# Measuring the Benefits of International Collaboration. A Case Study of the Relationship between Latin-American and European Countries

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# Introduction

In previous studies the principal conditions that promote international collaboration have been analysed (Frame and Carpenter: 1979). Different works have shown the benefits of international collaboration regarding the impact and the visibility of publications (Van Raan: 1998) and have detected possible relation between international collaboration and the increase of the quality of coauthored papers (Persson et.al: 2004). When analysing international collaboration it is important also to consider - as argued Glänzel and Schubert (2001) -that, in general, the benefits of international collaboration are distributed in different ways between countries, due to the existence of "attractive" centres of collaboration (that increase the visibility) and "non attractive" ones. The thematic area in which the cooperation is developed has to be considered as the collaboration presents a different impact in each scientific field (Wagner: 2005). Considering Latin-American (LA)production in WoS an increase around 140% of production in the last 15 years is observed obtaining a greater international visibility. Therefore, further studies considering international collaboration from the LA perspective are relevant for the region.

# Objectives

The principal aim of this study –within the EULARINET project- is to measure and analyse the importance and impact that collaboration with European countries has for Latin-American countries by thematic area.

### **Sources and Methodology**

The Web of Science (WoS) database was used to obtain the mainstream scientific production of LA countries in the period 2002-2006 (corresponding to the VI Framework Programme). For the purposes of this study, the LA region is comprised by: Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela. Caribbean countries are excluded. WoS subfields were assigned to a selection of 10 broad scientific areas. Full count of documents was applied. Citations were collected from publication date to February 2007. Bibliometric indicators: - Output of each LA country per year and area. Thematic Specialization Index and Relative Citation Index were obtained

- Collaboration profile of each country, principal EU partners (EU vs. USA), size of networks, visualization of networks per thematic area through Social Network Analysis (SNA) with PAJEK

- Impact of European collaboration in number of citations/document in each country and thematic area. We introduce the Impact Collaboration Rate (ICR) as the number of citations/document of LA countries co-authored with the EU, versus citation/documents to only LA domestic publications.

# Results

- Output and thematic specialization of each Latin-American country. Between 2002 and 2006, the output of the Latin-American countries retrieved from WoS is over 191,000 documents. The four great producers of the region (Brazil, Mexico, Argentina and Chile) concentrate 93% of the total. The distribution of the output by thematic area shows that the most important areas are: Clinical Medicine (25%), Agriculture, Biology & Environmental Sciences and Biomedical Research. The distribution of the production by areas in the high producers is quite homogenous. In the medium producers, a specialization in Agriculture and in Biomedical Research is observed and, in the low producers Agriculture and Clinical Medicine are usually very significant.

- Collaboration. The collaboration profile changes with the size of LA countries. Large countries show a higher proportion of papers originated in only one national centre (around 30%) and their national collaboration is also very important. Considering European countries the most important collaborators are Spain, France, the UK, Germany and Italy. To analyse the importance of international collaboration per thematic area, we obtained the percentage of LA documents coauthored with each EU country per area and we define a profile of specialization in collaboration with EU countries. Through SNA we study and visualise the size of networks per area, the principal partners and the most relevant co-authors for each country (see an example in Figure 1).



Figure 1. International collaboration in Clinical Medicine (countries with >100 doc. in collaboration)

- Impact of the European collaboration. Through the Impact Collaboration Rate we can observe that in the four largest countries there is a clear increase of visibility originated by EU partners: citations/doc are multiplied by a factor of 5-6 in Clinical Medicine, by 2-3 in Physics and in Social Sciences and by a factor of 2 in Agriculture, Biology & Environmental Sciences and Biomedical Research. Importance of Highly Cited Papers per area was also calculated.

### Conclusions

During the years 2002-2006 the increase of international publications of the LA region has been larger than that of the world (32% versus 19%). The specialization profile varies with the size of the countries -as detected in a previous study by Fernandez et al (2005). When analysing the international collaboration we detected, as Luukkonnen et al (1992) argued, that the size of the country is inversely related to its international collaboration rate. Our data show that high producers have a strong relationship with European countries but in some small countries there is a predominance of links with the US due to geographic proximity and scientific and cultural influence. Through the SNA we can observe that Physics is the strongest area in collaboration networks as was detected in previous works. We determine the influence of Europe in the LA region through the Impact Collaboration Rate. This collaboration improves the visibility of all LA countries in the majority of areas (as previously described by Narin et al: 2001; Lewison: 1991). It can be due to the increase of the number of collaborators associated with the possibility to obtain more potential citations. In this work we can see that in those areas with greater production, the

collaboration with the EU multiplies by a factor of 2 or 3 the number of citations per document, whereas in those other areas with fewer documents, the impact can be higher. In high producer countries the impact of EU collaboration is more reduced because they have a consolidated scientific system and an important development in all areas. Therefore, they establish more "symmetrical research collaboration" with EU countries (Kim: 2006). On the contrary, lower producers are related with the EU countries with an "asymmetrical cooperation" and the impact of this collaboration is more evident for them. We can observe that in those areas with a strong multinational link the collaboration with EU countries increases the visibility notoriously.

### References

- Fernández, MT.; Sancho, R; Morillo, F; De Filippo; Gómez, I. (2005). Indicadores de especialización temática de los países de América Larina y el Caribe. In Albornoz, M; Ratto, D (eds) Indicadores de CyT en Iberoamérica. Agenda 2005 (pp. 191-209). Buenos Aires: RICYT
- Frame, J. D.; Carpenter M.P. (1979). International research collaboration. Social Studies of Sciences, 9: 481-497.
- Glänzel, W.; Schubert, A. (2001). Double effort=Double impact? A critical view at international co-authorship in chemistry. Scientometrics, 50 (2): 199-214.
- Kim, KW (2006). Measuring international research collaboration of peripheral countries: taking the context into consideration. Scientometrics, 66 (2): 231-240
- Lewison, G. (1991). The advantages of dual nationality. *New Scientist*, 130: 50-51
- Luukkonen, T; Persson, O; Silversten, G. (1992). An outline for understanding patterns of international scientific collaboration. Science, technology and Human Values, 17: 101-126
- Narin, F; Stevens, K; Whitlow, E.S. (1991). Scientific cooperation in Europe and the citation of multinational co-authored papers. Scientometrics, 21 (3): 313-323.
- Persson, O.; Glänzel, W.; Dannell, R. (2004). Inflationary bibliometric values: the role of scientific collaboration and the need of relative indicators in evaluative studies. Scientometrics, 60 (3): 421-432.
- Van Raan, A. (1998). The influence of international collaboration on the impact of research results: Some simple mathematical considerations concerning the role of self-citations. Scientometrics, 42 (3): 423-428.
- Wagner C. (2005). Six cases of studies of international collaboration in science. Scientometrics, 62 (1): 3-26.