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IMPACTS OF INNOVATION POLICY

LESSONS FROM VINNOVA´s IMPACT STUDIES

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VINNOVA develops Sweden´s innovation capacity for sustainable growth

VINNOVA is Sweden's innovation agency and our aim is to increase the competitiveness of Swedish researchers and companies.

Our task is to promote sustainable growth in Sweden by funding needs-driven research and the development of effective innovation systems. To this end, we have 220 million euro to invest in new and ongoing projects each year.

An important part of VINNOVA´s activities consists of increasing the cooperation between companies, universities, research institutes and other organisations in the Swedish innovation system. We do this in a number of ways, including long-term investment in strong research and innovation milieus, investment in projects to increase commercialisation of research results and by creating catalytic meeting places in the form of conferences and seminars.

VINNOVA is a Swedish government agency under the Ministry of Enterprise, Energy and Communications and the national contact agency for the EU Framework Programme for R&D. Some 200 people work at VINNOVA´s offices in Stockholm and Brussels. VINNOVA was established in January 2001.

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Impacts of Innovation Policy

Lessons from VINNOVA´s impact studies

by

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&
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VINNOVA

Preface

VINNOVA's impact studies describe and provide an understanding of the broader, long-term effects of public investments in research and development.

This report aims to synthesise lessons learned from 13 impact studies held during the period 2003-2010. It does so by comparing the studies' conclusions and focusing on how we contributed to the effects shown.

The synthesis was conducted by Staffan Håkansson and Lennart Elg from VINNOVA's Department of Operational Development. The conclusions have been tested in a number of internal and external workshops.

VINNOVA in February 2012

Charlotte Brogren
Director General

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Deputy Director General
Head of Operational Development Division

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Summary: Lessons learned

VINNOVA and its forerunners have made a difference, chiefly in two ways:

- We have played a role in identifying and defining new needs-driven fields of research, in dialogue with stakeholders. This is a role which neither peer review nor industry-led consortia can fulfil on their own.
- In the later stages we have also been able to expand promising areas through active collaboration programmes between companies and universities. Calls for proposals in open competition have been an important profile factor, with Triple Helix involvement in the planning and implementation.

Combining both roles requires a mix of “bottom-up” projects, to identify potential new areas of interest and programme efforts, to scale up promising areas.

Our impact studies show that we consistently underestimate how long it takes for new knowledge to provide tangible economic impact. Lead times of 10-20 years are not unusual before effects can be traced at the socioeconomic level. The key results of our efforts have been competence development and organisational learning in new knowledge areas. The impact of these efforts has been to develop the capability of the innovation system – rather than individual innovations.

It is not always the size of investments which matters most but the choice of areas and how research is organised, alongside business and public actors.

New businesses play an important role in industry dynamics, as experimental workshops for new business ideas and for testing different ways of exploiting new technological opportunities. The policy rationale for supporting new knowledge and technology-based companies is providing more experiments for the market to evaluate.

It is important to understand the differences between different areas and see VINNOVA’s role in a larger context. What VINNOVA sees as a “project” is almost always part of larger R&D processes within companies and at universities. This has implications for how we regard the objects of VINNOVA’s support but, at the same time, makes it hard to distinguish the effects of individual support measures.

Each effort is unique in terms of research field, market environment, stakeholders etc. For this reason, it is important to build flexibility into our approach, but linked to a clear vision of the direction we want to take. Flexibility over time is also important; the study shows that successful programmes have been developed along the way. Programmes also need to adapt to changing conditions which means VINNOVA must be ready to rethink things and learn lessons.

Flexibility needs to be combined with continuity: Long-term programmes have produced lasting changes in the knowledge strategies and collaborative relationships of both companies and universities and thus advanced the innovative capacity of the system.

Urgent social needs are not enough to bring new knowledge and new technology into use, unless market demand already exists or can be generated through policy changes.

Over time, we can see three main themes in the development towards what is now VINNOVA:

- To develop the competence base for Swedish industry.
- To ensure that new knowledge is actually put to use.
- To build a competence base for Sweden's participation in EU Framework Programmes.

In learning from these experiences, we must also be aware that conditions have changed in important ways: VINNOVA's share of R&D technology funding is more limited today. New actors have emerged at national and regional levels, and the EU Framework Programmes has developed into an important source of funding for research at Swedish universities. We must increasingly cooperate with others to advance the innovative capacity of the system, carving out our own role in this context. Furthermore, business R&D investments in Sweden now take place in global value chains, and for each new investment decision, localisation is evaluated in international competition.

1 Impact Studies - a source of learning

Long-term impact studies have been part of VINNOVA's performance reporting since 2003. Up to March 2011, 13 impact studies were delivered to the Swedish government. These studies complement, but do not replace, the monitoring and evaluations which are a normal part of VINNOVA's programme management[1].

Impact studies are conducted by external experts on VINNOVA's behalf. Commenting meaningfully on long-term impacts requires extensive work; about one person-year per study on average.

Because a long-term perspective is needed, the studies also cover VINNOVA's forerunners going back more than 20 years and the efforts of other actors in the studied areas[2]. However, the choice of studies focuses on activities which are still within VINNOVA's remit.

The purpose of these studies was to demonstrate *what* impacts public support yielded on the research system and for industry and society. Jointly, they also provide an opportunity to reflect on *how* the support could play a role and what future activities can learn from this. VINNOVA initiated such an analysis in 2010 as part of a strategic review.

This analysis aimed to see what could be learned as to the kind of impacts we might expect from supporting needs-driven R&D and how these impacts were influenced by the way support was provided. A number of the studies have also attempted to quantify the economic impact; we can also learn some lessons from these.

1.1 VINNOVA's task

VINNOVA is a government agency under the Ministry of Enterprise, Energy and Communications whose main task is innovation policy. VINNOVA's mission is stated in its instructions (SFS 2009:1101).

[1] VINNOVA Analys VA 2007:14 VINNOVAs fokus på effekter. En samlad ansats för effektlogikprövning, uppföljning, utvärdering och effektanalys (VINNOVA Analysis VA 2008:01 *VINNOVA's focus on impacts. A comprehensive strategy for impact logic assessment, monitoring, evaluation and impact assessment*).
[2] VINNOVA was formed in 2001 through a merger of the technology division of NUTEK (the Swedish Agency for Industrial and Technical Development) with the Swedish Agency for Transport Research and part of the Agency for Work Organisation. NUTEK, in its turn, was the result of a merger of STU, the Swedish National Board for Technical Development (1968-1991), with the Swedish Industry Board and the Swedish Energy Agency.

> *The Agency for Innovation Systems shall promote sustainable growth by funding needs-driven research and the development of effective innovation systems. The Agency has a special responsibility in the field of technology, as well as transport, communications and work organisation. Innovation systems are networks of public and private actors where new technologies and knowledge are produced, disseminated and used.*

Thus VINNOVA's research and innovation programmes are justified by their anticipated ability to contribute to sustainable growth. VINNOVA's activities have three main themes:

- Human resource development in industry-relevant areas.
- Developing public/private collaboration in innovation.
- Business experiments to test and introduce new technology.

The focus of these activities is on creating greater synergies between the public and private actors involved in various innovation systems, rather than on subsidising individual innovation projects. Most programmes include active cooperation between enterprises and universities and/or public research institutes. Many also involve other public actors, particularly in the transport sector. However, representatives of many other sectors of society are also involved in the programmes. The degree of co-financing with other actors varies depending on the nature of each programme.

Historically, long-term knowledge development with universities as principal actors has played a key role. This role has been narrowed by structural changes in the public support system (see Section 3.1), but remains an important task.

New businesses play an important role in industry dynamics, as experimental workshops for new business ideas that do not fit existing companies' portfolios and for testing opportunities for using new technological opportunities. Even so, start-ups based on unproven technology are difficult to evaluate for private investors; most countries provide some form of public support for such companies.

A distinctive feature is the broad range of collaborations and timescales. VINNOVA's portfolio includes VINN Excellence Centres, a programme funded jointly by VINNOVA, a group of companies and universities. Its focus is on combining high-quality academic research of industrial relevance and with a duration of up to 10 years. It also incorporates Research & Grow, which focuses on investment in early-stage innovation projects in small and medium enterprises with explicit commercial aims.

A changing policy landscape

A difficulty in learning from efforts which may have originated over 20 years back is that the policy context has changed over time. Around 1990, the then STU accounted for more than 50% of external research funding of technical faculties. For VINNOVA

today the corresponding proportion is 10.3%. A number of new funding agencies have come on the scene: Foundations, EU Framework Programmes and others. These developments are described in more detail in Chapter 3 below.

1.2 Funding reasons

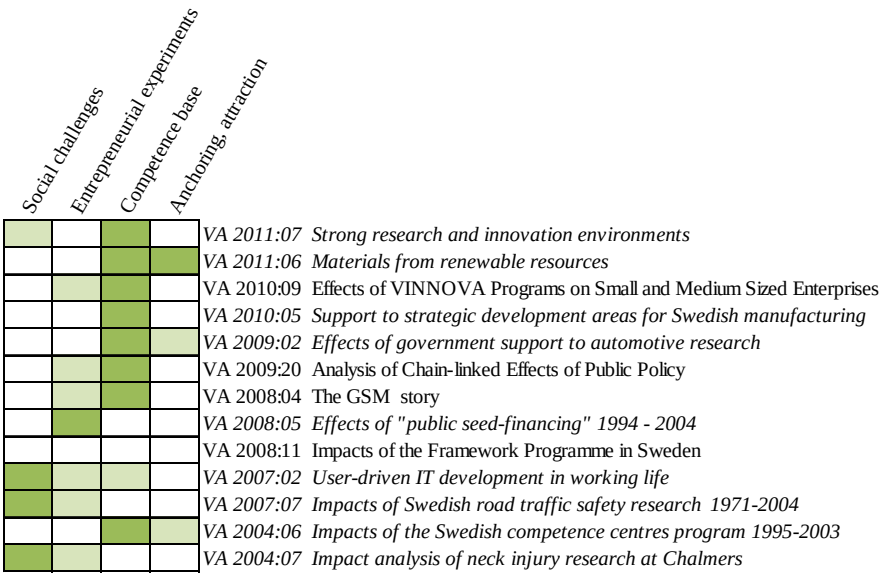
Our review of impact studies shows that a variety of reasons are given for the investments. There is not always a simple relationship between the initial rationale and the actual effects observed afterwards.

For VINNOVA and its forerunners the main task has been to strengthen the economy's long-term competitiveness. However the mission also includes supporting other social goals, most notably in the transport sector. The role involves both building competence in relevant areas and ensuring such competence can actually be put to use.

Since the early 1990s, the globalisation of business has brought a shift in the role of the competence base, from providing obviously "Swedish" companies with the competences they need, to strengthening Sweden's attractiveness as a base for investments (see section 2.1.3 below).

However, it is rarely possible to attribute the results to just one of the reasons and the main results may not always correspond to the original reasons for the investment. In User-driven Development of IT in Working Life for example, the starting point was combining the social and economic policy roles. The aim was to develop local production of IT systems that were particularly user-friendly, given Sweden's traditions of labour relations. This aim was only slightly fulfilled. Instead, largely due to the interdisciplinary approach of the programme, the enduring value of the investment was competence based on IT usage.

Figure 1 Main reasons for the studied programmes



2 Lessons from the impact studies

2.1 Competence the primary output

Both the impact studies analysed and other research[3] show that the contribution of research to business development is much broader than initiating new product ideas or new technology-based companies.

Rather, the main impacts on businesses are: helping them to develop capability in new areas by recruiting staff with relevant research backgrounds; accessing research networks and thus an overview of what is happening in developing knowledge field, etc. Another way of putting that is that the primary function of government support was developing the capacity for innovation, not subsidising individual innovations.

Companies' incentives to cooperate with universities can be illustrated by the reasons companies give for participating in EU Framework Programmes:

Companies´reason for Framework prticipation

- ✓ Knowledge development
- ✓ Building networks – with other companies and with university researchers
- ✓ Learning experience for young industry research staff
- ✓ Impact on standards (esp. In ICT)

VINNOVA Analysis VA 2008:11 *Impacts of the Framework Programme in Sweden*

Companies' reasons for cooperating are not only to support existing operations but also to gain a better basis for strategic decisions as to new areas in which individual companies need to accumulate knowledge – uncertainty reduction.

> *"One of Ericsson's success factors has been an ability to clearly separate research from development and organise these areas in different ways. Scientific research provides knowledge and uncertainty reduction, not products and processes. "*
>
> VINNOVA Analysis VA 2008:04 *The GSM Story*

For university researchers, the partnership provides a better understanding of the key issues for businesses and the context in which knowledge can be used.

For example, the impact study of automotive research4 indicates that a succession of automotive research programmes led to an expansion of application-oriented research

[3] Cf. Jacobsson & Perez (2010), Martin & Tang (2007), Salter et al (2000), Broström (2009).
[4] VINNOVA VA 2009:02 Effekter av statligt stöd till fordonsforskning (*Effects of government support on automotive research*).

in the areas of safety, environment and quality. The focus was applications and problem-solving whilst maintaining academic production and quality. These programmes have enabled research environments to build critical mass as a basis for European participation and the research groups have become a partner of interest to foreign vehicle manufacturers. Cooperation with companies has also affected undergraduate course content, contributed practical examples and a sense of reality as well as a theme for master's theses.

At the same time, the study highlights how the heavy dependence by automotive research on strongly industrial external financing carries the risk of focusing research too narrowly on today's needs.

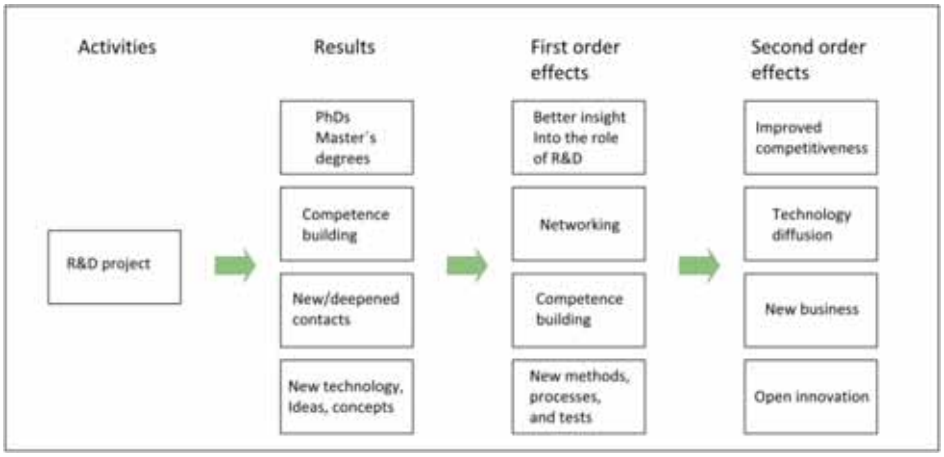
The study of the impact of public research on the development of the mobile telephone industry in Sweden5 suggests that expertise in radio communications, built up through a series of programmes, was central to Ericsson's ability to rapidly acquire a leading position as a systems supplier. Even so, the study notes that no single product concept has derived from university research.

> *" Digital mobile telephony did not happen because someone did some research and realised they could build a GSM handset with the results. It happened because organisations understood that digital technology was the key to mass mobile telephony and set about solving problems in order to get there. Some of those problems were solved via R&D. "*
> VINNOVA Analysis VA 2008:04 *The GSM Story*

An impact study of support for strategic development areas in the Swedish manufacturing industry also emphasises competence development as a first-order effect:

[5] VINNOVA VA 2008:04 The GSM Story.

Figure 2 Generalised impact logic: Strategic development areas for Swedish manufacturing[6]



The need to develop corporate capability through collaboration in public R&D programmes is not limited to the largest firms. Approximately 300 (30%) of the companies which participated in the Competence Centre Programme (later VINN EX) were smaller firms; primarily small high-tech companies, but also more established companies which felt the need to improve their adoption and use of technology.

2.1.1 Defining new competence fields

Structured partnerships with formal commitments from companies and universities have proved effective in building skills in new areas where industry can see future needs. At the same time, such requirements for formal commitment could create barriers to knowledge development in areas where the need is not yet obvious.

A key role of VINNOVA's forerunners seems to have been contributing to the early identification and definition of new areas of knowledge which may become important to business and society. If this has been an important function, then a pertinent question for the future is how this need for renewal can be fulfilled now and in future, given that funding is currently divided between several actors with separate agendas. This is discussed further in Section 4.2.

[6] VINNOVA Analys VA 2010:05 Effektanalys av stöd till strategiska utvecklingsområden för svensk tillverkningsindustri *(Support to strategic development areas for Swedish manufacturing).*

2.1.2 Examples of new competence fields

Microelectronics

Sweden was late in realising the new opportunities afforded by micro-electronics. STU played an important role in building microelectronics competence at universities[7], at a time when universities were slow to take this new field on board. STU's ability to act was limited by a lack of industry support, partly because industry itself did not yet see the need and partly due to a general mistrust of "active industrial policy". STU's contribution was mainly in providing a basis for expanding education within the field rather than in specific research results.

Road traffic safety

Research into road traffic safety89 has played a significant role in reducing fatalities and injuries in traffic. Meanwhile, the fundamental understanding of failure mechanisms made it possible for Volvo Cars, Saab Automobile and Autoliv to develop competitive products and brand themselves with safety.

The far-reaching research has enabled the development of a systems approach to traffic safety. This broad scope has been a more important success factor than excellence in any specific research field. The ability to interact across the whole range from basic research to technological development has also been important.

The broad expertise and systems approach has also given Sweden a strong role in the EU's work on traffic safety issues.

Digital radio communications

The GSM study[10] indicates that strong interactions between visionary technologists, in particular at Svenska Radioaktiebolaget (SRA)[11], a group of university researchers and STU was instrumental in building capability in radio communications. The research was initiated at a time when the radio communications field was deemed "mature" in the mainstream of academic research. Neither was this a primary interest for Ericsson, whose focus at that time was on becoming a player in the personal computer industry. Competence development in digital radio communications might therefore have been blocked by academic "peer review" as well as early demands for a formal commitment from Ericsson's top management.

[7] Jacobson, 1997.
[8] VINNOVA Analys VA 2004:07 Effektanalys av nackskadeforskningen vid *Chalmers (Impact analysis of neck injury research at Chalmers).*
[9] VINNOVA Analys VA 2007:07 Effekter av den svenske trafikksikkerhetsforskningen 1971-2004 *(Impacts of Swedish road traffic safety research 1971-2004).*
[10] VINNOVA Analysis VA 2008:04 The GSM Story.
[11] A company focusing on military radio communications, which was acquired by Ericsson in 1982.

Biotechnology

In the first half of the 1980s STU accounted for more than half the biotechnology research funding at universities and played a major role in giving Swedish biotechnology research a good start. Research councils ventured into the field only after the ethics debate around 1995 had subsided[12].

2.1.3 Anchoring and attractiveness

At a time when the major R&D firms were clearly national actors, R&D policy goals could be formulated to provide these companies with the skills they would need for future competitiveness. Today, a greater share of global companies have more flexibility in choosing where to locate R&D. This means research funding and R&D support has become a focus of policy competition between countries and regions, as they seek to remain attractive locations for companies and their R&D activities. A clear example of this is when General Motors pitted Russelsheim against Trollhattan in competition for the production of the next Saab/Opel model. To strengthen Sweden's attractiveness, the government initiated two new R&D support programmes in 2005. One was in production technology, Manufacturing Research Area (MERA) and the other in Vehicle Information and Communication Technology (Victor).

When the Competence Centre programme was initiated in the early 1990s, the focus was on building competence for "Swedish" companies. When its successor VINN Excellence Center was planned, the perspective had partially shifted. Strong research and innovation environments were also seen as an important means of anchoring companies in Sweden. A clear example of how Competence Centres played a role in developing attractiveness for companies is a study of global expertise in catalysis, in which Toyota highlighted the Catalysis Competence Centre[13] at Chalmers as one of the most interesting in the world[14].

2.1.4 Continuity

A long-term perspective is important if interaction is to have a lasting impact on the way companies and universities utilise each other's competences[15]. These are two different cultures which need to become mutually acquainted and build respect for each others' abilities.

The Competence Centres study[16], for example, notes that major progress is seen after 5-8 years. In a longer programme it becomes worthwhile to reassess the programme

[12] Granat et al, 2002.
[13] Responsibility for this centre was transferred to the new Swedish Energy Agency in 1998
[14] Matsumoto, 2000.
[15] VINNOVA Analys VA 2010:05 Effektanalys av stöd till strategiska utvecklingsområden för svensk tillverkningsindustri *(Support for strategic development areas of Swedish manufacturing).*
[16] VINNOVA Analys VA 2004:06 Effekter av det svenska kompetens-centrumprogrammet 1995-2003 (*Impacts of the Swedish competence centres programme 1995-2003*).

approach, based on what has been learned along the way. Longer programmes also help build longer-term, strategic thinking with an explicit focus on competence and human capital development. For example, companies' experience of working in the centres affects their strategies on which competence needs are resolved internally and which issues are deemed to benefit from external collaboration.

2.1.5 Long lead times to economic impact

The economic impact shown by our studies are normally the result of a long sequence of R&D activities. Although some studies took a 20-year perspective, we know that there was often a history going much further back. What is seen as a project or programme from a funding agency's perspective is only part of a larger research agenda for a research group or company, with various parts supported by different policy actors.

To then try and quantify what proportion of earnings is attributable to the various support activities will make little sense. The various interventions are not cumulative; they have played different roles in a historical process. The best measure of policy impact is perhaps companies' continued interest, since our R&D programmes normally require commitment from companies in terms of funding and, more importantly, active participation.

2.2 Entrepreneurial experiments

New technologies are not born fully developed, and no-one can predict exactly where and how they will find applications[17]. Many options need to be tested in order to take full advantage of the opportunities presented by new technology. There must be effective methods for identifying and rewarding successful experiments and actors must have the ability to learn from these experiments and adapt their behaviour[18].

For this reason, new companies play an important role in industry dynamics as experimental workshops. New business ideas which do not fit into existing companies' portfolios can be tested, as can various ways of exploiting new technological opportunities. As demonstrated by ICT and biotechnology, this role is especially important when a new base technology opens up a wide range of new opportunities.

At the same time, the role of such companies experimenting with new and untried things makes it hard for private investors to assess their value. In most countries the government has taken a special role in financing the early stages of their development, as with the US Small Business innovation Research programme for example. One study shows that SBIR serves as a "nursery" where companies qualify for financing

[17] Rosenberg & Birdzell, 1986.
[18] Eliasson, 1993.

from private venture capitalists[19]. About 10 times more companies participate in SBIR programmes than will receive private equity investments. In Sweden, 18 of the 33 companies identified two major business and technology publications as "Sweden's hottest technology companies in 2011", had received support from VINNOVA.

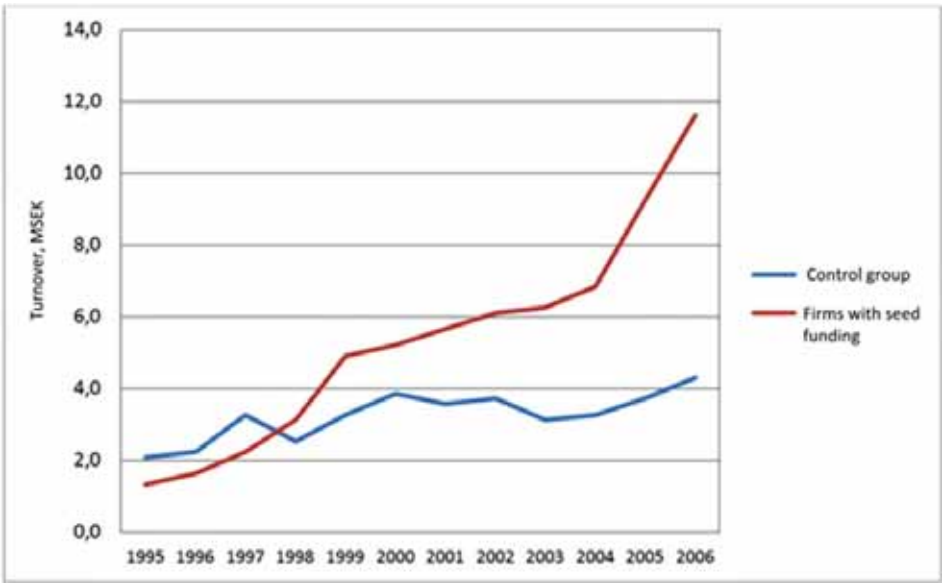
Sweden's 33 hottest technology companies in 2011

Company	Started	Empl.	Turnover 2010 (SEK)	Risk capital (SEK)	VINNOVA funding
Accumulate	2005	15	1 million	25 million	
Actiwave	2007	6	0.1 million	4.4 million	
Algoryx Simulations	2007	16	9 million	0	0.3 million
Applied Nano Surfaces	2008	7	3.4 million	15 million	1.5 million
Atlas Antibodies	2006	15	25.8 million	25 million	
Bambuser	2007	12	0	25 million	1.2 million
Biolamina	2009	5	5 million	0	4.7 million
C3 Technologies	2008	35	118.5 million	56 million	
Coresonic	2004	17	14 million	45 million	1.6 million
Flatfrog Laboratories	2007	35	0	195 million	
Glo	2005	30	0	345.2 million	9.0 million
Hövding	2006	14	0	30 million	0.4 million
Keybroker	2005	45	177 million	63 million	
Lumenradio	2008	10	3.6 million	15 million	
Magnetic Components	2005	9	4 million	17 million	
Malvacom	2009	12	c. 6 million	No info	
Mantex	2004	18	3 million	23.5 million	3.8 million
Mindmancer	2006	13	8.2 million	c. 13 million	
Mosync	2004	30	10 million	c. 18 million	1.8 million
Nanologica	2004	18	3.7 million	23 million	9.8 million
Neo Technology	2007	15	1.5 million	c. 16 million	
Nexam Chemical	2009	8	0.92 million	39 million	1.5 million
Promimic	2004	7	0.5 million	18 million	1.6 million
Redsense Medical	2006	26	4.8 million	No info	0.4 million
Rolling Optics	2005	15	5 million	40 million	4.2 million
Saplo	2008	10	0.2 million	4 million	1.3 million
Scandinavian Energy Efficiency	2006	3	2.7 million	1 million	
Solarus	2006	12	0.6 million	15 million	0.5 million
Spotify	2006	200	No info	No info	
Synthetic MR	2007	5	0.85 million	11 million	
Voddler	2005	33	No info	151 million	
Xbrane Bioscience	2008	4	1.0 million	7.2 million	1.3 million
Yubico	2007	14	9.3 million	No info	1.3 million

[19] Block et al (2009).

An impact study of several different programmes in Sweden for early financing of technology-based companies (so-called seed funding)[20] shows this support had significant additionality. New business platforms have been built and tested, the companies have grown twice as fast as a control group and several companies have reached a significant size. Public support has improved the ability of companies to receive continued funding from private investors and, according to interviews, often had decisive impact.

Figure 3 Impact of seed funding



2.3 Addressing social challenges

In addition to its industrial policy role, VINNOVA has a pronounced societal role in the transport field. However, other areas also show examples of programmes initiated with a clear intention of addressing social challenges.

Since 1970, the risk of traffic fatalities in Sweden has decreased by 80%. According to one of VINNOVA's impact analyses[21], research into road traffic safety (supported by VINNOVA's predecessor) made a major contribution to 17% of the lives saved and played some part in an additional 70%. This research has become a Swedish area of strength with a high proportion of publications and EU funding.

[20] VINNOVA Analys VA 2008:05 Effektanalys av "offentlig såddfinansiering" 1994-2004 *(Impacts of "Public Seed-Financing" 1994-2004).*
[21] VINNOVA Analys VA 2007:07 Effekter av den svenske trafikksikkerhetsforskningen 1971-2004 *(Impacts of Swedish Road Traffic Safety Research 1971-2004).*

At the same time – and this was not a stated objective at the start – the basic understanding of failure mechanisms derived from this research allowed Volvo Cars, Saab Automobile and Autoliv to develop competitive products and use safety as a part of corporate branding. This has not been a one-way process from research to competitiveness, more a mutual learning process in which companies and research have developed together.

The study suggests that the broad scope of research has made it possible to develop a systems approach to road traffic safety, and this breadth has been more important to success than excellence in any specific research field. The ability to interact across the whole range from basic research to technological development has also been important.

2.3.1 Social needs not enough

An urgent social need is not enough to ensure that new knowledge and new technology will be put to use unless market demand evolves, or is created, through policy changes.

The programme User-Driven Development of IT in Working Life[22] shows the importance of taking market conditions into account even in programmes which are not based in this. The programme aimed to take advantage of users' experiences in developing new IT systems, based on the Swedish tradition of collaboration between social partners. The ideal of user participation located the projects close to the "shop floor" of participating companies, with projects obliquely grounded in corporate management. During the programme other factors led to increased outsourcing of corporate IT functions and the implementation of standard business systems developed by major international companies like Microsoft and SAP. This development was partly driven by international mergers and acquisitions and severely limited the scope of locally developed IT systems.

The programme Materials from Renewable Resources[23] has resulted in a number of technically successful projects. It developed materials based on high-functionality, renewable primary products. However, at current oil prices, these cannot compete with petroleum-based materials. The environmental impact has not yet been worked out and whether this can be done in the future depends partly on oil price and/or changes in environmental regulations.

The replacement of a material in a product requires substantial investment in learning how to use the new material, ensuring that performance is acceptable and so on. Even so, it is hard for a new material to compete initially on price as, due to "learning effects", production costs usually decrease sharply with production volume. New

[22] VINNOVA Analys VA 2007:02 Användningsdriven utveckling av IT i arbetslivet *(User-Driven IT Development in Working Life).*
[23] VINNOVA Analys VA 2011:06.. Effektanalys av forskningsprogram inom material från förnyelsebara råvaror *(Materials from Renewable Resources).*

materials/components must be able to offer a unique feature to compensate for the costs of redesign/relearning and a higher initial price. Such a unique feature may be that the policy starts to put a price on environmental impact - or changes in consumer demand.

Although the programme (with some exceptions) has not led to radically new or different products on the market, it has created a knowledge base to help companies meet future requirements. The competence which has been added, often via postgraduate students going into industry, has also helped improve and streamline conventional products and processes. By participating in the programme, for example, Domsjö has learned to systematically monitor the effects of various treatments of materials in the existing production. Domsjö has also contacted the development side of client firms, thereby learning how they think and what material properties they value.

3 A changing policy landscape

Historically, R&D-intensive businesses in Sweden have built their strength largely on long-term partnerships with competent public customers: ASEA (now ABB) and the Swedish Power Transmission Board, Ericsson and Swedish Telecom etc. Nowadays, these key customers have been deregulated and/or privatised and lost their roles as national champions.

One third of current corporate R&D in Sweden is conducted in companies headquartered outside Sweden. The extensive R&D activities which companies still perform in Sweden are part of global value chains and there is no obvious link between the location of R&D and production or employment.

The changing role of the competence base as discussed in Section 2.1.3 (with Sweden's attractiveness in international competition an increasingly important policy objective) means that even industrially relevant publicly-funded research is subject to competition. Instead of being "good enough" to provide Swedish companies with expertise in all areas, we must be among the best in the world in some areas.

3.1 A more diverse policy arena

The activities of the Board for Technical Development (STU, 1968-91) covered all non-military technical R&D from basic research to exploitation, licensing and technology procurement and, in 1990, accounted for about 50% of competitive research funding at technical universities.24 The corresponding proportion for VINNOVA today is 10.3%.

In 1991, responsibility for funding basic engineering research was transferred to the newly established Technical Research Council, which has since grown significantly. When the Foundation for Strategic Research was established in the mid-90s, part of the research funding at what was then NUTEK (especially the materials research consortia and electronics research) was taken over by the Foundation and NUTEK's technology budget reduced by a third. In the mid-90s, responsibility for energy R&D was moved to the newly created National Energy Agency.

The creation of VINNOVA in 2001 meant that transport research and part of working life research was integrated with industry-relevant technological R&D from the former NUTEK Technology. In the mid-00's, VINNOVA's support for research-based start-ups through university-based incubators was spun off to a new organisation. The

[24] Funding from the Communications Research Board and Council for Working Life Research (independent authorities at the time) should be added to this.

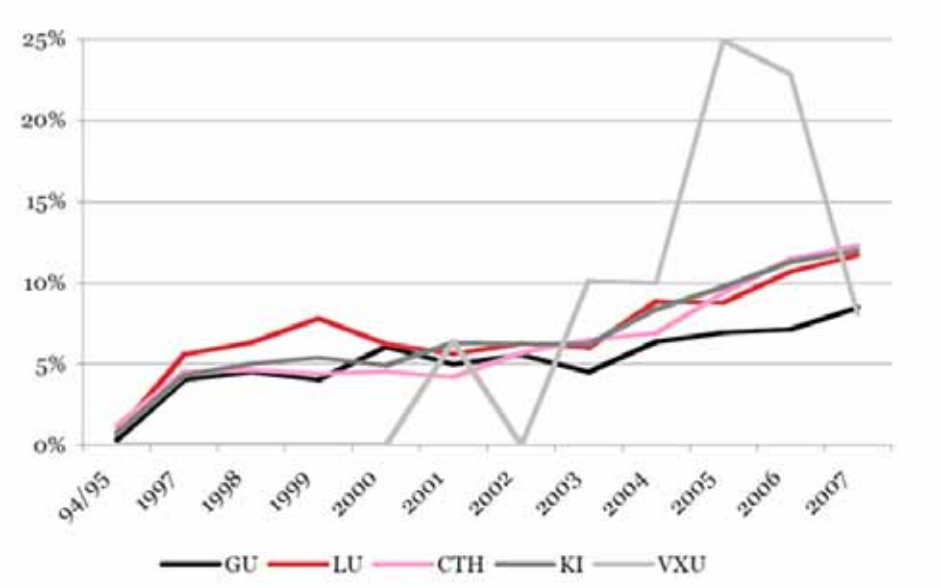
strategic research areas identified in the Research Bill 2009 meant that business relevance became a criterion when targeting increases to universities' basic funding.

In parallel with these changes in the national innovation policy landscape, innovation has become more clearly a part of regional policy, as it develops towards regional innovation policies and more strong regional players have appeared. The EU Structural Funds, and the partnership managing them in Sweden, currently has a significant budget allocated to innovation, including pre-venture capital investments. Several regions have developed stronger collaborative ambitions and at the local level we are seeing municipalities and business associations which have innovation policy ambitions (Business Region Gothenburg, Stockholm Business Region).

3.2 EU Framework Programmes

Since Sweden's accession to the European Union in 1994, the EU Framework Programmes have developed into an important source of funding for research at Swedish universities, currently of the same magnitude as VINNOVA's share of external funding at technical universities.

Figure 4 FP share of competitive funding at some universities



The study of the impacts of Sweden's participation in EU Framework Programmes[25] underlines how Sweden lacks a conscious strategy as to how it wants the Framework Programme to interact with national research and innovation policy; also that this lack

[25] VINNOVA VA 2008:11 Impacts of the Framework Programme in Sweden.

of strategy has limited our ability to influence the future direction of Framework Programmes:

> *"Where the FPs have had limited strategic impact, this is because there are not many strategies to impact."*

This lack of strategy relates to national policy as well as individual universities. An important future challenge for VINNOVA is developing a strategy for relating to the EU Framework Programmes in interaction with other Swedish actors; not just at the project level but at the strategic level too.

Volvo – an example of strategic behaviour[26]

Volvo provides an example of how companies have developed a deliberate collaboration strategy in which various research programmes serve different functions.

Participation in EU Framework Programmes aims to develop a long-term shared vision of where technology is headed.

The purpose of participation in the National Vehicle Research is to develop (in cooperation with other European transport equipment manufacturers) expertise to provide better opportunities for product development in existing business areas.

At the same time Volvo is involved in a number of other VINNOVA programmes, in order to monitor developments in a broader set of knowledge areas considered to be of long-term interest: materials, manufacturing technology and so on.

[26] VINNOVA VA 2009:02 Effekter av statligt stöd till fordonsforskning *(Effects of Government Support to Automotive Research)*

4 Reflections

4.1 VINNOVA's future role?

Over time, we can see three main themes in the development of today's VINNOVA:

- Developing the competence base of Swedish industry.
- Ensuring new knowledge is actually put to use.
- Building a competence base for Sweden's participation in EU Framework Programmes.

Developing the competence base of Swedish industry has always been a central task. Policy changes have occasionally sought to shift the focus, but it has always swung back, perhaps because this role is desired by industry as well as being seen as a legitimate task of government. Meanwhile, as indicated in Section 3.1, changes in the policy landscape have continuously narrowed our role. This raises the question of whether there is a unique role for VINNOVA today.

Our impact studies indicate two aspects where VINNOVA and its forerunners have played a role that is difficult for other actors to fill:

We have identified and defined new needs-driven fields of research, in dialogue with the stakeholders. This is a role which neither peer review nor industry-led consortia can fulfil alone. Left to their own devices, scientific peer review tends to reward academic excellence within the prevailing paradigm, whereas industry representatives tend to request more knowledge to support today's business.

In later stages we have also been able to expand promising areas through active collaboration programmes between companies and universities. Calls for proposals in open competition, involving Triple Helix in the planning and implementation, have been an important profile factor.

To combine both roles requires a mix of "bottom-up" projects to identify potential new areas of interest and programme efforts to scale up promising areas. With limited resources, VINNOVA can no longer do this on its own; we need to develop our ability to build consensus and coordination with other funding organisations.

There are many new actors now in the arena for commercialising new technologies and competencies. We have not been able to orientate ourselves in this new world or create a clear role.

The EU Framework Programme covers areas in which VINNOVA is strong and we have a clear role as experts on the committees. We should be able to develop this by linking it more closely to our own programmes. At any rate, this will become a

necessity if/when the Commission's ambition to base the 8th Framework Programme on national co-financing is realised. How should VINNOVA's overall portfolio of measures relate to the European programme? To what extent should we try to amplify Swedish strengths, in order to make us more competitive in the European arena and to what extent should we focus on areas where EU programmes work less well? Support for small, start-up firms? Radical innovation?

4.2 Developing new competence areas

An activity that can meet industry's long-term need for research-based competencies must balance the risk of being totally controlled by industry's current needs (automotive research) at the expense of future competence needs against the risk of being seduced by urgent societal needs not linked to any real demand (IT in working life).

Those efforts which played an important role in defining new industry-relevant research areas (including road safety, digital radio communications and biotechnology) took place at a time when STU/NUTEK had a significantly greater proportion of research funding than now and hence a broader mandate/more responsibility.

The current issue is more one of whether the overall public R&D system is able to identify and focus on research areas of importance to future business development. This means areas which, for various reasons, were not given priority in the academic community; no industrial demand was articulated when efforts were initiated either. Moreover, the actions were not based on superior foresight on the part of the agency. Rather, they came about because STU/NUTEK was ready to listen to visionaries in industry and the research community and was prepared to take chances. Are there other actors in the current system who can fulfil this role and what does it mean for Sweden's regenerative capacity if this capability is weakened? Have universities been able to develop their own capacity for strategic renewal?

What conclusions should VINNOVA, and its political masters, draw from the observation that long-term strategic choices need to be made early on? What VINNOVA's forerunners did in microelectronics, digital radio communications and biotechnology was to build skills allowing the development of new areas of strength "new competence for existing – and new – markets". Focusing on "challenge-driven" innovation seems to be more about seeing where we can apply existing areas of strength to new needs, "existing competence for new markets." Both roles are needed; the question is who can take them on?

Open calls are one way of building creative processes. VINNOVA's mode of operation means that we do not have to say yes or no to the original proposals; we can participate in developing these in dialogue with the proponents.

The investment that the Foundation for Strategic Research has done in “future research leaders” is one way of making room for initiating new areas of knowledge.

4.3 Continuity versus renewal?

In Section 2.1.4 it was found that continuity of financing in joint research programmes is important if interaction is to have lasting impact on the way companies and universities utilise each other’s competences. This need for continuity must be balanced against the need for renewal, in terms of research focus as well as the constellations in which research is conducted. If VINNOVA (with limited resources) wants to act as a change agent it becomes necessary to release funds for new initiatives.

An informal follow-up of the first generation of Competence Centres shows that the majority were dismantled when VINNOVA’s funding ended after the ten-year contract period. In some cases this was deemed natural as the area was considered “exhausted”. However in others there was interest and motivation to continue, but an emphasis on relatively basic knowledge production meant participating companies were not guaranteed sole use of all results generated. Thus they were not prepared to bear the full cost; a classic example of market failure. This conclusion is supported by the fact that the five Competence Centres which were taken over by the National Energy Agency (STEM) all continued when STEM decided to extend its share of the funding.

4.4 Each programme unique – need for flexibility

A general lesson from the impact analysis is that each programme is unique in regard to the area’s character, stakeholders etc. This makes it important to combine a clear sense of direction in terms of programme goals with a flexibility in research approach and programme form. Different competences and areas of application have different developmental logic and their modes of interaction with the research system will differ in nature.

4.4.1 Project versus programme funding

Public support for needs-driven R&D needs to include support to individual R&D projects as well as to longer-term programmes. These complement each other and fill different roles. Individual projects are needed to identify and explore the potential of promising new technologies, whilst more comprehensive programmes are important instruments in building and distributing capabilities in areas which seem viable and in which industry demonstrates a willingness to get involved. The public role in the development of expertise in digital communication was developed through a variety of programmes over a long time; 30 years. These included individual projects, programme

support and initiatives for the creation of large-scale, national programmes (the National Microelectronics Programme)[27].

4.4.2 Things seldom go as planned

Flexibility is important, not only in the initial design of a programme, but also during its operation. Several of the studies mentioned above show that even when a programme yielded valuable results it did not always pan out as predicted.

The National Microelectronics Programme (1981) was designed with the aim of building a Swedish electronic components industry. This aim severely underestimated the international concentration of component production which resulted from economies of scale in the manufacture of integrated circuits. Instead, the programme built research capacity in the field. This helped make Ericsson a more knowledgeable buyer of components and brought the company expertise in digital signal processing.

4.5 Seed funding

An analysis which focuses on the development of individual companies is likely to underestimate their impact on the innovation system as a whole. The vast majority of research-based companies start in consultancy roles, selling their expertise to other companies; the primary value and growth comes when competence is applied by their customers. However, they play an important role as links in the innovation system. A small proportion of these companies have ambitions to grow into “complete” businesses with their own products or services28. A study of research-based companies from Chalmers shows that successful research-based companies are often bought up by larger companies29. The business continues to evolve within the larger company, but can no longer be distinguished in studies of this type.

Even among those companies with their own growth ambitions, the financial yields are not normally distributed. Venture capitalists speak of a “J-curve”, with a few successful companies accounting for a large section of the financial results. In an economic evaluation, it is necessary to assess the overall effect of the whole portfolio’s development, rather than counting, say, the number of businesses which succeed or fail.

The experimental nature of new technology-based enterprises means that the ability to learn from experience and make reassessments are also crucial in individual projects. Good projects are built along the way. Active programme managers have played an important role as ongoing discussion partners and such active follow-up has probably been more important to the outcome than “choosing the right” project at the start.

[27] VINNOVA Analysis VA 2008:04 The GSM Story.
[28] Bullock, M. (1983).
[29] Lindholm, Åsa (1994).

The rationale for public seed funding is that it is legitimate for the state to support the starting of more business experiments, but that the market will determine who survives. This sounds simple, but in practice the question arises as to when one decides that an experiment should be terminated or allowed to continue. Studies of new firms, especially high-tech ones, show that these evolve in a turbulent world in which one or even two reconstructions may be common before companies find a successful business model. It often takes 8-10 years before growth picks up and along the way the population shows large swings in earnings. Where to draw the line for public involvement cannot be deduced from a textbook; this has to be learned by experience.

Private investor interest in risky technology is also highly cyclical. As in 1991, the recent financial crisis has seen private investors withdrawing from this market; there is no guarantee that they will return.

If we accept that there is a government role in supporting the creation of new business experiments, the question still remains (with so many other actors in this arena) whether there is a role for VINNOVA today. VINNOVA's unique expertise lies primarily in its overview of the technology frontier, as an experienced officer may evaluate 30-50 new project proposals per year. However, even for a high-tech company, the business platform is based on many more competencies than technology and the question remains as to whether VINNOVA's staff or networks possess the necessary skills to evaluate and support the development of these competencies.

VINNOVA's current strategy includes a "clearer focus on small and start-up companies." Meanwhile, Losec and GSM are examples of major business areas which once started as modest experiments outside their parent company's strategy. In both cases, public support played a limited but important role in the projects' survival. We usually describe the role of seed funding as "developing technology-based business platforms far enough to be evaluated by private investors." Can this argument be extended to the internal selection processes of large firms? VINNOVA's analysis of R&D statistics show that small firms with advanced R&D are largely part of larger groups.

5 Lessons for future impact studies

Many lessons from VINNOVA's impact studies become apparent only by reading a number of studies in parallel and making comparisons between them. For this reason we believe it would enrich future impact studies if a comparative perspective were built in right from the beginning. This would have implications, both for the selection of the areas to be studied at a particular time and for how these studies were commissioned.

For a comparative analysis to be meaningful, we need to compare areas which are similar in some respects but differing in others. Comparing the effects of different types of policy measures targeting the same needs, or similar interventions applied in various fields for example.

We also see a need to more clearly require a systems perspective in our studies, where VINNOVA's initiatives are analysed in relation to other actors and where the allocation of roles between different actors becomes an important issue. We recognise that such an aim further increases the complexity of the task.

5.1 Need for a historical perspective

VINNOVA's impact studies show that the economic and social impact of public support for R&D is the result of long-duration processes, involving interactions between a number of public and private actors. Moreover, the impact is affected by when, and how, public support was delivered.

With a historical approach, we can formulate reasonably credible views on the issue of whether state support played an important role, the way in which this occurred and what factors were important for the effects to occur. This provides important lessons to consider when designing and implementing VINNOVA's future activities. These lessons do not translate directly into simple recipes, since the conditions are different. However, they give us a better understanding to help us to interpret new situations.

To attempt to quantify the size of these effects, or the relative contribution of different actors and, on this basis, determine whether a specific action has been cost-effective is a more difficult proposition. Partly because of the long durations and partly because of the difficulty in allocating the effects to the contribution of specific actors. As noted above, whether public support played a part depends on when and how interventions were made and not only, or even primarily, on the scale of public support.

Nevertheless, our political masters will still keep asking for a simple answer to the question of whether government efforts "pay off". In this context, the deeper understanding provided by qualitative impact studies may hopefully help specify econometric analyses based on a more realistic picture of the processes modelled. A

shorter timescale focusing on intermediate outputs makes it more likely that effects can be attributed to a specific cause, whilst capturing fewer of the important long-term impacts. This is not just a problem for public policy: industry normally considers long-term competence-building in “corporate research” as a semi-fixed overhead cost; one in which the appropriate level cannot be calculated but is determined in a rule-of-thumb trade-off between how much competitors invest and what the company thinks it can afford.

References

Block, Fred & Keller, Matthew R. “Where do innovations come from? Transformations in the US economy, 1970–2006” Socioecon Rev (2009) 7 (3): 459-483.

Broström, A., 2009. Ph.D. Dissertation: Strategists and Academics – essays on interaction in R&D, Royal Institute of Technology.

Bullock, M. (1983): Academic Enterprise, Industrial Innovation and the Development of High Technology Financing in the United States. Brand Brothers & Company, London

Carlsson, Bo & Eliasson, G. (2003) “Industrial Dynamics and Endogenous Growth”, Industry & Innovation, Volume 10, Issue 4, 2003, Pages 435-455

Eliasson, G. (1993) “Den stökiga marknadsekonomin”. Tvivlet på nationalekonomin: Fyra ekonomer diskuterar vetenskapen och verkligheten. Källa/40. Forskningsrådsnämnden, mars 1993.

Granat, J., Markusson, N. & Norgren, L. 2002, Eonomiska effekter av STU/NUTEKs forskningsfinansiering – exemplet bioteknikforskning, i VF 2002:01 Effekter av VINNOVAs föregångares stöd till behovsmotiverad forskning.

Jacobsson, S & Perez Vico, E, Towards a systemic framework for capturing and explaining the effects of academic R&D, Technology Analysis & Strategic Management (2010), Vol 22, Issue 7, p 765-787

Jacobsson, S., 1997, Sweden’s technological system for electronics and computer technology, i Carlsson, Bo (red.), Technological systems and industrial dynamics, Dordrecht: Kluwer Academic Publishers

Lindholm, Åsa, 1994, The economics of technology-related ownership changes: a study of innovativeness and growth through acquisitions and spin-offs, PhD thesis, CTH

Martin, B.R., Tang, P., 2007. The benefits from publicly funded research. SPRU Electronic Working Paper Series, Brighton.

Matsumoto, S, 2000. Catalytic reduction of nitrogen oxides, CATTECH, vol 4 (2000) p 102-109

Rosenberg, Nathan & Birdzell Jr, L.E., 1986, How The West Grew Rich. The economic transformation of the industrial world. New York: Basic Books

Salter, A.J., D’Este, P., Pavitt, K., Scott, A., Martin, B.R., Genua, A., Nightingale, P., Patel, P., 2000. Talent, Not Technology: The Impact of Publicly Funded Research

on Innovation in the UK. SPRU, University of Sussex

VINNOVA Analys VA 2004:06 Effekter av det svenska kompetens-centrumprogrammet 1995-2003 (*Impacts of the Swedish competence centres programme 1995-2003)*

VINNOVA Analys VA 2004:07 Effektanalys av nackskadeforskningen vid Chalmers (*Impact analysis of neck injury research at Chalmers)*

VINNOVA Analys VA 2007:02 Användningsdriven utveckling av IT i arbetslivet (*User-driven IT development in working life)*

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