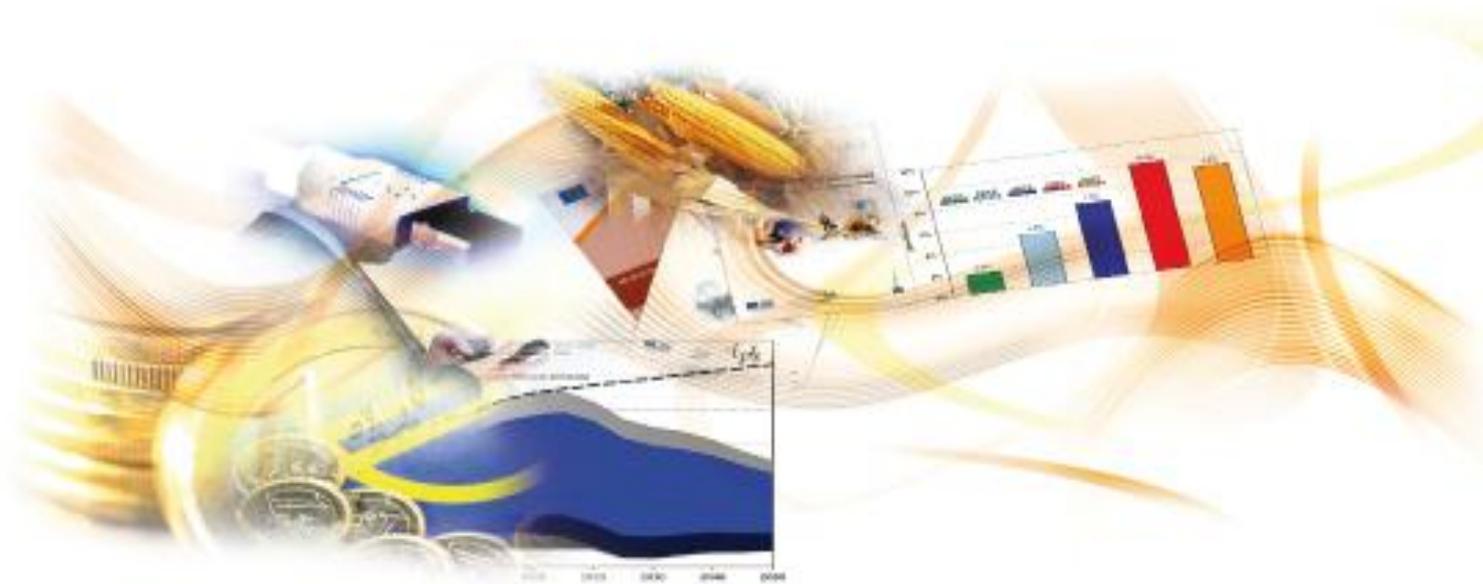


JRC SCIENTIFIC AND POLICY REPORTS

ERAWATCH Country Reports 2012: Sweden

Olof Hallonsten

2014



European Commission
Joint Research Centre
Institute for Prospective Technological Studies

Contact information

Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: jrc-ipts-secretariat@ec.europa.eu
Tel.: +34 954488318
Fax: +34 954488300

<http://ipts.jrc.ec.europa.eu>
<http://www.jrc.ec.europa.eu>

Legal Notice

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

Europe Direct is a service to help you find answers to your questions about the European Union
Freephone number (*): 00 800 6 7 8 9 10 11

(*): Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server <http://europa.eu/>.

JRC90739

This document replaces ERAWATCH Country Reports 2012: Sweden with ISBN number 978-92-79-34534-0 and PUBSY request number JRC83911.
The corrections made in the new document are to add the acknowledgements which were missing.

EUR 26300 EN

ISBN 978-92-79-38982-5 (pdf)

ISSN 1831-9424 (online)

doi:10.2791/91372

Luxembourg: Publications Office of the European Union, 2014

© European Union, 2014

Reproduction is authorised provided the source is acknowledged.

ACKNOWLEDGEMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). [ERAWATCH](#) is a joint initiative of the European Commission's [Directorate General for Research and Innovation](#) and [Joint Research Centre](#).

The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2012 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Jens SORVIK from JRC-IPTS. The contributions and comments from DG-RTD are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the [ERAWATCH website](#). Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

Copyright of this document belongs to the European Commission. Neither the European Commission, nor any person acting on its behalf, may be held responsible for the use of the information contained in this document, or for any errors which, despite careful preparation and checking, may appear. The report does not represent the official opinion of the European Commission, nor that of the national authorities. It has been prepared by independent external experts, who provide evidence based analysis of the national Research and Innovation system and policy.

EXECUTIVE SUMMARY

Sweden is among the highest ranked countries in the world in R&D investments as percentage of GDP (only surpassed by Finland and Israel) and is consequently well above EU average in this measure. Despite having managed the effects of the 2008-2012 economic crisis better than most EU countries and despite thorough efforts in the past few years to counter the negative trends, Swedish annual investment in R&D is in steady (relative) decline. The main reason for this is private sector R&D expenditure which is dropping. On the performer side, the private sector dominates, making almost 70% of the total R&D investments, although a small number of very large companies account for the largest part of the private sector R&D activities.

A strong academic sector consumes over 90% of the governmental appropriations for R&D and is thus responsible for most of the public R&D including not only basic research but also applied and strategic research programs for Swedish long-term competitiveness.

The single most important research and innovation policy measure in recent years was arguably the launch of the so called Strategic Research Areas in the 2008 research bill, which was followed up by a similar (albeit smaller) program in the 2012 research bill. Based on the assumption and the policy analysis that Swedish long-term competitiveness is under threat and needs to be secured by strategic profiling, resource increases to public R&D, and strengthening of the interaction between academia and industry, these programs have indeed altered the governance structure and priorities of the Swedish research system, although they have been in place for too little time for their effects to be properly evaluated. The naming of specific areas by the government does, however, signal its priorities both for the public R&D system and for industry.

The poor innovation performance of the Swedish economy, despite the comparably strong showing in R&D investments on both the public and the private side, has been a topic of discussion for at least two decades (the concept of a ‘Swedish Paradox’ is usually invoked to illustrate this) but only recently led to specific, targeted efforts to increase innovation in SMEs and improve the commercialization of academic research results. The main structural challenges facing the Swedish innovation system are attributable to this ‘Swedish Paradox’ and are thus also deeply historically rooted and structurally determined:

- The private R&D sector is dominated by a handful of MNCs, and there is hence a comparable lack of R&D efforts in the SME segment of the economy
- There is a deep structural division and separation between the public and private R&D sectors which prevents dynamic migration and exchange between them, especially academy-industry knowledge transfer
- The entrepreneurial climate is comparably poor which stems from a lack of adequate incentive structures for business startups compared to regular employment opportunities

In addition, there are also challenges that are specific and delimited to the public R&D sector:

- The public R&D system is characterized by breadth rather than cutting-edge
- The role of the academic sector in the innovation system is unclear and the organizational and managerial discretion of academic institutions is opaque

The business sector R&D was for the whole second half of the 20th century almost entirely internal to a handful of very large companies, with small and medium-sized enterprises (SMEs) playing a marginal role. The reasons are structural/historical and the situation is thus judged both difficult and time-consuming to change.

The 2012 research bill followed the theme of its two predecessors (2004 and 2008) in highlighting the need for Sweden to strengthen and improve quality of national R&D in order to keep a competitive position in the globalized knowledge economy. A similar assessment of the situation for Sweden was offered in the 2012 National Innovation Strategy issued by the Ministry of Enterprise, Energy and Communication. This document is, however, mainly a framework vision statement and does hence not launch any concrete policies. For example, the Innovation Strategy is completely silent on the Smart Specialization strategy and how it is supposed to be implemented in Sweden. Several policies and funding programs were launched in the research bill, further increasing governmental R&D funding mostly in existing academic institutions but also by specific investments. The most important policies include a general increase in the general appropriations for research in the academic sector; specific programs to make international recruitments of prominent researchers to Swedish academic institutions and to support young researchers; specific investments in the life sciences, including the new SciLifeLab; specific investments in strategic R&D areas; and a number of policy measures aimed at increasing the commercialization of academic research, including efforts to strengthen the institute sector and further develop innovation support structures at universities and university colleges, in answer to recommendations by the Council of the European Union made in the spring of 2012.

The public research policy system in Sweden is still characterized by broad decentralization and lack of central coordination, with the academic sector in a dominating role on the performer side and a diverse policy formulation and implementation landscape. The deregulation of the academic sector by a 2010 governmental bill has so far not led to any distinguishable changes in practice and its real effects thus remain to be seen. The policy mix has not been altered to any notable extent in the past year, and so it is basically the same system and actors that have been responsible, in 2012, for implementing and overseeing the policies and priorities of the 2008 research bill and that will, beginning in 2013, work with the priorities in the new research bill.

As to the private sector, BERD as percentage of GDP is shrinking in Sweden and has done so for the past decade. In recent years, some discontinuous changes have occurred to the private sector side of the innovation system, most importantly the closing of research sites in Lund (2010) and Södertälje (2012) by AstraZeneca and Sony Mobile's closing of an R&D site in Lund (2012). Though recent policy measures on central level undoubtedly have entailed specific investments in the life sciences in both Lund and Stockholm/Uppsala, it is difficult to assess the extent to which they were indeed tailored to directly mitigate the effects of these changes in the private sector.

Other structural challenges facing Sweden include unsatisfying degrees of interaction between the academic sector (basic research) and industry and commercialization of research results from academia. Furthermore, Swedish public R&D is generally characterized by breadth rather than cutting-edge, and there is a need for specialization and strengthening in specific areas.

There is also a general consensus that the historically determined domination of Swedish industry by large MNCs and the associated generally low level of R&D in SMEs is a structural deficit that requires attention and purposeful policy making. In recent years, another disturbing realization has been added in the shape of decreasing numbers of university graduates in science and engineering fields, a development that has been going on for at least the past decade. In combination with the relative dominance of MNCs in the private R&D sector, this development threatens Sweden's position as a high-skill labour market, since diminishing supplies of well-educated people in Sweden may lead to the relocation of the R&D activities of MNCs abroad.

Swedish policies for research and innovation are generally well at terms with the ERA pillars and objectives. In many ERA dimensions Swedish policies meet the goals, and the process from goal-setting to implementation often appears relatively efficient. However, beside shortcomings mentioned in the above paragraphs, Sweden is still relatively far from the goal of a single European labour market for researchers, in particular to offer attractive permanent positions at HEIs.

The main challenges facing the Swedish national innovation system, although both well-known among scholars and acknowledged in governmental policy documents, are only partially addressed in policymaking. Governmental research and innovation policies have launched strategic efforts to prioritize and strengthen particular areas of R&D judged to be critical for the future of Sweden, but not addressed those fundamental structural features of the economy that appears to inhibit nimble adaptation to the new globalized knowledge economy. The incentives structures for dynamic academy-industry interaction and innovation-based entrepreneurship are still insufficient and economic policy (including labour law) is still geared towards traditional production industry and the domination of a few large companies, thus not particularly suited for meeting the global competitiveness challenges of the 21st century. In short, it seems governmental innovation policy is limited to some institutional and legal rearrangement within existing policy areas and sectors (academic, labour market, tax code) but is curtailed when it comes to profound restructuring of the economy and the innovation system. While this is a seemingly normal state of affairs in the Western world, it does constitute a growing problem.

TABLE OF CONTENTS

| | | |
|-----|---|----|
| 1 | Introduction | 6 |
| 2 | Recent developments of the research and innovation policy and system..... | 10 |
| 2.1 | <i>National economic and political context</i> | 10 |
| 2.2 | <i>Funding trends</i> | 11 |
| 2.3 | <i>New policy measures</i> | 12 |
| 2.4 | <i>Recent policy documents</i> | 13 |
| 2.5 | <i>Research and innovation system changes</i> | 14 |
| 2.6 | <i>Regional and/ or National Research and Innovation Strategies on Smart Specialisation (RIS3)</i> | 16 |
| 2.7 | <i>Evaluations, consultations</i> | 16 |
| 2.8 | <i>Policy developments related to Council Country Specific Recommendations</i> | 17 |
| 3 | Structural challenges facing the national system | 19 |
| 4 | Assessment of the national innovation strategy..... | 22 |
| 4.1 | <i>National research and innovation priorities</i> | 22 |
| 4.2 | <i>Evolution and analysis of the policy mixes</i> | 24 |
| 4.3 | <i>Assessment of the policy mix</i> | 25 |
| 5 | National policy and the European perspective | 28 |
| | List of abbreviations | 34 |

1 INTRODUCTION

With a population of 9 551 781 (November 30, 2012), Sweden is the home of approximately 1.9% of the total EU-27 population.¹ Sweden's GDP per capita (2011) is 1.3 times that of the EU-27 average, namely €41 100 (EU-27 average €25 100), and the GDP growth rate was 3.7% in 2011, compared to 6.6% in 2010.² Sweden has long since been one of the countries in the world with a highest annual R&D investment in percentage of GDP (only surpassed by Finland and Israel) and is consequently the EU country with the second highest total annual R&D expenditure relative to GDP, after Finland. In 2011, Swedish domestic R&D expenditure amounted to 3.37% of GDP, compared to an estimated average of 2.01% for EU-27.³ Interestingly, however, the trend for Sweden is a relative decrease in overall R&D expenditure; in 2009, the figure was 3.62% and a decade ago, in 2001, 4.18%. This development is opposite to most EU countries, where corresponding figures have increased over the same period. The explanation for the decline lies predominantly in the private sector, as Business Expenditures for Research and Development (BERD) relative to GDP has shrunk from 2.74% in 2008 to 2.34% in 2011. Public investment in R&D has remained steady in the same time period, amounting to approximately 1% of GDP in 2011.

On the performer side, the public R&D system is dominated by the academic sector. The universities, in total 15, consumes over 90% of the governmental appropriations for R&D and are in principle responsible not only for basic research but also applied and strategic research programs, including those launched in recent governmental research and innovation bills to strengthen Swedish long-term competitiveness and increase the societal benefit and commercialization of R&D. The several regional university colleges and the very small (albeit growing) R&D institute sector complement the universities but account for a very small share of the public R&D appropriations.⁴ The business sector R&D is mainly internal to large enterprises, as the majority of the funding of R&D in the private sector remains within the comparatively small number of very large companies, i.e. the same organizations (firms or groups) are both funder and performer.

Sweden is widely regarded as one of the world's most knowledge-intensive countries, and is mentioned as part of the group of "very high knowledge-intensity countries" (together with Denmark, Finland and Switzerland) in the Innovation Union Competitiveness Report.⁵ Apart from the relatively high level of R&D investment as % of GDP mentioned above, the Innovation Union Competitiveness Report cites the following: More than 42 % of the Swedish work force is employed in knowledge-intensive activities. Sweden has among the highest R&D intensities (in terms of GERD as % of GDP), high shares of researchers and skilled human resources in the economy, low unemployment rates for researchers and high levels of new academic-oriented tertiary education degrees.

Sweden has two national research facilities, the synchrotron radiation laboratory MAX-lab in Lund and the Onsala Space Observatory outside Gothenburg. The former is a national (and international) resource for research in materials and life sciences, and it is currently undergoing a vast upgrade in the shape of an all new accelerator-based facility (MAX IV) that will turn the lab into a global competitor in synchrotron radiation technology for science. Sweden also has a national resource for life sciences, the Science for Life Laboratory (SciLifeLab) in

¹ Statistics Sweden (2012)

² Eurostat (2012)

³ Eurostat (2012)

⁴ Hallonsten and Holmberg (2013); Swedish Agency for Higher Education (2012).

⁵ European Commission (2011).

Stockholm/Uppsala which was opened in 2010 as collaboration between four universities in the region. The quest to build the European Spallation Source (ESS), a large European centre for materials science research, in Lund, will enter a critical phase of finalization of technical and scientific documentation and the negotiations of funding and organizational agreements on European inter-governmental level, in 2013.

The scientific production is high, with a ratio of 14 % of the Swedish scientific publications being among the 10 % most cited in the world (although this is lower than the 16 % for the reference group of countries in the Innovation Union Competitiveness Report). Sweden scores above the reference group on PCT patent applications per billion GDP (11.01 to 9.67), almost equals the reference group when it comes to PCT patent applications in societal challenges per billion GDP but below the reference group (2.01 to 2.06), but scores below the reference group of countries in the Innovation Union Competitiveness Report on Licence and patent revenues from abroad as % of GDP (1.18 to 1.32). On all these indicators, however, Sweden scores well above the EU-27 average.⁶ In terms of scientific productivity, Sweden is especially strong in medicine and the life sciences in general, and has a strong tradition also in classic natural science fields such as chemistry and physics. The dominance of the large universities in research volume (governmental R&D appropriations, see above) is quite naturally reflected in these measures of output.⁷

Four consecutive governmental research bills (these are normally issued every four years) have underscored the urgent need for Sweden to strengthen and improve the quality of national R&D in order to keep a competitive position in the globalized knowledge economy.⁸ Governmental research bills summarize and formulate Swedish national research and innovation policy and are also partly carved out through a well-structured procedure of input and advice from all governmental agencies engaged in R&D policy as well as the academic institutions. The bills have, consequently, launched several specific policy and funding programs and the two most recent bills have also launched significant increases of governmental R&D funding, mostly in existing academic institutions but also in the shape of specific laboratories and research facilities (see a later section). The most recent governmental research bill was issued on October 11, 2012 and reinforced this message: Sweden is a prominent research nation and a comparably strong player in the globalized knowledge economy, but efforts to strengthen this position and increase the level of quality of R&D in all parts of the system are nonetheless required. On top of a major increase in the general appropriations for academic research and doctoral training, benefiting the whole academic sector, the bill launches targeted efforts to strengthen specifically chosen scientific areas and research environments. International recruitment of prominent researchers and a special program for young researchers are among these, as well as an earmarked amount of funding for life science (including the founding of a national life science laboratory in Stockholm/Uppsala), and the establishing of new research facilities for materials science. The government also continues its practice from the previous research bill (2008), to identify and give special support to a number of areas that they judge as especially important for Swedish industry, and thus in the long run, for Swedish competitiveness. It also intensifies its programs to facilitate better exchange between academia and industry, including most of all structural efforts to commercialize research results.⁹

These policy measures are rather typical for Swedish governmental research policy, which has traditionally been in harmony with the demands of the business sector. Historically, the Swedish

⁶ Melin et al (2012).

⁷ Nordforsk (2010), p 17

⁸ Hallonsten and Silander (2012).

⁹ Swedish Government (2008a; 2012b).

economy has been largely dependent on a rather small number of large (nowadays multinational) with high R&D intensity. Small and medium-sized enterprises (SMEs) have historically had a minor role, although this picture has changed somewhat in recent decades. The large multinational companies (MNC) are mainly found in sectors such as engineering (accounting for 50% of the production), forestry, ICT, biotechnology and life sciences, environmental industries, and renewable energy.¹⁰ The five largest performers of R&D in the private sector are (2011) Ericsson (telecom), AstraZeneca (pharmaceuticals), Volvo (automotive), ABB (robotics/power and automation), and SonyEricsson (telecom).¹¹ To some extent, the areas of strength in private sector R&D correspond to the strength of Swedish public R&D, although quite naturally, the academically dominated public R&D system is more oriented towards fundamental research in classic disciplines such as physics, chemistry and biology.

The public research policy system is characterized by broad decentralization and lack of central coordination. The dominating role of the academic sector on the performer side has led to a diverse and pluralist landscape with a high degree of autonomy and self-governance on individual, group, department and institution level. In combination with the absence of a governmental ministry of science and the subordination of research policy under the ministry of education, and the relatively influential role of the (researcher-led) research councils, the policy landscape is diverse and lacks some coordination.¹² While general policy formulation is carried out largely at a ministerial level, different agencies are responsible for the design and implementation of individual policy instruments and the level of autonomy and freedom to determine research directions in the academic institutions is still high, although this situation is changing. Regional authorities play a minor role but in specific initiatives, they can be important funding bodies, such as for the financing of the major MAX IV investment (see above). The main agency supporting R&D is the Swedish Research Council (Vetenskapsrådet, VR), funded by the Ministry of Education and Research. Its main responsibilities include funding of research across all fields of the natural and technical sciences, medicine, and social sciences and humanities. Two specialized research councils support working life and social science, and ecological, conservation, natural resources-related and construction issues. The Swedish Agency for Innovation Systems (VINNOVA) has the specific task of supporting innovation and application-oriented research in academia as well as in the private sector. Funded by the Ministry of Enterprise, Energy and Communication, VINNOVA has a battery of programs of various sizes aimed at supporting problem-oriented R&D and innovation-oriented activities linked to R&D, including the support of knowledge-based startups and innovation projects in established firms. Other governmental funders of R&D include the Swedish National Space Board, the Swedish Energy Agency, and the Swedish Defence Material Administration. In addition to these, six national semi-public foundations and a few private foundations are recurrent funders of R&D.

A peculiar feature of the system is the division of responsibilities between on one hand the Ministry for Education, responsible for R&D in the academic sector as well as all public funding of R&D through the research councils and extraordinary investments and engagements (such as the Swedish membership in international research organizations, e.g. CERN and ESO), and on the other hand, the Ministry of Enterprise, Energy and Communication, responsible for innovation policy formulation and also the founder of VINNOVA and the Swedish Agency for Economic and Regional Growth and the governmentally-owned investment company ALMI / the Innovation Bridge, mainly working with business support for SMEs and the facilitating of entrepreneurship. This peculiarity, whose effects for the exercise of authority in the research and

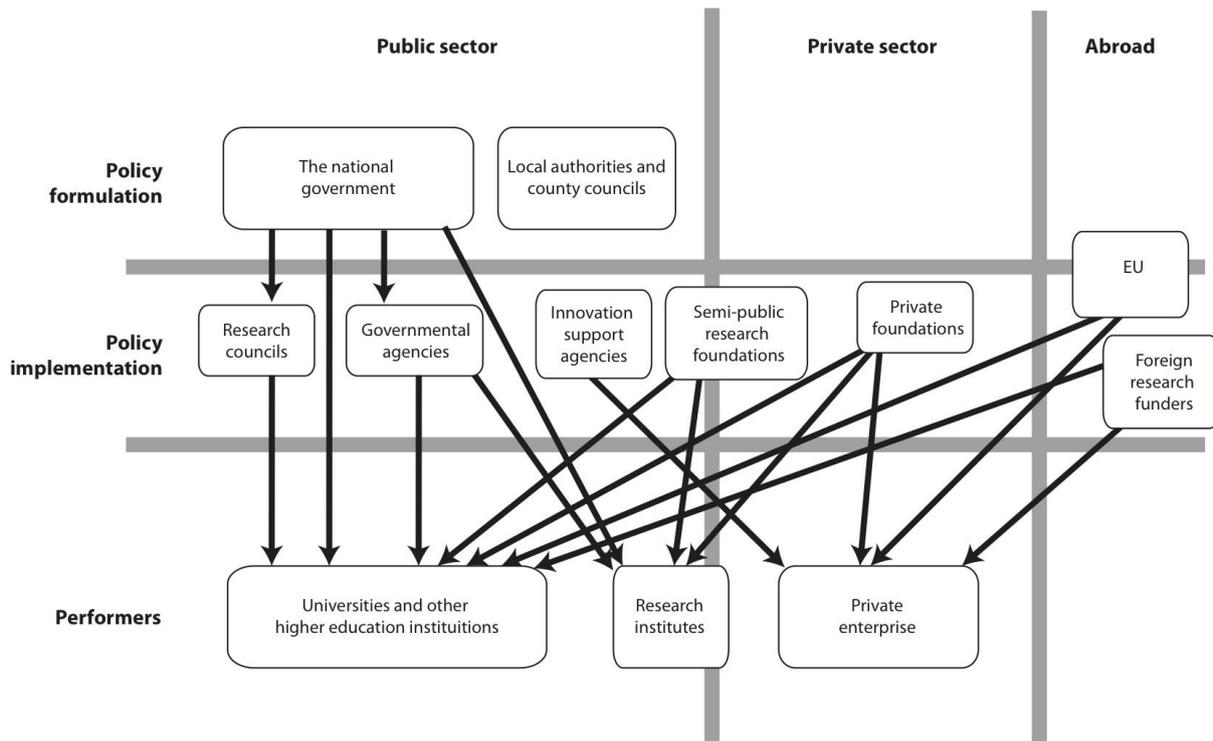
¹⁰ Melin et al (2012).

¹¹ Alpman (2011).

¹² Benner (2008); Hallonsten and Holmberg (2013).

policy system (the lack of coordination between the ministries and their agencies the Swedish Research Council and VINNOVA) has been criticised in investigations,¹³ was explicitly revealed in the fall of 2012 when, a mere month and a half after the presentation of the research and innovation bill by the minister for education, the minister for enterprise presented the National Innovation Strategy for Sweden. This strategy document largely echoed the research bill in its problem formulation: In order to meet the challenges of the future, including economic globalization and issues of sustainability, Sweden is in need of purposeful mobilization within its entire innovation system. Since this innovation strategy is a framework document expressing a vision rather than a governmental bill laying out policy, it is significantly vaguer in its character than the research bill and thus much less concrete in its (attempted) policy solutions to the identified problems. It emphasizes the need for high quality education, a vitalized innovation climate among especially SMEs, increased mobility between different sectors of the economy and society, quality enhancements of research in academia, a strengthened research institute sector, and stronger innovation support infrastructures. No explicit policies for achieving these goals are presented in the document, but will be formulated and executed through ordinary work of the ministry and its agencies.

Figure 1: Overview of the Swedish research system governance structure



¹³ Sandström et al (2008).

2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

The global financial crisis of 2007-2009 and the subsequent crisis of the Euro zone left its mark on Sweden just as other countries across Europe, although in the opinion of most analysts domestically as well as internationally, the Swedish economy was spared from the most disturbing effects of the crisis. That Sweden is not a member of the Economic and Monetary Union (EMU) has also put the country and its domestic economy in a relatively less exposed situation, and has also meant a direct advantage in most recent years. Expectedly, given the state of the international economy, Swedish growth in GDP was negative in 2008 and 2009 (-0.6% and -5.0% respectively) but turned up again in 2010 and reached the highest among the EU-27 countries that year, +6.6%. In 2011, the growth rate returned to a more typical level of +3.7%, compared to the EU-27 average of +1.5%. In all, the Swedish economy appears to have managed the financial crisis and the Euro crisis well, and these can therefore not be said to have had significant impact on the Swedish R&D system, although there are signs of coming impacts in the shape of possible cuts in the labour forces of large exporting companies, due to currency appreciation and the recession in some parts of the Swedish export markets.

Some domestic developments deserve mentioning. In the academic sector, some deregulation of the role of universities have been implemented by the government,¹⁴ and the effects of the 2008 research and innovation bill and its major increases in funding for university research, including the large Strategic Research Areas (SRA) grants, have started to show in 2011 and 2012.¹⁵ These increases in public research funding have, to some extent, mitigated the effects of the gradually diminishing private Swedish investments in R&D that are visible in statistics: BERD as % of GDP has shrunk from 2.74% in 2008 to 2.34% in 2011. Among the distinct events that play a part in this development is naturally the closing of two of the research sites of the multi-national company (MNC) AstraZeneca, in Lund and Södertälje respectively that occurred in 2010 and 2012 and meant the layoff of thousands of people with occupation in drug development and associated life sciences areas. Partly in response to these events, the government has decided to invest heavily in a new life science laboratory (the Science for Life Laboratory, SciLifeLab) in Stockholm/Uppsala.¹⁶ In addition to this, two large publicly funded research facilities for materials science are planned and under construction in Lund in Southern Sweden; the Nordic MAX IV facility for synchrotron radiation (under construction) and the intergovernmental collaborative European Spallation Source, ESS (under planning). These two, and SciLifeLab, together constitute heavy public lump sum investments in R&D on a scale unprecedented in Sweden.¹⁷

¹⁴ Swedish Government (2008b).

¹⁵ Swedish Government (2012b); Hellström (2012).

¹⁶ Swedish Government (2012a).

¹⁷ Benner (2012).

2.2 Funding trends

As mentioned, and as seen in the table below, the Swedish R&D investments as percentage of GDP are decreasing on overall level (all sectors), as well as in business enterprises and the public sector. It should be noted, in this context, that the major turn in GDP growth rates between 2009 and 2010 from -5.0% to +6.6%, as a result of, in turn, the financial crisis and Sweden's quick recovery, has an impact on these figures. The decrease in R&D investments as percentage of GDP is on par with the growth rates and thus, on the level of these statistics, there have been visible effects of the global financial crisis on the Swedish R&D funding system. However, in real terms, little change is discernible – the level of annual R&D investments has remained stable in the most recent years.

Table 1: National Swedish research and innovation system in numbers¹⁸

| | 2009 | 2010 | 2011 | EU27 |
|---|-----------|-----------|-----------|----------------------------|
| GDP growth rate | -5.0 | 6.6 | 3.7 | -0.3 (2012) |
| GERD as % of GDP | 3.62 | 3.39 | 3.37 | 2.03s (2011) |
| GERD (€ per capita) | 1,136.6 | 1,270.8 | 1,389 | 510.5s (2011) |
| GBAORD - Total R&D appropriations (€ million) | 2,438.87 | 2,859.824 | 2,958.537 | 91,277.1 (EU27 total 2011) |
| GBAORD as % of GDP | 0.91 | 0,88 | 0,83 | 0.69 |
| BERD (€ million) | 7,404,582 | 8,160,171 | 9,062,216 | 5,925,034 |
| BERD - R&D funded by Business Enterprise Sector (% of GDP) | 2.53 | 2.33 | 2.34 | 1.26 (2011) |
| R&D performed by HEIs (% of GERD) | 25.1 | 26.3 | 26.0 | 24% (2011) |
| R&D performed by Government Sector (% of GERD) | 4.4 | 4.9 | 4.3 | 12.7% (2011) |
| R&D performed by Business Enterprise sector (% of GERD) | 70,4 | 68.7 | 69.3 | 62.4% (2011) |

Sweden is not on track for R&D targets for EU2020, but rather trending negatively in this respect: The target for Sweden is 4% and the recent development is a decrease rather than growth (in relative terms) which means that Sweden will have to execute an average annual R&D intensity growth of 1.9% until 2020 to meet the target.¹⁹

It must be noted that the funding streams generally stay within sectors, as illustrated in table 2. The private sector consumes almost 98% of its expenditure on R&D, which in turn dominates the total R&D sector with roughly two-thirds of its volume. Public R&D is dominated by the academic sector, which consumes approximately two thirds of the governmental R&D appropriations, with the remaining part going roughly equally to in-house R&D at other governmental agencies and the private sector.

¹⁸ Source: Eurostat (2012); Statistics Sweden (2012).

¹⁹ European Commission (2012b)

Table 2 does not list EU funding for R&D specifically, since it comes to Swedish performers of R&D both through direct channels and via the governmental budget and the governmental funders of R&D; structural funds typically via the Swedish Agency for Economic and Regional Growth and the Swedish ESF Council and FP7 funds typically via Vinnova. The FP7 is an important funding source for Swedish R&D. Put in comparison with research funding agencies in Sweden, FP7 is the second-largest source for funding for Swedish public sector R&D (not counting governmental block grants to university research), in total contributing with approximately 234 million € to Swedish public R&D in 2010.²⁰ Similarly, the EU Structural Funds are not included in table 2 and should, furthermore, not be treated as R&D funding comparable with FP7 or domestic R&D funding since its aim and scope is somewhat different. It should, however, be mentioned that a total of approximately 1.7 billion € in Structural Funds was allocated to Sweden in the years 2007-2013, part of which undoubtedly has constituted an injection of funding to the R&D system, both public and private.

Table 2: Swedish R&D funding flows²¹

| Million € | | Performers of R&D | | | | |
|----------------|----------------------------|----------------------------|-----------------|--------------------|----------------------------|--------|
| | | Business enterprise sector | Academic sector | Other governmental | Private, non-profit sector | Total |
| Funders of R&D | Business enterprise sector | 8,369 | 174 | 32 | 0 | 8,575 |
| | Private, non-profit sector | 7 | 272 | 13 | 3 | 295 |
| | Government | 498 | 2,419 | 300 | 6 | 3,224 |
| | Abroad | 986 | 29 | 3 | 0 | 1,017 |
| | Total | 8,874 | 2,865 | 303 | 10 | 12,094 |

This has not changed in recent years; although the government has made significant increases in the funding stream directed to academia, and although there has been rather dramatic closures in the private sector (e.g. AstraZeneca, mentioned above), in the broader picture these are marginal changes. Significantly more interesting in this context is the long term development indicated by statistics: the volume of R&D expenditures has decreased gradually in the past decade from its peak of 4.18% of GDP in 2001, and the business enterprise sector seems to be the main cause, having decreased its R&D investments in the same period from 3.2% of GDP to today's (2011) 2.34%.²² The private sector R&D funding is dominated by investments in the sectors electronics and ICT, automotive/transport, pharmaceuticals and robotics.²³

2.3 New policy measures

As stated in the last section, those changes in the funding streams in the Swedish R&D system that are treated by commentators and pundits as major are in reality marginal. The policy measures launched and implemented by the government in the past few years to strengthen

²⁰ Vinnova (2012)

²¹ Source: Statistics Sweden (2012).

²² Melin et al (2012); Statistics Sweden (2012).

²³ Statistics Sweden (2012).

Swedish R&D, innovation and long-term competitiveness are not considered to be direct effects of the financial crisis or the general state of the economy but rather part of an on-going governmental ambition to increase quality of research and intensify the commercialization of R&D in Sweden, partly based on policymakers' interpretation of the popularized 'Swedish Paradox' concept; that despite the high level of R&D investments as share of GDP (see above), Sweden performs less well in knowledge-based innovation-driven economic growth.²⁴ The specific funding programs launched in the two most recent research bills are quite new and likely not possible to assess the effects of. Something similar can also be said about the policy reactions to the closing of the AstraZeneca site in Södertälje south of Stockholm in the shape of a new major investment in the SciLifeLab center; this investment will commence in 2013. The other two big facility projects ESS and MAX IV are likely to make their first deep imprints in the distribution of funds and in the performance of the R&D system as a whole in a decade's time, at the earliest.

2.4 Recent policy documents

The past two years of policy work by the Ministry of Education, to which research policy is subordinated, has been focused on the formulation and completion of the 2012 research and innovation bill, the content of which has been briefly mentioned several times above but will be outlined in greater detail here. The bill lays out the government's research and innovation policy for the coming four years and is the central policy document for all actors (see above) in the system. The National Innovation Strategy, published by the Ministry of Enterprise, Energy and Communication in November 2012, will be reviewed below.

The main parts of the 2012 research bill are as follows:

- The government considers increases in the appropriations for research and the stimulation of innovation to be important measures for increasing the general level of quality of Swedish research and accordingly launches several general and specific funding increases.
- The total R&D appropriations are given an increase of 200 m€ for 2013, and the government signals its intention to make further increases of 110 m€ in 2014 and 42 m€ in 2015.
- The appropriations for research and doctoral training in the academic sector gets an increase of 25 m€ 2013, and the government signals its intention to commence further gradual increases so that the level of appropriations for research and doctoral training in the academic sector is in total 140 m€ higher in 2016 than in 2012.
- The Swedish Research Council is given the task of launching targeted programs to make international recruitments of prominent researchers to Swedish academic institutions and to support young researchers, for which the council is given an additional funding of 20 m€ for 2013.
- A specific investment of 52 m€ is made in the life sciences, including targeted efforts in infections and antibiotics, aging and health, treatment research, and drug development. Part of this investment goes to SciLifeLab and a new institute for process development and catalysis.
- Specific investments of 48 m€ for 2013 are made in areas judged to be of particular importance for Swedish industry and the welfare society, including forestry and biomass, mining, minerals and steel, the sustainable society, space research, energy research and evidence-based education and preschool.

²⁴ For the scholarly debate on the 'Swedish Paradox' see, for example Edquist and McKelvey (1998); Ejermo and Kander (2006).

- A number of policy measures aimed at increasing the commercialization of academic research are also presented, including efforts to strengthen the institute sector and further develop innovation support structures at universities and university colleges.²⁵

The National Innovation Strategy is a general framework policy document formulated and issued by the Ministry of Enterprise, Energy and Communication. Contrary to the quadrennial research bill, it is not a governmental bill and consequently, it does not launch specific policies. Its weight as a policy document can therefore be questioned, especially since the actual policies delegated to VINNOVA have been stipulated in the already discussed research bill. However, the main elements of the National Innovation Strategy are as follows:

- Acknowledging that Sweden faces growing international competition as a knowledge-based economy, and that Sweden, Europe and the world will have to rely on its innovative capacity to meet the challenges of the future, there is a need for a purposeful and coordinated national innovation strategy in Sweden.
- Sweden has a favourable position but will have to mobilize to keep up with international developments.
- The framework conditions for innovation need to be improved, including high quality education, a vitalized innovation climate among especially SMEs, increased mobility between different sectors of the economy and society, and quality enhancements of research in academia
- Direct innovation support has to be intensified, foremost in the shape of bridging institutions between different societal sectors and especially academia and industry, and other innovation support infrastructures.
- The research institute sector is in need of vitalizing and strengthening.²⁶

2.5 Research and innovation system changes

The closing of research sites in Lund (2010) and Södertälje (2012) by AstraZeneca have been mentioned. These events naturally caused changes to the innovation system in the form of a removal of a large employer of highly skilled labour in the life sciences area. Similar events in the private sector includes Sony Mobile's closing of an R&D site in Lund, announced in August 2012, and the general scaling down by Ericsson, announced in November 2012, together entailing layoffs of approximately 2000 people in the telecom sector. In addition, the car manufacturing company SAAB, cut off from the bailout of its parent company General Motors in 2008/09, defaulted in 2011 and finalized its shutdown in 2012. Volvo Cars, previously part of Ford Motor Company, was sold to the Chinese car manufacturer Geely in 2010 and although there have been recurring guarantees issued by the new owner that the location of important Volvo manufacturing (and R&D) facilities in Sweden are not in danger, this switch in ownership has meant some alteration of the landscape. In a recent report, interviews with a large number of R&D-intensive firms globally yield a pessimistic outlook for renewal of Swedish private-sector R&D – 94% of the interviewed companies state that they do not consider Sweden a serious alternative for location of their R&D investments.²⁷

It is difficult to assess the extent to which recent policy measures on central level have been tailored to directly mitigate the effects of the changes in the private sector and improve the

²⁵ Swedish Government (2012b).

²⁶ Swedish Government (2012c).

²⁷ Confederation of Swedish Industries (2012)

prospects for Sweden to become a locus of international private sector R&D investment. Clear is that local debate has been intense, and that efforts have been made in both regions to compensate for the loss of jobs and to take advantage of the windows of opportunity created. In Lund, the creation of a new science park for life science, the *Ideon Medicin Village*, is underway. This science park is to be located in the building complex previously occupied by AstraZeneca. Several research groups from Lund University's medical faculty are reportedly contracted to move into the premises when renovation is completed, in 2013. As for Södertälje, it is reasonable to view the strong commitment to the new national life science laboratory SciLifeLab by the government (as manifested in the research bill, see above) as at least partly a direct answer to the announced departure of AstraZeneca from Södertälje. The investment in SciLifeLab is however scheduled to commence in 2013, as is the decommissioning of the AstraZeneca site, and so it is far too early to make any assessments of the effects of these changes to the innovation system in the life sciences area.

In the public R&D system, which in Sweden is roughly equal to academia (see above), there have been few or no changes of any magnitude. Any significant effects still remain to be seen of the 2010 so called autonomy reform for universities and university colleges, which in principle increased the managerial discretion of vice chancellors and central university managements significantly, including granting the universities freedom to reorganize and develop research and education activities in new ways.²⁸ No higher education institution has yet made any noteworthy organizational changes although a few have started investigative work on how to proceed and make use of their newly won freedom. Recent signals from the government indicate that the institutional landscape of the academic sector is likely to be reshaped in the coming years. Though not formulated in any official policy document or bill but rather conveyed in speeches and media interviews, it appears to be the viewpoint of the government that some of the smaller regional university colleges are unfit to survive the current process of strategic prioritization and overall quality enhancement of education and research (as formulated in the two most recent research bills, see above). So far, one merger has been executed and another announced: On January 1st, 2010, Växjö University and Kalmar University College merged to form the Linnaeus University, and on July 1st, 2013, Sweden's smallest regional academic institution, Gotland University College, will become part of Uppsala University.²⁹ Several rumours of other mergers circulate in media and among pundits, and some statements of intentions regarding future mergers of regional colleges with larger universities, or a few regional colleges with each other, have also been made by vice-chancellors. No concrete plans, let alone decisions, seem however to have been made except for the mentioned Uppsala-Gotland and the Kalmar-Växjö mergers.

The innovation support system for the business sector appears to be suffering slightly from lack of coordination. As mentioned, policy responsibility for innovation support lies with the Ministry of Enterprise, Energy and Communication whereas research policy lies with the Ministry of Education, and also within the Ministry of Enterprise, Energy and Communication, there is some fragmentation of tasks. Both Vinnova and the Swedish Agency for Economic and Regional Growth work with innovation support, as do the governmental investment firms ALMI / the Innovation Bridge and the innovation offices set up at universities around the country. ALMI and the Innovation Bridge have now been merged and there are also efforts to consolidate and streamline the roles of the different agencies and companies by clarification of their respective (and interrelated) mandates and roles in the innovation system.³⁰

²⁸ Swedish Government (2008b).

²⁹ Faugert & Co (2011); Uppsala Universitet (2012).

³⁰ Ivarsson (2012)

2.6 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

The implementation of the Regional/National Research and Innovation Strategies on Smart Specialisation (RIS3) in Sweden is only on early planning stage, and it is at this point not entirely clear on what level of government the responsibility for formulating and executing these strategies will be laid. Sweden is currently undergoing a gradual transformation of its regional government subdivisions; and so far, new so called Regional Boards have overtaken responsibilities for regional development from Country Administrative Boards in four regions; in Skåne, the southernmost region around Malmö; in Västra Götaland, the region around Gothenburg in south western Sweden; in Halland, the region geographically located between the two former; and in Gotland, the island county in the Baltic Sea. These Regional Boards, and an association of municipalities and the county administrative board in the north of Sweden called the Västerbotten Region, have made independent efforts to formulate regional innovation strategies,³¹ and it is expectable that RIS3 strategies will be incorporated in these strategies in the near future. On national level, the responsibility for RIS3 strategies lies with the Ministry of Enterprise, Energy and Communication, and its agency the Swedish Agency for Economic and Regional Growth (Tillväxtverket). Discussions are still underway regarding the approach to be taken by Sweden in the implementation of RIS3 strategies.

2.7 Evaluations, consultations

The Ministry for Enterprise, Energy and Environment gave the task to the OECD to undertake an evaluation of the Swedish innovation system and suggest policy measures for its improvement. The report, presented in November 2012, names Sweden one of the world's leading countries in the area of innovation but criticizes the Swedish system for insufficient academy-industry interaction, lack of strong enough excellence centres at Swedish universities and lack of national coherence in innovation policy. The report also echoes previously mentioned themes; Sweden is too heavily reliant on MNCs and their R&D investments in Sweden, which presents great risk if any one or a few of these very large companies decide to move their R&D investments elsewhere. The report recommends an oversight of the system of venture capital and a consolidation of national policymaking to create better policy coherence.³²

An evaluation by the Royal Swedish Academy of Engineering Sciences makes a similar analysis, criticizing the Swedish innovation system for lack of coherence and too many actors working independently of one another. The report proposes a comprehensive strategy to create a more favourable culture for innovation in Sweden, largely driven by a strong policy showing that signals a determination on behalf of Swedish policymakers to enhance the innovation climate. A number of concrete proposals are also made, including changes in the incentives structures for innovation and entrepreneurship, such as tax deductions for venture capital, simplification of regulations, and better legal frameworks for intellectual property.³³

³¹ Region Skåne (2011).

³² Sundström (2012).

³³ IVA (2011).

2.8 Policy developments related to Council Country Specific Recommendations

The Council of the European Union made the following recommendation to Sweden on 30.05.2012:

“Focus the upcoming research and innovation bill on measures to improve the commercialisation of innovative products and the development of new technologies to support high-growth innovative firms.”³⁴

The 2012 research bill launches policies and new funding schemes to enhance quality (excellence) in academic R&D. With regard to commercialisation, the bill responds to the call in a separate chapter which outlines the following specific policies:

- Strengthening of the industrial research institutes. These institutes are active in the borderland between academia and industry and work to enhance knowledge and competence in innovation, and they are coordinated by a governmentally owned holding company called Research Institutes of Sweden (RISE). Their earmarked funds for strategic competence enhancement are increased by 3 m€ in 2013, 7 m€ in 2014, 3.5 m€ in 2015, and 1 m€ in 2016. In addition, RISE is given the explicit tasks of working towards better coherence among institutes within industrial sectors; streamline the legal and organizational structures of the institutes; strengthen the RISE brand to increase its recognition as a reliable player in the innovation system; deepen its collaborative efforts with academia as well as industry in order to facilitate more knowledge and competence exchange between them; increase its financial support to innovation activities in SMEs; and strengthen its in-house competence in intellectual property.
- Support of the efforts to interact and commercialize in the academic sector. The annual governmental grant to academic institutions for so called special expenditure is given an increase of 2 m€ in 2013, to strengthen the role of the so called innovation offices at universities and university colleges. The innovation offices give support to academic staff in their work to commercialize their results, and have contributed to create some coherence in the innovation support activities at academic institutions, and are now given an increase of resources. Furthermore, VINNOVA and the Swedish Research Council are given the task of actively supporting the strategic work of academic institutions to interact with the surrounding society and commercialize knowledge.
- Strengthening of the innovation infrastructure. In the years 2013-2016, VINNOVA is given a gradual resource increase of 6 m€ to increase the availability of technical facilities for testing and validation within the institutes of RISE.³⁵

In addition to this, the bill reports on on-going developments in its work to modify patent rights, the deductibility of donations to R&D, and strengthen the innovative regions in Sweden, none of which however have reached any stages concrete enough to render further attention in this context but will have to take up space in coming assessments.

The 2020 national target for R&D intensity is 4%. As noted in previous sections, the current and recent trend in R&D intensity is negative, and there are no real signs in sight that this

³⁴ European Commission (2012).

³⁵ Swedish Government (2012b).

development will turn. In order to fulfil the national target, an average annual growth of R&D intensity of 1.6% is necessary from 2012 and on. The chief challenges to these prospects lies in the developments in the private sector; BERD makes up almost 70% of total GERD and is declining; furthermore the government has made unprecedented efforts (also in terms of real investments) in the public R&D sector (academia), to increase R&D intensity and elevate general quality levels.

3 STRUCTURAL CHALLENGES FACED BY THE NATIONAL SYSTEM

As noted in previous chapters, the Swedish R&D system is dominated by the two comparably insulated sectors of business enterprises, responsible for two-thirds of the total annual investment in R&D in Sweden and largely spending this money internally, on in-house R&D, and the public side which is still dominated by the academic sector and funded by the government. The reach of national policymaking therefore extends mainly to the academic sector, and though efforts are and have been made (see previous chapter) to strengthen the role of actors working in the borderland between academia and industry, the main structural challenge is still the relatively stark separation between the two dominating sectors.

Table 3: Sweden Innovation Union indicators (EU27=100).³⁶

| | |
|--|-----|
| Human resources | |
| New doctorate graduates (ISCED 6) per 1000 population aged 25-34 | 207 |
| Percentage population aged 25-64 having completed tertiary education | 136 |
| Open, excellent and attractive research systems | |
| International scientific co-publications per million population | 493 |
| Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country | 114 |
| Finance and support | |
| R&D expenditure in the public sector as % of GDP | 141 |
| Firm activities | |
| R&D expenditure in the business sector as % of GDP | 191 |
| Linkages & entrepreneurship | |
| Public-private co-publications per million population | 324 |
| Intellectual assets | |
| PCT patents applications per billion GDP (in PPSE) | 239 |
| PCT patents applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health) | 282 |
| Outputs | |
| Economic effects | |
| Medium and high-tech product exports as % total product exports | 106 |
| Knowledge-intensive services exports as % total service exports | 89 |
| License and patent revenues from abroad as % of GDP | 220 |

This is, naturally, also reflected in the 2012 research bill which first and foremost is concerned with the academic sector – its prime area for policymaking – and beyond that launches some efforts to facilitate better interaction between the academic sector and business.

Most of the policies launched in the 2012 research bill are not to be executed until 2013, which in a sense makes them irrelevant in this context, but the government's general assessment of the national innovation system is also formulated in the bill and can indeed give clues to its status and the main challenges it is facing. However, formulations are quite general and not very different from those of the previous research bill (2008) and the overall message of the ERAWATCH country reports of 2009, 2010 and 2011. The bill highlights the following structural challenges for the Swedish R&D system, largely echoing both the 2008 and the 2004 research bills:

³⁶ Source; European Union (2012)

- Although the general level of quality of Swedish (academic) research is already high, it will have to be improved in order to be globally competitive in the coming decades.
- The degree of interaction between the academic sector (basic research) and industry, and the commercialization of research results from academia, is unsatisfying and needs to be increased.
- Swedish public R&D is characterized by breadth rather than cutting-edge, and there is a need for specialization and strengthening in specific areas.³⁷

The 2011 country report revisited the 2009 country report when laying out the structural challenges facing the Swedish national innovation system, and identified some challenges as “more critical than others”, in light of Sweden’s strong showing in the Innovation Union Competitiveness Report, where it joined Denmark, Finland and Switzerland in the group of “very high knowledge-intensity countries”. The conclusion is, hence, that structural challenges facing Sweden can or should be viewed differently in Swedish domestic perspective than in the broader perspective of comparison across EU.³⁸

Generally, the policymakers’ collective view on shortcomings in the Swedish innovation system goes back to the identification of a “Swedish paradox” in 1990s academic research on innovation and entrepreneurship, a concept that has earned great influence in policy circles and established as common knowledge that compared to its strong figures of annual R&D investment as percentage of GDP, Sweden suffers from an inadequate level of returns from public investments in R&D. Several factors for this “paradox” have been highlighted by innovation scholars and policy and system analysts, and the 2011 country report summarizes these exemplarily:

- A historically determined structural division of labour between the state sponsoring basic research in academia and the private sector sponsoring applied research and development in-house
- A partly historically determined relative dominance of large MNCs in the industrial sector and a consequent relative lack of venture capital and other critical resources for innovation in SMEs
- A generally poor entrepreneurial climate in comparison with many other European countries; mainly comprising of poor incentive structures for starting firms compared to regular employment, that largely stems from the structure of the welfare system which favours wage earners³⁹

Also on the level of specific indicators, there is evidence to be found for the existence of a paradox in the sense that results and returns do not match investments, compared to other countries: In the Innovation Union Competitiveness Report, R&D intensity in Sweden is higher than the reference group (measuring GERD as % of GDP; BERD as % of GDP; and GBAORD as % of GDP), and the figures on doctoral graduates per thousand population aged 25-34 and researchers per thousand labour force also come out in Sweden’s favour compared to the reference group. However, as the 2011 country report highlights, Sweden scores lower than the reference groups when it comes to e.g. highly cited publications and patent statistics, which confirms the generally held view in Sweden that there is indeed an overall structural deficit along the lines of what has been called the “Swedish paradox”.⁴⁰

³⁷ Swedish Government (2012b).

³⁸ Melin et al (2012).

³⁹ Melin et al (2012).

⁴⁰ European Commission (2011).

The government has been explicit in at least three consecutive research bills (2004, 2008, 2012), as well as other official documents (e.g. the 2012 National Innovation Strategy) that the public R&D system is in need of strategic mobilization and purposeful efforts to enhance the level of interaction between academia and industry/society to strengthen the innovativeness of the economy at large.⁴¹ It has also, as reviewed in earlier chapters, launched several specific policies both to mobilize strategically (the Strategic Research Areas and the recent programs to recruit internationally leading scientists), to raise overall quality levels (resource increases) and to facilitate commercialization of research results (investments in the institute sector and in innovation offices). However, it must be noted in this context that *structural challenges facing the national innovation system* also include profound features of the Swedish economy and society in general, and the configuration of the public R&D system specifically. We have commented, in the introduction to this report, on the general level of decentralization and lack of coordination in the research policy system, which has historical reasons in the shape of a strong academic sector and a lack of central initiative in research policymaking. It must be acknowledged that while these general features of the system indeed, in their own right, pose structural challenges to the system, they also inhibit the government's room for manoeuvre in attempting to meet the challenges through national research policy: The system is still decentralized and the governmental agencies with responsibilities in the area are still either highly specialized (as in the case of VINNOVA), mainly concerned with the education side of the academic sector (the Swedish National Agency for Higher Education), or diversified and decentralized by design, through its stipulated collegial and program-oriented governance structures (the research councils).⁴² Paradoxically enough, though the government repeatedly complains about this lack of mechanisms for strategic mobilization and coordinated system-wide efforts, it continues to delegate responsibilities for quality enhancement, the design of new governance mechanisms, and specifically prioritized investments to its agencies and to the academic institutions. The most recent governmental reforms to the framework for steering of the public R&D system have strengthened the formal autonomy of universities and stripped the government of its previous privileges of prioritizing between research areas in the R&D appropriations. The responsibility for design and implementation of new quality assessment schemes is laid on the Swedish Research Council. With the exception of the Strategic Research Areas funding scheme and some similar earmarks for specifically designated research areas in the latest research bill (see next chapter), the government relies on the academic institutions and the research councils to distribute funding, and hence also make priorities.

⁴¹ Swedish Government (2004; 2008a; 2012b; 2012c); Hallonsten and Silander (2012).

⁴² Sandström et al (2008).

4 ASSESSMENT OF THE NATIONAL INNOVATION STRATEGY

4.1 National research and innovation priorities

The result of the 2010 general election in Sweden was historically unprecedented, namely the re-election of an incumbent centre-right coalition government. After having embarked on an ambitious path towards general quality enhancements and not least system-wide funding increases for public (academic) R&D in its first term, culminating with the 2008 research bill, this government was allowed to continue the course set and could follow up on the policies in the 2012 research bill.

As noted under a separate headline below, the policy mix has not been altered to any notable extent in the past year, and so it is basically the same system and actors that have been responsible, in 2012, for implementing and overseeing the policies and priorities of the 2008 research bill and that will, beginning in 2013, work with the priorities in the new research bill.

The most significant policy priority introduced in the 2008 research bill was, besides the general funding increase for academic R&D and the strengthening of academy-industry links, the introduction of the Strategic Research Area funding scheme, allocating a total of 300 m€ over five years to university research groups and consortia of research groups within 20 specifically chosen areas:

- Energy
- Sustainable exploitation of natural resources
- Effects on natural resources, ecosystems and biological diversity
- Climate models
- Sea environmental research
- Cancer
- Diabetes
- Epidemiology
- Molecular biology
- Neuroscience, incl. brain- and nerve system diseases
- Stem cells and regenerative medicine
- Health
- Nanoscience and nanotechnology
- E-science
- Material science, incl. functional materials
- IT and mobile communication, incl. future solutions for communication and monitoring systems
- Production technology
- Transport research
- Security and crisis management
- Politically important geographical regions⁴³

As noted in the 2011 country report, this funding scheme “signals which fields are prioritised and emerging” in the government’s view.⁴⁴ Although the groups eventually receiving the funding

⁴³ Swedish Government (2008a).

were chosen through open calls and a peer review process organized by the research councils, the Strategic Research Areas funding scheme is unprecedented policy prioritization on governmental level and signalled a shift in the government's attitude towards steering of the academic sector.⁴⁵ The government is continuously underscoring the need to guard and secure academic freedom, not only as a value in itself but also as a means to achieve a higher general quality of research, and this principle is given prominence also in the latest research bill, in whose introductory paragraphs it is stated that the freedom of research, and its autonomous role in society, ensures its vital ability to independently choose and formulate research questions. Nonetheless, the bill is also quick to point out areas of special prioritization for Swedish science that are also to receive special funding in the years 2013-2016, namely:

- Mining, mineral and steel research (23.6 m€)
- Forestry and biomass (22 m€)
- Sustainable societal development (23.6 m€)
- Life science; including infections and antibiotics (30.5 m€), ageing and health (40.2 m€), drug development (19.5 m€), clinical treatment research (25.3 m€), clinical studies (18.4 m€) as well as investments in the national Science for Life Laboratory (75 m€) and Institute for Process Development and Catalysis (17.2 m€).
- Evidence based education and preschool (18.4 m€)
- Artistic research (16 m€)
- Space research (37.4 m€)⁴⁶

In addition, heavy investments are made in research infrastructures for materials and life science research, namely:

- the European Spallation Source (72 m€)
- the MAX IV synchrotron radiation facility (11.5 m€)⁴⁷

It should also be mentioned that three other clear governmental research and innovation priorities for the coming four years are evident in the bill, both of which are not directed towards specific areas but for which responsibility is delegated to the concerned councils, agencies and not least academic institutions (total increase over the years 2013-2016 in parenthesis):

- Increased base grant funding for academic R&D (240 m€)
- Programs for the recruitment of international top-level researchers (86.2 m€) and young researchers (20.1 m€), to be administered by the Swedish Research Council
- Increased general funding for the research councils and the Swedish Energy Agency's R&D programs (253 m€)⁴⁸

As already mentioned, a few evaluation reports have recently commended the Swedish innovation system for its comparably healthy state but simultaneously criticized the system and not least policymaking for lack of coherence and coordination. Generally, evaluations of this sort tend to call for more comprehensive and purposeful innovation strategies on behalf of the government, although the specific nature of the suggested changes naturally varies.⁴⁹

⁴⁴ Melin et al (2012).

⁴⁵ Hallonsten and Silander (2012).

⁴⁶ Swedish Government (2012b).

⁴⁷ Swedish Government (2012b).

⁴⁸ Swedish Government (2012b).

⁴⁹ Sundström (2012); IVA (2011).

To some extent, it can therefore be said that the government has continued its effort to both strategically prioritize and increase the funding of essentially all areas, thus “keeping the balance” as noted in the 2011 country report.

Finally, the government’s efforts to enhance the interaction between academia and private sector and the commercialization of research results, described in better detail elsewhere in this report, should also be mentioned as a clear policy priority.

4.2 Evolution and analysis of the policy mixes

The Swedish RDI strategy is multi annual, with governmental research bills normally issued every four years, laying out the general policy framework as well as specific initiatives and investments for a coming period of a few years. This means that substantial changes in the policy mix are normally only expectable at the issuing of a new research bill, and in the past, shifts have indeed occurred at such points, most recently with the 2008 research bill which signalled and outlined a comprehensive effort to strengthen the Swedish public R&D system. The 2011 country report stated that with the 2008 research bill in effect, the years 2009-2012 have not seen any substantial changes in the policy mix. As noted in the previous section, a chief feature of the 2012 research bill is its emphasis on continuity and perpetuation of the policy direction set out in the 2008 bill. There have, hence, not occurred any major shifts in 2012 that will alter the policy mix.

But the continuity itself does of course deserve mentioning. The general trend among policymakers as well as in the general public is that R&D activities as well as innovation activities are of great importance for long-term Swedish competitiveness in an increasingly globalized economy. Research and innovation will therefore most likely continue to be a priority (though naturally one among several) of national policy in Sweden, and to the extent that the fairly diversified system allows for it, national research and innovation policy will remain a fairly strategic, coherent and integrated policy area oriented towards addressing major societal challenges which also reflect EU priorities.

In terms of policy formulation, research and innovation are thus effective policy areas near the centre of government structure and securing the input of a great variety of stakeholders through and institutionalized process of crystallizing research policy priorities in advance of every new research bill. This procedure has not been changed in 2012; all relevant actors in the system have evidently been offered the privilege of contributing, by advance input, to the content of the research bill.

Earlier assessments have pointed out imbalances and highlighted corresponding policy instruments, for example the previous perceived focus on “knowledge creation” rather than “value creation”, something that the two consecutive research bills of 2008 and 2012 have taken seriously by proposing a number of new policies to correct imbalances and increase private R&D investment (see also paragraphs in previous section on the “Swedish Paradox”). Among these are, as mentioned, instruments promoting the establishment of new indigenous R&D performing firms include increased provision of venture capital, especially in the early stages of the innovation processes, the strengthening of Intellectual Property Rights (IPR) and the initiative to establish ‘innovation offices’ at the major universities; the strengthening of the institute sector, and the investment in new strategic innovation areas administered by

VINNOVA. The overall efforts to increase academy-industry interaction and commercialization of research results include a total of 153 m€ to be spent in the years 2013-2016.⁵⁰

It also deserves mentioning that in 2012, the issues raised among scholars and pundits regarding the Strategic Research Areas funding scheme launched in the 2008 research bill (see previous section), as well as predecessor programs aimed at strengthening larger research environments in specially prioritized areas, have continued to be the topic of heated discussion. The alleged one-sided focus on ‘excellence’ in the definition of the word used by the government, i.e. the allocation of vast sums of money to already comparably successful research environments, has been a specific point of criticism, and the funding schemes have been accused of skewing competition in favour of those prejudiced to be excellent rather than those with proven qualities. Not least the non-university side of the academic sector, i.e. the smaller regional colleges, are said to have been discriminated against by the launch of these programs.⁵¹

As mentioned at other places in this report, it is widely accepted among Swedish policymakers, scholars and analysts, that the historically determined domination of Swedish industry by large MNCs and the associated generally low level of R&D in SMEs is a structural deficit that requires attention and purposeful policy making. In recent years, another disturbing realization has been added in the shape of decreasing numbers of university graduates in science and engineering fields, a development, in relative terms, that has been going on for at least the past decade. In combination with the relative dominance of MNCs in the private R&D sector, this development threatens Sweden’s position as a high-skill labour market, since diminishing supplies of well-educated people in Sweden may lead to the relocation of the R&D activities of MNCs abroad.

Efforts to enhance the innovation climate for SMEs are continuously launched by a variety of actors in the system, most notably of course the government through previously cited policy measures in the research bills (strengthening the research institute sector, opening of offices for innovation at universities, and increasing the availability of testing and simulation facilities) but also in the shape of specific programs by e.g. VINNOVA that aim to bridge the gap between academia and industry and facilitate academic spinoffs, as well as support SMEs in joint R&D projects with academia. The resulting plethora of actors has been mentioned before and not least criticized by various evaluations, and it is clearly one of the challenges being addressed in current policy.

4.3 Assessment of the policy mix

As already noted, the past decade’s recurring research bills issued by the Swedish government have been consistent in their assessment of the structural challenges facing the Swedish innovation system, and also launched several measures to meet challenges.

Sweden has a long tradition of carrying out high quality research and education, and there is generally a high level of trust in research among Swedish citizens. Though Sweden has a high showing in international indicators for basic R&D as well as macro-level figures for R&D investments (see previous sections), the performance is widely considered to be decreasing. Furthermore, the economic crisis and the effects of globalization have actualized the structurally and historically determined weak connections between academic research and industry.

The role of the Swedish universities is not entirely clear but rather complex. There are signs of mission overload or functional overload that reasonably stems from the dominance of the

⁵⁰ Swedish Government (2012b).

⁵¹ Benner et al. (2010); Sandström et al (2010); Hallonsten and Silander (2012); Hallonsten (2012).

academic sector in the public R&D system which has prevented the emergence and growth of e.g. an institute sector with a mission complementary to the academic institutions.⁵² The latest model for distribution of resources puts more emphasis on performance and quality, but there is also an apparent ambivalence on the level of the government as to how performance and quality is supposed to be measured. The 2008 research bill called for bibliometric measures to be the foundation of the quality- and performance-based resource distribution system whereas the 2012 research bill, apparently as a result of strong criticism from the performer side, instead envisions a quality assessment scheme based on traditional organized peer review. This system is supposed to be implemented in 2018, at the earliest, and the Swedish Research Council has been given the mission of designing it.⁵³

The recent economic crises is likely to lead to a further decrease in private investment in R&D. Companies are facing increasing globalisation, as well as increasing competition, which may result in the larger, transnational companies moving their R&D investments abroad. Examples (AstraZeneca, Sony Ericsson) have been mentioned in earlier sections, although it is at this point difficult to assess the causalities between globalization/economic crisis and the decisions of these companies to close R&D-intensive plants in Sweden.

The traditionally low investments in R&D among SMEs have also been mentioned, and the policy measures introduced in the 2008 and 2012 research bills to strengthen the interaction between the academic sector and private enterprises are evidence to both that there are structural challenges in this area and that the government is determined to handle them.

The launch of the Strategic Research Areas in the 2008 research bill is arguably the most significant single policy/funding instrument deployed by a Swedish government in the area of public R&D in recent times. Within it are efforts to strengthen interaction and co-operation between higher education institutions and industry, but the key rationale for the policy is undoubtedly to achieve lasting effects in the shape of a turn from breadth to cutting edge in the public R&D system, a structural challenge repeatedly mentioned in research bills and other policy documents.

Vinnova, on their part, has also launched a program in what they call “Challenge-driven Innovation”, aimed at supporting innovation activities in four specific areas where there is judged to be a combination of especially good preconditions in Sweden and a pressing need for innovation (societal challenges). These are *Information society 3.0*, *Sustainable Attractive Cities*, *Future Healthcare* and *Competitive Production*. The program allocated in total 182 million SEK in 2011 and 2012.⁵⁴

Most of these policy measures are relatively new and have not been comprehensively evaluated. Assessments and evaluations of specific programs and policies do exist but the possibility of drawing sharp conclusions on overall level is limited (see table 3). On basis of the assessments of the structural challenges offered in the research bills, however, it can be said that the policy mix is quite well articulated for addressing the challenges.

⁵² Sörlin (2006); Jacob et al (2003); Jacob and Orsenigo (2007).

⁵³ Swedish Government (2012b).

⁵⁴ Vinnova (2013)

Table 3: Assessment of the policy mix

| Challenges | Policy measures/actions addressing the challenge ⁵⁵ | Assessment in terms of appropriateness, efficiency and effectiveness |
|--|---|---|
| Private R&D sector dominated by a handful of MNCs and a comparable lack of SME R&D efforts | Broad set of reforms on long term | Under implementation; not yet evaluated |
| Structural division/separation between public and private R&D sectors | Launch of additional innovation offices at universities, strengthened funding for existing ones | Implemented; not yet evaluated |
| Weak connections between academic research and industry | | |
| Poor climate for entrepreneurship stemming from lack of adequate incentive structures for business startups compared to regular employment | No systematic efforts; partially addressed by increase in efforts by e.g. VINNOVA to stimulate innovation among SMEs | Evaluations of specific programs are generally positive but no overall results are discernible. |
| Breadth rather than cutting-edge characterizes public R&D system | Generously funded national excellence programs launched in research bills (SRA funding, Linneaus Grants, etc.) | Only available evaluation critical to the efficiency and appropriateness of the programs launched ⁵⁶ |
| Role of the HEI sector unclear. Organizational and managerial discretion opaque | Government continuously stresses academic freedom and has gradually increased the organizational autonomy of universities through a series of reforms | Implementation is on-going; no clear effects yet visible and no comprehensive evaluation yet undertaken |

⁵⁵ Changes in the legislation and other initiatives not necessarily related with funding are also included.

⁵⁶ Sandström et al (2010).

5 NATIONAL POLICY AND THE EUROPEAN PERSPECTIVE

In purely quantitative terms, the Swedish R&D system is strong and healthy. The most obvious indicator of this is of course the high level of investment on R&D as a share of GDP, not least of course in the business and enterprise sector. but the performance of the public R&D system is also high in quantitative terms. This also means that Sweden scores high in measures of number of researchers per thousand in the labour force and on doctoral graduates per thousand population aged 25-34. Sweden also has a relatively high standard of research infrastructure. It has been argued that the amount of future business and enterprise investments in R&D will be heavily dependent on access to skilled employees and a good research infrastructure, and so it is important that the investments remain on a high level also in the years to come.

The recent half a decade's governmental research and innovation policy has been focused on priorities and increasing resources. Strategic Research Areas of special national importance have been identified in the 2008 and 2012 research bills and generous resources have been earmarked for their development. These areas (listed in previous sections) are typically also relevant in European perspective. Most of the strategic areas are within the natural and technical sciences and they are considered to be of high priority because of their connection to the demands from the business and enterprise sector; given their identified 'strategic' importance, this is highly natural. But considering these priorities, the decreasing numbers of doctoral graduates in engineering and medicine⁵⁷ is a worrying aspect of the overall picture. It is important that national science policy acknowledges this apparent discrepancy and launches measures to meet the associated challenges.

In international comparison, the general standard of Swedish research is high. Swedish researchers are, on average, strong in international publishing and well-cited, but citation rates are rather low in several of those fields identified as Strategic Research Areas, and the small academic community means that the critical mass in research areas is insufficient and thus the number of researchers at the frontier of scientific fields inadequate. It would therefore also be recommended that Swedish policies focus on enhancing research quality. Several steps have already been taken, for example to encourage competition between researchers and between HEIs/PROs as well as to encourage recurring evaluations. There is inconsistency in the government's view on the standards for measuring and evaluating quality and performance in research: the 2008 bibliometric schemes are supposed to be replaced by peer review based evaluations by 2018. This inconsistency is somewhat worrying because it creates a lack of predictability of evaluation schemes which is a generally disturbing factor for researchers and research groups already strained by competition. Furthermore, it may create unnecessary discontinuities in the overall efforts to enhance quality across the full disciplinary breadth of Swedish research.

It is has been widely argued, for at least two decades, that Sweden is comparably poor at translating research findings into commercial products and services. This is for example indicated in the relatively weak Swedish scores on licence and patent revenues from abroad in the Innovation Union's Competitiveness Report. Swedish policies have for years, at least in policy formulation, focused on combating this 'Swedish Paradox'. One recent policy measure that has been realised is the innovation offices at eight universities, aiming to reach critical mass and more professionalism in technology transfer activities. This policy has been followed up with

⁵⁷ Melin et al (2012).

additional resources in the 2012 research bill. A second policy in the area has been the support of cooperative research centres and other partnerships between HEIs/PROs and industry. A third policy effort has been an evaluation of methods to make public procurement boost innovation. In line with the 2011 report, it is here recommended that Swedish policies continue to stimulate those and related activities.

Although Swedish research and innovation policy is formulated and developed in dialogue with key stakeholders, and occupies a central position among governmental priorities, the general policy and governance system is repeatedly criticized for incoherence, decentralization and weakness of central and critical policy actors. Efforts to keep the positive elements of a pluralized and decentralized system (e.g. academic self-governance, participation, and consensus) while simultaneously improving the governance system and achieve better policy coherence and opportunities for necessary strategic mobilization and central priorities is key to a favourable long-term evolution of Swedish national research and innovation policy in the globalized knowledge-based economy.

More specifically, there is the apparent lack of dynamic connections between the academic and the business sides of the system; an issue that requires a comprehensive and long-term strategy on national level to work out favourable legal frameworks and incentives structures. This could be a key piece in both preventing the relocation (outsourcing) of MNC R&D to other countries and the stimulation of innovation-based SME growth. Education has a clear role to play; after all, the supply of skilled labour is one of the most vital functions of the (public) education and research system in maintaining industrial competitiveness.

Future challenges for funding of research and innovation policy in Sweden include the creation and development of support measures which target the 'Grand Challenges', which are as valid in Sweden as elsewhere in the European Union. Public procurement and user-driven innovation procurement of various kinds ought to be strengthened, but finding efficient instruments for this may prove to be a challenge as well. The Government has made strong investments in R&D funding the last years, and there is currently pressure from the industry and the surrounding society to put more focus on investments in utilization and commercialization of scientific results, than has been the case. It is critically important that the sharp division between the academic and private sectors is overcome and bridges are established between them, for example by the increase in resource allocation to specific VINNOVA programs and the Institute Sector. Measures of this type are currently being implemented, and their success is vital for a favorable development on long-term.

Swedish policies for research and innovation are generally well at terms with the ERA pillars and objectives. The five key priorities and their correspondence in national policy are listed:

- 1) **More effective national research systems:** Governmental efforts to increase the competitive element in public R&D funding and make use of international evaluative panels and assessments in the distribution of research funding in the academic system.
- 2) **Optimal transnational co-operation and competition:** While contributing greatly as host and initiator of the 2009 conference where the Lund Declaration for transnational mobilization of R&D and innovation in the European Union was drafted, the Swedish government's research and innovation policy is almost completely geared towards increasing Swedish national competitiveness in a European as well as global context. It should, however, be noted that some specific policies, with aims of strengthening domestic performances (notably the Strategic Research Areas and the research infrastructures, see above), are well in line with pan-European priorities as expressed in

the ERA pillars and objectives, but this is likely coincidental rather than deliberate from the Swedish government's part.

- 3) **An open labour market for researchers:** The recent so-called Autonomy Reform of the Swedish academic system has brought increasing freedom to the universities and higher education institutions which is likely to have positive effects on the mobility of researchers and the openness of the Swedish system to foreigners. While the motivation for this reform was a general belief in the correlation between self-governance for academic institutions and high research performance in academia, rather than mobility and internationalization in itself, the reform answers well to this ERA priority.
- 4) **Gender equality and gender mainstreaming in research:** No governmental initiatives; quite the opposite, there is widespread criticism towards the current research and innovation policy doctrine in Sweden that it has inadvertent negative consequences for gender balance.
- 5) **Optimal circulation, access to and transfer of scientific knowledge including via digital ERA:** No particular governmental initiatives, although there are several efforts on the level of governmental agencies and academic institutions to promote open access publishing and facilitate better exchange of scientific information.

REFERENCES

Alpman (2011). FoU stagnerar - trots bra tider. Ny Teknik 20 April 2011.

Benner, M. (2008). Kunskapsnation i kris? Nya Doxa.

Benner, M. (2012). Big Science in a small country: constraints and possibilities of research policy. In Hallonsten, O. (ed.) In Pursuit of a Promise. Perspectives on the political process to establish the European Spallation Source (ESS) in Lund, Sweden. Arkiv Förlag.

Benner, M., Stensaker, B. and I. Unemar-Öst (2010). Universitets- och högskolepolitiken Avsikter och konsekvenser för de nya lärosätena. Report. http://www.oru.se/PageFiles/30118/Universitets-och_hogskolepolitiken.pdf

Confederation of Swedish Industries (2012). Hur starkt står Sverige? http://www.svensktnaringsliv.se/multimedia/archive/00034/Hur_starkt_st_r_Sver_34844a.pdf

Edquist, C. and M. McKelvey (1998). High R&D Intensity Without High Tech Products: A Swedish Paradox? In Nielsen K. and B. Johnson (eds.) Institutions and Economic Change: New Perspectives on Markets, Firms and Technology. Edward Elgar.

Ejermo, O. and Kander A. (2006) The Swedish Paradox. CIRCLE Discussion Paper 2006/01. http://www.circle.lu.se/upload/CIRCLE/workingpapers/200601_Ejermo_Kander.pdf

European Commission (2011). Innovation Union Competitiveness Report 2011. http://ec.europa.eu/research/innovation-union/index_en.cfm?section=competitiveness-report&year=2011

European Commission (2012). Council recommendation on Sweden's 2012 national reform programme and delivering a Council Opinion on Sweden's convergence programme for 2012-2015. http://ec.europa.eu/europe2020/pdf/nd/csr2012_sweden_en.pdf

European Commission (2012b). Europe 2020 targets: Research and development. http://ec.europa.eu/europe2020/pdf/themes/12_research_development.pdf

European Union (2012). Innovation Union Scoreboard 2011. http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011_en.pdf

Eurostat (2012). <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>

Faugert&Co (2011) Linnéuniversitetets tillkomst. En studie av fusionsprocessen. http://www.technopolis-group.com/resources/downloads/se/rapporter/universitetet_rapport_final.pdf

Hallonsten, O. (2012). De stora universiteten favoriseras. Svenska Dagbladet. http://www.svd.se/opinion/brannpunkt/de-stora-universiteten-favoriseras-i-forskningspolitiken_6924835.svd

Hallonsten, O. and C. Silander (2012). Commissioning the university of excellence: Swedish research policy and new public research funding programs. Quality in Higher Education 18(3): 367-381.

Hallonsten, O. and D. Holmberg (2013). Analyzing structural stratification in the Swedish higher education system: data contextualization with policy-history analysis. Journal of the American Society for Information Science and Technology, in press.

Hellström, T. (2012). Epistemic capacity in research environments: a framework for process evaluation. Prometheus 30(4): 395-409.

IVA (2011) Innovationsplan Sverige – underlag till en svensk innovationsstrategi. <http://www.iva.se/PageFiles/13779/201109-IVA-Innovationsplanen-O.pdf>

Ivarsson, M. (2012) Flertalet innovationssatsningar innan jul. <http://www.naringsbloggen.se/innovation/innovationsstrategi/flertalet-innovationssatsningar-innan-jul/>

Jacob, M. and L. Orsenigo (2007). Leveraging Science for Innovation. Swedish policy for university–industry collaboration 1990–2005. SNS Förlag.

Jacob, M., Lundqvist, M. and H. Hellsmark (2003). Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology. Research Policy 32: 1555-1568.

Melin, G., Fridholm, T., Håkansson, A., Jansson, T., Stern, P. and N. Thorell (2012). 2011 Erawatch Country Report Sweden. http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/reports/countries/se/report_0006

Nordforsk (2010). Bibliometric Research Performance Indicators for the Nordic Countries. <http://www.nordforsk.org/en/publikasjoner/bibliometric-research-performance-indicators-for-the-nordic-countries>

Region Skåne (2011). An International Innovation strategy for Skåne. <http://www.skane.se/Upload/Webbplatser/Naringsliv/Dokument/IIFS%20Strategi%20Version%20Slutligt%20dokument%20Original%20Version%202012-2020.pdf>

Sandström, M., Gerdes-Barriere, S. and M. Benner (2008). Forskningsfinansiering - kvalitet och relevans. SOU 2008:30. <http://www.regeringen.se/sb/d/108/a/101177>

Sandström, U., Wold, A., Jordansson, B., Ohlsson, B. and Å. Smedberg (2010). Hans Excellens: om miljardsatsningarna på starka forskningsmiljöer. Report. <http://www.hsv.se/download/18.328ff76512e968468bc80003456/DJ-satsningar-starka-forskningsmiljoer.pdf>

Statistics Sweden (2012). <http://www.scb.se/>

Sundström, A (2012) OECD-utvärdering: "Slå samman finansierarna" <http://lifescience.idg.se/2.1763/1.478930>

Swedish Agency for Higher Education (2012). Universitet och högskolor. Högskoleverkets årsrapport 2012. <http://www.hsv.se/publikationer/rapporter/2012/universitetochhogskolorhogskoleverketsarsrapport2012.5.8b3a8c21372be32ace80001985.html>

Swedish Government (2004). Forskning för ett bättre liv. Prop. 2004/05:80. <http://www.regeringen.se/sb/d/108/a/41135>

Swedish Government (2008a). Ett lyft för forskning och innovation. Prop. 2008/09:50. <http://www.regeringen.se/sb/d/108/a/113957>

Swedish Government (2008b). En akademi i tiden - ökad frihet för universitet och högskolor. Prop. 2009/10:149. <http://www.regeringen.se/sb/d/108/a/142310>

Swedish Government (2012a). Sweden Science for Life Laboratory ska bli världsledande forskningsinstitut. Press release April 3, 2012. <http://www.regeringen.se/sb/d/15620/a/190011>

Swedish Government (2012b). Forskning och innovation. Prop. 2012/13:30. <http://www.regeringen.se/sb/d/108/a/201368>

Swedish Government (2012c). Den nationella innovationsstrategin. N2012.27. <http://www.regeringen.se/sb/d/15700/a/201184>

Sörlin, S. (2006). En ny institutsektor. En analys av industriforskningsinstitutens villkor och framtid ur ett närings- och innovationspolitiskt perspektiv. Report, Royal Institute of Technology. <http://www.ri.se/sites/default/files/Slutrapport060620.pdf>

Uppsala Universitet (2012). Högskolan på Gotland blir snart Uppsala universitet - Campus Gotland. Press release. <http://www.uu.se/nyheter/nyhetsvisning/?id=2230&area=1,13,16&typ=artikel&na=&lang=sv>

Vinnova (2012) Sveriges deltagande i sjunde ramprogrammet för forskning och teknisk utveckling (FP7): Lägesrapport 2007 - 2011. <http://www.vinnova.se/upload/EPiStorePDF/va-12-05.pdf>

Vinnova (2013). Challenge-driven innovation: Societal challenges as a driving force for increased growth. http://www.vinnova.se/upload/EPiStorePDF/vi_13_04.pdf

LIST OF ABBREVIATIONS

| | |
|---------|--|
| BERD | Business Expenditures for Research and Development |
| CERN | European Organisation for Nuclear Research |
| ERA | European Research Area |
| ESO | European Southern Observatory |
| EU | European Union |
| EU-27 | European Union including 27 Member States |
| FTE | Full-time Equivalent |
| GBAORD | Government Budget Appropriations or Outlays on R&D |
| GDP | Gross Domestic Product |
| GERD | Gross Domestic Expenditure on R&D |
| HEI | Higher education institutions |
| HSV | Swedish National Agency for Higher Education |
| IP | Intellectual Property |
| IPR | Intellectual Property Rights |
| MNC | Multi-national Companies |
| PRO | Public Research Organisations |
| R&D | Research and development |
| RIS3 | Research and Innovation Strategies on Smart Specialisation |
| SEK | Swedish krona |
| SME | Small and Medium Sized Enterprise |
| VINNOVA | Swedish National Agency for Innovation Systems |
| VR | Swedish Research Council |

European Commission

EUR 26300 – Joint Research Centre – Institute for Prospective Technological Studies

Title: ERAWATCH Country Reports 2012: Sweden

Author: Olof Hallonsten

Luxembourg: Publications Office of the European Union

2014- 34 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-38982-5 (pdf)

doi:10.2791/91372

Abstract

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries.

The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. These reports were originally produced in December 2012, focusing on policy developments over the previous twelve months.

The reports were produced by independent experts under direct contract with IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from external experts.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

