

## **Human resources indicators in Colombia: Doctoral studies, mobility and scientific production of researchers for building networks**

Sandra Carolina Rivera Torres<sup>1</sup>, Jenny Marcela Sanchez-Torres<sup>2</sup>, Mónica Salazar Acosta<sup>3</sup> y Mercy García Cardenas<sup>4</sup>

### **Introduction**

Researchers international mobility is an important way for human capital (HC) qualification process and knowledge generation for building research networks in developing countries. Literature shows qualitative analysis about researchers mobility flows, however, desing indicators depends of available information .

The aim of this paper is measure the relationship between mobility and knowledge generation considering the international collaboration in indexed papers in databases.

To achieve this target We defined and charactized a dataset of PhD colombian researchers based on the *Curricula Vitae* (CV) registered in the ScienTI plataform<sup>5</sup>. After, We identified mobility flows and knowledge products derived of its activities. Then, We did a co-authoring analyst in order the stablish international collaboration using SCOPUS database; Finally, We made a correlational analyst between co-authoring and mobility flows for building networks.

Preliminary results shows that there is a high correlationship between the country which researchers have done their doctoral studies and temporal mobility flows subsequents ; the second result are related with co-authoring analyst, in order words, more temporal mobility flows more international collaboration in papers; Finally, analyzing relationships between these variables – PhD researchers profile, mobility flows and co-authoring- we find that there are some networks on specific field.

### **Conceptual reference**

The concept and measuring of scientific mobility has drawn interest in recent years and it is a widely discussed topic in the literature (Cañibano, Otamendi, & Andújar, 2008). In capability analysis, the mobility concept is associated with the collaborative mechanisms related to difussion and knowledge generation. In turn, mobility is regarded as a resource in terms of human resource qualification and the collaboration dynamics to produce scientific knowledge.

The mobility concept is shown as a widely phenomenon in terms of the human relationships -cognitive and material- involved and the carried effects (Meyer, Kaplan, & Charum, 2001). In turn, its measurement and interpretation are both complex due to the way the mobility flows are prompted (Fontes, 2007), to its incidence in scientific production (Bozeman, Dietz, & Gaughan, 2001) and ties for collaboration and building research networks (Jonkers & Tijssen, 2008)

Some authors state that visits to research centres are crucial in the researchers' formation process (Woolley & Turpin, 2009) has connection with the structure of doctoral programmes. The ways in which the mobility effect is shown in the S&T activities differ depending on the type of individuals and organisations

The analysis of scientific careers is a multivariate process (Cañibano Sánchez & Bozeman, 2009) determined by the HC posgradual studies and the scientific knowledge

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<sup>1</sup> Researcher Observatorio Colombiano de Ciencia y Tecnología. PhD student Universidad Nacional de Colombia, Scholar of the COLCIENCIAS. e-mail: criverat@ocyt.org.co

<sup>2</sup> Associated Professor Universidad Nacional de Colombia. e-mail: jmsanchezt@unal.edu.co

<sup>3</sup> Director Observatorio Colombiano de Ciencia y Tecnología. e-mail: msalazar@ocyt.org.co

<sup>4</sup> Researcher Observatorio Colombiano de Ciencia y Tecnología. Master student Universidad Nacional de Colombia, e-mail: mgarcia@ocyt.org.co

<sup>5</sup> Scienti is a set of data bases administered by Colciencias with services and applications for registering information about researchers (CvLAC), research groups (GrupLAC) and institutions (InstituLAC), among other things. Information available online at <http://www.colciencias.gov.co/scienti/>

generation, which increase and define different kinds of mobility activities (Cañibano Sánchez, Otamendi, & Solís, 2010)

To use the CV allows identifying the researcher's ways of working and collaborating. On the methodological, the CV provides information about different dimensions of the researchers' activities. The CV allows analysing individual capabilities through its scientific background, specially analyzing the ties and the interactions established with peers, creating collective capacity (Cañibano, et al., 2008; Lepori & Probst, 2009). Cañibano and Bozeman (2009) review different approaches to evaluation and suggest to overcome the "product paradigm" and to focus on the "capacity paradigm".

In turn, regarding high-qualified HC education, mobility is key to social and cognitive capital strengthening, which are both part of HC (Bozeman, et al., 2001). Some other works suggest that the generated links through temporary stays have influence over the creation of collaboration networks which are shown in co-publishing of scientific products (Cañibano, et al., 2008).

Because of the researchers are part of a proper scenario for generating networks and thus, the configuration of links or connections is a crucial element to measure the collective capacity. A key point for this work is the relationship between collaboration and scientific production.

Woolley and Turpin (2009) review the networks for knowledge distribution as an approach to account for the institutional links. Other works are focused on identifying the ties and their effect on the scientific communities (Cañibano Sánchez, et al., 2010; Lepori & Probst, 2009; Woolley & Turpin, 2009).

Subsequently, in this proposal, mobility is understood as a regular exchange process that is key for the scientific activities and some interactions are carried on network and relations system in which the institutional ties (Cañibano Sánchez & Bozeman, 2009; Cañibano Sánchez, et al., 2010; Woolley & Turpin, 2009).

### **Research hypothesis**

The description of researchers' mobility by constructing HC indicators in terms of capacity, states as main hypothesis, that temporary mobility affects in a positively individual and collective capacities.

An additional hypothesis is related to the possibility of identifying the variables that explain partly the relation between education, mobility, links and scientific production, considering the available CV information in ScienTI. These inputs will allow having a methodological reference for the creation of indicators and the individual and collective capabilities measurement. In this sense, it would be possible to advance in studies related to scientific backgrounds and measurement of capacity in terms of HC (OCDE, 2010).

### **Methodology**

This work defined three phases:

- i) Define and characterize a dataset of PhD colombian researchers based on the *Curricula Vitae* (CV) registered in the ScienTI plataform.
- ii) Identify mobility flows and knowledge products derived of its activities.
- iii) Identify international collaboration using co-authoring analyst registered in SCOPUS database during 2000-2009;
- iv) Made a correlational analyst between co-authoring and mobility flows for building networks.

(See figure 1)

FIGURE 1. STAGES, AN

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### **Preliminary results**

Preliminary results show that researchers have done their research in countries like USA, Spain, etc. 60% of the PhD studies of these researchers subsequently have done these studies in their doctoral programs.

The second result is that researchers with more international mobility flows more international research production; researchers have 10 or more articles published;

Finally, analyzing research mobility flows and co-authorship, it is evident that most researchers with international mobility are those who work in the Natural Sciences like Physics, Chemistry, etc.

On the other hand, human resources analyses show that collective links through institutions are important; researchers become part of a network; observation accounts partly to the mobility of researchers in Colombia which is something that should be taken into account.

### **Conclusions**

In order to identify the mobility of researchers, access to other databases related to research production as well as to information systems and verification mechanism.

As a summary, the current situation is that of collaboration in scientific production; description of the dynamics of research production; capabilities of the SNCTI taking into account the process of building collaborative research networks that would increase scientific production.

Thus it is important for policy makers and stakeholders in the construction of research networks considered by the Colombian government and the Colombiano de Ciencia y Tecnología.