INTRODUCTION

In the Brazilian public health system (SUS), the government has a significant role in directing the health industry, which ultimately focuses the local technological capability in public institutions. In this scenario, collaboration networks become especially important for the development of innovations, as they can contribute to the reduction of government spending, decreasing the balance of trade deficit, stimulating national development and increasing the population access to good quality products, of high technology content. The Oswaldo Cruz Foundation (FOCRUZ), an organ of Science and Technology of the Brazilian Ministry of Health (MoH), plays a major role in SUS (Figure 1A). It consists of a complex 14 institutes that associate the generation of scientific knowledge and the development of technologies with the production of strategic health inputs and provision of diagnostic services (Figure 1B). Within FOCRUZ, the Bio-Manguinhos occupies a prominent position in the country as an important innovation agent in SUS by developing and producing biopharmaceutical products, diagnostic reagents and vaccines for the MoH (Figure 1C).

OBJECTIVE

To map the science-technology pathway that Bio-Manguinhos has been pursuing in order to comprehend the social context on which the Institute is embedded and provide information on both opportunities and constraints that could have important performance implications for the strategic planning and management of public health policies.

METHODS

Social network analysis was used to construct and analyze patent and scientific publication networks that involve Bio-Manguinhos in order to understand its collaboration pattern and identify its partners. A summary of the methodology used is shown in Figure 2.

RESULTS AND DISCUSSION

Data collection on Bio-Manguinhos scientific publications and patents revealed 175 and 13 records, respectively. The 13 patent applications, nine of them were also filed in other countries and 12 of them were co-filed with other organizations. Figure 3 shows the number of papers (A) and patents (B) of Bio-Manguinhos authors reviewed per year and the average number of collaborators involved in these activities.

Analysis of centrality measures of both networks (Table 1) demonstrates that Bio-Manguinhos currently relies on the same individuals to cope with the current challenges of technological and scientific research productivity. This finding indicates that, in Bio-Manguinhos, industrial development is not isolated from the scientific community at all. Nevertheless, this result indicates the need for collaboration and scientific productivity and technological development rely on the hands of only a few individuals, the exit of these professionals from the Institute would mean a great loss for its technological capabilities.

Analysis of the type of institutions that collaborate with Bio-Manguinhos, revealed that cooperation is mostly restricted to universities, government-related institutions and other FOCRUZ units (Table 2). There is lack of participation by industry, especially in patent applications, and the most frequent Bio-Manguinhos partners is a FOCRUZ unit. Despite several technology transfer agreements between Bio-Manguinhos and private companies, this result demonstrates an absence of cooperation with regard to product development. Additionally, it shows the Institute's frequent engagement in multiple same-type alliances, which may hinder access to diverse pools of information and complementary assets necessary for successful growth.

CONCLUSION

Social network analysis generated valuable information on Bio-Manguinhos network patterns and processes. The comparison of publishing and patenting networks showed a marked difference between both, suggesting that their articulation could be the key to consolidate Bio-Manguinhos scientific research productivity into patents and ultimately products. Most importantly, it also revealed fragility in the Institute’s innovation chain, which relies on only a few key individuals to cope with scientific productivity and product development. Further analysis of the publications and patenting networks that are related to Bio-Manguinhos sphere of action could provide insights into the most adequate partnerships for improving public health in Brazil.

Figure 4: Co-authorship network of Bio-Manguinhos authors – scientific papers (A) and patents (B). The nodes represent authors and an edge exists between two nodes if these authors have co-authored a paper (A) or a patent (B). Node colors indicate whether the author is affiliated to Bio-Manguinhos (red), to a Brazilian institution (blue), or to an international institution (black). The size of the nodes indicates their degree centrality.

Table 1: Top three authors based on total number of papers or patents and centrality measures.

Table 2: Type of institution participating in the collaboration networks.