Local Benefits from International Research?

Policy Aspirations and "Real" Interaction between Firms and the *European Spallation Source* (ESS)

Abstract

There is a tendency today to highlight the "societal usefulness" of scientific research rather than the scientific achievements. Even organizations doing "pure" basic research, like *CERN* – the European Organization for Nuclear Research – or *ESA* – the European Space Agency – are increasingly arguing for how basic research benefits society, and not least industry, in their member states. One of these benefits is technology transfer, which is claimed to move from science to industry.

Another trend within both regional policy and research within the social sciences emphasizes proximity in relation to usefulness; cluster studies show that firms within certain industries benefit from both being close to each other and to research centres/universities, and industrial growth is used as an argument for regional investments.

In the southern part of Sweden, two complementary research facilities – ESS and MAX IV – are currently under construction (MAX IV is estimated to be up and running in 2015 and ESS in 2019). MAX IV is a national research facility, while ESS is a joint European undertaking which is hosted jointly by Sweden and Denmark. The research facilities are of multidisciplinary character within areas such as functional materials, molecular biotechnology, energy technology, nano-science, geology, medicine and environmental research.

In addition to the ground breaking research expected to take place within these two research facilities, there is a (political) focus on maximizing usefulness to society and utilizing spin-off effects of the establishment. It has been stated that there is a huge potential for the regions in southern Sweden, especially Skåne and Blekinge, to benefit from the research facilities when it comes to new business, technology transfer, and an innovative climate – which in turn will lead to the creation of new firms and an influx of educated people.

The aim of the paper is to investigate the potential benefits to (local) industry from the establishment of an international research facility in a certain area. The main focus will therefore be on ESS rather than on MAX IV. The paper constitutes a first introduction to the area, and only in the next phase of the study will firms in the Southern parts of Sweden be included.

Keywords: Science organizations, clusters, networks, interaction, innovation.

Introduction

There is a tendency today to highlight the "societal usefulness" of scientific research almost to the point of downplaying the scientific achievements. Even organizations doing "pure" basic research, like *CERN* – the European Organization for Nuclear Research – or *ESA* – the European Space Agency – are increasingly arguing for how basic research benefits society, and not least industry, in their member states. Among these benefits are innovations which are believed to often come about through technology transfer; which is claimed to move from science to industry[1]. It is not only the people connected to the research organisations that promote these arguments, however. Politicians, as well as functionaries within governmental organisations, are also adhering to the same ideas. According to Jacob and Hallonsten (2012:411), there have been "*considerable efforts exerted by national (predominantly European) efforts to integrate the commercialization of science and other innovation-type activities into the everyday life of public R&D institutions*".

As research facilities grow in size and complexity, basic science is becoming increasingly expensive to fund. Therefore, many of the largest research facilities today are the outcome of international collaboration. There is an ongoing debate as to whether the localization of a research facility to a certain region/country will primarily benefit industry in close proximity to the facility. Whether geographical proximity (alone) creates business opportunities has been debated (see e.g. Markgren, 2001), but the cluster concept[2] has made inroads within several areas. According to Visser (2009:167), *"Over the past decades, researchers and policymakers around the globe have been paying attention to the concept of clusters of related firms, industries and institutions, with a view to the presumably positive effects of clustering for productivity and innovation"*.

In the southern part of Sweden, two complementary research facilities – MAX IV and ESS – are currently under construction (MAX IV is estimated to be up and running in 2015 and ESS in 2019). The research facilities are of multidisciplinary character within areas such as functional materials, molecular biotechnology, energy technology, nano-science, geology, medicine and environmental research. In addition to the ground-breaking research expected to

[1] That this way of viewing technology transfer is overly simplified has been shown in several studies (see e.g. Åberg, 2013). Vuola (2005) even shows that technology transfer may move in the opposite direction, i.e. from industry to the research facility, so-called reverse technology transfer.

[2] In this paper, a cluster is defined as a concentration of firms within the same or closely related industries to a certain area.

take place within these two research facilities, there is a (political) focus on maximizing usefulness to society and utilizing spin-off effects of the establishment. It has been stated that there is a huge potential for the regions in southern Sweden, especially Skåne and Blekinge, to benefit from the research facilities when it comes to new business, technology transfer, and an innovative climate – which in turn will lead to new firms and an influx of educated people (*Region Skåne* website). There are major differences between the two research facilities, however. MAX IV is an extension of an already existing national laboratory, MAX-LAB, which is hosted by Lund University. The European Spallation Source, ESS, is going to be an international research laboratory. So far, seventeen European countries have shown an interest in participating, but the final signatures are not yet in place.

The aim of the paper is to investigate the potential benefits to (local) industry from the establishment of an international research facility in a certain area. The main empirical focus is placed on ESS and the potential benefits to the surrounding areas, with a specific emphasis on interaction with industry.

The structure of the paper is as follows: After this brief introduction the theoretical underpinnings will be presented. The theory section is divided into two main parts; where the first part introduces a discussion on the interaction between science and industry in general, whereas the second part focuses more on the cluster concept and opposes this concept to IMP literature on networks. Thereafter a brief comment on method is provided, followed by a short presentation of ESS. The concluding discussion focuses on the next steps of the study and discusses potentially interesting developments of the study.

Theoretical Underpinnings

Interaction between Science and Industry

The concept "Big Science" became widespread in the 1960s and refers to scientific research needing big investments, big laboratories, big machines and many people involved. One of the early references describes these large-scale research organizations in the following way;

> "*Not only are the manifestations of modern scientific hardware so monumental that they have been usefully compared with the pyramids of Egypt and the great cathedrals of medieval Europe, but the national expenditures of manpower and money on it have suddenly made science a major segment of our national economy. The large-scale character of modern science, new and shining an all-powerful, is so apparent that the happy term 'Big Science' has been coined to describe it*" (de Solla Price, 1963:2)

In many cases the usefulness of big science is considered a given, and the trick is simply a matter of making people aware of it; "*The awareness of the potential of big science centres in industrial development is continuously increasing*" (Autio et al., 1996:307). From this perspective, the management of these science centres has a role to fulfil, because with the help of "*well-designed industrial collaboration policies, a big science centre can increase its attractiveness in the eyes of national policy-makers*" (Autio et al., 1996:307).

That large-scale research organizations are important for national policy-makers today is highlighted by other researchers as well; Hackett et al. (2004), state, for instance, that these science endeavours position science on the maps of politicians and policy makers. Jacob and Hallonsten (2012:412) develop this argument further, claiming that "*large-scale research infrastructure represents a route through which science and technology policy-making (alternatively known as research and innovation policy) may be understood*".

What needs to be considered, however, is that scientific research does not necessarily lead directly to technical innovations. According to Basalla (1988:91-92),

> "*Proponents of scientific research have exaggerated the importance of science by claiming it to be the root of virtually all major technological changes. A more realistic and historically accurate assessment of the influence of science on technological change is that it is one of several, interacting sources of novelty*".

The quote above points at some important aspects of the relation between science and technology: firstly, that there are other factors besides scientific research that are important for technological development, and secondly, that technological development is a result of interaction rather than a linear outcome of scientific research. Therefore, *in what way* the technological advances that improve society emerge from science is also a debated question.

Therefore, *in what way* the technological advances that improve society emerge from science is also a much debated question. According to Nowotny (2005:3), the fact that since

> "*science and technology are rightly seen to be the major driving forces of wealth creation and economic growth, some of the latter's governing principles are now expected to work as well in the production of scientific and technological knowledge. The efficiency of markets, competition, and intellectual property rights are to prove themselves by increasing the productivity and output of scientific knowledge […] and technological artefacts, all of which constitute the potential of science and technology.*"

In other words, there is a belief that increased market-driven efficiency will also increase the outcome of the investments in science, thereby "making business out of science". Concepts from business are also introduced in order to describe this "new" efficiency, and to, in a way, legitimise scientific research.

There is a small problem with these developments within science, though. Not with the developments in themselves, but in the ideas that they entail. According to Rosenberg (1994:10);

> "*The findings of scientific research, and their economic consequences, remain shrouded in uncertainty. They reflect certain properties of the physical universe that are uncovered by the search, and not the economic goals that were in the mind of decision-makers who allocated resources to the research process in the first place*" (Rosenberg, 1994:10).

What is certain, however, is that an increased demand for results from investments in science will result in an increased number of attempts to influence the outcome of those investments, thus leading to policy changes.

Clusters and Networks

If investments in large-scale science infrastructure are justified by the potential benefits to (national) industries; then the idea of creating dynamic and innovative areas is another policy

dream. In addition, by investing in a facility for scientific research, there is always the potential of creating an innovative area around the facility, i.e. creating a cluster. According to Porter (1998:78), "*Clusters are geographic concentrations of interconnected companies and institutions in a particular field*". Furthermore, it has been claimed that *"Over the past decades, economic and innovation policy across Europe moved in the direction of creating regional clusters of related firms and institutions. Creating clusters through public policy is risky, complex and costly, however"* (Visser & Atzema, 2008:1169).

Within the cluster literature, there seem to be rather fuzzy boundaries between different kinds of clusters, and different definitions of clusters. On the one hand, there are clusters that have existed for a long time (e.g. the Italian industrial districts). These clusters are also the kind that Porter refers to when he talks about "enduring competitive advantages"; "*Clusters are not unique, however; they are highly typical – and therein lies a paradox: the enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match*" (Porter, 1998:78). A firm located within such a cluster has many advantages over an isolated competitor when it comes to innovation. Some of the advantages include access to sophisticated buyers; possibilities to learn more quickly about customer needs, trends, evolving technologies etc.; and easier access to resources needed (Porter, 1998:83). On the other hand, there seems to be, if not a strong belief in, then at least a strong wish for the possibilities to create a cluster through policy measures.

So far, we have mainly focused on the effects that clusters are considered to have on innovation, but IMP literature would rather focus on network dynamics and their role in innovation. There are a few researchers, however, that try to combine the two concepts. Visser (2009:167) claims that "*clusters and networks are two separate concepts that both merit attention, especially—albeit not exclusively—with a view to learning, knowledge development and innovation*". The differences, according to Visser (2009), between clusters and networks are the following:

> "[…] *clusters refer to spatial concentration processes involving a set of related activities in which context firms may, but need not, cooperate, for example, to achieve dynamic purposes, whereas networks refer to dynamic cooperation in the form of knowledge exchange between firms and other actors that may, but need not, develop these links at the local or regional level*" (Visser, 2009:168-9).

Thus, the basic differences between networks and clusters are that clusters refer to similar activities in a specific area, while networks always involve some sort of interaction. It is likely that the effects sought after by policy makers are the network effects, while, at the same time, the policies are intended to benefit cluster formation. When Waluszewski (2004) studied the so-called Uppsala biotech cluster, what she found was that:

> "*Instead of being the result of an overnight success and events taking place within a spatial cluster, technological and economic effects appears [sic!] as due to combinatory efforts that stretch over at least seven decades and over the borders of many regions and nations. Taking place within and between companies and organisations of different size and age, with different technologic and economic logic, and not least, located at different places, these processes show the power of interaction and the encountering of resources"* (Waluszewski, 2004:146).

Concluding Remarks on Theory

The theoretical part of the paper has broadly focused on two different aspects; first it recapitulated some of the discussion on the interplay between scientific research and industrial activities, thereafter it focused on the cluster concept and how it differs from industrial networks. The purpose of presenting these strains of literature is that both spending on scientific research and cluster creation are often justified by potential usefulness to industry, through increased innovativeness, and therefore usefulness to society.

Methodological Considerations

This paper introduces a research project that will be initiated during the autumn of 2014. So far, the data collection carried out has been limited to Internet searches and participation in a whole-day seminar; *The European Spallation Source ESS – An Opportunity for Swedish Organisations and Companies* (held at The Royal School of Technology, Stockholm, Sweden on June 10, 2014). The seminar lead to the conclusion that, while both MAX IV and ESS are/will be situated in Lund, Sweden, there is a large difference between the two facilities. While MAX IV is a national facility and an extension of an ongoing endeavour, ESS is a completely new facility. The study will be limited to only focus on ESS. This paper is a first draft and there is very little primary data included.

During previous Internet searches and the seminar in Stockholm, some 20 companies with contacts with ESS have been identified. These companies will be contacted during the end of the summer 2014 and interviews will be carried out. The type of questions will focus on ESS-company interaction and will partly build on a previous study of CERN-company interaction (see Åberg, 2013) where some 100 interviews were carried out. In addition to interviews in the companies, interviews with people at *Region Skåne*, the local government in the area where ESS is situated, will be carried out; as well as interviews with people working within the research organisation itself.

Preliminary Empirical Data

> *"ESS will be a different kind of scientific facility: different in the way it engages with the user community; different in the way in which it deals with innovation; and different in its goal to be the first sustainable large-scale scientific facility."* (ESS website)[3]

What is ESS?[4]

The ESS is the biggest research infrastructure project in Europe today – and the biggest project ever in Sweden. The ESS is a multi-disciplinary research facility which will provide the scientific community with new possibilities for research using neutrons. Once constructed, the ESS will constitute the world's most powerful neutron source – about 30 times brighter than today's leading facilities. Researchers from as diverse areas as life sciences, energy, environmental technology, cultural heritage and fundamental physics will find uses for the facility. The fact that ESS is multidisciplinary, and therefore not only for physicists using neutrons, has not been fully acknowledged so far – not in Europe, and perhaps not even in Sweden. The proponents of ESS have had problems raising an interest in ESS both in Europe and in Sweden (Honeth, ESS day).

Advanced research requires advanced tools. A neutron source and its complementary detection instruments enable scientists to see and understand basic atomic structures and forces. It can be compared with a giant microscope for the study of different materials – from plastics and pharmaceuticals, to engines, and molecules.

[3]ESS website: http://europeanspallationsource.se/ess-organisation
[4]ESS website: http://europeanspallationsource.se/european-spallation-source-0

The ESS is one of the largest science and technology infrastructure projects being built today. The facility design and construction includes a linear proton accelerator, a heavy-metal target station, a large array of state-of-the-art neutron instruments, a suite of laboratories, and a supercomputing data management and software development center.

Europe's need for an advanced, high-power neutron facility was first articulated over 20 years ago. The ESS facility will (hopefully) be built by at least 17 European countries, with Sweden and Denmark as host nations. The neutron facility will be built in Lund, while the data management and software center will be located in Copenhagen. Between two and three thousand guest researchers are expected to carry out experiments at ESS each year. Most of the users will be based at European universities and institutes, but some will be based within industry.

The ESS research program is being planned now. Scientists and engineers from more than 60 partner laboratories are working on updating the advanced technical design of the ESS facility, and at the same time are exploring and imagining how it will be used. These partner laboratories, universities and research institutes will also take part in the construction phase, contributing human resources, knowledge, equipment, and financial support. The ESS is very near the start of construction; but there are still some decisions to participate needed from future partner countries. On June 12, 2014, a milestone was reached, however, when the Swedish Environmental Court approved the ESS plans to start the construction

The timing of the ESS construction is by no means perfect. It was decided during a very difficult financial situation (the latest financial crisis), and there are always debates as to whether big research infrastructures are the best way to spend research funding. Sweden finances about 35% of the construction, or some 2 billion euros, but this money is not taken out of the "standard" research funding.

ESS Organization and Governance[5]

More than 50 universities, research institutes and laboratories from all over the world take part in the ESS collaboration. They are involved in the technical design of, and will also take

[5] ESS website: http://europeanspallationsource.se/ess-governance , http://europeanspallationsource.se/ess-organisation

part in the construction phase. The future research at ESS is being planned in cooperation with European researchers and partners.

ESS is owned by the Swedish government and, as of December 2010, by the Danish government. The company is governed by a Board which consists of eight members appointed by the two current owners. In addition, ESS has an international "Steering Committee" which consists of 17 Partner Countries. The Steering Committee deals with the scientific, technical and financial planning for the facility.

ESS has a dual-governance structure, made up of the ESS AB Board and the ESS Steering Committee. European Spallation Source ESS AB is responsible for planning, designing, building, owning and operating the ESS research center in Lund. The company also takes an active role in negotiations with current and potential partners, and in particular in creating a international agreement to begin construction, which is scheduled for 2014. ESS AB is a public company owned by the Swedish and Danish governments. All partner countries will be offered shares in the company.

ESS and its Counterparts

The expectations on the investments in the ESS are huge and it is believed that research done will result in major research findings within life science and material science. In addition, there are also great expectations on what the research facilities will mean for the development of the industry in the surrounding areas (Region Skåne website)[6]. Since the regional government of the area where ESS is built – *Region Skåne* – hosts ESS and contributes with substantial funding, its representatives claim that they have a responsibility that the knowledge production and usefulness to society which can be derived from the facilities are taken advantage of as much as possible areas (Region Skåne)[7]. Furthermore, they state that there is great potential for Skåne and Blekinge to take advantage of the establishment of ESS. The construction alone, as well as the future running of the facilities, provide the local firms with potential business opportunities and technology diffusion. From a broader perspective, there are even greater regional opportunities since the establishment may entail further spin-

[6] Region Skåne: http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Regional-mobilisering-kring-ESS-och-MAX-IV/.

[7] Region Skåne: http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Regional-mobilisering-kring-ESS-och-MAX-IV/.

off effects when it comes to an innovative climate and increased competitiveness for business, as well as a strengthened research community. These aspects may entail, in turn, creation of new businesses as well as an influx of skilled labour (Region Skåne)[8].

As with many international research infrastructure projects, the procurement for the ESS will be where many firms can come in contact with the facility. Procurement for the ESS will be carried out as a restricted procedure in two steps. Stage one will be an open procedure, with a call for expression of interest, and during this stage firms will be short-listed. Stage two will be restricted, and only firms that were short-listed during stage one will be welcome to tender. Many of the future partner countries will contribute in-kind (perhaps with as much as 70% of their total contributions), while the host countries (Sweden and Denmark) will make their contributions in cash. This has already been a bone of contention in Sweden, where actors wanting to contribute to the construction feel that they compete on unequal terms (Ekelöf, ESS Day).

What the societal benefits from ESS will be remains to be seen, however, but there are already some firms that have delivered to ESS. The next stage of the study is therefore to contacts these firms.

Concluding Discussion

It has been stated that the ESS is the biggest investment ever in Scandinavia. Lindroos (ESS Day) confirms that this is true, but only if you consider modern time investments. Tycho Brahe's observatory Stjärneborg, however, is claimed to ha cost the Danish king 1% of the state budget in 1580.

The aim of the paper has been to investigate the potential benefits to (local) industry from the establishment of an international research facility in a certain area. As the construction phase of the ESS has not yet been initiated, there is so far very little direct benefits to industry. It is interesting to see, however, what the justifications for investing in a research infrastructure project. According to Agrell (2012), the ESS consortium had to run a public campaign with

[8] Region Skåne: http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Regional-mobilisering-kring-ESS-och-MAX-IV/.

the dual purpose to both win the bid in the European context and gain legitimacy for the project from the Swedish public. The arguments for the ESS project definitely include potential industry collaboration (Jacob & Hallonsten, 2012), and thus ideas of usefulness to society.

The themes presented in the paper are so far only roughly sketched out. Concrete questions that will be asked in the future include the following: *How and why do firms in (southern) Sweden interact with ESS? How is this interaction framed from a policy perspective? How does the construction of a large-scale research infrastructure affect the industry in the surrounding area?*

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ESS Organisation: http://europeanspallationsource.se/ess-organisation

The ESS Story: http://europeanspallationsource.se/ess-story

Why ESS?: http://europeanspallationsource.se/ess-science-everyday-life

Region Skåne: http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Regional-mobilisering-kring-ESS-och-MAX-IV/

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