TRANSLATIONAL TWISTS AND TURNS: SCIENCE AS A SOCIO-ECONOMIC ENDEAVOR

PROCEEDINGS OF STI 2013 BERLIN

18TH INTERNATIONAL CONFERENCE ON SCIENCE AND TECHNOLOGY INDICATORS

iFQ
Institute for Research Information and Quality Assurance

ENID
European Network of Indicators Designers

Published for the 18th International Conference on Science and Technology Indicators
"Translational twists and turns: Science as a socio-economic endeavor"

organized under the auspice of the European Network of Indicator Designers (ENID)
hosted by the Institute for Research Information and Quality Assurance (iFQ)
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www.research-information.de (English)

ISSN 1864-2799

September 2013

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Proceedings of STI 2013 Berlin

18th International Conference on Science and Technology Indicators
Berlin, Germany | September 4 – 6, 2013

Edited by Sybille Hinze / André Lottmann

Access and utilisation of social capital in knowledge transfer

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For start-ups choosing to locate in Science Parks, the physical and social environments are sources of social capital for firm founders. In this study we examine the social and physical proximity, contextual origins and application spheres of various sources of social capital available to start-ups prior to, and following, their choice to locate within a Science Park. Interviews are conducted with biotechnology-oriented start-up founders, specifically investigating their sources of social capital in three key phases of the firm development. We find that start-ups choose to locate in the Science Park based primarily on neo-classical location theory and social capital is primarily externally sourced with minimum involvement of the Science Park itself or with other firms located within the Science Park. The local HEI is also cited as being instrumental in sourcing and mobilising social capital.

Introduction

Science Parks have entered the literature in waves with each crest bringing new ideas and theories as to their utility to science, innovation, and society. Studies typically evaluate the utility of a Science Park (Dettwiler, et al., 2006), compare Science Parks (Fukugawa, 2006), or to compare firms on and off Science Parks (Squicciarini, 2008). The aim of this study is to highlight the social developments experienced by firm founders in the particular environment of a Science Park.

Conceptual framework

Science Parks have been wielded as a policy tool for many years, and numerous policy initiatives such as the EU Framework Programmes and the Bayh-Dole Act (which signalled a change in the intellectual property regime in favour of universities) have incentivised the formation of Science Parks across the globe (Siegel 2003).

Common threads link previous studies on science parks. These include:

(1) No common definition: Science Parks, and the utility of Science Parks, have been extensively studied, yet common definitions are hard to come by. General descriptions of a Science Park sum to a property-based, technology-oriented agglomeration of firms of varying specialisation and size, with close links and opportunities – either cognitively, geographically, structurally or commercially – between firms and to a higher education or research institution (T. K. Das & Teng, 1997; Löfsten & Lindelöf, 2005; Quintas, et al., 1992; Siegel, et al., 2003).

(2) Unique origins: Each Science Park has unique origins and context. They can be a rejuvenation response to natural disaster (Kobe Science Park), the result of agglomeration (Silicon Valley), or the result of competition from other Science Parks (Hsinchu was a response to Silicon Valley) (Koh, et al., 2005).

(3) Host of motivations for Science Park formation: They provide an environment for large firms to develop relationships with small firms; promote formal and informal links between firms, universities and other small labs (Löfsten & Lindelöf, 2005); to provide a contact space between "fast applied science" and "slow basic science" (Quintas, et al., 1992); to promote foreign investment (Koh, et al., 2005); or development on a regional or national basis (Phillimore, 1999).

(4) A Science Park must seek tenants, regardless of the ulterior motives of the firm founder. There is an expectation of economic and social return to investments. Science Parks compete with each other to attract new firms to their location (Phan, et al., 2005). Firms choosing to locate on a Science Park can be a HEI spin-off/start-up or as the subsidiary of an outside firm (without links to the HEI).

(5) Different tenants seek different benefits. There are various location theories including Neo-classical (transport, labour costs, distances and agglomeration economies), Behavioural (mediators, gatekeepers, information channels and reputational advantages) and Structuralist (innovative milieu as well as geographical agglomeration effects (Westhead & Batstone, 1998)). The network benefits of a Science Park can be financial (promoting access to investments (Koh, et al., 2005)); commercial (access to potential clients within the park); and organisational, (non-scientific or technical expertise from Science Park administration itself as well as on-park firms.)

Resources, networks and social capital

Literature related to the social capital of firm founders is of particular interest. Human and social capital studies are numerous (Audretsch, et al., 2005; Lanciano-Morandat, et al., 2009), with studies from strategic alliances (T.K. Das & Teng, 2000; Deeds & Hill, 1996) and entrepreneurial development (Ho & Wilson, 2007) also referencing the deployment of social capital.

Social capital can best be described as supplementary and enabling resources, complementing the stock knowledge, financial capital and skills of an entrepreneur (Greve & Salaff, 2001). Entrepreneurial activity is often marked by the ability of a firm founder to mobilise such social capital through their familial and social relations, as well as the networks they develop on entry to a field. For firms choosing to locate in a science park, social capital takes on physical- and market- proximity aspects (Sorenson, 2003). The presence of a university nearby also opens up the option of entraining and accruing (if the university is an alma mater) academic social capital resources. A general model related to social capital is that of Elfring & Hulsink (2003) in which operate three processes. *The discovery of opportunities* (prior knowledge about the opportunity), *securing resources* (accessing, mobilising and deploying resources), and *obtaining legitimacy* (enhancing visibility through affiliations, alliances and networks).

Aim

We previously researched (Lanciano-Morandat, et al., 2009) the development of the social networks of biotechnology-oriented firm founders. We build on this study by examining the role of science parks in facilitating the social capital of firm founders.

We do so by investigating:

(a) The social interactions in differing contextual settings between firm founder(s) and stakeholders within, and outside, a science park;
(b) The social interactions with, or mediated by, the science park administration.

Method

Science Park and firm selection

Leiden BioScience Park (LBP) is the subject of our analysis. LBP is a biomedical science cluster in the Netherlands. Nearby HEIs include Leiden University (and their Medical Centre), The Hogeschool Leiden (Applied Sciences) and other knowledge institutions such as TNO and Top Institute Pharma. There is a park administration partnered with a facilities and strategy manager.

The firms were selected on 3 primary criteria: firm formation was within the last 10 years; the firm was founded by a university or knowledge institute researcher; and lastly, the firm is from the life sciences and health sector. Following these criteria, we were able to interview and collect full patent and publication data for 9 firms.

Interviews

The interviews were semi-structured with a pre-determined list of topics to be discussed. If any of the topics were not discussed in the interview, they were asked as direct questions at the end of the

interview. The topics revolved around the nature of interactions between the firm founder and stakeholders involved during the development of the firm. The topics and interviewing coding typology (from Lanciano-Morandat et al. (2009) concerned:

(1) Actor types:
- Academia (e.g. universities, scientific advisors or students)
- Organisational and training groups (e.g. patient groups, consortia or professional networks),
- Finance (e.g. banks or venture capital firms),
- Commerce (e.g. customers, marketing firms or suppliers)
- Industrial partners (e.g. manufacturers, other biotechnology firms or pharmaceutical partners)
- Policy and regulation (e.g. lawyers, trial administrators/enablers or safety officials)
- Science Park (e.g. Science Park administrators or facilities management).

(2) The specific context of the interaction which included:
- Scientific – scientific knowledge involved in developing the firms' products or processes;
- Commercial – commercial or sales aspect of the products or processes offered by the firm;
- Financial – venture-capital or grants and the like;
- Technical – technical, including equipment, knowledge required for the functioning of research activities;
- Organisational – regulatory and/or administrative requirements for product/process development or for firm operation.

(3) The proximity of the interacting individual/institution of which the entity could be:
- Personally related – in which the entity is/was a family member, friend or close acquaintance known before the firm was founded;
- Not personally related but within the physical confines of the Science Park;
- Not personally related but from outside the physical confines of the Science Park.

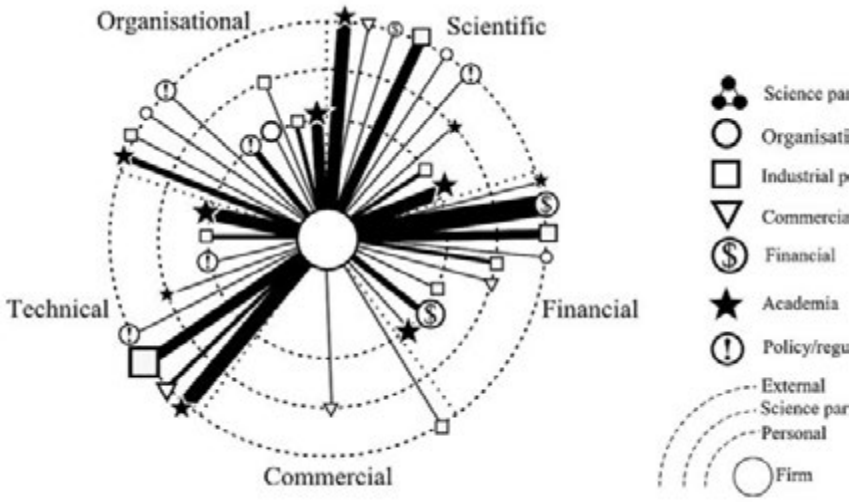
(4) The interactions are classed according to phases in the formation of the firm, specifically:
- The pre-entrepreneurial phase (this includes the time before the firm was officially incorporated, to shortly after incorporation)
- Entrepreneurial phase (wherein the technology of the firm was believed to have surpassed its viability phase)
- Managerial phase (where the duties of the founder as CEO have migrated to that of CSO)

Due to the content and depth of the issues discussed with the interviewees and in accordance with confidentiality agreements with the interviewees/firms, the results presented have been generalised with all identifying data removed.

Results

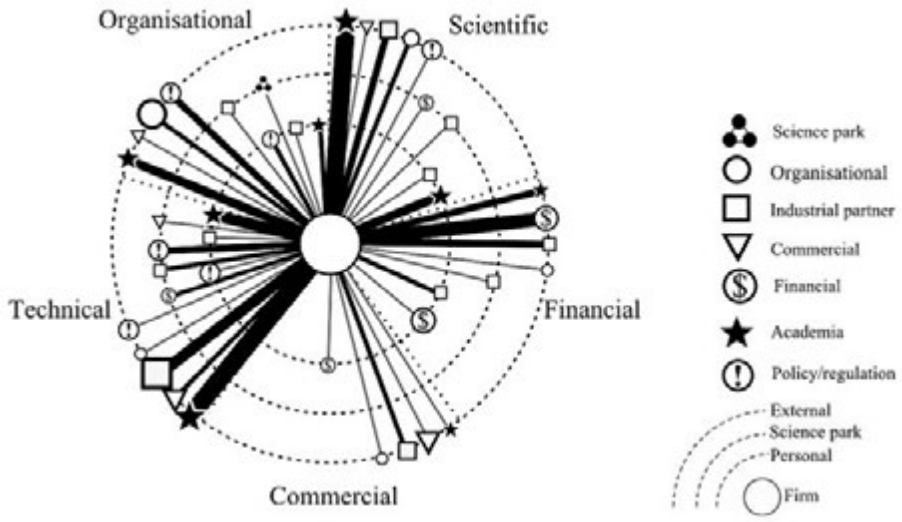
In Figure 1, in terms of funding sources, there are only incidental interactions with financial actor types in the scientific sphere, with those being small financial interactions (such as rent payments) with universities. The bulks of interactions over funding resources come from the financial sphere, and are from internal and externally-oriented interactions. In terms of proximity, personal interactions are primarily knowledge and financially oriented, along with some interactions with industrial partners. External interactions are primarily related to funding sources, industrial partners and knowledge sources.

Figure 1. Leiden collective interactions during the pre-entrepreneurial phase. *(Note: Size of node indicates average number of interactions. Edge thickness signifies count of firms reporting interactions. Grey edges signify only one firm reporting interaction.)*



In Figure 2, there was an increase in the number of commercial interactions, as firms were securing their first customers. An increase was also seen in the number of interactions with academic actor types within the technical sphere.

Figure 2. Leiden collective interactions during the entrepreneurial phase. *(Note: Size of node indicates average number of interactions. Edge thickness signifies count of firms reporting interactions. Grey edges signify only one firm reporting interaction.)*

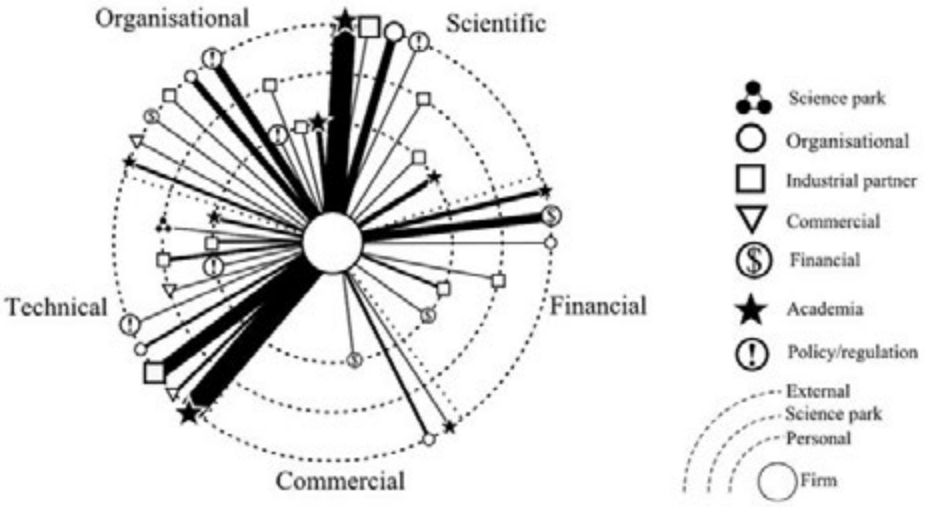


In terms of knowledge sources, most relations (and the strongest) are with academia and external to the science park in nature. In contrast to the pre-entrepreneurial phase, more firms report knowledge sources from the external relations in the financial sphere. The external interactions reported by the founders were overwhelmingly international. The founders commonly reported interactions with universities or public research institutes. However, these interactions were the result of many of the firm founders being active faculty within the universities named. In terms of proximity personal relations seem less important; the occasional firm mentions funding or industrial partners and the most pronounced are relations with academia. The role of the Science Park is more pronounced and diverse than in the pre-entrepreneurial phase, especially in the technical sphere. The Science Park itself appears as an actor in the organisational sphere and its main function seems to be to provide access to industrial partners. External relations are to knowledge sources in the scientific and technical spheres, and to industrial partners in the scientific, technical, and financial spheres. There is also a degree of emerging commercial relations.

In Figure 3, relations with policy/regulators are stronger than in preceding phases. Funding has become gradually less important in the networks of founders; mostly in the financial sphere and external, and the financial sphere is less prominent than before. In relation to network partners, the Science Park mainly serves to find industrial partners and these are found in primarily in the technical sphere and not at all in the commercial sphere. In terms of proximity, personal relations primarily draw in knowledge, industrial partners and occasionally, funding opportunities. Relations within the Science Park draw in industrial partners and little else, and as such the

Science Park now has a role in the technical sphere. External interactions result in knowledge from the scientific and technical spheres, industrial partners and organisational relations.

Figure 3. Leiden collective interactions during the managerial phase. *(Note: Size of node indicates average number of interactions. Edge thickness signifies count of firms reporting interactions. Grey edges signify only one firm reporting interaction.)*



Discussion and conclusions

The sum of the reported interactions runs contrary to many of the stated goals of a Science Park, where the firms within the park and the Science Park administration interact, exploiting the network benefits of locating on a Science Park. The principal scientific and technological pull of the Science Park as reported by the founders was the proximity to the local HEI, a motivation also reported in Löfsten & Lindelöf (2003).

The motivations cited by the firm founders to locate within the Science Park were mostly in line with neo-classical theory, where transport access and distance were important determinants to location, although one firm reported commercial and collaborative opportunities initiated by the Science Park. In terms of the Science Park being a potential innovative milieu, such as with the structuralist theories of Westhead & Batstone (1998), we found little evidence. The interactions of the firms that led to innovative outcomes were primarily with external HEIs or industry with significant contact between the firms and Leiden University, even if founders claimed another university as their alma mater. However, it is important to repeat here that for this study we considered the local university to be external to the Science Park.

The social capital of the firms was primarily determined by relations external to the science park. The networks developed by the firm founders prior to formation and with external entities were more significant sources of social capital than the Science Park or firms within the Science Park. In terms of Elfring and Hulsink's (2003) processes in developing social capital, the *discovery of opportunities*, *securing resources*, and *obtaining legitimacy*, many of the opportunities afforded to the firms came from prior personal relations. Similarly the resources acquired and mobilised by the firms were also external in nature. There was an increase of visibility and these were through collaborative efforts between the firm founders and their alma maters in terms of scientific research, and industrial partners, of which all were external to the Science Park.

This study is not without limitations. Our sample size is restricted by our selection criteria, and the diversity of the firms, in terms of their origins, sub-fields and products, is too high to conduct statistical comparisons. The level of detail and the amount of effort involved in data processing and cleaning makes our method difficult to replicate on a large scale. For our future research plans, we aim to streamline the analysis of firms.

We believe that the level of detail in our study outweighs the restrictive selection criteria and adds a new dimension to future studies on Science Parks and academic entrepreneurs who choose to locate to Science Parks. Our qualitative approach can be of help to policymakers to re-examine the purported benefits of a Science Park and if a Science Park is in fact the ideal carrier of these benefits.

The results of this paper add new weight to the need for a careful re-examination of the role of the Science Park in the regional and national spheres. As the Netherlands is a geographically compact country, many of the logistical benefits may be moot. However, our results seem to suggest that the close association of start-ups with the local university and with national industrial partners lead to a more innovative firm.

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