

PUBLIC KNOWLEDGE PRODUCTION IN THE KNOWLEDGE SOCIETY

**The Swedish Research and Innovation Policy
Development 1980-2001**

DRAFT 31-05-04

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PAPER FOR CHEPS SUMMER SCHOOL, 2004.

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ABSTRACT

One of the problems that the knowledge society encounters is to understand the changing prerequisites for publicly governed knowledge production. There have been several attempts, and one of the most debated is the concept of changing modes of knowledge production by Gibbons et al. This article aims at empirically test if the concept can be used to analyse the Swedish research policy development.

In analysing the research policy process in Sweden 1980-2001, the main result is that there is not enough evidence to fully support or prove Gibbons et al. right. The Swedish research system turns into a two track system of research and innovation. The major weakness of the concept from Gibbons et al. is that it does not capture the emphasis of basic research, which is evident in the case of Sweden. The two track system also has implications for the usage and diffusion of publicly produced knowledge where the outcomes of the innovation track is put on the market, and the outcome of the basic research track is brought to society by law.

Key words: Mode 1, Mode 2, Research policy, Innovation policy, Policy process, Ideas of Knowledge production.

AN EMERGING KNOWLEDGE SOCIETY?

The term “knowledge society” is usually ascribed to Daniel Bell and the book *The Coming of Post-industrial Society* from 1973. Bell’s argument was that knowledge and information are the major features of a post-industrial society; just as capital and labour were for the industrial society.¹ Over the years, several debates have been going on about the term and its uses.²

One of the major concerns in the debate of the making of a knowledge society has been the economic issues. Questions like what is the relevant economic definition of knowledge and when is knowledge a major factor in production have been debated. The result of these debates is that knowledge is important, however it is difficult to determine to what extent.³ This conclusion is even more explicitly pronounced when the impact of R&D (Research and Development) on economic growth is discussed. For instance, Baskins and Lau concluded “... R&D is an important source of economic growth, but the size of its effect econometrically is modest”.⁴ In addition the economic impact of higher education has been questioned by Alison Wolf. She argues that there is no direct connection between governmental spending on higher education and economic growth. It is true that wealthy countries invest a lot in higher education. But is it because they are rich that the countries can afford to invest, or have the investments in higher education made them rich? Wolf argues that before any “high flying” investments are

¹ Brint (2001), p 101.

² In some cases the notion of “Knowledge Society” is regarded as very poor description of the development of the society. See for instance Fuller (2001), pp. 177–204.

³ Brint (2001), pp. 110–111.

⁴ Boskin & Lau (1996), p 104.

made in higher education this problem needs to be solved.⁵ Moreover, recent research has questioned the returns of higher education for the individual.⁶

The debate on the (emerging) knowledge society also has extensions into social and political issues. The social issues are mainly concentrated around the term “Knowledge workers”. Knowledge workers have been defined in many ways. Maybe Robert Reich’s “symbol analysts” has gotten the most attention.⁷ The symbol analysts are defined as socially competent and well educated, mainly with university degrees. In addition, the symbol analyst does not stop educating him or herself when graduation day has past. During his or her carrier, training is a major factor.⁸ The social consequences of the symbol analysts is a new “two third” society were the symbol analysts is the wealth creating “two thirds” and the remaining “one third” are mainly employed in a low paid service sector.

The “Reichian” definition of knowledge workers is implicitly criticised by Brint. He argues that this kind of definition does not single out something new about knowledge and work. For instance what would be the principle difference between recurrent training for a symbol analyst and “on the job training” for a desk clerk with a diploma in accounting? The knowledge worker has to have something that singles him or her out from the “highly skilled”. Brint argues that there are two criteria that defines knowledge workers: ” (1) principles and methods of analysis (in some cases, scientific theory) that can be used to expand the knowledge base, to solve problems, or to develop new applications; and (2) a continuous body of research aimed at utilizing these principles and methods.”⁹ Having this definition of knowledge

⁵ Wolf (2002).

⁶ The economist (2004), 15th January.

⁷ Reich (1994), pp. 151–173.

⁸ Reich (1994), pp. 151–173.

⁹ Brint (2001), p 114.

workers the universities become a key player since it is at the universities this type of knowledge workers has to be trained. Therefore the role of the university in the knowledge society has also been widely discussed and analysed.¹⁰

This short introduction of the debate of the knowledge society has shown that study of knowledge is import if one is to understand the changes in society during the last twenty to thirty years. And maybe because the changes have implications in almost every part of society it is not possible to get a clear definition of the knowledge society. In addition, if knowledge is changing society, it would also mean that the rules of interaction in society have changed. Hence, the institutions of the knowledge society should be designed to facilitate, the production, diffusion and use of knowledge. This would mean that “the rules of the game”, i.e. both the formal and informal institutions have changed.¹¹ This reasoning leads to the questions of what kind of institutions would be the basis of an emerging knowledge society, and why and how do they develop?

These questions have been studied in various ways.¹² One of the major debates on the rules of the game of the knowledge society concerns the role of research policy in shaping prerequisites of knowledge production, diffusion and uses of knowledge.¹³ This debate discusses the development of research policy during the post World War II period. However, its focus is on the developments during the last twenty to thirty years. I will in the next section argue that an understanding of research policy trends is helpful if one wishes to address the prerequisites of knowledge production.

¹⁰ For a summary of the debate see for instance Delanty (2001); Baggen, Tellings & van Haaften (eds.) (1998).

¹¹ North (1990); Whitley (ed) (1992).

¹² See for instance Mokyr (2002).

¹³ For recent research see, Larédo & Mustar (2001).

RESEARCH AND INNOVATION POLICY TRENDS

There have been several attempts to identify the trends of research policies during the post second world war period.¹⁴ The most comprehensive and the most debated claim, of understanding research policy and the consequences for knowledge production, is the book *The new production of knowledge* by Gibbons et al. They present a “concept” of different modes of knowledge production in order to understand the changes in knowledge production during the period 1980-2000. Gibbons et. al. argue that Mode 2 knowledge production should be seen in contrast to Mode 1 knowledge production. Mode 1 is organised in a traditional matter thus in departments with disciplinary research and hierarchies. Furthermore, international collaboration is rather scarce. Mode 1 is governed by a science policy from the principle of science push, i.e. a linear approach to research and its practical uses. Mode 2, on the other hand, is characterised by transdisciplinary research that is more loosely organised in research groups. Internationalisation of research becomes essential. Mode 2 research is governed by an innovation policy with a complex approach to how research transforms into products and services where the relationship between the state, the universities and the industry is characterised by interconnectivity.¹⁵

From this definition of Mode 1 and Mode 2, Gibbons et al. argues that the research/science policy¹⁶ development during the last twenty years is characterised by the transition of research policy to innovation policy. This

¹⁴ Ruivo (1994); Larédo & Mustar (2001); Edquist (2003),

¹⁵ Gibbons, Limoges, Nowotny, Schartzman, Scott & Trow (1994), pp. 1-2 & 159-160.

¹⁶ The difference between science policy and research policy in this paper is that science policy is a much narrower concept and deals with issues of basic research. On the other hand, research policy deals with all aspects of research for instance organisation, appropriation and all types of research (basic, applied, strategic etc.). Hence, research policy is a much broader concept and covers most aspects of scientific knowledge production.

development is driven mainly by changing conditions of research organisation and internationalisation/globalisation. In the development the research organisation Gibbons et al. identifies two major driving forces. Firstly, an increased co-operation/interaction between the universities, the industry and the state¹⁷, and, secondly, that research is becoming more transdisciplinary. The international impact also has two features. Firstly, research is becoming more international in the sense that research collaboration increases and secondly, that research is more and more influenced by international trends.¹⁸

The concept of Mode 2 thus claims both to describe the development of research policy and to identify the driving forces that can explain this development.¹⁹ From this claim this article's aim is to test if the concept of a Mode 2 knowledge production can explain the Swedish research policy development. In order to operationalize this aim, three questions are asked.

1. Does Swedish research policy turn into an innovation policy during the period 1980–2001? If not, how does Swedish research policy develop during the period?
2. Does the co-operation/interaction between the universities, the state and the industry increase and does this presumed development explain the research policy development? Is this also the case for the presumed move from disciplinary research to a more transdisciplinary way of organisation research?
3. What is the role of internationalisation in the Swedish research policy during the period 1980–2001?

¹⁷ In this paper the state is defined as the government and parliament since the focus is on research policy development and policy process.

¹⁸ Gibbons, Limoges, Nowotny, Schartzman, Scott & Trow (1994), pp. 34-43 & 111-135.

¹⁹ There are several critics of Gibbons et al. see for instance: *Science and Public Policy* (2003), vol 30, issue 4, august 2003; *Minerva* (2003), vol 41, issue 3; Shinn (1999); Shinn(2003); Tuunainen (2002); Hicks & Katz (1996).

From this aim and research questions I have chosen to analyse the policy/decision making process and its effects on institutional change. The method of using ideas/views on knowledge production as an indicator of policy change is derived from Goldstein & Keohanes' analytical frame for analysing impact of ideas on policy.²⁰ Explicit I will analyse the role of an increased co-operation, a development from disciplinary research to a more interdisciplinary research and the international issues. Since the notion of transdisciplinary is a bit unclear in the concept of Mode 2, I will use the development of interdisciplinary research instead of transdisciplinary research.

This starting point makes it possible to analyse different ideas/views on how knowledge production should be organised and hence, the policy making process – the discussion of reports and the impact of these views in policy – can be traced over time. Having this approach and taken into account that Gibbons et al argues that the presumed changes is most evident in the technical, the natural and the medical sciences the participants of the discussion have been delimited to three specialised universities (KTH, CTH and KI)²¹ and to three industrial interest groups (IVA, SI and SAF)²².

The policies become institutions when they are implemented. In this study implementation has not been the focus. However, I will study the output and the outcome of the research policy process. The research policy output is what the different research policy bills decide for the Swedish public research system and the outcome is the long term changes that the output leads to. The result (outcome) of the policy making processes is later interpreted from both the concepts of changing modes of knowledge production and in the perspective of institutional change.

²⁰ Goldstein & Keohane (1993).

²¹ KTH (Kungliga Tekniska Högskolan), Royal Institute of Technology; CTH (Chalmers Tekniska Högskola), Chalmers University of Technology; KI (Karolinska Institutet) Karolinska Institute.

²² IVA (Ingenjörsvetenskapsakademien), Royal Academy of Engineering Sciences; SI (Svenska Industriförbundet), Federation of Swedish Industries; SAF (Svenska Arbetsgivarföreningen) Swedish Employers' Federation.

IDEAS OF KNOWLEDGE PRODUCTION AND RESEARCH POLICY DEVELOPMENT – THE SWEDISH CASE

The main research policy issue of the early 1980s was handling the “balance problem” between “sector” and basic research.²³ It was solved by implementing a planning process for sector research that was co-ordinated by the higher education planning agency UHÄ (Universitets- och Högskoleämbetet). This centralised and highly regulatory planning process was abandoned during the course of the 1980s.²⁴ From 1986 and onward, the policy changed from planning to a more open attitude.²⁵ This meant that the policies were giving the universities opportunities to handle the “balance problem”. By using the suggestions from the (basic) research councils as the basis of the research policy, the government focused by the late 1980s on improving the conditions for basic research. This is also backed up by an increase of funds for basic research, both via direct appropriations at the universities and to the research councils.²⁶ Hence, the “balance problem” of the early 1980s was turned into focus on basic research. In addition, very few policy initiatives to enhance “sector” research were at hand during the 1990s. However, the development of funds for “sector” research indicates that the implementation of the policy was slow since the funds for “sector research” are increasing during the decade and has the sharpest increase during the late 1980s.²⁷

²³ In this paper research can either mean basic which is research on the initiative of the researchers themselves or “sector” research, which is research initiated by others, for instance governmental agencies or industry. Otherwise, I will use the common understanding of research defined in OECD (1993). For a discussion see: Senker (1999) and Calvert (2001).

²⁴ Prefors (1986), pp. 34–36. For an in-depth study of the development of “sector” research see Persson (2001).

²⁵ Schilling (2003).

²⁶ Heyman & Lundberg (2002), p 13.

²⁷ Heyman & Lundberg (2002), p 13.

During the years 1991–94 the conditions for the Swedish public research changed. Both de–regulation and decentralisation were major issues. This was done from the starting point of giving both the universities and the individual researchers “freedom for quality”. The government introduced new research foundations and increased the funds for the “basic” research councils. And along the lines of excellence for the individual, which was gained in highly competitive environments the government did not increase the direct appropriations to the universities. Just as in the late 1980s, the focus was on basic research. In addition, this government introduced the concept of strategic research that translates to basic research with a specific aim. This type of research should be funded by the new research foundations.²⁸ Hence, this government let the new private research foundations deal with the implementation of their major policy initiative.

The new foundations were also an issue for the new social democratic government that came into office in 1994. This government “nationalised” the foundations in the sense that government could change the statutes of the foundations. This regulatory tendency is maybe best expressed by the regulation of the “third mission”. The “third mission” – the universities interaction with society – was the major novelty of the research policy of 1996/97.²⁹ In addition, the “third mission” reflects the new direction that Swedish public research should have. Hence, the major issues in the research policy were not focused on different types of research; it was concentrated on making research useful for society. This government did not change the decentralised governance but it did decrease the funding in absolute terms for basic research. In other words, the government cut the budget and regulated

²⁸ Benner (2001), pp. 212–214. One of the features of conservative-liberal agenda for reform was privatisation. “The wage earners funds” were created in the early 1980s to enhance “economic democracy” of the Swedish industries. These funds were paid for by the Swedish industry. Now they were dissolved and the assets were used to support research instead of enhancing economic democracy.

²⁹ Regeringens proposition 1996/97:5, p 60.

the Swedish research but let the universities themselves deal with the situation.

Having this situation in the late 1990s, the new Social Democratic government tried to re-establish good relations with the universities.³⁰ They got help from the report *Research 2000* where it was argued that basic research at the universities should be major issue in the research policy.³¹ This was also the case for the research policy bill of 1998/99. This bill had mainly two consequences for the direction of the Swedish research system. Firstly, the government identified its role as a safe guarder of basic research and academic freedom. Secondly, the research funding system had to be re-organised.³² In the research policy bill of 2000/01 this process was finalised. The different councils for basic research was merged into one and organised in three areas of research (Science & Technology, Medicine, and Humanities & Social Sciences). “Sectorised” research was almost disbanded and a new agency Vinnova (Swedish Agency for Innovation Systems) that should deal with targeted research was created. The importance of basic research is also reflected in the additional governmental appropriations in the research bill of 2000/01 where the Swedish Research Council (Basic research) got 86% of the additions and the remaining 14% were almost equality divided between FAS (Swedish Council for Working life and Social research) and FORMAS (The Swedish Council for Environment, Agricultural Sciences and Spatial Planning), i.e. Sector research and Vinnova.³³

Since the research policy bill of 2000/01 dealt with both research and innovation, it might be argued that this bill is a good example of a Mode 2 research policy. However, already in 2001 the government came up with an

³⁰ Benner (2001), pp. 167–169.

³¹ SOU 1998:128.

³² Regeringens proposition 1998/99:94, p 18 and 44.

³³ Own calculations from: Regeringens proposition 2000/01:3, p 97.

innovation policy with the purpose of regulating targeted research for the innovation system. In this bill it is clear that the government made a distinction between targeted research and basic research. The pillars of Swedish research i.e. safeguarding academic freedom, basic research and Ph. D.–training were the main ingredients of the Swedish research policy and the innovation policy is the government's way of regulating targeted research.³⁴

From this description it is not evident that the notion of Mode 2 is a good description of the Swedish research policy development, because it is not possible to argue that research policy is turning into a policy for innovation. Both the policies and the appropriations suggest instead that the research policies are focused on basic research. However, all the aspects of Mode 2 are at hand in the innovation policy. Thus, the conclusion is that the concept of Mode 2 might be a part of the Swedish research system, but not the major tendency which is a focus on basic research.

This overall policy development indicates that the driving forces of Mode 2 could be evident in the analysis of the making of the innovation policy. If that is the case, it would be possible to argue that the concept of Mode 2 by Gibbons et al. explains this development. In the following the identified driving forces, an increased co-operation between the universities and the industry, a move towards more interdisciplinary research and increased international impact will be traced in the policy making process. Through the views on knowledge production of the selected universities and the industrial groups it will be possible to investigate if the identified driving forces are evident. These views are later on dealt with one way or the other in the government's policies i.e. they become the policy or not (output).

³⁴ Regeringens proposition 2001/02:2.

The issue of co-operation was discussed throughout the 1980s. During this decade it is evident, that views from the universities and the industry on this issue are very similar and that these views have policy impact in the sense that the government dealt with the issue along the lines of the suggestions from the discussion.³⁵ The output have very few traces of interconnectivity since the government's major principle was to give the universities opportunities but the government also allocated resources for the implementation of some initiatives for instance the liaison researchers. However, it is not possible to argue that this was in policy and funding terms important for the overall research policy development.

In the early 1990s the issue of co-operation was both part of the policy making process and had an actual policy impact. For the conservative-liberal government this issue was maybe the only area for governmental intervention in the research policy of 1992/93. The government argued that even though the principle was non-intervention it could under certain circumstances appropriate funds for research in the industry.³⁶ With this exception, the interconnectivity between the state (the government), the industry and the university was systematically abandoned during the early 1990s.

This development of a decreased interconnectivity is turned up-side down in the mid 1990s. The main suggestion of the report *Co-operation between the universities and the industry* was that the universities' interaction with society should be fixed by law.³⁷ On this issue there was a break in the common views among the universities. KI did not favour this suggestion. However, both the technical universities and the industrial interest groups did.³⁸ As argued above, this suggestion also became the policy and the "third mission"

³⁵ Schilling (2003).

³⁶ Regeringens proposition 1992/93:170, pp. 29–34.

³⁷ SOU 1996:70, pp. 185–190.

³⁸ KTH, Remissyttrande 1996–06–26, p 2; Remissyttrande, CTH 1996–06–20, p 1; KI, Remissyttrande 1996–06–26, pp. 1–3.

was added to the higher education act. Here, the development of the co-operation issue got on the one hand finalised, the issue can be followed during the period 1980–97 and its importance increases and the interconnectivity between the state, the universities and the industry becomes formalised. On the other hand, this development did not turn the research policy into an innovation policy. Hence, co-operation was a driving force of policy development, but it did not lead to the result that Gibbons et al. presumed.

Governmental initiatives on innovation are evident throughout the period 1980–2001. However, it was not until the suggestions in the report *Research 2000* had a policy impact that the idea of a merging research and innovation policy was put on the agenda. Before 1999, the governments' report on innovation suggested that research and innovation should not be mixed.³⁹ The main message from *Research 2000* was that the research policy should focus on basic research.⁴⁰ In the discussion this focus was criticised by the industrial interest groups and the technical universities, KI on the other hand sympathised with *Research 2000*.⁴¹ The technical universities' and the industrial interests groups' main argument was that the government should also keep their responsibility of "sector" research. This view did not get any policy impact. Instead the government decided to restructure the intermediate level of the Swedish research system, i.e. both the research council for basic and "sector" research should be reformed.

The report *Some agencies* dealt with the "sector" research governed from the Ministry of Industry, Employment and Communications. The main suggestion from the report was to create an agency for innovation by a

³⁹ SOU 1993:84, p 171.

⁴⁰ SOU 1998:128, p 35.

⁴¹ KTH, Remissyttrande 1999–02–03; CTH, Remissyttrande 1999–02–03; KI, Remissyttrande 1999–02–03; IVA, Remissyttrande 1999–02–03; SI, Remissyttrande 1999–02–05; SAF, Remissyttrande 1999–02–04.

merger of the different “sector” research funding councils. This suggestion was motivated mainly from an international comparison that concluded that the Swedish research system did not have a transparent organisation for handling innovation and research.⁴² As argued above these suggestions had a clear policy impact. This report was not put through the policy making process. However, it is possible to argue indirectly – using the results from the discussion of *Research 2000* – that the development clearly followed the concept of Mode 2 since several suggestions from the industrial groups and the technical universities were put in the report *Some agencies*. And, as we have seen, the research policy of 2000/01 contained both research and innovation and the policy making process showed that the driving forces of Mode 2 can explain the output. However, the making of Vinnova suggests that the interconnectivity is not at hand since that role of the government is to set the aim and the direction of the innovation system i.e. similar to the role of the state in the research policies.

On the international issues the government during the 1980s continued to support the “big science projects” and the Swedish participation in EC-research program became an issue. In addition, in 1986 the Swedish research system was evaluated by the OECD.⁴³ However, none of these developments were issues for the policy process in this paper’s definition. A hearing was used to discuss the OECD evaluation and not a “remissrunda”⁴⁴. Hence, it is not possible to investigate the policy process. The OECD evaluation indicates that the international trends could have had an impact. However, the main result from this evaluation was that the Swedish research system had “...more to teach than learn”⁴⁵ which in policy terms meant that the evaluation was

⁴² Flodström (1999).

⁴³ OECD (1987).

⁴⁴ A “remissrunda” is a written discussion of governmental reports which is well documented and preserved. A hearing (in Sweden) is an oral discussion of a report that is usually only documented with a summary of the discussion, if documented at all.

⁴⁵ OECD (1987), p 69.

only briefly commented on. The impact of the international development was not possible to trace.

During the early 1990s internationalisation was a research policy issue since internationalisation was an important part of the conservative-liberal government's agenda. The initiatives were discussed and during this period, there were clear evidence that the universities and the industry favoured the suggestions. An increased internationalisation with the focus on the individual researcher is also the policy.⁴⁶ The fact that one of the new foundations (STINT) had the objective to enhance internationalisation, supports the argument that internationalisation had become important. This development might suggest that the interconnectivity between the government, the universities and the industry increased. In one sense it did, they agreed on the development. However, the implementation of the outcome was that the government should not take part in the internationalisation of research, since the main purpose of this initiative was to let the researchers themselves govern internationalisation. Hence, an increased interconnectivity is not at hand.

During the Social Democratic governments of the 1990s, internationalisation was not a major research policy issue since it moved from the policy level to the research councils.⁴⁷ This development makes it possible to conclude that the issue of internationalisation does not have great impact on policy. However, one must bear in mind that both in relative and in absolute terms funding from abroad had become more important at the universities during the 1990s.⁴⁸ Hence, it is hard to argue that internationalisation of research is driving the research policy development, but it might be of increased significance at the universities.

⁴⁶ Regeringens proposition 1992/93:170, pp. 27–29 and 53.

⁴⁷ Regeringens proposition 1996/97:5, pp. 43–44; Regeringens proposition 2000/2001:3, pp. 30 – 35.

⁴⁸ Hällsten & Sandström (2002).

The same argument can be made for the presumed move to more interdisciplinary research, because it is dealt with in a similar way. However, the development of the issues of interdisciplinary research and internationalisation are a bit different during the 1980s. The government dealt with interdisciplinary research by supporting the TEMA-departments at Linköping University.⁴⁹ This way of handling the interdisciplinary research is along the lines of the way the government handled the co-operation at the same period, i.e. the government supported certain initiatives.

Neither did the 1990s bring about an investigation on interdisciplinary research that was put through the policy making process. Instead the research councils were asked to investigate what should be done to enhance interdisciplinary research. The result from this report was that interdisciplinary research is best organised *ad hoc*.⁵⁰ The policy outcome was that the research councils should deal with interdisciplinary research projects, just as any other research projects. Hence, the government put the development of interdisciplinary research on the newly founded (basic) research council.⁵¹

From this analysis of the development of the Swedish research policy it is not clear that Gibbons et al. notion of a Mode 2 system of knowledge production is evident in Sweden. However, the concept of Mode 2 identifies the elements of research policy development and in some cases the driving forces i.e. the innovation policy development. But, as has been shown the overall development or the trend of the Swedish research policy is quite different. Hence, it is not yet possible to argue that the Swedish public research system is developing into a Mode 2 system of knowledge production.

⁴⁹ Schilling (2003), p .

⁵⁰ FRN, HSFR, MFR, NFR, TFR (1996), pp. 7–8.

⁵¹Regeringens proposition 2000/2001:3, pp. 47–49.

A TWO TRACK SYSTEM OF RESEARCH AND INNOVATION – THE TREND OF SWEDISH PUBLIC RESEARCH POLICY 1980–2001?

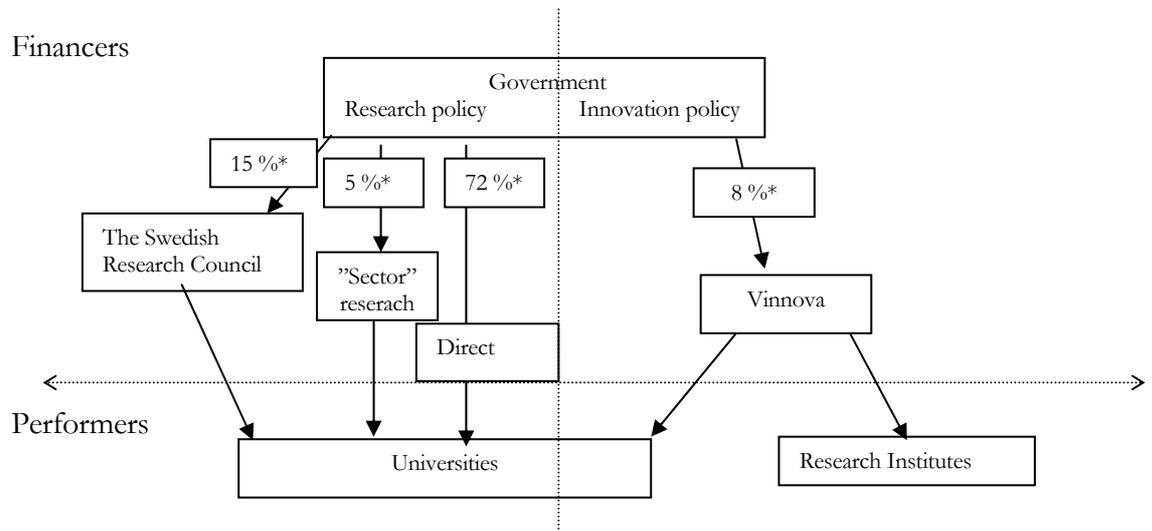
The analysis of the policy development in the former section suggests that the government starts to focus on basic research at the end of the 1980s. This process is finalised in early 2000s, with the government as a safe guarder of basic research and academic freedom. The origin of the innovation policy can be sought in the same period. Consequently, the innovation policy evolves from the development of “sector” research and its relation to the issue of co-operation between the universities and the industry. It is clear that the co-operation issue becomes more important during the period 1985–2001. In 1997 it becomes – even though as a part of the universities interaction with society – legislated. It is also evident that “sector” research is questioned during these years. First, the planning process is abandoned and secondly, later in the 1990s *Research 2000* suggests that resources for “sector” research should be put on basic research. From the discussion of *Research 2000* it becomes clear that both the technical universities and the industrial interest groups argue for funding and policy for “sector” research and co-operation. The report *Some agencies* puts this in the context of innovation. The outcome – as we have seen – is an innovation policy that deals with targeted research for the innovation system.

This policy development also indicates that the intermediate level of the research system becomes more important. The policy analysis showed that the driving forces - or in this paper’s terms the policy issues - that would lead to a Mode 2 of knowledge production are put on the intermediate level of the research system. The co-operation between the universities and the industry is an important ingredient of the objectives of Vinnova. The (basic) research

council is not only responsible for research funding. It is also handling the enhancement of interdisciplinary research and supports the internationalisation of (basic) research. Hence, the outcome of the policy process can be described as a two track system of research.

Figure 1 describes the current Swedish public research system by financiers and performers. Hence, other financiers such as the new foundations (semi private), industry and financing from abroad are not accounted for, since they are not directly policy dependent. Interpreting this schematic description in the context of policy a two track system of research and innovation is evident.

Figure 1. The Swedish public two track research system by financiers and performers in 2001.



*Own calculation from Regeringens proposition 2001/02:1, Utgiftsområde 16, table 3.1, pp. 25-27, table 10.1 pp. 233-234.

Note: The governments' direct appropriation includes Ph.D.-training, clinical training and research and R&D at the Swedish art colleges. The appropriations for the The Swedish Research Council, for "Sector research" and Vinnova do not include administrative costs.

The trend of the Swedish research policy during the period 1980–2001 suggests that it also had an impact on the structure of the public research system. This is most obvious on the policy level and the intermediate level.

On the performance level the universities still in 2001 are the major research performers. How this development affected the universities is of course an interesting question, but not the objective of this paper. In addition, in the innovation bill of 2001/02 the government also identifies the industrial research institutes as an important part of the innovation system. This might be an indicator of change in the only constant view of different governments since 1945 and onwards, i.e. that the universities are the public research performers. If that is the case, my suggestion of a two track system of research and innovation would be strengthened.

This development of the “the rules of the game” for the public knowledge production indicates that the prerequisites of knowledge production has changed during the last 20-30 years. This also has implications for usage of knowledge. The focus on basic research takes its arguments from the “science push” thinking i.e. basic research will evidently come to use. This linear approach is also the policy in the “basic research track”. On the other hand a more complex approach to the usage of knowledge is to be found in the “innovation track”. Here knowledge should be produced with sole purpose of usefulness in the sense that it will put products or services on the market and there by create new jobs and make the economy grow.

The two track system of research and innovation brought both refinement and changes to the diffusion of publicly produced knowledge. The diffusion of knowledge in the “basic research track” has been refined in the sense that knowledge produced at the universities must be diffused to the public as required by the legislated “third mission”. The “third mission” should be seen as an addition to the traditional ways of diffusion of basic research i.e. journals, conferences and teaching. Hence, public interest in the diffusion and usage of the knowledge produced in the “basic research track” has become more important.

In the “innovation track” scientific knowledge is produced, used and diffused within the innovation system i.e. the institutions also becomes targeted. It is with in the companies and the research groups/researcher that collaborates where the knowledge gets diffused. The outcome of the production, diffusion and usage of knowledge is brought to the market. In the innovation system the knowledge has turn away from the public interest, which is obvious in the “basic research track”. In this sense the “innovation track” is some thing fundamentally new to the Swedish research system.

CONCLUSION

The aim of this article was to investigate if the changing modes of knowledge production suggested by Gibbons et al. could be used to analyse the Swedish research policy development. The main result from the thesis is that there is not enough evidence to fully support or prove them right. Instead the outcome of the policy making process is that the Swedish research system turns into a two track system of research and innovation. It is however evident that the innovation track of the Swedish research system develops along similar lines as suggested in the model of changing Modes of knowledge production. Hence, the weakness of the concept from Gibbons et al. is that it does not capture the emphasis of basic research, which is evident in the case of Sweden.

This two track system of knowledge production has also had implications on the usages and diffusion of knowledge. Where the “basic research track” both use and the diffuse knowledge in traditional matter i.e. the “science push” ideology with diffusion via journals, conferences, teaching and service to society. The important change is that diffusion gets regulated by law i.e. the “third mission” forces the universities to systematically diffuse its knowledge to the public. The innovation track on the other hand use scientific knowledge for the purpose of commercialisation and thereby makes the

diffusion deeper and narrower in the sense that it is the firm that co-operates with the university that usually get exclusive rights to the usage.

In sum, the rules of the game for public knowledge production have gone through major changes during the last twenty years. The Swedish case has shown that the development is different from suggestion made by Gibbons et al. The two track system of knowledge production also changes the institutions for diffusion and usage of publicly produced knowledge. However, it remains to investigate if the conclusion from this paper is evident in a systematic comparative study. From the research done, it is not so far evident that either the two track system or the concept of changing modes of knowledge production can explain the changes in the public research systems during the last decades.

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