



Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Science and technology park: Future challenges[☆]

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ARTICLE INFO

Article history:

Received 18 April 2017

Received in revised form

14 December 2017

Accepted 17 January 2018

Available online 13 February 2018

JEL codes:

O32

O39

Keywords:

Science and technology parks

Literature review

Performance

ABSTRACT

Science and Technology Parks (STPs) originated in the 1950s in the US. Since then, a number of countries have implemented these types of parks to develop and revitalize regions, boost high-tech industry sectors, foster greater industry-academia interaction, support new technology-based firms (NTBFs), and encourage academic spin-offs. Although these parks have operated for many years, there is no universally accepted definition in the literature or consensus regarding the contributions of STPs to the region and tenant companies. Using the method proposed by Lage Junior and Godinho Filho (2010), this study analyses 56 articles, indicating their objectives and results and providing guidance on controversial topics, and identifies existing gaps, opportunities, and challenges for future studies. The results suggest that the multiple definitions of STPs make expectations about these parks very high. Much of the literature identifies positive contributions for both the region and tenant companies and the main impact is fostering greater interaction with universities.

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1. Introduction

Science and Technology Parks (STPs) are an important tool for uniting industry and academia. According to Dierdonck et al. [1]; p. 109), the gap between academic science and industrial technology stems from the belief that academia and industry represent two different worlds that are frequently inconsistent with each other. It is precisely in this context that STPs stand out by providing an environment in which the interaction between research institutes and companies is encouraged. Díez-Vial and Montoro-Sánchez [2]; p. 41) note that STPs create an atmosphere that favours the exchange of knowledge between companies located in the park, universities, and the market.

Using a metaphor [3], points to two main objectives of STPs: to be a seedbed of innovation, which consists of fostering the development and growth of New Technology-Based Firms (NTBFs), to promote the transfer of university know-how to tenant companies and to encourage the development of faculty-based spin-offs. According to this author, the second objective is to be a catalyst for regional development by stimulating economic growth and revitalizing urban areas.

After their emergence in the 1950s in the US, STPs quickly spread around the world. Success stories in the US, such as Silicon Valley and Route 128, encouraged a number of public officials to implement STPs in other countries. However, despite several successful cases, many STPs did not achieve their goals, raising several questions in the literature regarding the true effectiveness of these parks. An important argument by Yang et al. [4]; p. 85) provides guidance on these questions, asserting that the success of an STP cannot simply be replicated from one region to another. In other words, the policy of boosting technological development through parks cannot be implemented without limits and adaptation to different realities.

Despite many years in operation, the contribution of STPs is still not completely clear [5]; p. 137) [6], analyses 52 Chinese STPs in the period from 1992 to 2000 and finds no evidence that companies benefit when they are located in STPs [7]. evaluate three STPs in Greece, where formal links with universities are identified in only one STP. These authors state that, in general, STPs do not meet expectations. On the other hand [8], identifies that NTBFs located in STPs have a higher propensity to engage in joint research with research institutes by studying six parks in Japan from 1998 to 2003. Similarly, when comparing on-park NTBFs with off-park NTBFs [9], find that the NTBFs in the STPs have more connections with universities whereas the sample of off-park NTBFs has lower performance.

A major difficulty in assessing STPs is clearly defining what their

[☆] This document was a collaborative effort.

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purpose is [10], states that the idea of STPs is to provide infrastructure for technical, logistical, administrative, and financial support to help new companies survive and gain market share. In contrast [2], claim that STPs are created with the goal of transferring technology from universities to tenant companies. In addition [11], suggest that there is no systematic framework for understanding STPs. In certain situations, an STP may fulfil one expected role but not meet another. Thus, many authors believe STPs are not contributing in the expected manner because the expectations are very high, given that the hope is that such parks will satisfy all of the different existing needs and demands. What is clear is that, despite controversial results, STPs generally contribute to tenant firms in some manner.

Given this context, this study analyses 56 articles published in different journals from the 1980s to September 2016 that are identified using keywords such as “technology park”, “science park”, “technopark”, and “techpark”. This work fills a gap identified in the STP literature through the analysis of the researched articles and studies that review the literature, as demonstrated in Section 5. Thus, in more detail, the objectives of this work are as follows:

1. To classify and code the studies, integrating results and relating them to emerging issues in the researched topic;
2. To briefly analyse and present the state of the art for the central topics of science and technology park, mainly in terms of their impacts, whether on the region or on the companies; and
3. To provide a research agenda, highlighting the major gaps and challenges in the subject for future researchers.

To fulfil these objectives, this article is structured as follows: the research method is presented in Section 2; the classification and coding criteria for the analysed articles are described in Section 3; a brief contextualization of STPs is performed in Section 4; the results of the coding are discussed in Section 5; and finally, the conclusions are provided in Section 6.

2. Methods

A literature review is an important tool for gathering the results of previous studies on a particular topic [12]; p. 7), by presenting an in-depth analysis of the main studies. In addition, Jabbour [13]; p. 145) notes that this technique identifies challenges for the development of future studies; that is, after identifying the characteristics of how the literature has been discussing a theme, it is possible to discover possible gaps and opportunities for topics that are not being discussed in the same proportion as others. Therefore, such a review makes it possible to indicate a direction for future studies.

Given the relevance that the literature review adds to the academic debate on a given topic, Lage Junior and Godinho Filho [14]; p. 14) present five steps to be followed in conducting this process, as demonstrated in Refs. [15] and [13]:

- 1 Conduct a search for articles published on the subject in large academic databases using keywords;
- 2 Filter the articles by ascertaining their relationship with the research topic;
- 3 Develop criteria for classifying and coding the analysed articles;
- 4 Through the application of the coding, present the main topics studied and the results found in the analysed articles and provide a complete view of the existing knowledge on the subject; and
- 5 Analyse existing gaps and opportunities, indicating suggestions for future studies.

Although several researchers use literature reviews in studies in

diverse areas [12–17], a gap in the topic of STPs has been observed, shown in Sec. 5. Given this context, this study provides an important contribution by presenting the state of the art and offering guidance for future studies.

Considering step 1, this study used the following keywords to identify articles in the *ScienceDirect* search engine: “science park”, “technology park”, “technopark”, and “techpark”. According to Löfsten and Lindelöf [70]; p. 1016), there is no universally accepted term for defining STPs, so the choice of several synonymous keywords aimed to provide a more complete search of the topic and to find the relevant material available. We did not analyse other databases such as *Web of Science* or *Scopus* due to our restricted access to them, which allowed for only the query in the abstract at the time of the collection of the data. Although the method can limit the scope of results, the significant number of papers investigated in our study, published in highly influential journals in the field, allowed us to map how the scientific literature is discussing central topics regarding the impacts of STPs on tenant firms and in the surrounding region. The reason for not considering more keywords related to technological parks is that the inclusion of the search engine was only marginally relevant. As new keywords were added, fewer new articles were identified because they had already been found through other searches.

Once the articles are identified, the next step is to verify their relationship with the research topic. Although many articles had a keyword in their title, their focus was often very distinct and might not have even concerned STPs. To perform such an inquiry, the abstracts of the studies were analysed. In Table 1, the total number of articles found using keywords and how many of these were selected are displayed. First, we searched for the word “science park”. A total of 297 articles were found for this search. After checking their relationship with the research theme, we selected 34 articles. Subsequently, we searched for “technology park”, finding 226 articles. After careful analysis, only 20 articles were included in this study. The next term searched was “techpark” which resulted in 10 selected articles. The last keyword searched was “technopark”, in which three articles that were all related to the theme were identified. Although the total number of articles selected from each keyword is 67, it must be noted that the same article can be identified by different keywords. Bearing this fact in mind, 11 articles were repeated, and therefore, the final analysis considered 56 articles.

3. Classification and coding

After the articles were collected, an analytical framework was elaborated with eight classifications relating to relevant topics in the literature on STPs. Consequently, each article was classified and coded based on its characteristics and the results found. The classifications are composed of numbers and letters (A, B, C, D, E, and so on). Therefore, the code consists of a combination of letters and numbers. This step is important to identify the topics that are being studied the most and possible gaps in studies in the area.

Classification 1 identifies the economic context of the country of the study in question, with a range of coding possibilities from A to

Table 1
Number of articles identified per keyword.

Keyword	Total of Identified Articles	Total of Selected Articles
Science Park.	297	34
Technology Park.	226	20
TechnoPark.	3	3
Tech Park.	14	10
Papers considered.	-	56

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