

Perceptions of Scientific Markets

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Abstract

The purpose of this work-in-progress paper is to elaborate on how the perceptions of the environment affect scientific research and its outcomes. The study uses and contrasts a traditional view of markets and a network approach to discuss the difference in effects on the three concepts *research*, *politics*, and *business*. The study that this paper is based on includes over one hundred in-depth interviews, and could be described to use an abductive approach. Although the paper is still very much a work-in-progress, the aim is, when the paper has been properly developed, to contribute both to STS-studies (Science and Technology in Society, or Science and Technology Studies) and to the IMP approach.

Keywords: perceptions, markets, networks, actors, science

Introduction

“In 1951, a number of European scientists and statesmen came to the conclusion that only by combining the efforts and resources of their respective countries would it be possible to establish a laboratory, for research relating to high energy particles, that would rank among the foremost in the world and participate, on behalf of the Europe of tomorrow, in the most advanced work in this field.

When, on 29th September 1954, the Convention for the Establishment of a European Organization for Nuclear Research came into operation, the event, though modestly heralded, opened up far-reaching possibilities.

For the first time, twelve European states had by agreement become members of a nuclear research organization, of a purely fundamental and scientific character, whose aim was to extend the frontiers of knowledge.

Supported by the confidence of the twelve Member States, guided by the advice of members of our Scientific Policy Committee, and aided by the goodwill of Switzerland, whose hospitality we enjoy, we have now passed the early stage of tentative effort and overcome our first difficulties, and we believe that we are progressing along the right road”.

The quote above can be found in the “First Annual Report of the European Organization for Nuclear Research” (1955, p.1). The text is taken from an introduction given by the Director-General Professor C. J. Bakker, and it retells, in short, the story of how the European Organization for Nuclear Research, or CERN¹, was founded. The quote mentions two groups that were crucial for the establishment of CERN, namely scientists and politicians. A third group, extremely important especially during period of construction at CERN, is mentioned the following year. This group of actors is of course different industrial actors, which is mentioned in the Annual Report of the following year: “As a rule, orders for special equipment, particularly for important equipment, were placed with firms of very high repute. These firms often proved extremely keen on gaining the high prestige of being purveyors to CERN” (Annual Report 1956, p.59). Less than a decade later, the importance of interaction with industry is further stressed: “This collaboration with industry is very important because, after all, industry actually builds 95% of our equipment. We only build about 5% ourselves within the Organization. Of course industry can live without us, but we could not live without them” (Zilverschoon 1974:32).

The aim of this paper is to start to develop a model for analysing different kinds of actors involved in the production of science. The point of departure is different perceptions of “the market” that were presented in interviews made especially at CERN, but also in industry, with politicians and with scientists outside of CERN. These perceptions, or assumptions, can also be seen to affect an organisation’s possibilities to engage in long-term relationships with other actors. The paper is based on a study that had its initial focus on the relationships between CERN and Swedish industry. The study has been carried out with an interactive perspective, and the theoretical underpinnings are firmly rooted in the IMP (network) approach (see e.g. Axelsson & Easton 1992; Ford 1998; Håkansson 1987, 1989; Håkansson & Snehota 1995; Håkansson & Waluszewski 2002).

The idea behind this paper emerged during the course of making interviews for a doctoral research project concerning CERN and industry. The empirical material is based on over one hundred interviews made from 1998 to 2004, and the respondents come from a large array of different contexts (from industry, politics, national research institutes, and, of course, from many different positions at CERN)². While conducting interviews, I found it fascinating that people seemed to have diametrically opposed views on issues of great importance to CERN. Coming from an environment with strong traditions in an interactive approach (mostly IMP based), I was looking for interaction, but I sometimes ended up getting answers about the importance of free competition etc., based on a more traditional

¹ The European Organization for Nuclear Research, CERN (Conseil Européen pour la Recherche Nucléaire), will be introduced briefly in the next part of the paper.

² In addition, a rather extensive source of secondary data – in the form of annual reports, previous studies etc. – has been used.

view of markets and competition. Therefore, I would like to explore what impact these different perceptions of the environment may have for different actors.

Although the doctoral project can be described more as an inductive study, this background of this paper is more based on an abductive logic. Dubois and Gadde (2002) have chosen to call the method systematic combining, and it suggests that the researcher should move between an empirical world and a theoretical world in a *“non-linear, path-dependent process of combining efforts with the ultimate objective of matching theory and reality”* (Dubois and Gadde, 2002, p.556). Ragin (1994) uses the concepts of ideas and evidence, but proposes the same sort of movement between the two in something he calls a *retroductive process*. The actual process of linking ideas and evidence together is called *casing* (Ragin and Becker, 1992, p.218). The whole result of research done in this fashion can then be described in the following way: *“empirical research can be seen as culminating in theoretically structured descriptions – understandings that result from the application of constraining ideas to infinite evidence”* (Ragin, 1992, p.218). The same sort of reasoning, albeit with a slightly different terminology, has been used by a number of researchers.

Following this introduction, a short empirical description will be given, starting with an introduction of CERN, and moving over to discussing CERN and its environment. A substantial part of the paper then focuses on the theoretical thoughts I would like to develop. The paper is concluded with a discussion and suggestions for further research.

Constructing Science

This part of the paper aims at giving a short presentation of CERN, the research organisation in focus, and to describe some of its counterparts. For brevity's sake, counterparts are divided into groups rather than described individually.

Introducing CERN

“To the uninitiated a first visit to CERN is, more than anything else, highly confusing. He knows he is going to see a laboratory, and he therefore has certain preconceptions. But what he actually sees exceeds by far what he had anticipated, in terms of buildings and machinery. It is virtually an entire city. There, one finds not only a post office, bank, travel bureau, and nursery school but a power plant, sewage disposal system, cooling towers, and garages as well. There is also a widespread network of asphalt streets, along which are workshops, laboratories, office buildings, and computing centers” (Jungk 1969, pp.7-8).

“On a first visit, CERN gives the impression of a huge industrial complex. The buildings crowd untidily around the large machines devoted to the production of high-energy particles.

It is in the restaurants that a visiting scientist discovers the true flavour of CERN, along with the Swiss cooking. At surrounding tables animated discussions about high-flown theories, intricate experiments, or the best places for skiing, are going on in half a dozen languages, with Broken English predominant. Physicists from many lands, dressed informally for hard work, forge friendships over their hurried meals.

With experience, one begins to take such things for granted which may be a pity, because there is nothing quite like CERN anywhere else on Earth...”
(Egil Lillestol, Norwegian physicist, CERN webpage, 2004-04-19)

“CERN is an intersection of many things. First and foremost, it is a scientific organisation. But it is a highly multicultural organisation, not just because of the nationality of the people, but also because of the background of the people who come here. You have physicists, engineers, administrators, and, at the level of the council, there are politicians. Or civil servants, who obey politicians. And CERN is trying to function with all of that taken into account, and has managed to make it a success.” (Oscar Barbalat, interview 99-11-15)

These are a few different images presented by different people when trying to describe CERN. But what is it? CERN, le *Conseil Européen pour la Recherche Nucléaire*, or the European Organization for Nuclear Research, is the world's leading laboratory for experimental particle physics. Its mission is to "create new knowledge on subjects ranging from anti-hydrogen to neutrinos, to the proton's inner structure, to the generation of mass and dark matter" (Lucio Maiani, CERN's former Director-General). In order to create new knowledge, the physicists need some kind of tools. At CERN, these tools consist of enormous accelerators, which accelerate different kinds of particles almost up to the speed of light, and then smash them together. These particle collisions are then studied in detectors that can be compared to giant magnifying glasses. The particle collisions are too quick to be studied when they take place, however, so what is actually studied is the traces of the collisions; just like policemen coming to a car crash have to study what is left behind in order to determine what has taken place. At CERN today, the research is focused on the preparations for the next big accelerator project, the LHC, with its five different detectors (or experiments).

CERN was founded in 1954, as one of Europe's first joint ventures. By the time it was founded, however, the idea had been discussed by the leading physicists in Europe for several years. Already in 1949, the French physicist and Nobel prize winner Louis de Broglie proposed the creation of a European science laboratory, and in 1952 it was decided that a laboratory should be built close to Geneva, on the border between Switzerland and France (CERN's homepage, 990107). An important reason for the co-operation was that it was impossible for a single European country to reach the critical volume of resources, in the form of money and researchers, that was necessary for a research project of CERN's magnitude. Another reason was that it was seen as an excellent way to control research within particle physics, or nuclear physics as it was called - the bombings of Hiroshima and Nagasaki were still in fresh memory. A third reason for the building of the laboratory was that prominent researchers could be kept in Europe (Wallerius 1997).

From the beginning, 12 countries signed the CERN convention³, and all except Yugoslavia, which withdrew in 1961, are still members. At present, CERN has 20 member states⁴, but the laboratory is open for all countries with enough competence to participate in the experiments. The member states provide financial contributions in proportion to their Net National Incomes. CERN's budget currently amounts to about 825 million Euros (i.e. 1.3 billion CHF) for the year 2004. Besides the member states, there is a large number of other countries present at CERN. The physicists and their funding agencies from both member and non-member states are responsible for the financing, construction and operation of the experiments on which they collaborate (CERN homepage, 010315).

CERN is divided into four sectors: physics research, accelerators, the technical sector and the administrative sector. The physics research sector is the odd one – it includes all physicists doing research at CERN, i.e. some 6500 people each year, and these are financed by their home institutes. The other three sectors are CERN-financed, and their task, giving a simplistic picture of it, is to provide the infrastructure for the physics research. Until some ten years ago, the number of people working at CERN increased from year to year, but recently the number of employees has been cut quite drastically – from about 3,500 employees to approximately 2,600 today (2004).

³ Among other things, the convention states that *"The Organization shall provide for collaboration among European states in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available"*.

⁴ Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom.

CERN and its Environment⁵

In the early days of CERN, there was a large number of different actors involved in the construction of the research facility. The initiative was taken by a number of scientists within the field of physics, but contrary to what one might believe, not all physicists were positive towards the idea. A substantial part of the scientific community believed that an international organisation would be detrimental to the national research laboratories. The idea slowly gained momentum, however, and for politicians in Europe, there was a strong will to create an international organisation. As soon as a site had been chosen for the laboratory, industry became involved. Industrial *“orders were shared out as far as possible between Member States, including the furthest distant”* (Annual Report 1956, p.60). Based on this quote, there seems to have been a will for some sort of fair return, in the form of industrial contracts, very early on.

During the over 50 years of its existence, different arguments have been used to justify CERN. These arguments differ depending both on the user and the intended recipient. Money has always been a big issue, but in the early days scientific and political arguments were used to promote CERN, whereas lately economic arguments, such as transfer of technology and knowledge, spin-off effects and fair industrial returns, have become far more common.

After CERN was founded, and the first accelerator built, there was another big debate among the member states concerning the next phase of physics research, or CERN II. From the beginning, the plan was to situate this laboratory somewhere else than outside Geneva, but in the end it became cheaper to co-locate it with the original CERN. For a long time, it was unclear whether all the original member states would participate in CERN II, because it was a question of a lot of money. In several member states, both politicians and “non-CERN” scientists wanted to spend the money internally instead. The arguments for national, as opposed to international, spending were (in the scientific community) that more researchers could benefit from spending on national research institutes, and, among politicians, that it was a lot of money to spend in a very limited field of research. In Sweden, for instance, the main political reason to why CERN was supported was that Sweden had to take part in an international endeavour – it had just been decided that Sweden would stay out of NATO, and the political pressure was strong on Sweden not to stay out of CERN as well (see e.g. Hadenius 1972). Jungk described the political influence on research matters during the end of the 1960's in the following way: *“Politics, the New Force in Physics’ /.../ had been affecting the construction plans of CERN in a multitude of ways since 1966. Heading the list were the slowing down of the economic boom and the growing burden of social welfare expenditures for European governments”* (1969, p.220).

In the beginning of the 1970's, the debate about economic benefits from CERN contracts was brought into light, and a study was commissioned (Schmied 1975). This study, as well as later studies (see e.g. Bianchi-Streit et al 1984) showed an additional economic utility (apart from the initial contract) from CERN high-tech contracts. During the 1980's, CERN introduced a special office that was to deal with industry and technology transfer, and during the same period, a multitude of papers about technology transfer from CERN to industry appeared. Finally, in the beginning of the 1990's, new purchasing procedures were introduced, which in short meant that member states that did not get enough industrial contracts to match their contributions would have a slight advantage.

Today, there is quite a strong focus on issues of technology transfer. Initially, CERN did not have a system for handling immaterial rights (patents etc.), and all CERN inventions were considered free for the taking. Today, however, the practices have changed, and currently CERN holds a number of patents with the aim to licence these out to companies in the member states. In addition, there is a technology transfer group at CERN aiming at interaction with industry. On the CERN web site, the following quote can be found, indicating in what areas CERN has been contributing to industry:

⁵ This part of the paper is based on a number of different sources and references, see for instance Bengtson & Åberg 2002; Bressan 2004; Hadenius 1972; *History of CERN* Vol. I-III; *Infinitely CERN – Memories of fifty years of research* 2004; Krige 1990, 1993, 2000; Krige & Pestre 1997; Nyberg & Zetterberg 1977; Widmalm 1993; and various CERN documents. In addition, an extensive interview material has been used.

“CERN's accelerators and detectors require the leading edge in technology. For this, CERN works in close collaboration with industries, to the benefits of both partners. Related spin-offs, in all kinds of other domains, are now incorporated in our daily lives.

Cancer therapy, medical and industrial imaging, radiation processing, electronics, measuring instruments, new manufacturing processes and materials, the WWW, these are just some of the many technologies developed at CERN during research in particle physics.”⁶

When it comes to relations between CERN and industry, there are a number of problems that have been pointed out (during interviews at CERN and elsewhere). Number one is the problems with technological development; if you start a development project with one company, there is no guarantee that that company gets the contract in the end. This fact results in two problems: the first one is that companies may be hesitant to enter into a development project at all, and the second one means that valuable knowledge and a working relation may be wasted if another company gets the contract after a development project. Another problem has to do with slack within organisations. Over the last ten-fifteen years, the number of employees has decreased substantially, which means that CERN does not have any extra staff if there are problems with an industry contract. At the same time, companies are perceived to have seriously reduced slack as well, which means that they cannot work with CERN just out of curiosity or interest – it has to be profitable. If a company then experiences difficulties with a contract, if for instance they have underestimated the complexity of a contract, then there are no resources on either side to easily overcome the problem.

Having made a short presentation of CERN, we will now move on to the theoretical part of the paper.

Theoretical Background

The theoretical background is divided up into two different parts. The first part deals with a discussion about the markets concept, while the second part deals with the network concept (primarily from an IMP perspective).

Markets

One of the basic characteristics of human interaction throughout history has been various forms of exchange. From the moment humans implemented some sort of division of labour exchange was a means of getting products needed. Also, different opportunities within different settlements meant that one group of people may have had what another group lacked and vice versa. Traditional, or neoclassical economics talks about exchange as something happening in a market. According to Loasby, however, it is important to distinguish between markets and exchange: *“an exchange is an event – or if /.../ one wishes to include all the preliminaries, it is a process; it is something that happens. A market is a setting within which exchanges may take place – a setting which refers to ‘a group or groups of people, some of whom desire to obtain certain things, and some of whom are in a position to supply what the others want’ (Marshall, 1919:182). The relationship between markets and exchange therefore requires some analysis” (Loasby, 1999:107).* In this paper, however, the focus will be on the market as perceptions of a setting, rather than on any objective setting as such.

The market concept is by no means as old as the phenomenon of exchange. According to Powell, *“the word market first enters the English language during the twelfth century to refer to specific locations where provisions and livestock were sold. /.../ It was not until the latter part of the eighteenth century that among the British educated classes the term market became separated from physical and social space and came to imply a boundless and timeless phenomenon of buying and selling” (1990:298).* Today, the word *market* is used substantially in everyday language, depicting a large array of phenomena (Helgesson, Kjellberg & Liljenberg 2004).

The “ideal” market, according to economic theory, is a market with a large number of firms that produce an identical good. All firms are small enough that the actions of one particular firm do not

⁶ See the CERN website:

<http://public.web.cern.ch/Public/Content/Chapters/AboutCERN/ResearchUseful/ResearchUseful-en.html>

significantly affect the market (neither when it comes to price nor output). The number of buyers also has to be large, so that no single buyer can influence the market. In addition, all firms and buyers have full information about each firm's prices. When these conditions are fulfilled, perfect competition can be said to occur (see e.g. Parkin, 1992).

Obviously the market concept is vital to economic theory, but it is also used in a wide variety of other theoretical fields. However, *"the market concept is one of the central constructs in the price theory that constitutes the very foundations of the neoclassical economic theory. Economics appear somehow to claim the paternity, if not the monopoly, of the conceptual apparatus descriptive and explanatory of the market phenomenon"* (Snehota, 1990, p.89). According to the same author, the monopoly neoclassical economic theory has on the market concept *"has lead to ascribing to the market phenomenon properties from the assumptions made when constructing models for quite different purposes and has generated explanations of the market phenomenon and of market behaviour which indeed are not satisfactory for the purpose of explaining business behaviour"* (Snehota, 1990, p.90). Thus, if we use the market concept without defining it, it is the definition from neoclassical economics that will be considered.

In the neoclassical market, we have buyers and sellers exchanging goods for money. These market exchange opportunities *"arise when there is a pair of market participants who attribute different values to goods, to a bundle of benefits, to a potential object of exchange (product or service). Market exchange opportunities can be exploited and gain can be achieved through market exchange transactions by which a redistribution of property rights is achieved"* (Snehota 1990, p.36). The market in itself is viewed as *"a place or device enabling people to negotiate exchanges"* (Alchian & Allen, 1994, p.63), but, according to Snehota, it *"is then usually given the meaning of a 'device' that has certain characteristics; the salient characteristic of the market being the use of the price mechanism for contracting the exchange between independent buyers and sellers"* (1990, p.92). Put differently, the market is viewed as something that is exogenous to market exchange. In Snehota's words, the market is *"something an agent is facing but is not part of; one sells to a market, one adapts to a market. Markets exist to facilitate the exchange but they exist and function independently of the agents"* (1990, pp.92-93). This is coherent with Loasby's view on the concepts of exchange and markets. This author claims that confusing *"markets with exchange is a category mistake; it is a confusion of institutions and activities"* (1999, p.107).

How is a market defined? In many cases, *"markets tend to be /.../ defined departing from categories of products exchanged (objects of exchange) or from production technologies that /accommodate/ a set of actors. Such a way of defining markets contrasts neatly with the conclusions reached about the point of anchorage being actors rather than products or technologies"* (Snehota 1990, p.128). A market is thus, traditionally, a group of companies producing the same products for the same type of customers.

The economic theory of the firm has been criticised in recent years, mainly based on three lines of attack. Firstly, firms are said to be too complex to act in a rational way: *"Because firms are composed of many individuals and departments that cannot easily coordinate their activities, information is hard to obtain and aggregate; firms, moreover, face uncertain environments about which they can predict relatively little"* (Zukin & DiMaggio 1990, p.6). Secondly, there is a problem with control: *"the people who work in firms have so many diverse motivations that they cannot be guided toward a single coherent goal"* (ibid.). Thirdly, *"all firms are not equally constrained by economic discipline. If the economy generates large oligopolies that, within broad bounds, are invulnerable to market competition, such firms can get away with a great deal of submaximizing behaviour"* (ibid.). There are other perspectives that try to address this critique, one of which will be presented in the next section.

Networks

Many marketing theories and models are, openly or covertly, based on assumptions about market exchange that are derived from neoclassical economics. Numerous studies, however, show that these assumptions cannot be validated. Or, differently put: *"there is a definite clash between how the nature of transactions is depicted in economic theory, which is central to the state of the art of marketing, and how it presents itself in empirical observations of contemporary marketing"* (Håkansson, Harrison & Waluszewski 2004, p.7). According to Zukin and DiMaggio, *"it is not very difficult to identify the failures*

of neoclassical tradition. A greater challenge is to develop an alternative scenario, one in which economic institutions are thoroughly integrated with social relations" (1990, p.14).

According to Easton, "defining a paradigm is often helped by making clear what it is not. The industrial network approach has used traditional, and not so traditional economics, as stalking horses. In particular the notions of pure competition with atomistic and unconnected firms striking individual and instant deals with one another, in the face of competitors doing the same thing, is rejected" (in Axelsson and Easton 1992, p.6). Zukin and DiMaggio state that "the social embeddedness of economic action leads to numerous outcomes that neoclassical models would not anticipate. Networks serve as templates that channel market exchange; and they facilitate collective action both within and outside market contexts" (1990, p.20). According to Snehota, however, whether a market can be defined as a network ("markets-as-networks") "depends essentially on the characteristics of the market exchange relationships and on the impact they have on the behaviour of market actors" (1990, p.124).

According to Axelsson and Easton, "a network is a model or metaphor which describes a number, usually a large number, of entities, which are connected" (1992, p.xiv). "In the case of industrial /.../ networks, the entities are actors involved in the economic processes which convert resources to finished goods and services for consumption by end users whether they be individuals or organisations" (loc. cit.). A commonly used model within the industrial network approach is the ARA-model. ARA stands for activities, resources and actors, and these have been the main components of analysis in many studies (see e.g. Håkansson 1987; Lundgren 1995). The ARA model has later been developed to include an analysis of the three components on different levels, i.e. company-, relationship-, and network level (see Håkansson & Snehota 1995). As a further development researchers have focused on one of the three components⁷ or studied these three components in relation to another concept⁸. The focus of this paper will be mainly on the actor level, in relation to different perceptions of the market.

Developing a Model of Analysis

As mentioned earlier, most of CERN's funding comes from its 20 member states, which means that political considerations become important, since it in the end comes down to spending tax payers' money. Political arguments are thus used to promote CERN, both from CERN towards its member states, and within the member states to justify the spending. One such argument is the emergence of spin-off effects, or spin-off products, from the research. CERN has always, to a smaller or larger extent, needed industry to produce different kinds of instruments for the physics research. In some cases, these contacts have resulted in new products, new production methods or other kinds of new knowledge for the involved company. In other cases, the actual instrument produced can later be used in industry, or in other organisations, and in this way benefit society (a common example is small particle accelerators used in hospitals). As member states become more restrictive with money, however, CERN's need for industry also increases. Instrumentation has to be produced outside CERN, by companies who are experts within their respective fields. Based on specifics behind the funding of CERN, it becomes important for member states (and thus their tax payers) to be perceived to "get something out" of being part of CERN. Theoretically, this means that the market model, rather than the network model, will be favoured: concepts like fair returns etc. have been introduced at CERN in the last ten years.

It is important to clarify, that the focus is not on what markets **are**, but on how they are **perceived**. The paper is based on the belief that there are no "ready markets" "out there" that can be studied objectively. Therefore it becomes interesting to discuss different actors' perceptions. In this case, the units of analysis will be politics, business and research. These units of analysis do not represent specific groups of actors *per se*: governments and governmental organisations will of course act politically in some ways, but so will other actors like companies, for instance. It is thus the acts in specific situations that will decide whether an actor, in a specific moment, will be classed as belonging to the political-, to the business-, or to the research unit of analysis. Nevertheless, the actors that have

⁷ For studies of activities, see e.g. Dubois (1994). For studies of resources, see e.g. Waluszewski (1989), Wedin (2001), Holmen (2001), Baraldi (2003). For studies of actors, see e.g. Snehota (1990).

⁸ See for instance Bengtson (2003) for a study on the concept context in relation to activities, resources and actors.

been studied are governmental organisations, companies, universities and research facilities. These actors' influence on scientific markets, and marketing of science, will be studied. One of the questions to answer is then what roles do these actors play in a market situation, and what roles do they play in a network situation? In order to be able to discuss this however, we first have to clarify what roles research, politics and business play in the market situation, and what roles they play in the network situation.

The Market Situation

In the market situation, research can be seen as a linear process, starting from (basic) research in universities and similar institutions, moving on to technological development and commercialisation in companies. Research is also something that is done within each unit, without any real interaction between companies, or between companies and research institutions.

In neo-classical economics, the state plays an important role in many aspects. State regulations etc. are always exogenous to the market, however, so they therefore put a pressure on the market from the outside. Since companies in the market are fairly homogenous, political regulations will affect all companies equally. Also, only the government, or governmental institution, can affect the market politically. A single company cannot affect the market, and thus cannot have a political impact.

Since the market, according to Loasby (1999), can be seen as an institution to organise a specific set of activities, namely exchange, the identity of the different companies has little or no value. The market is in place to guarantee to actors that they can purchase what they want, and need, without having to know the other actors in the market. Thus, there is no need for relationships between the companies, and interaction is limited to single business events. This also means that history becomes unimportant.

To summarise, in the market situation:

- Research is perceived as linear
- Politics is seen as exogenous
- Business is considered to be without history, without identity

The Network Situation

In the network situation, research, like any other activity is a result of interaction. No research facility is an isolated unit, just like no company is an isolated unit (cf. Håkansson & Snehota 1989). Research takes place in many places and on several levels, and innovation does not always start in a research unit. Instead, there is constant interaction between universities, companies and other organisations in society, and through this constant interaction ideas and knowledge are spread, and innovation and technological development occur. It is also important to point out, that research in one area may not lead to development in the same area, but may result in new product in completely different areas.

When it comes to politics, it is all part of the network. Governments, governmental organisations and other policy makers cannot be singled out – as long as they are affecting the network, they are part of the network. According to Laumann et al., *“state policies are the products of complex interactions among governmental and non-governmental organizations, each seeking to influence the collectively binding decisions arising from policy making events that have consequences for their interests”* (1991, p.63). It is important to point out, however, that non-governmental organisations in this case will also include companies, as well as universities, since they also influence the politics aspect of the network.

In an industrial network, companies are perceived to develop and maintain (long-term) relationships. According to Johanson and Mattsson, *“such relationships take time and efforts to establish and develop, which constrains the firms' possibilities to change counterparts”* (1987, p.35). The exchange activities in the market are replaced by repeat interaction developing into relationships. It also follows, that *“if strong relationships exist among buyers and sellers then the facile switching among easily available alternatives which is assumed in economic analysis no longer applies. History becomes important. Inertia is introduced into the system and the rules of optimum resource allocation fail as relational constraints start to bite and motives other than short term profit maximisation begin to dominate”* (Easton, in Axelsson and Easton 1992, p.6).

To summarise, in the network situation:

- Research is perceived as interactive, non-linear
- Politics is seen as part of the network
- Business is considered dependent on history

The text in the sections above can be summed up in a table to give a more concise picture of what theoretical concepts are important for this paper (see table 1 below).

Table 1

	Market	Network
Research	Linear	Interactive, non-linear
Politics	Exogenous	Part of the network
Business	Without history, without identity	Dependent on history, distinct identities

We will now move on to a discussion about how these different perceptions of the environment affect what actions are considered possible and/or desirable.

Discussion

The way the environment is perceived greatly affects the views of what can be done. If we start with the research aspect, a market oriented view will result in a belief in research as a linear process. The postulate of the linear model is quite simple: If the universities perform large quantities of high quality basic research within relevant areas, the other actors in the innovation system will be able to use the discoveries for inventions and innovations. This way of looking at things is based on a view on the research chain as going down a one-way street (Sandström, Heyman & Hällsten 2004, p.9). In his defence of basic science, Llwellyn Smith also comments on the linear model: *“Misunderstandings also arise from the frequent assumption that advocates of the utility of basic science subscribe to the so-called “linear model” according to which basic research is supposed to lead to applied research, which in turn leads to industrial development and then to products. While there are many cases in which this has happened, it is also easy to find examples of advances in technology which have led to advances in basic science”* (Llwellyn Smith 1997). The author continues with a description of science which could be described as network-based: *“So the connection of science and technology is **neither linear nor anti-linear**, but in fact highly non-linear, and it has been claimed that “historical study of successful modern research has repeatedly shown that the interplay between initially unrelated basic knowledge, technology and products is so intense that, far from being separate and distinct, they are all portions of a single, tightly woven fabric”* (ibid.).

Another aspect of linearity vs. interaction is the view on spin offs. If we take a market perspective, spin-offs are seen as coming from research going to industry, but this is not always the case. Think again about the quote in the beginning of the text, when it was stated that “CERN needs industry, but industry does not need CERN”. According to Llwellyn Smith, *“When justifying particle physics, it is tempting to invoke spin-offs, such as the World Wide Web which was invented at CERN.../, but in my opinion they provide a secondary argument and the contribution to knowledge should be put first. In my opinion the general public generally finds the cultural argument at least, if not more, convincing than spin-offs, and it is dangerous to base arguments on examples of spin-off which may not stand up to careful analysis”* (1997). In reality, there may be as many, if not more, spin-offs going from industry to CERN.

Being a joint effort between a large number of member states, the official rules of CERN have to be seen to be fair to all of them. This means, that even though different people at CERN have different views of “how the world works”, the rules are based on a traditional market view. Based on the purchasing procedures, there is a focus on competitiveness, and all companies that fulfil the technical requirements are seen as “equally good”. There is thus no focus on history, nor on identity, within the purchasing system, and perhaps this would be difficult to change. But, as was pointed out in several interviews, this is a large problem for the technical staff at CERN, and it is believed to, in some cases,

cause lower quality and increased costs: “even if you have found the perfect partner, you are not allowed to keep him. Or her”.

When it comes to the political side of things at CERN, this is the only aspect, or group of actors, that seem to be perceived by everybody as part of the network. Admittedly, by some people politicians are considered an exogenous force when it comes to the purchasing procedures, but on the whole there has been no evidence of a market perspective.

Although this is only a first attempt at elaborating on these ideas and concepts, it becomes obvious almost immediately that people have different perceptions of what the environment looks like and how it works. From a theoretical perspective we can choose to give these perceptions names like “markets” and “networks”. The interesting thing, however, is how these perceptions affect what is done, maybe just through what is considered possible to do. A second step in the life of this paper would therefore be to further develop both the empirical and the theoretical part of the paper, in order to achieve a more stringent analysis.

References

Alchian & Allen, (1994),

Axelsson, B. & Easton, G., (eds.), (1992), *Industrial Networks – A New View of Reality*, London: Routledge.

Bengtson, A. & Åberg, S., (2002), “On Particle Accelerators and Timber-Houses – How Network Dependencies Condition the Transfer of Technological Knowledge”, in *Sinergie*, 58/2002, pp.137-156, Verona: CUEIM.

Bengtson, A., (2003), *Framing Technological Development in a Concrete Context*, Doctoral Dissertation no. 99, Department of Business Studies, Uppsala University.

Bressan, B., (2004), *A Study of the Research and Development Benefits to Society Resulting from an International Research Centre – CERN*, Doctoral Dissertation, Report Series in Physics HU-P-D112, Department of Physical Sciences, University of Helsinki.

Dubois, A. & Gadde, L-E., (2002), “Systematic Combining: An Abductive Approach to Case Research”, *Journal of Business Research*, Vol. 55, pp.553-560.

Ford, D., (ed.), (1998), *Managing Business Relationships*, London: Wiley.

Hadenius, A., (1972), *Sweden and CERN II – The Swedish Research Policy Debate*, The Committee on Research Economics (FEK), Stockholm, Report 3, Lund: NFR, Editorial Service.

Helgesson, C-F., Kjellberg, H. & Liljenberg, A., (eds.), (2004), *Den där marknaden*, Lund: Studentlitteratur.

History of CERN vol. I, Hermann, A. et al, (1987), Amsterdam: North-Holland.

History of CERN vol. II, Hermann, A. et al, (1990), Amsterdam: North-Holland.

History of CERN vol. III, Krige, J. (ed.), (1996), Amsterdam: North-Holland.

Holmen, E., (2001), *Notes on a Conceptualisation of resource-Related Embeddedness of Interorganisational Product Development*, Doctoral thesis, University of Southern Denmark, Sønderborg.

Håkansson, H. (ed.), (1987), *Industrial Technological Development. A Network Approach*, London, UK: Croom Helm.

Håkansson, H., (1989), *Corporate Technological Behaviour – Co-operation and Networks*, London: Routledge.

- Håkansson, H., Harrison, D. & Waluszewski, A., (2004), *Rethinking Marketing: Developing a New Understanding of Markets*, Chichester: John Wiley & Sons Ltd.
- Håkansson, H. & Snehota, I., (1989), "No Business is an Island. The Network Concept of Business Strategy", *Scandinavian Journal of Management*, 5(3), pp. 187-200.
- Håkansson, H. & Snehota, I., (eds.), (1995), *Developing Relationships in Business Networks*, London: Routledge.
- Håkansson, H. & Waluszewski, A., (2002), *Managing Technological Development: IKEA, the environment and technology*, London: Routledge.
- Infinitely CERN – Memories of fifty years of research*, (2004), Geneva: CERN and Editions Suzanne Hurter.
- Johanson, J. & Mattsson, L-G., (1987), "Interorganizational Relations in Industrial Systems: A Network Approach Compared to the Transaction-Cost Approach", *International Studies of Management & Organization*, Vol. 17, No. 1, pp. 34-48.
- Johanson, M., (2001), *Searching the Known, Discovering the Unknown. The Russian Transition from Plan to Market as Network Change Processes*, Doctoral Dissertation no. 89, Department of Business Studies, Uppsala University.
- Jungk, R., (1969), *The Big Machine*, London: Andre Deutsch.
- Krige, J., (1990), "Scientists as Policymakers: British Physicists' "Advice" to Their Government on Membership of CERN (1951-1952)", in Frängsmyr, T. (ed.), *Solomon's House Revisited: The Organization and Institutionalization of Science*, Nobel Symposium 75, USA: Science History Publications.
- Krige, J., (1993), "The Public Image of CERN", in Durant, J. and Gregory, J. (eds.), 1993, *Science and Culture in Europe*, London: Science Museum, pp. 153-157.
- Krige, J., (2000), Paper about CERN presented at KTH in March 2000.
- Krige, J. & Pestre, D., (eds.), (1997), *Science in the Twentieth Century*, Amsterdam: Harwood Academic Publishers.
- Laumann et al, (1991), "Organizations in Political Action: Representing Interests in National Policy Making", in Marin, B. & Mayntz, R. (Eds.), (1991), *Policy Networks: empirical evidence and theoretical considerations*, Frankfurt am Main: Campus Verlag, pp. 63-95.
- Loasby, B., (1999), *Knowledge, Institutions and Evolution in Economics*, New York: Routledge.
- Lundgren, A., (1995), *Technological Innovation and Network Evolution*, London: Routledge
- Nyberg, S. & Zetterberg, K., (1977), *Sweden and CERN I – the decision-making process, 1949-1964*, The Committee on Research Economics (FEK), Stockholm, Report 9, London, UK: NFR, Editorial Service.
- Parkin, M., (1992), *Economics*, Workingham: Addison-Wesley.
- Powell, W. W., (1990), "Neither Market nor Hierarchy: Network Forms of Organization", *Research in Organizational Behavior*, Vol. 12, pp. 295-336.
- Ragin, C., (1994), *Constructing Social Research: the unity and diversity of method*, Thousand Oaks: Pine Forge Press.

Ragin, C. & Becker, S., (1992), *What is a Case? Exploring the Foundations of Social Inquiry*, New York: Cambridge University Press.

Sandström, U., Heyman, U. & Hällsten, M., (2004), *Svensk forskningsfinansiering: inriktning och styrning*, Stockholm: Vetenskapsrådet.

Snehota, I., (1990), *Notes on a Theory of Business Enterprise*, Doctoral thesis, Uppsala University, Department of Business Studies.

Waluszewski, A., (1989), *Framväxten av en ny mekanisk massateknik*, Uppsala: Acta no. 31.

Wedin, T., (2001), *Networks and Demand. The Use of Electricity in an Industrial Process*, Doctoral Thesis no. 83, Department of Business Studies, Uppsala University.

Widmalm, S., (1993), "Big Science in a Small Country – Sweden and CERN II", in Lindqvist, (ed.), *Center on the Periphery*, USA: Science History Publications.

Zukin, S. & DiMaggio, P.J., (eds.), (1990), *Structures of Capital: The Social Organisation of the Economy*, Cambridge: Cambridge University Press.

CERN Documents

Annual Reports

-- *First Annual Report of the European Organization for Nuclear Research, 1955*

-- *European Organization for Nuclear Research, Second Annual Report, 1956*

Autio, E., Bianchi-Streit, M. and, Hameri, A., (2003), *Technology Transfer and Technological Learning through CERN's Procurement Activity*, CERN, 2003-005, Geneva: CERN.

Basic Science and Technology Transfer: Means and Methods in the CERN Environment, Workshop Records, Geneva 28-29 November 1997.

Bianchi-Streit, M. et al, (1984), *Economic Utility Resulting from CERN Contracts (Second Study)*, CERN yellow report 84-14, Geneva: CERN.

Llewellyn Smith, C.H., (1997), "What's the Use of Basic Science?", paper based on a colloquium given at CERN on June 12 1997, from http://www.cern.ch/Public/bs_1.html 2000-01-03.

Meeting on Technology arising from High-Energy Physics, 1974, CERN yellow report 74-9, Geneva: CERN.

Peter, M., (1974), "Closing Remarks", *Meeting on Technology arising from High-Energy Physics*, 1974, CERN yellow report 74-9, p. 167, Geneva: CERN.

Purchasing Procedures at CERN, CERN document.

Schmied, H., (1975), *A Study of Economic Utility Resulting from CERN Contracts*, CERN yellow report 75-5, Geneva: CERN.

Technology Transfer Policy at CERN, CERN document.

Zilverschoon, C. J., (1974), "Some Aspects of the Realization of High-Energy Projects in CERN", *Meeting on Technology arising from High-Energy Physics*, CERN yellow report 74-9, pp. 27-33, Geneva: CERN.