
HOW TO IDENTIFY NETWORKS TO ENCOURAGE OPEN INNOVATION. TECH MINING APPLICATION

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Abstract. This paper proposes how to foster open innovation through the establishment of collaborative networks. It displays how to elaborate and to visualize innovation networks existing through the analysis of the information contained in scientifically and technical databases. Show two cases, the first focusing on open innovation applied at a country level through a web portal, which creates an open network of experts led by the Brazilian department of science and technology. Second case is focused on determining the global experts in the field of waste recycling. It comes to show two networks for innovation, made with text mining, the inventors' network made upon information of the Intellectual property register and other network for innovation composed by authors of technical papers. These developments applying tech-mining techniques will allow companies to interact with numerous other companies and experts in every part of the world. Results can be of value to researchers, research managers, public institutions or decision makers in general who need to keep abreast of changing technical domains and anticipate future developments or establish for further knowledge transfer partnerships. The concept and application of open innovation and its collaborative networks will be integrated in the future innovation management systems.

Keywords: open-innovation, tech-mining, R&D management, innovation, collaborative networks

1. Open innovation approach

The basic premise of open innovation is opening up the innovation processes. For that, studies of innovation [1, 2] have pointed to the growing relevance of external sources of innovation. More than relying on internal research and development, R&D, everything indicates that greater results are obtained if the innovation effort is shared; this is the concept called "open innovation" or interactive innovation [3]. This innovation approach requires mastering new skills like the knowledge of the net of organizations that work in a field termed "networks for innovation" and the relevance of their relationships.

Open innovation grows from people working together on a mutually agreed-upon topic that inspires them. In a firm it's developed when the environment is favourable to the innovation. For this to occur, it is necessary to meet together: Complementary competences and excellence, transparent management and collaboration rules, and it is basic to use collaboration platforms. These collaboration platforms are a key tool for the development of the open innovation.

In order to make good decisions, for example investing in R&D it is essential to know what is

happening in a technological field. Organizations increasingly rely on external sources of innovation specifically in science and technology works and projects [4] due to globalization. Technological management explains the generation of innovations from technological inputs [5]. In this function, together with conventional inputs, is included as indicator the existence of cooperative R&D agreements as a starting point for innovation.

Open innovation is bi-directional. Huizingh establishes that inbound open innovation refers to internal use of external knowledge, while outbound open innovation refers to external exploitation of internal knowledge. In the case of inbound open innovations, companies take advantage of external R&D to innovate in their products and services.

Several additional innovation approaches [6] reinforce the message that knowledge of external R&D is vital, and of course it is necessary to identify the authors, patent assignees and inventors in general players of these R&D. Follow up to the activities of said actors becomes part of the companies' strategy and establishing collaboration agreements could be the starting point for new innovations. Therefore the collaborative networks are the basis for future alliances.

Research in strategic alliances in R&D, focuses on the effects of university–industry links. Usually on innovation-specific variables such as patents or projects; however, the organizational dynamics of these relationships remain under-researched [7, 8].

The most obvious external context characteristic is industry. In the case of Small-Medium Enterprises, have been defined two concepts. First is closed innovation, where the companies generate their own innovation ideas and they develop, build and market, distribute, service, finance and support them on their own [9]. Open innovation is just the opposite concept and takes place in terms of, for example, joint R&D, patenting and crowd sourcing. It is argued that ‘open innovation’ provides access to technologies, and modern laboratory facilities that take years and require major R&D investment to acquire in-house. Open innovation is increasingly receiving attention in academic research. Normally the existent investigation about open innovation is focused on high technology multinational firms or large companies; however, there exist some experiences like Newcastle University Project which work with open innovation practices in SMEs [10]. The importance of small and medium-sized enterprises (SMEs) in economic growth has made them a central element in much recent policymaking. Of particular interest is the ways in which SMEs innovate, and much recent policymaking has been directed at mechanisms to support this activity such as Knowledge Transfer Partnerships (KTP), an agreement between companies and academic centres so that the former can access the knowledge created in investigative settings. It is another way to establish networks for innovation.

This paper explores the characteristics of collaborative relationships through cases and proposes how to foster open innovation through the establishment of collaborative networks.

2. Contributions in the field of open innovation

One of the tools for fostering open innovation that can be implemented by governments and region’s public organizations are those called Innovation Platforms, (IPs). They are physical and telematic platforms for interaction between governments, research community, promoters and investors, in order to share knowledge, in order to propose measurements to future areas of collaboration, specific projects and so on.

A great application of this concept has been realized by the Ministry of Science and Technology of Brazil. It has performed a series of agreements with institutions that have databases and websites for publishing information in science and technology. With this information, a matrix has been elaborated. Through a nice graphic viewer is showed the results of the queries, for example is possible to search for a certain Researcher Profile and have it appear with its co-publications map or networks for innovation, see Figure 1. Apart from personal details, the keywords appear along with the scientific topics that this researcher is working on, as well as his or her publications by year.

The Co-publications matrix viewer is the most interesting; the researcher is in the centre, surrounded by all his collaborators. Figure 2 depicts how it is possible to mark and select from the collaborators group a second researcher to look at him/her in detail.

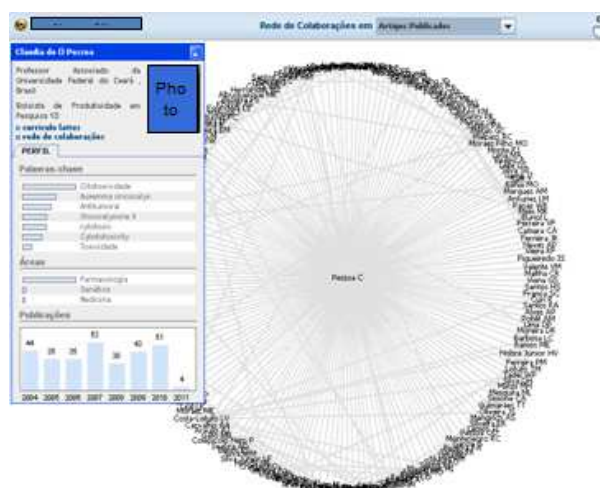


Figure 1. Shows each Researcher profile and the network of collaborations

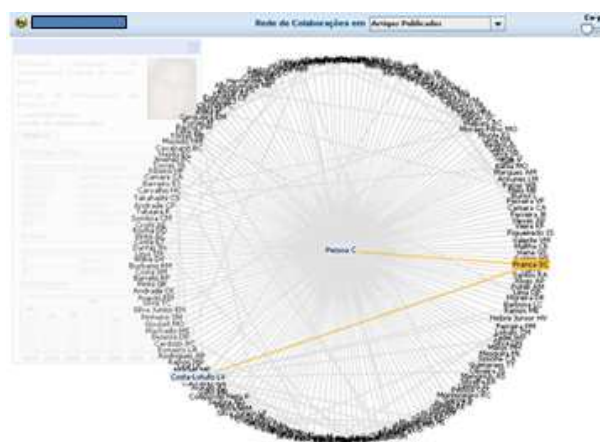


Figure 2. Highlights Co-occurrences between every researcher type “circle viewer”

Analyzing the connection lines is possible analyzed all the structure of the network, who are the main inventors, how many collaborations has everyone, in which areas and so on. It can be clearly found potential collaboration opportunities to establish an advanced network for innovation.

Observing the figure 4, one can notice a nucleus of inventors that form a hinge and collaborate with the remainders. That is to say that there is a group whose collaboration makes up the net's core competence. Through the visualization and analysis of the members of the network of innovation, a company can ascertain its principal knots at a World level.

In the second case there were applied mining to articles and proceedings databases in order to establish the Innovation platform in the academic world. This step uses the CSA Environmental Sciences and Pollution Management database which belongs to Cambridge Scientific Abstracts, the same query was applied in waste recycling sector as in the first case and 11167 records were retrieved.

After mining this database, it is possible understand the structure of the knowledge field. Perhaps is more interesting focus in the core of the knowledge in waste recycling. For example, 43 authors who published more than 10 articles in the field were identified. Analyzing the contributions of these 43 authors can know that these articles have been published in 2054 journals which is necessary to read it. This may seem large, but it can be stated that it is possible to visualise 50% of the field of the knowledge using only 85 magazines and 25 % of the field of waste recycled can be analysed by making use of the first eight journals. To establish networks of collaboration it has been determined the 28 most prolific authors and the companies that each author worked for.

However in this second case it was shown the result of other analyzed bigger to understand the structure of the networks for innovation. Figure 5 shows all the Aduna diagram of the top 200 hundred authors. In this figure it is possible to point out various networks of collaboration to be studied separately. There are groups of different size, individuals or little collaboration and others that it is possible called network.

The analysis denotes the existence of five collaborative networks signalled by circles and some other single entities whose collaborations are so scarce that it cannot be incorporated them in an open innovation concept.

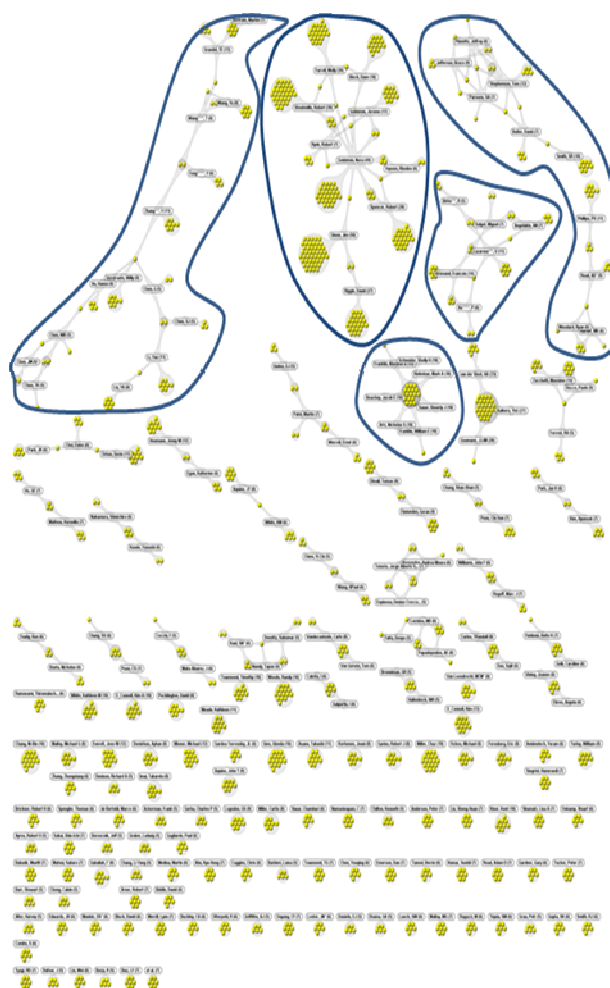


Figure 5. Networks for innovation of top 200 authors

If these structures detected are crossed with the dates of their publications, it will be seen that they can be grouped by decades. The group circled by one ellipse centred on the one of the oldest authors, Goldstein, published during the last decade of the XX century. Nevertheless, the cluster of the left be made up of authors such as Graedel TE, (13 contributions) or Bertram Marlen (7 contributions), authors that start publishing from 2000 and, therefore, have a greater degree of novelty.

4. Conclusions

Open innovation refers to internal use of external knowledge and this paper proposes how to foster open innovation through the establishment of collaborative networks.

It displays how to detect and to visualize innovation networks existing through the analysis of the information of R&D contained in scientifically and technical databases. The main patent-assignees, inventors and authors which shape the networks for

innovations in the waste recycling sector were identified and their collaborations were as well established.

Another case example upon Brazilian researcher database Lattes and the visualization of the collaboration network of each researcher were presented as well.

Developments in Tech-mining will allow companies to interact with numerous other companies and experts in every part of the world. Results can be of value to researchers, research managers, public institutions or decision makers in general who need to keep abreast of changing technical domains and anticipate future developments or establish for further knowledge transfer partnerships.

These results confirm that Tech-Mining is a suitable technique to satisfy the open-innovation requirement for identifying and optimizing the best potential partners and for choosing the right technological alternative.

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