

# The Journal of Technology Transfer

## The Contribution of Science Parks: A Literature Review and Future Research Agenda

--Manuscript Draft--

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<b>Response to the editor</b>
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Dear Editor,

We would like to thank you for giving us the opportunity to revise our paper and resubmit it to The Journal of Technology Transfer. As we explain in the following, we aimed to carefully address all comments made by the two reviewers. In the next section, we each time repeat the reviewer's comment, followed by a response from our side, alongside a detailed communication on how we altered the manuscript accordingly. Further, we updated the review and have now included all relevant papers until 2018.

We would like to explicitly thank you and the reviewers for the comments which have helped us in significantly strengthening the paper.

<b>Response to the reviewers</b>
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**Reviewer 1:**

POSITIVE

You use a framework for the review: input, mediators and outcomes (IMO) which I think is a good thing. There could be different way to implement it, but the fact you follow a model, to me, is positive.

You include a good number of papers compared with other reviews on SPs.

- **Our response:** We would like to thank you for taking the time to carefully read our paper and providing us with comments which have truly helped us in strengthening our paper. In what follows, we provide a detailed overview of how we addressed your comments and how this led to changes in the paper's core text.

TO BE IMPROVED

An important drawback is that you talk a lot about SP effectiveness, but you do not define what effectiveness means for a SP. I mean...we can have more or less an idea, but we may argue that the outcomes you use in your model (which you do not directly relate with park effectiveness) are actually effectiveness proxies.

- **Our response:** Thank you for making this highly important comment. We agree with you that "SP effectiveness" is an ambiguous term. This term refers to how successful SPs are in achieving their objectives, yet not all papers in the review explicitly make this link to SP objectives. Therefore, we have now dropped the term "SP effectiveness" and changed it into "SP contribution" since this is a more appropriate term for what we aim to examine in this paper. Particularly, we now define the term "SP contribution" as *all potential advantages and positive effects that different stakeholders may experience from the SP phenomenon*. Studies assessing "SP contribution" are concerned with examining the contribution of SPs to (one of) their different stakeholders (e.g. to their tenants, the partner university, the local and national economy), how and under which circumstances this contribution is achieved and how it can be assessed and measured. We have now extended the introduction section and clearly explained how we define "SP contribution" and what we exactly aim to examine in this literature review.

Following the IMO-framework, we argue that *'inputs'* deal with all features and attributes that drive or constrain the contribution of SPs. For instance, quality SP management is regarded as an indispensable driver of the contributions SPs provide to their tenants. *'Mediators'* are mechanisms and processes through which SPs provide value-added contributions to stakeholders. For instance, within SPs, synergies between tenants or between the tenant and the partner university are expected to take place, leading to improved innovative outcomes. The theme *'outcomes'* then discusses the outcome indicators that are typically used to assess SP contribution. Studies in this theme for instance examine whether and when SPs contribute to tenants' innovative performance. We have more clearly articulated this in the manuscript (in 2.1. Review Strategy).

The papers should be restructured. It is hard, most of all at the beginning, to follow a logical thread. For examples, section 3 (results) for me is too fragmented. Issues are often split-off into different paragraphs...you leave and come back to the same issue.

- **Our response: Thank you for this comment. First, we have now more clearly introduced the structure of the results section to facilitate its understanding (in the first paragraph of Section 3. Results). Second, we have restructured the results section in that we have eliminated unnecessary subheadings, and have made sure that all headings are fully consistent with Figure 1. Particularly, we did so for section '3.1.1. Regional-level Inputs', '3.2.1. SP-level Mediators' and for section '3.2.2. Firm-level Mediators'. In order to enhance the reader's understanding of the structure in our text, we have made sure that we cover one topic per paragraph, and we have introduced new topics in our manuscript by putting the keywords in italics. Further, we have more frequently inserted "first", "second" etc. in the text.**

**For instance, section '3.2.1. SP-level Mediators' now reads as follows:**

"First, as to what *networking with universities and HEIs* is concerned, ...  
Second, considering *networking between one SP and other SPs*, some authors argue ...  
Third, SPs can also engage in *networking with other parties*, such as regional networks or ecosystems (van der Borgh et al., 2012). ..."

- **We do agree that we sometimes come back to the same issue, which mainly has to do with the fact that some papers are required to understand different elements in our framework, for instance papers that deal with inputs, mediators and outputs. However, we have now made sure to minimize repetition in terms of the findings we discuss.**

Some relevant citations are missing (even if you have the paper in the review). E.g. pag. 10 lines 20/27 you speak about the influence of park age. You do not cite Liberati et al., 2016 (a paper you have reviewed). This happens also with other parts/sentences; pag. 13 when you speak of SPs' image, you should cite Salvador (2011) or the Albarahari paper Science vs Technology parks when you talk about the relation with universities.

- **Our response: Thank you for pointing this out. We have checked all the key findings from the papers in our sample and made sure that for each topic, we included the relevant studies that deeply discuss or empirically examine that topic. Particularly, we have added about 35 additional citations in the text.**

**To give some examples, in the section ‘3.1.1. Regional level inputs’ we now added the following references:** Xue (1997), Hu et al. (2005), Lai and Shyu (2005) and Link and Scott (2007).

**In the section ‘SP Ownership and Governance’, we added** Koh et al. (2005), Sofouli and Vonortas (2007)

**In the section ‘SP Generation, Age and Size’, we added** Liberati et al. (2016)

Other citations are wrong. For example you say Liberati et al., find a positive effect on patent (pag. 24 line 30). Wrong. They do not find any positive effect of on-park location on patenting activity.

- **Our response: Thank you for pointing this out. While we attempted to carefully present all findings in the reviewed papers, this is indeed an inaccuracy that occurred. In order to make sure there were no other findings that were incorrectly presented, we re-checked all findings and adjusted them if necessary.**

Some strong statement must be better supported by citations. For example you write (pag.23 line 2) "...the overall contributions of SPs to the regional economy is fairly limited" but then you have papers that found also a positive effect.

- **Our response: We agree with you that we did not provide enough evidence to make this claim. We have now better motivated the stronger statements in our literature review with more evidence and we have nuanced the statements if necessary.**

**With regard to the above statement, we changed it in the text as follows:**

*“While some authors argue that SPs contribute (to some extent) to the regional or national innovation system (e.g., Colombo and Delmastro, 2002, in Italy; Löfsten and Lindelöf, 2002, in Sweden; Hu, 2007, in China; Vaidyanathan, 2008, in India; Zou and Zhao, 2014, in China), other scholars agree that - apart from the cases of excellence - the overall contribution of traditional SPs to the regional economy is fairly modest (Amirahmadi and Saff, 1993; Storey and Tether, 1998; Shearmur and Doloreux, 2000; Hansson et al., 2005; Ratinho and Henriques, 2010).”*

There are also some other minor inaccuracy (e.g. pag.13, line 17, my study was performed with Spanish SPs, not Italian as you say).

- **Our response: Many thanks for raising this issue. While checking the key findings from the articles in our sample (in line with the previous comments), we have also double-checked whether the other details of the studies (such as ‘country studied’) were mentioned correctly. If not, we have made sure to adjust them.**

Overall is not a bad paper. But the impression is that you have been inaccurate in some aspects. I suggest major revisions!

Good luck!

- **Our response: Thanks again for your detailed and valuable comments. These have truly helped us in strengthening the paper.**

## **Reviewer 2:**

General overview:

The paper proposes a critical survey of the literature on Science Parks and their effectiveness. As in the last 10 years the number of contributions on the topic has rose substantially, a critical review of the literature would be useful to guide future research on a topic of both academic and policy relevance. My concerns follow in detail but, in general, I believe the paper is interesting for JOTT readers.

- **Our response: We would like to thank you for taking the time to carefully read our paper and providing us with comments which have significantly helped us in strengthening our paper. In what follows, we provide a detailed overview of how we addressed your comments and how this led to changes in the paper's core text.**

Comments:

An issue regards the space left after the recent surveys offered by Hobbs et al. (2017) and Mian et al (2016). I would suggest the authors to stress the fact that they not just focus on effectiveness (which is present also in other surveys), but that they also distinguish in a more rigorous way “inputs”, “mechanisms” and “output” of SPs' activities. Also, they look at the methodology of investigation, which I appreciate.

- **Our response: Thank you for this nice suggestion. In the introduction, we now emphasize that we also provide a detailed understanding of the input factors and mechanisms initiated by SPs. We argue that this is an important contribution which distinguishes our review from prior ones.**

**Particularly, we adjusted this in our manuscript as follows:**

*“By focusing on literature on the contributions of SPs, we differentiate ourselves from prior reviews that have focused on SPs in general (e.g., Phan et al., 2005; Hobbs et al., 2017) or on business incubation mechanisms in general (e.g., Mian et al., 2016; Eveleens et al., 2017). Additionally, we rigorously present extant insights into the features that drive or constrain the potential contributions of SPs and we discuss the processes and mechanisms within SPs that provide value-added contributions. By doing so, we significantly contribute to the technology transfer literature, the innovation literatures and the SP literature specifically.”*

The following is a major concern I have. I feel that the “effectiveness of SP” is loosely defined. SP are complex institutions with a variety of objectives. Throughout the whole paper, but especially in section 3.1, the authors use terms like “SP effectiveness” or “SP success” without really digging into what the surveyed contributions analyze. This sometimes make the results of the literature review rather obscure. Further, from the very beginning - i.e. with respect to the selection of articles to consider (section 2.1) - I would suggest to explicitly state what the authors define as “effectiveness”, which appears to be the inclusion/exclusion criterion that is somehow arbitrarily applied by the authors.

- **Our response: Thank you for making this highly important comment, which is in line with one of the comments made by reviewer 1. We agree with you that “SP effectiveness” is an ambiguous term. This term refers to how successful SPs are in achieving their objectives, yet many papers do not make this link to SP objectives. Therefore, we have dropped the term “SP effectiveness” and changed it into “SP contribution” since this is a more appropriate term for what we actually aim to examine in this paper. Particularly, studies**

assessing the “contribution of SPs” are concerned with examining whether or not SPs contribute to (one of) their different stakeholders (e.g. to their tenants, the partner university, the local and national economy), in which ways they contribute to them, under which circumstances they contribute and what the (measurable) impact of these contributions is.

By consequence, we now use the term “SP contribution” and define it as *all potential advantages and positive effects that different stakeholders may experience from the SP phenomenon*.

We deliberately chose to define the term “SP contribution” as broad as possible as we did not want to restrict our search to any specific type of contribution or stakeholders a priori. In the introduction section, we have now more profoundly discussed how we define “SP contribution” and what we exactly aim to examine in this literature review. Similarly, we have extended our methodology section. Particularly, we now explicitly state what we mean by “SP contribution” and provide a more detailed description on how we selected the articles and constructed our final sample.

I believe the selection of papers to review has somehow limited the number of contributions on the regional-level outcome of SP. However, even relying on those selected and the literature review therein I think it is possible to expand the discussion (see e.g. Tan 2006, Ratinho and Henriques 2010, Vasquez-Urriago et al 2016). Also see a recent paper by Arauzo-Carod et al (2018). On the other side, I feel section 3.3.2 can be removed as it is really adding little information.

- **Our response:** Thank you for these suggestions. First, we went back to the papers that discuss regional-level outcomes and we have now significantly extended this section (please note that we did not include the Arauzo-Carod et al. (2018) paper as this paper is outside of the timeframe of our study).  
Second, we agree with you that the prior section ‘3.3.2. SP-level Outcomes’ did not have a lot of value. This would have been even more the case in the new version, as we defined “SP contribution” as *all potential advantages and positive effects that different stakeholders may experience from the SP phenomenon*. Therefore, we have now deleted this section.

Finally, even though I am sympathetic with the paper and the messages the authors convey on SP effectiveness, I would ask to include a broader discussion on “how to design science and innovation policy” in the theoretical discussion (4.2), including also more skeptical views (e.g. Dosi et al. 2006) and, in the methodological discussion (4.1), I would stress more the importance of addressing the issue of performance measurement of such complex and multifaceted institutions (see e.g. Ferrara et al. 2016, Guadix et al, 2016[in the ref list of the paper]).

See also:

Arauzo-Carod, J. M., Segarra-Blasco, A., & Teruel, M. (2018). The role of science and technology parks as firm growth boosters: an empirical analysis in Catalonia. *Regional Studies*, 52(5), 645-658.

Dosi, G., Llerena, P., & Labini, M. S. (2006). The relationships between science, technologies and their industrial exploitation: An illustration through the myths and realities of the so-called ‘European Paradox’. *Research Policy*, 35(10), 1450-1464.

- **Our response:** Thank you for these suggestions. We agree that a broader discussion will strengthen the paper significantly. Therefore, we have now added a section in the

**theoretical discussion ('4.3.1. Theories targeted at exploring novel topics and levels of analysis'), in which we call for future research to focus on the science and innovation policy level. In this paragraph, we provide potentially fruitful research avenues to optimize science and innovation policy.**

**Furthermore, we also added a new section ('4.2.2. Performance measurement') in the methodological discussion specifically devoted to extant performance measurement issues and related future research suggestions.**

Minor

In Appendix II (table) the journal "Technological Forecasting and Social Change" is repeated, please double-check the whole table.

- **Our response: Thank you for pointing out this inaccuracy. We have corrected it and double-checked the whole table.**

Pag 7, line 51-52, what kind of effectiveness are the authors referring to?

- **Our response: Some studies examined the influence of the size of the region in which SPs are located in order to determine where SPs are optimally located. Goldstein and Luger (1992) found that there is no influence of the size of the region in which the SP is located on the success of the park in terms of firm employment growth. Particularly, they state "size of region turned out to be statistically insignificant in explaining relative gain in employment growth rates among counties with research parks". Similarly, Hu (2007) argues that "there is no apparent relationship between the rate of labor productivity growth in a technology park and the initial size of the host city".**

**We altered the text to make more clear what outcome measures are studied in these papers:**

*"Finally, there is no evidence that size of the region in which the SP is located affects the contribution that SPs provide in terms of firm employment growth (Goldstein and Luger, 1992) or in terms of labor productivity growth (Hu, 2007)."*

See:

Ferrara, M., Lamperti, F., & Mavilia, R. (2016). Looking for best performers: a pilot study towards the evaluation of science parks. *Scientometrics*, 106(2), 717-750.

- **Our response: We would like to thank you for your great suggestions and valuable comments. They have really helped us to strengthen the paper!**

## **The Contribution of Science Parks: A Literature Review and Future Research Agenda**

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**Keywords:** science parks; contribution; literature review; technology transfer

**JEL:** M13

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## The Contribution of Science Parks: A Literature Review and Future Research Agenda

### ABSTRACT

Over the past decades, public policy has promoted the establishment of science parks to support the development and growth of technology-based firms and, as such, spur economic prosperity. However, despite the worldwide proliferation of science parks and scholarly interest, their contribution is yet to be fully understood. This paper presents the current state of knowledge on science park contribution using the IMO (Input-Mediator-Outcome) framework and is based upon an analysis of 175 journal articles published between 1988 and 2018. Furthermore, the paper uncovers critical methodological and theoretical deficiencies in the literature, and identifies promising avenues for future research, which will provide important insights to both academics and practitioners.

**Keywords:** science parks; contribution; literature review; technology transfer

**JEL:** M13

## 1. INTRODUCTION

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4 Technology-based firms, and particularly those of small and medium sizes, contribute  
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6 significantly to innovation, employment growth and economic development (Hoffman et al.,  
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8 1998). Therefore, policy makers all over the world have engaged in initiatives to support the  
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10 growth and development of technology-based firms and, eventually, to spur economic  
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12 prosperity (Mian et al., 2016). One of the earliest and most significant initiatives in this regard  
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14 involves the establishment of science parks (SPs). A SP is defined by the United Kingdom SP  
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16 Association (UKSPA)<sup>1</sup> as a “*business support and technology transfer initiative that: (1)*  
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18 *encourages and supports the start-up and incubation of innovation-led, high-growth,*  
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20 *knowledge-based businesses; (2) provides an environment where larger and international*  
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22 *businesses can develop specific and close interactions with a particular center of knowledge*  
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24 *creation for their mutual benefit; (3) has formal and operational links with centers of knowledge*  
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26 *creation such as universities, higher education institutes and research organizations” (UKSPA,*  
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28 *2017).*

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36 While SPs emerged in the early 1950s with the establishment of Stanford Research Park, it was  
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38 not until the 1980s that the SP phenomenon truly flourished and became one of the most  
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40 appealing regional development initiatives (Link and Link, 2003; Anttiroiko, 2004).  
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42 Particularly, early success stories of SPs such as Research Triangle park made both developed  
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44 and developing countries all over the world eager to establish SPs (Castells and Hall, 1994).  
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46 After a slightly declined interest in SPs in the 1990s due to the economic recession (Annerstedt,  
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48 2006), the SP phenomenon strongly regained interest in the late 1990s and, from then on, the  
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50 number of SPs rose dramatically (Anttiroiko, 2004). Over the past fifteen years, SP activity  
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52 worldwide has approximately doubled. Recent statistics report on about 400 SPs in Europe,  
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60 <sup>1</sup> This is the most cited definition in the SP literature.  
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1 employing more than 750,000 people (Rowe, 2014), and over 300 SP initiatives in the U.S.A.  
2 and Canada (Association of University Research Parks, 2013). Furthermore, SP activity has  
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4 grown exponentially in Asia (Annerstedt, 2006; Vaidyanathan, 2008), and numerous SP  
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6 initiatives have been developed in Africa, Australia and Latin-America (Phillimore, 1999; Chan  
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8 et al., 2010, 2011).  
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12 Following this worldwide spread of the SP phenomenon, the contribution of SPs has become  
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14 the focus of a vibrant academic debate. In their seminal work, Monck et al. (1988) aimed to  
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16 uncover whether or not SPs contribute to their tenants and to the broader economy. This first  
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18 attempt was soon followed by numerous studies seeking to understand the contribution of SPs  
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20 to a broad range of stakeholders, such as the private sector and the local and national economy.  
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22 We define the term “SP contribution” as *all potential advantages and positive effects that*  
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24 *different stakeholders may experience from the SP phenomenon.* Studies assessing SP  
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26 contribution are typically concerned with examining whether or not SPs contribute to (one of)  
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28 their different stakeholders (e.g. to their tenants, the partner university, the local and national  
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30 economy), in which ways they contribute to them, and what the (measurable) impact of the  
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32 contribution is. Recently, studies have also started examining under which circumstances SPs  
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34 contribute to a broad range of parties, hereby identifying contingencies of SP contribution  
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36 (Huang et al., 2012; Albahari et al., 2016). The purpose of this literature review is to provide  
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38 an overview on the current state of knowledge on SP contribution, and to provide ways that can  
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40 advance this state of knowledge. Focusing on SP contribution is particularly relevant in current  
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42 times, in which SPs have become common practice, but in which their relevance and impact is  
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44 far from understood and often debated. By focusing on literature on the contribution of SPs, we  
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46 differentiate ourselves from prior reviews that have focused on SPs in general (e.g., Phan et al.,  
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48 2005; Hobbs et al., 2017) or on business incubation mechanisms in general (e.g., Mian et al.,  
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50 2016; Eveleens et al., 2017). Additionally, we rigorously present extant insights into the  
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1 features that drive or constrain the potential contributions of SPs and we discuss the processes  
2 and mechanisms through which SPs provide value-added contributions. By doing so, we  
3 significantly contribute to the technology transfer literature, the innovation literatures and the  
4 SP literature specifically. Moreover, our study is particularly relevant for practitioners and  
5 policy makers, who have recently expressed their interest in identifying drivers of good SP  
6 practice and in gaining a better understanding on how SPs actually contribute to their different  
7 stakeholders (Rowe, 2014).  
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10 The literature review is organized as follows. In the next section, we present the methodology  
11 used in carrying out the literature search. Subsequently, we synthesize and discuss the findings  
12 from our extensive reading of the literature. We then go on to identify important shortcomings  
13 and gaps in this literature and provide avenues for future research.  
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## 17 **2. METHODOLOGY**

### 18 **2.1. Review Strategy**

19 We built a comprehensive database by selecting relevant articles in various steps. In a first step,  
20 we employed the Web of Science (WoS) database to identify articles on SPs in general. The  
21 WoS database provides access to high-quality, international research in more than 50  
22 disciplines (Falagas et al., 2008) and is very frequently used in literature reviews (e.g., Schmitt  
23 et al., 2018). We limited our search to English-language journal articles, published between  
24 1988 (the year of Monck et al.'s seminal work on SPs) and 2018. Further, we focused on  
25 journals in the following WoS categories: "Business", "Management", "Environmental  
26 studies", "Geography", "Planning development", and "Urban studies". We searched for the  
27 following terms in 'title' or 'topic': "science park\*", "science and technology park\*",  
28 "technology park\*", "research park\*" and "technopole\*". These terms were selected based on  
29 the general assertion that these are used interchangeably, as substitutes, or only indicate  
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country-specific traditions without significant differences in content (Chordá, 1996; Appold, 2004; Zhang, 2004; Sofouli and Vonortas, 2007). The total number of journal articles generated for each search term is provided in the first column of Table 1.

In a second step, we refined the set of papers, hereby excluding articles that did not assess SP contribution. We did so by reviewing the abstracts of the identified articles to determine whether or not they examined any aspect of the contribution of SPs to (one of) their potential stakeholders. In other words, we selected studies that evaluated *potential advantages and positive effects of SPs on (one of) their stakeholders*. In order to make our review as inclusive as possible, we did not restrict our sample to any specific type of contribution or stakeholder upfront. In case of doubt on whether the article dealt with SP contribution, the article was fully read by the authors and included in our database if any aspect of SP contribution was examined. In that way, we are able to present a comprehensive picture of the current knowledge on SP contribution. This procedure led to the final sample of 175 relevant journal articles, as depicted in Table 1.

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 Insert Table 1 about here  
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In the subsequent data analysis, the 175 articles were fully read, analyzed and coded. First, we assigned the following generic codes to each article: (1) Authors, (2) Publication year, (3) Journal, (4) Research question(s) and objective(s), (5) Methodology, (6) Country of study, (7) Theoretical perspectives, (8) Key variables, constructs and/or topics discussed (and level of analysis), and (9) Key findings. Second, while analyzing the content of the papers, we identified recurring themes in the selected articles (Dixon-Woods et al., 2005). Particularly, the findings on the contribution of SPs could be adequately structured along three broad themes, namely *inputs, mediators* and *outcomes*. Findings from the literature under the theme '*inputs*' deal with all features and attributes that drive or constrain the contribution of SPs. Findings on the theme

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'mediators' deal with the mechanisms and processes causing inputs to be transformed into purposeful outcomes (Klotz et al., 2014) or, in other words, the mechanisms and processes through which SPs provide value-added contributions to stakeholders. The theme 'outcomes' discusses the outcome indicators that are typically used to assess SP contribution. By consequence, we decided to structure our literature review along the *Input-Mediator-Outcome* (IMO) framework. This framework has been employed to present literature reviews in other domains as well (e.g., Mathieu et al., 2008; Klotz et al., 2014) and was deemed particularly relevant following the themes that arose from our review. Additionally, we noticed that the literature on SP contribution is characterized by studies on different levels of analysis. *Regional-level* studies focus on the regional context in which SPs are embedded. Studies within the *SP-level* focus on specific SP characteristics. *Firm-level* studies typically focus on the tenant firms. Therefore, in this review, we structure our findings by using the IMO framework, while at the same time paying attention to the different levels of analysis. Finally, based on the analysis of content and the listing of key variables, constructs and/or topics of each paper, the key findings could be compiled into subthemes within the IMO framework, as depicted in Figure 1.

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Insert Figure 1 about here  
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As can be noted from Figure 1, firms are clustered within SPs, and SPs are clustered within regions. Therefore, there is a high degree of interdependence between the three levels of analysis. By consequence, factors at different levels of analysis influence each other. For instance, regional inputs frequently affect SP input characteristics (Massey and Wield, 2003). Furthermore, it is also possible that inputs, mediators and outcomes affect one another at different levels. For example, regional-level inputs may influence SP-level mediators, and SP-level mediators may influence firm-level outcomes. Finally, the figure indicates feedback loops

1 may exist, through which the obtained outcomes may also have an influence on inputs and  
2 mediators. It is important to acknowledge these feedback loops in order to understand the  
3 cyclical nature of SP processes. For instance, when a SP helps in building regional outcomes,  
4 this park may in turn have an enhanced park image (input), resulting in increased networking  
5 opportunities (mediator). We visualize these interdependencies and feedback loops with dashed  
6 arrows in Figure 1.  
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## 14 **2.2.Descriptive Data**

15 Analyzing our set of articles according to publication year (Figure 2) indicates a steep increase  
16 in academic interest in the topic since the year 2000, which is fully in line with the revival of  
17 interest in SPs as a policy instrument. The geographical distribution of studies is quite  
18 unbalanced, with 48.6 % of the studies conducted in Europe, 34.9 % in Asia, 8.0 % in North-  
19 America, 0.6 % in South-America, and 1.1 % both in Africa and Australia. The geographical  
20 distribution of studies per year is depicted in Appendix I. Appendix II then presents an overview  
21 of the journals in which the 175 studies appeared.  
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## 41 **3. RESULTS**

42 In this section, we present the key findings from our data analysis, hereby following the IMO  
43 framework and structuring our discussion along the different levels of analysis. In section 3.1.,  
44 we discuss the findings on the input factors at the three different levels of analysis. In section  
45 3.2., we present the results on the mediator factors (i.e. the mechanisms and processes through  
46 which SPs provide value-added contributions to stakeholders (e.g., networking mechanisms)).  
47 Finally, in section 3.3., we provide a detailed overview on the outcome measures that are used  
48 to assess the contributions that SPs provide. These outcome measures are typically at regional  
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and firm level since SPs are expected to contribute to their tenants (e.g., innovative performance) and to the local, regional and national economy (e.g., job creation).

### 3.1.Inputs

Many studies have examined the inputs to SP contribution, hereby referring to the attributes on regional-, SP- and firm-level that drive or constrain the contribution SPs provide.

#### 3.1.1. Regional-level Inputs

As SPs occur worldwide in highly diverse areas and in varying regional contexts, multiple (case) studies discuss which regional features are most favorable for SPs. First, studies have considered the *level of regional development and urbanization* (Chorda, 1996). Whereas some authors argue that SPs can contribute more in emerging economies, characterized by less developed innovation systems (Colombo and Delmastro, 2002; Wonglimpiyarat, 2010; Albahari, 2015; Albahari et al., 2016), not all authors agree (Radosevic and Myrzakhmet, 2009). Furthermore, Díez-Vial and Fernández-Olmos (2017) find that the benefits provided by SPs are reinforced in periods of economic downturn. The literature also identifies location factors that are crucial in SP success. Particularly, factors affecting the quality of life (such as a pleasant and affordable residential area, good education possibilities, a well-functioning transportation system and cultural offerings) seem crucial in attracting firms and talent to the SP and the region (Amirahmadi and Saff, 1993; Shin, 2001; Walcott, 2002; Ramasamy et al., 2004; Zhang, 2004; Eto, 2005; Ku et al., 2005; Mieg, 2012; van Winden and Carvalho, 2016; Cummings, 2017; Eckard, 2017; Miao, 2017). Therefore, many assume that SPs are optimally located in urban or metropolitan areas (Nahm, 2000), which explains the rise in SP creation in urban areas (Annerstedt, 2006; van Winden and Carvalho, 2016). At the same time, however, some studies argue that SPs can also be highly beneficial in non-urban areas (Goldstein and Luger, 1992; van Winden and Carvalho, 2016). In either case, it is argued that SP developers should take into



1 account opportunities and constraints associated with the region's institutional architecture  
2 (Fikirkoça and Saritas, 2012; Carvalho and van Winden, 2017).  
3

4  
5 Second, some studies have considered the impact of *region size* on SP contribution. These  
6  
7 studies have however not found any relationship between the size of the region in which the SP  
8  
9 is located and the contribution that SPs provide in terms of firm employment growth (Goldstein  
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11 and Luger, 1992) or labor productivity growth (Hu, 2007).  
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15 Third, SPs are frequently provided with financial support by the *government*, often in the form  
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17 of loans, subsidies and grants, tax incentives and fiscal concessions (Goldstein and Luger, 1990;  
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19 Amirahmadi and Saff, 1993; Bass, 1998; Kihlgren, 2003; Lai and Shyu, 2005; Hu, 2007; Link  
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21 and Scott, 2007; Su and Hung, 2009; Yang et al., 2009a). Abundant case studies thoroughly  
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23 describe the role of public policy makers in setting up and supporting SPs (Gwynne, 1993; Bass,  
24  
25 1998; Walcott, 2002; Chou and Lin, 2007; Vaidyanathan, 2008). According to this literature,  
26  
27 government support and funding are indispensable for SP contribution (Amirahmadi and Saff,  
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29 1993; Xue, 1997; Cabral, 1998; Lee and Yang, 2000; Hu, 2007; Vaidyanathan, 2008; Phelps  
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31 and Dawood, 2014; Gkypali et al., 2016), especially in developing countries that usually lack  
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33 risk capital to support start-up companies (Wonglimpiyarat, 2010; Phelps and Dawood, 2014;  
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35 Phelps et al., 2014). Public policy interventions are also supposed to contribute by attracting  
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37 high-quality human and financial capital to the SP, which is beneficial for the whole region (Su  
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39 and Hung, 2009). At the same time, it is argued that too much public interference (accompanied  
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41 with bureaucracy and rigid control) constraints the park's flexibility and innovative activities,  
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43 which in turn decreases its efficiency (Bass, 1998).  
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### 51 52 53 **3.1.2. SP-level Inputs** 54 55

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57 Overall, abundant SP studies have examined the influence of SP features and attributes, such  
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59 as SP ownership and governance, SP generation and age, SP management and SP image,  
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prestige and outlook. As the following overview shows, the literature has largely failed to provide clear-cut answers on the importance of SP-level input factors in affecting SP contribution.

### *SP Ownership and Governance*

SPs are typically established by different initiators. In general, three broad groups of founders can be identified: the government, universities and other HEIs (Higher Education Institutes), and private sector interest groups (Shearmur and Doloreux, 2000). SPs typically originate from alliances between these parties (Storey and Tether, 1998; Nahm, 2000). Miao and Hall (2014) distinguish between three types of SPs: the spontaneous, the cooperative and the cultivated park, and find that the spontaneous type, in which the private sector takes the lead, is particularly efficient in spurring innovation. The cultivated park, in which the government takes the lead, can evolve into well-functioning innovation systems, although they often turn into ordinary industrial areas without providing much contribution to the region.

Which ownership or governance structure has the most potential to create value-added contributions is not fully understood, yet some authors argue that more involvement of the private sector is beneficial in promoting innovation (Koh et al., 2005). Sofouli and Vonortas (2007) argue that more private sector engagement in SP ownership, management and financing spurs the establishment of innovative companies. Similarly, Link and Scott (2006) find that SPs governed by a private organization grow faster than university-operated parks. Huang et al. (2012)'s study in Taiwan shows that SPs organized by the central government are better able to achieve tenant innovation than parks organized by the local government.

### *SP Generation, Age and Size*

Some authors have identified different *SP generations* within SP history, with each generation having different characteristics, strategies and outcomes. Hansson et al. (2005) distinguish

1 between the traditional greenhouse model and the campus model. Annerstedt (2006) discerns  
2 three generations: science push, market pull and interactive glocal flows. The latest generation,  
3  
4 in which SPs have extended their scope and serve as urban catalysts for innovation in the region  
5  
6 (Annerstedt, 2006; Bigliardi et al., 2006) are considered the most promising (Bigliardi et al.,  
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8 2006).  
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12 Some studies examined the influence of *SP age*. One empirical study shows that firms in  
13  
14 younger as well as in older parks perform better compared to firms in middle-aged parks  
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16 (Albahari, 2015; Albahari et al., 2016). Liberati et al. (2016) find that the effect of SPs on tenant  
17  
18 performance is stronger in older parks, suggesting that SPs need some time to affect tenants.  
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20 Contrarily, Squicciarini (2009) finds that firms situated in older parks perform worse in terms  
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22 of patenting activity.  
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27 As to what *SP size* is concerned, it is generally accepted that firms in larger parks outperform  
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29 those in smaller parks, hereby underscoring the existence of economies of agglomeration  
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31 (Squicciarini, 2009; Albahari, 2015; Albahari et al., 2016). It is further argued that SP size  
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33 positively affects the per capita income growth in the SP's host city (Hu, 2007).  
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### 37 38 *SP Management* 39

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42 It is widely recognized that the presence of knowledgeable SP management has a critical role  
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44 in the success of SPs (Cabral, 1998; Link and Scott, 2003a; Zhang, 2004; Ratinho and  
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46 Henriques, 2010; Zou and Zhao, 2014). Early studies on SPs have distinguished between  
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48 managed and non-managed parks (Westhead and Batstone, 1998, 1999). Whereas managed  
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50 parks have at least one full-time manager on park, non-managed parks are typically managed  
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52 by informal teams consisting of SP partners or stakeholders with no (full-time) presence on  
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54 park (Westhead and Storey, 1994; Westhead and Batstone, 1998). Studies on the differences  
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56 between managed and non-managed SPs have however largely remained descriptive.  
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Other studies have recognized the heterogeneity among SP management, hereby discussing best management practices that lead to SP success (Cabral, 1998; Chang et al., 2009; Ratinho and Henriques, 2010) and leverage tenant performance (Löfsten and Lindelöf, 2003). Particularly, these studies argue that SP managers should hold a broad set of skills in order to provide value-added contributions. Specifically, park managers should have appropriate sector experience and expertise in management (Cabral, 1998; Kihlgren, 2003; Löfsten and Lindelöf, 2003), in marketing and promotion to attract eminent firms to the park and to select promising startups (Cabral, 1998; Zhang, 2004; Koh et al., 2005; Koçak and Can, 2014), and in social skills to engage in networks that yield added value for their tenants (Cabral, 1998; Westhead and Batstone, 1999; Phillips and Yeung, 2003; Löfsten and Lindelöf, 2005). Additionally, the size of the park's management team is found to be positively related to tenants' innovative performance (Albahari, 2015; Albahari et al., 2016).

In what follows, we discuss the findings concerning the two management activities that are most discussed in relation to SP contribution, namely tenant selection and the provision of services and facilities.

*Tenant Selection.* For SPs to be successful, they must attract and select the most suitable and promising firms to reside on the park. It is argued that tenant selection is crucial in creating a place that can truly spur innovation (Bakouros et al., 2002; Phillips and Yeung, 2003; Chen et al., 2006). Therefore, SPs usually follow a selection policy in which potential tenant firms are conscientiously screened. While some SPs opt for a more open policy without major restrictions, most parks follow a more restrictive entry policy (Link and Link, 2003; Chen et al., 2006). The SP literature has examined the influence of rigorous selection criteria to a limited extent and has provided mainly favorable evidence for restrictive entry policies. Link and Link (2003) show that SPs with tenant criteria grow faster than parks without tenant criteria. Salvador

(2011) finds that SPs that follow a strict entry policy represent a stronger brand and therefore SP residence provides a stronger signal to residents' potential financiers and customers.

Other SPs go one step further and target sector-specific firms, as such creating a specialized park (Gwynne, 1993; Shearmur and Doloreux, 2000; Vaidyanathan, 2008; Schwartz and Hornych, 2010; Koçak and Can, 2014). SP studies comparing specialized with diversified parks provide rather mixed findings. Specialized parks easier attract firms in that particular sector (Liberati et al., 2016), enhance the image of the region (Liberati et al., 2016), facilitate knowledge spillovers (Koçak and Can, 2014) and positively affect the tenants' investments in R&D (Lamperti et al., 2017). Some scholars find that specialized parks promote on-park relationships (Koçak and Can, 2014), while others find no differences between diversified and specialized parks in terms of on-park networking and linkages with the academic partner (Schwartz and Hornych, 2000).

*Services and Facilities.* SPs typically offer services and facilities, either at low cost or free-of-charge. The package of services differs significantly in range and type, but when delivered effectively, it is expected to contribute substantially to tenant development and growth (Colombo and Delmastro, 2002; Durão et al., 2005; Díez-Vial and Montoro-Sánchez, 2017). Many studies have distinguished between (1) property-related services, (2) business and innovation support and (3) networking services.

First, property-related services include the provision of infrastructure and many shared services, such as the availability of laboratories, conference and meeting rooms, restaurant and cafeteria (Guy, 1996; Sofouli and Vonortas, 2007; Rowe, 2014). These services are most commonly utilized (Westhead and Batstone, 1998, 1999; Salvador, 2011) and are generally perceived as advantageous for tenants as they allow lowering their overhead costs (Westhead and Batstone, 1999; Siegel et al., 2003b; Benneworth and Ratinho, 2014).

1 Second, business and innovation support services assist firms by providing (customized) advice  
2 and consulting in areas such as marketing, business planning, intellectual property (IP) and  
3  
4 research activities. Furthermore, SPs also play an important role in informing firms on how to  
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6 gain access to public or private finance (Salvador, 2011). A range of studies find these services  
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8 to be valuable for tenant firms (Monck et al., 1988; Westhead and Batstone, 1998, 1999),  
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10 especially for young firms (Löfsten and Lindelöf, 2003). One study in Spain however finds the  
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12 impact of general consultancy services on tenants' innovative performance to be negative  
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14 (Albahari, 2015; Albahari et al., 2016).  
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20 The final category, networking services, consists of creating networking opportunities for  
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22 tenants with valuable parties such as other tenants, the academic partner institution, and a range  
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24 of other external partners (Koçak and Can, 2014; Rowe, 2014). Participation in these  
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26 networking activities leads to more knowledge sharing among tenants (Koçak and Can, 2014).  
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### 30 *SP Image, Prestige and Outlook*

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34 Generally, given their reputation as sources of knowledge, innovation and progress (Rowe,  
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36 2014), SPs are perceived as prestigious real estate developments (Massey and Wield, 2003;  
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38 Salvador, 2011). The park's reputation is frequently found to be one of the most crucial reasons  
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40 for organizations to locate on park (e.g., Monck et al., 1988; Bakouros et al., 2002; Squicciarini,  
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42 2009; van der Borgh et al., 2012). Particularly, tenants expect to benefit from the positive image  
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44 of the park (Walcott, 2002), for instance through the social signaling function of the park toward  
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46 external actors such as customers, financiers and suppliers (Salvador, 2011). While some  
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48 studies do not find evidence of image benefits (Ferguson and Olofsson, 2004; Chan and Lau,  
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50 2005), many (case) studies point to the importance of SP image for tenants (Walcott, 2002;  
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52 Salvador, 2011; van der Borgh et al., 2012).  
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1 Recently, the literature has considered the presence of greenspaces at SPs. Such greenspaces  
2 encourage employees to take outdoor breaks, which allow them to psychologically separate  
3 themselves from work and which lead to enhanced innovation and creativity (Colley et al.,  
4 2016). Moreover, the use and view of greenspaces at SP workplaces foster employee wellbeing  
5 (Gilchrist et al., 2015; Colley et al., 2016).  
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### 11 **3.1.3. Firm-level Inputs**

12 A body of literature investigates whether tenants differ across SPs or from their off-park  
13 counterparts in terms of firm characteristics, and whether these firm-level input factors affect  
14 SP contribution. These characteristics include firm age and size, origin, technological and  
15 financial resources.  
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#### 25 *Firm Age and Size*

26 A limited number of studies assess the impact of *firm age* on SP contribution, and find that  
27 especially young and small firms benefit from residing on SPs (Vásquez-Urriago et al., 2015).  
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36 As to what *firm size* is concerned, a study in Taiwan shows that smaller firms benefit more than  
37 larger firms from SP location in terms of innovation performance, whereas larger firms benefit  
38 more than smaller firms in terms of market performance (Huang et al., 2012).  
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#### 44 *Firm Origin*

45 The SP literature has frequently focused on university spin-offs (USOs), which refer to firms  
46 established by founders with an academic background (e.g., Link and Scott, 2005; Cantù, 2010;  
47 Salvador, 2011), and corporate spin-offs (CSOs), which are firms founded by entrepreneurs  
48 with practical business skills developed in the industry, who left their organization to set up  
49 their own (e.g., Lindelöf and Löfsten, 2005, 2006; Löfsten and Lindelöf, 2005). When  
50 examining USOs on SPs, Salvador and Rolfo (2011) point to the limited role of SPs in  
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1 encouraging the growth and performance of USOs. Later, Fernández-Alles et al. (2015) nuance  
 2 these findings by stating that USOs in early stages do largely benefit from SP residence. Once  
 3 these USOs are however well-established, the role of the SP becomes negligible. Other studies  
 4 find that on-park USOs are more internationally oriented than off-park USOs (Salvador, 2011;  
 5 Salvador and Rolfo, 2011). When comparing on-park USOs and CSOs, Löfsten and Lindelöf  
 6 (2005) find no significant differences in terms of sales growth and profitability.

### 14 *Technological Resources*

15 The literature has investigated the importance of technological resources (mainly R&D inputs)  
 16 as an input factor, however without providing univocal results. While two studies find no  
 17 difference in R&D inputs between on- and off-park firms (Westhead, 1997; Colombo and  
 18 Delmastro, 2002), the majority of studies find on-park firms to be more R&D-intensive  
 19 compared to off-park firms (Monck et al., 1988; Leyden et al., 2008; Yang et al., 2009a;  
 20 Lamperti et al., 2017). Whether SP residence strengthens tenants' R&D intensity or whether  
 21 this higher R&D intensity can be attributed to the type of firm that is attracted to SPs (e.g.  
 22 through entry criteria) remains largely unclear. Furthermore, Huang et al. (2012) and Vásquez-  
 23 Urriago et al. (2015) show that firms with limited in-house R&D capability can gain relatively  
 24 better innovative performance from locating on a SP compared to those with more in-house  
 25 R&D capability, however, a minimal level of internal R&D capability seems needed to benefit  
 26 from SP location (Vásquez-Urriago et al., 2015).

### 48 *Financial Resources*

49 SPs are expected to help in overcoming the difficulties early-stage high-tech firms face in  
 50 raising sufficient financing (Westhead and Batstone, 1998; Dettwiler et al., 2006) by  
 51 legitimizing their tenants toward external actors, such as equity providers and bankers  
 52 (Ferguson and Olofsson, 2004). Accordingly, SP contribution studies have examined whether



1 tenants indeed obtain more financing compared to off-park firms. While some reveal difficulties  
 2 of tenants to attract financing (Salvador, 2011), other evidence suggests that slightly more  
 3  
 4 tenant firms are venture capital-backed than off-park firms (Lindelöf and Löfsten, 2002;  
 5  
 6 Kihlgren, 2003; Dettwiler et al., 2006). Salvador and Rolfo (2011) did not notice significant  
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 8 differences between the sources of finance of on- and off-park firms.  
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### 11 **3.2. Mediators**

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 13 We identified some mechanisms and processes at SP- and firm-level through which value-  
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 15 added contributions are provided to stakeholders.  
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#### 22 **3.2.1. SP-level Mediator: networking**

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 25 At SP level, we identified one major mechanism that enables SPs to enhance the transformation  
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 27 of inputs into outcomes, namely networking. Specifically, SPs engage in networking activities  
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 29 with universities or HEIs, take part in national or international SP networks, and engage in  
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 31 networking with other parties such as technology transfer offices (TTOs).  
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36 First, as to what *networking with universities and HEIs* is concerned, the type of linkage and  
 37  
 38 degree of university involvement greatly differs across SPs, ranging from parks owned or solely  
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 40 managed by the university to parks with limited and passive linkages with the university. The  
 41  
 42 linkage between the partner university and the SP is frequently found to be of paramount  
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 44 importance to the park's operation, success and growth (Hommen et al., 2006; Ratinho and  
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 46 Henriques, 2010) and to the subsequent innovativeness of tenants (Lamperti et al., 2017).  
 47  
 48 However, Albahari et al. (2017) nuance these findings and show that a larger involvement of a  
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 50 university in the SP is positively related to the patenting activity of the tenants, but negatively  
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 52 to the tenants' innovation sales. Further, strong linkages between the SP and the partner  
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 54 university are often shown to facilitate technology transfer and the commercialization of  
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1 research, with some studies pointing to the importance of geographical proximity between SP  
2 and university (Link and Scott, 2003b, 2006). Nevertheless, some researchers question this  
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4 networking role of SPs, arguing that the creation of a SP as intermediary institution in order to  
5  
6 bridge the gap between HEIs and industry, also keeps these latter two apart (Hansson et al.,  
7  
8 2005). Similarly, Albahari et al. (2017) find no evidence that larger involvement of a university  
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10 in a SP is positively related to the propensity of tenants to cooperate with the partner university.  
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14 Second, considering *networking between one SP and other SPs*, some authors argue that SPs  
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16 can learn from sharing their experiences with other parks (Koh et al., 2005; Armanios et al.,  
17  
18 2017). Accordingly, in many countries, overarching regional, national or international SP  
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20 associations have emerged in order to serve as a platform to share experiences, ideas, best  
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22 practices and learn from each other (Albahari et al., 2013; Rowe, 2014). These associations  
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24 provide state-of-the-art business opportunities, assist in the development of new parks and  
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26 increase the visibility of their members (IASP, 2017). To the best of our knowledge, no studies  
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28 have assessed the extent to which networking benefits also occur in reality, despite the calls to  
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30 pay more attention to the interaction between SPs (Lai and Shyu, 2005). Recently, however,  
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32 Bathelt and Zhao (2016) distinguish between collaborating and competing SPs in the same  
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34 region and indicate that, in the case of collaborating SPs, proximity advantages are successfully  
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36 exploited.  
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45 Third, SPs can also engage in *networking with other parties*, such as regional networks or  
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47 ecosystems (van der Borgh et al., 2012). Apart from some case studies that discuss parks that  
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49 are part of such networks, evidence on the importance of specific relationships is largely  
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51 missing. One particular type of networking relationship is that with technology transfer offices  
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53 (TTOs). TTOs are typically established by universities and play a critical role in  
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55 commercializing university-generated intellectual property (IP), for instance through the  
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57 creation of USOs (Olcay and Bulu, 2016). Even though it is argued that the interplay between  
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1 SPs and TTOs is important in exploiting the full potential of these firms (Olcay and Bulu, 2016),  
 2 the importance of these networking relationships has, so far, been understudied.  
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### 4 5 6 **3.2.2. Firm-level Mediators**

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9 Two major mediating mechanisms and processes take place at firm level, namely networking  
 10 and legitimacy building. The SP literature has mainly focused on tenants' networking activities  
 11 and legitimacy building. The SP literature has mainly focused on tenants' networking activities  
 12 with academic institutions, other tenants, and to a lesser extent, with other parties. Furthermore,  
 13 it has studied how tenant firms can enhance their outcomes through legitimacy strengthening.  
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 15 In what follows, we first discuss networking as a mechanism, and subsequently elaborate on  
 16 legitimacy building.  
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#### 25 *Networking*

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 27 First, a large body of research examines whether SP residence influences the level of *firm-*  
 28 *university linkages*, mainly by comparing on- and off-park firms. The assertion that SP  
 29 residence facilitates university-industry linkages is rejected in some studies (Joseph, 1989;  
 30 Massey and Wield, 1992; Malairaja and Zawdie, 2008). One study even finds off-park firms to  
 31 have stronger links with HEIs than on-park firms (Radosevic and Myrzakhmet, 2009). At the  
 32 same time, many other studies demonstrate that SP tenants do engage more frequently in  
 33 university-industry linkages compared to off-park firms (Colombo and Delmastro, 2002;  
 34 Löffsten and Lindelöf, 2002; Lindelöf and Löffsten, 2004; Fukugawa, 2006; Hung, 2012;  
 35 Vásquez-Urriago et al., 2016). When considering the nature of the linkages, SP residence  
 36 principally seems to facilitate the establishment of informal and human resource linkages, and  
 37 appears to have little or no influence on the development of formal linkages (Monck et al.,  
 38 1988; Massey and Wield, 1992; Quintas et al., 1992; Westhead and Storey, 1995; Vedovello,  
 39 1997; Bakouros et al., 2002; Schwartz and Hornysh, 2010; Motohashi, 2013). Some studies  
 40 however find tenants to be more likely to engage in formal linkages than off-park firms  
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(Colombo and Delmastro, 2002; Löfsten and Lindelöf, 2002; Lindelöf and Löfsten, 2004; Fukugawa, 2006; Vásquez-Urriago et al., 2016). Subsequently, many researchers have investigated the impact of university-industry linkages on tenant performance, however often providing weak and contradictive results. With regards to innovative performance, some scholars find that tenants with linkages to the university perform better in the development of new products, processes and technologies (Liefner et al., 2006; Díez-Vial and Fernández-Olmos, 2015; Díez-Vial and Montoro-Sánchez, 2016). By contrast, others find that university-industry linkages do not necessarily translate into stronger innovative firm performance (Felsenstein, 1994; Hung, 2012; Jimenez-Moreno et al., 2013; Motohashi, 2013). Along the same lines, studies examining the relationship between university linkages and the tenant's financial performance or other outcomes are scant: Ferguson and Olofsson (2004) show that tenants benefited from university collaboration in terms of growth, Westhead and Story find a positive association with firm survival, and Jimenez-Moreno et al. (2013) show that university-industry relationships result in stronger firm reputation. In sum, despite the widespread perception of SPs as facilitators of university-industry linkages, empirical studies have provided rather contradictory and weak results.

Second, scholars have considered *networking and knowledge spillovers between tenants* (Schwartz and Hornysh, 2010; Montoro-Sanchez et al., 2011; Díez-Vial and Montoro-Sánchez, 2017; Latorre et al., 2017). While some scholars demonstrate that SP residence has a positive effect on the prevalence of interfirm linkages (Phillimore, 1999; Hu, 2008; Squicciarini, 2009; Cantù, 2010; Vásquez-Urriago et al., 2016), others indicate that interaction between tenants rarely takes place, leading to minimal linkage formation among tenants (Felsenstein, 1994; Jonsson, 2002; Chan and Lau, 2005; Su and Hung, 2009; Motohashi, 2013; Minguillo and Thelwall, 2015). When considering the nature of the linkages that occur among tenants, evidence points to the dominance of informal linkages and the limited impact on formal

1 linkages among tenants (Bakouros et al., 2002; Schwartz and Hornych, 2010). In particular,  
2 two reasons clarify the dearth and informal nature of linkages among tenants. First, the lack of  
3  
4 (formal) linkages can be attributed to the heterogeneity of firms residing on park (Dettwiler et  
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6 al., 2006), leading to tenant firms basically having nothing in common (Chan and Lau, 2005).  
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9 Second, the greater competition among neighboring firms may make tenants reluctant to share  
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11 knowledge (Hu et al., 2005) due to the risk of suffering from knowledge outflows rather than  
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13 to gain from knowledge spillovers (Huang et al., 2012). Further, other studies consider the  
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15 mediating effect of on-park networking and investigated whether SP residence fosters firm  
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17 (innovative) performance following knowledge spillovers or tenant linkages. Montoro-Sánchez  
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19 et al. (2011) show that SPs stimulate knowledge flows among firms which in turn positively  
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21 influences the firm's propensity to innovate. Similarly, Hu (2008) and Martínez-Cañas et al.  
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23 (2012) find SP residence to facilitate interaction among tenants, which leads to more knowledge  
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25 acquisition and increased innovation outcomes. On the contrary, other scholars reveal that on-  
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27 park linkages do not influence the tenants' innovative capabilities (Chan and Lau, 2005; Chan  
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29 et al., 2010) or that too many informal linkages reduce the tenants' innovation outcomes (Chan  
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31 et al., 2011). In sum, clustering organizations with the purpose of generating positive  
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33 agglomeration externalities, which in turn promotes innovation, is one of the main reasons for  
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35 developing SPs. At the same time, however, studies into these effects have provided  
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37 contradictory results and frequently point to the lack of interaction among on-park  
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39 organizations.  
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49 Third, SPs can also encourage *networking with other parties*, beyond the university or park  
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51 tenants. For instance, they can contribute to tenants by facilitating access to wide, existing  
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53 networks of organizations in the area (Hansson et al., 2005) or facilitating linkages to foreign  
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55 companies (Liefner et al., 2006). However, few studies have examined the relationships of  
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57 tenants with outside organizations or parties. Vásquez-Urriago et al. (2016) and Colombo and  
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1 Delmastro (2002) find that the likelihood of engaging in linkages with other parties is higher  
2 for firms located on SPs. Chan et al. (2010) find that tenants that engage in linkages with other  
3 tenants, also have more relationships with firms outside the park than tenants without on-park  
4 linkages. Contrarily, Lindelöf and Löfsten (2003) show that tenants were not better able to build  
5 supporting networks than off-park firms.  
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### 11 *Legitimacy Building*

12 In providing tenants with a prestigious and high-image location, SPs may contribute to the  
13 firms' legitimacy (Ferguson and Olofsson, 2004), in turn affecting SP contribution. Particularly,  
14 the fact that firms are deliberately selected by knowledgeable institutions to reside on a SP  
15 assures and signals the firm's quality to the outside world (Massey and Wield, 1992; Armanios  
16 et al., 2017). As a result, tenants are likely to be regarded as trustworthy and reliable (Salvador,  
17 2011) and uncertainties about the firms' capabilities are mitigated (Westhead and Batstone,  
18 1998; Armanios et al., 2017). These reputational advantages may facilitate tenants in attracting  
19 partners, new customers, proficient employees, and public and private funding (Jonsson, 2002;  
20 Salvador, 2011; Armanios et al., 2017), thereby contributing to the firm's survival and growth.  
21 However, while benefits related to legitimacy have therefore been frequently assumed, there is  
22 little evidence in the literature that these effects actually occur. The only study on the topic by  
23 Ferguson and Olofsson in 2004 find that these presumed image benefits do not affect tenant  
24 growth nor survival.  
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### 46 **3.3.Outcomes**

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51 Researchers have measured SP contribution by assessing many different outcome factors. A  
52 detailed overview of the specific outcome indicators used throughout the literature is provided  
53 in Appendix III. Following Appendix III, we notice that outcomes are mainly studied at regional  
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1 and firm level. In what follows, we briefly discuss the different outcome indicators that have  
2 been used in the SP literature.  
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### 4 5 **3.3.1. Regional-level Outcomes** 6

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9 SPs are typically established as regional development instruments (Xue, 1997; Hu et al., 2005;  
10 Anttiroiko, 2004; Phelps et al., 2014; Zou and Zhao, 2014) embedded in a regional or national  
11 innovation system (Colombo and Delmastro, 2002; Zou and Zhao, 2014). SPs are thus expected  
12 to contribute to the local, regional or national economy (Link and Scott, 2006). To evaluate  
13 whether SPs indeed contribute to the wider economy, a broad range of regional outcome  
14 indicators has been employed, which we categorize (in Appendix III) in new firm creation, firm  
15 attraction, job creation and economic growth and development. Studies examining these  
16 regional-level outcomes are most frequently case-based or focus on a specific context (e.g.,  
17 Hommen et al., 2006; Tan, 2006). While some authors argue that SPs contribute (to some  
18 extent) to the regional or national innovation system (e.g., Colombo and Delmastro, 2002, in  
19 Italy; Löfsten and Lindelöf, 2002, in Sweden; Hu, 2007, in China; Vaidyanathan, 2008, in India;  
20 Zou and Zhao, 2014, in China), other scholars suggest that - apart from the cases of excellence  
21 - the overall contribution of traditional SPs to the regional and national economy is fairly  
22 modest (Amirahmadi and Saff, 1993; Storey and Tether, 1998; Shearmur and Doloreux, 2000;  
23 Hansson et al., 2005; Ratinho and Henriques, 2010) and that they might have a local impact at  
24 best. Specifically, Shearmur and Doloreux (2000) find that the establishment of SPs in Canada  
25 does not have a discernible effect on high-tech employment. Similarly, Storey and Tether  
26 (1998) mention that European SPs only exert a modest contribution to employment creation  
27 and that their contribution is only local. Correspondingly, Ratinho and Henriques (2010) argue  
28 that the contribution of SPs in Portugal is minimal in terms of company and job creation and  
29 could at best have a local impact. Also Amirahmadi and Saff (1993) argue that the regional and  
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1 national economic impact of SPs has been exaggerated. On the contrary, in some (case) studies,  
2 especially in Asia, the contributions of SPs to the regional economy seem more evident. For  
3 instance, Tan (2006) argues that the Zhongguancun SP in China brought technological  
4 superiority to the region driven by technology transfer from leading research institutions, which  
5 in turn led to wealth creation. Hu (2007) finds that establishing SPs in China has spurred  
6 economic growth to some extent. This growth is mainly due to foreign direct investment that  
7 host cities receive and not because of knowledge spillover and other externalities stemming  
8 from clustering. Lee and Yang (2000) argue that the establishment of Hsinchu SP drove the  
9 development of the whole electronics information industry in Taiwan. Similarly, Vaidyanathan  
10 (2008) finds that SPs in India are successful in attracting foreign investments to the country as  
11 many multinational companies established on the parks. Furthermore, the SPs have played a  
12 crucial role in the growth of the software sector in India.  
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29 In sum, the contributions different SPs provide to their local, regional or national economy are  
30 highly divergent and very hard to capture.  
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### 35 ***3.3.2. Firm-level Outcomes***

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39 SPs are expected to stimulate the development, growth and innovative capabilities of their  
40 tenant firms. Therefore, the majority of studies in our sample have examined SP contribution  
41 by assessing a broad range of firm outcomes. Particularly, the outcomes studied can be  
42 subdivided in three types, namely innovative, financial and other outcomes (Appendix III). In  
43 what follows, we provide an overview on the literature that examines the effect of SP residence  
44 on the three types of firm outcome indicators.  
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#### 54 ***Innovative Outcomes***

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1 Since SPs are expected to contribute to their tenants' innovative capabilities, many SP scholars  
2 have examined the effect of SP residence on the innovative performance of firms. These studies  
3 typically use a variety of indicators which are either related to IP or new products and services.  
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5 IP is a broad concept that covers many types of legally recognized rights arising from  
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7 intellectual creativity, such as trademarks, copyrights, design rights and patents (Kinsella,  
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9 2001).  
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14 Studies examining whether SP residence fosters tenant's innovative performance provide  
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16 conflicting findings. Particularly, some authors conclude that SP residence is positively related  
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18 to firm performance in terms of patent-related measures (Siegel et al., 2003a; Squicciarini,  
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20 2008, 2009; Yang et al., 2009a; Huang et al., 2012; Lamperti et al., 2017) and in terms of new  
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22 product/service-related measures (Siegel et al., 2003a; Lai et al., 2014; Vásquez-Urriago et al.,  
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24 2014, 2015). In contrast, others find no difference between tenants and similar off-park firms  
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26 in terms of patenting activity (Westhead, 1997; Colombo and Delmastro, 2002; Lindelöf and  
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28 Löfsten, 2002, 2003; Liberati et al., 2016), copyright activity (Westhead, 1997; Colombo and  
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30 Delmastro, 2002; Siegel et al., 2003a) and new products and services (Felsenstein, 1994;  
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32 Westhead, 1997; Lindelöf and Löfsten, 2003; Radosevic and Myrzakhmet, 2009). Therefore,  
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34 these scholars (partially) refute the premise that SPs enable tenants to be more innovative than  
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36 comparable off-park firms, which they attribute to several factors. First, it is often argued that  
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38 SP managers ease their tenant selection criteria to secure sufficient rental income, hereby  
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40 accepting firms that do not perform research (Westhead, 1997). Second, technological  
41  
42 spillovers and information flows on park may not necessarily lead to innovation because  
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44 university knowledge is often general, which makes it hard or too cost-ineffective to translate  
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46 into viable products or services (Felsenstein, 1994; Radosevic and Myrzakhmet, 2009).  
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### 57 *Financial Outcomes*

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1 Many researchers have examined whether or not SP residence boosts tenants' financial  
2 performance. Some scholars find a positive influence of SP residence on sales-related variables  
3 (Löfsten and Lindelöf, 2001, 2002, Lindelöf and Löfsten, 2003; Dettwiler et al., 2006). At the  
4 same time, the majority of studies indicate no significant difference between on- and off-park  
5 firms in terms of profitability (Löfsten and Lindelöf, 2001, 2002, Lindelöf and Löfsten, 2003;  
6 Dettwiler et al., 2006; Liberati et al., 2016; Vásquez-Urriago et al., 2016), sales-related  
7 variables (Ferguson and Olofsson, 2004; Lamperti et al., 2017; Vásquez-Urriago et al., 2016)  
8 and other financial indicators (Sung et al., 2003; Liberati et al., 2016; Vásquez-Urriago et al.,  
9 2016). Furthermore, some authors find that the group of SP tenants had great variation in their  
10 economic performance, which indicates that there are both high-performing as well as poor-  
11 performing firms on park (Ferguson and Olofsson, 2004).

#### 27 *Other Outcomes*

28 Finally, some studies focus on other performance indicators and study firm survival and  
29 employment growth. First, the literature indicates that SP residence increases the probability of  
30 firm survival (Bower, 1993; Ferguson and Olofsson, 2004; Radosevic and Myrzakhmet, 2009).  
31 Second, most scholars find higher employment growth rates among tenant firms than among  
32 comparable off-park firms (Löfsten and Lindelöf, 2001, 2002; Colombo and Delmastro, 2002;  
33 Lindelöf and Löfsten, 2003; Dettwiler et al., 2006), while others find no significant difference  
34 in employment growth rates (Monck et al., 1988; Shearmur and Doloreux, 2000; Ferguson and  
35 Olofsson, 2004).

#### 50 **4. AN AGENDA FOR FUTURE SP CONTRIBUTION RESEARCH**

51 Building on the current state of the SP contribution literature, we develop a future research  
52 agenda that is aimed at improving our understanding on the contributions SPs provide. In doing  
53 so, we first point to a number of underexplored areas in SP contribution research, then provide  
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1 pathways to overcoming the methodological shortcomings in the literature and, finally, we  
 2 propose avenues that allow for the theoretical strengthening of SP contribution research.  
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#### 5 **4.1.Underexplored Areas in SP Contribution Research**

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 9 In what follows, we present an overview of underexplored areas in SP contribution research  
 10 that need further assessment in order to advance the current state of knowledge (Table 2). In  
 11 particular, we first focus on the understudied topics in the traditional levels of the IMO  
 12 framework. Subsequently, we discuss unexplored research topics within underexplored levels  
 13 of analysis.  
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##### 26 **4.1.1. Underexplored Topics in the Traditional Levels in the IMO Framework**

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 30 *Regional level.* More research is needed in order to understand the impact of regional factors,  
 31 and, particularly, to understand the relationship between the region that the SP is located in and  
 32 the contribution the SP can provide. So far, few studies consider regional factors, such as  
 33 *regional development or related policy mechanisms*, and those that do are typically case-based,  
 34 focusing on one specific region. We urge further research to capture the heterogeneity of  
 35 regional factors and to provide a more fine-grained understanding of the regional contingencies  
 36 under which SPs contribute to the region. Furthermore, in line with Fulgencio (2017), we call  
 37 for researchers to move beyond the study of economic value generated by SPs and to include  
 38 social value or the *societal impact* of SPs in their research designs.  
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 53 *SP level.* Our literature review identifies a number of gaps in terms of SP-level input  
 54 characteristics. Specifically, little is known about how *ownership and governance*  
 55 characteristics affect SP contribution. An interesting research area lies in the corporate  
 56 governance of SPs, for instance examining the relationship between the financial parties  
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involved, the composition of the SP's board of directors, and the contribution of SPs. Further, little attention is attributed to the *culture* governing the SP, which is surprising as organizational culture is known to affect the strategy and activities of organizations (Denison, 1996), in this case the SPs and its tenants. As to what concerns mediator mechanisms at SP level, future research could assess how and when it matters for SPs to engage in *networking with other SPs*, as well as to what extent such networking activities affect tenants and their activities. As to what SP-level outcomes are concerned, we call for *purpose-related measures*, as we explain in section 4.2.2. Performance Measurement.

*Firm level.* More research is needed on firm-level inputs and outcomes. In particular, we find that there is a dearth of research evaluating the relationship between tenants' *top management team characteristics* (such as human capital, size of and diversity in the team) and the tenant's potential gains from SP residence. Further, research should consider the *objectives, goal orientation* and *entry motivations* of tenants alongside the outcomes they realized. With regard to firm-level outcomes, we identify multiple issues related to the prevailing outcome measures. As we extensively discuss in section 4.2.2. Performance Measurement, we call for *purpose-related measures* when assessing SP contribution through tenant performance. Further, we suggest future studies to directly assess SP contribution by incorporating alternative measures, such as *affective reactions* and *perceptual measures*. We argue that examining perceptual measures, such as perceived value and satisfaction, will complement our current knowledge on SP contribution and will largely enrich our insights into the actual benefits provided by SPs.

#### **4.1.2. Underexplored Levels of Analysis in the IMO Framework**

Most reviewed papers integrated regional, SP-, and/or firm-level variables in their analyses. Despite the relevance of these traditional levels of analysis, we claim that tapping into new

1 levels of analysis is an excellent way to advance and expand our knowledge on the contribution  
2 of SPs.  
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4  
5 *Technology transfer ecosystem level.* First, we make a call for future research to consider the  
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7 SP as one of the actors within the broader ecosystem, which comprises, amongst others, TTOs,  
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9 incubators, accelerators, university venture funds, and SPs (Siegel and Wright, 2015; Good et  
10  
11 al., 2018). Thus, it is relevant to consider SP contribution within the broader picture of this  
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13 ecosystem, in which unconsidered input factors arise. Future research could, for instance,  
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15 purposefully assess to what extent the SP is complementary or supplementary to other  
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17 organizations within the university technology transfer ecosystem. Furthermore, as SPs are  
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19 largely linked to universities and HEIs, aiming to support the university's mission of technology  
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21 transfer, it is important to consider the *university mission* alongside its *culture* and engagement  
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23 in academic entrepreneurship. Furthermore, the extent to which the university can help  
24  
25 *strengthen the SP's and tenants' legitimacy* can be considered as an important mediator.  
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27 Finally, this also brings an additional, yet equally important, outcome factor to the fore, namely  
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29 the extent to which SPs contribute or live up to their mission of contributing to the broader  
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31 university technology transfer mission, which we label as *university technology transfer*  
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33 *effectiveness*. As such, output measures for technology transfer performance, which are  
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35 increasingly implemented in university performance measurement systems (Secundo and Elia,  
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37 2014), can become relevant output factors.  
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47 *Individual level.* Second, we call for future studies to consider the level of the individual  
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49 entrepreneur. Indeed, despite early calls by Phan et al. (2005) to incorporate the role of  
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51 individual entrepreneurs and entrepreneurial teams in SP studies, there are few attempts in this  
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53 direction. This is surprising, as it is well acknowledged that the characteristics of entrepreneurs  
54  
55 affect the paths through which firms benefit from institutional intermediaries such as SPs  
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57 (Armanios et al., 2017). Interesting characteristics to study include the entrepreneurs'  
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*absorptive capacity* (Cohen and Levinthal, 1990), *motivations* (Stephan et al., 2015), *entrepreneurial orientation* (Lumpkin and Dess, 1996), and *experience* (Brockhaus and Horwitz, 1986), as these characteristics are likely to affect the extent to which mediator mechanisms take place. Mediator mechanisms at the individual level may include social cognitive mechanisms such as *learning* (e.g. from observing others) (Wood and Bandura, 1989), and *networking*, through which entrepreneurs may, amongst others, enhance their *human* and/or *social capital*.

## 4.2. Methodological Strengthening of SP Contribution Research

Apart from these underexplored topics and levels, our review points to a number of methodological shortcomings, which have resulted in discrepancies, conflicting evidence, and deficiencies in the SP contribution literature. In what follows, we elaborate on how future research can innovate in terms of methods and, as such, advance our knowledge of SP contribution.

### 4.2.1. Qualitative process studies

The majority of studies in our literature review rely either on case study research, conducted in one specific region, or on ‘matched sampling’ techniques. The first type of studies are typically descriptive in nature, hereby describing the operations, impact and contribution of one particular park, and are therefore parlous to generalize. The latter type of studies, comparing whether or not SPs contribute to their tenants and/or to the regional development, provide highly inconclusive results. The above issues call for gaining in-depth insights into *when, how, and why SPs are effective* in achieving their objectives. Therefore, we urge future research to take a real process perspective in studying SP contribution, hereby targeting richer “when”, “how” and “why” research questions through qualitative research methods (Yin, 2004). This also implies that the heterogeneous nature of SPs, tenants and the region they are embedded in

1 should be taken into consideration. Such (longitudinal) research designs could shed light on the  
2 process through which, and circumstances or contingencies under which, SP activities and  
3 services provide value-added contributions, which would significantly advance the current state  
4 of knowledge.  
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#### 10 **4.2.2. Performance measurement**

11 For many years scholars have called for more rigorous approaches to measure the performance  
12 and contribution of SPs since there are multiple issues and shortcomings related to current  
13 approaches (Bigliardi et al., 2006). Not only scholars are concerned with these performance  
14 measurement issues, but this is crucial for practitioners and policy makers as well.  
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23 First, there is no generally accepted approach to evaluate the performance of SPs. Therefore,  
24 the results are highly dependent on the specific indicators used, are difficult to compare, and do  
25 not take all stakeholders into consideration (Ferrara et al., 2016). Over the past years, some  
26 attempts have been undertaken to formalize SP performance measurement. For instance Chan  
27 and Lau (2005) identified about nine criteria to assess the contributions of SPs, Bigliardi et al.  
28 (2006) provided an assessment method, Ferrara et al. (2016) developed a measurement tool, yet  
29 no approach is truly ingrained in the SP literature. In evaluating the performance of SPs, we  
30 emphasize the necessity to use *SP purpose-related measures*. For instance, it makes no sense  
31 to assess a SP on financial indicators when the SP is not for profit.  
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46 Second, many studies have evaluated SP contribution by measuring and comparing firms'  
47 innovative or financial outcomes. Yet, issues can occur by focusing on this approach.  
48 Specifically, the selection of appropriate firm outcome indicators is precarious due to  
49 differences in firm objectives (Bigliardi et al., 2006). For instance, many studies assess patent  
50 productivity and quality in order to evaluate the innovative performance of tenants. At the same  
51 time, it is well acknowledged that not all firms have the same objectives: while some firms aim  
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1 at developing codified knowledge and play on a market for technology, others target at  
2 producing products and play on a market for products (Gans and Stern, 2003). Whereas firms  
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4 of the first type would typically outperform the latter in terms of patenting output, the latter can  
5  
6 also be successful in achieving its objectives. Consequently, we also call for *firm purpose*  
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9 *related measures* when assessing SP contribution through tenant performance. Additionally,  
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11 SPs often host many young, small and high-tech firms in different sectors, which raises some  
12  
13 additional issues with respect to outcome indicators. Patent behavior is often used to assess the  
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15 firms' innovative outcome, yet it is acknowledged that patent behavior largely varies across  
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17 sectors, firm size and country (Hagedoorn and Cloudt, 2003). Further, also financial outcomes  
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19 may be precarious indicators in young, technology-based ventures since they often have no  
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21 products or sales in the beginning of their lifecycle (Wright et al., 2008). Young and small firms  
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23 also provide less financial account information, making it difficult to find reliable financial  
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25 data. Furthermore, it is likely that SPs will provide contributions to tenants that are not  
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27 (immediately) translated into formal (innovative or financial) performance improvements. That  
28  
29 is why we argue that our current insights into SP contributions can be complemented by  
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31 examining *perceptual measures*, such as perceived benefits from SPs. Finally, examining  
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33 whether tenants outperform off-park firms in terms of innovative or financial performance is  
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35 precarious as it is particularly difficult to differentiate the selection from the treatment effect.  
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37 Consequently, SPs applying stricter selection criteria may consistently outperform less selective  
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39 parks, irrespective of whether they actually support or contribute to their tenants. Here again,  
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41 we suggest future studies to directly assess SP contribution by incorporating alternative  
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43 measures, such as *affective reactions* and *perceptual measures*. Such alternative measures may,  
44  
45 for instance, include tenants' perceived value or 'additionality' (Falk, 2007) from SP residence.  
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### 4.2.3. *Longitudinal studies*

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4 Second, as our review reveals that many SP contribution studies employ a cross-sectional  
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6 research design, the literature may encounter ‘reversed causality’ problems, especially when  
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8 examining the relationship between SP residence and outcome measures. For instance, when  
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10 evidence shows that SP residence is positively related to tenant performance, this raises the  
11  
12 question whether SP residence contributes to firm performance or whether high-performing  
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14 firms are more likely to cluster in SPs (Felsenstein, 1994; Schiavone et al., 2014). Therefore,  
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16 we call for studies to use a longitudinal research design when studying the relationship between  
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18 SP residence and outcome indicators. Longitudinal research designs will also allow for  
19  
20 incorporating the dynamic nature of SPs, with firms entering and leaving the park, thus  
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22 providing a significant improvement to the state of the literature, which mainly provides a rather  
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24 static view of SP contribution.  
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### 4.2.4. *Multilevel studies*

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35 The IMO framework clearly shows that the data used in SP contribution studies are hierarchical  
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37 in nature. Indeed, firms are nested in SPs and SPs are nested in regions. Many quantitative  
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39 studies use traditional statistical methods, such as OLS regression analysis, to analyze data at  
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41 different levels of analysis, thereby assuming that observations are independent. However,  
42  
43 hierarchical data show some degree of interdependence (McCoach, 2010), which should be  
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45 taken into consideration. This leads us to urge SP scholars to employ more appropriate  
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47 techniques, such as multilevel analysis (e.g., hierarchical linear modeling), when studying  
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49 tenants situated in diverse SPs and/or regions. Interestingly, using these more advanced  
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51 techniques will allow assessing the influence of variables at different levels of analysis, as well  
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53 as the cross-level interactions between those variables (McCoach, 2010). In other words, this  
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55 could for instance explain how much of the variance in tenant performance is attributable to  
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1 tenant, SP, or regional characteristics. Furthermore, it allows assessing how factors at one level  
2 enhance or weaken factors at another level, thus providing a more fine-grained understanding  
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4 on the contribution of SPs and its contingencies.  
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### 7 **4.3.Theoretical strengthening of SP Contribution Research**

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11 The SP literature and the SP contribution literature is rather a-theoretical in nature (Leyden et  
12 al., 2008; Ratinho and Henriques, 2010) and theoretical contributions based on these studies  
13  
14 are minimal. Although some efforts to relate the topic of SP contribution to theory exist, most  
15  
16 studies draw on prior empirical findings to build hypotheses and focus on providing empirical  
17  
18 implications. The establishment of SPs is often justified by referring to cluster theory (Phillips  
19 and Yeung, 2003; Hu et al., 2005; Link and Scott, 2007), the theory of agglomeration economies  
20  
21 (Shearmur and Doloreux, 2000; Koçak and Can, 2014; Ramirez et al., 2014), regional  
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23 development theory (Goldstein and Luger, 1990, 1992), transaction cost theory (Cabral, 1998),  
24  
25 and structural theory (Chan and Lau, 2005). In specifically studying SP contributions,  
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27 theoretical guidance remains limited, with some authors building upon the resource-based view,  
28  
29 arguing that SPs add significantly to their tenants' stock of resources (Lindelöf and Löfsten,  
30  
31 2004, 2005; Huang et al., 2012). Other studies use organizational ecology theory (Tan, 2006)  
32  
33 in order to study the innovation level of SP tenants. We call for future research to further  
34  
35 integrate theories from management, organizational behavior, strategy, and psychology, and, in  
36  
37 turn, to contribute to these theories. In what follows, we elaborate on how theories could help  
38  
39 in developing the research agenda outlined above. Specifically, we first explore useful  
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41 theoretical perspectives in addressing gaps in levels and topics in the IMO framework, then we  
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43 go on to focus on theories that are able to bridge different levels of analysis.  
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#### 4.3.1. Theories targeted at exploring novel topics and levels of analysis

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3 We pay specific attention to relevant theories in studying the gaps in levels and topics  
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5 elaborated on above.  
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9 First, we encourage future studies to continue to consider the *firm level*, focusing on the tenants,  
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11 but to integrate theory more strongly. A particularly worthwhile avenue of further research lies,  
12  
13 in our opinion, in studying the top management teams running the ventures. Consequently,  
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15 interesting theoretical perspectives can be found in behavioral theory (Cyert and March, 1963)  
16  
17 and the upper echelon theory of the firm (Hambrick and Mason, 1984). Furthermore, we point  
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19 to the potential merits of organizational learning (Cohen and Levinthal, 1990) and team learning  
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21 (Ellis et al., 2003) in the context of SP residence.  
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27 Second, we call for future research to consider the level of the *individual entrepreneur*. In  
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29 studying input factors at individual level, alongside mediating mechanisms and outcomes from  
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31 SP residence on this level, we propose that future research builds upon social and human capital  
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33 theory (Becker, 1964; Coleman, 1988), the attention-based view (Ocasio, 1997), and  
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35 information-processing theory (Galbraith, 1973; Vanacker and Forbes, 2016), as these theories  
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37 allow assessing under which circumstances the individual is likely to reap benefits from their  
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39 SP residence or to contribute to SP success. Furthermore, we see merit in the use of theories  
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41 that can consider the motivations of entrepreneurs to locate on a SP. A particularly relevant  
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43 theory in this respect is goal setting theory, indicating that goals impact behavior as they have  
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45 a directive function, can energize, affect persistence, as well as lead to arousal, discovery and  
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47 emergence of strategies (Carsrud et al. 2009).  
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54 Fourth, we urge future research to consider the *university ecosystem* that the SP belongs to and  
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56 to consider the influence of the university and other institutions that the SP belongs to or  
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collaborates with. We believe institutional theory (DiMaggio and Powell, 1983) to be particularly relevant in undertaking such future research endeavors.

Finally, we call for future research to focus on the *science and innovation policy level*. Policy makers expect SPs to contribute to regional development following cumulative agglomeration effects of co-located research active organizations (Link and Scott, 2018). The OECD (2011), however, concludes that the impact of SPs on regional development is inconclusive, which is in line with the findings from our literature review. This is because knowledge flows between the scientific world and the market have been identified as notoriously difficult and are by no means an automated process (Dosi et al., 2006). Subsequently, in line with Dosso et al. (2018), we emphasize the need for policymakers to turn to an evidence-based policy approach stemming from systematic research. The heterogeneity of SPs and the complex aspects of R&D and innovation have an impact on the conceptualization, design and evaluation of innovation policy related to these parks. Also the mimicking behavior of policymakers can only be effectively counteracted by using the insights from evidence-based policy. Policymakers cannot create a Silicon Valley type of SP in every region as regional heterogeneity prevents one-size-fits-all solutions. Hence as became clear in section 3.1.1. on regional-level input, it is necessary to incorporate context-specific evidence accounting for social, spatial, and cultural aspects, alongside appropriate theoretical perspectives allowing to understand these aspects and mechanisms that originate from them. One potentially fruitful research avenue is the study of the implementation of smart specialization strategies (Foray, 2018). These strategies are directed at transforming regional economic structures in such a way that they are ready for future challenges but, at the same time, take the regional potential as a basis. By consequence, SPs can also be viewed as exponents of smart specialization strategies in the sense that they are embedding a range of local stakeholders to mobilize transformative activities.

### 4.3.2. *Theories targeted at bridging different levels*

We call for future research to consider theories that allow bridging the levels of the tenant, SP, and region in studying SP contribution. For instance, resource dependency theory, which views the firm as an open system, dependent on external organizations for the supply of key resources (Pfeffer and Salancik, 1978), may be particularly relevant for studying the contribution of SPs in supplying these resources. Particularly, following this theory, SPs either become a resource supplier or an enabler for the firm to acquire key resources, as such bridging the firm and SP levels. Further, SPs can be considered as public sponsorship initiatives aimed at creating a conducive, resource-munificent environment in which birth, survival, and growth of entrepreneurial organizations is stimulated (Flynn, 1993; Amezcua et al., 2013; Autio and Rannikko, 2016). Building on public sponsorship theory, future research could purposefully study the effects of firm-level and SP-level contingencies on SP contribution measures.

## 5. CONCLUSION

Studies exploring the contributions SPs provide to their different are legion, yet highly inconclusive. Our literature review aimed at providing insights into what is currently known about SP contribution and to provide ways that enable the advancement of this state of knowledge. We proposed topics and levels of analysis that need further investigation in order to advance our understanding of the contribution of SPs and identified deficiencies at a methodological and theoretical level along with future research avenues. The extant inconclusive results regarding SP contribution call for gaining in-depth insights into when, how and why SPs provide value-added contributions, and for taking a multilevel contingency perspective, hereby considering the heterogeneous nature of SPs, their tenants and the region they are located in. Our study contributes to the technology transfer literature, the innovation literatures and the SP literature specifically. Moreover, our study is highly relevant for

1 practitioners and policy makers, who have recently expressed their interest in identifying  
2 drivers of good SP practice and in gaining a better understanding on the contributions SPs  
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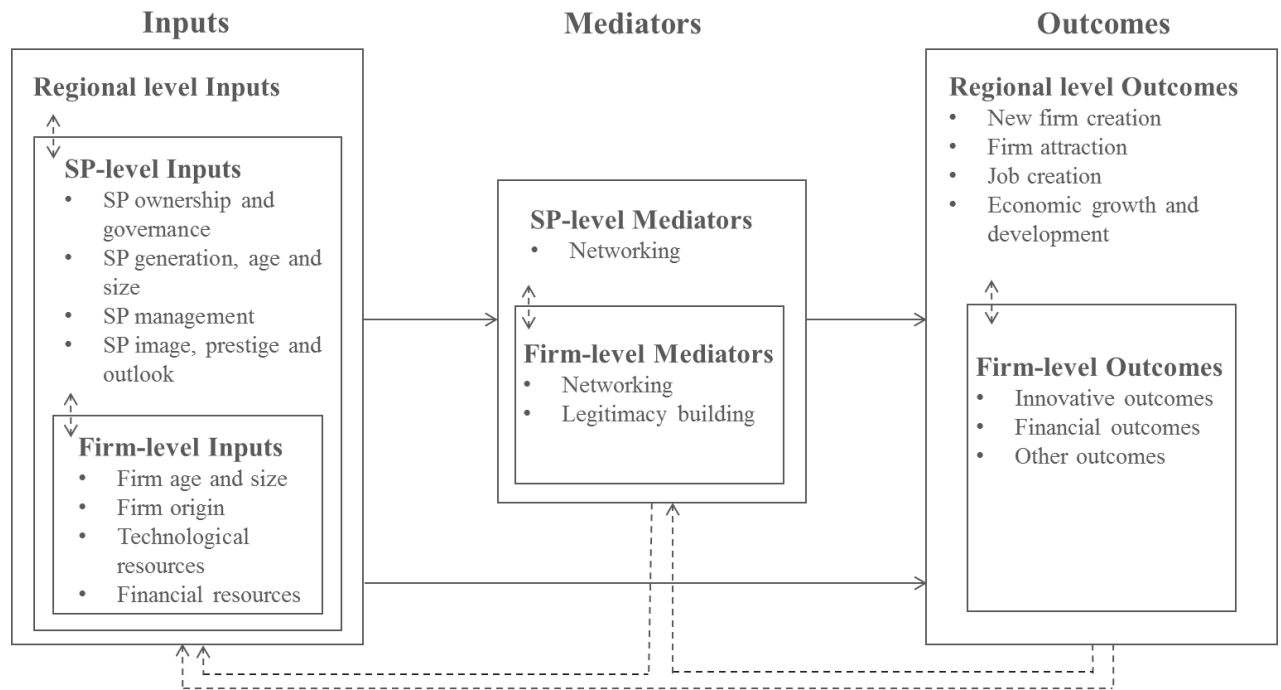
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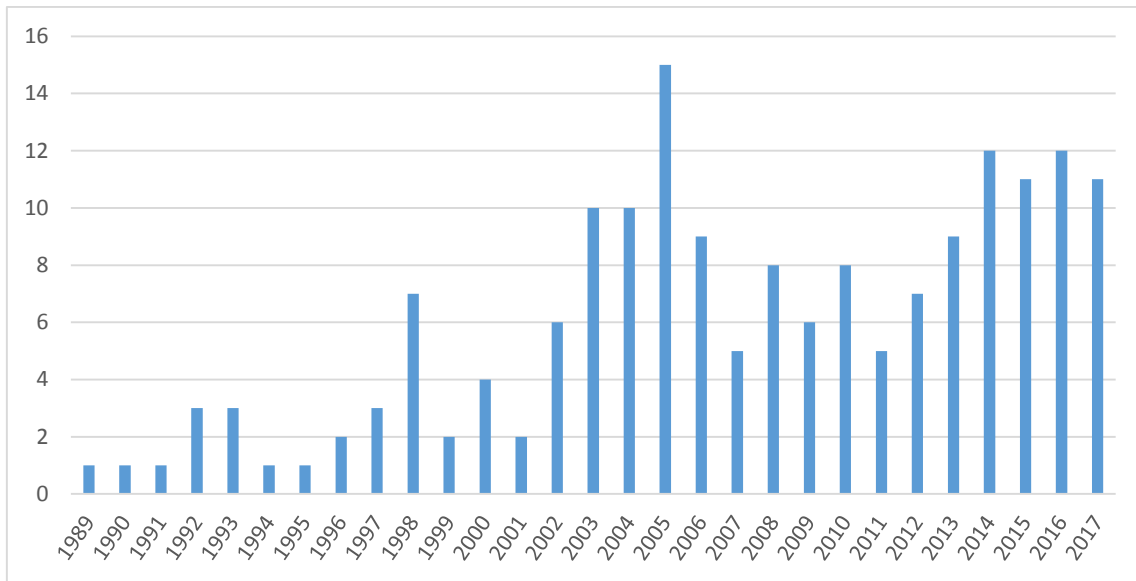
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**TABLES AND FIGURES****Table 1.** Search Terms and Results

	<b>Total number articles on SPs</b>	<b>Total number of articles on SP contribution</b>
“Science Park*”	431	142
“Technology Park*”	162	37
“Science and Technology Park*”	106	25
“Research Park*”	46	15
“Technopole*”	40	8
<b>Total</b>		<b>175</b>

**Figure 1. SP Contribution: IMO framework**

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**Figure 2.** Number of published SP contribution articles per year

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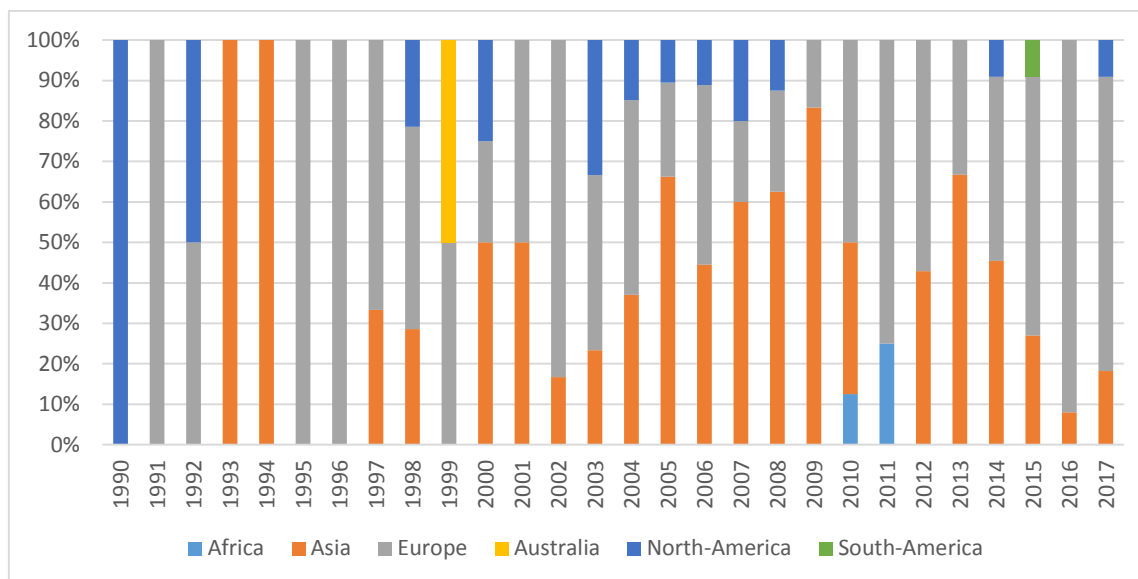
**Table 2.** Underexplored topics and levels of analysis in the IMO framework

		<b>Inputs</b>	<b>Mediators</b>	<b>Outcomes</b>
Traditional Levels	Regional level	Regional development policy		Societal impact
	SP level	Ownership and governance Culture	Inter-SP networking	Purpose-related measures
	Firm level	TMT characteristics Objectives and goal orientation Entry Motivations		Purpose-related measures Affective reactions Perceptual measures
Underexplored Levels	University Ecosystem level	Technology Transfer Infrastructure University Mission and Culture	Legitimacy building	University technology transfer effectiveness
	Individual level	Absorptive capacity Motivations Entrepreneurial orientation Experience	Learning Networking	Human capital Social capital

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## APPENDICES

## Appendix I. Geographical distribution of SP contribution journal articles per year





**Appendix II.** Descriptive statistics on journals publishing SP contribution articles until 2018

<b>Journal</b>	<b>Number of papers</b>	<b>Percent of papers</b>
Technovation	25	14.29%
The Journal of Technology Transfer	18	10.29%
International Journal of Technology Management	9	5.14%
Research Policy	9	5.14%
Technology Analysis & Strategic Management	8	4.57%
Environment and Planning C: Government and Policy	6	3.43%
Technological Forecasting and Social Change	6	3.43%
Small Business Economics	5	2.86%
Urban Studies	5	2.86%
Environment and Planning A	4	2.29%
R&D Management	4	2.29%
European Planning Studies	3	1.71%
International Journal of Industrial Organization	3	1.71%
Journal of Business Research	3	1.71%
Journal of Business Venturing	3	1.71%
Regional Studies	3	1.71%
Entrepreneurship & Regional Development	2	1.14%
Innovation-Management Policy & Practice	2	1.14%
Journal of Intellectual Capital	2	1.14%
Journal of Knowledge Management	2	1.14%
Journal of Small Business Management	2	1.14%
Journal of Urban Technology	2	1.14%
Omega	2	1.14%
Papers in Regional Science	2	1.14%
Research Evaluation	2	1.14%
Research Technology Management	2	1.14%
Science and Public Policy	2	1.14%
Scientometrics	2	1.14%
Urban Geography	2	1.14%
Asia Pacific Business Review	1	0.57%
Asia Pacific Viewpoint	1	0.57%
Economic Development Quarterly	1	0.57%
Entrepreneurship Theory and Practice	1	0.57%
Environment and Planning D: Society and Space	1	0.57%
European Journal of Innovation Management	1	0.57%
Geoforum	1	0.57%
IEEE Transactions on Engineering Management	1	0.57%
Industrial and Corporate Change	1	0.57%
Industrial Marketing Management	1	0.57%
Information & Management	1	0.57%
International Journal of Entrepreneurship and Innovation Management	1	0.57%
International Journal of Entrepreneurship Behavior	1	0.57%
International Journal of Innovation and Technology	1	0.57%

1	International Journal of Innovation Science	1	0.57%
2	International Journal of Knowledge-Based Development	1	0.57%
3	International Journal of Urban Sciences	1	0.57%
4	Journal of Evolutionary Economics	1	0.57%
5	Journal of Planning Literature	1	0.57%
6	Journal of Productivity Analysis	1	0.57%
7	Journal of Technology Management & Innovation	1	0.57%
8	Journal of Urban History	1	0.57%
9	Journal on Innovation and Sustainability	1	0.57%
10	Landscape and Urban Planning	1	0.57%
11	Landscape Research	1	0.57%
12	Long range planning	1	0.57%
13	Oxford Review of Economic Policy	1	0.57%
14	Policy Studies Journal	1	0.57%
15	Professional Geographer	1	0.57%
16	Progress in Planning	1	0.57%
17	Regional Studies Regional Science	1	0.57%
18	South African Journal of Economics and Management	1	0.57%
19	Strategic Management Journal	1	0.57%
20	Sustainability and Innovation	1	0.57%
21	Urban Design International	1	0.57%
22	<b>Total</b>	<b>175</b>	<b>100</b>
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## Appendix III. Outcome measures of SP contribution

Position in Framework	Outcome Measure	Specific indicators used	Study and Country studied
Regional level outcomes	<b>New Firm Creation</b>	<i>Creation of new ventures, creation of high-tech startups, creation of academic spinoffs, growth in number of new companies, generation rate of new startups</i>	Benneworth and Ratinho (2014), The Netherlands Chan and Lau (2005), Hong Kong Chen et al. (2013a), Taiwan Chordà (1996), France and Belgium Del Castillo Hermosa and Barroeta (1998), Spain Druilhe and Garnsey (2000), France and U.K. Eto (2005), Japan Guy (1996), U.K. Hansson et al. (2005), Denmark and U.K. Hu et al. (2005), Taiwan Kihlgren (2003), Russia Koh et al. (2005), Singapore Lee and Yang (2000), Taiwan Link and Scott (2005), U.S.A. Massey and Wield (1992), U.K. Ratinho and Henriques (2010), Portugal Salvador and Rolfo (2011), Italy Shin (2001), Korea Sofouli and Vonortas (2007), Greece Wonglimpiyarat (2010), Thailand
	<b>Firm Attraction</b>	<i>Attraction of international leaders in technology, (international) high tech companies, university-affiliated firms, research institutions, attraction of international knowledge workers</i>	Appold (2004), U.S.A. Cheng et al. (2013), China Eckardt (2017), The Netherlands Eto (2005), Japan Hansson et al. (2005), Denmark and U.K. Lee and Yang (2000), Taiwan Vaidyanathan (2008), India Zou and Zhao (2014), China
	<b>Job Creation</b>	<i>Growth in terms of jobs, number of jobs created, growth in number of employees, job creation rate</i>	Chordà (1996), France and Belgium Forsyth and Crewe (2010), Japan Goldstein and Luger (1990), U.S.A.

		<p>Goldstein and Luger (1992), U.S.A.  Guy (1996), U.K.  Hu et al. (2005), Taiwan  Kihlgren (2003), Russia  Lee and Yang (2000), Taiwan  Massey and Wield (1992), U.K.  Ratinho and Henriques (2010), Portugal  Shearmur and Doloreux (2000), Canada</p>
<p><b>Economic Growth and Development</b></p>	<p><i>Labor productivity growth, growth of particular sector/industries, percentage of total industrial growth attributed to SP, perception of net economic impact of SP on region, regional innovation outputs, contribution of SP to national GDP, national competitiveness, competitive advantage, technological growth, employment growth, economic modernization, diversification of the economy, per capita income growth, foreign direct investments,</i></p>	<p>Barbera and Fassero (2013), France  Bass (1998), Japan  Chen et al. (2006), Taiwan  Chen et al. (2013a), Taiwan  Chou (2007), Taiwan  Eto (2005), Japan  Feldman (2007), Sweden  Gkypali et al. (2016), Greece  Goldstein and Luger (1992), U.S.A.  Gwynne (1993), Singapore, South-Korea and Taiwan  Hu (2007), China  Huang et al. (2013), China  Jonsson (2002), Sweden  Ku et al. (2005), Taiwan  Lin and Sun (2010), Taiwan  Miao and Hall (2014), China  Minguillo and Thelwall (2015), U.K.  Olcay and Bulu (2016), Turkey  Phelps and Dawood (2014), Malaysia  Phillips and Yeung (2003), Singapore  Radosevic and Myrzakhmet (2009), Kazakhstan  Shearmur and Doloreux (2000), Canada  Vaidyanathan (2008), India  Walcott (2002), China  Zhang and Wu (2012), China  Zhu and Tan (2005), China</p>

Firm level outcomes	<p><b>Innovative Outcome</b></p>					
	<table border="0"> <tr> <td data-bbox="385 268 649 906"> <ul style="list-style-type: none"> <li>• IP-related indicators</li> </ul> </td> <td data-bbox="658 268 1344 906"> <p><i>Number of patents granted per/last year, number of patent applications per/last year, number of patent applications nationally, number of patent applications internationally, number of patent applications per employee, number of copyrights or applications (last year), time between patents, growth in number of patents, dummy patent application, patent elasticity</i></p> </td> <td data-bbox="1352 268 2047 906"> <p>Albahari et al. (2013), Spain  Albahari et al. (2017), Spain  Chan et al. (2010), South-Africa  Chan et al. (2011), South-Africa  Colombo and Delmastro (2002), Italy  Hu (2008), Taiwan  Hu et al. (2005), Taiwan  Huang et al. (2012), Taiwan  Lamperti et al. (2017), Italy  Liberati et al. (2016), Italy  Lindelöf and Löfsten (2003), Sweden  Löfsten and Lindelöf (2005), Sweden  Motohashi (2013), China  Siegel et al. (2003a), U.K.  Squicciarini (2008, 2009), Finland  Villasalero (2014), Spain  Westhead (1997), U.K.  Yang et al. (2009a), Taiwan  Zhang and Wu (2012), China</p> </td> </tr> <tr> <td data-bbox="385 912 649 1378"> <ul style="list-style-type: none"> <li>• Product/service-related indicators</li> </ul> </td> <td data-bbox="658 912 1344 1378"> <p><i>Introduction of new products, percentage of sales from new products, new product/service introductions to existing customers versus to new markets, significant innovation level versus incremental innovation level, sales of new-to-the-market products, sales per employee of new-to-the-market products, annual total turnover from product innovation new to the market, launch of new products/services new for firm and new to the market, number of new products/services developed but not yet introduced to market, percentage of sales from technologically improved products/services in year x, percentage of sales of products/services new to the firm in year x, percentage of company turnover from product innovations that are new to the market</i></p> </td> <td data-bbox="1352 912 2047 1378"> <p>Albahari et al. (2013), Spain  Albahari et al. (2016), Spain  Albahari et al. (2017), Spain  Chan et al. (2010), South-Africa  Chan et al. (2011), South-Africa  Díez-Vial and Fernández-Olmos (2015), Spain  Díez-Vial and Montoro-Sánchez (2016), Spain  Díez-Vial and Montoro-Sánchez (2017), Spain  Felsenstein (1994), Israel  Jimenez-Moreno et al. (2013), Spain  Lai et al. (2014), Taiwan &amp; China  Liefner et al. (2006), China  Lindelöf and Löfsten (2003), Sweden  Löfsten and Lindelöf (2005), Sweden</p> </td> </tr> </table>	<ul style="list-style-type: none"> <li>• IP-related indicators</li> </ul>	<p><i>Number of patents granted per/last year, number of patent applications per/last year, number of patent applications nationally, number of patent applications internationally, number of patent applications per employee, number of copyrights or applications (last year), time between patents, growth in number of patents, dummy patent application, patent elasticity</i></p>	<p>Albahari et al. (2013), Spain  Albahari et al. (2017), Spain  Chan et al. (2010), South-Africa  Chan et al. (2011), South-Africa  Colombo and Delmastro (2002), Italy  Hu (2008), Taiwan  Hu et al. (2005), Taiwan  Huang et al. (2012), Taiwan  Lamperti et al. (2017), Italy  Liberati et al. (2016), Italy  Lindelöf and Löfsten (2003), Sweden  Löfsten and Lindelöf (2005), Sweden  Motohashi (2013), China  Siegel et al. (2003a), U.K.  Squicciarini (2008, 2009), Finland  Villasalero (2014), Spain  Westhead (1997), U.K.  Yang et al. (2009a), Taiwan  Zhang and Wu (2012), China</p>	<ul style="list-style-type: none"> <li>• Product/service-related indicators</li> </ul>	<p><i>Introduction of new products, percentage of sales from new products, new product/service introductions to existing customers versus to new markets, significant innovation level versus incremental innovation level, sales of new-to-the-market products, sales per employee of new-to-the-market products, annual total turnover from product innovation new to the market, launch of new products/services new for firm and new to the market, number of new products/services developed but not yet introduced to market, percentage of sales from technologically improved products/services in year x, percentage of sales of products/services new to the firm in year x, percentage of company turnover from product innovations that are new to the market</i></p>
<ul style="list-style-type: none"> <li>• IP-related indicators</li> </ul>	<p><i>Number of patents granted per/last year, number of patent applications per/last year, number of patent applications nationally, number of patent applications internationally, number of patent applications per employee, number of copyrights or applications (last year), time between patents, growth in number of patents, dummy patent application, patent elasticity</i></p>	<p>Albahari et al. (2013), Spain  Albahari et al. (2017), Spain  Chan et al. (2010), South-Africa  Chan et al. (2011), South-Africa  Colombo and Delmastro (2002), Italy  Hu (2008), Taiwan  Hu et al. (2005), Taiwan  Huang et al. (2012), Taiwan  Lamperti et al. (2017), Italy  Liberati et al. (2016), Italy  Lindelöf and Löfsten (2003), Sweden  Löfsten and Lindelöf (2005), Sweden  Motohashi (2013), China  Siegel et al. (2003a), U.K.  Squicciarini (2008, 2009), Finland  Villasalero (2014), Spain  Westhead (1997), U.K.  Yang et al. (2009a), Taiwan  Zhang and Wu (2012), China</p>				
<ul style="list-style-type: none"> <li>• Product/service-related indicators</li> </ul>	<p><i>Introduction of new products, percentage of sales from new products, new product/service introductions to existing customers versus to new markets, significant innovation level versus incremental innovation level, sales of new-to-the-market products, sales per employee of new-to-the-market products, annual total turnover from product innovation new to the market, launch of new products/services new for firm and new to the market, number of new products/services developed but not yet introduced to market, percentage of sales from technologically improved products/services in year x, percentage of sales of products/services new to the firm in year x, percentage of company turnover from product innovations that are new to the market</i></p>	<p>Albahari et al. (2013), Spain  Albahari et al. (2016), Spain  Albahari et al. (2017), Spain  Chan et al. (2010), South-Africa  Chan et al. (2011), South-Africa  Díez-Vial and Fernández-Olmos (2015), Spain  Díez-Vial and Montoro-Sánchez (2016), Spain  Díez-Vial and Montoro-Sánchez (2017), Spain  Felsenstein (1994), Israel  Jimenez-Moreno et al. (2013), Spain  Lai et al. (2014), Taiwan &amp; China  Liefner et al. (2006), China  Lindelöf and Löfsten (2003), Sweden  Löfsten and Lindelöf (2005), Sweden</p>				

		<p>Martínez-Cañas et al. (2012), Spain          Radosevic and Myrzakhmet (2009), Kazakhstan          Siegel et al. (2003a), U.K.          Vásquez-Urriago et al. (2014, 2015), Spain          Westhead (1997), U.K.</p>
<ul style="list-style-type: none"> <li>• Other (or unspecified) innovative indicators</li> </ul>	<p><i>Dummy firm engaged in innovation, number of firms involved in EU R&amp;D projects, ratio intangible investment and total assets, knowledge acquisition, technological distinctiveness, dummy product innovation, dummy process innovation, scope of innovation outcomes</i></p>	<p>Albahari (2015), Spain          Cantù (2010), Italy          Chan and Lau (2005), Hong Kong          Chan et al. (2010), South-Africa          Chan et al. (2011), South-Africa          Colombo and Delmastro (2002), Italy          Forsyth and Crewe (2010), Japan          Jimenez-Moreno et al. (2013), Spain          Joseph (1989), Australia          Lai et al. (2014), Taiwan          Liberati et al. (2016), Italy          Liefner et al. (2006), China          Montoro-Sanchez et al. (2011), Spain          Motohashi (2013), China          Tan (2006), China</p>
<b>Financial outcomes</b>		
<ul style="list-style-type: none"> <li>• Sales-related indicators</li> </ul>	<p><i>Sales growth, annual average of sales growth, annual sales, annual operative value added, export</i></p>	<p>Dettwiler et al. (2006), Sweden          Ferguson and Olofsson (2004), Sweden          Lamperti et al. (2017), Italy          Liberati et al. (2016), Italy          Lindelöf and Löfsten (2002), Sweden          Lindelöf and Löfsten (2003), Sweden          Löfsten and Lindelöf (2001), Sweden          Löfsten and Lindelöf (2002), Sweden          Löfsten and Lindelöf (2005), Sweden          Motohashi (2013), China          Vásquez-Urriago et al. (2016), Spain          Westhead and Storey (1994), U.K.          Zou and Zhao (2014), China</p>

	<ul style="list-style-type: none"> <li>Profitability-related indicators</li> </ul>	<i>Profit margin, ROA, gross operative margin over total assets,</i>	Dettwiler et al. (2006), Sweden Liberati et al. (2016), Italy Lindelöf and Löfsten (2002), Sweden Lindelöf and Löfsten (2003), Sweden Löfsten and Lindelöf (2001), Sweden Löfsten and Lindelöf (2002), Sweden Löfsten and Lindelöf (2005), Sweden Vásquez-Urriago et al. (2016), Spain Westhead and Storey (1994), U.K.
	<ul style="list-style-type: none"> <li>Other financial indicators</li> </ul>	<i>Investment propensity, investment growth rate, value added, net worth, market performance</i>	Liberati et al. (2016), Italy Lindelöf and Löfsten (2003), Sweden Sung et al. (2003), Korea Vásquez-Urriago et al. (2016), Spain Lai et al. (2014), Taiwan & China
	<b>Other outcomes</b>		
	<ul style="list-style-type: none"> <li>Firm survival</li> </ul>	<i>Firm survival, continued legal existence of firm</i>	Bower (1993), N/A Felsenstein (1994), Israel Ferguson and Olofsson (2004), Sweden Radosevic and Myrzakhmet (2009), Kazakhstan Westhead and Storey (1994), U.K. Westhead and Storey (1995), U.K.
	<ul style="list-style-type: none"> <li>Employment growth</li> </ul>	<i>Employment growth</i>	Colombo and Delmastro (2002), Italy Dettwiler et al. (2006), Sweden Ferguson and Olofsson (2004), Israel Lindelöf and Löfsten (2002), Sweden Lindelöf and Löfsten (2003), Sweden Lindelöf and Löfsten (2005), Sweden Löfsten and Lindelöf (2001), Sweden Löfsten and Lindelöf (2002), Sweden Monck et al. (1988), U.K. Shearmur and Doloreux (2000), Canada Westhead and Storey (1994), U.K.

	<ul style="list-style-type: none"> <li>• Other</li> </ul> <p><i>Intangible results, intellectual capital performance, perceived benefits, perceived advantages, employee well-being, firm development</i></p>	<p>Colley et al. (2016), Scotland          Gilchrist et al. (2015), Scotland          Hu (2007), China          McAdam and McAdam (2008), Ireland and U.K.          Salvador et al. (2013), Italy          Schiavone et al. (2014), Italy          Van der Borgh et al. (2012), The Netherlands          Vásquez-Urriago et al. (2016), Spain          Westhead and Batstone (1998, 1999), U.K.</p>
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