Available online at www.sciencedirect.com

RAI Revista de Administração e Inovação xxx (2016) xxx–xxx

http://www.revistas.usp.br/rai

University–industry interaction in Santa Catarina: evolutionary phases, forms of interaction, benefits, and barriers

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Received 13 August 2015; accepted 25 July 2016

Scientific Editor: Felipe Mendes Borini

Abstract

University–industry interaction (U–I) acquires relevance to countries to the extent that they identify how scientific knowledge produced within universities enhances technological development in firms and facilitates innovations. Universities are invigorated by the possibility of new scientific investigations that these relationships provide. The objective of this article is to analyze the establishment and development of U–I interactions in Santa Catarina, Brazil, of four universities through evolutionary phases, forms of interaction, benefits, and barriers. A total of 38 in-depth interviews were conducted during the data collection stage. To support the analysis and presentation of results, the qualitative data analysis software Atlas/ti, version 7.1.3 was used. The results pointed to non-linearity in the evolution of U–I interaction and demonstrate that most of the relationships between universities and firms are concentrated in traditional and services channels. Moreover, their interaction intensity is evident in the short term with the flow of knowledge being directed from universities to firms. With regard to benefits and barriers, the research results expand on the avenues outlined in the literature, which reflects some characteristics of this interaction type in Brazil, whose relationships are still new and do not yet have a solid trajectory.

Keywords: University; Firm; Interaction

Introduction

The study of university–industry interaction (U–I) has emerged as a specific research field in the last three decades as part of the increase in policies that emphasize the commercialization of research and the links between basic research and social needs (Bekkers & Freitas, 2008; Rothaermel, Agung, & Jiang, 2007; Teixeira & Mota, 2012). Published studies in this area are recent with a significant volume occurring in the period from 2000 to 2004. Their scientific roots come from fields related to management, business, and economics, showing the multidisciplinary nature of this area (Teixeira & Mota, 2012).

The importance given to the subject has generated a body of research that varies in perspective (university, company, government), structure (formal, informal), level of analysis (market, organization, individual), and effect (economic, academic, institutional, cultural, management) (Boardman & Ponomariov, 2009; Freitas, Geuna, & Rossi, 2012). The main themes studied in the area point to the knowledge transfer process and how this can be influenced by the characteristics of firms, universities, and researchers; the channels through which interaction occurs, the creation of spin-offs, the importance and role of intermediary agents, such as technology transfer offices; geographical questions (importance of location and spillover); the implications for science and technology policy, and the measurement of U–I cooperation (Teixeira & Mota, 2012).

Interest in this field of study has also been stimulated by the rapid growth of research related to the National System of Innovation (NSI) and other similar focuses, such as technology transfer, licensing and patenting, non-linear innovation, the ivory tower, and the triple helix (Gulbrandsen, Mowery, &

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Peer Review under the responsibility of Departamento de Administração, Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo – FEA/USP.

http://dx.doi.org/10.1016/j.rai.2016.12.001

Feldman, 2011; Lee, 2000; Teixeira & Mota, 2012). This literature emphasizes the importance of interactions and institutional arrangements, seeing universities as actors that can contribute to economic development in knowledge-based economies. Within the NSI, universities can establish links with productive structures that allow the acceleration of the transfer of knowledge and technology (Mowery & Sampat, 2007).

Many countries have implemented policies to strengthen interactions between universities and firms in order to achieve better economic performance supported by academic research (Muller, 2006; Tartari & Breschi, 2012). Such policies in many cases involved changes in legislation, creating support mechanisms that encourage U–I interaction in the belief that firm innovation requires academic research (Gulbrandsen et al., 2011). Similarly, firms have been increasing the pressure for academic researchers engaged in projects with commercial partners (Arza, 2010).

In Brazil, the NSI occupies a median position globally along with countries such as Mexico, Argentina, South Africa, India, and China (Fernandes et al., 2010; Rapini et al., 2009). Suzigan and Albuquerque (2011a, p.18) report that "an important component of the developed innovation systems is limited: a strong interactive dynamic between firms and universities . . . that would provide positive feedback loops between scientific and technological dimensions".

Research on U–I interaction is an area that has been explored in the country with notable contributions on the historical roots of U–I interaction in Brazil (Suzigan & Albuquerque, 2011a; Suzigan & Albuquerque, 2011b); U–I interaction based on Research Groups in the Brazil Directory of the National Research Council (PGD-CNPq) (Rapini & Righi, 2006; Rapini & Righi, 2007; Rapini, 2007; Righi & Rapini, 2011); technological intensity (Pinho, 2011); geographical proximity (Costa, da Ruffoni, & Puffal, 2011; Garcia, Araújo, Mascarini, & Santos, 2011); industry standards (Britto & de Oliveira, 2011); the sources of funding (Rapini, de Oliveira, do Couto, & Neto, 2013); and studies with regional samples that include Santa Catarina (Cario, Nicolau, Fernandes, Zulow, & Lemos, 2011; Cario, Lemos, & da Simonini, 2011).

In general, the literature on U–I interaction in Brazil points to the existence of only localized points or "interaction spots" (Albuquerque, Suzigan, Kruss, & Lee, 2015; Albuquerque, 2003; Rapini, 2007; Righi & Rapini, 2011; Suzigan & Albuquerque, 2011a). These points refer to specific sectors and areas where U–I interaction functions in a systematic and consolidated manner. They have their origins in cooperation incentives, sectoral policies, the formation of knowledge and technology-intensive sectors, the stimulation of scientific production, science funding, and the scientific community's interests in relation to certain sectors (Righi & Rapini, 2011).

Interaction spots are the result of the historical process of the late establishment of universities in Brazil and the country's pattern of industrialization, which lays the foundation for understanding the U–I interaction phenomenon. In Santa Catarina, a movement similar to the national standard is seen. In relations to U–I interaction, Santa Catarina state has the seventh largest number of research groups in Brazil, and, of all groups registered in the CNPq in the 2010 Census (i.e., 1263 groups), 18.92% have relations to industry. This is higher than the national average—which is around 12.74%—and the highest percentage for all Brazilian federal states (CNPq, 2013).

This article aims to broaden the debate on the theme and contribute information that supports discussion about policies and actions in the State System of Science, Technology, and Innovation of Santa Catarina. Science, technology, and innovation policy in Santa Catarina has expressed the need to strengthen S&T institutions (such as universities), as well as increase interactions between such institutions and local production arrangements (i.e., firms).

The overall objective of this study is to analyze the establishment and development of U–I interactions in Santa Catarina. The text is organized into five sections, including this introduction. The second section presents a theoretical review that contemplates aspects of U–I interaction processes in categories of analysis. The methodological procedures are described in the third section. In the fourth section presents research results, organized into analysis categories: evolutionary phases, interaction formats, and benefits and barriers. The fifth section closes with final remarks.

Process U–I interaction

The process that generates innovations is complex because it depends intrinsically on elements related to knowledge that translate into new products and processes, which are embedded in an environment characterized by feedback mechanisms and interactions involving science, technology, learning, production, policy, and demand (Edquist, 1997). Therefore, it must be noted that although most innovations happen inside innovative firms, other institutions such as universities, government laboratories, and coordinating and financing agencies of the government play a key role in the creation of new technologies (Niosi, Bellon, Saviotti, & Crow, 1992).

In this view, a systemic view of innovation is developed that emphasizes the role of interactions between the agents involved in innovation processes and institutional arrangements that create conditions for the competitiveness of a country, distinguishing it from others (Freeman & Soete, 2008). Both universities and firms vary greatly in the extent to which they engage in projects that promote the commercialization of academic research as well as the extent that such mechanisms are shown to be successful or not, because even within countries there are great levels of heterogeneity in approaches taken by universities when interacting with firms (Geuna & Muscio, 2009). Thus U–I interaction is set in a learning process, both by the university and the firm, whose relations are established within a logic that involves the sharing of knowledge, mutual trust, and the transfer of personnel between the two actors (Albuquerque et al., 2015).

Plewa et al. (2013) define the dynamics of U–I interaction and show the different phases through which relationships evolve. They note that such development does not necessarily follow a linear path, but varies according to intensity and involvement. The first phase is "pre-linkage" and is characterized by the identification of individuals or teams as potential research partners,

Please cite this article in press as: Lemos, D. C., & Cario, S.A. University–industry interaction in Santa Catarina: evolutionary phases, forms of interaction, benefits, and barriers. *RAI Revista de Administração e Inovação* (2016), http://dx.doi.org/10.1016/j.rai.2016.12.001