

# **BIBLIOMETRIC ANALYSIS AND GLOBAL WARMING**

## **ANCHOR DESK**

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### **SUMMARY**

This article reports on the theoretical evolution of the research entitled "bibliometric analysis of scientific production of universities in Bogota, on global warming 2003-2009", whose purpose is to review the scientific production of the University of the City of Bogota . The paper makes a theoretical approach Bibliometrics as a technical element to review the scientific literature, with the focus of generating proprietary indicators to address the units own Research analysis.

Keywords: Scientific article, production, research, bibliometrics.

## INTRODUCTION

This article aims to reflect on the bibliometric study, as a useful mechanism for the analysis of the

scientific production of a particular scientific community, in case the analysis is supported in articles as

the unit of analysis, which emit universities in the City Bogota, on the subject of Global Warming.

Bibliometrics allows analysis of scientific production, dissemination and use of information recorded and

from there make decisions regarding such research processes (Sampere, 2000). Therefore, the article

reviews the technical tool Bibliométríacomo addressing the review of the scientific production of

universities in Bogota against the global warming issue.

### **Bibliometrics in the service of science:**

Bibliometrics is first defined as a method of analysis of science, in the year 1969 by Alana Pritchard

(Sampere, 2000) as a means of analysis of scientific production and its measurement, which was based on

statistics and metrics, it which makes the tool extremely versatile, as far as possible from applicability

statistical elements. Sure bibliometrics initially was more related with the libraries, however its possible

evolution and allows dissimilar applications, but is useful to determine which differs infometría (analysis

of scientific information) and scientometrics (Science Study) . Today is clearly identifiable direct

relationship with science bibliometrics literature and the study bibliotecometría libraries. (Sampere M., 2000)

However, there is some confusion at the time of application of the scientific analysis, as there are several

methods for doing so: Bibliometrics, Scientometrics, Infometría, each with particular characteristics and

of course different objectives. In the table provided there is a comparison between these three types of

analysis, this with the aim of focusing on Bibliometrics and to differentiate it from other methodologies. (Araujo, 2002)

While Bibliometrics focuses on the books, documents, articles, authors and users as a study,

Scientometrics it more on discipline, subjects and fields of knowledge, on the other hand does the

Infometría in words and bases data. Similarly, each identifying the object of study, certain

features observed in them: To make its bibliometric analysis in quantitative yield, appointments

made, Scientometrics analyzes how scientists communicate and Infometría measures the

reminder and the relevance in recovery. (Baker, 1999)

comparisons between countries, areas, blocks, etc.; Searching analysis attain unveil the elements its own evolution. (Quintana, 1996)

Meanwhile the Infometría, focuses on the quantification of information, from the compilation of scientific production represented in the formal and informal communication (written or oral). (Quintana, 1996).

Bibliometrics other hand, appears to be the tool by which you can set the state of science and technology through the global production of scientific literature. Ie bibliometrics requires the application of a method to achieve characterize and quantify the scientific production. (Macias, 1998).

An important aspect in the creation of science is that it is made up of researchers, that the interest in thematic approach them scientifically (Application of the scientific method) and from that base is generated and application of thought was the actually, the importance of bibliometrics is that cares for compiling the production of products represented by scientific researchers (articles, books, documentaries, lectures, exhibitions, etc..) and analyzed objectively, from the application of methodology. (Macias, 1998)

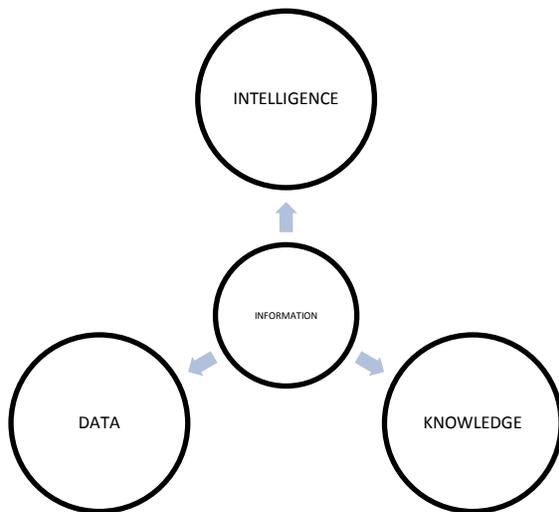
The mechanisms of the analysis of science, such as Scientometrics, Bibliometrics the Infometría and revolve around information, and is that today plays an important role in the development of humanity, science can not escape from this reality and necessity, is and gives prominence to the contribution made by scientific methodology to mankind, and especially the role of

<u>TIPOLOGIA</u>	<u>BIBLIOMETRIA</u>	<u>CIENCIOMETRIA</u>	<u>INFORMETRIA</u>
<u>Objeto de estudio</u>	Libros, documentos, revistas, artículos, autores, usuarios	Disciplinas, Materia, Campos, Esferas	Palabras, Documentos, Bases de datos.
<u>Variables, Citas, frecuencia</u>	No. De Circulación, aparición de palabras, análisis de producción científica cuantitativo	Aspectos que diferencia su disciplinas, revistas, autores, trabajos, comunicación de los científicos	Mide recuperación relevancia, el recordatorio.
<u>Método</u>	Clasificación, frecuencia, distribución	Análisis de conjunto y de correspondencia	Modelo vector espacio, modelo booleanos de recuperación, modelos probabilísticos, lenguaje del procesamiento, enfoques basados en el conocimiento.
<u>Objetivo</u>	Asignar recursos, identificar tendencias	Identificar esferas de interés, comprender cómo y con qué frecuencia se comunican los científicos	Aumentar la eficiencia de la recuperación

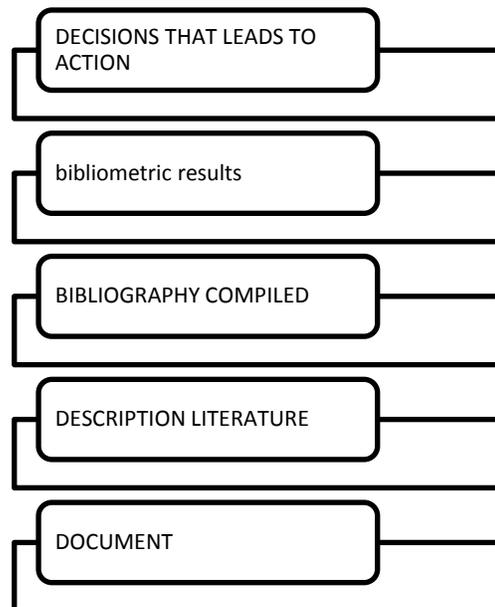
Differentiation mechanisms study of Science. (Macias, 1998).

Scientometrics focuses on the analysis of the structure and prognosis (foreknowledge of the occurrence of an event) of the information contained in scientific research. (Quintana, 1996). Additionally examines science as a discipline or economic activity actually tracks the development of science itself, from

information (Sampere, 2000), information flows through the following scheme, which combines a number of elements belonging knowledge.



The system seen thus determines the importance of information and how it then generates knowledge, ie the value added tax in the information and then be capitalized and included in a scheme of knowledge generation, the scheme suggests: Signage, classification , order. This implies that the information informative knowledge becomes a must transit the analysis process that includes synthesis, interpretation, understanding, comparison, validation and evaluation. For bibliographic information which is subject to bibliometric analysis should generate the transition scheme (Sampere, 2000):



Thus science is seen as an institution that is transcending from stadium to stadium, both during production and in its historical phase, hence the importance of suggesting opportunities for reflection on their generation and compilation of production that account for the quantity and quality of it, in fact it is a way to address the continuous improvement and introspection especially the system and its actors. Regarding the evolution of science, we see both the epistemological aspect of analytic philosophical basis as hermeneutics (understanding of science), this implies eclectic positions against the same obviously requires knowledge about the evolution of science and nature inherent in both science and production. (Bunge, 1981)

Science therefore needs to be reviewed and analyzed, and that in this way the same system realizes its evolution, so much as the inherent characteristics hermeneutics, always seeking to

understand where science goes. This generates what Bunge mentions the concept of Science for Science (Bunge, 1981), ie the elements put science at the service of science and knowledge and for this metric is included elements of production same, which objectify and analysis of subjectivities pervading or incited unsuspecting (and Terrada JM López Piñero, 1992).

Then Bibliometrics suggests the application of indicators that give quantitative connotation of scientific production that could be analyzed (Quintana, 1996), allowing objectively infer about this production, with the application of the indicators, we seek to follow up on issues such as : production size, growth, distribution production, the producers, among others. Indicators are mathematical formulas that are used to measure the aspect to be analyzed, as in the case of the number of articles on a specific topic of total articles analyzed, thus determining an indicator of participation of articles on the topic given total items subject to analysis.

The bibliometric indicator determines important information for the analysis fueling the diagnosis and allowing decisions (Arújo, 2002), the methodology relies on the need to establish the units of analysis, ie identify productoscintíficos on which indicators apply: books, journals, articles, newspapers, Bibliographies, Collections, Magazines, ID production by countries, institutions, authors, etc.. (Arújo, 2002).

The application of bibliometric analysis is of great importance since 1963, with the publication in ScienceCitationIndex (SCI) Impact Factor (IF), this factor can measure how many times an article is cited by the scientific community, is part of the premise that the greater number of times an article is cited is of

higher quality and that the magazine publish it also affects the subpoena since this is of higher quality. This is determined that a scientific journal quality gains to the extent that the articles published in it have more citations, it is referred to as the impact factor. Currently on the Internet is accessible JournalCitationReports (JCR), generated by the Institute for Scientific platform, reporting magazines with more information (SCI) ([www.isinet.com/products/evaltools/jrc/](http://www.isinet.com/products/evaltools/jrc/)), which compiles the production of several disciplines, in more than 30 languages (Garfield, 1996). The SCI has several bibliometric indicators, which used for the analysis of publications through its platform, does not mean they are the only indicators, but constitute major fashion regarding how to group (Garfield, 1996): 1) account items, 2) productivity index, 3) impact factor, 4) or immediacy index instantaneity; 5) Cited Half-life, 6) Collaboration Index; (Bordons M, 1999)

We see scientific production, can be subjected to a series of indicators for analysis, according to Bordons indicators can be determined in the following classification (Bordons M, 1999): 1) Activity Indicators, 2) Productivity, 3 ) Dispersion of publications, 4) Collaboration; 5) Cited Half-life, 6) Connections between Authors

However, according to some studies, including Camps, limitations are found in the activity indicators, according to the study by Avila Camps and based on the study in the journal Archives of Medicine (Camps A, 2006), several drawbacks were detected at the time of applying bibliometric indicators of activity: a) the activity indicators have greater application in those key areas, b) activity Indicators, give quantitative information, but are very limited at the time of

assess the quality of scientific output; c) special care should be taken when making comparisons between subject areas, since in terms of production depends on its characteristics and this determines its dynamics; d) some authors do not include all sources in the scientific and in some other cases include sources that were probably not relevant in the same production. (Sampere M. 2,000)

Thus, even with the limitations bounded, the scientific community at large has an appropriate methodology to track their own production and with it begins the development of a series of studies worldwide that allow to account on the one hand, its evolution and the other, for inclusion in various disciplines of science. However disciplines of psychology has been using it consistently with appropriate evolution and apprehension for their own needs, in 1978 there is an analysis of the scientific output of the psychology faculties of 100 universities in the United States and Canada, where it could determine the most cited authors in the various investigations were: Simon Freud, Piaget, Winer, Bandura, Eysenck, Campbell, Goffman. Skinner, Siegel, these results reinforce the benefits of such a study (Rivera, 2008).

In Latin America, the progress shown in the application of bibliometric methodology, presents a dynamic in which countries with more jobs presents Mexico, Argentina, Chile and Brazil, primarily discipline and more progress is psychology (Rivera , 2008).

In 1998 Wilson Lopez, performed bibliometric analysis applied to Latin American Journal of Psychology, in which it was determined that the

most widely read in psychology eranRuben Ardila and Luis Bravo, the universities more participatory in production were determined National Autonomous University of Mexico and the Universidad de los Andes in Colombia, the most cited authors in scientific production and Eynseck Skinner were determined, the most cited journals were the Journal of Psychology and Latin American Psychologist (Rivera, 2008).

Mexico in 2004 performed similarly bibliometric study a bit more robust, in fact the time frame of the investigation took psychology research in the past 50 years, being the most cited authors Choynewsky (Psychology) and Ostrosky (Neuropsychology) (Rivera , 2008).

On the other hand Brazil conducted a study in 1999 from six journals in psychology, where it was determined that the most cited journals in psychology and Baletin Brasileiro Theory and Research, more participatory institutions: University of Brasilia and Rio de Janeiro (Rivera, 2008).

For Colombia, in 1993 Wilson Lopez performed a bibliometric study to determine the most representative works by authors Colombians since 1965-1990, the study applied to different topics on production: Title, year of publication, author, topic , communication channel, authors with more publications, most cited authors. The analysis was concluded that the subject area with more jobs is social psychology, the authors more participatory: Ruben Ardila, Alfredo Ardila, Gerardo Marin authors cited: Rubén Ardila, Jose Gonzalez, the most used channel is the scientific journal. A major contribution of the study is that raised the need to consolidate a

strong community in Colombia, who will resume training policies and promoting research. (Rivera, 2008).

In 2008, the Pontificia Universidad Javeriana in Colombia, is a bibliometric analysis of the journal *UniversitasPsychologica*, which stated that despite having the magazine only 6 years old, is the acceptance of the 19 agencies and organizations that produce base data of general psychology, Latin American and International level. (Rivera, 2008).

#### Environmental Policy in Colombia:

With regard to environmental issues, in Colombia there's Environmental Policy, which determines the parameters of research policy Environment and which in turn is part of the environmental strategy in the country, covered normatively to Law 99 of 1993 and beginning to be managed from the year 1997, the policy is designed in association with the Institute of Environmental Studies-IDEA-National University, Research design Environmental Policy in Colombia.

As part of the policy implemented in Colombia, it is determined that the Ministry of Environment (hereafter MMA), is responsible to coordinate, promote and guide the research activities on the subject Environmental and natural resources, giving character to mainstreaming productive sectors (public and private) (MMA, 2001).

For the year 2001 the first report is generated on the policy, which includes support for environmental research to develop different public and / or private: Colciencias, Research Institutes, Regional Autonomous Corporations (CARs), urban environmental authorities, NGOs and private sector entities, the report originates overview of research and serves as a diagnostic for the strategic implementation to be deployed in Colombia, with the aim of improving the low level of research on the subject.

The report suggests the Research Diagnostic Environment developed in Colombia, for which we must make clear what is considered research for MMA Environment "means the environmental research, as one that is concerned with the study of physical-biotic environment, its relationship with the socio-cultural structure and the dynamics of such a relationship entails "(MMA, 2001) this definition expresses a close relationship between research, knowledge of the environment and the everyday population, thus creating harmonious relationships between humans and the environment and the need for listening on the scientific strategy and work together to generate knowledge expansion.

As lines of research addressed by the development of the policy are: Environmental Policy Environmental Management Policy and Development Plans and Zoning, participatory processes at the national or regional generation oriented environmental research agendas

For Policy Research in Environment, pay special attention to articulation processes and institutional strengthening. To which differentiation is made in the ways of doing research on how contemporary research environment, involves a wider range and

heterogeneous: government, industry and society in general, which is proposed to observe it from the beginning of knowledge and its practitioners, instead of science and scientists.

Now research environment, acts in a complex context-oriented application, which generates the need no longer see it as the result of specialists working in isolation, requires consensus against cognitive and social practices (and inter Suggests transdisciplinarity). Therefore the development of research on Environment, realizes three critical axes, in which all institutions must work research: a) feasibility of the research activity, which is derived from human, technical and financial, with that conducts scientific output and knowledge about environmental issues, b) relevance and significance of the research, for which knowledge of the production is vital c) feasibility and effectiveness of the investigation. (COLCIENCIAS, 2008).

In addition, the report determined that the number and type of entities researching the topic, and not just the academic and specialized institutions developing research contributions, but other actors are joining forces: laboratories, NGOs, consulting and advisory entities, communities and civic groups. And this happens because the report finds that the issue must be addressed not only from the scientific or technical, but considers citizens preferences and values, influencing mainstreaming philosophy proposed environmental policy (MMA, 2001).

The report makes clear the principles against determinants of environmental research in Colombia:

1. The phenomena and environmental issues are holistic (cultural considerations, regional, and thematic, which generates precisely

transdisciplinarity, complementarity and interdependence).

2. The research includes in its generation and transmission of knowledge explicit recognition of the cultural and social contexts.

3. Sustainable development in the generation of knowledge is an inclusive process of collective construction of all stakeholders.

4. It must respect cultural diversity and the contribution that each player makes to the research.

5. Research policy on environmental issues should be horizon short, medium and long term. This means responding to interests of the State and Government and not primarily strategic routing knowledge generation.

6. Environmental research must articulate public and private, as a matter integrative proposal: Preventive, prospective and proactive.

Colombia has been generated against institutional research environment within which we can stand out from other (COLCIENCIAS, 2008): a) creation of the National Science and Technology - SNCyT (Act 29 of 1990), b) creation of the Colombian Fund for Scientific Research and Special Projects - Colciencias and the National Institute of Renewable Natural Resources and the Environment - INDERENA (1968); c) approval Act 29 of 1990, creates provisions for the promotion of scientific research; d) in work started in November 1991 the national marine science and habitat - PNCMAyH e) with Decree 585/91, established the national Council for Science and Technology, organized by the Institute for the Development of Science and technology "Francisco José de Caldas-Colciencias f) Law

99/1993 established the national Environmental System SINA g) decree 1600/94 regulated the national Environmental Information system, establishing the IDEAM h) decree 1603/94 establishing institutes: Alexander Von Humboldt Biological Resources, Environmental Research Institute John Von Neuman Pacific ei) decree 1276/94 assigned to the support INVEMAR SINA, to generate information on oceanography, marine ecosystems, resources and processes .

Bibliométricas incluidas variables in research:

As for research, Colombia is considered an emerging country in production of research on Global Warming (COLCIENCIAS, 2008), which determines work in an orderly and strategic issue, with the aim of bringing about knowledge thereof, from research projects with dissimilar approaches.

The proposed bibliometric analysis is intended to provide technical elements of the way the scientific community, especially in the universities of Bogotá have supported the scientific literature on the topic, for which be reviewed from the aspects bibliometric analysis methodology as scientific production , topics addressed, people involved in research, methodology, conclusions, for periods production, Productivity by Universities and authors is precisely the goodness of a bibliometric study, while methodologically allows review of that production on the subject interest.

In the study "Technology Watch Report, Climate Change and Some Environmental Effects: Natural disasters, melting and Marine Ecosystems" presented internationally in May 2008 (COLCIENCIAS, 2008), 1073 articles were analyzed and 944 for climate change disaster natural impact on marine ecosystems,

once the study was completed in 2007, the following:

1. The number of publications related to the topic of global warming is growing, we define two periods: a) 1963-1995 The first emergency phase with low number of items, b) From 1995 presents further development and consolidation of the subject .

2. Countries featured in publications is 12, corresponding to 15% of all countries included, though they represent 78% of the publications found; internationally top producing countries are: United States, United Kingdom, China , Germany, France, Canada, Netherlands, Australia, Italy, India, Poland and Israel.

3. Production in Latin America, is based in the United States (with a low production of the other countries in the region: 11 out of 35), while in Europe the research is distributed among countries (involved 32 out of 45 countries Europe) and in the case of Asia shows high concentration in three countries: China, India and Japan. Africa and the Middle East have the lowest production in the subject (articles 43 and 24 respectively), but in Latin America, the trend is down, the only prominent Argentina (11 items) and Brazil (8 items).

4. As far as institutions, can demonstrate the existence of 14 to account for 20% of publications, of which 50% are U.S., countries like China, United Kingdom and Germany, show great dynamic.

5. The most prolific authors on the subject of global warming are: Baker and Knox, in recent years (2000 onwards) is gaining prominence Zhu and Zhang Kundzewicz.

6. As Marine Ecosystem dynamics scientific publications, 66% is concentrated in the U.S., UK and Canada. Of which are presented within ten leaders: America (USA and Canada), 6 European, one Asian and one Pacific.

7. In Marine Ecosystems related production, we have the classification: Argentina (9 items) and Mexico (8 items), Brazil and Chile considered supporters countries, Colombia, Uruguay, Ecuador, Barbados, Guatemala and Bermeo, Emerging considered, given their low production.

8. Among the issues addressed in research on marine ecosystems are: Estuaries, Coral, Fishing, fish stocks, marine biology, coastal zone studies on oceanography, sea levels, water temperatures.

9. Within the analysis Patent found only 7 during the given period.

10. For Colombia evidenced the existence of 19 research groups whose theme Climate Change and Marine Ecosystem, of which 50% (recognized and categorized as A), 22% (recognized and categorized as B) and 17 % (recognized and categorized as C).

The 19 groups reach 18% coverage nationally, of which 36% are concentrated in the Department of Magdalena (leaders in the field). The 19 research groups working 261.

The research system in Colombia has 22 research groups in Climate Change and Natural Disasters (representing 5.6% of the registered groups) and belonging to 12 universities and one institute departments distributed in 8 (25% coverage) . The research community on global warming in Colombia are 414 researchers (7% of registered researchers) in their training profile have 52% mastery, 34% and 14% doctorates with specialization.

11. In the period between 2002 and 2006, Colciencias has financed 8 projects on climate change and natural disasters on marine ecosystems. The projects are developed in 5 departments with 15% coverage nationally, which are run by universities and research centers.

According to the report, presented by Colciencias (COLCIENCIAS, 2008) is expected to more dynamic in terms of scientific production led by universities, research management that has to serve for the sustainable development of human beings, obviously possessed knowledge on their surrounding reality. The social extension university project involves the development of scientific and practical capacity consistent with identified

needs, for it must be fully aware of the research development of the same, and that not having clarity in research production, decimates aspects the application of research processes as determinants:

- Critical thinking and creativity, which precisely sharpen their knowledge of reality from investigative processes usually developed within educational bodies (largely motivated by research), this connection helps the world's smartest problematization surrounding human.
- Determinants of research output in relation to interiority, the binding relationship of actors and authors present in scientific production, the relationship with nature and the imperative need for relationship between phenomena and knowledge, generation of ownership, the same relationship to interconnection rooted manifestations of life, the sense of spatial location on the planet, the relationship versus idiosyncratic fact generate and consume knowledge.
- The scientific production should primarily serve as a source for human sustainability, since research is one of the ways in which the human being is worth to ensure their livelihood, by producing knowledge that let you know, explain and dominate theoretical, conceptual and practically to their surroundings, requiring the activation of cognitive processes and understanding of phenomena, thereby allowing observe, perceive, think and reason against reality in a local and global environment.

Moreover, it is useful to note the importance rests on scientific publications, while allowing among other things, the research output visible by research centers operating in the research and technology system (for the Colombian case leads Colciencias the system keeps track of the

production, from the platform SCIENTI). Publications constitute observation instrument of science itself, as it allows through its revision has been happening in scientific production.

Regarding the scientific detail that could SCIENTI Colciencias platform, for 2009 has 154 registered research groups focused on Environment and Habitat nationwide, of which 41 belong to groups of Bogotá Universities. On the subject of global warming identified 60 articles are generated by the 41 research groups identified in Bogotá. Note that in the analysis in the platform is not bibliometric study of the production of the universities in Bogotá regarding Global Warming and therefore there is no detailed analysis of the characteristics of the production that supports these articles. The absence of this analysis address the research implies that the system has compiled detailed information on production, specifically on the issue of global warming at Bogota. Precisely the present work suggests that account bibliometric report production development from analysis of articles published in scientific journals on the subject of Global Warming (Colciencias, 2010). To which are used bibliometric analysis methodology, which consists of a quantitative review the scientific front.

The main feature that presents research on Environment in Colombia, it is not articulated, not thematically oriented and prioritized according to the national environmental policy and programs and regional and sectoral projects. This is why individual efforts do not add value to the management processes and decision-making on environmental issues in the country. (COLCIENCIAS, 2008).

That is a critical aspect of the research environment, there is no consensus on the

production of knowledge on the subject, calling for unity and interest (MMA, 2001). Another issue that determines the report nerve, is the lack of diagnosis in research on environment, it does not allow the identification of knowledge needs, which has the country in terms of sustainable development research project, on the other hand the bodies develop support research projects that serve their own agenda and disjointed with national policy

The report identifies the lack of monitoring and evaluation of environmental research, which prevents measuring progress, timely reorient research policies, apply adjustments and articulation has decimated the low growth in the production process of the actors synergistic nourish research and knowledge and the consequent loss of enable learning from experience of others (MMA, 2001).

The scientific production in environmental issues is led by the Universities to Colombia (MMA, 2001), however, is low compared to international standards (Carolina, 2007), partly participation is decimated by several factors: a) low time available for research by teachers, b) The universities do not have a strong infrastructure in the field of environmental research, c) In a few cases available lines of research on environmental issues and sustainable with increased production , d) meager financial resources to support the generation of research projects, e) There are a tiny number of researchers in the environmental, f) No evidence of the structure of a research community in environmental issues, d) Low articulation between researchers and research centers, g) There is no information system be feeding gradually allowing the generation of knowledge, h) There is no communication between the

actors of research, i) Lower socialization of research results, generating low feedback.

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The research project is part of bibliometric studies from the data collection is to measure them and analyze them quantitatively (Hernandez & Fernandez, 2006). It is a documentary of bibliometric research as it presents a methodological basis for the systematic analysis of existing information, obtained through outreach to university research centers in the city of Bogota.

The research method to be used is descriptive as to identify characteristics of the object of research, like raises and identifies specific behaviors relationship variables involved, otherwise the method will allow methodological management data collection tools such as questionnaires, interviews, observation, reports, documents, forums, developed by other researchers and leading us to compile this information in a systematic way and from there start coding process, tabulation and analysis. (Alvarez, 2006). Furthermore the study is exploratory, hypothesis formulation allowing

first and second degree with the option of delving into the research topic.

## Procedure

Bibliometric indicators proposed research:

According to the revision against the scientific production of the research centers of universities in Bogota, during the period 2003-2009, it was found that during the period in question and going to the database Colciencias, were taken as sample 14 Universities with production on the issue of Global Warming: University Corporation for Piloto de Colombia, Monserrate University Foundation, La Salle University, the University Foundation Libertadores Forest University, Pontificia Universidad Javeriana, Agricultural University Foundation, Nueva Granada Military University, University of Andes, Universidad Francisco José de Caldas, External University of Colombia, Colombia Free University, National University and University of St. Thomas.

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