Chapter 37
Canadian Biotechnology Systems: The Stakeholders and the Institutional Infrastructure

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ABSTRACT

In this chapter, the authors seek to estimate the importance of the clustering phenomenon in link with the biotechnological system as external factors that influence the growth of SBEs (specialised biotechnology enterprises). This is a first step in determining the geographical proximity of SBEs and researchers, and secondly, to identify the players involved in biotechnological systems of different clusters of agglomeration. Thus, the authors specify the number of SBEs by region, the number of researchers, and their links with industry. Therefore, in terms of biotechnological systems in place, the identification of the different stakeholders allow for revealing strengths and weaknesses of those regions for the sustaining of innovation in Canadian SBEs.

INTRODUCTION

The main aim of this research was to investigate the relationships between intellectual capital and the pace of growth of Canadian biotechnology firms located in urban clusters. Furthermore, the research aimed at investigating the clustering processes in technology and the likely benefits to the firms of being part of a strong regional cluster.

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In this chapter, the term biotechnology means "*the application of scientific and technological knowledge to living organisms, as to their parts, products and models, to transform living and non-living matter for the production of knowledge, goods and services*" (OEDC, 2005, p.1). As for the Science and Technology Based Enterprises (STBEs) they are those "*firms using biotechnology to develop new products and processes and that have R&D activities in biotechnology*" (Statistics Canada, 2001, p.8).

The study focused on human health biotechnology because some of the most important discoveries in recent years have been made in that particular industrial application. Furthermore, the research looked into the role of those people regarded as "Star Bio-Scientists" - that is to say those individuals featuring on top of the chart because of the number of patents they held and scientific papers they have published - in the process of starting-up and managing the STBEs in a sample of 150 firms of the Canadian human health biotechnology industry.

First, the features of STBEs are briefly described. Then, the system approach is presented before the innovation system's approach as used in the context of the economic literature is explained. Reasons for using the technological systems approach are provided and so are its major shortcomings as well as its occurrence in studying biotechnology innovation processes in Canada.

The Systems Approach: A Definition

The most common definition of the word "system" that can be found in modern English dictionaries is: *"a group of interacting, interrelated, or interdependent elements forming a complex whole"* (Cambridge Dictionary Online). As Hugues (1987) pointed out all systems are therefore conceived of three key elements:

1. The components;
2. The relations and
3. Their characteristics.

The "components" are the operational parts of a system. They can be of different nature: actors or organizations like the researchers, the companies, the banks, the venture capital firms, the universities, the research institutions, the hospitals and other public organizations. They can also be physical artefacts or technologies such as the drugs, the diagnostic tests and the technological processes. The second element of a system is the relations: They are the interactions between the components. Features and behaviours of each component of a system can change the features and behaviours of the others. Because of their interdependencies, a particular component does not display the same behaviour when it is found in another independent sub-system. The most important relationships in an innovation system are the communication and the acquisition of technological knowledge that usually takes place inside formal and informal networks as well as in the community of practices. Relationships can also be developed via financial and non-financial interactions. Some technological knowledge can be passed on in spite of intention. In such a case, the term "spillovers" is often used. Technological knowledge can also be communicated in full intent from the sender to the receiver (Hughes, 1987). In any cases, the transfer of knowledge is more not done without a significant investment of time and energy from the receiver that must have already developed the competencies in order to use that new knowledge. Furthermore, the process of technological knowledge acquisition usually involves a collaborative process that has been lasting for some time. Highly skilled workers move between firms exchanging knowledge. As a result, the firms can perform continuous knowledge reconfigurations, adjust product to changing market needs and create new applications.

The third element of all system is the "characteristics". They are the various properties of the components and the links between them. They characterize the system "*because the components of a technological system interact, their characteristics derive from the system*" (Hughes, 1987, p. 52). In other words, the key characteristics to understand the systems are related to the function perform by each of them and their apparatus. The key functions of an innovation system are to create, diffuse and use technologies of economic value (Carlsson & Eliasson, 1994). The dynamic properties of a system – its solidity, its flexibility, and its skills at generating change as well as reacting