Patentometric Study of Nanotechnology in Spain

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Abstract
In this work, which is based on a PhD thesis [1] in the framework of a funded project [2], a patentometric study of Spanish nanotechnology is done for the years 2004 to 2014. Based on an adapted search query [3] and the use of the patent database *Espacenet* as the one with the best data coverage for the purpose [4] more than 3400 nanotechnology related patent records were retrieved that had Spanish authorship. After an exhaustive data harmonization process subsequently a detailed analysis was performed using the patent statistics software tool *Matheo Patent*.

First, Spanish patenting in Nanotechnology was compared to worldwide patenting and publishing. We could identify two types of countries. On the one hand we detected a group comprising the United States, Japan and South Korea where the production of patents is relatively higher than the scientific production. On the other hand we identified a group with the opposite behavior, which includes especially China and to a lesser extent the UK and Spain.

Spain intervenes at 1% of the patents on nanotechnology in the world, but has more than double the representation for scientific papers. There is no doubt that the country has made great efforts to strengthen the scientific field, but it has an emphasis on the public and academic sector. The initiative of private enterprises has not had the same luck in recent years.

Regarding the Spanish Nanotechnology thematic profile we compared it with worldwide patenting and could identify an above average patenting in the field of nano-medicine and nano-biotechnology. On the contrary we found a deficit in patents related to nano-optics, nano-magnetism and nanotechnologies related to information and communication technologies (ICT). In the field of materials science related to nanocomposites, production is equivalent in relative terms to the rest of the world.

Regarding the nanotechnology patenting output of Spain the temporal evolution has found to be steady for several years and the most productive provinces were Barcelona, Madrid, Valencia, Sevilla and La Coruña. If we analyze the patent output according to its applicant's sector affiliation the universities are prevalent (37%), followed by private enterprises (24%), the CSIC (20%) and other research centres (16%). From the academic world we can point out the *Universidad de Sevilla* and the *Universidade de Santiago de Compostela*, followed by the *Universitat Polytechnic of Valencia*. Among the CSIC stands out in both, its production of patents and papers, the *Instituto de Ciencia de Materiales de Madrid*. The only two companies which appear in the ranking are *Advancell* and *Nanobiomatters*.

In order to measure the effort of internationalization we describe an indicator, which is a ratio between the number of patent registrations (in different offices) and patent families (the invention or innovation itself) and can be used to measure the value of patents. When we analyze the rate of internationalization in Spain, we find that the highest values are presented by the companies, whose business model is based on the protection of such innovations and therefore are willing to such an effort. Some universities appear to have higher capacity of internationalization than the CSIC centres.

The institutions which really stand out are the *Universidad de Sevilla* and the *Universidade de Santiago de Compostela*. Both have such a positive productive behaviour that a further study of their technology transfer offices (TTO) would be of interest.

Finally, by analyzing the co-authoring and co-applicant behaviour of Spanish Nanotechnology patents, we could reveal collaboration patterns of institutions and researchers which are visualized via network maps (example in figure 1). Furthermore by analyzing the patent classifications we could define thematically the relationships of the most important patent applicants (example in figure 2).

References

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[2] Framework project “Vigilancia tecnológica de la nanotecnología Española a través de sus patentes”, grant by Spanish Ministry of Science and Economy (Plan Nacional de I&D&i 2008-2011, project code: CSO2012-38801)

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Figures

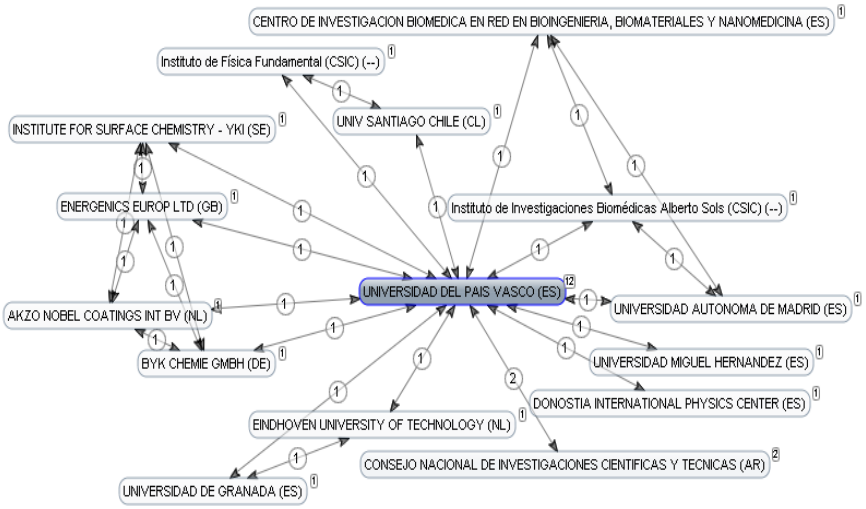

Figure 1: Applicant collaboration network from Universidad del Pais Vasco

Figure 2: Inventor-Technology (left) and Inventor-Applicant (right) networks of Jose Maria Lagaron Cabello