

# Quantifying and visualizing different types of scientific collaboration

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## Introduction

International collaboration in the creation of knowledge is responsible to change the structural stratification of science. This change in the relation between the geographical and intellectual dimensions of science has profound implications for the governance of science (Leydesdorff et al. 2013). Initiatives to promote and support research adopt different forms from one region to another, and may include technical assistance, local training, and support for the development of specific institutions, institutional partnering, or intercountry agreements. Analysis of collaboration in Latin American and Caribbean countries is of particular significance, because initiatives are often the result of “research-for-aid” arrangements, generally based on North–South asymmetries (Bonfiglioli, 2000). Over the years, however, collaboration for mutual benefit and excellence has gained increasing acceptance, with “partner” selection becoming a strategic priority to enhance one’s own production (Velho, 2002). In this context, a key prerequisite for the design of regional collaboration policies is the determination of how Latin American partners attain higher research potential (more and better results). Collaboration is an added value for increasing productivity and visibility (Gazni, Sugimoto & Didegah, 2012). Multi-country publication increases the chances that an article be more cited; it has also been demonstrated that countries benefit from participation in multinational projects, which ultimately leads to an improved citation factor (Glanzel & Shubert, 2001; Glanzel & De Lange, 2002). Furthermore, increasing international collaborations and developing mixed research teams has a positive effect on the impact factor and the research quality of publications (Wagner et al., 2001). Yet the effects of collaboration do not always translate into benefits at the same magnitude (Persson, 2010). Whatever type of collaboration may be quantified through collaborative projects, publications in common, informal contacts, the interchange of researchers or fellows among different countries, and participation in congresses (Fernández et al., 1998; Chinchilla & Moya, 2007; Guerrero, Olmeda & Moya, 2013), it can be said that studies based on the authorship of scientific publications afford a good estimate of this information (Katz & Martin, 1997; Glanzel, 2001). Depending on the level of aggregation under analysis and the techniques used, these conditioning factors can be explored in greater detail. Such a focus affords an opportunity to elaborate indicators that reveal the organization of the patterns of communication, and the possibility of generating visual representations of the system in which they are rooted. Moreover, we may determine the volume and impact of each country’s scientific output, the breadth and scope of its networks of collaboration, and, consequently, the national capacity for receiving or transmitting the flow of knowledge (Chinchilla et al., 2010).

## Objectives

The general aim of this study is to quantify the benefit rate in visibility and impact of scientific production in the field of N&N bearing in mind the different types of output (total, in leadership, excellent, and excellent with leadership) of the six main producers of knowledge in N&N in Latin America in the period 2003-2013. More specifically we aspire to visualize the networks of international collaboration in a given country, Argentina (ego-network) to represent the difference between the citations received per type of output, and identify the associates with whom a country has greater potential and capacity to generate knowledge of high quality, as well as the differences existing in terms of visibility depending on the type of production analyzed. In short, we wish to determine the benefits of such collaborative efforts.

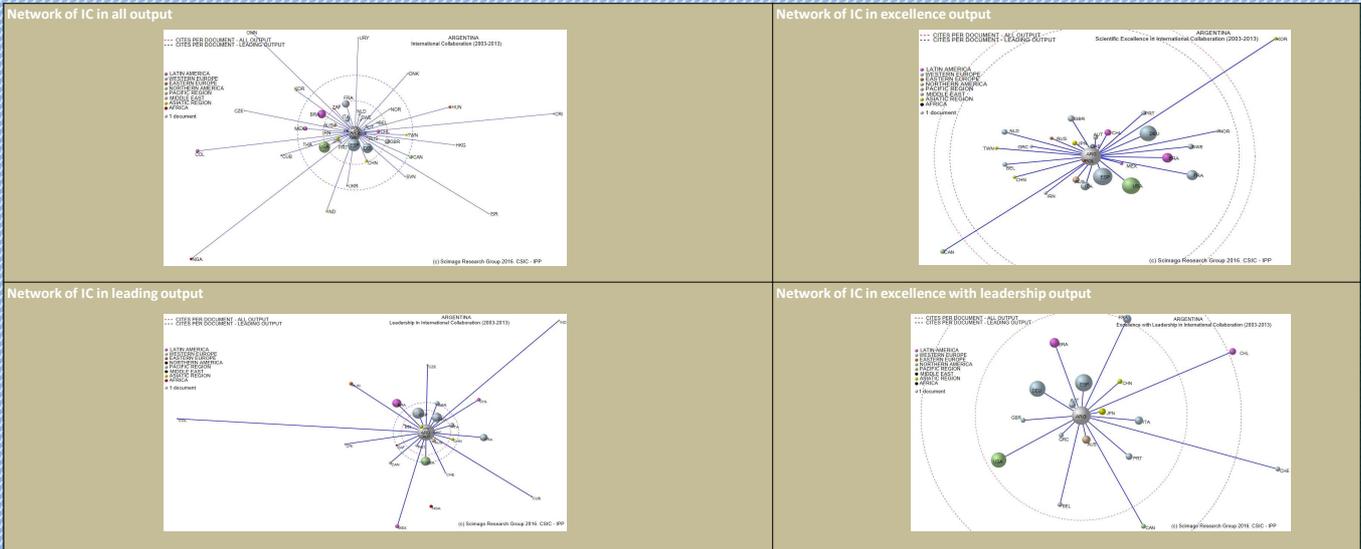
## Material and methods

The data set was obtained from SCImago Journal & Country Rank (SJR) (SCImago 2007) and SCImago Institutions Rankings (SIR) (SCImago 2013), based on the Scopus database. The indicators used are: Output; % Collaboration types (IC – International Collaboration); % Leadership; CPD – Cites per document (all output and leading output); Normalized citation impact

## Scientific IC and CPD by types of production in Argentina

The heliocentric representations depict the international collaboration of Argentinean scientific output in N&N. Thus, one can quickly spot with which countries more is published (greater volume) and with which one is more visible (closer to the center) (Chinchilla-Rodríguez, et al., 2010).

In the four heliocentric networks the countries located into the red orbit are the more cited and put Argentinean research on the map of excellence achieving the highest visibility and international impact.



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