except Perú and Chile, in which the lowest priority corresponds to Physics and Mathematics in the former, and to Engineering in the latter.

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FIGURE 1

ORIGIN OF PAPERS BY COUNTRY

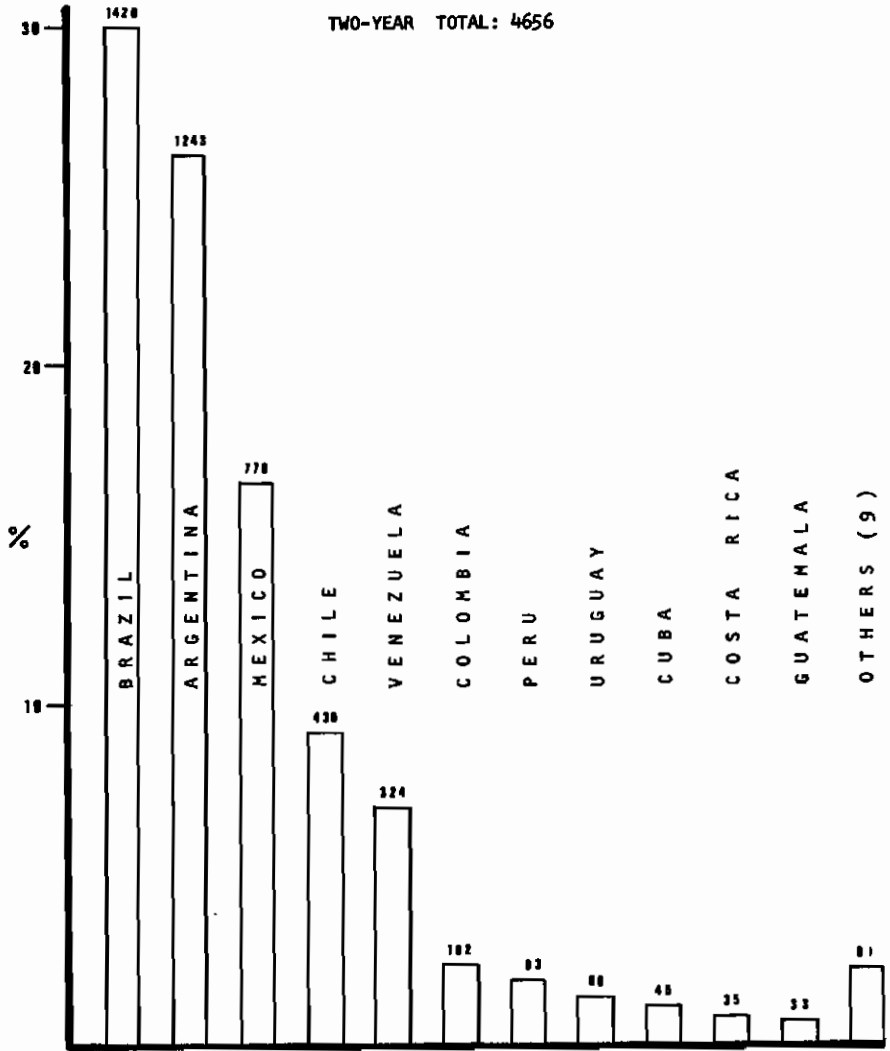


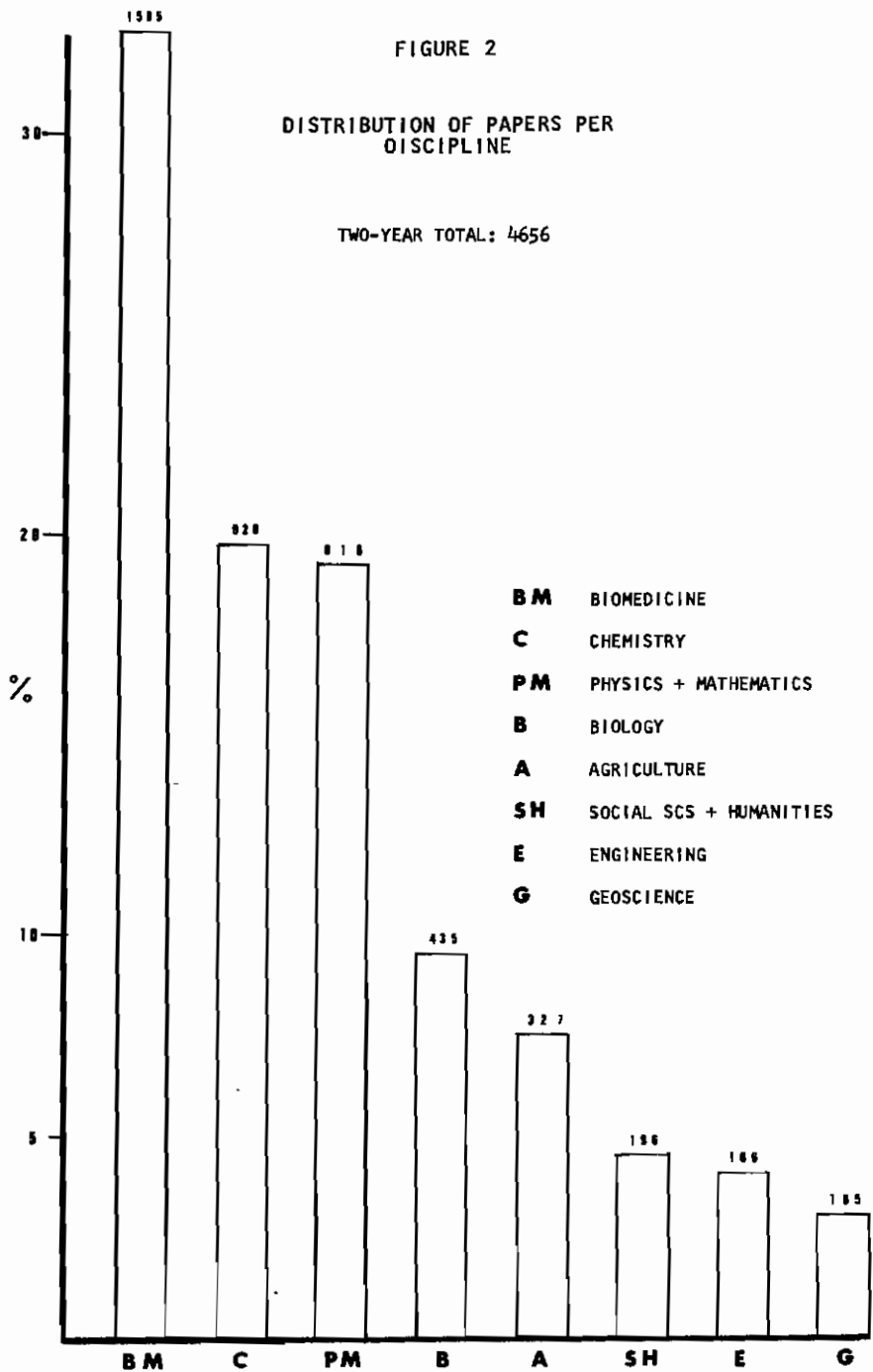
TABLE 1. DISTRIBUTION OF COUNTRIES PER DISCIPLINES

CATEGORY	BIOMEDICINE	CHEMISTRY	PHYSICS & MATHEMATICS	BIOLOGY	AGRICULTURE	SOCIAL SCIENCES & HUMANITIES	ENGINEERING	GEOSCIENCE
1	ARGENTINA 32.11	ARGENTINA 37.25	BRAZIL 40.50	BRAZIL 34.71	BRAZIL 24.15	MEXICO 27.04	BRAZIL 45.18	BRAZIL 35.23
2	BRAZIL 25.55	BRAZIL 28.07	ARGENTINA 22.48	ARGENTINA 19.31	MEXICO 18.96	BRAZIL 21.42	MEXICO 25.30	MEXICO 20.00
3	MEXICO 16.84	MEXICO 12.63	MEXICO 17.79	MEXICO 12.41	ARGENTINA 14.37	CHILE 14.28	ARGENTINA 14.45	CHILE 15.23
4	CHILE 8.45	CHILE 9.28	CHILE 11.24	VENEZUELA 8.50	COLOMBIA 7.64	ARGENTINA 10.20	PERU 1.20	ARGENTINA 7.61
5	VENEZUELA 5.80	VENEZUELA 9.17	VENEZUELA 6.00	CHILE 8.04	CHILE 7.33	COLOMBIA 6.63	VENEZUELA 6.62	VENEZUELA 6.66
6	PERU 2.01	PERU 0.43 COLOMBIA 0.43	COLOMBIA 0.54	COLOMBIA 4.82	PERU 4.28	PERU 6.12	CHILE 2.40	PERU 5.71
7	COLOMBIA 1.95	PERU 0.10	PERU 0.10	PERU 2.75	VENEZUELA 2.75	VENEZUELA 4.08	COLOMBIA 1.80	COLOMBIA 0.00
OTHERS	7.29	2.74	1.35	9.46	20.52	10.23	3.05	9.56

FIGURE 2

DISTRIBUTION OF PAPERS PER DISCIPLINE

TWO-YEAR TOTAL: 4656



- BM** BIOMEDICINE
- C** CHEMISTRY
- PM** PHYSICS + MATHEMATICS
- B** BIOLOGY
- A** AGRICULTURE
- SH** SOCIAL SCI + HUMANITIES
- E** ENGINEERING
- G** GEOSCIENCE

TABLE 3. SOCIOECONOMIC DATA (1973)

COUNTRY	POPULATION x 10 ⁶	PER CAPITA INCOME	GROSS NTL. PROD. x 10 ⁶ US DLS.	RESEARCH POPULATION	RESEARCHERS/10 ⁶ INHAB.	PAPERS/YEAR 10 ⁶ INHAB.	PAPERS/YEAR AUTHOR	US DLS./PAPER (SALARIES)
ARGENTINA	23.92 (2)	1154 (4)	27609.7 (6)	7700 (8)	322	26.0	0.08	14297
BRAZIL	103.4 (1)	765 (3)	77853 (3)	- 0 -	- 0 -	6.9	- 0 -	- 0 -
CHILE	10.23 (2)	802 (4)	8202.5 (6)	4904 (9)	479	21.0	0.04	18293
COLOMBIA	23.0682 (1)	516 (3)	11980 (3)	1140 (8)	49	2.2	0.04	11534
MEXICO	54.027 (1)	914 (3)	49656 (3)	4064 (9)	75	7.2	0.10	9537
PERU	14.87733 (1)	539 (5)	8400 (7)	858 (9)	58	2.8	0.05	11144
VENEZUELA	11.51795 (1)	1579 (3)	17822 (3)	1779 (9)	154	14.1	0.09	17340

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