Governance of Innovation Systems

VOLUME 2: CASE STUDIES IN INNOVATION POLICY



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Governance of Innovation Systems

Volume 2

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Foreword

This publication constitutes Volume 2 of *Governance of Innovation Policy,* a three-volume compilation of the proceedings of collaborative work in the MONIT project (Monitoring and Implementing National Innovation Policies). It provides an overview of the analytical work on innovation governance in the member countries participating in the project. The chapters in this volume and in Volume 3 form the empirical basis for Volume 1 of the series: *Governance of Innovation Systems - Synthesis Report.*

The publication was prepared under the aegis of the OECD's Committee on Science and Technological Policy (CSTP) and its Working Party on Technology and Innovation Policy (TIP). The report was edited by Svend Otto Remøe, who co-ordinated the MONIT project together with Mari Hjelt, Pim den Hertog, Patries Boekholt and Wolfgang Polt.

TABLE OF CONTENTS

	Foreword	3
	Executive Summary	7
Part 1.	*Adapting Institutions in Innovation Policy*	*11*
Chapter 1.	Profiling and Assessing Innovation Governance in Greece: Do Increased Funding and the Modernisation of Governance Co-evolve?	13
Chapter 2.	Governance and Institutional Change in Ireland	43
Chapter 3.	Evolution of the Korean National Innovation System: Toward an Integrated Model	65
Chapter 4.	Policy Making in a Competitive Environment: Governance in the Austrian STI Policy Framework	87
Chapter 5.	Changing Governance for Innovation Policy Integration in Finland	111
Chapter 6.	Japan's Industrial Technology and Innovation Policies and the Effects of "Agencification"	139
Part 2.	*Integrating Policies for Innovation*	*177*
Chapter 7.	Shaking Up the Dutch Innovation System: How to Overcome Inertia in Governance	179
Chapter 8.	Governing Fragmentation: The Case of Norway	217
Chapter 9.	The End of an Era? Governance of Swedish Innovation Policy	245
Chapter 10.	Frameworks for Horizontal Innovation Policy in New Zealand	283
Chapter 11.	Governing Innovation Policy: The Australian Experience	307
Chapter 12.	Towards a Third-Generation Innovation Policy in Flanders: Policy Profile of the Flemish Innovation System	333

EXECUTIVE SUMMARY

Patries Boekholt, Pim den Hertog and Svend Otto Remøe

The MONIT project

The OECD's project on national innovation systems (NIS) began in 1995. It was managed by the Working Party on Technology and Innovation Policy (TIP) and set out to explore the requirements for redirecting innovation policy in OECD countries. It took into account new insights into the innovation process arising from innovation research. While many accepted that the linear model of innovation did not capture the realities of the innovation process, they also acknowledged that public policy was still founded upon the linear model and its implications for policy. Hence, the OECD NIS project became an important collaborative mechanism for generating new data based on the interactive model of innovation and for developing a set of recommendations for public policy.

Formally, the OECD NIS project ended in 2001. Over the years, many of its findings fed into other OECD work. It also generated several publications on industrial clusters, networks and human mobility as well as synthesis reports aimed at renewing innovation policy. However, the concluding publication (OECD, 2002) raised a crucial question which became the starting point for the current MONIT project. If the developed economies are shifting towards a more innovation-oriented and dynamic mode, is it feasible for the policy-making modes of national governments to remain largely unaffected? More precisely, given needed changes in the content of policy, how can or should governments modify their structures and processes to better accommodate the dynamism of their environment?

To explore these issues, the OECD and the TIP working party endorsed a new collaborative study called MONIT (monitoring and implementing national innovation policies). The project was organised in two work packages, one to study the main innovation governance issues in each country and the second to select and study policy areas relevant to innovation policy. This volume contains the studies undertaken in the first part. Volume 3 (OECD, 2005b) contains those resulting from the second part of the project.

MONIT's basic assumption was that innovation policy and its governance require significant changes. While the earlier linear and systemic models of innovation can be seen as the first and second generations of innovation policy, MONIT set out to explore the foundations of a third generation, in which innovation policy constitutes a process, and to examine its institutional, structural and political characteristics. From the point of view of firms, such a policy forms a nexus in which policies interact to produce innovation outcomes. Thus, coherence of innovation policy across ministerial boundaries is key to successful governance.

The case for flexibility and adaptation

In recent decades there has been an increasing trend towards globalisation of the world economy, as flows of goods, services, capital and labour transcend national borders more easily and to a far greater extent. Further, the world economy has become more dynamic, with knowledge production and use, innovation and technology development becoming more important for economic growth and restructuring. Hence, the need for more flexible economies.

As knowledge and its diffusion and use have become more important for innovation and innovation systems, the earlier linear model of innovation has revealed its weaknesses. The systemic or interactive model of innovation, currently broadly accepted as a representative picture of how the innovation-driven economy works, postulates the need for dynamic and flexible structures and processes that facilitate the diffusion of knowledge throughout the economy (OECD, 2002). However, non-economic institutions that are not exposed to market forces often continue to develop along an earlier path (path dependency). Public institutions such as governments typically operate according to a rationale different from that of commercial firms and change slowly, if at all. They may thus remain out of step with a wider need for flexibility and adaptation.

Recently, greater attention has been given to the need for governments to change and develop institutional capabilities and governance practices more in line with a dynamic, innovation-driven economy. A third-generation innovation policy (going beyond the linear and interactive models) is emerging. It calls attention to institutional adaptation in the area of science, technology and innovation (STI) policy as well as to the need to develop innovation policy components across ministerial boundaries and thus redefine innovation policy horizontally. By implication, this will require new government capabilities. The more an economy needs to release lock-ins and develop new development paths, the more will be demanded of governmental institutions and policy making to accommodate these changes.

A variety of projects

This volume of contributions represents analytical work on governance structures and processes in participating countries. Many of these chapters draw on earlier reports and papers, as major efforts have been made in many countries to study in depth the challenges to current governance practices. In most cases, independent research teams have done research on contract for governmental agencies. In some countries, the MONIT activity has also been linked to major policy learning processes aimed at assisting ongoing policy formulation. Other chapters are written by civil servants who have taken part in the MONIT project and reflect insiders' views of governance challenges and processes in their countries.

These proceedings have as their focus important developments taking place in each country. They do not aim at an overall treatment of all issues analysed in the various national projects. Hence, the individual chapters focus on a variety of issues, reflecting what is at stake in a given country and what seems to offer lessons of value for other countries. Conclusions for the study as a whole are to be found in the synthesis report contained in Volume 1 (OECD, 2005a).

A guide to this volume

This volume is divided into two parts which reflect two broad trends in how governance challenges are being met across countries: On the one hand, countries may redefine or reform their STI-related institutions. On the other, they may develop broader framework policies with the aim to induce an improved strategic orientation across ministerial boundaries.

Part 1: Adapting institutions in innovation policy

In Chapter 1, Lena Tsipouri and Mona Papadakou present a study of a dilemma in the Greek innovation policy system and focus on the lack of development of governance capabilities, because the innovation system is strongly influenced by external funding from EU sources. They see the challenges to be the creation of effective governance structures and the need for policy makers to find efficient ways to spend external funding for high-impact activities, given that that the market is not mature and most actors have limited experience.

In Chapter 2, Rachel Hilliard and Roy Green present an analysis of the Irish innovation policy system. They argue that the system has been struggling with two significant, and interrelated, challenges. The first is stimulation of a national innovation system (NIS). The second is securing the role of policy in achieving effective links and integration between the elements of the NIS.

In Chapter 3, Yoo Soo Hong discusses key changes occurring in Korea which needs to overhaul and renew its formerly successful catch-up policy. Hong argues that the Korean system is changing to meet the challenges of increasing complexity and responds in various ways to leverage the authority of science and technology policy.

In Chapter 4, Leonard Jorg studies Austria's governance practice as a competitive environment in which policy learning is underdeveloped. He argues that Austria's STI policy system lacks strategic focus and needs a centre of gravity and a referee function for supervising the allocation process and imposing a common point of reference for innovators and policy makers.

Chapter 5 contains an analysis of the Finnish governance system by Marja Häyrinen-Alestalo, Antti Pelkonen, Tuula Teräväinen and Sampo Villanen. Their analysis shows that, compared to other nations, Finnish policy has succeeded in raising the STI profile. At the same time it has prevented further horizontalisation of innovation policy. The case study of Finland indicates that it is difficult for actors outside core STI policy to participate in the wider policy-making process.

In Chapter 6, two contributions discuss developments in Japan. Bunro Shiozawa gives an overview of key changes in Japanese industrial policy, pointing notably to basic changes in the institutional organisation, new priorities in innovation policy, such as science-industry relationships, and the development of cluster policies. Tagui Ichikawa presents a particular development in the Japanese governance system, the "agencification" of governmental institutions, with a clearer demarcation between the ministerial policy-making level and the agency policy-implementing level.

Part 2: Integrating policies for innovation

In Chapter 7, Patries Boekholt and Pim den Hertog study the increasing tendency towards integration in the Dutch policy system in a context of strong inertia. Against the background of deteriorating STI performance, existing innovation governance mechanisms are under discussion and new innovation governance mechanisms are being introduced. These are evolutionary rather than revolutionary changes, as both the perceived policy challenges and the arsenal of policy responses develop only slowly.

In Chapter 8, Svend Otto Remøe discusses recent Norwegian efforts to leverage innovation policy to achieve a broader strategy. He discusses current challenges in the innovation policy system and emphasises the inherent tendency towards fragmentation, the low level of co-ordination among autonomous institutions and ministries, and short-termism in priorities. Recent developments to promote a more coherent or horizontal innovation policy are assessed against this background.

In Chapter 9, Jenny Granath Thorslund, Lennart Elg and Patrick Sandgren discuss Sweden. Over the years, large firms have played a central role, and this has led to the Swedish paradox: the Swedish economy is not particularly innovative despite great investments in R&D by Swedish industry. Recent institutional innovations represent a trend towards leveraging innovation policy to develop a broader strategy than traditional R&D policy.

Chapter 10 examines the recent New Zealand strategy to redefine earlier market-oriented priorities and launch a broader policy framework for innovation policy. This framework, it is shown, builds upon the idea of integrating policy areas to support coherent and sustainable economic development. Information on the institutional set-up to ensure this is provided.

In Chapter 11, Mel Timpson and Nathan Rudder describe similar developments in Australia. They discuss how Australia's economic and political structures have shaped, and continue to shape, innovation policy, as well as the influence of past science and industry policies on current innovation policy.

In Chapter 12, Jan Larosse discusses ongoing changes in the Flemish innovation policy system in the context of the devolution of competences in Belgium from the national to the regional level. He argues that in order to fully implement an innovation policy that emphasises the integration of policy domains, new governance structures are needed that support strategic convergence and interactive policy development. The study points to the formalisation of the policy cycle as a key governance issue for strategic innovation policy in Flanders.

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Part 1

ADAPTING INSTITUTIONS IN INNOVATION POLICY

Chapter 1

PROFILING AND ASSESSING INNOVATION GOVERNANCE IN GREECE: DO INCREASED FUNDING AND THE MODERNISATION OF GOVERNANCE CO-EVOLVE?

Lena Tsipouri
Associate Professor, University of Athens, Centre of Financial Studies

Mona Papadakou
Research Fellow, University of Athens, Centre of Financial Studies

Greece's national innovation system is among the least developed in the OECD area, in terms both of actors and of linkages. The productive sector relies on traditional activities, market mechanisms do not trigger change and the economy remains dependent on low costs for competitiveness. Innovation policy is strongly influenced by factors external to the system because of ample funding for intangibles by the Community Support Frameworks. This increased funding is managed in a not yet mature governance system. The EU Commission, although a partner in policy design, does not exercise any influence on governance, as the subsidiarity principle strongly limits its potential to intervene. Substantial funding with limited checks and balances may be seen as the key reason for frequent changes in governance structures and policy design in search for a more effective governance scheme.

So far the system has only achieved significant progress in co-ordinating funds because of strong pressure for efficient allocation and avoidance of overlap in the funding of projects. In terms of policy content, formal co-ordination was gradually introduced but did not result in thematic co-ordination. Stakeholder involvement is foreseen but informal interventions are often observed to be more effective than formal ones. Policy learning remains limited, and the use of modern evidence-based techniques is rudimentary. Evaluation is marginal, for practical purposes it is limited to legal obligations *vis-à-vis* the European Union. The challenge for the system is the creation of effective governance structures, and policy makers are requested to find efficient ways to spend external funding on high-impact activities, under the constraints that the market is not mature and most actors have limited experience.

Introduction

Greece developed very rapidly after 1950, without however succeeding in deepening its production structure to achieve economic sustainability. Industrialisation was based on embodied technology and non-embedded inward investment, while the public procurement system did not attempt to generate endogenous technology development. Although Greece had one of the highest shares of defence spending to GDP among the NATO countries, the Ministry of Defence invested little in R&D (Deniozos, 1993). Hence, when international competitive pressures increased, the consequences of the previous "short-termist" policy were immediately visible. Eventually, after deindustrialisation and systematically deteriorating competitiveness over two decades, external funding provided by the EU in the context of regional development policies have the country the means to improve its infrastructure and attempt structural change.

At the end of the 20th and beginning of the 21st centuries, Greece was the poorest of the 15 EU member states.[1] Physical and human capital are inadequate to meet current competitive pressures, and innovative capabilities are considerably below the EU average (European Commission, 2005). The European Commission, through EU regional development policy, exercises strong pressure to use EU funds to invest in intangibles (mainly R&D infrastructure and project funding, enhancement of skills, the information society and lifelong learning). The crucial point, however, is that, while the Commission is a partner in policy design, it does not exercise any influence on governance, since the subsidiarity principle has strongly limited its potential to intervene.

Substantial funding with limited checks and balances led to frequent changes in governance structures and policy design, partly owing to general EU regional development reforms and partly owing to a logic internal to the Greek R&D system. The following discussion analyses the formal structure of the nodes of Greek innovation actors, policies and interactions and seeks to identify relevant lessons for innovation governance in lagging countries. The key issues are low income, structural problems and sufficient external funding. The following sections first briefly describe the evolution of the performance and structures of the national innovation system that play a key role in the need for change (or the lack thereof) in governance. Next, the governance structures, with their problems and barriers, are addressed. In conclusion, there are some general remarks on the need for parallel progress in technical and social institutions, if change is to be sustainable.

The national innovation system: evolution and performance

Overview of Greek economic performance[2]

Innovation policies and governance are context-dependent, and the overall economic and business climate has been a determining factor in their evolution. During the last decade, the macroeconomic environment stabilised and Greece met, last but still on time, the Maastricht criteria to access the euro zone. The GDP growth rate for 2003 was around 4%, almost twice the EU average. The main driving forces of economic activity are private consumption, as well as private and public investment. However, investment depends too much on financial flows from EU structural funds. According to the Stability and Growth Programme for the period 2003-06 (Ministry of Economy and Finance, 2004), the prospects for the next two years are good, since growth is expected to remain above average and unemployment and inflation are projected to decrease (but still remain

higher than the EU averages). At the same time, the national fiscal situation will improve, partly because of the end of the burden of expenditures for the Olympic Games and partly because of the strict austerity policies imposed by the Growth and Stability Pact.

Despite its recent improvements, Greece remains among the poorest OECD member states, labour productivity remains below average, and productive activities are mainly oriented towards low or medium-low technologies. In the majority of companies, quality, design, innovation and the level of specialisation of products (goods and services) is not the driving force of sales. As a country, Greece scores very low in all world competitiveness indicators. According the World Economic Forum (WEF), Greece occupied the 38th rank among 80 countries in "growth competitiveness" and the 43rd rank in "micro-economic competitiveness"[3] despite the fact that it performs relatively better in technology and innovation. In the ICT sub-index, Greece ranks 31st, in innovation 27th and in technology transfer 31st. Similarly, the World Competitiveness Scoreboard 2004[4] classifies it in 44th position among 60 countries and regions. The country receives its lowest rank in government efficiency, where it ranks 49th, while in business efficiency and infrastructure it is in 39th place. Technological and scientific infrastructures are not the weakest elements. The European Competitiveness Report 2003[5] stresses high rates of GDP and per capita GDP growth, as well as productivity per hour and per worker, but increasing unemployment.

Two main structural weaknesses hamper a rapid shift into a high-performance S&T system. First is limited entrepreneurship and second is the low attractiveness of the country for inward investment. The number of new firms created annually during the last 15 years remains stable (around 90 000), while the number of firms interrupting operations has increased sharply (from 35 000 to 65 000). In addition, Greece scores last among the EU25 in terms of inward investments, with an average of 0.9% of GDP for 1999-2001, about seven times below the EU average for the same period (European Commission, 2004b). The overall picture of the Greek productive system is largely one of "dualism" (Tsipouri and Papadakou, 2004). Most small and medium-sized enterprises (SMEs) do not appear to be able to respond to new difficulties and challenges. The business climate is unfavourable and investment in physical capital is low. The entry/exit ratio and the lack of new technology-based firms, which could grow rapidly to change the composition of the productive sector, indicate that restructuring will take some time. However, a non-negligible group of companies grows and adapts to competitive pressures with a modernisation strategy and outward investment.

The overall economic context in Greece explains why innovation has not been market-driven. However, unlike countries with similar structural set-ups, the political decision to join the EU created the opportunity for massive transfers of supranational[6] resources to modernise the economy. Part of these resources should be and are used to leverage intangible investments, of which science, technology and innovation (STI) are key components. No wonder, then, that the emergence of science and technology (S&T) policy was supply-driven. Its characteristics and performance are described below. The best reference group for measuring Greek progress is the other southern European countries with similar characteristics. By the same token, the lessons to be learned from Greece apply to countries of intermediate level of development.

STI characteristics and performance

Greece has gone a long way in the last ten years towards creating an S&T policy and more recently towards efforts to use technological resources to improve competitiveness. Low but rising gross domestic expenditure on R&D (GERD) and business enterprise expenditure on R&D (BERD) and increasing emphasis on industrial relevance are important aspects of the current situation.

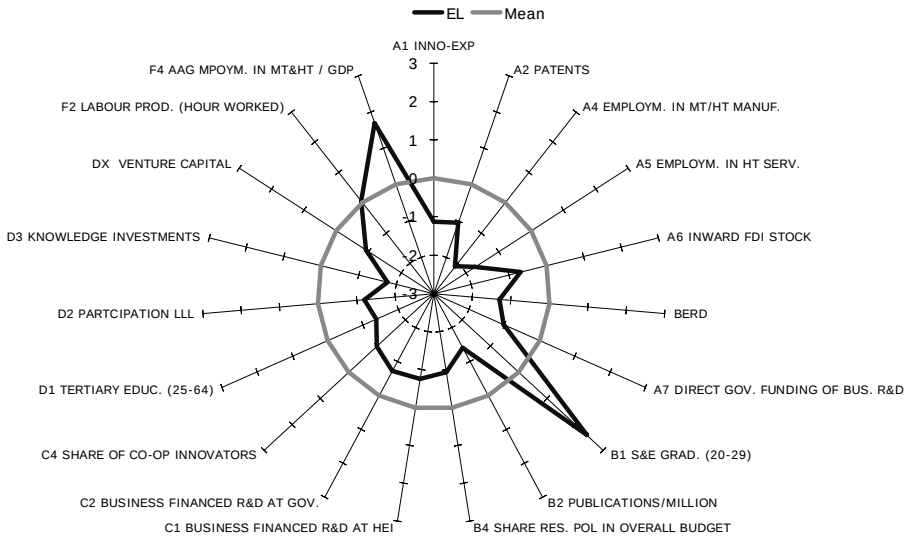
The *Science, Technology and Industry Scoreboard* (OECD, 2003), places Greece in last place among OECD member states with respect to investment in knowledge (research and technological development [RTD], software and higher education) with a share in 2000 below 2% of GDP, well below the OECD average. In terms of efforts to speed up the transition to the knowledge-based economy, Greece, together with Portugal, Spain and Italy, lagged behind in 2001. Their investment levels were below the EU15 average and they had growth in investment comparable to average growth in 2000-01 with Greece slightly above that average (European Commission, 2004c). The ratio GERD/GDP stagnated between 1999 and 2001 around 0.65%. Business expenditure increased strongly (16.7% in 1997-99), although from a very low level, while government funding increased by only 2.1% (1997-2001). As a result, the share of industry financing of GERD increased from 24% in 1999 to 30% in 2001 (OECD, 2003).

Greece performs well in terms of the share of foreign funds financing R&D, at 20.6% in 1999, rising to 21.4% in 2001. The scientific system was in a very good position to exploit the opportunities offered by the competitive EU Framework Programme on R&D, and the national authorities agreed to channel an increasing share of the structural funds to research. The latter are less "foreign" than "national", since the funding is fully managed by national authorities and institutions, and European funds are matched with national funds. In addition, Greece performs well above average in the share of young science and engineering(S&E) graduates, which suggests a solid basis for further development if framework conditions improve.

Figure 1.1 shows STI performance in Greece compared to the other MONIT countries. Greece outperforms the rest in only two indicators. Average annual growth in employment in high- and medium-technology sectors compared to the average annual growth of total employment reflects a very low initial position, so that the positive evolution in the indicator remains at a far too low level to be considered a driving force of the system. A more encouraging sign is the share of S&E graduates in the 20-29 age group, again with two major reservations. First, benchmarks show low quality of training curricula and performance;[7] second, this only applies to university graduates, as the level of technicians is not as good.

All the other indicators are below the average for the rest of the MONIT countries, and many represent the worst performance in the group. In terms of innovation in the business sector, all Greek indicators are well below 50% of the MONIT mean, with the worst relative performance in patents and inward foreign direct investment (FDI). Not only is innovation generation weak, so is absorption capacity, particularly in terms of lifelong learning. The country performs substantially better in knowledge generation. Industry-science linkages are weak although persistent public intervention has slightly increased co-operation among firms, universities and public research institutions.

Figure 1.1. STI performance in Greece[8]



Source: MONIT network. Comparable indicators for MONIT countries. Indicators based on the following sources: European Commission (2002), OECD (2002a), UNCTAD (2002), IRCE (2002), OECD (2002b), Eurostat, CIS-2 (CD-Rom).

The overall capacity and performance of the S&T system is weak, not only in static terms. As demonstrated by the group of indicators referring to absorption, significant improvement is very unlikely in the near future because the system cannot support a significant pace of knowledge and technology diffusion.

Evolution of the STI system

In terms of structures the first steps in the development of S&T policy date back to 1964, when the Greek government asked an OECD research team to study the situation of domestic research and technology (R&T), recommend policies and propose a co-ordination scheme that would assist in the country's development efforts. The result (following political turmoil), was the creation in 1971 of the National Council of Research and Development and the Public Service of Scientific Research and Development (YEEA) of the then Ministry of Culture and Science. In 1976, owing to the lack of expertise in the public sector, the Prime Minister decided to give a team of foreign experts the task of elaborating a bill for the co-ordination of R&T in Greece. The result was the establishment of the Interministerial Committee for R&T and the National Advisory Council for R&T which reported directly to the powerful Minister of Co-ordination. Moreover, according to the new law YEEA was also under the authority of that ministry. Direct collaboration between the three institutions and the Ministry of Co-ordination facilitated the co-ordination of funds. The second most important change was the adoption, for the first time, of a project-funding philosophy. The first National Research Programme was addressed mainly to the academic research system.

In 1982 YEEA became an independent Ministry of Science and Technology with a broader mission. Novel elements were the recognition of the regional dimension of research, the acknowledgement of the professional status of researchers, the creation of intermediaries and the orientation of research towards sectors of national economic and social interest through the Programme for the Development of Science and Technology (PAET). In 1985 the Ministry of S&T became the General Secretariat of Research and Technology (GSRT) of the Ministry of Industry (later extended and renamed Ministry of Development), which is still the main body responsible for STI in Greece. As this brief history shows, there has been a frequent shift in responsibilities around the same theme: a central agency for R&D and no substantial co-operation with sectoral ministries.

In terms of policies, the issue of technology and innovation was not raised until the mid-1980s. The first attempt to approach the private sector was the 1985 Programme for the Development of Industrial Research (PAVE), which was launched systematically and has occasionally been revamped since. The real breakthrough took place in the 1990s with the implementation of the 1st Community Support Framework 1988-93 (CSF). This was the country's first chance to attempt a large-scale central S&T strategy. A significant challenge was the establishment of research infrastructures, a goal which also inspired much of the 2nd CSF (1994-2000). Emphasis was placed on technological services through the creation of new agencies for the protection of industrial property, documentation and the dissemination of information. However, it was not until the 3rd CSF (2001-06) that the overall aim shifted towards improving competitiveness in alliance with EU policy. For the first time R&D is viewed as an input for innovation rather than as an input for education or a target in itself. Because of funding increases, the Commission imposes new rules and organisations for the management of regional policies, including STI.

In terms of innovation governance the system and policies suggest a categorisation into three distinct periods:

- **The birth of the innovation system**, up to 1985, with a central agency (not always the same) for R&D, managing limited funds and addressing mainly academic research capabilities.
- **The uncoordinated growth phase**, 1985-99, in which agencies continued to shift, funds increased substantially, R&D content expanded to include more missions, new actors were created, but the emphasis remained on academia, and interaction among ministries and agencies remained marginal; and innovation represented a "shopping list" rather than a consistent policy.
- **The phase of financial co-ordination**, from 2000 onwards, in which more ministries and secretariats not only recognise but also incorporate innovation in their policy agenda; a special mechanism for co-ordinating financial means has been established to ensure avoidance of overlaps and cumulative funding. However, there is still no real co-ordination with an emphasis on vision, agenda setting and prioritisation.

It is this last phase that is analysed in detail in the rest of the chapter.

Science, technology and innovation actors: worlds apart

The public administration

The public sector is responsible for regulation and is the major funder of Greek research activities. Government Budget Appropriations or Outlays for R&D (GBAORD) during most of 1985-2000 varied between 0.20% and 0.30% of GDP, and in 2000 reached 0.35%.

Two key features characterise the public administration. The first is the dual role of ministries, which both design and implement policies, and thus the lack of a body responsible only for debating and agenda setting. The second is that the GSRT is responsible for STI but has limited, if any, interaction with the sectoral ministries and agencies (Agriculture, Defence, Health, Public Works, Labour and Information Society), the Ministry of Education has an increasing role and the Ministry of Economy and Finance undertakes a general monitoring.

The Ministry of Economy and Finance (MEF)

The MEF is responsible for the Treasury and for macroeconomic policy design and implementation. Its major immediate contribution to innovation policy is the incentive mechanisms foreseen in the legal framework for private investment. They include grants, tax exemptions on R&D and interest rate subsidies. The so-called Development Law provides for special support to innovative companies and to investments in high-technology products and services. MEF can also affect S&T indirectly through the allocation of funds for public investment programmes and through ministries' budgets for R&D.

The MEF is also responsible for the implementation of the national information society (IS) policy through its Special Secretariat for the Information Society (SSIS). The SSIS was created in 2001 in order to co-ordinate IS policy in an effort to catch up with European averages. The SSIS is very active. Its main responsibility is co-ordination of the implementation of IS procurement and measures foreseen in the Operational Programme "Information Society" at a higher political level. Implementation is the responsibility of the respective Managing Authority, supervised by the Special Secretary.

However, the MEF plays a central role in the financial co-ordination of the country's regional and sectoral development funds, on the basis of the Central Development Plan agreed with the European Commission at the beginning of each programming period. The process, as set up by the European Commission, foresees the adoption of Regional and Sectoral Operational Programmes, which specify not only broad areas but also specific schemes to which funds are to be distributed. The MEF plays a key role in the implementation of the CSF in terms of financial consistency and accountability. In this context, its most significant agencies are the CSF Managing Authority, which co-ordinates, guides, gives opinion if necessary and controls projects that receive financing; the Monitoring Committee, which is responsible for design and programme strategy; the Payments Authority, which provides matching funds and controls the legality of payments. The way in which this co-ordinating role affects the co-ordination of innovation policy is discussed below.

The Ministry of Development

The Ministry of Development, created in the late 1990s to put emphasis on economic development, is one of the most powerful ministries with responsibilities for industry, research, technology, energy and trade. The *General Secretariat for Research and Technology* (GSRT) is the key organisation responsible both for the strategy and the implementation of the national research and technology policy. STI was to be considered an integral part of economic development rather than an independent target or a function of the education system. This was the first attempt to raise the issue of innovation in Greece, and the GSRT is now formally entrusted with innovation policy. It manages approximately one-third of the overall public S&T budget with a view to improving competitiveness, transferring technological know-how from the research centres to the productive sector and restructuring and reinforcing human resources for scientific research. Beyond its policy delivery responsibilities, the GSRT "supervises" 11 small and medium-sized research centres. Its role thus mixes policy design, design of laws on researchers' status and careers, regular institutional funding and management of incentives in the form of project funding. The GRST lacks sufficient resources to perform all these tasks. The academic lobbies, as major participants in policy implementation, systematically succeed in promoting basic, blue-sky or university-based research.

Innovation policy is characterised by rhetoric, timid implementation and discontinuity. The GSRT is assisted by an advisory body for policy making and management of research institutions, the National Council for Research and Technology (NCRT). The NCRT advises the government on national R&D priorities and on the selection and appointment of the senior management of the research centres (selection of the directors of the centres and their institutes). To date, the chairman of the NCRT has always been a hard-science academic and has influenced priorities accordingly. A special merit of the GSRT is its unique (even if very limited) efforts to introduce strategic intelligence and evidence-based policies, including an evaluation culture. It is the only public service that has organised a few evaluations of its own programmes, and it has twice supported an institutional evaluation of the supervised research centres.

The task of the General Secretariat for Industry (GSI), a twin secretariat to the GSRT, is to support and inspect Greek industry, and it becomes a relevant player because of its strong links to the manufacturing sector. As funding opportunities from the CSF increased, the GSI started launching a broad number of incentive schemes, which tackle innovation directly or indirectly: programmes enhancing entrepreneurship, supporting the incorporation of ICT in SMEs, etc., are a GSI responsibility. The Hellenic Organisation of Small and Medium-sized Enterprises and Handicraft S.A. (EOMMEX), the SME organisation supervised by the GSI, is one of the few independent implementing agencies. EOMMEX has been severely criticised for lack of effective management and has never been formally evaluated.

Recognising the limited effectiveness of STI in the service of the productive sector, the Ministry established in 2003 the National Competitiveness Council, an advisory body to the Minister. The main aim of the Council is to group under the same roof representatives of government and the business sector. During the first years of its existence the Council was not very effective; it focused on expressing opinions and making recommendations. Towards the end of 2004 there were signs of a more active lobbying position.

In conclusion, the Ministry of Development, through two strong funding secretariats, is the key actor in the conception and implementation of innovation. However, the secretariats have insufficient resources in light of their mission, they are supported by agencies and councils which do not accomplish their tasks objectively or effectively, and they do not dispose of a broader power of co-ordination. Interaction between them and with the wider institutional set-up is effected via the financial co-ordination mechanism described below.

The Ministry of Education and Religious Affairs (MERA)

The MERA is responsible for the development of human capital at all levels of formal education and initial vocational training. In terms of interaction between the higher educations institutions (HEIs) and the Ministry of Education, on the one hand the Ministry has full budgetary authority and legal responsibility even for insignificant matters (like hiring support personnel), but, on the other, the board of the university is *de facto* not accountable to anyone for the management of the institution. The combination of central planning for enrolment, the absence of an assessment mechanism and constitutionally based free education deprive the system of any quasi-market mechanisms that would impose a performance orientation.

Only since 1995 has MERA tried to modernise and use CSF funds to upgrade education. In this context, it has launched schemes to support educational infrastructure (libraries, new graduate departments and ICT labs), research projects (mainly basic research to avoid overlapping with the GSRT), and schemes to increase links between HEIs and productive activities. These last are integral parts of innovation promotion, but co-ordination with the formally responsible GSRT again remains limited to the financial level.

The role of other ministries

Other public authorities with potential impact on innovation policy are the Ministry of Agricultural Development, the Ministry of Public Works and Environment, the Ministry of Transport and Communications, the Ministry of Health and the Ministry of Defence. The Ministry of Agriculture operates a National Centre for the Development and Dissemination of knowledge in the agricultural and food sectors. The Ministry of Public Works supervises the public works (testing) laboratories and launched in the past a scheme supporting environmental R&D. The Ministry of Transport and Communications co-operates with the Regulator for Telecommunications, setting rules for the dissemination of ICT technologies; it has a central role in exploiting the potential of satellites and introducing new services. Important clients for space technology are the Ministry of Merchant Marine, the Ministry of Tourism and the Ministry of Defence. The last has research units, which are extremely small compared to the size of the Greek defence budget, because procurement of major defence systems comes from foreign suppliers. A directorate on procurement tried to mobilise procurement to leverage local innovative production with limited, if any, effect.

Table 1.1 shows the relative importance of each ministry in budgetary terms. The high ranking of the Ministry of Education reflects the statistical capturing of research data, because a share of personnel costs (equal to the time sharing of faculty between research and education) is assumed to be dedicated to research. Thus only the Ministries of Education, Development and Agriculture play a significant role, although Agriculture has lost much of its relative importance (in shares) during the last decade.

Table 1.1. Government appropriations on R&D, by ministry

	1993	1995	1997	1999	2001
Ministry of Education	46.1%	49.6%	54.3%	54.4%	53.4%
Ministry of Development	33.4%	36.5%	34.0%	35.2%	36.9%
Ministry of Agriculture	14.6%	11.0%	8.2%	7.2%	6.4%
Ministry of Defence	2.3%	1.2%	1.2%	0.8%	0.7%
Ministry of Economy and Finance	1.9%	0.7%	0.9%	1.0%	1.0%
Ministry of Culture	0.9%	0.7%	0.9%	0.6%	0.8%
Other Ministries	0.7%	0.3%	0.5%	0.7%	0.8%
Total budget (EUR millions)	161.9	258.4	323.3	365.4	418.8

Source: GSRT (2004*b*), *Towards a Knowledge-based Economy*, Athens.

The interaction between the GSRT and the sectoral ministries is very limited and *ad hoc*. Given the limited budgetary resources of the other ministries this may not constitute a major area of concern in static terms. If the management authorities suspect overlaps, they investigate and make sure that there is no double-funding of the same project or programmes addressing exactly the same needs. But there is neither higher-level discussion on how to achieve complementarities in the various systems, nor a systematic exchange of information for either priority setting or exploitation of the research results of GSRT-funded research.

Advisory committees and intermediate bodies

Advisory committees have no institutional responsibility in terms of decision making, but their presence in the context of social dialogue and as advisors of policy makers and interested groups may influence or improve the policy context on the issues of interest to them. Their ultimate contribution then depends on the personalities involved and the circumstances. In the context of the formation and the implementation of S&T policy, four committees (one permanent parliamentary committee and three committees active in the GSRT) seem to play a role:

- **Technology Assessment Committee (TAC).** The TAC is one of the three permanent special committees of the Greek Parliament. Its aim is to observe and evaluate the consequences of technological development and to provide advisory services to policy makers when elaborating national technology strategy. The members of the TAC are members of the Greek Parliament appointed at the beginning of each annual period.
- **Greek National Committee for Astronomy (GNCA).** GNCA is the official advisory panel to the government for all matters relevant to astronomical and astrophysical research. The Committee is nominated by the GSRT.
- **Greek Atomic Energy Commission (GAEC).** GAEC is an independent civil service under the Minister of Development and is supervised by the GSRT. It is responsible for matters concerning nuclear energy, nuclear technology and radiological protection from ionising radiation and from artificially produced non-ionising radiation. GAEC's main statutory responsibilities deal with the protection of workers, the general public and the environment against the dangers of radiation.

Intermediary bodies are less developed in Greece, and wherever they exist, they arise from political and legislative initiatives but operate under a "private" law regime for flexibility purposes. Recognising the failures of both the civil service and the market, the government earlier adopted initiatives to develop intermediary institutions that would improve the management of schemes for public R&D and disseminate know-how and technology. In the early 1980s, the introduction of the Special Research Account (SRA) freed university and other public researchers from dysfunctions in the public accounting and financial control system. This has been a quasi private law institution, which operates inside public service organisations. Although the SRAs proved a tremendous success, if judged by the funds they mobilise and manage (in particular in the four bigger establishments), they face hostility to their autonomy from the established public accounting system. Their hybrid role – each supervised by its own university board and all together by both the Ministry of Education, which supervises HEIs in general, and the GSRT, which established them by law – leaves them in a governance vacuum.

The structural programmes since the late 1980s have supported the creation of S&T parks near research centres, technical R&D semi-public research associations, liaison offices in universities and research centres, technology brokers, and public-private R&D consortia funded on a project basis. Since 2001 the structural programmes try to give support to private initiatives for the development of intermediary institutions and expect greater management efficiency from private actors. However, these new organisations, with few exceptions, have never been able to become self-sustaining, not even in terms of operating costs. They depend on public funding and some have had to discontinue their operations or are in hibernation.

The public research system

Universities account for almost 50% of the research effort, public research institutes for almost 25%. HEIs lead the national research effort. The R&D expenditures of HEIs as percentage of GDP increased from 0.07% in 1988 to 0.33% in 1999, and HEIs accounted for 49.5% of expenditures in 1999 and 45.5% in 2001. Much of their funding comes from the EU, either from the structural funds or the Framework Programmes, since there is limited connection between businesses and universities in Greece at least at formal or institutional level. Universities are responsible for the quite good representation of the Greek research community in the EU Framework Programme; Greek participation is about 4-5%, and Greek researchers represent 1-1.5% of EU human capital for research.

However, the Greek universities have the lowest R&D expenditures per researcher (FTE) in the EU15 and among the other sectors of R&D performance (Greek government institutes represent 51% of the EU15 average, industry 45%, universities 37%). This is a major source of difficulty in concentrating the limited resources on a few effective targets, a difficulty that is also sustained by the distortions in the educational system. The share of new PhDs in S&E fields per 1 000 population aged 25-34 in 2001 is only 0.19%, compared to 1.37% in Sweden and an EU15 average of 0,.55%. Greece's average annual growth for 1998-2001 was 8.3%, which exceeds that of the EU15 (2.4%) and equals that of Sweden.

In addition to its universities, Greece has about 35 public research organisations. The five most active research institutes manage close to 60% of the total. A few have acquired a reputation for international excellence in certain niches. Industry linkages and spin-offs are marginal.

Neither the National Rectors' Conference nor the trade unions of researchers have ever initiated a public debate on innovation policy and their role in it.

The business sector

The Greek business sector is the weakest element of the national innovation system (European Commission, 2004a). Composed of very small and, for the great majority, traditional firms, it is slow to adopt process innovations (through purchase of embodied technology) and even slower to develop its own technological base. A very high share of business expenditure for R&D is concentrated in ICT firms established in the last two to three decades. In terms of finance, the contribution of the private sector remains persistently close to half of the OECD average. This is unlikely to change in the near future, since the structure of the productive sector has not changed. The business sector is improving more in terms of R&D performance than in terms of finance. During the last decade, there has been a five-fold increase in the number of companies with some form of R&TD activity. This increase, however, has not been accompanied by a corresponding increase in expenditure since a large proportion of the companies involved are SMEs with limited ability to fund research. In 1998-2000 (latest data available), the number of innovating companies increased considerably and reached 27.3% (GSRT, 2004a), but the innovations identified were mainly incremental, without ambitions for world market expansion.

The opening of the Balkan and Black Sea markets has created new opportunities for the Greek economy in the last decade. Exports were followed by outward investment from the bigger and most competitive Greek companies, not only in supplier-dominated sectors, but also by telecommunications and software firms. In addition, the modern part of the Greek services sector, namely financial, health and educational services, has started investing in these new markets.

Three main actors represent industry. One is the Federation of Greek Industries (SEV), an independent, non-profit lobbying association of employers which aims at the improvement of the business climate and business development in Greece. SEV has a confederation structure, its members being sectoral, local and regional industrial and employer organisations. It plays a prominent role in advocating and advancing entrepreneurship in Greece and throughout the European Union. Although with a lag compared to similar employers' associations in the rest of Europe, SEV is now active in structural policies: it has created its own private non-profit company to manage regional support schemes launched by the public sector, it takes part in many committees and policy design bodies and it is usually strongly represented in *ex ante* evaluation committees for public support. SEV has participated in development studies and is a member of technology transfer organisations.

A second is the Federation of Industries of Northern Greece. It was founded in 1915, and has since been active in efforts to promote the industrial, economic and social progress of northern Greece. In the late 1980s it was, in virtual competition with SEV, the first employers' association to take an active part in structural innovation policies, applying and receiving the only world grant ever managed by the private sector in Greece. Towards the end of the 1990s, however, it appears to be losing momentum in this particular area, leaving structural responsibilities to SEV (of which it is also a member) and concentrating more on the role of the Balkan market for the development of northern Greek enterprises.

Finally, there are the Federation of Hellenic Information Technology & Communications Enterprises (SEPE) and the Federation of Information Technology & Communications Enterprises of Northern Greece (SEPVE). These non-profit organisations were established in 1995. Their main objectives are to promote information technology and telecommunications in Greece and to enlarge the market of the information and communications technology (ICT) industry. They also represent the interests of Greek ICT enterprises *vis-à-vis* the Greek government, the European Commission and other bodies. In this role, they are involved in activities to raise public awareness of the importance of ICT and the transition to an information society for all, the modernisation of the public administration with the use of information technology, the development of a high-speed telecommunications network to improve the current communication infrastructure, the design and implementation of programmes aimed at addressing the needs of SMEs and improving their competitiveness in the market and the co-operation between the ICT market and the educational system in order to co-ordinate the design of the relevant curricula to meet market needs.

Structural variables explain why industry and professional associations have limited involvement in discussions for the formation of innovation strategy. The few modern and dynamic firms appear disappointed by scattered past efforts and unwilling to participate in new *ad hoc* efforts at co-ordination. Only the two Federations of Industry and the two Federations of Hellenic Information Technology and Communications Enterprises express the sector's interests when requested to do so. However, their priority is the general business climate and not innovation.

Mapping the actors

Matching the different components of innovation policy with the main policy actors described above, Table 1.2 shows that two main conclusions can be drawn:

- No policy actor appears at the same time in all areas relevant for innovation.
- Education and S&T policies are primarily designed by public actors. The private-sector lobbies only act indirectly when matters of industrial policy are directly connected to S&T.

Table 1.2. Mapping Greek innovation policy actors

	Education policy	Science and technology policy	Industrial policy	Institutional and legal framework
Major actors	**Government** **Parliament**			
	MERA (primary, secondary education, institutional funding to HEIs, initial vocational training)	**MoD** (GSRT – thematic actions through the OPC, S&T policy planning)	**MoD** (GSI – thematic actions through the OPC, SME programmes)	**MEF** (private investment laws, VC operation)
Other actors	MoL **(lifelong vocational training)** **MoD** (GSRT – indirect influence on the quality of teaching through skill improvements and new infrastructures)	OBI (industrial property and design protection) MEF (investment law, SSIS – ICTs actions through the OPIS) MERA **(framework for the operation of research accounts, funding of HEIs)** **Regional governments** (S&T actions through the ROPs) **Sectoral ministries** (financing of research activities)	**Regional governments** (thematic actions through the ROPs) EOMMEX (development of SMEs) ELOT **(standards setting)**	**MERA** (framework for the operation of HEIs)
Private sector actors			SEV (representation of the Greek industries) SVVE (representation of the Greek industries in Northern Greece) SEPE **(representation of the ICT companies)** **SEPVE** (representation of the ICT companies in Northern Greece)	

ELOT: Greek Standardisation Organisation
EOMMEX: Organisation for Greek SMEs
EPEAEK: Operational Programme for Education and Initial Vocational Training
GSI: General Secretariat of Industry
GSRT: General Secretariat of Research and Technology
IRA: Independent Regulatory Authorities
MERA: Ministry of Education and Religious Affairs
MoD: Ministry of Development
MoL: Ministry of Labour
OPC: Operational Programme Competitiveness
OBI: Greek Patent Office
OPIS: Operational Programme Information Society
ROP: Regional Operational Programme
SSIS: Special Secretariat of Information Society

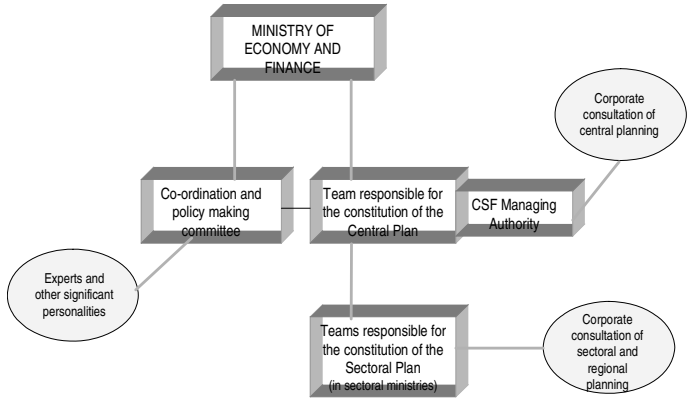
Innovation governance

Having described the main actors, their roles and bilateral contacts, it is now important to turn to actual innovation governance issues. As already pointed out, until now interaction and co-ordination have been limited, fragmented and often imposed by obligations external to the system. In order to capture the details and present an integrated picture, the various aspects of innovation governance related to the policy cycle, such as co-ordination mechanisms, agenda setting, stakeholder involvement, implementation and strategic intelligence, evaluation and policy learning, are analysed in the following sections.

Formal policy co-ordination: priority setting processes

There is a formal policy co-ordination framework for the elaboration and implementation of the economic development programme financed by the CSF. The decision tree is presented in Figure 1.2. At the beginning of the programming period, MEF appoints a Committee for Co-ordination and Policy Making (CCPM), composed of high-level officials of the entire public administration, stakeholders and experts. At the same time, *ad hoc* committees, composed of representatives of the ministries involved in the topic, work on the conception of each regional and sectoral operational plan. A social dialogue and consultations with different interest groups are part of the process. The CCPM interacts constantly with the specific committees. As soon as sectoral and regional plans are agreed between the Greek government and the European Commission, they take the form of detailed operational programmes and are put in force.

Figure 1.2. Organisation flowchart of the structural policy planning process



Source: Ministry of Economy and Finance (2004), *Proceedings from the 1st Meeting for the constitution of the "National Development Plan 2007-2013"* (in Greek). www.hellaskps.gr.

Because of its very nature, innovation touches on more than one operational programme (OP), notably:

- OP "Competitiveness", which has innovation in each core, under the Ministry of Development.
- OP "Education and Initial Vocational Training" under the Ministry of Education.

- OP "Employment and Vocational Training", under the Ministry of Employment and Social Protection.
- OP "Information Society" under the Ministry of Economy and Finance.
- OPs referring to particular sectors.
- Regional OPs, one under each of the 13 regional secretaries; for the first time all 13 have been asked by MEF to include measures for the promotion of innovation.

Co-ordination is organised by ministry and not by topic. Overall, there is no formal mechanism for co-ordinating priorities and policy across OPs. Each ministry submits its OP complement to the CSF Managing Authority, where potential overlaps or gaps can be identified. However, they have no remit on the substance of each programme but rather on its conformity with the formal development goals. There is no time or competence for an exhaustive discussion and co-operation to agree on a coherent framework and incorporate the priorities of the various ministries and regions. Co-ordination is left to the implementation phase.

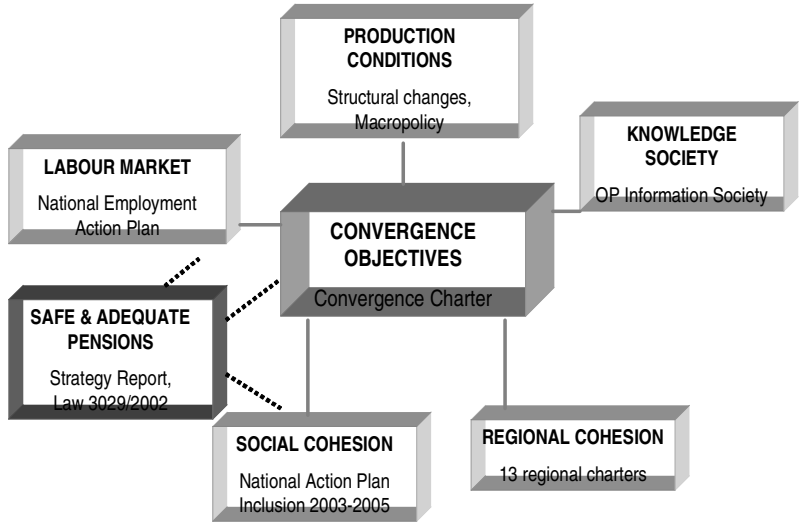
In this context, each of the above OPs includes some measures related to innovation without systematically following or complementing the logic introduced by the GSRT. There is no horizontal structure across OPs focused on innovation. The most interesting part of the co-ordination process is that of the GSRT, which follows a top-down approach in the formulation of the innovation strategy agenda, incorporating the directions provided by EU policies.

Loose rather than tight governance: priority-setting content

S&T priorities were decided top-down for the first time from the Prime Minister's Office. The challenge for economic development is the co-ordination of policies and policy measures to meet the target set by the Lisbon European Council in March 2000 to make the EU the world's most dynamic and competitive economy. In this context, in September 2003, the then Prime Minister announced a comprehensive strategy, called the "Convergence Charter", for accelerating the process of real and social convergence of the Greek economy and society. The Charter sets out a number of specific goals for 2008, classified into ten "convergence fronts", some of which are relevant for innovation, notably "Education and the knowledge-based society" (the primary targets in this context are to increase public expenditure on education to 5% of GDP by 2008 and to develop free choice of school, lifelong learning and education opportunities for all), "Fostering entrepreneurship, encouraging investment", and "Structural reforms for increased competition and competitiveness and the creation of an infrastructure for a modern economy".

The "Convergence Charter" is equivalent to a clear statement of Greece's own input into the overall Lisbon Strategy (Ministry of Economy and Finance, 2003a). It defines explicit and quantitative targets and outlines specific commitments as well as policy directions with respect to all of the above areas. It also outlines policies aimed at boosting productivity and the long-term growth potential of the Greek economy, while creating more and better jobs, strengthening social cohesion and safeguarding the environment. Despite a change of government in March 2004 the structural priorities remain the same. Figure 1.3 summarises the national objectives towards real convergence.

Figure 1.3. National objectives towards real convergence



The implementation of the "Convergence Charter 2004-2008" implies the widening of the scope of structural reforms to put emphasis on the following areas (Ministry of Economy and Finance, 2003b):

- Further simplification of administrative procedures in order to facilitate business start-ups and reduce compliance costs for firms.
- Intensified competition in product markets and especially network utilities.
- Accelerated creation of the knowledge-based society.
- Support for the introduction of market-based instruments to protect and improve the environment.
- A more flexible labour market in order to tackle structural unemployment and address specific groups of interest.

A major challenge in order to comply with the Lisbon and Barcelona objectives[9] is to ensure that the funds, inputs and incentives for industry reach explicit quantitative targets. A reasonable objective adopted by the GSRT is to pass from 0.65% GERD/GDP to 1.5% by 2010, of which 40% would be industry-financed (GSRT, 2004b). The inputs necessary to translate these targets into operational figures show the size of the challenge: From 55 000 research personnel in 2000 the system should reach 125 000 by 2010. The additional 70 000 should include 35 000 new researchers, which means that 3 500 to 4 000 new qualified researchers (additional, not including replacements) per year should enter the system, compared to 1 000 to 1 200 in the 1990s.

The broad targets mentioned above are the result of an internal consultation process, with help from experts and consultants in the framework of the GSRT. The research community and the business sector are formally invited to participate, but, as neither the one nor the other has its own concise and fully elaborated strategy, they cannot play a pivotal role in directing innovation policy. The picture is totally different from that in

countries such as Sweden, Switzerland, Korea or Japan, where the private sector has a leading position in policy suggestions owing to its large contribution to R&D funding.

The strategic priorities of innovation policy are elaborated by the GSRT and translated into operational targets (measures, actions, support schemes) based on experience accumulated during previous programming periods, with evidence from comparative statistical data and indicators of the Greek innovation system. The evaluations implemented by international experts, on behalf of the Regional Policy Directorate General of the European Commission, are made available to national authorities and are used by the EU services as a guideline for agreeing on priorities. There are no similar national evaluations. GSRT officials use their knowledge of good practices in other countries, in the EU or elsewhere. The broad areas for the 2000-06 priorities are detailed below.

Increasing demand for new knowledge and research results in Greece

This includes a variety of activities to support the much-needed transformation of the business sector: increasing investment in knowledge-intensive sectors, creating new business activities that attract high value added inward investment, increasing the employment of research personnel in businesses, improving science-industry co-operation and raising awareness.

This priority reflects the crucial problems of the Greek economy, which have been repeatedly stressed in the past. However, in the present formulation they are more clearly expressed and for the first time they appear at the top of the agenda. It is noteworthy, though, that these priorities seem to be a guideline for implementation for the GSRT only, while the GSI and the MERA, highly relevant for the particular area, follow their own agendas.

Reorganisation of the research system and provision of knowledge in Greece

This refers to reorientation of the priorities of the GSRT-supervised research organisations towards applied research to meet the needs of the productive sector and increase "critical mass" by restricting the number of organisations and centralising resources in the most appropriate of these. This will allow supervised public research centres to distinguish themselves from academic research. The focus of MERA remains on strengthening academic research in universities to support the education process.

In terms of priority setting, this area reflects good interaction between two ministries that shape different visions.

Liberating the Greek research system and opening it further to the international field

This will increase collaboration by Greek research teams with their counterparts abroad, including in EU-funded partnerships. This priority has been strongly influenced by the position of the academic community.

Development and technological infrastructure in the context of an S&T policy

This is a follow-up from previous development plans. A new element is the upgrading of both the patenting and standardisation certification/validation systems. This was the result of needs agreed in common between the productive sectors and the two General Secretariats of the Ministry of Development.

Thematic/sector priorities for an S&T policy

This area absorbs a large share of the budget and follows up from the past. Its relevance lies in the selection of sectors, which are expected to form the future competitive edge of the Greek economy. However, there is no indication of broader consultation when designing policy, and selection is based on the current strengths of the academic system. A technology foresight exercise is organised to ensure better planning for the future.

In conclusion, one can argue that S&T priorities and agenda setting are systematic, with the GSRT playing a dominant role and increasing evidence of bilateral co-operation in selected areas. There is no horizontal co-ordination, nor any evidence of a multilateral, longer-term and systematic consultation on the agenda-setting process, with the exception of the process organised by the European Commission at the adoption of each development plan. The latter involves all relevant actors but for short time intervals and with a management rather than a vision-creation character. Since the public sector is the main funding source of the domestic research effort, the specialisation of the country's research priorities is to a large extent led and will continue to be led by the internal elaboration of priorities by the GSRT in connection with the priorities of the EU R&D Framework Programmes, as well as by the dominant philosophy of the Directorate General of Regional Development. However, these needs have proved to be of a short-term nature. This does not facilitate longer-term programming and a strategic vision for innovation, while the limited involvement of the private sector does not allow for ambitious predictions.

Informal rather than institutionalised co-ordination: stakeholder involvement

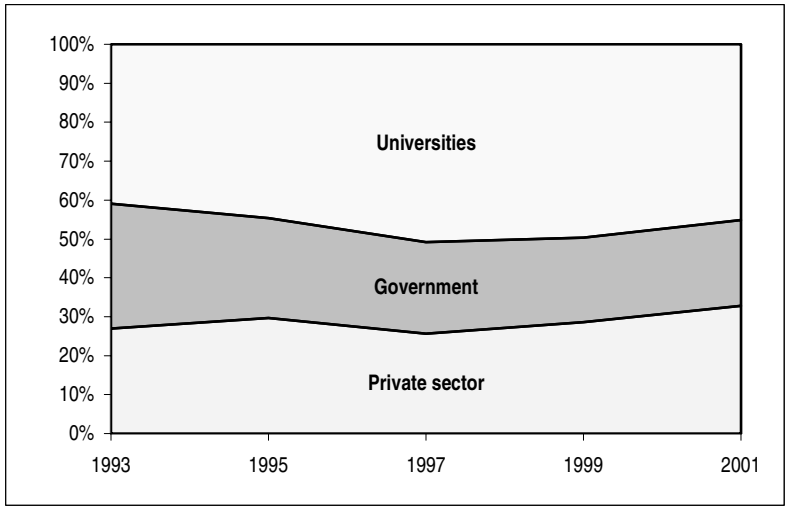
The public authorities consider the business and the academic sectors as relevant stakeholders in the innovation process. Trade unions are sometimes invited to participate in committees but their role has always been marginal. The involvement of society has not progressed. As mentioned above, the relevant stakeholders' involvement is formally foreseen in the various committees. Thus, both the academic and the business sector have an *ex officio* presence in all the committees that matter. The most powerful stakeholders in the research and technology arena are the universities, followed by researchers in public research organisations. The influence of academia is felt both at the higher levels of policy design and at the level of implementation. However, its effectiveness depends on the personality of individual representatives, as there is no policy organisation to which the various representatives are accountable.

This situation is partly due to the role of academics and partly to the late start and continuing reluctance of the business sector to play a very active role. Employers never made innovation a priority of their lobbying and they remain focused on general economic incentives and labour market regulation (see, for example, SEV, 2003). Support for private initiatives for investment continues to favour the reproduction of the traditional industrial structure. Innovative and knowledge-intensive investments are viewed as exceptional compared to the actual strategic behaviour of investors who continue to emphasise the transfer of embodied technology.

The above remarks are reflected in Figure 1.4, which shows the pattern of finance in Greece during the last decade (available years). It is obvious that the universities and the public research centres combined lead the national R&D effort, while the business sector represents less than 30% of GERD. In a sense, these figures also reflect the relative weight

of each group in priority setting. There is neither an expressed will nor a mechanism to reverse the status quo.

Figure 1.4. R&D expenditure by source of funding (shares based on current prices)



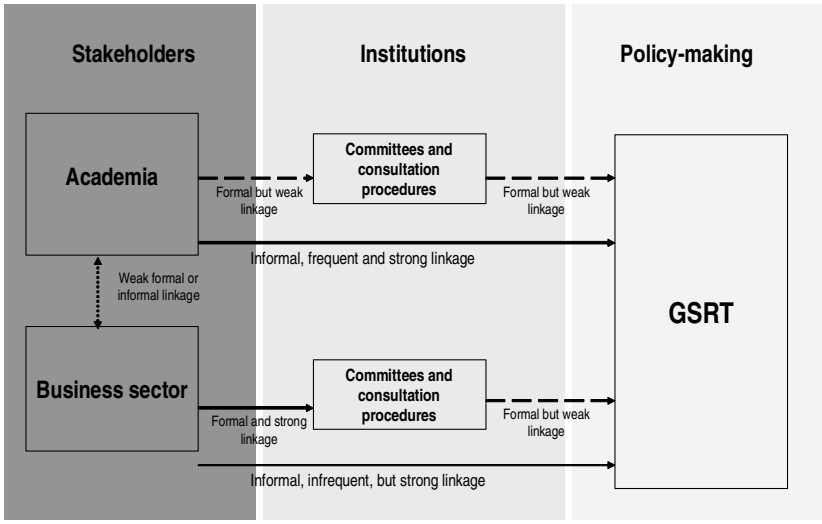
Source: GSRT (1999, 2004), Science and Technology Indicators.

The description of the actors and the priority setting, in terms both of process and content, demonstrate inclusive and well-organised stakeholder involvement. However, when studying the multilateral interaction and the effectiveness of the process, a somewhat different picture appears. There is no general public debate with strong involvement, and interaction is organised within and through the variety of committees described above. Stakeholders' influence is weak because it is diluted:

- Stakeholders do not have a broad, encompassing and long-term strategy for modernisation. The academic sector has no union representing it as a whole, since the rectors' conference, the researchers' union and individual centres all have their own interests. The business sector is represented by its federations, but their interests are primarily focused elsewhere, not on innovation.
- The role of the committees is more limited than originally conceived. The debate in these committees, as shown by the frequency of their meetings, their agendas and their output, is often fragmented, as in the case of advisory councils. In the case of the CSF-related committees, the agendas and frequency are more systematic but the emphasis is on speed and absorption at the expense of content. In addition, because of the weak strategies and the legitimacy of the representatives in the committees, the latter take a defensive attitude and are unlikely to shape agendas.

However, although the links are diluted in the formal arena, they are often strong informally (Figure 1.5). Informally the influence of the academic sector is considerable. The head of the GSRT has always been a university professor, and advisory boards are also composed and mostly chaired by personalities from higher education. Nominations to EU committees are also largely dominated by academics. This leads to a certain bias more in favour of research than of development, while content may be dictated by the priorities and the capabilities of certain powerful university research institutes.

Figure 1.5. Formal and informal involvement of stakeholders



In conclusion, one can say that institutionalised stakeholder involvement has progressed in terms of process but remains weak in terms of debate and influence. This weakness is compensated for by informal stakeholder involvement based on personal connections and institutional power. These informal bridges may hamper the strengthening of formal links. This vicious circle is hard to break, as demonstrated by the results of the GSRT's effort to trigger cultural change by launching an electronic debate on the future of the knowledge-based economy in Greece, as stakeholder response was virtually nil (see Box 1.1).

Box 1.1. Electronic debate launched with no response

In 2003 the GSRT published on the Web a discussion document, "Towards a knowledge based economy". The document presents a detailed description of the current state of the Greek economy relative to its main competitors, as well as the country's main strengths and weaknesses in terms of knowledge-based economic development. It also addresses the set of goals to be achieved, as well as the distinctive role of all potential stakeholders in this context.

The GSRT's ambitious goal was to see this document become the basis of a consultation process among all the relevant actors in the country's innovation effort. The basic characteristic distinguishing this document from the usual policy documents was its encompassing content and the fact that it was not linked to immediate decisions but had a longer- term horizon.

It was hoped that the outcome of this debate would be a coherent policy document in the form of a White Paper. However, there was little response from stakeholders, indicating either lack of interest (if money is not at stake) or lack of trust in any attempt to promote the involvement of a large number of actors in the policy design process.

Financial rather than content co-ordination: implementation and policy learning

Innovation really moved centre stage for the first time during the planning for the programming for 2000-06. In terms of implementation, the common elements of the choices of the last ten years were the support for funding projects conducted either by universities or industry or by consortia of the two. For the current programming period, policy makers had to decide how to ensure the transition from a structural policy emphasising the development of research infrastructures to the exploitation of research results, the development of material and financial infrastructures to host spin-offs and new technology-based firms, and the establishment of long-range linkages between public research and the business sector for the provision of knowledge-intensive services. The new period has also given more emphasis to international co-operation through funding of projects and active participation of European organisations.

To meet these targets, the main components of the "new" innovation policy include the following measures:

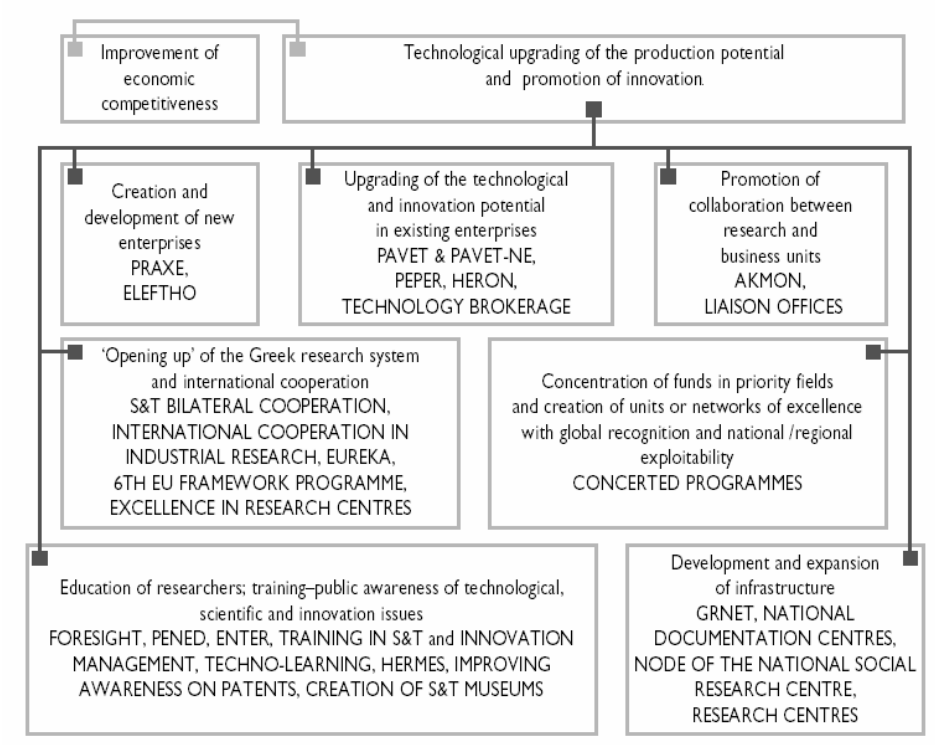
- Creation and development of privately operated S&T parks and incubators.
- Exploitation of public research results, on the initiative of the researchers themselves and private financing institutions, companies or individuals.
- Development of venture capital with the support of a public fund of funds.
- Organisation of the supply of knowledge-intensive services by public laboratories to industry on a medium- and long-term basis.
- Training of research directors in the public and private sectors, opinion makers and young researchers in the management of innovation and research.
- Foresight exercises.
- Promotion of entrepreneurship in schools and universities.

These measures complement existing schemes for supporting:

- Industrial research and demonstration.
- International co-operation on industrial research.
- Co-operative RTD through projects implemented by consortia of research and productive institutions.
- Training of young researchers in projects co-financed by industry.
- Employment of researchers from abroad, in projects co-financed by industry.
- Familiarisation of the public with scientific and technological change.

The correspondence between goals and measures, as shown in Figure 1.6, indubitably has an internal logic.

Figure 1.6. Correspondence of competitiveness goals and measures



Source: Ministry of Development, General Secretariat of Research and Technology (2003) *Research and Development in Greece*, Athens.

The decision-making process for the new measures was based on a general knowledge of the public administration and not on a systematic debate on evidence and alternative schemes among the various public actors, let alone a higher-level institution like the Parliament or the Prime Minister's Office. The limited use of evidence-based design is strongly linked to the lack of funds dedicated to benchmarking, foresight and evaluation. Like most of the cohesion and accession countries, as well as candidate countries, Greece has no evaluation culture and undertakes marginal evaluation activities only. Evaluations are undertaken mainly when imposed by the European Commission, and there are very few evaluations of specific measures or institutions. No benchmarking has been undertaken in Greece, and there is limited evidence of use of OECD, EIS or World Forum benchmarks. The implementation of a national foresight exercise in 2003-05 is hoped to offer better evidence for future design, although there is absolutely no evidence of a change in the propensity to evaluate.

The limited use of modern tools and broader interaction in the implementation stage can be further corroborated by some qualitative analysis:

- **Importance and frequency of innovation white papers.** There is no official white paper on innovation. The government's strategic vision with respect to STI is expressed through documents related to the operational programmes for the implementation of structural actions in co-ordination with EU policy. In November 2003, the GSRT published a paper, "Towards a Knowledge-based Economy: Prospects and Responsibilities", to serve as the basis for a broader

discussion between political, intellectual and business authorities on the prospects for a knowledge-based competitiveness enhancement policy.

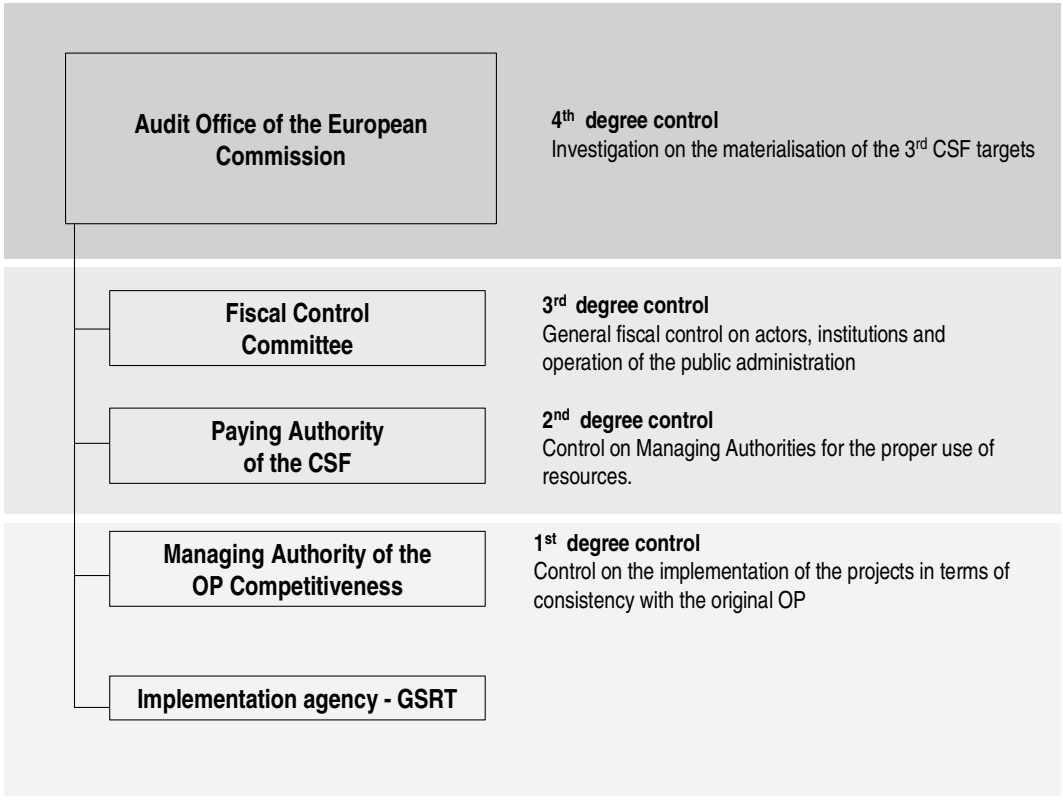
- **A mechanism for regularly producing a government innovation policy agenda or an innovation strategy.** The GSRT is responsible for the prioritisation and implementation of S&T policies in Greece but has no influence over the priorities set by other ministries. However, implementation in the context of the 3rd CSF has as a prerequisite the co-ordination of actions to avoid overlapping in funding and a maximum degree of complementarity. However, this form of co-ordination is far from a coherent mechanism for co-ordinating innovation strategy.
- **The number of ministries mentioning innovation in their mission statements.** The only ministry that is explicitly involved in innovation actions is the Ministry of Development through the GSRT. The involvement of the Ministry of Economy and Finance occurs through the provisions of the Investment Law on innovative investments and the administration of the OP "Information Society". Other ministries have only indirect involvement in research activities through the financing of R&D projects conducted either by their supervised research centres or other third parties. The Ministry of Defence is an exception, since it also manages large amounts of public funds for imports of technology embodied in defence equipment.
- **Number of STI programmes governed by more than one ministry.** Sectoral operational programmes foresee the implementation of some multidisciplinary actions, for which some form of co-operation among several ministries is required. As one example, the operational programme "Information Society" is governed by the Ministry of Economy and Finance and the Ministry of Internal Affairs, as many of its funds are dedicated to actions for the modernisation of the public administration.

Finally, in the implementation process, the interaction between ministries is limited to participation in one another's OP monitoring committees. Indirect control is exercised by the auditing procedure, which is more structured (Figure 1.7). Once the OPs are approved, their implementation is entrusted to special managing authorities (one per programme) responsible for the elaboration of calls for proposals or tenders and the supervision of implementation of actions. Central supervision is exercised by:

- The CSF Managing Authority (described above) which co-ordinates, guides, gives conforming opinion when necessary and controls projects that have financial inflows.
- The CSF Monitoring Committee which has responsibility for design and programme strategy.
- The Payments Authority provides matching funds and controls the legality of payments decided by each OP's managing authority. Each managing authority has full financial responsibility and executive power, and is also responsible for the programming and the evaluation of any action in the OP under its responsibility. The Payments Authority can assure the national and European administration that there is no double funding and abuse of taxpayers money.

The flow of actions and responsibilities is the typical process which is followed for the entire CSF. Thus, financial co-ordination at least is effective.

Figure 1.7. Auditing mechanism of the 3rd CSF



An additional level of complication is innovation governance at the regional level, where the policy of the regional authorities needs to be taken into account. Greece is governed centrally, but is trying to increase regional autonomy, with responsibilities for the enhancement of endogenous growth are gradually shifted to lower levels, despite limited administrative capabilities. Table 1.3 gives an overview of the regional history and structures. R&D is concentrated in very few regions as is the history of innovation policy. Since 2000, all regions have been asked to incorporate elements of innovation promotion in their development, which they did as a part of the planning process, following the steps described above.

Initial discussions demonstrate that regional policy makers have given strong priority to research infrastructure in an effort to reinforce regional HEIs and research centres. This was unacceptable in the light of the new national priorities, and the lack of clear rules (or in fact of acceptable rules) for co-ordinating national and regional policies has caused delays. As a result, the funds earmarked for R&D and innovation at the regional level have not, with very few exceptions, been mobilised. The difficulties of co-ordination are behind the inability to give innovation policy a new dimension. Central Macedonia is one example of a region that could escape from this process and create its own momentum. A series of debates and strategic plans as well as the pivotal roles of both the regional university and the Federation of Industries of Northern Greece contributed to more ambitious governance. Again, individual capabilities and informal links helped overcome the burden of inadequate formal co-ordination.

Table 1.3. Regional R&D performance and innovation policy

Region	% GERD/GDP	BERD/GERD	Previous regional innovation funding[1]	Total regional innovation funding foreseen for 2000-2006 (EUR millions)
East Macedonia-Thrace	0.32	0.161	Marginal	255
Central Macedonia	0.55	0.177	Yes	254
West Macedonia	0.12	0.547	No	92
Thessaly	0.15	0.312	Yes	245
Epirus	0.64	0.101	Marginal	297
Ionian Islands	0.17	0.106	No	121
Western Greece	0.60	0.108	No	188
Continental Greece	0.14	0.894	No	129[2]
Peloponnesus	0.10	0.818	No	113
Attica	0.70	0.321	Yes	228
North Aegean	0.38	0.055	No	134
South Aegean	0.05	0.250	No	139
Crete	0.85	0.058	Yes	169

1. This column refers to regional funding only, even regions with no regional funding had R&D and innovation expenditure supported from the national budget.

2 This sum refers to public financing and not to total cost.

Source: Regional Operational Programmes (3rd CSF, Greece).

Conclusions and assessment

Greek innovation policy is recent, fragmented and partly externally triggered, since its financial resources and the emphasis placed on it are a result of the Community Support Frameworks that have offered substantial funding for intangibles. This flow of funds is without precedent for the Greek economy. In a country like Greece, where the productive sector relies on traditional activities, market mechanisms do not generally create sufficient incentives to change the local development model and the economy remains in a low-cost competitiveness trap. Funding is one of the constraints.

When the funding constraint is – artificially[10] – eliminated, there is a need for efficient governance to manage these funds. It is argued that it is more difficult to create such a structure in this case than when wealth and social routines co-evolve, in other words when the market matures and decides to dedicate efforts to research and innovation. In the latter case, actors are more aware of their decisions and willing to dedicate the necessary effort to influence overall policy making. Consultation processes result almost automatically, because their absence would lead to tension. The opposite may be observed when funding is external, as it is considered as a "free meal", thus requiring no effort.

The Greek system and policies suggest a categorisation of innovation governance into three distinct periods, following increasing funding for intangibles and slow shifts from infrastructure to research exploitation:

- The birth of the innovation system, until 1985.
- Uncoordinated growth, from 1985 to 1999, with an intensification of R&D but with no real emphasis on innovation.
- Financial co-ordination, from 2000 onwards, when more ministries and secretariats not only recognise but also incorporate innovation in their policy agenda. In this period a special mechanisms for co-ordinating financial means has been established to ensure the avoidance of overlaps and cumulative funding. However, there is still no real co-ordination with emphasis on vision, agenda setting and prioritisation.

These periods are well explained by the country's somewhat artificial and externally triggered innovation policy: market conditions did not favour an innovative culture in the business sector but policy design introduced a top-down effort to modernise the economy. Innovation policy in this context is funded through the EU regional support policy and co-decided by European and Greek policy makers.

This externally triggered innovation policy broadly determined what happened afterwards. After a decade of experience a system has been set in motion, which disposes of many components of success: a planning process, an agency responsible for innovation and a consultation process. But the institutions were designed before actors were mature enough to respond to the new challenges and thus these well-designed institutions are underperforming: Formal co-ordination was gradually introduced at the level of priority setting, but it did not succeed in bringing different actors into thematic co-ordination. Individual kingdoms are built around the relevant ministries, which have the dual role of designing and implementing policies. There is loose rather than tight governance regarding the content of priority setting, since each organisation respects the priorities of others and does not attempt to interfere. Stakeholder involvement is foreseen, but the stakeholders themselves do not wish to take an active, long-term and systematic role, and the functioning of the various committees does not allow for effective debate. A few experiments to introduce a content-based, vision-oriented debate failed to trigger the envisaged response. Therefore, stakeholder involvement is institutionalised but informal interventions are often more effective than formal ones. Financial co-ordination functions best and ensures that implementation does not lead to overlaps. Policy learning remains limited, utilisation of modern evidence-based techniques is rudimentary, and evaluation is marginal and in practice essentially limited to legal obligations *vis-à-vis* the European Union.

History and structures explain this situation. Industry and professional associations have limited involvement in discussion for developing an innovation strategy. The few modern and dynamic firms appear disappointed by scattered past efforts and unwilling to participate in new *ad hoc* co-ordination efforts. Only the federations express sectoral interests, and only when requested to do so. Their priority is the general business climate rather than innovation. The academic sector has no unified position but informal links are important, as academics dominate committees in Greece and Brussels, they chair the National Council of R&T and are nearly always Secretaries of S&T, the top administrative position for innovation policy.

In Greece no radical changes have accompanied the substantially increased funding. The central agency model, with no powerful co-ordination, was never particularly effective, yet it was never changed and replaced by horizontal or higher-level thematic co-ordination. In order to manage the new system, the national ministries need to re-

invent themselves, demonstrate persistence and an ability to guide the system away from its path dependencies. To do so, they require evidence-based policies and strong political backing. However, the lack of an efficient administration has never allowed for the use of tools like evaluation and benchmarking, except to the extent that they are imposed and paid for by the European Commission. At the same time, ministries are unwilling to go along with agendas set by others and advisory boards have neither the power nor the willingness to play a crucial role. Ministerial realms rather than thematic forums are the inevitable result.

The lessons learned and recommendations to a system, which envisages leapfrogging through innovation funding, is that when funding is available, effective accompanying governance is needed. This does not happen automatically and only slow progress can be expected unless a powerful co-ordination structure using evidence-based policy, systematic evaluation and the right checks and balances are put in place. The political power of one body responsible for policy design (preferably distinct from execution to minimise friction), appears to be a good theoretical solution. Needless to say, there is no universal solution and every system needs tailor-made approaches to break with its own path dependency.

To conclude, one should recognise that it is not easy to meet the challenge of creating effective governance: policy makers were requested to find efficient ways to spend external funding channelled towards activities for which the market was not mature and the actors were not experienced. It is hoped that the government will not fail, although the market did.

Notes

1. In Community jargon it is referred to as a "cohesion country", meaning a member state with GDP per head under 75% of the EU average. All 13 regions of the country had a "less-favoured region" status, meaning that GDP per head was below 75% of the average in regional terms.

2. European Commission (2004a).

3. *www.weforum.org*, 2002-2003.

4. *www.imd.ch/wcy/tour*

5. *http://europa.eu.int/comm/entreprise/entreprise_policy/competitiveness/doc*

6. These are more than international in the sense that the decisions of the supranational authority can be imposed on the national level.

7. Greek universities do not appear highly rated in international rankings.

8. Data are normalised and can only facilitate comparisons between the mean performances of national and MONIT (countries).

9. GERD should be 3% of GDP and industry-financed GERD 2% of GDP by 2010 in the EU.

10. That is, through external funding rather than generated by local savings.

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Chapter 2

GOVERNANCE AND INSTITUTIONAL CHANGE IN IRELAND

Rachel Hilliard and Roy Green[1]
Centre for Innovation & Structural Change, National University of Ireland, Galway

An innovation-driven policy agenda has emerged in Ireland against a backdrop of remarkable economic growth and convergence. Policy makers now recognise that convergence in innovative performance will also be required for a sustainable economic future. Nonetheless, over the past decade, the Irish policy system has been struggling with two significant, and interrelated, innovation policy challenges. The first is to stimulate a national innovation system (NIS). The second is to secure the role of policy in achieving effective links and integration between the elements of the NIS.

The failure to link policy elements may simply reflect the early stage of development of the Irish NIS. Alternatively, the problem may be a particular incidence of a wider problem affecting policy, namely the prevalence in the Irish policy system of a culture of strong ministerial autonomy. The innovation agenda may also have failed to gain wide support within government and society. The lack of a shared understanding of the importance of innovation for continued economic growth and of the costs of failure weakens the political imperative for a coherent and integrated approach to developing the Irish NIS. Recent attempts to strengthen elements and interaction within the NIS can be seen as attempts to address these issues.

Introduction

This chapter aims to provide information about current systems of governance and institutional change in Ireland. The timeframe of the MONIT project has coincided with a period of reorganisation of Irish policy governance arrangements. Following consultations in 2001, new governance arrangements were announced by the Minister for Enterprise, Trade and Employment in July 2004. For this research project, this has been both a constraint and an opportunity. The constraint has been a contested, and therefore protracted, process, which has made it difficult to draw conclusions about the impact and effectiveness of both proposed and recently established structures. The opportunity is that the process has thrown into sharp focus the weaknesses of the existing governance structures.

This chapter thus offers an analytical overview of the current status of Irish innovation policy governance and grounds the analysis in its historical context. It examines where mechanisms for coherence have developed and where their absence has led to obstacles and missed opportunities for synergy. The analysis is based on an extensive review of the documentation on Irish innovation policy over the last 15 years and on interviews with key actors in the Irish policy system.[2]

Policy challenges

The most recent statement of the key policy challenges for the Irish economy place innovation firmly at the heart of the government's policy focus:

> Ireland is vulnerable in the growth sectors of the knowledge economy as the R&D capability to underpin success in these sectors is not well developed in the public and private sectors … A failure to address the structural deficiencies in R&D performance in the enterprise base will mean we are not replacing low skill industries with new technology companies, 'high-tech' manufacturing operations will be more vulnerable and we will not attract and create new waves of firms in the technology areas of the future. (IDC, 2004, p. 19)

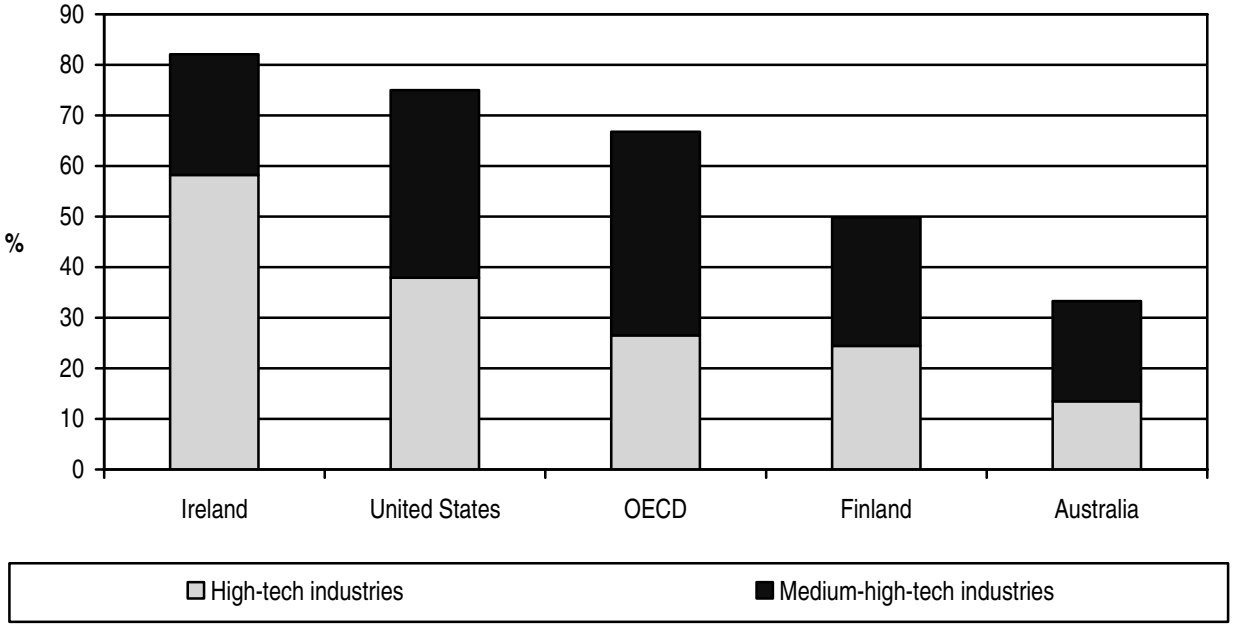
The key feature of the Irish economy over the past ten years has been the remarkable rate of economic growth and convergence with other European Union (EU) member states. Irish GNP[3] as a percentage of the EU15 average has risen from 75% in 1993 to 101% in 2003. There are many reasons for this; they include strategic targeting of foreign direct investment (FDI), the associated growth in global markets and favourable framework conditions such as the corporate tax regime, the social partnership, the skills base and the demographic profile, and the effective deployment of EU structural funds. According to the Enterprise Strategy Group,[4] "Ireland's economic progress over the past decade was the result of both good planning and of providence" (ESG, 2004, p. x).

One characteristic[5] of the period of Irish growth is the emerging gap between the economic and innovative performance of the highly export-oriented FDI sector and the weaker indigenous sector, which comprises mainly small to medium-sized enterprises (SMEs). This is also reflected in Ireland's paradoxical situation (Figures 2.1 and 2.2): it is a world leader in exports of high-technology products – especially in information and communication technology (ICT), pharmaceuticals and medical devices – without being a significant generator of innovation (Green *et al*., 2001). Given that the economy is one of the most trade-dependent in the OECD, with one in four jobs directly export-dependent, the global shift to knowledge-based products and services leaves the economy particularly vulnerable. The current structure, weighted towards externally generated R&D, puts control of the key technology drivers outside domestic influence.

Gross expenditure on R&D, at 1.4% of GDP (in 2001) is below the OECD average of 2.33% of GDP, and well below the levels of the economies looked to as possible models, such as Finland (3.49% of GDP) and Denmark (2.40% of GDP). Disaggregating this expenditure, R&D performance in the business sector, both indigenous and under foreign control, is comparatively poor. In 2001, business enterprise expenditure on R&D (BERD) was 73% of the EU average and 57% of the OECD average:

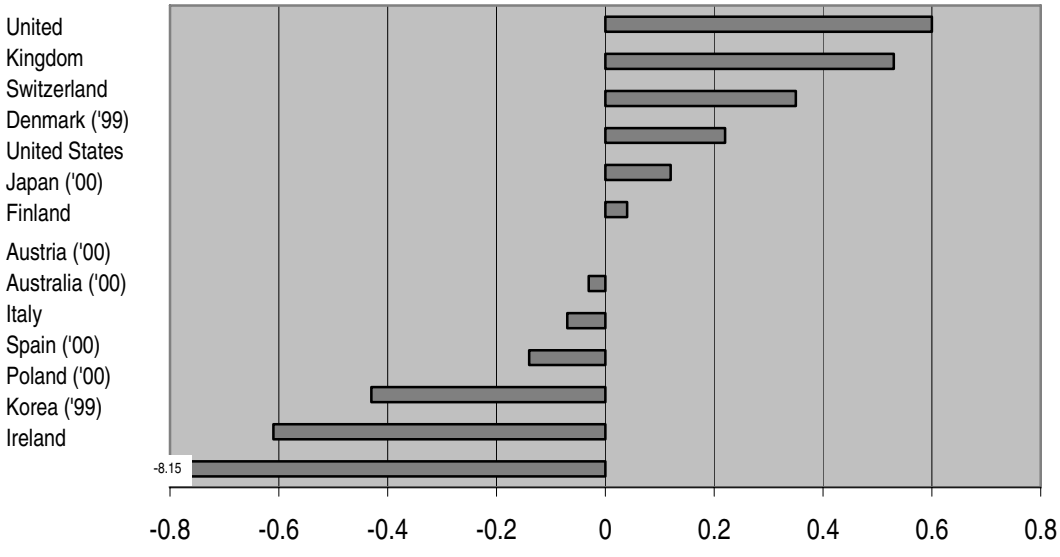
- One-third of indigenous industry had some level of R&D, but just 50 firms, out of a total indigenous base of 3 000 firms, accounted for 43% of R&D investment.
- The level of R&D is higher in the FDI sector of the economy, but still low. Some 20 firms, out of a total base of 1 000 firms, accounted for 64.5% of R&D investment.

Figure 2.1. Share of high- and medium-high-technology industries in manufacturing exports, 2001



Source: *OECD Science, Technology and Industry Outlook 2003*.

Figure 2.2. Technology balance of payments as a percentage of GDP for selected countries, 2001



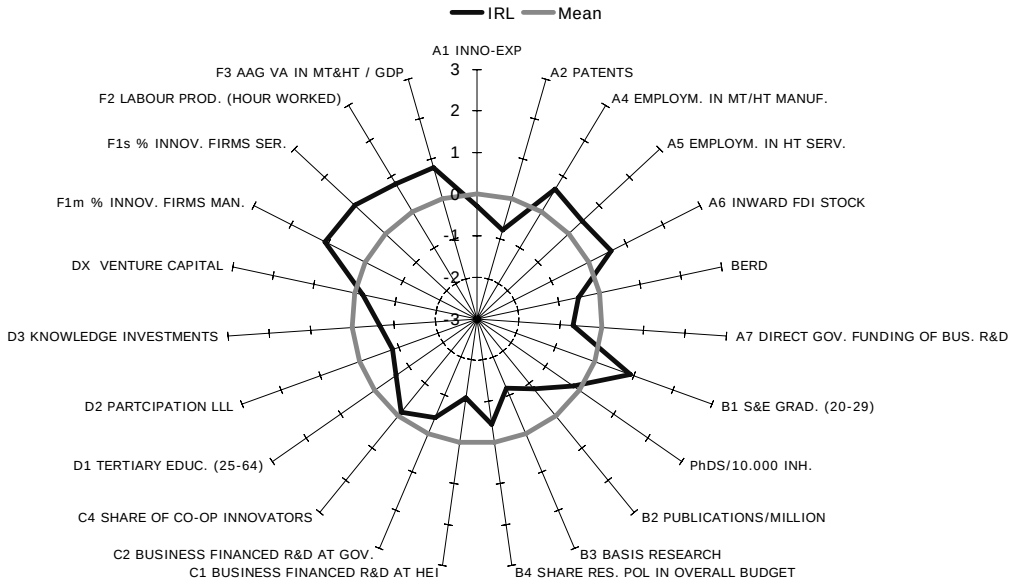
Source: *OECD Science, Technology and Industry Scoreboard 2003*.

The public-sector contribution to R&D expenditure in Ireland has also lagged behind comparable countries. The higher education sector, particularly in terms of research funding support, suffered during the period of fiscal restraint in the 1980s and 1990s. While this is now being addressed through new research funding initiatives, in addition to the EU Framework Programme, there are still weaknesses owing to the low level of industry-academic collaboration and a lag in producing the level of high-quality researchers required.

- Irish higher education has a good record in producing science and engineering graduates. For example, in 2000, 35% of Irish graduates were in science and engineering, compared with an EU average of 26%, and 30% for the next best performer, Finland.
- However, the number of researchers in the economy, at 5.1 researchers per 1 000 total employment (in 2001), still lags behind the OECD average of 6.5 researchers per 1 000 total employment and the Finnish figure of 15.8 per 1 000 total employment.

Figure 2.3 compares Irish performance on key input and output indicators to the average performance of the MONIT countries. The Irish system clearly demonstrates strong employment in medium- and high-technology manufacturing and services, and above average performance in FDI and labour productivity. The share of innovative firms in services and manufacturing is also above the MONIT average, as are the levels of science and engineering graduates. However, indicators more closely related to innovative performance, such as funding of R&D, level of patenting and other knowledge investments are below the MONIT average.

Figure 2.3. Performance of the science, technology and innovation system



While the Irish economy therefore has a strong company system and good overall macroeconomic performance, there are weaknesses in the knowledge system. This accords with the views articulated in a number of government policy documents, starting with the White Paper setting out the government's position on science and technology (DETE, 1996) to more recent reports on the future of industrial policy (ESG, 2004) and RTDI investment (IDC, 2004). Over the past decade, the Irish policy system has been struggling with two significant, and interrelated, innovation policy challenges. The first is stimulating a national innovation system (NIS). The second is securing the role of policy in achieving effective links and integration between the elements of the NIS.

Current policy mix

Framework conditions in Ireland have traditionally focused on encouraging employment growth and reducing unemployment. However, in line with a changing policy emphasis, embodied in the Enterprise Strategy Group report (2004), these conditions are being reoriented towards innovation, with a range of initiatives to make Ireland an attractive environment for world-class researchers; provide a strong intellectual property management framework; realign enterprise support budgets and services towards R&D; introduce tax credits for R&D investment; and develop a national pro-innovation culture.

While the persistent industrial policy challenges have been *i)* to embed multinational companies (MNCs) in the economy and *ii)* to develop an internationally competitive indigenous sector, more recent policy goals have addressed the objective of moving to a knowledge-based economy, which was reinforced by the Lisbon 2000 strategy, which formulated Europe's ambition to become "the most competitive and dynamic knowledge-based economy in the world by 2010". Hence, the first goal for the Irish government has been to promote a strategic shift to R&D-based MNC activity, by developing the existing MNC base and attracting new investment as an appealing location for mobile R&D FDI. The second goal is to stimulate the innovative and absorptive capacity of the indigenous sector, which has long been a poor performer in terms of innovation, specifically through the development of internationally competitive clusters of high-technology indigenous industry.

In particular, the Enterprise Strategy Group has recognised that being a "technology taker" rather than "technology maker", in other words relying predominantly on being the export base for technologies invented elsewhere, leaves the Irish economy overly dependent on external factors with limited room to manoeuvre domestically:

> Whereas in the past, products manufactured in Ireland were designed elsewhere, in the future, more of the ideas, the designs and the technology must originate here. Companies in Ireland will have to innovate and gain leadership positions in their target markets. (ESG, 2004, p. 36)

This recognition has also become the starting point for a Knowledge Society Foresight project, driven by the Taoiseach and building on the successful Technology Foresight of the late 1990s, which contributed to the subsequent policy shift towards building national innovation capacity:

> Ireland has lost the basis for one economic development model (low cost, pool of young educated workers, hidden reserves of labour) without yet having completed the construction of another (R&D infrastructure, childcare, adult learning, etc.). (Information Society Commission Secretariat, 2004, p. 2)

With national policy goals now framed to attract R&D-based MNC activity and to develop high-technology clusters of indigenous industry, the supporting STI objectives and instruments are: *i)* to develop the capacity of research institutions to conduct both basic and applied research and to commercialise this research successfully; *ii)* to increase Ireland's attractiveness to mobile MNC R&D, while permitting a managed transition from increasingly uncompetitive labour-intensive, routinised operations through offshoring, downsizing and closure; *iii)* to upgrade the research capacity of Irish firms, both internally and through external collaboration and networks, and *iv)* to expand the pool of high-quality, technical graduates available to industry, including at postdoctoral level.

The shift in Ireland's industry policy focus over the last three decades is illustrated in Table 2.1. It has been supported by the largest investment in STI in the country's history. While STI investment for 1994-99 was EUR 0.5 billion, the National Development Plan 2000-2006 has committed the Irish government to public investment in STI of EUR 2.5 billion, with only 20% contributed by the EU. The plan began from the explicit recognition that "there is a strong link between investment in the research and innovation base of the economy and sustained economic growth… The accumulation of 'knowledge capital' will facilitate the evolution of the 'knowledge-based' economy" (NDP, 2000).

Table 2.1. Evolution of industrial policy focus

1970s to 1990s	2000 to present
• Employment focus	• Innovation focus
• Attract and embed MNC activity	• Attract and embed R&D-based MNC activity
• Develop export-led indigenous industry	• Develop high-tech clustered indigenous industry

In this respect the policy mix has moved towards more targeted support to MNCs, including through the CSET initiative at Science Foundation Ireland, where significant investment is made available for long-term university-industry research partnerships. The Industrial Development Authority is reorienting its support to existing FDI towards assisting subsidiaries to negotiate the location of higher-value activities in Ireland. This is further supported by recent changes in the corporate tax structure that provide R&D tax credits.

The change in approach recognises that the economic success enjoyed by Ireland in the 1990s was not sustainable in the longer term on the basis of current institutional arrangements. Changing demography and higher living standards mean that its original strengths as a cost-competitive country with a large, young educated workforce cannot be relied on. In 2000 Ireland ranked fourth in the WEF Competitiveness rankings, but by 2003 it had fallen to 30th place. While the policy concerns have remained stable in so far as they are concentrated on securing economic growth through the twin-track development of FDI and indigenous industry, the goals have shifted from an emphasis on employment to the long-run need for higher-value economic activities and knowledge-intensive activities. This shift, and the associated pressure for more far-reaching changes, have produced their own tensions in the policy system.

Innovation policy governance

The key policy challenges for the Irish economy have evolved gradually over the last 20 years. Internal and external reviews of industrial policy have identified the reliance of the Irish economy on weakly embedded FDI, combined with the failure to develop an internationally competitive indigenous industrial sector. These reviews have concluded with broadly similar recommendations: to upgrade human capital, upgrade technological capability and provide an environment conducive to investment in innovation.

However, the development of STI policy in Ireland is a relatively recent phenomenon. Although OECD reports in the 1980s had identified the lack of an articulated innovation policy and the Science and Technology Act of 1987 was a first step towards creating a set of science and technology policy institutions, STI was still not seen as a central element of industrial performance. In the late 1980s, concerned Irish scientists made representations to the government about the reduction of already low levels of state support for STI during the fiscal crises of the 1980s. This neglect had led to a running down of research infrastructure and a lack of funding for research programmes. The government brought together a representative group, the Science Technology and Innovation Advisory Council (STIAC), whose report, *Making Knowledge Work for Us* (STIAC, 1995), became the precursor of Ireland's first White Paper on STI.

In terms of innovation policy governance, the 1996 White Paper identified the need for coherent innovation policy governance. However, this requirement is still unmet, despite being highlighted in a series of government reports. The Interdepartmental Committee on Science, Technology and Innovation made the case as follows:

> A country's innovation performance depends not just on how it performs on each individual element of the innovation system, but how these separate elements interact. Science, technology and innovation policies need to be consistent, coherent and predictable. Increased partnership and a joined-up approach at all levels with effective over-sight and review mechanisms have the potential to improve policy formulation and policy implementation. (IDC, 2004, p. 23)

In spite of the recent introduction a number of measures aimed at moving the system towards improved coherence, concerns that this may not suffice were expressed by the National Competitiveness Council (NCC) and Forfás:

> In the view of the NCC, the constituent elements of the Irish innovation system, their roles and interaction, are not very clearly defined… The Irish innovation system needs to be more clearly mapped out and the exact roles and responsibilities of the actors in the system need to be explicitly agreed. This should include setting out key interactions and allocations of responsibility, *e.g.* it should be clear who in the state system is primarily responsible for engaging with the enterprise sector on a regular basis to elicit its research needs. (NCC, 2004, p. 28)

Finally, these concerns were echoed and elaborated by the Enterprise Strategy Group, which highlighted the impediments to innovation for companies and the potential for lost opportunities to improve performance in the absence of further reform:

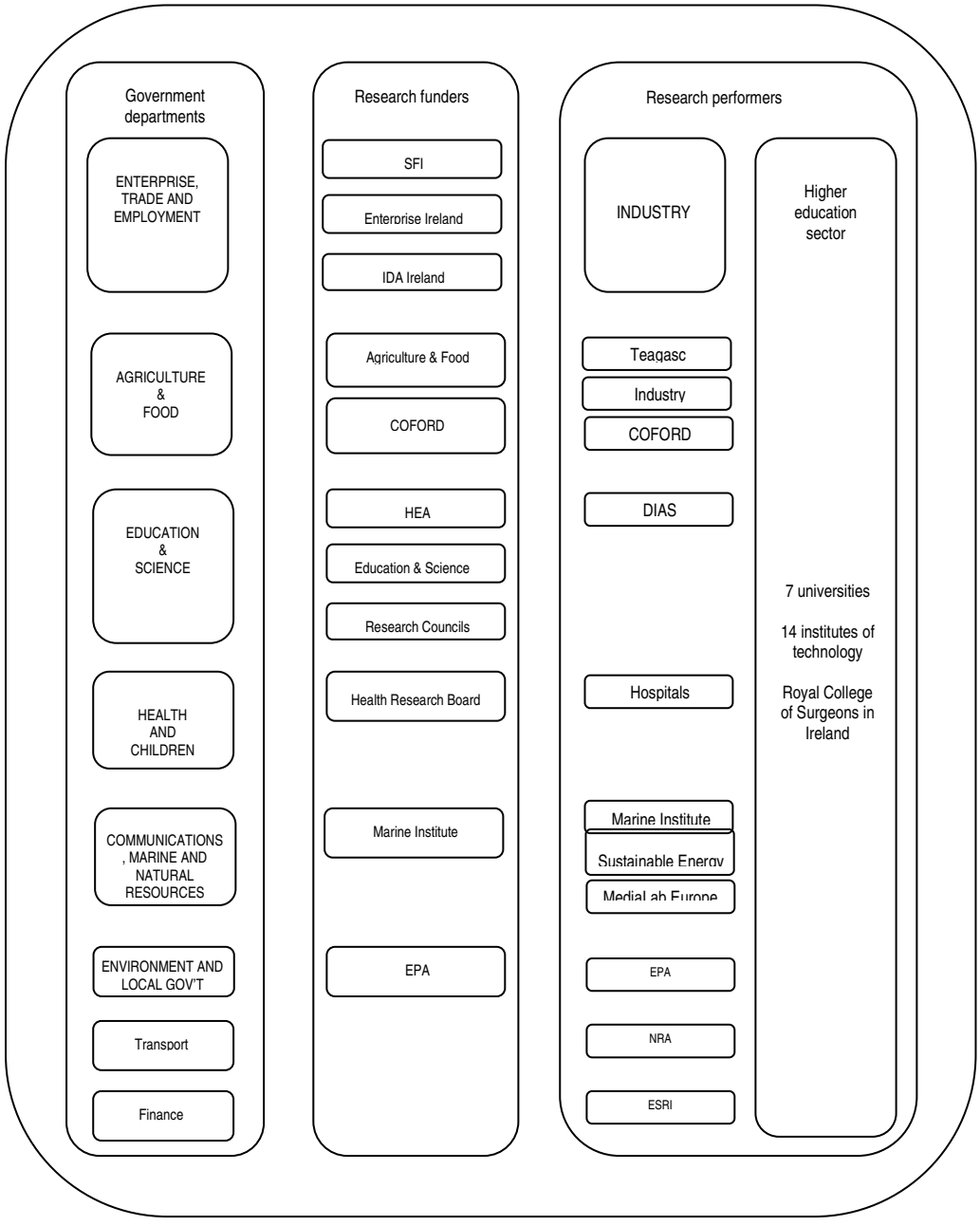
> Ireland's existing support mechanisms for R&D are based on direct interventions through isolated funding measures. There is a need for greater coherence among all the relevant players, including research institutes and higher education institutions, enterprise and state agencies, to ensure that resources are used to optimum effect. If innovation in Ireland is to operate effectively, a continuous process of foresight, policy development, implementation and monitoring need to be put in place. Funding schemes, priorities, objectives and targets need to be strategically aligned and clear lines of responsibility agreed between funding bodies, agencies and enterprise. An integrated national innovation strategy should form the basis for decision-making and focusing resources and funding on a number of niche areas where we can demonstrate world-class capability and realise economic benefit. (ESG 2004, p. 95)

To some extent, the problem lies in the very complexity of the institutions and arrangements that comprise the governance system, which have their own historical origins and rationale, but at the same time reflect an insupportable policy overload for a small country, with associated gaps and duplication at the point of policy delivery. The main players in the system are readily identified:[6]

- **Forfás**: The national policy and advisory agency for enterprise, trade, science technology and innovation.
- **IDA Ireland**: The IDA's focus is on attracting inward FDI, increasingly targeted, STI-based and influenced by the government's "spatial strategy".
- **Enterprise Ireland**: The EI focus is on supporting growth and innovation in indigenous industry, including through supply chains to the FDI companies.
- **HEA**: The Higher Education Authority is the planning and development body for higher education, including the Programme for Research in Third-level Institutions (PRTLI).
- **SFI**: Science Foundation Ireland is the primary funding body for world-class basic research in two key strategic areas: ICT and biotechnology.

However, a plethora of additional government departments, agencies and institutions are engaged in the STI areas in the Irish policy system (Figure 2.4).

Figure 2.4. Public sector STI actors



Source: Forfás (2004).

The complexity of the system poses a major challenge for the implementation of the National Development Plan 2000-2006, which outlined the government's commitment to an RTDI investment of EUR 2.5 billion over the six-year period. Owing to the difficulty of introducing coherent mechanisms for policy governance, the intended policy framework to oversee this investment in an integrated and synergistic fashion is only now starting to emerge. A recent OECD review of higher education in Ireland reinforced the views expressed in recent reports and concluded that "while there is a consensus about the importance of investment in research to create a knowledge-based society, there appears to be *a lack of a clear strategic framework* within which such public funds are invested" (OECD, 2004a, p. 37, emphasis added). As can be seen from Figure 2.4 and Table 2.2, the Irish system has a large number of public R&D institutions within an already extended STI system. These were described by the OECD as "a very large number of organisations for a small country … many of which are responsible for distributing quite small sums of money" (OECD, 2004a, p. 37). While coherence does not necessarily, or even optimally, have to be achieved through consolidation, it is also true that in the Irish case this large number of institutions leads to a situation in which "investment programmes seem to have been embarked upon to meet individual institutional perceived needs rather than as part of a co-ordinated approach" (OECD, 2004a, p. 37).

Table 2.2. Public funding of R&D in Ireland (NDP estimates)

Organisation	2001	2003	2006	2010
	EUR millions			
Higher Education Authority (HEA)/PRTLI	80.4	106.0	130.8	146.0
Department of Education & Science	41.1	62.4	158.4	175.3
Science Foundation Ireland (SFI)	11.1	70.0	131.0	153.0
Department of Enterprise, Trade & Employment	78.4	78.4	99.2	120.6
Teagasc	40.1	38.5	40.3	41.0
Department of Agriculture and Food	18.6	13.9	16.1	16.3
Marine Institute	9.7	11.0	13.0	15.0
Bord Iscaigh Mhara	8.4	2.7	4.0	6.0
Public Enterprise	18.0			
Health Research Board/Department of Health	15.5	17.9	44.0	60.0
Environmental Protection Agency (EPA)	4.5	4.0	6.0	7.0
Other	16.0	17.0	22.0	25.0
Total	**341.8**	**421.8**	**664.8**	**765.2**
GNP (EUR billions)	96.8	110.8	119.4	131.8
Public R&D/GNP	0.35%	0.38%	0.56%	0.58%

Source: OECD (2004a).

The past four years have been a period of rapid change for Ireland in respect of STI policy and investments. In 1990, Mjøset argued that the challenge for Ireland "must be to stimulate an Irish system of innovation" (1990, p. 18). While the 1996 White Paper on Science and Technology identified the need to develop strong elements within the NIS and strong interactions among them, it was not until 2000 that the government made a commitment to meeting that challenge.

Tensions in the policy system

Given the strongly departmentalised and autonomous policy domains in the Irish system, it is perhaps inevitable that conflicts arise from the failure to develop effective horizontal mechanisms. In this context, these refer to ways of ensuring that the policy system demonstrates coherence, such that "individual or sectoral policies build on each other and minimise inconsistencies in the case of (seemingly) conflicting goals" (OECD, 2004c, p. 8).

Fragmentation and segmentation

One of the key tensions in the Irish innovation policy system is between the two departments with the most responsibility for innovation investments, the Department of Education and Science (DES) (controlling almost 60% of the RTDI budget) and the Department of Enterprise, Trade and Employment (DETE) (controlling almost 12% of the RTDI budget). A key example of this is the development of two parallel funding programmes (Table 2.3).

On the one hand, the Programme for Research in Third-level Institutions (PRTLI) has its origins in the donation of substantial funds by a private philanthropist, matched and then built upon by exchequer funding. Under the control of the DES, these funds were used to implement a programme of investment primarily in university research infrastructure. The aim is to strengthen the basic research capabilities of third-level institutions and improve their capacity to engage in high-quality research, nationally and internationally.

On the other hand, Science Foundation Ireland is a DETE initiative. A technology foresight exercise completed in 1998 identified ICT and biotechnology as the two areas of science that Ireland should target to support innovation and long-term economic growth. The National Development Plan 2000-2006 allocated EUR 711 million to this objective. SFI is the mechanism created to administer most of this fund. It is modelled very closely on the US National Science Foundation (NSF) and is headed by a former NSF director. The objective is to support world-class standards of excellence in mission-oriented basic research in the two strategic areas. Funding is of individuals, research teams and industry-academic partnerships.

Table 2.3. Divergence in two major R&D funding programmes

PRTLI	SFI
Department of Education & Science	Department of Enterprise Trade & Employment
Funding: EUR 605million	Funding: EUR 648 million
Timescale: 1998-2005	Timescale: 2000-2006
Focus:	Focus:
• Universities' own research strategies	• Research in national strategic areas
• Collaboration between universities	• Collaboration with industry partners
• Infrastructure-focus	• Research based

The two programmes are in some senses complementary – up to 50% of SFI-funded researchers are based in PRTLI-funded physical infrastructure. However, the programmes are fundamentally different in their orientation. The PRTLI asks institutions to submit a single application for funding of their strategic objectives. SFI funds world-class research

in the national priority areas of ICT and biotechnology. A recent international assessment of the PRTLI was critical of the lack of coherence between the two programmes:

> Our concern about coherence in research funding extends especially to the relationship between PRTLI and SFI. In our view, and from the evidence of our investigations, there is a mutual synergy between the two, which needs to be better managed. (…) We are not convinced from what we have seen and heard that this relationship is managed in the most effective way within the existing government structures. (HEA, 2004, p. 13)

"Short termism" in resource allocation

In 2002, the Minister of Finance, faced with a potential budget deficit, announced a "pause" in EUR 150 million of research funding in the DES/HEA's PRTLI research programme. No date for resumption was set, and it was almost a year before funding flows resumed. This caused considerable disruption and uncertainty in the research programmes. An international assessment concluded that "it has undermined confidence, nationally and internationally, and has explicitly signalled a lack of commitment in public policy towards the research enterprise generally" (HEA, 2004, Vol. II p. 45).

One of the authors wrote at the time:

> [A] renewed commitment in the Budget to the National Development Plan targets would have made sense not only in terms of the longer term objective of a knowledge-based economy but also as short to medium term counter-cyclical policy. Yet, almost unbelievably, these arguments have been rejected in favour of a sharply contractionary budget…. The position is even more serious for strategic research and education infrastructure. The Budget imposes a 'pause' in capital spending for research programmes – that is to say no spending commitments at all for programmes which in some cases have only just got off the ground – and a nominal cut of 24% in capital spending across the third-level sector as a whole, translating into a real cut of around a third. These measures are as short-sighted as they are unnecessary. (Green, 2002a)

As well as indicating short-termism and vertical incoherence, this event also revealed horizontal incoherence. At the same time as the DES faced a pause in its research investments, the SFI research programme run by DETE was unaffected. It is generally understood that the reason was the political influence of DETE's minister, who was also the deputy prime minister and leader of the minority coalition partner in government.

Ministerial influence

The uneven treatment of similar, complementary STI initiatives co-ordinated by different ministries can also be seen as an example of the influence of policy makers' individual effectiveness and ambitions. The deputy prime minister and leader of the minority coalition partner in government has a long track record of bringing energy and focus to the portfolio she holds and this commitment was evident when she was Minister for Enterprise, Trade and Employment. This was very significant in developing the role of DETE as the innovation champion within government. However, it could also be argued that strengthening the influence of an individual ministry may work against a culture of horizontal co-ordination, as appeared in the struggle over the creation of the new, independent Chief Scientific Adviser (CSA). While the cross-cutting nature of the position was widely acceptable, the decision to house the CSA in DETE, for admini-

strative purposes, was resisted by other departments on the grounds that it would further strengthen DETE's ownership of the innovation agenda.

Competing rationales

One of the key tensions in recent attempts to stimulate the NIS has been the difference in rationales of the Department of Finance and other departments. While the Department of Enterprise, Trade and Employment is committed to implementing the Lisbon strategy (the EU template for developing a knowledge-based economy), the Department of Finance is equally firmly committed to the goals of the Stability and Growth Pact and the associated Broad Economic Policy Guidelines (BEPG) for keeping tight control of public finances and debt. This has led to difficulties with short-termism and vertical coherence, as well as broader issues of developing cross-cutting approaches to innovation policy. These difficulties are not peculiar to Ireland as they reflect positions adopted at Ecofin, the committee of EU finance ministers, which is also charged with implementing the "Cardiff process" of product and capital market reform:

> The Cardiff process… required an annual audit or 'stocktake' of structural reform by member states in a number of defined areas, subject to peer review by other member state governments as well as to an assessment by Ecofin.... The process was incorporated into the mainstream of EU policy at the Lisbon Summit in 2000…. Nevertheless, the heads of government stamped their own authority on the Cardiff process with the introduction of a new, ultimately all-encompassing element at Lisbon – promotion of the knowledge-based economy. While this objective could be interpreted to fit the deregulation agenda, possibly through more competition in service and infrastructure provision and reforms to business finance, it could equally be seen as necessitating a more co-ordinated policy on industry, skill development and STI. These are the fault-lines of current economic debate in Europe. (Green, 2002b)

The change in economic model to an innovation-driven economy, replacing the old model of employment growth, is being championed by DETE, although it is not clear that there is a similar commitment or even understanding in the rest of government or the wider society. Concern about this can be seen in the creation of the position of chief scientist (discussed below), the rationale being that this post could be a very public advocate for STI in the policy system and, by establishing the value of STI investments, encourage the development of a positive societal attitude to the innovation agenda.

Different views of innovation

The premise of the MONIT project is that governments have accepted the logic of the NIS approach to innovation policy, but have experienced difficulties in taking that approach because of problems in achieving coherent, cross-cutting policy making. In Ireland, it is not yet clear that the NIS model is accepted across the whole of government. Acceptance is hampered by the fact that the Irish innovation system, and in particular interactions within the system, are poorly understood and under-researched (HEA, 2004). DETE is championing an integrated approach, but commitment to the NIS model varies even among agencies within the ministry.

Furthermore, there are quite deep cultural obstacles to the adoption of an NIS approach in both government and the rest of society. First, there is no culture of cross-cutting approaches to governance. As one senior policy official put it, "everyone in Ireland believes in co-ordination, but nobody wants to be co-ordinated". A small number

of crises have been tackled in this way (notably a drug use crisis in the 1980s), but otherwise the policy culture is strongly departmental. Even during the prolonged economic crisis of the 1980s, with society and government committed to improving economic conditions, some policy makers found it hard to achieve a co-ordinated response to developing and implementing policy solutions. Second, within government and within society, the innovation agenda has not achieved similar levels of understanding and commitment, and the value and logic of the move to a knowledge-based economy is not widely recognised in practice.

Nevertheless, increased reliance on stakeholder involvement to drive policy, building on the ethos of social partnership, has raised the prospect of a broader impact in the medium to longer term. For example, in setting up the SFI, significant use was made of strategic intelligence, and the key sectors of biotechnology and ICT were determined by a technology foresight exercise in 1998. Policy makers have noted that the main benefit of this initiative was less the selection of strategic sectors than the government's commitment to a step increase in the level of state R&D investment.

In addition to the statutory role of the Irish Council for Science, Technology and Innovation (ICSTI), and now the Chief Scientist, in providing consultative inputs to policy, there is a long history of *ad hoc* policy reviews to incorporate stakeholders' interests and perspectives. The three exercises undertaken in the last two years are: *i)* the Enterprise Strategy Group review of challenges to innovation and enterprise development; *ii)* the Inter-Departmental Committee on Science, Technology and Innovation action plan for promoting investment in R&D; and *iii)* the current Knowledge Society Foresight exercise on the next iteration of the "Irish model". Together with the efforts of politicians and commentators, government departments and agencies, and research and education institutions, these reviews provide the necessary groundwork for translating the rhetoric of the knowledge-based economy into a broadly based consensus on policy and implementation.

The emerging governance system

In Ireland recognition of innovation governance as an issue began with the 1996 White Paper on Science and Technology, which identified the challenge as being to develop, first, the key elements of a national innovation system and, second, strong interactions between those elements. The need for governance arrangements that would cut across departmental interests and integrate innovation concerns into the whole of government was reflected in the White Paper's proposals, which called for:

- A supra-departmental STI budget that would place STI budgets above sectoral interests.
- A Cabinet sub-committee on STI, so that support and commitment could be co-ordinated at a government, not just department level.
- A junior minister with responsibilities in the two key STI departments of Enterprise Trade and Employment and Education and Science.
- The establishment of an Office of Science and Technology (OST) within DETE, with responsibility for co-ordination of STI policy across all government departments.

However, these proposals were largely premature and thus unrealisable at the time. No serious consideration was given to the idea of moving the budget process away from the system of bilaterally negotiated departmental budgets co-ordinated by the Department of Finance. The proposal for a Cabinet Committee, chaired by the Taoiseach, was accepted in principle but it was never formed. A junior minister with a joint portfolio in the DES and DETE was appointed, but the arrangement proved ineffective and the minister was reassigned to DETE alone. On the other hand, the OST became, and still remains, an important driver of innovation policy within DETE, but its anticipated role in ensuring cross-departmental coherence has not materialised. There are a number of possible reasons for this. One is the role of the Department of Finance. The fiscal crises in the Irish economy in the 1980s led to the development of a strong Department of Finance that is not inclined to relinquish the control provided by a bilateral budget allocation process, and a supra-departmental innovation budget would have seriously threatened its dominance. Second, the White Paper emerged during the start of a period of high growth and prosperity. With national income growing at 8.6% a year, the logic and urgency of the innovation agenda was not readily apparent. The Minister responsible for commissioning the White Paper left government the following year, leaving the reforms without a champion and further hampering the chances of implementation.

However, recognition of the need for improved innovation policy governance eventually acquired greater urgency in 2001 when the Minister for Enterprise, Trade and Employment announced that she was appointing a Commission, under the auspices of ICSTI, to develop an overarching framework for national policy in research and technological development. The objective was presented as follows:

> [W]ith a view to underpinning innovation for economic and social development in Ireland, [the Commission will] make recommendations for improving the structures and mechanisms for the formulation and implementation of national policy for Research and Technological Development including co-ordination, synergy and linkages across the sectors and activities in the National Development Plan and securing appropriate funding balance. (ICSTI, 2001)

The ICSTI Commission consulted widely among stakeholders and received submissions from over 30 organisations. The resulting report explicitly recognised the need for coherence between the NIS elements and the requirement for a shared vision of the core elements. It identified problems with existing weak linkages and poor communication among government departments with STI responsibilities. It argued for improved structures and mechanisms in Ireland to create and maintain a coherent NIS.

The fundamental requirements of an STI policy framework were identified as being such that the framework would support a "whole of government" approach to STI, focused on key national economic and social priorities, with sufficient authority to induce departments to take a coherent and co-ordinated approach. Specific measures recommended in the report included:

- The appointment of a chief scientist to advise government on the scale and balance of STI investments, with responsibility for creating and sustaining synergy between departments, as well as stimulating and co-ordinating elements of the NIS.
- A Cabinet Committee for STI to be chaired by the Taoiseach.

However, some of the recommendations were highly contested. In particular, media reports pointed to a fundamental divergence of views on the location of the chief scientist. The Commission's recommendation was that the chief scientist, while independent of any department, should be "hosted" within DETE. The rationale was that DETE, as the current champion of innovation within government, was the most appropriate location, with the caveat that the decision be open to review after five years. This recommendation met with resistance, and it was suggested that there was "fear that the creation of a powerful new science office within that Department will cause all funding and policy decisions to gravitate towards it" (Ahlstrom, 2003).

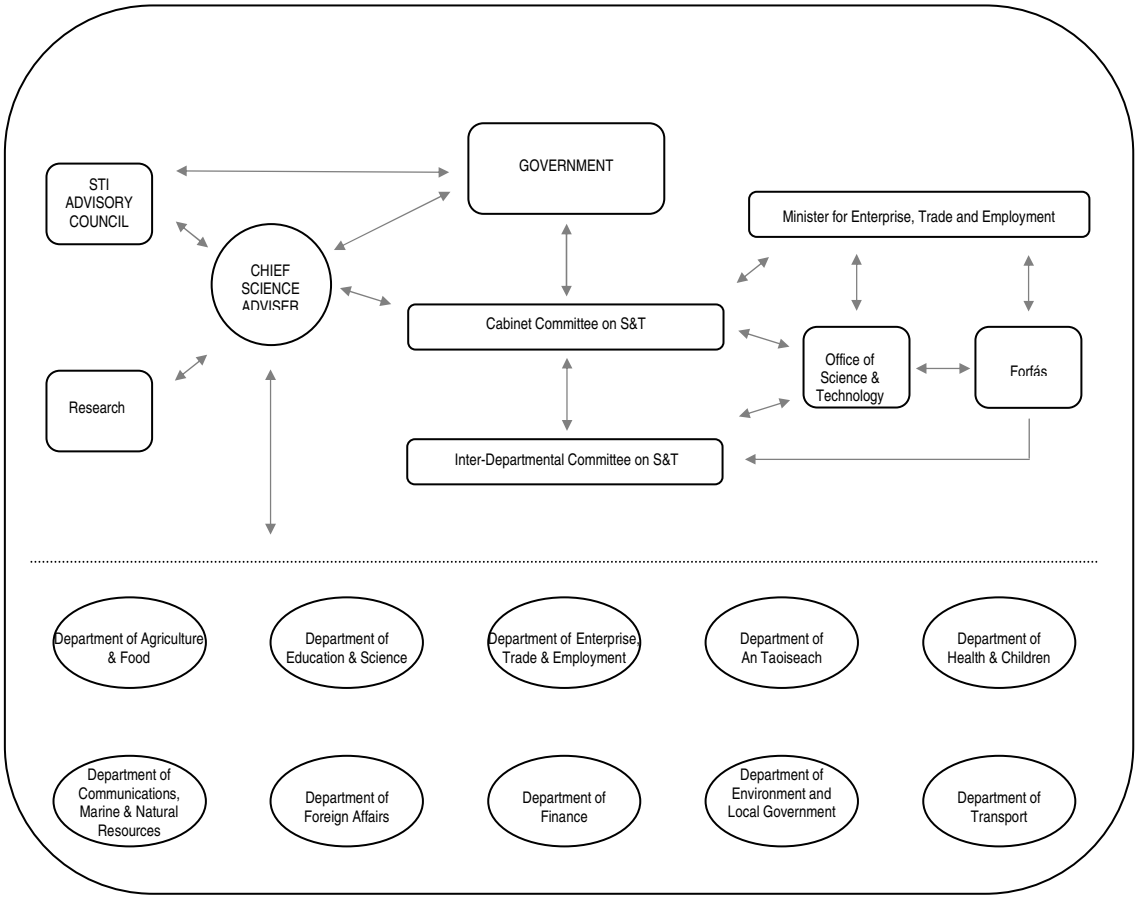
The final report was delivered to the minister in December 2002, but has not been published. Its recommendations were only implemented in June 2004, a delay attributed to problems about the departmental affiliation of the chief scientist. Announcing the package of measures, including the location of the chief scientist within Forfás, the science and technology policy agency of DETE, the minister "acknowledged that there had been considerable debate on this point" (DETE, 2004). The delay and contested nature of the departmental affiliation suggest that departments, while publicly welcoming measures to achieve coherence, are still unconvinced that departmental interests will not be pursued.

As a result of these reviews and considerations, a whole suite of institutions has been introduced with a view to achieving greater focus on STI. Specifically, the following measures were announced in 2004, resulting in a new innovation policy framework (Figure 2.5):

- The appointment of a Chief Scientific Adviser.
- The introduction of a Cabinet Committee on STI to co-ordinate a "whole of government" approach to setting and delivering on STI priorities.
- Initial work on a Knowledge Society Foresight exercise, co-ordinated by the Department of the Taoiseach.

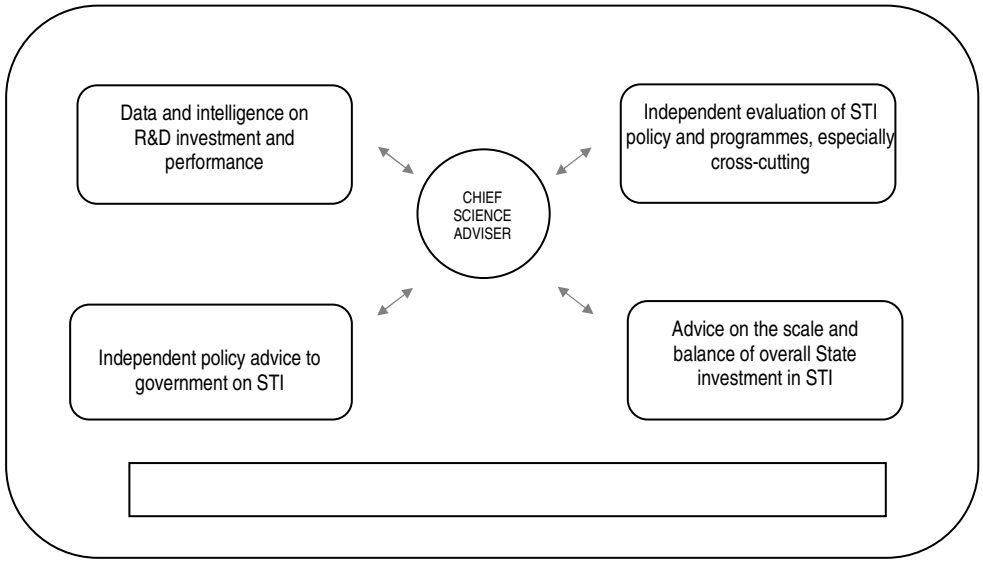
The centrepiece of the government's new innovation policy framework is the creation of the Office of the Chief Scientific Adviser (Figure 2.6). It will have a number of responsibilities which reflect concerns about potential sources of weakness in the Irish innovation system. Its principal role is to provide independent advice to the government, including analysis of policy proposals and the relevance and impact of international STI issues. Its responsibilities in relation to coherence include advising the government on the scale and balance of overall state investment in STI and, through co-ordination of stake-holder input into this advice, the evaluation of cross-cutting STI policy and programmes.

Figure 2.5. Overarching framework for innovation policy in Ireland, 2005



The recent OECD review of higher education in Ireland raised concerns that the remit of the post may not yet be sufficient to address the lack of "effective machinery for co-ordinating a government strategy" (OECD, 2004a, p. 38). The review pointed to the role of "provid[ing] independent expert advice on any aspect of science, technology and innovation", and suggested that it should be strengthened to include responsibility for "the co-ordination of civil science across government departments" (OECD, 2004a, p. 39). However, given the strong culture of departmental autonomy, some observers find it difficult to imagine how the Chief Scientific Adviser can be expected to assume responsibility for this task without also being assigned the authority necessary to effect the required co-ordination and co-operation. The newly formed Cabinet Committee on STI may be in a better position to make progress in this area, though again the OECD review was critical of the Cabinet Committee's defined purpose of "address[ing] and co-ordinate[ing] science and technology issues", and recommended that it would be preferable for the Committee to adopt the more ambitious aim of "seek[ing] to develop and oversee a national strategy for research, R&D and innovation" (OECD, 2004a, p. 39).

Figure 2.6. Responsibilities of the Chief Scientific Adviser



There is also concern about the capabilities of the Irish policy system with respect to evaluation and policy learning. The overall assessment would tend to the view that the policy system is weak in this regard, which is why the Chief Scientific Adviser has been given, as a priority function, responsibility for implementing a system of independent evaluation of science policy and programmes. Recent research has supported the general view that evaluation is an underdeveloped aspect of the policy system. As one writer put it, "Various changes in the focus of Irish industrial policy have taken place over the years, in many cases without the insights of evaluation" (Lenihan, 2004).

The evaluation processes that do exist have developed from the stringent requirements associated with EU transfers. In particular, "The Structural Funds Programme imposed the discipline of evaluation on the Irish policy system" (Cogan and McDevitt, 2000, p. 11). Another form of evaluation has been the articulation of the role of STI in contributing to economic goals through periodic, high-profile reviews of industrial policy, such as Telesis (1982), Culliton (1992) and the Enterprise Strategy Review Group (2004). Some consideration is also given to transnational learning, through benchmarking exercises (CEC, 2003).

Ongoing, lower level evaluation processes are perhaps less effective in their impact on policy learning. The argument is made that evaluation processes during the period of technological catch-up may not be sufficient, given that "the demands of the next decade are likely to be of a different order of complexity" (Cogan and McDevitt, 2000, p. 25). Post-convergence investments in STI will necessarily be more strategic and targeted, requiring more rigorous *ex ante* evaluation capabilities.

Conclusions

Studying the coherence of innovation policy governance in Ireland at this time is like trying to shoot a moving target. The past five years have been a period of intense and rapid change which is transforming STI institutions and policies. Key elements of the NIS have been strengthened (notably public investment in R&D) often by the introduction of new institutions (such as Science Foundation Ireland and the Office of the Chief Scientific Adviser), but coherence in the operation and governance of these elements is yet to be achieved.

The main driver in this period has been the new focus on innovation within the policy system, supported by the introduction of new elements aimed at building an effective NIS, as well as new policy mechanisms aimed at strengthening interactions between the elements of the NIS. Lack of coherence is a recognised weakness in the Irish policy system, one that has been highlighted in a series of policy reviews since the 1990s. Attempts to introduce horizontalisation mechanisms have so far been largely unsuccessful; this may in large part be attributed to the relative immaturity of the Irish NIS. Outside the championing ministries and agencies, there is imperfect understanding of the importance of the innovation agenda for the whole of government. This has been reflected in a lack of shared vision and commitment to a cross-cutting innovation agenda and was the key rationale for the appointment of a Chief Scientific Adviser. The recent restructuring of the policy system is as much about securing cross-departmental commitment to the *value* of STI investment, as it is about implementing coherent policy.

The introduction of new STI institutions, including SFI, and new policy mechanisms based on the establishment of the post of Chief Scientific Adviser and a new Cabinet Committee, may be seen as catalysts for rethinking priorities. However, it remains to be seen how these will integrate with existing institutions and whether they will carry weight or be marginalised, as earlier mechanisms were. It may be that a shared vision of the role of innovation in Ireland's future must precede the acceptance of horizontalisation measures. Furthermore, greater maturity in what is a very newly emerged NIS is required before innovation policy coherence can be achieved. Given the recent introduction of these mechanisms, it is too early to predict whether this level of maturity has been achieved.

Notes

1. The help received from colleagues at the Centre for Innovation & Structural Change (CISC) at NUI Galway is gratefully acknowledged. Special thanks to Aidan Kane, Majella Giblin and Emlyn Nardone.

2. Interviewees included representatives of ICSTI, HEA, Forfás, Office of Science & Technology at the Department of Enterprise, Trade & Employment, Industrial Development Authority, Enterprise Ireland, Science Foundation Ireland and the Irish Business & Employers' Confederation (IBEC).

3. GNP is chosen as the most appropriate output indicator for this purpose, as it discounts the repatriated profits component of GDP.

4. The Enterprise Strategy Group was appointed by the Tánaiste to prepare an enterprise strategy for growth and employment in Ireland up to the year 2015. The group consulted widely, with over 200 stakeholders involved in advisory groups. This review is one of a series of large-scale reviews of industrial policy undertaken every decade; earlier reviews were Telesis (1982) and Culliton (1992).

5. Interestingly, this characteristic of segmentation can be observed in other MONIT countries, such as Norway and Finland.

6. This description is taken from the Irish Country Response to Policy Questionnaire, submitted to the OECD *Science, Technology and Industry Outlook* 2004 (OECD, 2004b).

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Chapter 3

EVOLUTION OF THE KOREAN NATIONAL INNOVATION SYSTEM: TOWARDS AN INTEGRATED MODEL

Yoo Soo Hong
Chaired Research Fellow, Korea Institute for International Economic Policy

In 2004 the Korean government launched a dramatic reform of science, technology and innovation (STI) governance with the goal of using the national innovation system (NIS) to establish an innovation-driven economy and a science- and technology-based society. Although there had been pressures for such reform for a long time, the current "participatory government" undertook the reform, which was an outcome of policy learning over a long period. It is too early to assess the reform since it is still being implemented. However, it is a bold move towards a new kind of NIS, based on the third-generation innovation model, which emphasises integration and coherence of STI policy within its own sphere and with other policies.

Introduction

The concept of the national innovation system (NIS) is closely related to innovation models. The first generation of innovation models is the so-called "linear" model. The second is the "interactive" or "chain" model and the third, emerging model is characterised by integration and coherence. Science, technology and innovation (STI) policies and activities in Korea in the 1960s and 1970s reflect the first-generation linear model. In the 1980s, many government-sponsored research institutes (GRIs) were established and consortia of private companies, GRIs, universities and/or the government were formed. The model followed in the 1980s and 1990s reflects the second-generation NIS. Korea's recent bold reform of its NIS reflects the concepts of the third-generation NIS.

This chapter reviews the evolution of NIS concepts and practices with an emphasis on the emerging third-generation NIS model as applied in Korea. Following a review of the historical evolution of the Korean NIS since the 1960s, the focus is on the 2004 reform, including a discussion of the background, main features, implementation and implications.

In the past, the Korean NIS was characterised by a strong hierarchical decision-making structure. Although the system was relatively successful in mobilising resources, it has recently been severely criticised as inefficient for an innovation-driven economy, in which innovation is the most important factor.

Korea is at a crossroads. Its information technology (IT) industry has been highly successful, as indicated by its success in mobile phone manufacturing. However, Korea's growth is losing momentum and youth unemployment and the rapid ageing of the work force have reached a serious level. Most of all, business investment has been stagnant. The Korean education system is widely believed to be in need of reform, although no strategy has emerged. China is perceived to be the most serious external challenge.

If Korea cannot overcome such challenges, it will not be able to escape from the so-called USD 10 0000 trap.[1] In the past, human capital was the most important factor in Korea's strong international competitiveness. This should be even more the case in the coming innovation-driven economy. The new administration, the so-called "participatory government", has formulated a grand strategy for reforming the Korean NIS in terms of structure, resource allocation and balanced regional development. In late 2004, the reform was put in place with the restructuring of STI policy governance. If successful, this reform will be a good example for the third-generation model of innovation.

Technology catch-up and evolution of the NIS in Korea

Technology catch-up

Since the 1960s, Korea has transformed its industrial structure and caught up with developed countries. Its achievements over the past four decades were hailed as successful in terms of economic development. Table 3.1 shows the stages of Korea's industrial development and its relation to technological development. Technology imports were an important vehicle for technology development, particularly in the earlier stages. Korea's industrialisation process was very similar to that of Japan.

Korea began its industrialisation in the early 1960s. The industrial development strategy adopted during this period was to develop import-substitution industries and export-oriented light industries. Although Korea had a comparative advantage in inexpensive but skilled labour, it had neither indigenous technological capability nor sufficient domestic savings to establish and operate production facilities and plants.

An export-led, outward-looking strategy put pressure on firms to acquire foreign technology and use it effectively in order to compete in world markets. Without local capability to establish and operate production systems, Korean entrepreneurs had to rely on imported technology.

The choice of appropriate technology and its assimilation required a minimum of indigenous R&D capability. To build up the scientific and technological infrastructure, the Ministry of Science and Technology (MOST) and the Korea Institute of Science and Technology (KIST) were established in the 1960s.

In the 1970s, industrial strategy shifted towards the development of heavy and chemical industries, improving the process of technology assimilation and promoting research to meet industrial needs. Since these industries were still unable to develop their own R&D, the government played a key role in the establishment of domestic R&D capability, with the establishment of ten GRIs in the areas of machinery, electronics, chemistry, shipbuilding, etc. These research institutes focused on the development and dissemination of industrial technology.

The 1980s were characterised by structural adjustment and technology-intensive industrial development. A rapid increase in real wages and labour disputes forced firms to look to technological innovation. The gradual opening of domestic markets forced Korean firms to improve their technological capabilities through technology transfer from abroad and their own R&D. Korea's science and technology (S&T) policy during this period emphasised the localisation of key strategic technologies, development of highly skilled technological manpower, and promotion of private-sector R&D capabilities. The National R&D Programme, started in 1982, is one of the most ambitious ever adopted by the government. The Korean government tried to induce more advanced technology through foreign direct investment (FDI) by liberalising FDI policy.

Korea has not yet reached the level of advanced economies in terms of overall technology level. However, it has achieved very impressive technological capability building in some high-technology areas. It has reached an advanced level in such areas as information and telecommunications, semi-conductors and LCDs, steel, shipbuilding and automobiles. Especially, Korea has the highest world market shares in high-technology industries such as DRAM semiconductors, TFT-LCD and CDMA cellular phones.

Table 3.1. Development of industry and technology

	Industrial development	Technology development	Highlight
1960s	• Develop import-substitution industries • Expand export-oriented light industries • Support producer goods industries	• Strengthen S&T education • Deepen scientific and technological infrastructure • Promote foreign technology imports	• 1960: $79 • Labour
1970s	• Expand heavy and chemical industries • Shift emphasis from capital import to technology import • Strengthen export-oriented industrial competitiveness	• Expand technical training • Improve institutional mechanism for adapting imported technology • Promote research applicable to industrial needs	• 1970: $253 • Labour and capital
1980s	• Transform industrial structure to one of comparative advantage • Expand technology-intensive industry • Encourage manpower development and improve productivity of industries	• Develop and acquire top-level scientists and engineers • Perform national R&D projects efficiently • Promote industrial technology development	• 1980: $1 655 • Capital and technology
1990s	• Promote industrial restructuring and technical innovation • Promote efficient use of human and other resources • Improve information networks	• Reinforce national R&D projects • Strengthen demand-oriented technology development system • Institutional reforms	• 1990: $5 890 • Technology and innovation
2000-2003	• Move towards High tech and high value-added industries • Develop IT industry • Search the next generation engine of growth	• Strengthen national and regional innovation systems • Internationalise R&D systems and information networks • R&D increase in IT, BT, NT, ET, CT	•2000: $9 823 •Innovation and KBE

Source: Compiled from various documents.

Evolution of the Korean NIS

The evolution of the Korean NIS is closely related to its technology catch-up. Korea is regarded as a model of successful technology catch-up. It began as an imitator in the 1960s and became a leading innovator in several high-technology areas within a generation. The experience of Korea confirms that catch-up through imitation requires conscious efforts and well-designed policies. Imitation and learning are path-dependent and influenced by accumulated technological capabilities and supporting policies and institutions. The learning process is also influenced by the NIS and international institutions. Table 3.2 summarises the evolution of government R&D programmes since the 1960s. As mentioned, Korea's national R&D programme (NRDP) was first introduced by MOST in 1982. Its goal was to develop technology in order to enhance industrial competitiveness. To achieve this, the government took a very active role in upgrading industry's technological capabilities.

The launch and implementation of the NRDP was closely related to the development of the GRIs. The NRDP offered a tremendous opportunity to revitalise government-sponsored research, which was intended to complement research areas that would not be pursued by the private sector alone.

The Korean NIS has evolved in accordance with the development of the economy and industry and the accumulation of technological capabilities and its evolution can be described in terms of three stages.

MOST was established in 1967 as the Science and Technology Agency. According to the Government Organisation Act, its mission was the formulation of a comprehensive basic policy for the promotion of science and technology and of master plans and co-ordination. However, the co-ordinating function was undertaken by the Science and Technology Review Committee, which was established in 1973. Its chair was the Prime Minister and it consisted of 14 ministers with science and technology responsibilities. The Minister of Science and Technology was the co-ordinator.

This committee was not active in the 1970s and 1980s, but became very active during the first half of the 1990s as more and more ministries came to participate in R&D programmes. However, the committee convened irregularly and was criticised for its weak co-ordination of S&T policy and in particular for the lack of a link between S&T policy and the efficient allocation of R&D investment in the government budget.

Table 3.2. History of the government R&D programmes

Innovation model	Decade	Emphasis and Initiatives	Remarks
Linear innovation model stage	1960s (Infant stage of ST policy)	• Imports of foreign technology • Laws for ST promotion • Established MOST, KIST, etc.	R&D/GDP=0.3%
	1970s (Building institutions)	• Imitation and reverse engineering • Laws for R&D promotion • Established 16 GRIs	R&D/GDP=0.4~0.8% (Public:private = 50:50)
Interactive innovation model stage	1980s (National R&D Programme)	• Development of indigenous technology • Started National R&D programme • Promotion of private sector's laboratories	R&D/GDP=0.8~2% (Public:private = 20:80)
	1990s (Diversification of government R&D)	• Development of high-tech • Promotion of university research • Started Highly Advanced National (HAN) Project	R&D/GDP = 2~3% (Public:private = 20:80)
Integrated innovation model stage	2000s (Elaboration of government R&D)	• Development of innovation-based economy • Started Creative Research programme, National Research Laboratory Programme, The 21 Century Frontier Programme, etc.	R&D/GDP = 3% (Public:private = 20:80)

Source: Compiled from various documents.

In response, the Science and Technology Ministerial Meeting replaced the Science and Technology Review Committee in 1997 on the basis of the 1996 Special Law of Science and Technology Innovation. It was chaired by the Deputy Prime Minister of Finance and Economy and co-ordinated by the Minister of Science and Technology. The latter became the chair from 1998 when the Science and Technology Agency became the Ministry of Science and Technology.

Despite these institutional developments, the S&T policy co-ordinating function of MOST or any other organisations was rather weak from the 1960s through the 1990s.

Meanwhile, the Presidential Advisory Committee for Science and Technology (PACST) was established in 1991, but as it did not have any coercive power, its role was advisory. Over time, PACST expanded its role to include co-ordination of science and technology policy, which often resulted in conflicts with other government organisations rather than co-ordination.

Overall, co-ordinating efforts or functions during the period were not effective for the following reasons (Hwang and Kim, 2000, pp. 57-59):

- Lack of power of the Science and Technology Agency relative to the other ministries. When the Agency became a ministry, the problem of weak authority was not overcome. Each ministry pursued own vested R&D projects or programmes and did not actively participate in any co-ordination. The role of co-ordinating organisations was limited to endorsing each ministry's policy.
- The co-ordinating organisations were chaired by the Prime Minister (in the case of the Comprehensive Science and Technology Review Committee) or the Deputy Prime Minister of Finance and Economy (in the case of the Science and

Technology Ministerial Meeting). Since administrative power is concentrated in the president in Korea, the decisions of these organisations were not directly linked to presidential decisions.

- Co-ordinated decisions of these organisations were insufficiently implemented owing to the weak link between S&T policy formulation and the government budget process.
- These organisations were not effectively supported by specialists since government officials did not have the appropriate policy knowledge and changed frequently. The bureaucrats with budgetary functions did not have sufficient knowledge of science and technology.
- Information for policy co-ordination was not sufficient. An information system encompassing all government R&D allocation had not been established. There were no good S&T statistics and indicators. However, the 1997 Special Law for Science and Technology Innovation facilitated the development of the needed information system.
- There was no coherence in the operations of the co-ordinating organisations. Their meetings were held irregularly and there were several changes in the form and functions of the organisations. Consistent science and technology policy co-ordination was not maintained.

The "people's government" (the slogan of the Administration of President Kim Dae-Jung) which was inaugurated in 1998 took several measures to remedy problems in S&T policy. The government elevated the Science and Technology Agency to the Ministry of Science and Technology. In 1999 the Special Law for Science and Technology Innovation was enacted and the National Science and Technology Council (NSTC) was established. The main reason for the establishment of the NSTC, which replaced the previous co-ordinating organisations, was to strengthen the S&T co-ordinating function. However, the co-ordination problem was not resolved until the most recent reform.

The Korean NIS before the 2004 reform

R&D resources

Owing to recent efforts to put more resources into R&D activities and to overcome the economic crisis of 1997, R&D investment in Korea has been increasing rapidly. Table 3.3 shows that the ratio of R&D to gross domestic product (GDP) increased to 2.91% in 2002 from 2.55% in 1998. Table 3.3 clearly shows that Korea has focused on development research rather than basic research. In addition, the number of researchers has steadily increased. The private sector's R&D share of the national total was 74% in 2002, a proportion much higher than the OECD average. However, this does not necessarily mean that the private sector is very innovative. The private sector in general still concentrates on imitating and commercialising externally acquired technologies rather than on creating their own.

The trends in the use of R&D funds by major organisations are shown in Table 3.4. The portion of private companies has steadily increased whereas that of research institutes has decreased. This reflects the more active role of the private sector in R&D. It is noticeable that the role of universities has been weak.

Table 3.3. Overall R&D resources in Korea

		Unit	1998	2000	2002
Gross R&D funding	GDP	USD millions	317 079	461 519	496 819
	R&D investment	USD millions	8 089	12 245	14 433
	R&D investment/GDP	%	2.55	2.65	2.91
R&D sources	Government & public	USD millions	2 178	3 052	3 787
	Private funds	USD millions	5 911	9 913	10 644
	Government:private	%	27:73	25:75	26:74
R&D allocation	Basic research	USD millions	1 131	1 544	1 977
	Applied research	USD millions	2 032	2 980	3 135
	Development research	USD millions	4 926	7 721	9 321
Researchers	Total researchers	People	92 541	108 370	141 917
	Researchers/10 000 people (FTE)	People	20.0	23.1	29.8
R&D fund/researcher (FTE)		USD	87 410	112 993	101 700

Source: Ministry of Science and Technology (MOST).

The Korean NIS has often been criticised for its inefficiency. Compared to the OECD average, output, whether measured by patents, academic papers or otherwise, is usually relatively low compared to inputs. The problems and shortcomings not only of the private sector, but also of universities and public research institutes, are due to a low level of knowledge creation or basic research.

Table 3.4. Overall R&D expenditures by organisation in Korea, 2002

Millions of USD

	1998	2000	2002	2002 share (%)
Private company	5 689	9 062	10 809	74.9
University	903	1 381	1 497	10.4
Research institute	1 497	1 797	2 127	14.7
Total	8 089	12 245	14 433	100.0

Source: MOST.

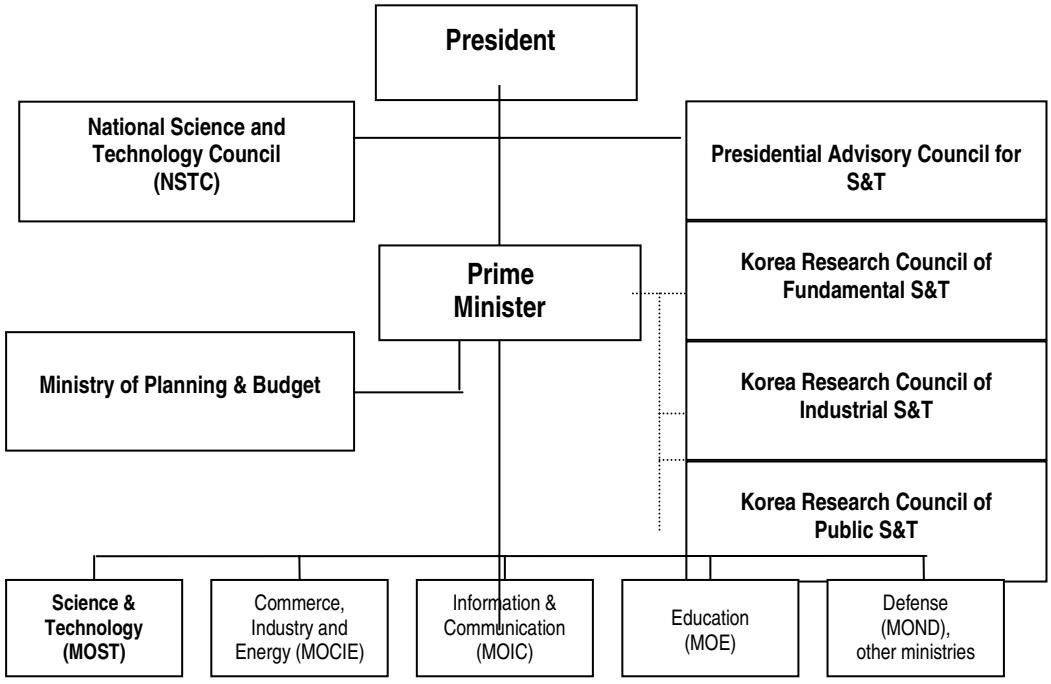
STI governance: structure and institutions

Government organisations

Figure 3.1 shows the core structure of S&T policy governance in Korea before the 2004 reform. Because various ministries implemented STI policies for their jurisdictions, co-ordinating these policies was crucial but very difficult. Three organisations undertook this co-ordinating function in different ways: NSTC, PACST and the Ministry of Planning and Budget. NSTC encompassed ten ministries, some of which are shown in Figure 3.1. MOST served as the Secretariat for the NSTC. The main function of the NSTC was short-term and long-term policy co-ordination, and its member ministries were in charge of implementation.

The role of PACST was to recommend long-term science, technology and innovation strategies to the president. The Ministry of Planning and Budget allocated the yearly government budget for R&D. Although there is a seemingly clear distinction between the role of NSTC and the role of PACST, in practice the distinction has sometimes been blurred.

Figure 3.1. National STI administration system in Korea



Source: MOST.

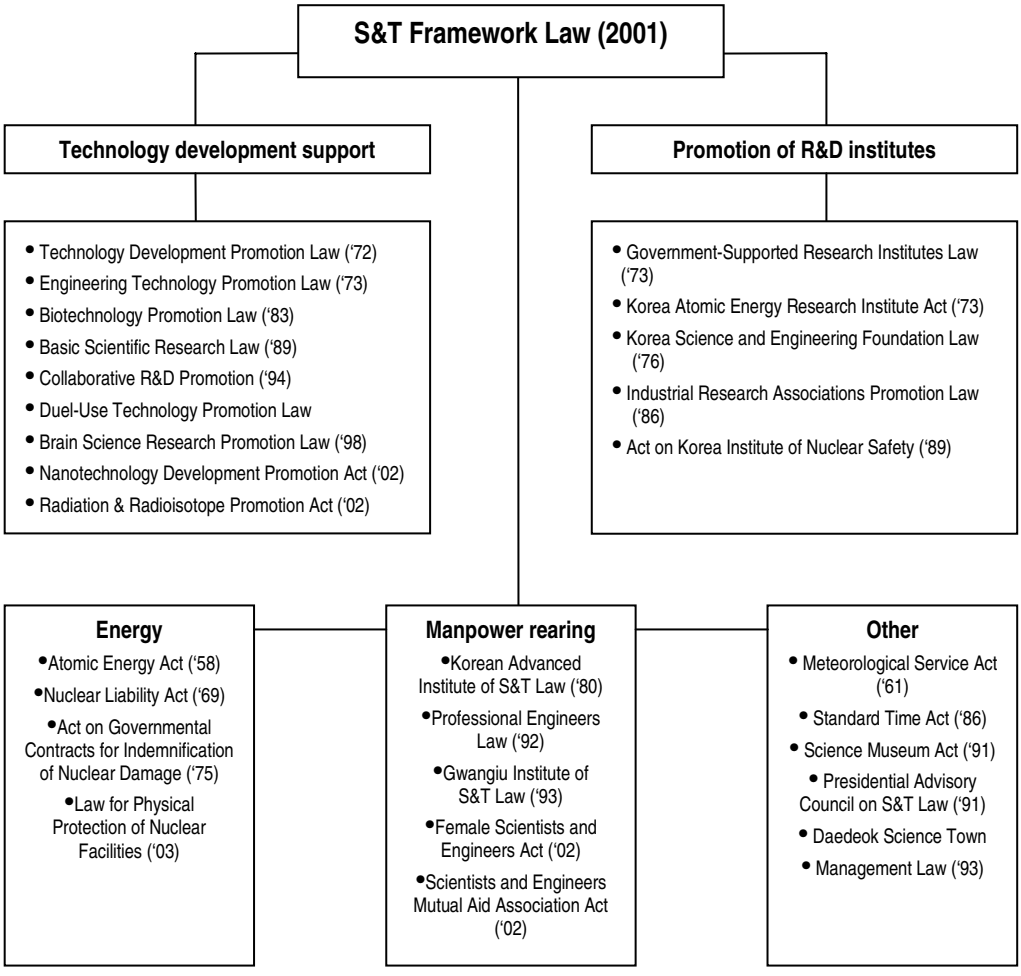
Laws and institutions

Figure 3.2 shows the major laws for science, technology and innovation in Korea. The Science and Technology Framework Law, enacted in 2001, is the most influential and comprehensive. It provides an institutional framework for all rules and regulations on science, technology and innovation. Other laws can be grouped into five areas: technology development support; promotion of R&D institutes; nuclear and energy; improving manpower; and others.

According to the Science and Technology Framework Law, Korea's STI policy has to encompass industry, human resources and balanced regional development. It stipulates that NSTC is commissioned with evaluation of national R&D programmes, pre-allocation of the proposed R&D budget and co-ordination of R&D programmes, while the final compilation of the budget is left to the Ministry of Planning and Budget.

There is a complicated set of laws and regulations for science, technology and innovation, as shown in Figure 3.2. This may reflect the government's active role and leadership, but, at the same time, it may indicate duplication and authoritative intervention. In fact, excessive regulations and duplication of R&D programmes are a problem.

Figure 3.2. Laws for STI



Note: Figures in parentheses are the years the listed laws were enacted.

Source: MOST.

Problems and shortcomings of the Korean NIS

Lack of comprehensive co-ordination

Although the government has tried to establish co-operation among ministries through such institutions as the S&T Ministerial Meeting and NSTC, effective co-ordination has not been achieved. Some ministries attempted to seize power and set up duplicate research institutes and programmes; this resulted in inefficient R&D investments. Co-ordination of the science and technology function within the government was weak, as indicated by the fragmentation of power and division of labour within the government relating to government R&D. Thus, the fundamental problem of the Korean NIS was the non-existence of a function for reviewing and co-ordinating government R&D programmes. Quite often myopic projects were pursued instead of long-term strategic projects. Duplications and uncoordinated priority setting resulted in inefficient resource allocation. As an example, Table 3.5 shows similar programmes and umbrella organisations operated by three leading S&T-related ministries in the recent period. A recent example of the conflict among the leading S&T-related ministries is the case of the "Next Generation Growth Engine Programme".

Table 3.5. Possible source of duplications in S&T policy measures in Korea

	MOST	MOCIE	MOIC
R&D programme	National R&D Programme	Industrial Technology Programme	Information and Telecommunication Technology Programme
Research centre or R&D consortium	SRC/ERC (45) RRC (45)	Techno-park (6) TIC (6)	Software Centre (6)
Information service agency	KORDIC	KINITI	-
R&D management agency	KISTEP	ITEP	ITA (Institute of Information Technology Assessment)

Note: Figures in parentheses are the number of organisations.

MOST: Ministry of Science and Technology. MOCIE: Ministry of Commerce, Industry and Energy. MOIC: Ministry of Information and Communication.

Source: Suh, 2000.

Although the government has actively supported the private sector with various policy measures, these measures have often been ineffective. Noticeable problems with or criticisms of the measures have included: mismatches between the objectives of the government's support measures and industry needs; lack of co-ordination between financial measures and tax-incentive measures; difficulty in securing credit or loans for small and medium-sized enterprises (SMEs); limitations on mobilising funds through market capital; high interest rates for bank loans; underdevelopment of the venture capital system; and other factors such as banking regulations and practices. Various ministries' overlapping policy measures have resulted in smaller-scale resource allocation and inefficient management of funds instead of greater efficiency through inter-ministerial co-operation (Suh, 2000).[2]

On 22 September 2003, the Korean government announced the selection of ten growth-engine industries for the future. The programme was called the "Next Generation Growth Engine Programme". It is worthwhile reviewing the background, process and

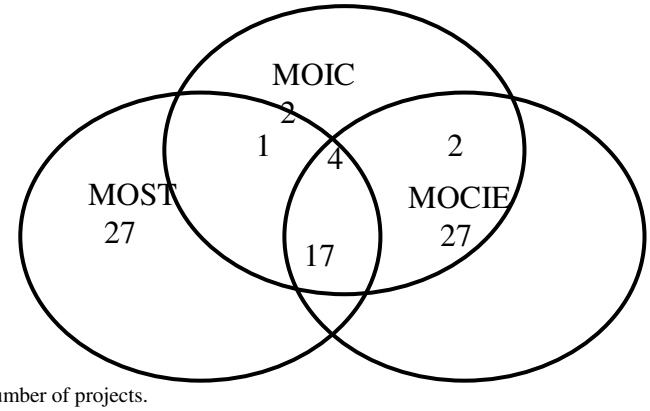
outcome of the programme as a typical example of the co-ordination problem in Korea's STI policy in the recent period, and assessing its merits and shortcomings.

The programme includes ten industrial sectors that involve several technologies or products. The ten new growth-engine industries/technologies are: digital TV/broadcasting, digital displays, intelligent robots, high-technology future automobiles, next-generation semiconductors, next-generation mobile telecommunication, intelligent home networking, digital content and software solutions, next-generation batteries and new biomedical products. These are further broken down into over 300 sub-categories. Since the inauguration of the current government, industrial leaders, researchers, experts, civil servants and politicians have voiced the need for the next-generation growth engines owing to a perception that Korea is losing national and industrial competitiveness in terms of technologies to countries such as China.

Three ministries in charge of science, technology and innovation have worked on recommendations for the next growth-engine industries and technology. These are MOST, the Ministry of Commerce, Industry and Energy (MOCIE) and the Ministry of Information and Communication (MOIC). It was decided that MOST would be responsible for the development of core and generic technologies, while MOCIE and MOIC were to be in charge of applied technologies.

It was difficult to reach consensus because the three ministries have been competing with each other for "business". Finally, PACST intervened to work out a compromise. As a result, each ministry may have both individual and joint projects according to their main functions, as shown in Figure 3.3. However, in spite of these negotiations and because of unclear definitions relating to technology areas, each ministry still has a great deal of leeway to interpret the agreement as it wishes. The intervention of PACST has been criticised, since it was the NSTC's role to co-ordinate in such a case. Its positive aspect is the agreement reached by these generally competing ministries (a rare occurrence in Korea), even if it was mainly due to the intervention of the PACST. Although this may be regarded as the beginning of a "horizontal innovation policy" in Korea, it seems to have given rise more to criticism than to praise of Korea's innovation policy regime.

Figure 3.3. Distribution of 80 Items for the next-generation growth programme among ministries



Note: Figures indicate the number of projects.

MOIC: Ministry of Information and Communication. MOST: Ministry of Science and Technology. MOCIE: Ministry of Commerce, Industry and Energy.

Source: MOST.

Weak link between S&T policy and government budget

The staff of the Ministry of Planning and Budget and the Ministry of Finance and Economy did not have sufficient expertise to review and allocate the budget for highly specialised S&T projects. Since the same was generally true of other ministries, the budget for such projects was not efficiently allocated. Monitoring and evaluation of national R&D programmes were not well developed. Superficial evaluations prevailed and participation of the private sector in the evaluation process was minimal.

The system of GRIs has changed several times in the last decades, reflecting economic development, changes in industrial structure and the government's conception of GRIs. The GRIs have not achieved autonomous management, despite government promises to this effect, owing to the GRIs' budgetary dependency on the government.

The government R&D budget has been allocated mainly to institutes in the Seoul metropolitan area, and provincial universities and institutes have grown relatively little. About 50% of the national population lives in the Seoul metropolitan area. S&T resources such as R&D manpower, universities, and research institutes and private institutions are also largely in that area. Another problem is that competitive regional development plans for technologies, technoparks, regional innovation centres, etc., have resulted in duplicate programmes and poor project selection.

Assessment

Korea's S&T policy governance has been characterised by strong government leadership and intervention and by a relatively weak private sector. When the economy was growing rapidly, this kind of governance was effective. However, as the economy moves towards becoming an innovation-driven economy that is dependent more on knowledge, technology and innovation than on labour and capital, a new STI governance paradigm is needed.

In this context, the problems and shortcomings were the following. First, scientists, engineers and researchers (the S&T community) participated only passively in the S&T policy process. Second, the government directly or indirectly affected major decisions in leading GRIs. Third, the participation of non-governmental organisations (NGOs) or citizens in the S&T policy process has been almost non-existent. Fourth, co-ordination of the science and technology function within the government was weak, as indicated by the fragmented power and the division of labour within the government (see Figure 3.1). Finally, the laws and regulations for science, technology and innovation are complex (see Figure 3.2).

New STI governance for co-ordination and integration

The reform process

Since 2004 the Korean NIS has undergone a revolutionary change owing to factors such as the need to reinforce the transition to an innovation-driven economy, to the government's vision of a "science- and technology-based economy" and to awareness of the need to improve the effectiveness of the NIS.

In February 2004, the President issued two directives during the annual business briefing by the Minister of Science and Technology. First, MOST was to prepare a plan to establish an NIS which involved the reorganisation of the ministry and its functions. Second, the President hinted that the Minister of Science and Technology was to be promoted to Deputy Prime Minister to oversee microeconomic aspects of the Korean economy and technology innovation.

In September 2004, the Korean government revised the relevant laws and regulations in order to promote the Minister of Science and Technology to Deputy Prime Minister level and, at the same time, commissioned him to supervise not only planning, co-ordination and evaluation of S&T-related policies but also to co-ordinate and allocate the government R&D budget on behalf of the Ministry of Planning and Budget. The GRIs under the Prime Minister's Office were transferred to the NSTC. An independent Office of Science, Technology and Innovation (OSTI) was established under MOST. It consists of officials from relevant ministries and private-sector experts. The authority of the NSTC for monitoring and co-ordinating STI strategies was strengthened.

The Minister of Science and Technology, elevated to Deputy Prime Minister, is also the Vice Chairman of NSTC. MOST was given the power to co-ordinate other ministries. The new Government Organisation Law gave added weight to the position and power of the minister.

MOST is now responsible for reviewing and adjusting the government S&T budget. The policy co-ordination and infrastructure business of other ministries has been transferred to MOST. During the budget planning process, he MOST's opinion should be reflected in the overall R&D budget allocations of the Ministry of Planning and Budget. MOST also has the power to allocate the S&T budget to relevant ministries after the review of the total S&T budget by the Ministry of Planning and Budget. According to the new system, most of the previous programmes for applied R&D or R&D commercialisation that were under the jurisdiction of MOST were transferred to the relevant ministries. For example, machinery, electronics and aero-technology R&D were transferred to the MOCIE. MOST is in charge of the national planning, co-ordination and evaluation activities.

This does not mean, however, that all of MOST's R&D programmes were re-allocated. Some, programmes such as big science and fusion technology programmes, continue to be the responsibility of MOST. Basic programmes, such as basic research, strengthening science and engineering education and enhancing the public's under-standing of science and technology culture also remain as responsibilities of MOST.

The outcome

In the new system, the co-ordinating function of NSTC was strengthened. The new NSTC inherited the following functions:

- Formulation and co-ordination of major policy and planning for S&T promotion.
- Planning of the Science and Technology Framework Plan and Comprehensive Plan for Regional Science and Technology Promotion Plan.
- Measures for increasing the S&T-related budget and inducing R&D investment.
- Measures for developing GRIs.

In addition, the following new functions were added:

- Allocation and co-ordination of the national R&D budget reflecting the result of the NSTC's review.
- Planning of the mid- and long-term National R&D Programme.
- Co-ordination of STI policies including the Next Growth Engine Programme.
- Co-ordination of training of S&T personnel.
- Building the support system for regional STI policy implementation.
- Co-ordination of funding policy for technological innovation.
- Co-ordination of national standards and IPR.

The Chairman of NSTC is the President and the Deputy Prime Minister of Science and Technology is the Vice Chairman. The Committee consists of the Operations Sub-Committee, the National Technological Innovation Special Committee and the Next Growth Engine Implementation Special Committee. The first committee is chaired by the Vice Minister of STI (*i.e.* the head of OSTI) and other two committees are chaired by the Deputy Prime Minister.

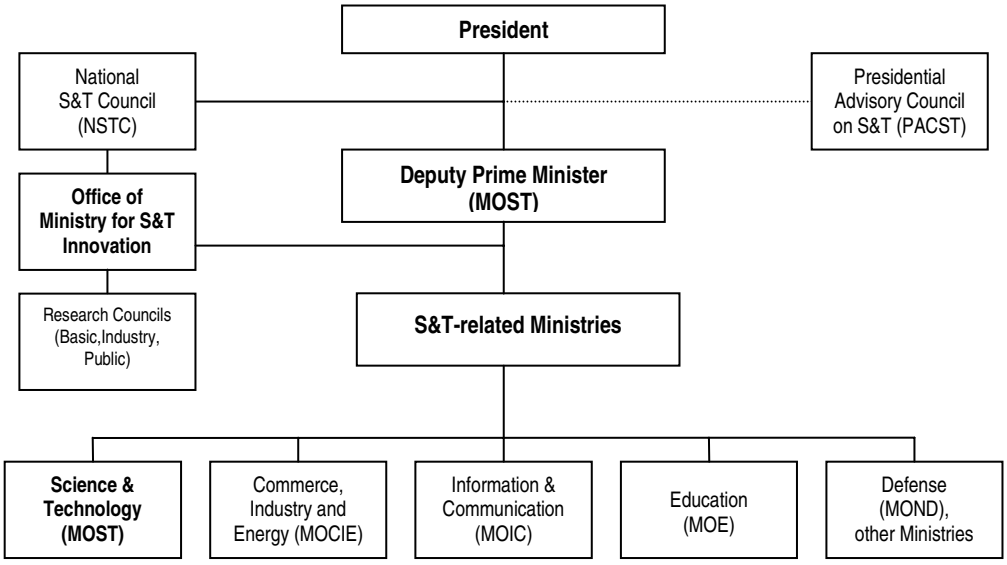
OSTI is the secretariat of the NSTC and is under the authority of the Deputy Prime Minister of Science and Technology and is part of MOST. OSTI has 106 officials, of whom 40% were recruited from MOST, another 40% from other ministries and 20% from the private sector. OSTI has three main bodies: the Deputy Minister of R&D Co-ordination, the S&T Policy Bureau and the Technology Evaluation Bureau.

The role of MOST as a core co-ordinator of the entire national STI policy is shown in Figure 3.4.

Other policies for improving the national innovation system aim to: Improve the efficiency of planning, technology transfer and commercialisation of national R&D projects through whole process management.

- Establish a proper planning system in which experts plan, consumers decide the direction of research projects, and the final goals are clear.
- Reduce the number of evaluations, but improve the use and depth of evaluation.
- Introduce a transparent evaluation system and abolish yearly evaluation of long-term projects.
- Support government-sponsored research institutes to improve their basic abilities, educate excellent research personnel, and perform mid- and long-term projects.

Figure 3.4. Current governance of STI policy in Korea



Source: MOST**Policy co-ordination and coherence under the new system**

Schemes, co-ordination mechanisms and processes of major STI policies

A policy process consists of formulation and adoption, implementation and evaluation. Three STI policy schemes under the current government are reviewed below with a focus on co-ordination mechanisms and processes in order to identify and evaluate the integrative nature of the new NIS. The schemes are the Science and Technology Framework Plan (2003-07), the NIS Establishment Measures Programme and the Annual Major Business Report of MOST.

Science and Technology Framework Plan (STFP)

STFP was first planned in 2001 for 2002-06, on the basis of the Science and Technology Framework Law enacted in 2001. However, the plan was revised in 2003 in order to adapt it to the vision and policy goals of the government inaugurated in February 2003 (MOST, 2003). There were no substantial changes in the plan or in the planning mechanisms and processes, but the period covered is now 2003-07. The plan is very comprehensive in terms of coverage and participating ministries, organisations and experts in the planning process. It consists of two parts: the technology-oriented plan and the policy-oriented plan.

In all, 16 ministries participated in the planning. Delegates from the ministries worked together with civilian experts for each priority policy area. The role of delegates was to submit the ministry's proposal and then inform the ministry of the results of review and discussions by the planning committee. Proposals were adjusted through committee discussions and the adjustments were usually accepted by the relevant ministry. The committee's decision was reached on the basis of consensus and voting was rare.

The new government's vision and policy goals were reflected in the plan so that the plan's priority policy areas were expected to be coherent with the overall national policy agenda. It was the intention of NSTC to revise the original Science and Technology Framework Plan, which was already in effect.

The government's annual science and technology budget reflects the policies and tasks included in the Framework Plan. In line with the Five Year Economic Development Plans, Korea has formulated long-term science and technology plans. The interesting feature of Korean long-term S&T planning is that each STI-related ministry has formulated its own long-term plans. Those of MOST are the most comprehensive. The time horizon for a plan is usually five years, but plans are sometimes formulated for ten or even 30 years.

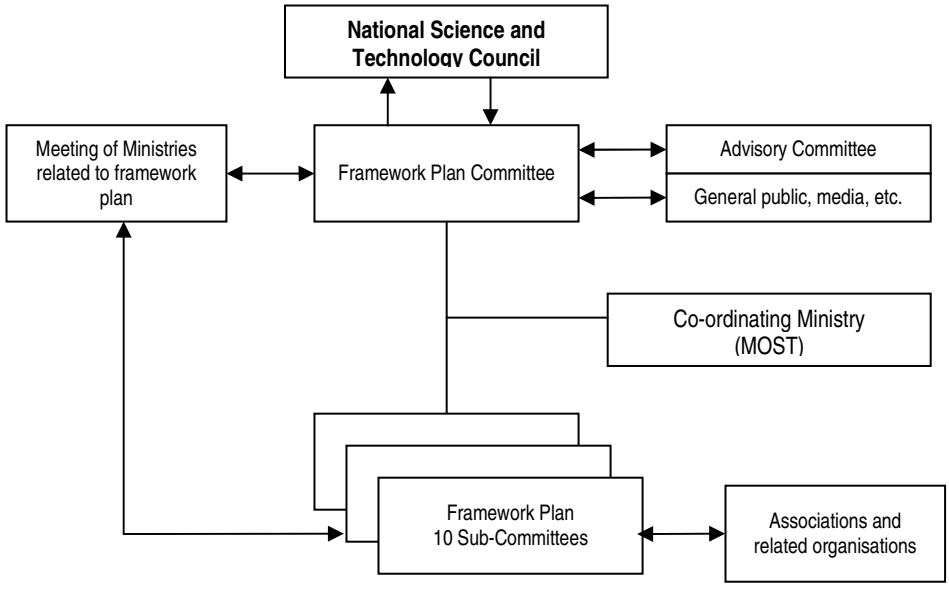
Subsequent efforts at government level have aimed to institutionalise the overall evaluation and co-ordination of national R&D programmes. National S&T planning has been strengthened so as to better reflect the S&T Basic Plan. It has become mandatory to set priorities for R&D at the national level.

The most recent plan is the Science and Technology Framework Plan, shown in Figure 3.5. The NSTC prepares guidelines for planning and approves formulated plans. Actual planning is the job of the planning committee (Framework Plan Committee), with advice from experts and leaders in the S&T community aided by various organisations and experts. The committee consists of ten sub-committees for each policy area. At least in principle, relevant ministries are expected to participate in the planning meetings and to dispatch delegate officers to sub-committees. In the process, public hearings are held to allow the general public and citizens to voice their opinions.

Since the introduction of the Science and Technology Framework Law, the basic direction and framework of STI policy in Korea have been formulated in the Five Year Science and Technology Framework Plan, which is established by a plan committee that works in close co-operation with ministries, advisors and experts. Thus basic strategies, policy priorities, agendas and responsibilities are all set by the plan. However, since each ministry can initiate own plans, which may not necessarily follow the Framework, coherence is not assured.

The current government has emphasised "balanced national development" and "new roles of science and technology". It also created the position of Presidential Advisor for Information, Science and Technology Policy, completing the groundwork for building a "science and technology-based society".

Figure 3.5. S&T framework planning system



Source: MOST (2003).

NIS Establishment Measures Programme

The NIS Establishment Measures Programme is an outcome of the election pledges of presidential candidate Roh Moo-hyun. One of his pledges was to establish the science and technology-based society, and during the Presidential Transfer Team period, policies were formulated for realising this goal. The interesting development is the adoption of the concepts of the NIS and the innovation-driven economy in line with the concept of the science and technology-based society in the formulation of the policy package. The resulting policy package was called the NIS Establishment Measures Programme and the programme was placed under the Presidential Commission on Policy Planning (PCPP), and decided as a national policy agenda. The policies were organised into five categories for establishing an effective NIS. Altogether, 30 policy areas or tasks were selected and assigned to relevant ministries for implementation. The programme started in the second half of 2004 and currently has no designated end date.

Operation of the programme was transferred to the NSTC, and a special sub-committee, led by the Deputy Prime Minister of Science and Technology, is in charge. The first operational meeting decided to divide the 30 policy tasks into 66 sub-tasks.

Several questions about the programme arise. What is its relationship to other STI programmes or packages such as the Science and Technology Framework Plan? Is it at a higher level than other packages in terms of coercive power? Are there conflicts or duplications with other packages? The answers to these questions help to show whether the Korean NIS has been moving towards a genuine third-generation model.

The programme is the most important at present because it is the extension of the presidential campaign pledge. Most of the 30 policy tasks are included in ministerial-level STI policies as tasks that must be carried out, so that there are few conflicts with other packages. In fact, the programme plays a key role in securing coherence with other STI policies and with other national policies since it brings together the concepts of the NIS, the innovation-driven economy and the science and technology-based society. The fact that the programme is operated by NSTC, the central organisation for all STI policies, confirms this observation.

2005 Major Business Report of MOST

In the early part of every year each ministry sends a yearly plan for policy activities (business) to the President. The report is documented and subsequently available to the public. The 2005 Major Business Report of MOST clearly shows the ministry's new role as co-ordinator of national STI policies and the efforts of the government to achieve an innovation-driven economy.

The report evaluates 2004 as the year in which the institutional basis for STI was established and the framework for pan-ministerial co-operation and co-ordination was prepared. The ministry's goal for 2005 is defined as "leading innovation as the ministry in charge of overall management and co-ordination of national micro-economic policy".

The major policy tasks for 2005 include not only components of the NIS Establishment Measures Programme, the Science and Technology Framework Plan and the Next Generation Growth Engine Programme, but also other ongoing and new STI policies that were selected as priority tasks of the year. Since the ministry has two main functions (overall policy co-ordination and implementing its own traditional S&T policies), the report covers all of these. The policy agenda related to overall STI policy co-ordination lists the ministries involved and shows that the ministry is the co-ordinator of all STI policies.

Policy co-ordination

MOST has two vice ministers: one for OSTI and the other for its traditional functions. OSTI might have been made an independent organisation or the new MOST might have been made identical with OSTI. However, according to the final restructuring decision, MOST took on both functions. There exists a view that this outcome is a result of political compromise. As the secretariat of NSTC, OSTI announced the implementation of the following priority policy agendas to establish an innovation-driven economy and a science and technology-based society. The priority agenda includes:

- Set up and co-ordinate strategic medium- and long-term plans.
- Establish a comprehensive co-ordination system to enhance the efficiency of national R&D programmes.
- Promote the next generation growth engine government-wide.
- Establish a performance-oriented system to promote national R&D programmes.

It has several channels for implementing its agenda. As the secretariat of NSTC, it prepares the agendas for the Council Meeting. During the preparation phase it usually pre-co-ordinates proposals and reports of ministries. Since the NSTC plans, evaluates and co-ordinates major STI policies and programmes, including important STI projects,

OSTI, as the secretariat, deals with all of these activities. For example, OSTI convened the Evaluation Strategy Meeting for the National R&D Programme in March 2005 to evaluate 125 R&D projects undertaken by 15 ministries or agencies in 2004. The result of the review and evaluation is reflected in the 2005 R&D budget allocation for each ministry or agency through the decision of NSTC.

Co-ordination of current policy issues is implemented through the monthly Science and Technology Ministerial Meeting, which chaired by the Deputy Prime Minister of Science and Technology. OSTI also plays the role of co-ordinator of practical administrative work for this meeting.

Policy learning

The politicians and government officials in the "participating government" have been exposed to policy learning. The new government is relatively younger than past governments and these younger leaders regard themselves as reformers of the old regime. Although they had the will and vision, they did not have sufficient knowledge of specific policy measures and agenda setting to realise their vision. Many committees and councils were organised, since the government was ambitious to achieve many reforms within a short period. Over time there has been some restructuring of the committees, but policy learning in line with the government's innovation drive has been more and more emphasised.

Many inter-ministerial meetings and cross-border collaborative activities have been organised. Furthermore, exchanges of officials between ministries have been encouraged and a few government positions were made open to civilian experts. These interactions have contributed to interactive policy learning. STI policies were no exception. Institutional changes, restructuring, changing policy agendas, new plans and measures are the outcomes of the learning.

Implications and lessons

The fundamental problem of Korea's NIS and S&T governance was that the system was designed for the era of imitation and became inefficient and created bottlenecks for an era of innovation. In particular, the following problems became clear:

- Lack of comprehensive co-ordination.
- Weak link between S&T policy and the government budget.
- Excessive competition among ministries.
- Weak function of planning and evaluation of the National R&D Programme.
- Problems in management of GRIs.
- Weak regional innovation systems.

Although the need to reform the NIS and the S&T governance structure had long been pointed out by experts and the media, it was the new administration, which promised broad and deep reforms of the whole social system, that was able to do so. The reform was an outcome of past policy learning, but it took place because of the new reformist political leadership.

It took a long time to recognise the specific problems for achieving an effective NIS and even longer to reach a consensus on the direction and measures for reform. The recognition came as a result of the combined and accumulated efforts of various actors. It was precipitated to some extent by a sense of crisis arising from the challenge of the rapidly rising Chinese economy.Korea has tried to find a creative way to solve its problems as its situation was more complicated than that of other advanced economies. Since the bold reform begun by the new administration in 2003 is still ongoing, the results are yet to be seen.

According to the 2005 Major Business Report of MOST, the objective to establish the structural basis for a new NIS for the innovation-driven economy is 2004 was achieved. As a result, many problems of the STI policy process have been resolved. Owing to the strengthened role of the NSTC as the central decision maker and co-ordinator of major STI policies, many instances of inter-ministerial conflict and duplication have been removed and a balance has been achieved between the centralisation of power for STI policy formulation and implementation by individual ministries. The coherence of various STI programmes have been emphasised and in many cases secured through the new STI policy governance structure and mechanisms.

However, the new NIS is not yet complete. As indicated by the special NIS Establishment Measures Programme, the reform of the NIS is still continuing. Several shortcomings or remaining tasks may be pointed out.

First, the reform in 2004 was, in fact, a reform of national STI policy governance rather than a full-scale NIS reform, since it focused on restructuring and the operation of government organisations. Such reform is a long-term task which the government cannot accomplish alone, particularly because the government's influence on the private sector may be limited since almost 80% of national R&D investment is made by the private sector and market mechanisms play a very strong role. Moreover, the NIS evolves over time as a result of interactions among various actors, some of which do not arise as the result of policies. Since the NIS Establishment Measures Programme intends to develop the NIS to support an innovation-driven economy over the long term, more efforts to develop a full-scale NIS can be expected in the coming years.

Second, remedies to correct the current unbalanced system have not yet been sufficiently applied. For example, universities and SMEs have not played a much needed role or contributed to building innovation capability. They are even regarded as bottle-necks. More than 50% of the private sector's R&D investment is made by the top ten large firms, an exceptionally high concentration compared to other developed countries. More effective measures are needed in the near future to remedy these problems.

Third, horizontal coherence of STI policy management has not yet been secured or seriously pursued. Although the government announced that MOST was to deal with all macroeconomic policies, serious efforts in that direction have not yet been made. At best, the inclusion of some national economic goals, such as doubling income per capita by 2010 or the inclusion of ministers from economic policy-related ministries, such as the Ministry of Finance and Economy, in NSTC or in the monthly STI-related Ministerial Meeting may be regarded as relevant efforts. Genuinely horizontal coherence of STI policy implies integrating STI policy from the outset with the government's other economic or non-economic policies and goals. It seems that a full understanding of the "announced" concept of dealing with microeconomic policies has not been reached among involved government officials.

In retrospect, the reform of the NIS in the second half of 2004 was based on the concept of the third-generation innovation model which emphasises integration and coherence of STI policy. Since the reform mainly targeted the government sector, it cannot be regarded as true NIS reform, but only as a reform of STI policy governance. However, the reform is expected to extend to the entire NIS, although it may take longer than expected. The steps already taken must be refined and complemented. Nevertheless, Korea has taken a big step towards introducing an NIS based on the third-generation innovation model.

Notes

1. Korea's national income per capita has not risen above USD 10 000 since 1997.

2. Some of the following comments are based on Suh (2000).

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Chapter 4

POLICY MAKING IN A COMPETITIVE ENVIRONMENT: GOVERNANCE IN THE AUSTRIAN STI POLICY FRAMEWORK

Leonhard Jörg
Technopolis GmbH

This chapter maps the governance of the Austrian science, technology and innovation policy system. It starts with an overview of Austria's STI performance and explores the evolution of the current STI policy system. Following a description of key actors, a range of specific governance aspects are discussed in more detail. Issues addressed are: policy mix, new ways of policy delivery (programming), and interaction between various policy levels (federal-regional). The final section focuses on the learning capability of the STI system. Important in this context are strategic intelligence, the involvement of stakeholders and the use of evaluation.

Introduction

This chapter contributes to the discussion of governance in science, technology and innovation (STI) policy. It aims to identify structures, mechanisms and attitudes that are central to the functioning of the STI policy-making process. It focuses on the interaction between policy and implementation. Given the complexity of the topic, the focus is on funding, which may be considered the backbone of the system, in an attempt to shed light on the dynamics of the allocation process and on the incentives created by specific organisational arrangements. The central message is that policy making can be described as an entrepreneurial activity. Policy makers act in competitive environments. The challenge is to use the benefits of competitive settings (innovativeness) yet avoid the drawbacks (fragmentation).

The analysis begins with a snapshot of Austria's STI performance during the last decades. Next the historical evolution is described and the main players in the Austrian funding system are introduced. Then, a range of specific governance issues that arise in the context of the funding system are discussed. Finally, the main lessons are drawn.

The study draws on several sources. One is the recent evaluation of the two main funding agencies which brought new insights into the governance of the Austrian funding system and, most interestingly, into the consequences of various forms of stakeholder involvement. The second important source is the tip survey conducted in preparation of

the technology report 2003 which produced a comprehensive picture of STI policy measures in place and evaluation activities.[1]

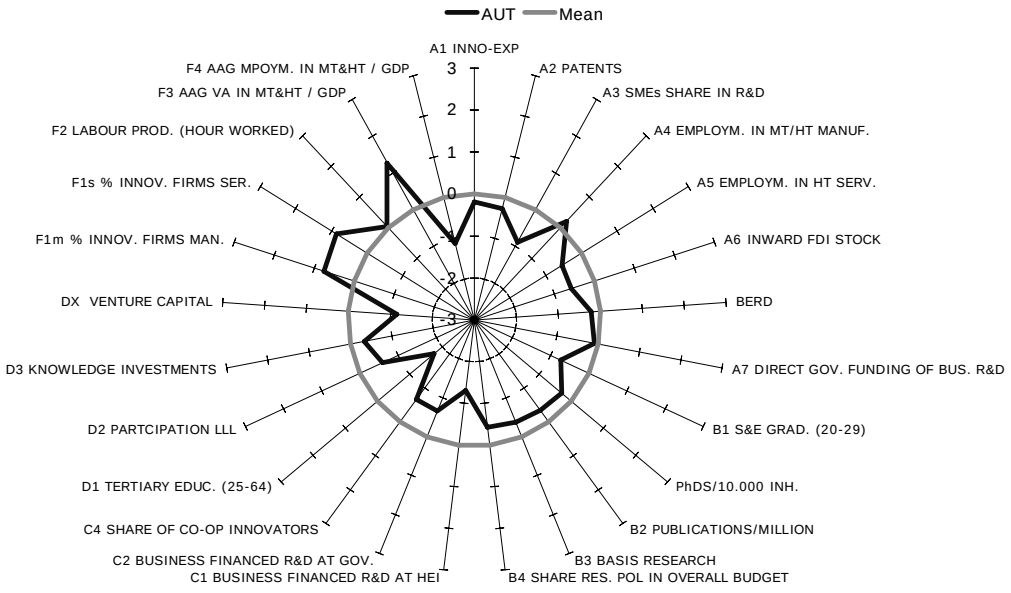
STI performance

At first sight, Austria's STI performance over the last two decades demonstrates the reverse of the "European paradox". Rather than high R&D and low economic performance, Austria has had good economic performance with comparatively little R&D.

Since joining the EU came onto the national agenda, Austria has made significant strides towards reaching EU levels of R&D activity. An economy based on industries with low R&D intensity and a structural bias towards small and medium-sized enterprises (SMEs) has moved towards the EU average of R&D intensity.

In terms of its strengths and weaknesses, Austria's STI performance profile is mixed (Figure 4.1). Taken together the indicators point to a national system of innovation with weaknesses in the science base, low propensity of the private sector to invest in R&D and, more generally, an underdeveloped culture of entrepreneurship. These weaknesses, however, have to be seen in the context of the economic structure and technological patterns of specialisation. Austria's economy is strongly anchored in low- and medium-technology industries and small firms. Its weak positioning in high-technology industries such as biotechnology and information and communication technology (ICT) and its lack of big R&D-intensive firms explain some of the modest positioning of Austria's STI performance as a whole.

Figure 4.1. STI performance profile, Austria

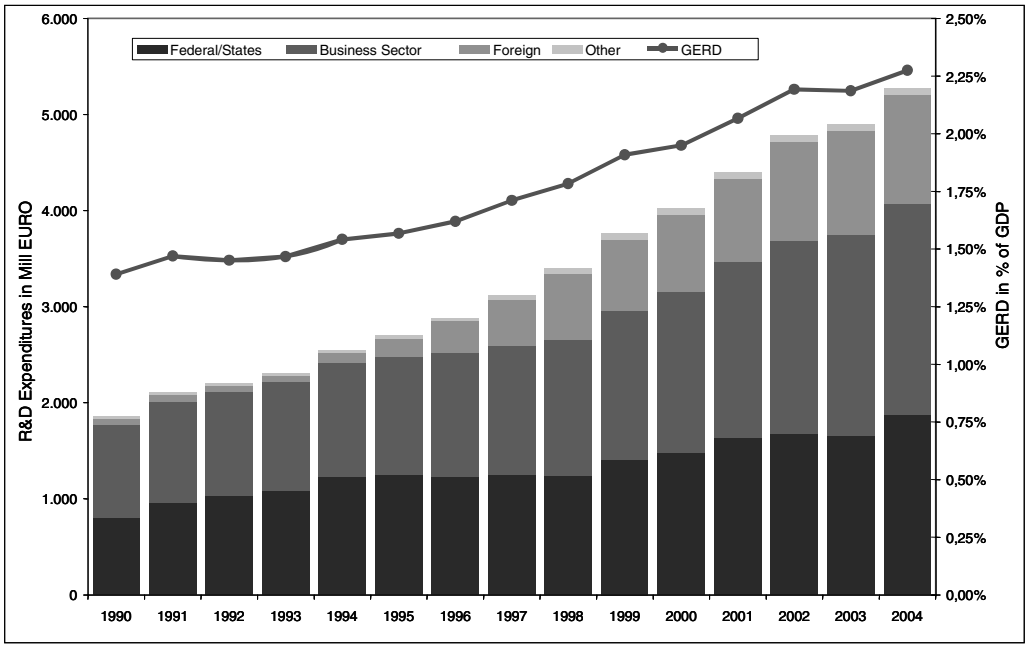


1. The "tip" is a research and consulting platform established and financed jointly by the Ministry of Transport and Innovation, the Ministry of Education and Science and the Ministry of Labour and Economic Affairs.

On the positive side, there is a relatively large share of innovative SMEs, and a high degree of "flexible specialisation", often leading to commanding shares in niche markets. Austria's enterprise sector seems to have developed good absorptive capacities that have resulted in fast diffusion of new production technologies. Furthermore, Austria seems to have made good progress in improving the co-operative culture within the enterprise sector as well as between science and industry.

The composition of R&D expenditures in Austria reveals some interesting developments. Beside continuous overall growth in financial resources available for R&D activities, the sources of financing have changed over time. Whereas the relative share of public sources (federal/states) has decreased, that of the business sector has increased substantially (Figure 4.2). Most interesting is the sharp increase in financial inflows from foreign countries. Only Greece and the United Kingdom have reached similar shares of foreign-financed R&D.

Figure 4.2. R&D expenditure in Austria by source of finance



Source: Statistik Austria (2004), *Science and Technology Report 2004*.

The overall growth of R&D expenditures together with a range of new policy initiatives have put Austria in a catch-up position in the European STI arena. Even though the share of R&D financed by the business sector has grown, it remains at a low level compared to the most R&D-intensive European member states.

Evolving governance structures and perceived challenges in the Austrian STI system

Historical context

The perception of challenges requires a basic understanding of how the STI system functions. As in many other developed countries the "linear model" set the basic principles of Austrian STI policy in the post-war period. The options were limited. In terms of technology and innovation policy, the exploration of new technological options ranked relatively low on the policy agenda. The challenge was first of all to rebuild and maintain industry infrastructure and to reduce the technological gap with neighbouring countries. In this context the relatively large amount of state-owned industry in the basic sector absorbed a good deal of policy attention. The development of technological capabilities was mainly based on importing new technology and incremental adaptations. With hindsight, these strategies of "incorporated technological change" and "continuous improvement" were fairly successful and one of the reasons of the Austrian paradox (good economic performance coupled with low R&D intensity). However, widening trade balance deficits and decreasing unit values of exports (an indicator of an increasing technological gap) in the late 1980s and early 1990s increased pressures for a more proactive STI policy.

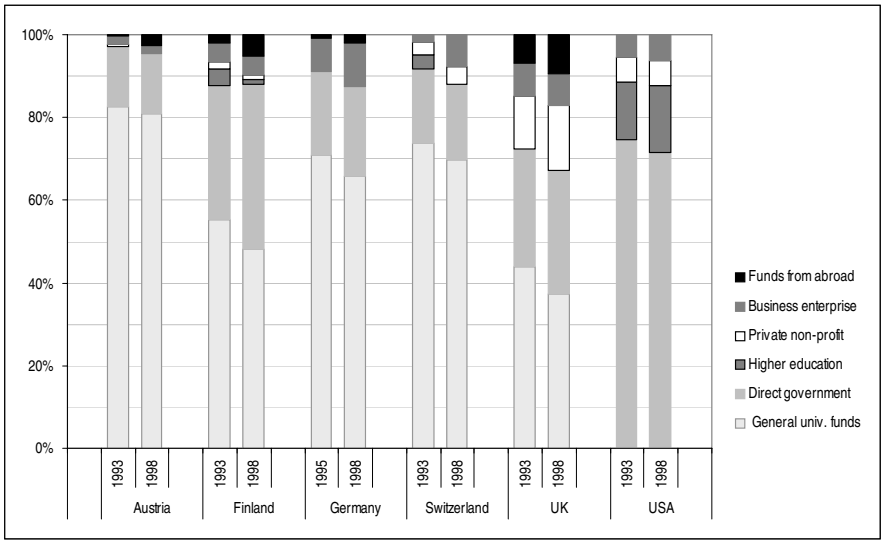
Science policy in the post-war period mainly concerned universities. Faced with a weakened science base after the war, the challenge was first of all to restore basic teaching capacity rather than build new research capacity. In organisational terms, the university sector only became autonomous in recent years, following the adoption of the new law on university organisation. Traditionally, universities were managed like public services and there was little scope for development of research. Moreover, university funding relied to an exceptionally high degree on general university funds, leaving little scope for strategic priorities. How persistent such historically defined allocation mechanisms can be is illustrated in Figure 4.3. Even though the share of GUF in financing the university sector was perceived as problematic, it remained at a high level until the late 1990s.

With large financial resources tied up in university budgets, Austria has been fairly cautious in establishing new non-university research organisations in new research fields, as happened in many other developed countries. The foundation of the nuclear energy research centre Seibersdorf in 1956 (now ARC – Austrian Research Centres) remains one of the few exceptions.

Evolution of the funding system

R&D project funding, as a financing instrument directly linked to performance and with potentially higher impact, was introduced relatively late. The basic principles of R&D funding up to recently were laid down in the 1960s. The Research Promotion Act established the two main funding bodies, the FFF (Austrian Industrial Research Promotion Fund) and the FWF (Austrian Science Fund). For both industrial innovation and scientific research, the funding model concentrated on bottom-up project funding administered by fairly autonomous funding agencies with the main beneficiaries dominating the governing boards. The third major funding agency, the ERP (European Recovery Programme), entered the STI funding scene in the early 1980s, when it started to extend its formerly investment-focused funding portfolio to innovation and new technologies.

Figure 4.3. Sources of higher education expenditure on R&D (HERD),[1] 1993[2] and 1998



1. Higher education expenditures on research and development.

2. Germany: 1995; Switzerland: average 1992/94.

Source: OECD; own calculations.

In retrospect, the foundation of FFF and FWF as two autonomous funding bodies with a fairly narrow mandate for bottom-up project funding set the conditions for the evolution of the STI policy governance structure:

- Policy influence over the short and medium term was limited, as big shares of available financial resources were tied up in general university funds and basic funding of the major research performers in the public realm.
- For the last three decades, bottom-up project funding has remained the dominant model for the industry sector.
- The political system, with relatively long periods of coalition governments and a strong role for social partners, supported the formation of a balanced system with a carefully designed division of influence at the political level. The fact that the STI policy agenda remained divided among three ministries is one of the most obvious results of this specific political culture, which seems to have ended in 2000 with the last coalition government.
- A high degree of independence and the strong involvement of beneficiaries in the steering of funding agencies reduced the risk of ad hoc political intervention. The funding agencies perceived themselves more as lobbying organisations serving their beneficiaries than as instruments for implementing STI policy.
- Given this balanced and mostly self-sufficient system, strategic priority setting and the introduction of new funding instruments has been difficult.

Overall, the balance between conservative and innovative forces in the Austrian STI system as it evolved in the post-war period leaned towards the conservative side. From the perspective of policy makers, room for manoeuvre was limited, as the bulk of

available resources were tied up with general funds and not available for strategic reorientation.

Against this background, the STI system has long relied on three fairly separate research communities, the biggest in the university sector and relatively small ones (compared to other developed countries) in public research institutes and in the industry sector.

Establishment of new agencies and research organisations

In the aftermath of the oil-price shock of the 1970s, the need for a more strategic STI policy approach became evident. It was at this time that the first technology programmes (energy technology) were launched. The pressure to take up new challenges in new ways increased with the continuing deterioration of the technological competitiveness of the big industry sectors. Lock-in problems in low- and medium-technology sectors, structural change and the need to develop new technological fields appeared on the policy agenda in the 1980s. Ways had to be explored to address specific technological fields and perceived deficits in the absorptive capacities and innovation management of the enterprise sector.

Supported by the government's commitment to significantly raise the level of public spending on R&D, the portfolio of support measures was broadened extensively in the second half of the 1990s. At the same time, a range of new agencies specialising in delivering specific instruments entered the scene. Table 4.A.1 gives an overview of the main milestones in the evolution of the Austrian STI system. These can be read as institutional innovations in reaction to perceived challenges (new funding agencies and research-performing bodies with more or less specified tasks and portfolios). In addition, the portfolio of initiatives, programmes and platforms launched by those agencies has flourished. The tip survey conducted in preparation of the 2003 technology report revealed 115 different measures at the federal level at the time of the survey.

The latest entry in this list concerns the governance structure of the system itself. With the establishment of the Council for Research and Technological Development, the government reacted to a perceived lack of strategic intelligence within the system. As an explicit measure to improve the system's coherence, the establishment of the Council set the starting point for a reorganisation process which is still under way.

To some extent, the evolution of the STI system also reflects changes in policy concepts and ideas. With its reliance on three fairly separate pillars and a funding system focused on bottom-up funding, Austria implicitly followed the linear concept of scientific performance and technological change throughout the 1960s and 1970s.

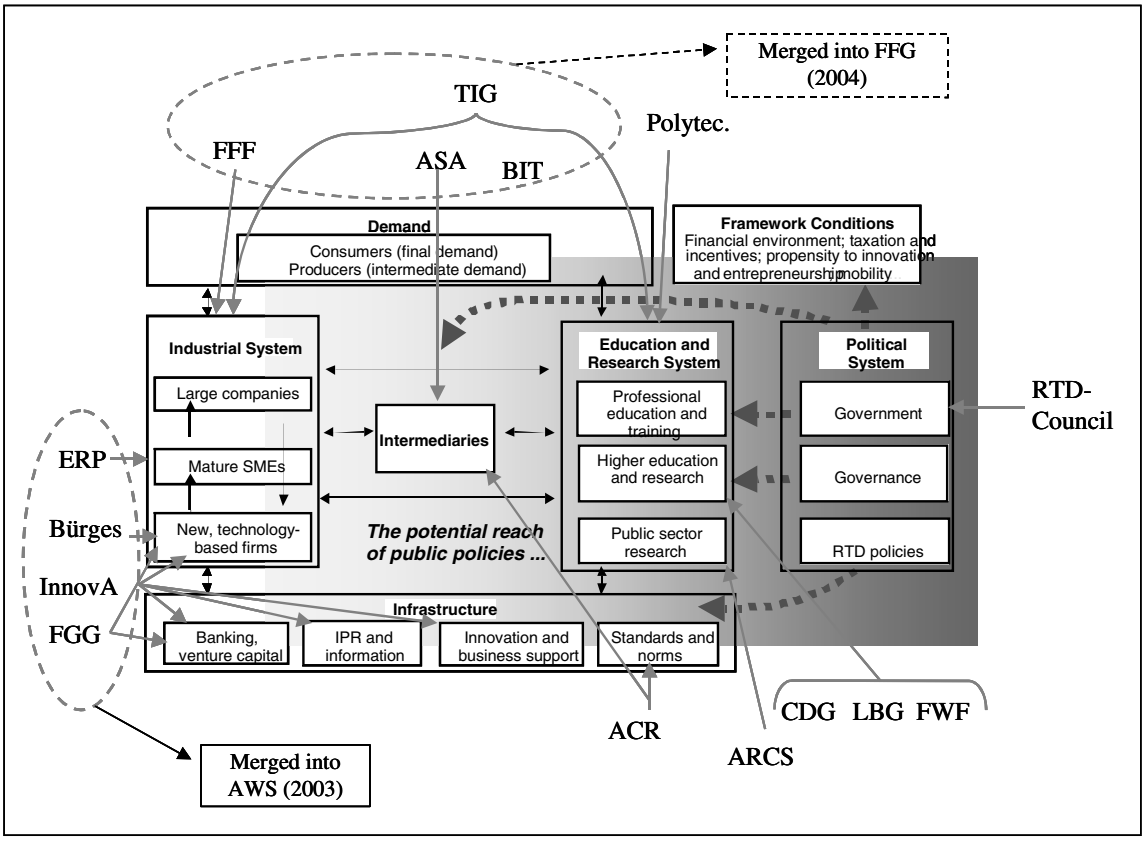
In 1984, with the establishment of the Innovation Agency (*Innovationsagentur*), public support of firms' innovative activities moved beyond the merely financial aspect, with support in areas such as management of IPR and market information.

In 1987, the Innovation and Technology Fund (ITF) was established. This allowed the Ministry of Public Economy and Transport to integrate innovation into its activities and fund larger innovation projects than those contemplated by FFF, even though FFF played a central role in the administration and implementation of research-based projects approved by this new fund. ITF gave the ministries a potentially powerful instrument for bypassing FFF's focus on "bottom-up" funding by running their own "top-down" programmes and for developing a national research and innovation strategy.

In the context of scientific research and higher education, the most influential change was the introduction of polytechnics. These were established in reaction to the perceived lack of highly qualified personnel in general, high drop-out rates at universities and weaknesses in the regional distribution of tertiary education.

Figure 4.4 illustrates the positioning of the various agencies and new research performers within the broader STI system.

Figure 4.4. Policy delivery in the Austrian STI system



Source: Based on: Erik Arnold and Stefan Kuhlman, *RCN in the Norwegian Research and Innovation System*, Background Report No. 12 in the Evaluation of the Research Council of Norway, Oslo: Royal Norwegian Ministry for Education, Research and Church Affairs, 2001.

While the Austrian STI system has evolved a range of new agencies, research-performing institutions and policy advisory bodies over the last three decades, the rate of "policy innovations" does not seem to have been stable over time. What Schumpeter observed for industrial innovations also seems to apply in the STI policy system as well: policy innovations seem to cluster.

Perceived challenges

As noted above, STI policy has only become a policy field in its own right in the last decade. Its emergence was supported by a number of developments that appeared to change Austria's economic place in a European context:

- The transition of eastern European countries increased competitive pressures mostly in Austria's low- and medium-technology industry.
- In 1995 Austria jointed the European Union. In the pre-accession period it proved difficult to mobilise the Austrian scientific community to actively participate in the EU Framework Programmes. Thus internationalisation and integration into the wider EU context was an important STI policy challenge.
- A range of new technology fields mobilised not only private equity capital but also STI policy, and STI policy moved more and more to the centre of political attention. Owing to its size and industry structure, Austria seemed poorly prepared to exploit new opportunities in telecommunication or the life sciences.

The opening of eastern European countries and European integration created a sense of urgency. Confronted with new competitors in low- and medium-technology sectors on the one hand and lagging behind in new markets on the other called the Austrian paradox more and more into question.

The four challenges receiving the most political attention – besides the general conviction that more financial resources are needed – are:

- **Low R&D intensity of the enterprise sector**: As already shown, the share of R&D expenditures in the enterprise sector in total R&D expenditures has been extremely low in Austria compared to other EU member states. This is due in part to the country's economic structure. Another important characteristic is the lack of big R&D-intensive firms. In translating these weaknesses into policy strategies, strong emphasis was put on leveraging public R&D funding on private R&D expenditures. An example of a way to improve the leveraging are the various competence centres programmes which introduced fairly advanced public-private partnership models in which public funding is explicitly linked to long-term private-sector commitment to bring in substantial financial resources. New fiscal incentives were introduced to mobilise additional private resources.
- **Structural change and new markets**: Persistent low rates of creation of new companies together with weak positioning in new high-technology markets raised concerns about the entrepreneurial drive of the Austrian economy as a whole. A range of support measures to increase the number and quality of business start-ups have been launched over the last decade. In this context another weakness of the Austrian innovation system became obvious: Austria lags behind in the availability of risk capital. Even though the gap with its European counterparts has shrunk during last three years Austria remains behind.
- **Fragmented science base**: For a long time Austrian science policy was reluctant to actively encourage the creation of critical mass in selected scientific fields. The university sector has relied to a large extent on general university funds; this did not create an environment for developing patterns of scientific specialisation. Fragmentation and mediocre scientific output were the result of this hands-off approach. As a result, the degree of autonomy of universities was increased (University Act 2002) and a range of governance mechanisms was introduced to enhance priority setting and professional management.

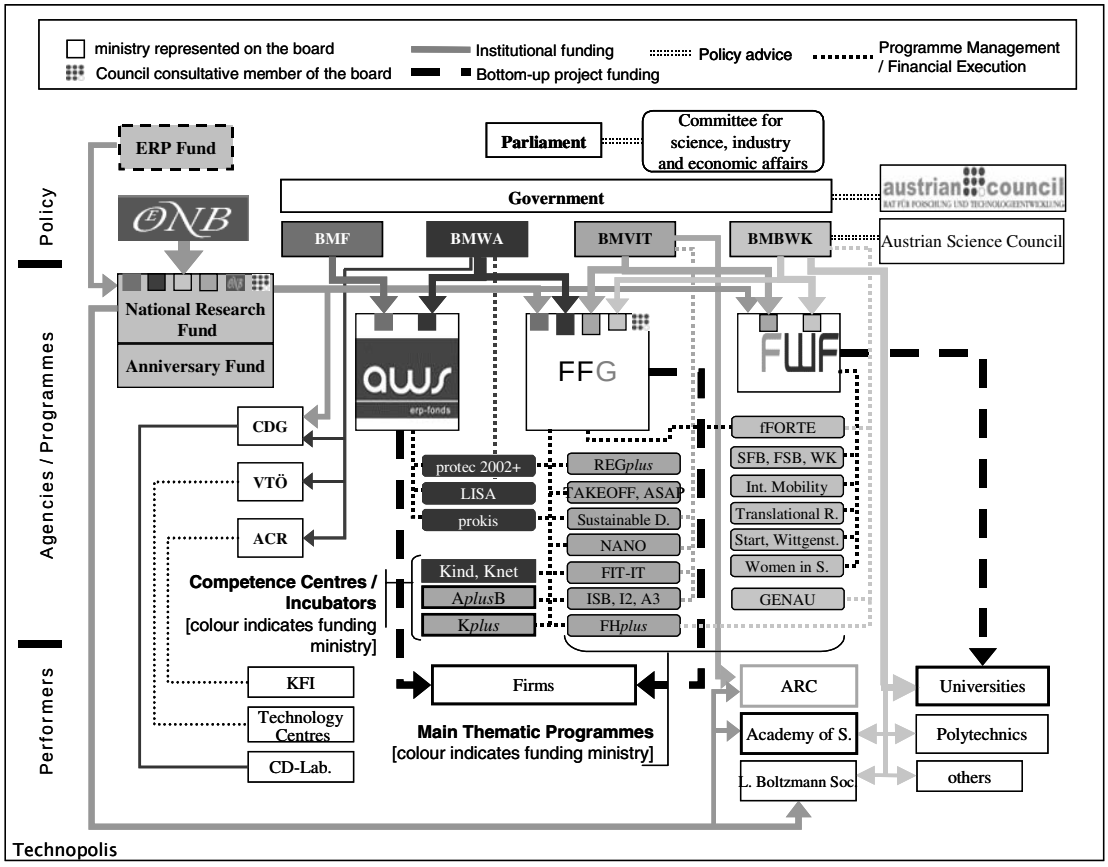
- **Co-operation**: Since the concept of national innovation systems entered national debate on STI policy,[2] enhancement of the co-operation culture both within the enterprise sector and between scientific research and industrial innovation became an integral element of almost every new policy measure launched since the mid-1980s.

The challenges highlighted above address specific weaknesses of the Austrian innovation system. Almost every challenge or bottleneck discussed is underpinned by international benchmarks. Apparently, the underlying assumption is that Austria is still a catch-up country trying to reduce perceived gaps with a peer group of foreign countries.

Overview of the current innovation system: key actors and roles

Figure 4.5 shows the institutional map of the Austrian STI policy system. The map differentiates between the policy, agency and performance levels. Flows of money (lines) and ownership (shading) are used to illustrate the basic interrelations between different players.

Figure 4.5. The Austrian STI policy map, with funding relations



Source: Technopolis.

2. The establishment of tip as a consulting and information programme was important in this context. The tip was the organisation for jointly commissioning research and consulting projects to expert groups. In retrospect it was the platform by which the NIS entered Austrian debate.

Key players at the policy level

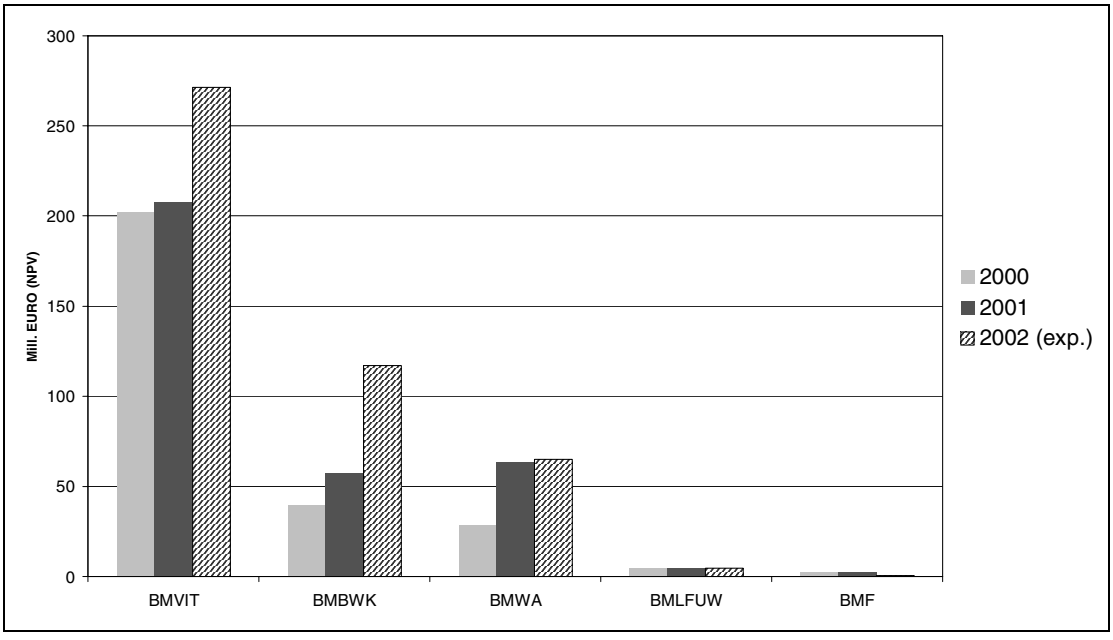
Ministries

At the policy level, core responsibilities are distributed across three ministries. The Ministry for Education, Science and Culture (BMBWK) governs the higher education sector, including universities, polytechnics and the academy of science. The Ministry for Transport, Infrastructure and Technology (BMVIT) is responsible for the major non-university research organisations, and most of the technology programmes implemented so far in Austria have been launched by BMVIT. The Ministry for Economy and Labour (BMWA) has innovation and technology policy issues on its agenda. It supports a range of organisations that support infrastructure and SMEs, such as the association of Austrian Technology Centres (VTÖ) or Austrian Co-operative Research (ACR). In addition, BMWA has set up several programmes on technology transfer, innovation management and mobilisation of equity capital for high-technology start-ups.

Figure 4.6 shows the distribution of financial resources for STI-related programmes and initiatives. As can be seen, BMVIT and BMBWK and BMVIT dominate the picture, so that STI issues appear quite marginalised in other ministries. In other countries, significant stimulus and resources come from other directions as well.

Figure 4.6. Programmes and initiatives of responsible ministries

EUR millions



Source: tip survey 2003.

BMF (the Ministry of Finance) plays an important role in the STI policy system as it governs the allocation of financial resources and sets, at least implicitly, standards for the design and monitoring of new programmes. It strengthened its position in the course of the last reorganisation of the funding system. It is represented on the board of the newly created AWS (Austrian *Wirtschaftsservice*) as well on the board of the national research

fund (*Nationalstiftung*) which has been set up to allocate the additional funds provided by the National Bank (see Figure 4.5).

Council for Research and Technology Development

Although the council's mandate does not include formal decision-making power for approving proposed programmes or initiatives, it received it *de facto* when the BMF committed itself to follow the council's recommendations. As a result, the council has become the central body for allocating additional financial resources made available by the government. In fulfilling this task, the council has set up a programme assessment scheme which includes explicit requirements for monitoring and evaluation. With hindsight, the establishment of the council and the commitment of the BMF to follow its advice brought something new to the system. For the first time ministries' initiatives were presented with a common point of reference and a kind of referee with control over the allocation process.

However, it should be stressed that the council's referee role is not formally defined. Its formal task is to provide strategic advice to the government. One of the visible results is the national innovation plan presented by the council in 2003. Other activities involve the establishment of temporary expert groups on specific themes as well as the commissioning of studies. In sum, the council has tried to actively play the role of moderator and referee.

Division of labour

It is difficult to see the underlying rationale behind the division of labour at the policy level. At first sight, responsibility for specific target groups is grouped in certain ministries. In a simplified picture, BMBWK focuses on the scientific research community, BMWA on SME-related issues and BMVIT on the industrial R&D themes of the high performers among Austrian firms. Underneath this simplified picture, however, the situation is less clear. In particular, there is overlapping between BMVIT and BMWA.

The clearest example is the competence centre programmes launched in parallel by both ministries during the last five years. K*plus*, launched by BMVIT and managed by TIG (*Technologie Impulse Gesellschaft)*, was the first. BMWA followed with the establishment of Kind and Knet, both managed by FFF. All three programmes address the science-industry interface by supporting the establishment of co-operative research platforms with strong involvement of industry partners. All three claim a high level of scientific quality and aim to enhance the creation of critical masses in areas of strengths. Differences among the programmes only involve funding volumes, timeframes and, more generally, styles of programme management.

Key players at the agency level

Figure 4.5 shows that each of the three ministries has at least one funding agency in its area of responsibility. Consequently, the positioning of funding agencies seems to reflect an overall orientation towards the specific target groups of their ministry. FWF is the main funding body for university researchers at the national level. For industry R&D, FFF and ERP are the main funding organisations. The division of work between FFF and ERP follows roughly the innovation cycle, with FFF covering research and ERP supporting development work closer to market and innovation-oriented investment activities. This division of labour reflects the historic mission of the funding agencies.

In the last decade R&D funding in Austria underwent some substantial changes which altered the division of labour at the agency level. Additional public funding together with increased programme orientation and the withdrawal of the policy level from implementation led to a broadening of the portfolio of most funding agencies as well as the establishment of new ones. There is no longer a single link between agencies and ministries (see Figure 4.5). Agencies can now implement programmes for various ministries. The important message is that the growing diversity of funding instruments has led to fragmented policy implementation. Several agencies operate in parallel with no clear specialisation pattern in terms of target groups, applied instruments, competence and visibility, and an evaluation of FFF and FWF (Arnold *et al*., 2004) came to following conclusion:

- There is a wide diversity of governance practice and therefore unclear interfaces between the ministries (as principals) and the agencies (as agents). In some cases, a ministry maintains different governance styles for different activities in its relationship with a single agency. This incoherence helps prevent ministries and agencies from building sufficient strategic intelligence to maintain a coherent division of labour.
- Differences in governance styles limit the possibilities for individual agencies to serve multiple ministries. The growing importance of knowledge and research as part of the responsibilities of all ministries means that agencies working for multiple principals will increasingly be needed.

This assessment highlights the costs of organisational fragmentation. However, fragmentation at both the policy and agency levels has been on the agenda for some time. It was highlighted in White Papers on the strategic orientation of Austrian STI policy in 1994 and 1996. There is a considerable amount of inertia within the system in the area of organisational structure, and the lag between perception of a problem and response has been fairly long.

It is hard to single out specific reasons for this inertia. Increasing budgets together with a good deal of protection of established measures opened the way for new approaches. Policy followed the way of least resistance and avoided allocation battles. The inability to reduce fragmentation is the consequence of a system in which central portfolio management has not been proposed. If conservative forces (established measures and agents) and innovative forces (new initiatives) are not placed in a systems perspective, fragmentation is hard to avoid.

As the evaluation of FWF and FFF showed, one of the conservative forces has been the high degree of autonomy of established agencies and the strong involvement of beneficiaries or stakeholders (universities with FWF and firms with FFF) in their governing boards. Consequently, funds have acted more as servants of their beneficiaries than as agents of STI policy. Furthermore, the strong involvement of beneficiaries seems to have caused a general reluctance to adopt new, more strategically oriented ways of funding. A fairly autonomous funding system with strong involvement of beneficiaries in the allocation process apparently makes it difficult to set priorities. This partly explains why programming, as a way to concentrate available resources on selected priority areas, entered Austrian funding practice relatively late.

Against this background, the last initiatives to restructure the agency level can be read as an attempt of the principal (STI policy maker) to recapture the steering role from its agents.

In 2003 BMWA took the first steps towards reducing fragmentation on the agency level when it merged three agencies into AWS. On the side of BMVIT a similar step is under way. In September 2004 the new law for the establishment of the *Forschungsförderungsgesellschaft* (FFG) entered into force. FFG brings FFF, TIG, BIT and the Austrian Space Agency (ASA) under one roof. Both mergers are expected to substantially change the Austrian STI arena.

To sum up, the Austrian STI system has undergone increasing fragmentation in terms of number, size and positioning of agencies. The organisational structure at the agency level, which did not change throughout the 1980s and 1990s, came under increasing pressure to take up new funding modes and set priorities. Unlike countries with large integrated agencies which tend to build up their own strategic intelligence and design capacities, Austria had agencies that largely remained focused on their historic and, in most cases, rather narrow mandate. Faced with fairly autonomous agencies, ministries were more and more involved in design and even implementation of new measures. This further contributed to the "wide diversity of governance practice".

Governance: structures and instruments

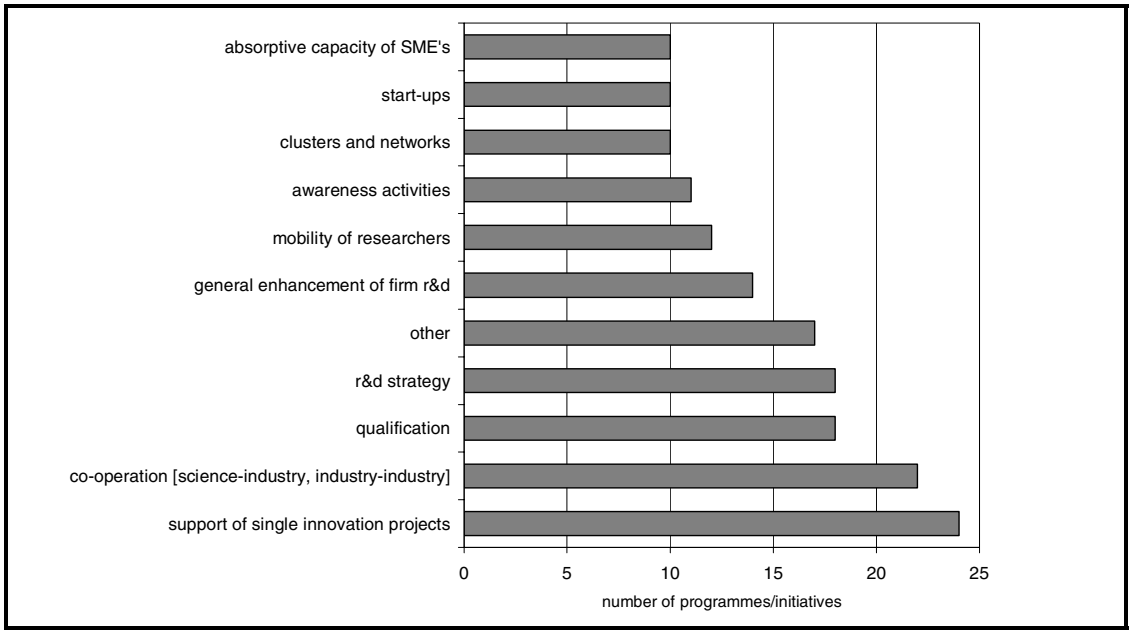
As the Austrian STI policy system is currently in the process of a reorganisation involving the mergers already mentioned at the funding agency level as well as a far-reaching reorientation of the university sector, this section explores in more detail some governance issues which have been identified as central within the MONIT project.

The need for portfolio management

The status of STI policy within the broader policy arena has risen during the last years. As a result, not only have budgets increased but also the diversity of measures, initiatives or programmes. A survey conducted in preparation of the 2002 technology report revealed about 120 different schemes in operation at the national level alone. Even though there are still discussions about possible gaps in the promotion portfolio (*Förderlücke*), attention has shifted from identification of gaps to reduction of diversity (*Förderdschungel*). The National Research and Innovation Plan (Austrian Council, 2003) also highlights the need to simplify a complicated institutional and organisational promotion structure as well as to improve co-ordination between the national government and the *Länder* (federal states).

The issues addressed by various programmes or initiatives (Figure 4.7) give a rough picture of the priorities in the current policy portfolio. As can be seen, single innovation projects still have the largest number of support measures. The next largest number (for co-operation, science-industry, industry-industry) points, however, to a profound shift. Encouraging co-operation among different NIS actors has become a standard goal of new measures. Lack of co-operation has long been perceived as a specifically Austrian characteristic. Given that enhancing co-operation has become a very prominent goal of STI policy in recent years, it remains to be seen whether that lack still exists. The question is the extent to which policy is able to fine-tune its interventions over time. As some interviewees have pointed out, fostering co-operation has increasingly become a goal in itself rather than a means of achieving primary goals.

Figure 4.7. Issues addressed through the measures of various programmes/initiatives*



* 1.75 entries on average.

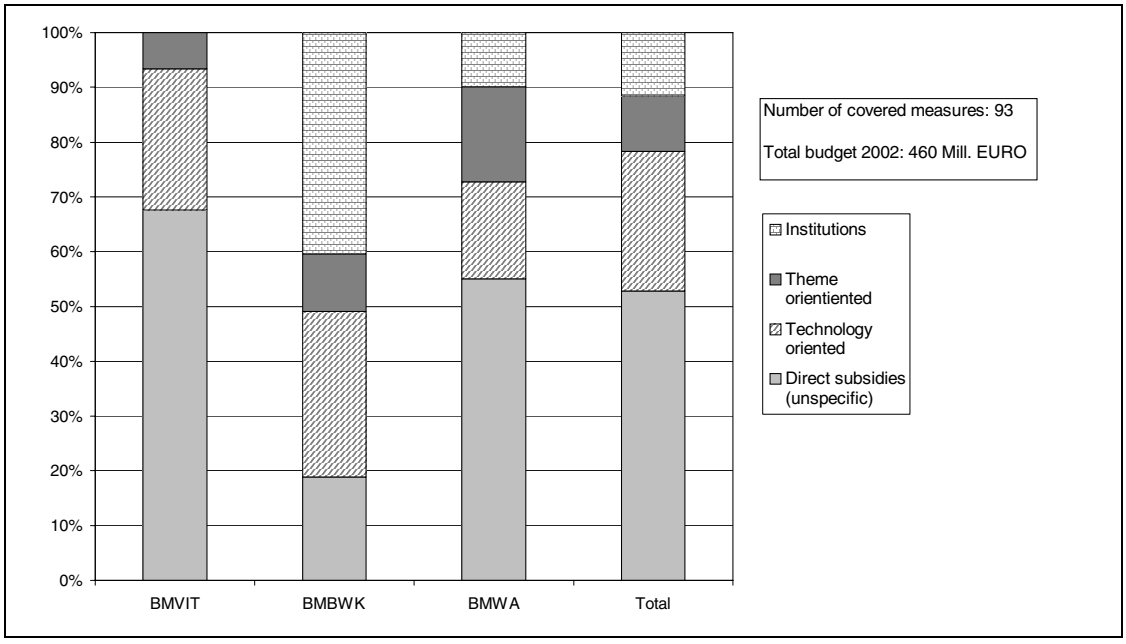
Source: tip survey.

Figure 4.7 also reveals that every issue is addressed by at least ten measures. Even though the issues overlap and may be difficult to assign to single measures, the numbers are high. This is even more the case if one considers that regional measures are not included. This again emphasises the picture of an overly fragmented STI portfolio.

In terms of the broad orientation of the measures in place, Figure 4.8 uses net present values of the measures covered (N=93) and illustrates the distribution. About 52% are for unspecified direct subsidies. This category includes most of the bottom-up project funding provided by FWF, FFF and ERP. Theme-oriented and technology-oriented measures refer to specific programmes.[3] Together their share amounts to about 37% of available funding. The remaining 10% goes to specific support measures for institutions (excluding general university budgets).

3. The distinction between theme- and technology-oriented programmes is not always clear, as some theme-oriented programmes address specific technologies as well. One example is the programme on technologies for sustainable development which addresses energy technology in one priority funding line.

Figure 4.8. Thematic orientation of support by providing ministry, 2002



Source: tip survey.

At the level of the three main funding ministries the distribution varies. BMBWK spends about 60% on institutional funding, whereas BMVIT has no specific funding schemes for institutions. The distribution reflects a division of labour at the policy level with BMBWK and BMWA responsible for a wide range of the science and technology infrastructure and BMVIT for the main funding agencies operating extensive bottom-up funding. It is difficult to know whether the distribution is appropriate or not. The general conviction that Austria's funding system is too strongly focused on unspecified direct subsidies is not, however, confirmed by the numbers.

Indirect measures have become increasingly important. Recent tax reforms have significantly expanded tax credits related to R&D. Austria now has one of the most attractive tax credit regimes for R&D-intensive firms. So far no empirical evidence on mobilisation effects, distribution over industries and broader impacts is available as there is no specific monitoring. Clearly, portfolio management covering the whole range of instruments requires comprehensive monitoring.

New means of policy implementation

The implementation of policy has changed substantially during the last decade. In retrospect the most influential driver has been the increasing separation of policy making and policy implementation. Traditionally ministries were strongly involved in policy implementation and direct funding of R&D activities.

With the appearance of technology programmes as a way to mobilise R&D activities in selected themes, pressure to outsource implementation increased. The pressure came first from the limited management capacities of the public administration. The first outsourcing steps were usually limited to single tasks in the implementation process. A well-documented example was the first transport technology programme launched by

BMVIT in the mid-1980s. Various steps in the implementation were distributed across three agencies and consulting firms: ITF was the virtual funding body, FFF handled execution of the financing, AMC was the programme manager and BMVIT supervised and co-ordinated the entire implementation process. The evaluation of the programme (Ohler *et al.*, 1998) recognised the benefits of outsourcing (increased transparency, avoidance of role conflicts) but also highlighted the drawbacks of the chosen model (high transaction costs, unclear division of roles, management capacity tied up in micro-management). Nevertheless BMVIT became one of the pioneers in giving priority to a clear separation of policy and implementation.

As Table 4.1 shows, outsourcing of policy implementation has almost become the standard model for BMVIT and BMWA. However, at BMBWK more than half of the covered measures launched by the ministry are also implemented there. This has partly to do with the high share of institutional measures, which in practice are support schemes for research organisations so that the management component seems less important. Outsourcing has not become an important issue yet.

Table 4.1. Policy responsibility and programme management

Programme management	Policy responsibility			
	BMBWK	BMWA	BMVIT	Total
BMBWK	24			
FFF		2	12	14
FWF	7		6	13
BMWA		9		9
ÖAW	6			6
AWSG		11	1	12
ERP		4		4
TIG		1	3	4
ASA			3	3
BMVIT			3	3
BIT		2		2
HIS	1			1
MAK	1			1
ÖAD	1			1
ÖFG	1			1
WKÖ		1		1
Total	41	30	28	99

Source: tip survey.

From the perspective of the target groups increased programming has substantially changed the rules of the game for accessing public support. The following issues are most important:

- Programmes not only have thematic focuses but also tend to set specific requirements with respect to co-operative settings, information on results, monitoring and evaluation standards.
- Most programmes use tenders for project acquisition and selection. Compared to the established bottom-up project funding, rejection rates are significantly higher.

- Greater selectivity and more demanding project requirements generally result in higher funding rates as a proportion of project costs.
- In order to participate in tenders applicants have to align their project planning on externally set deadlines.

In sum, increased programming has generally lifted the funding threshold in Austria. At this stage, increased programming seems to foster the evolution of "communities", *i.e.* relatively stable networks of firms, research institutions and universities focusing on concrete innovation challenges. Programmes are expected to support the development of critical masses and should ultimately increase the level of organisation among research performers.

New types of interaction between federal and regional STI policy

As elsewhere, regionalisation of STI policy has appeared in Austria. Most Austrian regions have developed STI strategies and mobilised substantial financial resources to implement them. This development has raised the question of the interaction of federal STI policy with its regional counterparts. At this stage no clear-cut model has evolved. Whereas some regions follow a strategy of complementarity, others focus resources on funding that supplements federal funding.

A good illustration is the supplementary funding granted to firms that have successfully applied for FFF project funding, which is offered by several regions. By doing so they delegate project assessment to a federal funding agency. This saves administrative costs and gives firms additional incentives to seek federal resources. From the perspective of federal policy, this approach seems to increase the leverage effect of its funding as additional funding provided by regions allows it to keep its own funding rates relatively low. With respect to the efficacy of public funding, supplementary funding by regions is problematic. The funds provided by regions are not likely to have any impact on project size and orientation, and supplementary funding mainly appears to be a reward for investing in R&D activities.

An interesting example of how federal STI policies can interact with regions is the K*plus* programme launched by BMVIT. This competence centres programme supports the establishment of research platforms that bring together scientific research and innovative firms. Public funding is provided jointly by the federal and regional governments. Federal STI policy sets programme goals and defines the rules for implementation. Participation of regions as co-funding partners in competence centres increases commitment to the programme and to the established centres.

A*plus*B and REG*plus* are other examples of how federal programmes stimulate regions. A*plus*B supports the establishment of incubator facilities at universities or other public research institutions, REG*plus* concerns technology centres and supports regional competence building and networking.

These examples indicate increasing attention to managing federal-regional efforts. Co-ordination mostly takes place on the basis of concrete programmes. Federal STI policy clearly has taken the leading role. From the perspective of regions, federal funding imposes at least implicitly some sort of competition between regions.

Broader co-ordination of federal and regional STI policy seems underdeveloped. Federal STI policy has clearly taken the leading role in terms of financial capability and setting the agenda. Regions often take federal policy as the basis on which to build regional policies.

Creating a learning system

The Austrian STI system is in flux. The trend of separating policy making and policy implementation has changed the governance of the system. The division of roles has become more transparent over time, and increased programming has triggered the establishment of dedicated programme management organisations. This raises a range of management issues. Information flows between the policy and agency levels become crucial, as policy makers who are no longer involved in implementing policies lack information about the success of the measures taken. The challenge is to develop a learning system aware of strengths, weaknesses and opportunities and able to reflect on past experience.

This section explores the ability to learn of the Austrian system with respect to: *i)* strategic intelligence and agenda setting; *ii)* stakeholder involvement; and *iii)* evaluation.

Strategic intelligence and agenda setting

The evaluation of FWF and FFF found a lack of strategic intelligence capacities in the Austrian system owing to a high degree of fragmentation at the policy level and among agencies implementing policy measures. In practice fragmentation means small organisational units (at the policy level) spread over several ministries and relatively small agencies, making it difficult to build strategic intelligence. Furthermore, Austrian ministries have traditionally been strongly involved in implementation (although outsourcing has increased), and this has further constrained tight resources as ministries have suffered from personnel shortages owing to continuing cuts in recruitment.

Given the lack of internal capacity, Austrian STI policy strongly relies on external expertise. Historically the social partners have played an important role, with huge policy consulting units covering major policy agendas. With their continuing withdrawal from decision-making processes, the lack of strategic intelligence has became evident.

Agenda setting

Explicit mechanisms for agenda setting are rare in the Austrian STI system. Agendas evolve informally and internally. The first attempts to define agendas for the whole STI system took place in the mid-1990s when the government commissioned an expert group to prepare a White Paper on research and technology policy. The latest crucial step towards a more transparent and explicit agenda-setting process was the establishment of the Council for Research and Technological Development in 2000. One of its core tasks is to develop long-term strategies for the whole spectrum of STI policy. The National Research and Innovation Plan (2002) was the first step. Unlike the White Papers, which were not binding and left relatively little trace in the policy-making process, the National Research and Innovation Plan has more practical relevance. Obviously, this is supported by the fact that the Council has gained substantial influence over the allocation of financial resources.

It should be recalled that the Council has no mandate for proposing concrete measures. This raises the question of where new measures are designed. Compared to countries with single or dominant agencies (*e.g.* Tekes in Finland) which often take the leading role in programme design, ministries have this role in Austria. In fact, the majority of programmes in the current programme portfolio have has been prepared and designed in ministries. Programmes flag areas of influence, create visibility and ultimately determine the influence of the policy makers that supervise programme budgets.

These conditions create a competitive environment at the policy-making level and are one of the reasons for the fragmentation of existing measures. On the positive side, this type of policy entrepreneurship has kept the system innovative and highly responsive to perceived needs.

Stakeholder involvement

Traditionally, stakeholder involvement has been strong in the Austrian STI system. Again the best examples are the FWF and the FFF, with beneficiaries dominating the steering boards and thus with a strong say in strategic decisions. In the case of FFF, the Federal Chamber of Commerce has played a leading role as it nominates most of the delegates to the presidium.

Involvement of stakeholders has also been institutionalised in the university sector. The University Act 2002 established university councils for each university. The university council has important supervisory functions, including the appointment of the rector. Members of the councils are appointed by the university senate (internal representation) and the ministry. The ministry usually seeks to involve external stakeholders (customers) of the universities. Thus, university councils can be seen as an intermediary between internal and external stakeholders.

At the level of programme development, involvement of stakeholders is not institutionalised. In practice, assessment of needs when preparing new programmes involves active communication with potential beneficiaries. How and at what point stakeholders should be involved in programme design is an important issue. The challenge is to remain responsive to articulated needs without allowing beneficiaries to capture the design process.

The influence of interest groups – most of all the social partners – seems to have declined in favour of "opinion leaders" directly appointed by ministries on various councils and boards.

Evaluation

Programme orientation, together with the increasing propensity of ministries to outsource management, has accelerated the creation of dedicated programme management capabilities at the agency level. Even though overt competition between agencies is still rare, pressures have increased to adopt good practice and accepted quality standards in programme management. At the same time, evaluation is increasingly used to assess performance and the impact of measures.

The establishment in 1996 of Platform Research & Technology Policy Evaluation *(www.fteval.at)* shows the progress made in including evaluation as a learning instrument in the policy-making process. Members include the three STI ministries, the major funding agencies and a group of policy consulting and research firms. The platform has

launched evaluation standards and runs a workshop aimed at improving the spread of good practices in evaluation.

The Austrian Council has supported the systematic use of evaluation by introducing evaluation requirements in its assessment scheme for new programmes. Furthermore, it has developed a strategy for evaluating programmes financed in recent years by additional resources invested by the government (*Sondermittel*). With these stimuli, the Council signals its commitment to evaluation as a policy instrument and positions itself as a portfolio manager relying on systematic information on the performance and impact of measures implemented.

Evaluation capabilities have not yet been developed at the level of policy making (ministries) or at the agency level. The relevant expertise is almost entirely procured from external firms and institutions. As the response to the training workshops offered by the evaluation platform has recently shown, there is a great need to build up internal evaluation competence.

The following tables summarise the results of a survey concerning the use of evaluations. Only 30 of the 110 measures covered by the survey have been evaluated within the last seven years. Evaluation cultures differ among ministries: while BMWA has evaluated 45% of its measures, the rate is 25% for BMVIT and only 19% for BMBWK.

The focus of most evaluation exercises covered by the survey is impact assessment (Table 4.2). Only 36% of conducted evaluations focus on processes and management of measures.

Table 4.2. Main focus of evaluations as a percentage of all evaluations conducted within the last seven years

Processes and management	36 % of conducted evaluations
Impacts (economic, scientific)	73 %
Quality of work	36 %
Other	33 %

Source: tip survey.

Table 4.3 reveals that evaluations mostly have a legitimating function (90%). Only one-fifth are used to make stop-or-go decisions. Only in two out of 30 cases did evaluation lead to changes of programme management processes.

Table 4.3. How have the results of the evaluation been used?

Impact of evaluation	N	%
Ex post legitimisation of the programme	27	90
Reallocation of funds	10	33
Input for stop-or-go decisions	6	20
Substantial change of funding policy	9	30
Change of processes	2	7
Other	9	30
Total	30	

Source: tip survey.

In sum, some progress has been made in using evaluation as a policy tool. Nevertheless the use remains somewhat defensive. The use of evaluation as a learning tool that helps to improve programme implementation and allocation of resources still plays a minor role. The strong involvement of policy in the implementation of measures partly explains the defensiveness in the use of evaluations.

Summary and lessons learned

Austria's STI policy system is currently in flux, with changing governance regimes and substantial reorganisations under way, so that the assessment of new regimes remains difficult. The main challenges ahead seem to be the reorganisation initiated by the University Act 2002 on the one hand and the reform of the funding system on the other.

The main findings with respect to the governance of the "old" system are as follows:

Organisational setting at the policy level. STI agendas are spread over three ministries. Historically the ministries focused on specific target groups. BMBWK focused on the university sector, BMVIT on state-owned industries and BMWA on SMEs and basic STI infrastructure for firms. This division of labour has blurred over time. At this stage distribution of agendas at the policy level is perceived as overly fragmented. BMF is the fourth ministry that plays an active role in STI policy. It recently reorganised the funding basis for public funding and plays an important role in the allocation process. STI seems to require further development as a horizontal policy field. On the basis of funding activities, about 95% of public funding of research, technology and innovation is governed by these four ministries.

Organisation at the agency level. Historically the funding system was built on the three main agencies. Bottom-up funding of single projects was the prevailing funding instrument. Governance of the funding system was marked by strong involvement of beneficiaries, and there was limited policy steering capacity. Increased programming led to the establishment of new dedicated programme management agencies and expanded portfolios for established agencies. As a result, the funding system became increasingly fragmented. In reaction, a reorganisation process has begun which involves the merger of funding agencies into two new ones.

Policy mix. Traditionally, institutional funding and bottom-up project funding were the main instruments. During the last decade increased programming, together with increasing public expenditures on R&D, has resulted in a very diverse policy mix. Institutional funding still plays an important role. General university funds are still extremely high by international standards. Indirect measures (taxation) have expanded substantially as a result of the last tax reforms. There does not seem to be sufficient systematic management of the policy mix.

Steering instruments. Recent changes indicate a profound shift in steering regimes. The policy level has tried to withdraw from the operational level and has set up control and incentive structures. The best example is university reform, which has introduced performance contracts as the central steering instrument between policy and the university.

Strategic intelligence. Owing to the high degree of fragmentation, the development of strategic intelligence capacities has been difficult. So far, policy has relied greatly on external expertise. To some extent the establishment of a consulting platform (tip) that has brought together the three STI ministries and several research institutes has compen-

sated for weaknesses in strategic intelligence. Furthermore the Austrian Council has taken up strategic tasks. Current discussions on the reorganisation of the funding system have put the question of where to locate "strategic intelligence" capacity back on the agenda. It is expected that the ministries will further withdraw from policy implementation and focus on more strategic tasks.

Agenda setting and policy entrepreneurship. Institutionalised mechanisms for agenda setting are rare. Agenda setting often seems driven by a specific type of policy entrepreneurship. This has to be seen in the context of fragmented institutional settings, which creates competitive environments at the policy level. In practice, competition is seen in programming activities with programmes the "currency" of the policy-making process. Programmes flag areas of influence and define room for manoeuvre in terms of control of financial sources.

Stakeholder involvement. Involvement of stakeholders is evident at different levels. Institutionalised forms of stakeholder involvement exist for university boards and major funding agencies. Moreover the composition of the Austrian Council represents to some extent a form of stakeholder involvement. Overall the influence of interest groups – most of all the social partners – seems to have been reduced in favour of "opinion leaders" directly appointed by ministries to represent their group in various councils and boards.

Evaluation. Progress has been made in using evaluation as a policy tool. Nevertheless it is used somewhat defensively in the sense that most evaluations are primarily used to legitimate programmes. The use of evaluation as a learning tool which can help to improve programme implementation and allocation of resources still plays a minor role.

In terms of lessons to be learned from Austria, the following seem worth highlighting:

- Policy makers act in a competitive environment, particularly when areas of responsibility between ministries overlap. Policy entrepreneurship creates fragmentation and does not replace strategic intelligence. On the positive side, policy entrepreneurship stimulates innovation and responsiveness to policy customers.
- To maintain innovativeness while keeping fragmentation at acceptable levels, STI policy systems need a centre of gravity and a referee that supervises the allocation process and imposes a common point of reference for performing communities and policy makers.
- Autonomous funding agencies with beneficiaries in the driving seat tend to preserve the status quo. Stakeholder involvement cannot compensate for deficits in strategic intelligence at the policy level. Reducing the flexibility of established systems encourages management to go beyond these systems and to rely on other sources of funding.

Annex 4.A

Table 4.A.1. Milestones in the evolving STI system

1954	Bürges	Bürges was set up as a bank specialising in the provision of equity capital for SMEs. Together with FFG it evolved as one of the two major agencies providing specific capital guarantee products for start-ups.
1954	ACR	Austrian Cooperative Research was established as the umbrella organisation for the co-operative research facilities of the Austrian business community
1956	ARCS	Foundation of the Austrian Nuclear Research Centre Seibersdorf. After Austria opted out of the nuclear energy production (plebiscite 1978) ARCS diversified its research portfolio into areas such as new materials, environment research, systems research and life sciences.
1959	LBG	Ludwig Boltzmann Gesellschaft. This network of research institutes tackles mid-term, use-oriented research, but does not involve industry. The 135 Boltzmann institutes together employ only 200 people and are mostly located at universities. The Society is at present relaunching its activities, aiming to link research better with research users and to reduce the fragmentation of the institute system it manages. It has an annual budget of EUR 12 million.
1962	ERP	The ERP Fund was established under the Marshall Plan for European reconstruction after the Second World War to support business development. ERP focuses on supporting technology transfer, R&D and innovation projects that are rather close to market and require significant investment in order to be realised. Support is primarily in the form of loans and guarantees.
1967	FFF	FFF provides bottom-up project funding for the industry sector. It focuses on pre-competitive research and tries to address specific areas (technology fields, sectors) via priority funding lines. Its budgetary scope has continuously increased in the last decades and it now operates at the level of around EUR 120 million cash-value of funding.
1967	FWF	FWF is the main funding source for scientific research. After continuously increasing during the last decade, the budget for one year has come close to EUR 100 million The bulk is still spent on bottom-up defined projects from the university sector. However during the last years FFF increased its effort to concentrate funding sources on high potential areas and scientific teams.
1969	FGG	In addition to Bürges, FGG provides equity capital for start-up companies as well as tailored guarantee products in specific technology fields.
1972	ASA	Austrian Space Agency (ASA) was set up by the Ministry of Transport and Innovation with the task of co-ordinating Austria's space activities. In recent years, it has edged into high-technology innovation programme management (for example in nanotechnology) and operating innovation-related awareness and information campaigns on behalf of BMVIT.
1984	Innovations-agentur	The innovation agency has launched a range of soft measures addressing perceived deficits in the management of intellectual property rights (TECMA) and in the access to market and technology information (Tecnet). Furthermore it has set-up the first Austrian business angel network (i2) and runs several innovation prize competitions.
1987	ITF	The innovation and technology fund (ITF) was set-up as virtual funds steered by a policy dominated board (*Kuratorium*) and administered jointly by ERP and FFF. ITF established technology programmes as a new way to target public R&D funding.
1989	CDG	Christian Doppler Gesellschaft (CDG) was established in 1989 and supports fairly small-scale co-operation between industry and academic research, using on-campus CD laboratories for this purpose. These are, in effect, similar to the Kplus competence centres, but operate on a much smaller scale. In 2003, the CDG had a budget of EUR 11.3 million and supported a total of 44 companies and nine universities in 33 CD laboratories.
1993	BIT	BIT was set up in preparation of Austrian membership in the EU. It provides information and practical help to Austrian applicants to the EU R&D and innovation programmes. Its beneficiaries include companies and parts of the knowledge infrastructure. It hosts the Austria Innovation Relay Centre, providing technology and partnership brokerage.
1998	TIG	*Technologie Impulse Gesellschaft* was established in order to run the K*plus* competence centres programme, which brings together industrial consortia and academic research over a seven-year period. TIG has grown to become the specialised agency for programmes that aim to induce structural change or changes in the way institutions work. Several of its programmes address science-industry links. All of TIG's instruments use rather formal calls for proposals and competitive processes for selecting projects. Its 2002 budget was some EUR 15 million.
1993	Polytechnics	Polytechnics have been set-up to expand the portfolio of tertiary education. The aim was to offer qualifications close to industry needs with immediate practical relevance. They should also help regional states with no university infrastructure to develop their education portfolio.
2000	RTD-Council	The Council for Research and Technology Development was set-up by the new government coalition as an advisory body to the federal government and regional authorities. This involves development of long-term strategies as well as monitoring functions.

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Chapter 5

CHANGING GOVERNANCE FOR INNOVATION POLICY INTEGRATION IN FINLAND

Marja Häyrinen-Alestalo, Antti Pelkonen, Tuula Teräväinen and Sampo Villanen
University of Helsinki, Department of Sociology,
Helsinki Institute of Science and Technology Studies

Finland has recently undergone a radical shift in government orientation from state regulation towards a market-driven science, technology and innovation (STI) policy. This strategy has raised the country to the top of performance indicators for the knowledge economy. It has also prevented further horizontalisation of innovation policy. Finland's experience indicates that it is difficult for actors outside core STI policy to participate in wider policy making and that some players do not have the competence needed to act horizontally. A hegemonic mode of action is evident in various policy practices that are also characteristic of the councils that have been set up to act in a horizontal framework and of the corporatist traditions of negotiation and representation. Even though sectoral strategies still predominate, there are attempts to expand innovation policy to include social issues. Such cases require co-operation between the private and public sectors.

The challenges of a systemic conception of innovation

This chapter examines the theoretical and empirical evidence of a desire for a coherent and integrated innovation policy and looks at the relevant opportunities and contradictions. Up to now, it has been increasingly demonstrated that science and technology are integral components of social change and promote market competitiveness. The theories of the knowledge society, the new economy and the globalising learning economy (Bell, 1973; European Commission, 1998, 2001) have tried to estimate the input/output ratio of human and material resources as well as the impacts of new technologies on economic growth. They have created an infrastructure for integrating technological, economic and industrial policies but have given social issues little attention.

When the concept of the new economy lost favour owing to the recent turbulence on world markets linked to information and communication technologies (ICT), the OECD and the European Union reintroduced the concept of the knowledge economy and emphasised its relation to socio-economic problems. Although there has been much discussion in the OECD of a national innovation system (NIS) that is capable of fulfilling more dynamic goals, the main emphasis has been on national institutions and economic growth. However, the idea of increasing innovation in a knowledge economy becomes problematic when the performance criteria are different from efficiency criteria and refer to activities that are non-marketable by nature.

Closely related to demands of for broader representation, horizontality is a concept that refers to the crossing of boundaries between different policy domains. The development of a horizontal policy involves putting a broader strategic approach above departmental goals through the integration of priorities and objectives across various policy sectors. In respect to innovation policy, horizontal governance has been seen to imply the integration of "innovation thinking" into other policy domains (Chamberlin and de la Mothe, 2004, p. 4) and greater attention to the interfaces with policy sectors that use and apply technologies. In the view of the European Commission (2003, p. 50), innovation is "too important and too ubiquitous in a knowledge economy to be addressed only by innovation policy". However, innovation policies in OECD countries still tend to be departmental or sectoral and characterised by low interdepartmental co-operation. Linear models tend to dominate, and innovation policy is seen in terms of specific, narrowly defined fields in which the central focus is on a simple calculus of national R&D spending. The development of horizontal innovation policies therefore requires a broader understanding of public policies for innovation, changes in how innovation is understood, systemic policy instruments and better co-ordination of European, national and regional levels (Edler *et al*., 2003). There is also a need to solve the division of labour between the public and private sectors.

Top-down co-ordination and decentralised market mechanisms have been used to promote horizontal activity. Yet such mechanisms may fail in increasingly complex societies. In principle, horizontal governance depends on the degree to which innovation policy is guided by a comprehensive strategy that integrates contributions from various sectors (Remøe, 2004). The establishment of high-level councils with the "authority to take into account issues of social and ecological sustainability and the power to counter short-term views of finance capital" has also been regarded as a way to develop more cross-sectoral innovation policies (Lundvall *et al*., 2002, p. 227). Furthermore, horizontal policy implies changes in innovation policy objectives to take account of different economic, social, cultural, human and ecological objectives. The development of a horizontal policy therefore not only implies the dominance of innovation over other policy domains but also integration of objectives of other policies in innovation policy. Integration as such is not, however, sufficient, as there are also important ethical issues relating to what a good policy and a good society should be.

This chapter analyses Finland's innovation policy from the viewpoint of a systemic approach. The key theme is horizontality and the means of achieving it for innovation policy. Four set of topics are considered:

- First, Finland's development from a low-technology country to an internationally recognised high-technology country is described, emphasising the interplay between the government's programmatic choices and the changing socio-economic environment. An historical and cultural section analyses the development of science and technology policies and their integration into innovation policy. It illustrates the recent rapid changes in the Finnish political climate in favour of a market-oriented knowledge economy and shows the kind of benefits but also rigidities that can result from massive public investments in new technologies. The same story can be told by looking at traditional and new indicators of national innovation performance. Both of these analyses reflect an authoritative government orientation that limits the scope for a horizontal policy.

- Second, attention is paid to the new demands of innovation policy in Finland and to the opportunities and obstacles of a more systemic and horizontal approach. Particular attention is paid to the forms of mediation and representation in political actions and in the processes adopted by Cabinet members and high-level government authorities to pursue a more expansive innovation policy. The principles of neo-liberalism are viewed as setting a frame for a reform agenda, and the possibilities for an NIS and knowledge economy to provide elements of a broader innovation policy are discussed. The limitations of the expertise and the mandates of the key ministries are illustrated by an analysis of the Academy of Finland and the National Agency of Technology.
- The peculiarities of Finnish political action and its tendency to pursue selective policies are explored in greater depth, with examples taken from the Science and Technology Policy Council of Finland and the corporatist decision-making system that is used outside Finland as well, to point out the horizontal elements of formal democratic action.
- Finally the increasing tension between market orientation and welfare services is explored by focusing on the interplay between innovation policy and health policy. The clash of interests between these policies is typical of Finland, where the public welfare sector has been undermined at a time when neo-liberal strategies of privatisation and competition have been introduced as a part of public-sector rationalisation.

The data used in the analysis consist of documentary material and interview data. The former includes relevant governmental strategies for STI policy, as well as for economic, industrial and health policy. The interviewees are high-level policy makers in the science and technology administration and the health sector. Earlier interview data consisting of interviews with decision makers in Finnish science and technology policy are also used.[1]

The importance of government orientation for policy integration in Finland

In Finland policy integration cannot be understood without looking at the welfare state that existed from the 1960s to the 1980s and the subsequent transformation of government ideology in the early 1990s. It was at that point that Finland began to move extremely rapidly from a Nordic welfare state to an internationally recognised market-driven high-technology economy with a neo-liberal political orientation. These two, almost opposing, processes have affected the consistency of policy making and the infrastructure of the former national knowledge creation system. Today there are important new power structures and policy tensions. Thus, policy integration is not a new phenomenon and changes in state ideology can modify the patterns of governance in notable ways.

1. We are grateful to Saara Kupsala for her contribution to data collection and elaboration.

The cross-cutting social dimension of the politics of the welfare state

It is characteristic of the Nordic welfare state that it tends to be hegemonic, interventionist and expansive in its social, cultural and economic functions. It aims to increase budgetary needs as well as ideological instruments for state intervention. In Finland the building of the welfare state from the late 1960s was accomplished through notable reforms in the education, social, health and childcare systems. These services became free and were funded from public resources, and the respective policies were linked together through the cross-cutting ideas of social rights and equal opportunities. Policy preparation was sector-based and founded on rational planning, state control and regulation.

Finland, like other Nordic welfare states, is committed to the promotion of scientific institutions and research, and both the natural and social sciences have benefited. In addition to the expansion of the science system in the 1960s and 1970s, the government incorporated the idea of social relevance in both university and science policies (Alestalo, 1993). The issues of education, university and science policies were also discussed in parliament. In line with the government's regional policy, new universities were established throughout the country, and the university system was placed under the Ministry of Education. The political aspiration was both to have a cultural impact on the regions and to create jobs that fulfil the needs of the welfare state.

State intervention in science policy was accomplished by reorganising the primary funding organisation for academic research, the Academy of Finland. By an initiative of the President of the Republic, who took the lead in university, science and industrial policy, a system of research councils was established and the Academy was placed administratively under the Ministry of Education. Increased state intervention on scientific issues was evident in the selection of five research priority areas, again based on the premises of well-being and equality of the welfare state.

While the early Finnish welfare state viewed the social dimension as an integral programmatic part of education, science and university policies, the government did not want to involve private capital. The It emphasised the importance of state control and tended to see private money as a danger to the development of a just society. This concept strengthened the integration of key policies but created the basis for a dual structure of science and technology policies. It also created tensions between the state and industry.

Using technology as a means of government intervention

The Finnish welfare state also expanded its economic function and made efforts to modernise export industries. Finland industrialised late and its structure of production was based on low-technology and primary industries (metal, pulp and paper). Foreign trade was strictly regulated up until the European Free Trade Association (EFTA) agreement of 1961.

As a sign of a strong nation state and as part of its regional policy, the government established new state-owned companies. It increasingly saw governance as dependent on international markets and wanted to regulate investment and take responsibility for balancing market fluctuations and market risk. The modernisation of industry required large investments which only the state could afford. The Ministry of Trade and Industry took the first steps towards technology policy by giving direct subsidies to industry.

Increased competition on world markets raised a discussion of the state's means of promoting innovation as part of economic, industry and competition policies. The committee that was set up to explore conditions for the structural transformation of industries emphasised the importance of export industries and compensative technologies and debated possibilities for increasing domestic technological resources and abolishing restraints on technological and commercial education (KTM-68 Committee, 1969). However, because old industries found markets in the Soviet Union, the development of high-technology areas was retarded. New investments were focused on the state-owned Finnish petrol industry which imported oil from the Soviet Union and based its high technology on foreign licences.

In the 1980s, Finland's international orientation increased and government R&D expenditures in general and direct support to economic innovations in particular were seen as strategically useful. Emphasis was also placed on economically and technologically relevant research. Concomitantly, the share of the Ministry of Trade and Industry in total government R&D expenditures increased between 1970 and 1986 from 19% to 39%, while the expenditures of the Ministry of Education dropped from 57% to 37% (Alestalo, 1988, p. 29). New strategic priorities challenged the established infrastructure of knowledge creation and diffusion. The government had already renovated the science infrastructure prior to the reorganisation of the industrial and technological systems. It recognised the need to pursue a selective technology policy (Lemola and Lovio, 1986) focused on ICT.

In the 1980s the government introduced changes that have influenced later technology policy governance and the division of labour between science and technology policies. The National Technology Agency of Finland (Tekes) was established in 1983 in order to rationalise the administration of technological R&D, to establish an expert organisation for international and national co-operation and to integrate national economic, industrial and competition policies. Administratively, it was placed under the Ministry of Trade and Industry. When almost the entire staff of the ministry's technology office moved to Tekes, the ministry's strategic role was weakened. A rapidly growing budget for technological R&D also strengthened Tekes's power.

The Science Policy Council, which had never achieved great prominence in science policy and did not have much influence on matters pertaining to the promotion of research, was reorganised into a new Science and Technology Policy Council with expanded functions for the promotion of high technology. It was also an attempt to create synergy between scientific and technological issues in policy planning and to increase the government's commitment to science and technology. The expansion of the Council in the direction of technology also strengthened the role of the Ministry of Trade and Industry. High political commitment to science and technology had already been given some years earlier when the government agreed on principles of technology policy and gave its report on technology policy to parliament.

While changes in technology policy were national in orientation, there was aggressive lobbying on the part of the government, Tekes and industry to gain Finland membership in Eureka, the European Space Agency and in CERN. The OECD and the EU became more important models for national economic and industrial progress. State activism reflected a corporatist decision to increase the financial input to high technology. Guidelines for political choices were formulated on the basis of recommendations and comparisons of national performance among OECD countries. Furthermore, the collapse of trade with the Soviet Union and economic depression activated interest in ICT as a

symbol of advanced western technology. However, some scientists and representatives of labour unions questioned the power of technology to solve social problems.

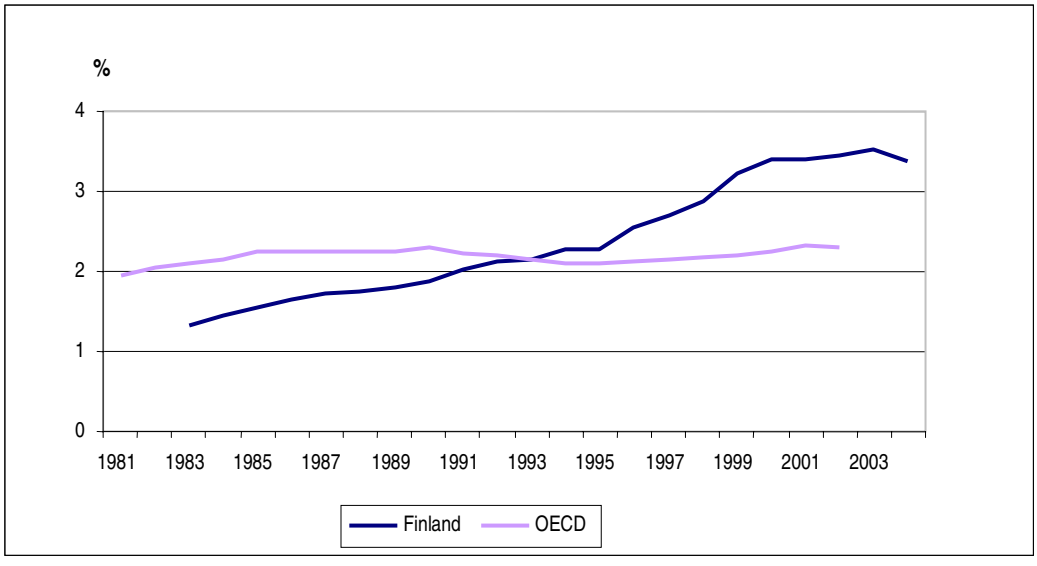
Becoming a model of the knowledge economy

In the early 1990s, Finland abandoned its welfare state ideology and reconsidered the government's responsibility as provider of welfare services. Successive governments have emphasised neo-liberal ideas, such as privatisation and market competition, questioned the regulatory mandate of the state and taken competitiveness in international markets as the primary criterion of national performance (Cabinet programmes, 1995, 1999, 2003). The shift from government control to market regulation has been more rapid in Finland than in the other Nordic countries.

After introducing the logic of market forces as a model for rational action, the government decided to privatise state-owned companies. When other European governments decreased their funding for science and technology, the Finnish government used the capital from the privatised companies "to make the functioning of the national innovation system more effective for contributing to the growth of the economy, entrepreneurial activities and employment" (Academy of Finland, 1997, p. 11). The money was used selectively in order to make Finland the most knowledge-based economy in Europe. Government inputs to R&D have been well over the OECD average (Figure 5.1).

Figure 5.1. Total R&D expenditure in Finland and in the OECD area, 1981-2004

Percentage of GDP



Source: Statistics Finland (2002, 2004, 2005).

While the Finnish welfare state used social justice and a community ethos as the cross-cutting idea behind policy integration, the vocabulary of the knowledge economy is market-oriented. This strategy is a mixture of the ideas of the new growth theory, the new economy and the knowledge economy. Finland's knowledge economy has directed R&D to new technologies, in particular to ICT, biotechnology and materials technology.

The Finnish model of a knowledge economy has taken innovation as a generic concept that is progressive and horizontal by definition. Innovation sets new challenges for science and technology and for their collaboration. It reflects political aspirations to regard all types of producers of knowledge as important and to weaken the monopoly of academic knowledge. Performance criteria emphasise competition and efficiency and are derived from international markets.

This view tends to follow those of the OECD and the European Union (OECD, 2001; European Commission, 1998). Since Finland became a member state of the EU in 1995, the government has defined its role as a supporter of market-driven activities. Still, it is unsure about the new means of governance. Cuts in the public sector, including for elementary schools and universities, have strengthened antagonism in the scientific community and among citizens. In fact the latest governments have faced the problem of maintaining credibility as builders of a Finnish society that "is democratic, just and socially coherent" (Cabinet programme, 1999). The latest Science Barometer (2004) shows that although citizens trust science and technology, they do not trust politicians and big industry.

In recent years the idea of the knowledge economy has penetrated technology, economic, industrial and competition policies. The push towards a market orientation has also entered science, university and education policies.

- In **science policy** references have been made to attaining market competitiveness through a strong science system. Funding instruments have been increasingly directed to multidisciplinary research programmes dealing with problems that are relevant to the knowledge economy. Some have been co-financed with Tekes. Furthermore, the Academy of Finland has made efforts to integrate the centres of excellence with the new technology competence centres. The evaluation criteria include high-level scientific work and actual or potential economic impacts. Most of the centres are in ICT or biotechnology. These new technology fields have also received most of the doctoral school places. Furthermore, the Academy has viewed university-industry links as important and has noted the social/economic impacts of a variety of scientific fields (Academy of Finland, 2003).

- In **university policy** the pressure towards market orientation has become stronger with the adoption of new regulatory instruments concerning management and commercialisation. The Ministry of Education increasingly ranks academic disciplines and research according to their investment and use value. The definition of human capital has changed. The aim of the welfare state to advance the development of the science system as a joint project of the natural and social sciences is no longer emphasised. Instead the social value of the social sciences and humanities is viewed in terms of ICT and biotechnology (Häyrinen-Alestalo and Peltola, 2005). At the same time, the concept of science-based knowledge is moving towards innovation-based technology and there is government pressure to develop awareness of market governance and entrepreneurship for the commercialisation of knowledge.

- In **education policy** knowledge and competences have been promoted as part of a competitive and globalising economy. Evaluation and ranking of schools have become part of knowledge management, and there is concern about the lack of an entrepreneurial spirit among pupils. In spite of reductions in resources for public education, the government has high expectations of basic and higher education.

In the face of the increasing uncertainties of the globalising economy, the Finnish government has pursued a systematic policy of promotion of new technologies. This support has been based on three premises:

- It is the state's duty to meet the challenges of globalisation by investing in new technologies.
- The government's money is capital-intensive.
- Markets are open to all producers of knowledge.

However, technology policy makers have found it difficult to decide on the extent of state intervention, and government authorities are unsure of how to maximise national utility and minimise national risk. Public inputs to biotechnology have also produced non-marketable goods and there is pressure to shift the concept of governance from the old forms of corporatist representation towards new forms of participatory democracy (Häyrinen-Alestalo and Kallerud, 2004). While ICT may be considered a model of a generic technology that can change the economic and social order, the extent to which biotechnology is a generic technology is less clear.

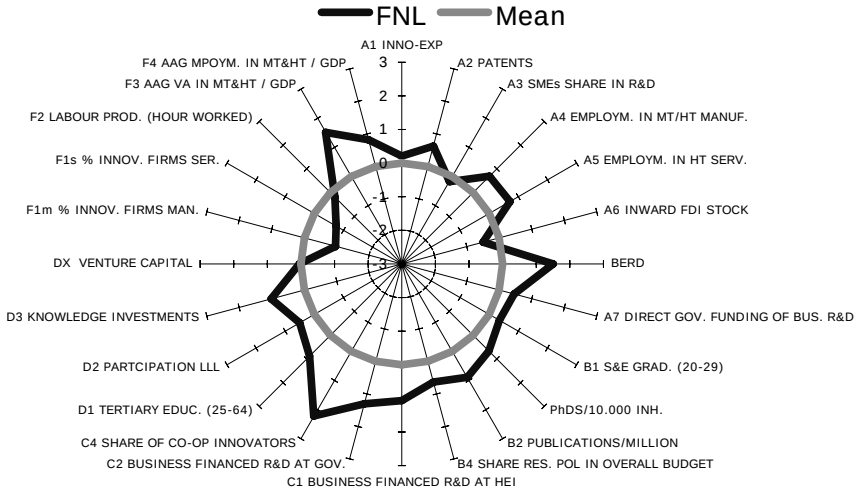
Profiling the dimensions of Finnish success

Today Finland is recognised as one of the world's leading knowledge economies, and there have been attempts to transfer its strategic choices to other countries. Although Finland has moved rapidly towards market governance, it also has an internationally favourable position in terms of features common to all Nordic countries, such as its business environment, low level of corruption, respect of contracts and rule of law (Transparency International, 2004).The Finnish model is based on strong and systematic STI policies, especially for developing the ICT sector. These efforts are evident in the STI indicators developed from various EU and OECD sources by den Hertog and Vandeberg (2003). To show Finland's specific characteristics, the information shown in Figure 5.2 is supplemented in the following discussion by additional indicators from the OECD, EU and Finnish statistics and evaluations.

Good performance in patenting

Patenting is an important indicator of technological competitiveness, and Finland ranks third among the MONIT countries in terms of patenting per 1 000 population. For high-technology patents, it is clearly above the EU average and the gap with other European countries seems to be increasing (European Commission, 2004). Patenting as an indicator of technological productivity is problematic, however, as all inventions are not patented (for secrecy, cost or timing reasons) and patents do not all have the same value (Eurostat, 2003, p. 84). Countries' industrial structure should be taken into account in international comparisons as well. Finland's strong performance in patenting can be partly explained by its specialisation in ICT and biotechnology.

Figure 5.2. Finland's STI performance in relation to the average level for MONIT countries



Strong science policy and strong and weak education policy

Finland's high investment in science and education is reflected in high rankings for education and research. The large share of the population with tertiary education is viewed as an important competitive advantage (Ministry of Trade and Industry, 2003, p. 55). Finland also ranks high on other education and research indicators, although, owing to restricted public funding, it seems to be losing momentum in terms of science and engineering (S&E) graduates, lifelong learning and tertiary education, when compared to other EU25 countries (European Commission, 2004).

Active in the commercialisation of academic knowledge

Owing to the increasing emphasis on commercialisation, Finnish universities, research institutes and companies are relatively highly networked. Among EU and MONIT countries, Finland had the highest share of innovative firms that co-operated with other firms, universities and public research institutes in 1994-96. National studies have, however, found many obstacles to commercialisation efforts (Pelkonen, 2003; Häyrinen-Alestalo and Peltola, 2005). Business funding of universities increased significantly in the 1990s, and Finland ranks high among the MONIT countries in terms of business-financed R&D performed by higher education institutions and government research institutes.

Problems in attracting foreign investment

In spite of the Finnish "miracle", the country does not attract a great deal of foreign direct investment (FDI). The government has attempted to increase Finland's attractiveness by gradually removing earlier restrictive policies. As a result, while the overall trend in many western countries has been in a decline in FDI inflows, they have increased in Finland (UNCTAD, 2003, p. 68). However, FDI as a share of GDP is still relatively low (Prime Minister's Office, 2004, p. 67), and it has been argued that further market deregulation is needed to improve the absorptive capacity of Finnish economy in this respect.

Weakness of systemic indicators

There is an imbalance between investments and outputs in terms of the efforts made to increase the national knowledge base. According to Naumanen (2004, p. 19), Finland invests heavily in knowledge production and learning but does not use investments optimally. In relation to the "knowledge-value society" indicators (bringing in sustainable development and social values), Finland lags behind other Nordic countries, especially Denmark, and the Netherlands. Problems for utilising innovations and exploiting R&D investments are seen as related to Finland's weakness in terms of product development and commercialisation, especially for customer-oriented innovations (Prime Minister's Office, 2004, pp. 47-48).

Problems with innovative small and medium-sized enterprises

The small number of innovative SMEs is one of Finland's weaknesses, although this is among the main policy priorities (Ministry of Trade and Industry, 2003, p. 56). In terms of business expenditure on R&D (BERD) as a percentage of GDP, Finland ranks second worldwide owing to the rapid growth of high-technology industries. Business innovation is, however, highly concentrated. The share of electronics in business R&D expenditures is approximately 50%, with Nokia alone accounting for the largest share (Statistics Finland, 2004). Likewise, the share of SMEs in BERD was only one-third of total business R&D performance in 1999 and is one of the areas in which Finland performs below the MONIT average (OECD, 2002, p. 119).

The problem of structural unemployment

High structural unemployment has been typical of Finland, even during the years of rapid high-technology-based economic growth (10.2% in 1999). Successive governments have presented programmes to solve this problem. However, in the 1990s the growth of total employment in high- and medium-high-technology industries was the fastest in Finland among the MONIT countries (European Commission, 2001, pp. 52-56). Growth continued in 1997-2003 (Eurostat, 2003, p. 116), but unemployment is still high by European standards at 10% in January 2005.

The Finnish miracle reconsidered

Even though Finland's success seems clear, as measured by traditional indicators of economic growth, other indicators suggest that its leading position can no longer be considered self-evident. During the past few years, Finland's position in international comparisons has clearly weakened. Its changing position in international markets is also shown in the recent decreasing numbers of industrial jobs and market-share losses,

especially in the ICT and wood industry sectors (Prime Minister's Office, 2004, p. 131). On the other hand, on may ask what is meant by a country's competitiveness. The indicators discussed tend to focus on the macroeconomic environment, public administration and R&D efforts and often elude social aspects such as health care and environmental issues.

Innovation policy as an agenda for reform

The national innovation system and new demands for coherence and flexibility

In general, positive expectations of progress and advancement have underpinned political arguments in favour of innovation in Europe, and there has been less discussion of possible negative effects. Today innovation is supposed to guarantee economic growth, competitiveness and employment, and a better quality of life and the transformation of the whole pattern of the citizens' lives are mentioned among the primary goals. When innovation is related to the capability to improve social spheres, even to change the whole social order, the need for integration and horizontality is clear. Innovations designed to provide good social services cannot serve as a systemic means to achieve greater well-being before the problem of shared responsibilities is solved.

Finland has been a pioneer in the adoption of the concept of the national innovation system which has also challenged the traditional knowledge infrastructure of science and technology (Miettinen, 2002; Smith, 2005). Since the 1990s the national innovation system has been used as a political instrument for linking elements of interaction to reformist aspirations of liberalisation, deregulation, marketisation and privatisation. The Finnish innovation system was created to favour a hybrid mode of knowledge production where the borders between science and technology tend to disappear. In many respects the innovation system is still seen as a forum where issues of venture capital, commercialisation and product development are discussed. International evaluations have regarded the Finnish innovation system as signalling political goodwill, high-level government commitment and an innovation-promoting environment. They have also referred to the need to improve the flow of human capital and to further increase co-operation among a broader set of relevant agencies (Ministry of Trade and Industry, 2003, p. 116).

To make the innovation system more flexible, some technology policy makers have begun to speak of a harmonised innovation system in which basic sciences can live together with instrumentally oriented sciences and are therefore worth financing. They have also referred to an innovation environment that is more open to new actors and policy areas. The views of interviewees reveal four types of conceptions of the national innovation system and innovation policy:

- The first type sees the innovation environment as requiring an interplay between broader uses of knowledge and competences in knowledge creation, diffusion and producer/customer relations. Here result-based management functions both as a means of regulation and policy learning. The desire to make the boundaries of the system more transparent is not very strong.
- The second type points to the generic nature of the innovation system and policy and their ability to form a common and coherent framework for other policies. These technology policy makers represent organisations that have defined the

core areas of innovation in a traditional way, with an exclusive and hegemonic innovation system.

- The third type regards the innovation system as representing one policy viewpoint among others and points to its limited use as a general policy framework. Decisions made by the actors in the innovation system do not concern innovation policy alone.
- The fourth type stresses the importance of a more systemic concept by pointing to the need to scrutinise the dominance of the Ministries of Education and Trade and Industry. They point to the need to see innovation from a liberal and comprehensive perspective that is open to ideas of non-marketability and delivery of services. This view emphasises the importance of understanding goals and means of decision making and of constructing new models of quality control and competition.

In Finland the idea of the innovation system is skewed owing to the primacy of technology policy. As a large share of public funding has gone to high technology, policy makers and government administrators have been primarily interested in industry issues. A specific bottom-up policy has been pursued in which the needs of industry have determined the choice of technology policy priorities. The structural peculiarity and rapid diversification of R&D performers can also be illustrated by looking at the growth of R&D expenditure in Finland by sector in 1983-2003. The rise in the share of business enterprises is dramatic (Figure 5.3).

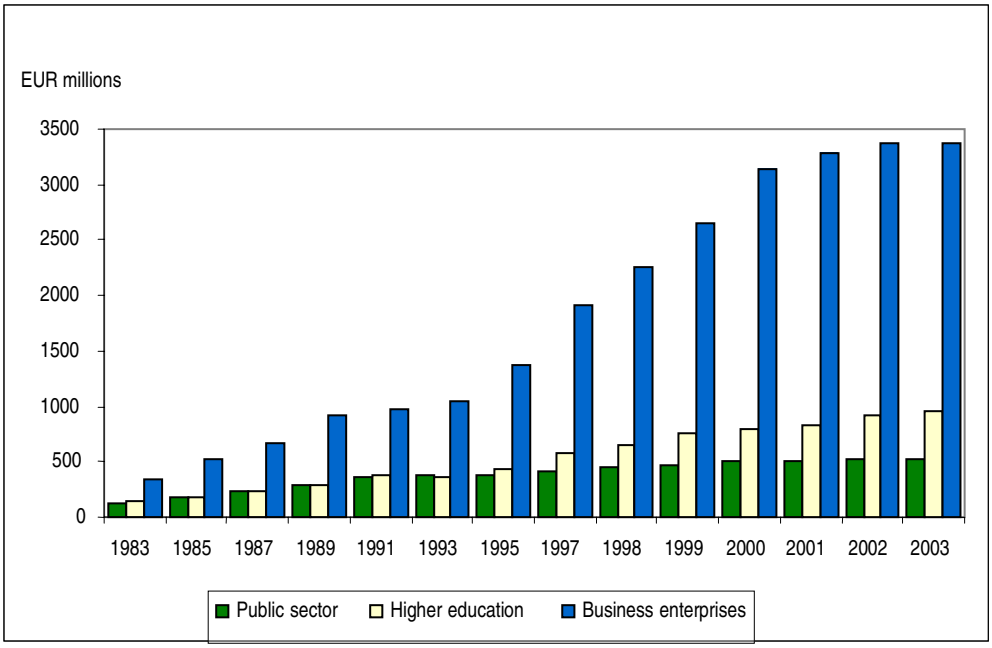
Accordingly, innovation policy can be used in Finland to pursue a politics of power and the powerful business sector occupies the space for market governance.

Integrated innovation policy poses questions of legitimacy and expertise

The search for conditions for a systemic approach to Finnish innovation policy raises new questions of legitimacy. The idea that innovation policy is more than science and technology policy shows the need for a new approach. This is not easy owing to a national consensus about the importance of science and technology policy which is evident in political action. However, as a result of this consensus, the setting of goals is in the hands of these two sectors, and many important issues are not addressed. Thus, the horizontality of consensus is not enough to achieve a broader innovation policy. From a strictly economic point of view, national innovation policy in Finland has been criticised for relying on the achievements of a model from the late 1990s, making it difficult to incorporate the elements of reform required to meet the challenges of globalisation, such as the lack of attractiveness for foreign capital and the rigidity of national labour markets (Vartia, 2005).

Figure 5.3. R&D expenditure in Finland, by sectors, 1983-2003

EUR millions



Sources: Statistics Finland, 2002; 2005.

As the responsibilities of various policy sectors (ministries) are determined by law in Finland, there seems to be a continuous struggle over whether to keep the old mandates or how to integrate new issues into the old structures of governance. While membership in the EU has modified these mandates, the main decisions and policy outlines are made at the highest level, *i.e.* in the Cabinet, which is responsible for all policy areas. Cabinet members should be able to make broad strategic choices and to discuss socio-economic issues. In principle, this can lead to a horizontal approach. Some policy makers stress, however, that ministries outside the core science and technology ministries do not have the competence necessary to formulate the goals of innovation policy, however encompassing it may become. Others think that they can act as the mediators of conflicting interests between the economic and social policies. At the same time they say that the social sphere and the idea of social innovations is new to them. They lack the competence to resolve many new issues.

In terms of a broader, horizontal innovation policy, governance issues are important. Some interviewees point out that there is no legally defined place for innovation policy. Given weak cross-sectoral activities, horizontality is not the appropriate concept to develop. In their view nobody is responsible for innovation policy. They even feel that no political definition has been given of what innovation policy is for and that the definition may vary depending on the context.

The notion of a networked society (Castells, 1996) tends to emphasise networking as a means to neutralise structures of power and conflicts of interest among the relevant actors. Owing to the Finnish consensus on a technology-driven innovation policy, conflicts of interest are not evident. But such consensus may be artificial, as ministries that

ought to be among the actors from the viewpoint of a systemic approach are not represented. For example, the Ministries of Social and Health Affairs, Agriculture and Forestry, and Traffic and Communication are not in the core science and technology policy group. Yet they are responsible for welfare services, for the modernisation and liberalisation of traffic and communication infrastructure and for the structural transformation of primary production. These policy areas are also important when discussing the issues of globalisation, employment, dimensions of welfare and ecology as a focus for a broader innovation policy. Aside from economic issues, they are linked to the aim of achieving better quality of life.

In the hierarchy of Finnish policy, the role of the Ministry of Finance deserves attention. It controls the growth of government expenditures, and it has made productivity a goal of all public activities. At the level of general goal setting for economic or budget policy, its representatives agree on the priority of a technology-driven innovation policy as a way to increase productivity. From their viewpoint, economic policy is a horizontal policy pursued in all policy sectors while innovation policy is only one aspect of economic policy. They believe that this is also the viewpoint of the business sector. As the Ministry's influence on economic policy is purely budgetary, its representatives prefer to speak of negotiations with the key actors of innovation policy during budget preparation and to describe their power as being related to budget regulation. They want to appear liberal by saying that substantive issues are the responsibility of individual ministries. Of course, when increased funding is available, tensions between sectoral goals and the state budget do not arise. When there are budget cuts, however, individual policy sectors have to adjust their goals to those of the Ministry of Finance.

The primary financers of science and technology: the Academy of Finland and the National Agency of Technology (Tekes) as reformers of innovation policy

According to many external evaluations, the primary financers of R&D in Finland, the Academy of Finland and Tekes, should make more strategic choices in their funding decisions and integrate their goals with broader socio-economic development (Gibbons *et al.,* 2004). In interviews, some critics also find that both organisations concentrate too much on funding and lack systematic reflection on their other responsibilities. On the basis of their budgets alone, Tekes has more societal power and visibility than the Academy.

In principle the Academy has more freedom to choose priorities, as it is the primary financer of academic research and there is a separate university policy. In its visions of the future of society, it has referred to the development of Finland as a knowledge society and to well-being as an outcome of research-based new knowledge (Academy of Finland, 2003). International evaluators have pointed out that "the link between basic research and economic performance and the translation of the former into the latter depends on the connectivity of the national innovation system. Without this connectivity the rate of innovation is likely to be insufficient to provide the resources to keep Finnish science linked, as it is currently, to the best in the world, except perhaps in a diminishing number of areas" (Gibbons *et al*., 2004). According to the panel the Academy should be able to attract top scientific research to Finland.

The Academy has taken the European Research Area (ERA) as its main focus of attention and has started to emphasise aspects of the knowledge economy. The ERA thus functions as a frame for European and national development programmes. There seems, however, to be a struggle in Finland between the Academy and the Ministry of Trade and

Industry concerning representation in the ERA. Irrespective of the increasing emphasis on technology, the European Union still has a dual structure for science and technology. Nevertheless, despite much talk of a more horizontal approach to the promotion of innovation, these goals are not apparent in the current Commission funding structure.

The Ministry of Education has much power over the universities and its Science Policy Division is also eager to intervene in Academy affairs. In its view the Academy's political relevance is limited and too inward-looking. The Ministry is concerned with internationalisation and wants to maintain Finnish performance at the top in terms of economic knowledge and competences. The Academy is more interested in centres of excellence and in the long-term advancement of science.

Even though change and dynamism are now catchwords at the Academy, the administrative personnel feels that there have been too many changes in science policy in a short time. The Academy has also found it laborious to take part in the national search for patents and to develop indicators of the economic effectiveness of the funded projects. In doctoral school evaluations, new criteria for evaluating careers outside the universities have been introduced. The latest international evaluation also points to weak funding of interdisciplinary projects (Gibbons *et al*., 2004).

It is characteristic of a small country that policy making depends to some extent on the personalities of the responsible actors. While previously there was almost no contact between the President of the Academy and the Director General of Tekes, both organisations are now keen to mention joint negotiations and preparation of research and technology programmes. The international evaluation of the Academy also emphasises the importance of a deeper collaboration with other research institutes, especially Tekes. The Academy should also develop a more comprehensive research policy and "horizontal connectivity across the research system".

Even though the Academy's strategic approach combines competition and complementarity, there is still a lack of synergy. The goals of the Academy's research and Tekes's technology programmes may be different. The Academy sometimes wants to set up a new research area as part of the research programme, while Tekes is more interested in possibilities for new competitive business areas and in finding the best constellations of networked partners. Because their aims are different, the issues of risk and uncertainty are different for the Academy and Tekes.

In recent years Tekes has taken a more visible role in providing a vision of ongoing and future socio-economic development. In this role it has not been very original. For the most part it has repeated ideas generated elsewhere, such as those of the new growth theory and the knowledge economy. It functions mainly through the technology programmes. Even though there is evidence of commercial success and new networks among the programme partners, the huge number of technology programmes makes a strategic approach difficult and the links to broader socio-economic issues thin and sometimes artificial. Some of these programmes deal with small-scale, micro-level problems and the relation between these programmes and macroeconomic issues is difficult to evaluate or is non-existent. The earlier cluster programmes were somewhat more coherent and sensitive to broader questions than most of the technology programmes. In the clusters, new technologies were favoured but the importance of old industries was also noted.

Today Tekes has made new openings towards a horizontal policy and towards social policy. It was active in integrating the concept of social innovation into the current government programme and into the recommendations of the Science and Technology Policy Council. Social innovation is intended to indicate the awareness of technology policy makers of the dimensions of welfare. Often, however, the representatives of social policy are marginal or lacking. In the Tekes framework, social innovations point to new models of competition that can be used in privatisation projects in the public sector. Representatives of Tekes emphasise the need to develop new solutions to the problem of welfare provision, to clarify the public-private division of responsibility and to reconsider what is meant by a competitive environment.

According to representatives of Ministry of Trade and Industry, bringing together innovation and social policies raises problems that are not easy to solve. If innovation policy comes closer to social policy, it is necessary to define the modes of action and the division of labour and responsibility. If innovation policy tries to become comprehensive, its power and expertise in technological issues may become scattered. As the interviews illustrate, social issues are unfamiliar to technology-sector administrators and competitive action is new to the social sector. The representatives of social policy have, however, become more responsive to the idea of social innovation and propose that it should be considered in light of the democratic traditions of the Nordic welfare state.

Horizontality as a form of political commitment

Although there have been attempts to develop a more systemic and integrated approach to innovation policy, the problem of combining horizontal and vertical governance remains. In addition, the current structure for stakeholder participation and the new policy instruments seem unable to tackle the problem of horizontal policy.

The Science and Technology Policy Council: combining vertical and horizontal governance

In the Finnish science and technology policy system, the Science and Technology Policy Council is responsible for the broad guidelines and for directing national science and technology policy. The Council acts as an advisory body to the government on science and technology issues, but it is often regarded as possessing significant political power and capable of effective policy formulation (Diederen *et al*., 1999). Furthermore, it is often seen to be in an authoritative position for balancing interests between different sectors and policies and co-ordinating science and technology policy with other policy domains (Edler *et al*., 2003). In international discussions, the Council is often considered an excellent example of a high-level body capable of coherent and efficient governance of science and technology policy (*e.g.* European Commission, 2003).

The Council's line-up includes the Prime Minister, the ministers of Education, Trade and Industry, and Finance, a maximum of four other ministers and up to ten other members representing key actors and stakeholders of the innovation system, such as Tekes, the Academy of Finland, universities, industry and employers' and employees' organisations. In its work, the Council is divided into two subcommittees – one for science policy and another for technology policy – which discuss and prepare all the issues that are dealt with in Council meetings. The preparatory work is carried out by two full-time chief planning officers, one located in the Ministry of Trade and Industry and

other in the Ministry of Education. The location was disputed when the Council was established, reflecting a controversy between the two ministries.

The Council has a strong position in science and technology policy. It also has strategic power owing to its aim to build a coherent national strategy for knowledge and innovation through its tri-annual policy review. It has launched new concepts that have regulated the discussion of important science and technology policy issues, such as the national innovation system and social innovations. It has also addressed some socio-economic transformations, although the theoretical basis of many has been weak.

The Science and Technology Policy Council has not, however, been as powerful as has been argued. Its recommendations have been well received but the government has also made decisions that have gone against its recommendations. Nevertheless, with its relatively broad participation, the Council makes possible strong vertical co-ordination among the key actors of Finnish innovation policy. It enables the flow of ideas and initiatives from the agency level and stakeholders to political decision makers and *vice versa*. The representation of the key agencies as well as universities and industry in the Council also facilitates the implementation of the Council's decisions and recommendations. In this respect the Council forms an important discussion forum for decision makers and stakeholders.

Yet, its strong vertical co-ordination is often balanced by problems of horizontal co-ordination (Peters, 1998), and from this perspective also the Council's model is insufficient. Its co-ordinating role as well as its practical impact on substantive research-related issues in different ministries is quite small. In ministries that play a lesser role in the STI policy setting (as compared to the Ministry of Trade and Industry and the Ministry of Education), the Council is considered remote and unable to co-ordinate activities that concern them. Furthermore, while the Council's participation seems relatively cross-cutting, in practice it tends to exclude some relevant sectors from policy discussions. In this respect, the problems are mainly related to the role of ministers who represent other than two core policy sectors.

First, sectoral ministers are appointed to the Council without due attention to the relevance of the sectors for research and innovation. Currently sectoral ministers are mainly considered representatives of the government coalition and political parties rather than representatives of their policy domains. This leads to randomness in the policy domains represented in the Council. Consequently, some very relevant policy domains have seldom been represented in the Council. For instance, ministers responsible for regional development, social and health policies, and agricultural policies have never been appointed as members of the Science and Technology Policy Council.

Second, the role of the sectoral ministers is quite marginal in terms of participation in and commitment to the Council's work. While some ministers have been active in the Council, some have not attended any meetings. Often none of the sectoral ministers is present in the Council meetings; this indicates a lack of commitment. Owing to the relatively weak role of sectoral ministers, the Council's mode of operation is still closely tied to the administrative branches of the Ministry of Education and the Ministry of Trade and Industry. This is particularly the case in the two subcommittees in which the Prime Minister and sectoral ministers do not have seats. Furthermore, besides one civil servant from the Prime Minister's Office, all the Council's permanent experts are from the two ministries.

The current solution to the lack of horizontal representation in the Council is an informal network of contact persons which consists of civil servants responsible for research activities in all ministries and the secretary general of the Economic Council. The network has been considered very important in terms of horizontal integration. It has been regarded as a platform for integrating sectoral research more closely with mainstream research and making it more strategic. Moreover, the network has been seen as permitting civil servants to contribute more substantively to the formulation of national policy (Boekholt *et al*., 2002, p. 49). According to the interviews, however, the role of the network seems clearly focused on the exchange of information, and its role from the perspective of policy formulation and co-ordination is rather weak. Its influence on the Council's strategy is also small. Furthermore, all ministries do not consider the network's meetings important although some take them very seriously.

The lack of precision in the horizontal aspect of the Council's composition is also reflected in its guidelines and documents. Indeed, the Council mainly concentrates on the core issues of traditional science and technology policy, such as the development of research funding and international co-operation on science and technology, but has only vaguely developed a broader, more horizontal approach to innovation and its relationships with other policy sectors. The Council appears to lack the ability or desire to tackle cross-cutting societal issues and to raise its profile in that respect. Currently, the Council has a broad mandate related to science and technology policy, but it has not strongly sought to expand its mandate to include a more cross-cutting and integrated concept of innovation policy. Many critics say that the Council has not developed new paths and that its guidelines tend to reiterate old issues.

Thus, the Council has not integrated science and technology policy objectives with those of other sectors. It has not developed a global view that might make it possible to merge priorities and search for interfaces with other sectors. Besides core science and technology policy, the Council has mainly integrated aspects of education policy in its policy framework, related in particular to postgraduate education. Sporadic references have also been made to regional development, employment and the information society (*e.g.* STPC, 1995, 2003), but a more systematic view of integrated policy is lacking. For instance, issues related to sustainable development and environmental technologies as well as social issues and the health sector have rarely been addressed. Furthermore, even for education policy, views among Council members diverge on how broad a perspective the Council should adopt.

To answer certain criticisms, the R&D system in Finland has recently been evaluated (STPC, 2005). The evaluation recommended a clearer innovation policy approach in the Council's work and proposed adding a third secretary. Even though it refers to the globalisation of the economy and technology and to the need to promote innovation dynamics, there is still a tendency to see science, technology and innovation policies as somewhat different policy sectors that join in efforts to achieve high performance in employment, productivity and competitiveness.

Changing governance meets the problem of stakeholders and representation

Finnish decision making for science and technology policies reflects corporatist traditions of governance. It follows the Nordic welfare state model of centralised action and responsibility in which corporatism implies closed processes of deliberation and negotiation and a relatively limited number of stakeholder groups. The Finnish version of corporatism has been based on strong institutionalised representation of labour unions and

employers' organisations in the state decision-making machinery. At the same time it has excluded civic interests and non-governmental organisations (NGOs) (Häyrinen-Alestalo *et al.*, 2004). In particular, science and technology policies have been expert-driven politics in which negotiations take place in small, closed circles of policy makers and chosen stakeholders. For a broader innovation policy, this model is too limited. Interviewees point to the need to start a discussion of values and new understandings in order to pursue a systemic innovation policy. The Finnish model of stakeholder representation is not suitable in this respect.

Because of Finland's consensual policy climate, labour unions and employers' organisations tend to agree on most issues, although they have different backgrounds and rationales for technology and innovation policy. The sceptical views of labour unions in the late 1970s on the negative relationship between the growth of high-technology industries and the number of jobs has disappeared. As labour unions see work as the basis of individual and collective well-being and civil rights, they have become favourable to new technologies. Strong commitment to technology policy has also tamed the labour unions.

Employers' organisations place the most emphasis on the components of a knowledge economy, such as the competitiveness of firms' operating environment and the attractiveness of Finland in international competition. Further developing the innovation environment and a positive climate towards entrepreneurship are regarded as key objectives. Recently, increasing attention is paid to service innovations and the services sector more broadly, thus emphasising the diversity of innovation.

In addition to labour unions and employers' organisations, high-technology industry, universities and public and private institutions are central stakeholders in Finnish science and technology policy governance. With the knowledge economy, universities have become more important intermediate-level negotiators, and there are plans to increase their economic autonomy. On the other hand, high-technology firms, Nokia in particular, have been gaining more weight in the corporatist system, and Nokia's representatives are numerous in the highest decision-making bodies. In general terms, Nokia's success and growth have made it very influential in Finnish society. Recently, Nokia's chief manager has increasingly taken on a politician's role. He makes promises about how long Nokia's headquarters will stay in Finland and comments on Finnish tax rates. From a systemic viewpoint, Nokia's strong societal position may be problematic. Its dominance tends to create new exclusive forms of power that tend to unsettle the corporatist tradition, and the resulting destabilisation is not conducive to a horizontal approach.

For its part, the Finnish corporatist system has strengthened the consensual approach in science and technology policies. Whereas in many other countries, the balance between science and technology policy is settled through debate, there is little political room for such debate in Finland, where consensus constitutes the Finnish concept of coherence and cooperation. As a result, issues of modern representation have not been resolved. For example, many decisions that are made by Tekes alone are in other countries made by the parliament. This makes for a flexible, but invisible, decision making process. On the other hand, in spite of the government's neo-liberal orientation, there is still too much control and regulation. Moreover, the more participatory forms of representation often do not receive much encouragement in Finland (Häyrinen-Alestalo and Kallerud, 2004). This is one of the reasons for the low level of citizen action.

Instruments for horizontal policy making

The government's commitment to promote science and technology policies has been of primary importance for Finland's achievements as a knowledge economy. The decision to use additional funding from the privatised state-owned companies has been the major instrument for the dramatic rise in Finnish technology performance. In the Cabinet Strategic Agenda (2004), science policy still has a paragraph of its own, while technology and innovation are grouped together.

Owing to an increasingly complicated political environment, broad issues, such as globalisation, employment, environment, co-production and balanced social distribution, have raised pressure for a horizontal policy outlook in Finland. The Cabinet has launched a set of cross-sectoral policy programmes (employment, information society, citizen participation, entrepreneurship). Because they are cross-sectoral, they are assumed to have common elements and to affect the division of labour. The aim is for ministries to start to develop deliberative forms of negotiation and to set priorities that will maintain and further develop Finland's high international ranking. Assessments of the promoted activities on socio-economic change are high on the political agenda.

Even though there is pressure to establish new forums in order to discuss socio-economic problems, many ministry representatives want to see sector-based policies remain the central sources of action. They say that a radical change in customary policy-making practices does not bring anything new to their preparatory and implementation work. Furthermore, many ministries have nothing in common and the commitment to joint priorities is not necessarily high.

In the context of new state-driven strategies the question arises of who will be the agents of change. The Cabinet, with four-year terms of action and controlled by parliament, may be too slow, weak and homogenous to recognise policy needs rapidly, especially when under the pressure of upcoming elections. Moreover, some horizontal issues are politically sensitive. The leader of a former working group on employment is bitter about the government's inability to take responsibility for this issue. In his view the government is defensive and does not engage in public discussion of such issues. He also says that the problems will not disappear, despite more and more working groups giving more and more recommendations.

Health care as an innovation policy target

The expansion of STI policy is analysed here in relation to the health sector. The health sector is an area in which Tekes has been searching for new markets for the past years. In terms of horizontal policy, this requires a dialogue on the objectives and instruments of health policy. The application of innovation policy objectives to the welfare sector is, however, problematic. Welfare services that promote equality in terms of citizens' well-being have been at the core of the welfare state ideology. Because the market cannot provide sufficiently inexpensive health care equally to all social groups and regions, this has justified the mainly public financing and provision of the services. Because tax revenues should be used in a responsible way to produce equally good services at reasonable cost, a central objective of the present health policy is cost containment and restricted growth in the sector. This is in contradiction with the logic of capital accumulation, which is embedded in innovation policy. In order to understand the possibilities and limitations of a broader innovation policy, it is fruitful to look at the interplay of the two policy sectors.

The health policy sector

Finnish health policy is now looking to structural changes to cope with the growing numbers of patients and the decreasing numbers of personnel due to ageing of the population. The health-care system is very fragmented. It is divided into primary care and hospital districts along the lines of two traditional health-care ideologies. The constitutional autonomy of municipalities has prevented the integration of health-care organisations, and the decentralisation of health-care planning in 1993 led to a situation in which the "totality of the services cannot be controlled through knowledge either in the case of the services the patient or customer receives, or in the case of the service system" (Ohtonen 2002, p. 6). Fragmentation has increased under the present management trend, which has organised the entire sector by projects. Different institutions finance hundreds of projects and even broad policy strategies look like projects.

The recession of the 1990s strongly affected the health-care system. Neo-liberal and managerial changes in the system were accompanied by spending cuts. State grants to municipalities were the main target of state budget cuts. A policy of expanding the welfare state led to cuts in service costs, and responsibility for financing and providing services was shifted from the state to municipalities. In recent years, health expenditures have been rising again, but worries about the future of the system have been expressed by both experts and the public. At present, citizens deem health care to be the most important issue for politics.

Expectations for technology

In health policy, new technologies are expected to cut health expenditures (Hyppönen, 2004). The Ministry of Social Affairs and Health has been pursuing projects to develop information technologies in social services and health care. The privatisation of state-owned companies provided financing for its welfare cluster project in 1999–2001, which was aimed at developing a regional information system for health care and electronic medical records for patients in order to reduce unnecessary loss of time and save personnel resources. Contrary to the plans of the ministry and of the Ministry of Trade and Industry, the programme evolved in such a way that Tekes did not finance it to the extent intended. The project did not manage to realise the objectives of developing health care and promoting business opportunities and new public-private co-operation, and was judged not useful by enterprises (Kivisaari *et al*., 2002). The "seamless service chain" remains a priority of the Ministry of Social Affairs and Health in its present programmes and the electronic medical record is going to be put in use throughout the country by the end of 2007. These are being developed separately from innovation policy actors and initiatives.

From the viewpoint of technology policy makers, health is an area of great potential for new businesses, but problems have arisen, especially in health-care technologies, for organising co-operation between SMEs and larger companies, as well as between the private and public sectors. In Tekes's technology programmes, the focus has shifted from health products to the service system. Tekes has learned from its previous projects and has also been encouraged by the Ministry of Trade and Industry to work more intensively with the public health-care services. The new technology programme is not only trying to produce new business, but also to help increase the efficiency and responsiveness of health policy for individuals. Its objectives are to "improve the quality and profitability of health care, and to promote business activities and exports in the field" (Tekes, 2004).

However, the integration of innovation policy goals with the public-sector-dominated health-care services has created difficulties for setting policy goals.

Public provision of health care and innovation policy

Among technology policy implementers, the productivity of health care is considered a serious problem. Private entrepreneurship and competition are presented as ways to improve public services as well. The principal objectives of Tekes's new health-care programme are promoting business, creating new markets and preserving the present ones. The new objective of improving public health services comes second as is apparent in Tekes's financing criteria for technology projects.

Social and health-care professionals are dissatisfied with the public speeches and work of the Ministry of Trade and Industry and Tekes regarding health care. Rigid boundaries exist between the two policy sectors, and despite many attempts they do not seem to have been sufficiently dismantled in Tekes's approach to health care. The problems centre on the question of the most cost-efficient and sustainable way to organise health care at large. Although the Ministry of Trade and Industry and Tekes are not openly advocating privatisation of the health-care system, they are seen by the Ministry of Social Affairs and Health as promoting private entrepreneurship at the expense of the public system. Private-sector suppliers of health-care provision are not automatically more productive or cheaper than public ones. According to health policy executives, the proper choice should be reviewed case by case and in relation to overall services. They link technology policy executives' image of the inefficiency of public health services to a lack of knowledge of the field.

A conflict of interests

The primary goals of the FinnWell technology programme are the promotion of new business (creating markets) and including the private sector in public-sector development projects. The general goal of increasing business opportunities in the sector stems from Tekes's original purpose as an organisation to promote the Finnish business sector by supporting technological development. Its policies on health-care technologies do not indicate, however, how the new technology projects are to develop the service system as a whole, which is the second goal of the FinnWell programme. From the point of view of health policy experts, the problem in pursuing innovation policy in the health sector seems to be the relationship between public institutions and private enterprises. The documents and actions of Tekes and the Ministry of Trade and Industry and the interviews indicate that promoting business in the sector is more important than improving the cost effectiveness of the health-care system. When these two are in contradiction, which is often the case, promoting private-sector activities goes against one of the top priorities of health policy, the cost-effectiveness of the entire system (OECD, 2004). If developing the health-care system is equivalent to promoting entrepreneurship and competition, the policies of the two ministries are partly contradictory. Tekes has argued that to develop the health sector they should include public-service providers in their development work. One goal of the present FinnWell programme is to increase and improve co-operation between the two sectors. Here clear progress has been made, but it is evident that more thorough discussions are required between the Ministry of Trade and Industry, Tekes, and the Ministry of Social Affairs and Health, which may have different views on the problems to be solved in the first place. If problems are defined incorrectly, acting on them will not help.

From the point of view of health policy executives and experts, the incorporation of health policy objectives in innovation policy has not succeeded so far. The approach taken by Tekes is an example of path dependency; it has not been able to appropriate and take into consideration the problems of the health policy sector, but continues to pursue old technology policy objectives in an entirely different field. The preparation and the working methods of the FinnWell programme show that the real experts in the predominantly public-service-driven sector are only superficially represented in the development of health-care-related innovation policy. The objective of promoting private business in this area is complex if combined with the objective of keeping health expenditure as low as possible.

Tekes and the Ministry of Trade and Industry explicitly say that they do not want to intervene in another ministry's sector. However, promoting innovation policy objectives for health risks replacing the latter's policy goals by other goals. In such cases, policy actions should be preceded by sufficient analysis of the possible consequences for the existing logic and practice of another policy sector. It is not only welfare services that tend to expand. New health-care technologies require resources for assessing them and for educating users. Adding technology to a given human setting does not automatically reduce costs. The development of medicine and technology is in fact one of the main reasons for the persistent growth of health expenditure. Developing new social and health-care practices with the help of new technologies has proven an untenable way to reduce costs in small-scale settings, if the technology is developed without addressing the actual development needs of the system (Miettinen *et al*., 2003). Similar problems seem to arise at the broader policy level. Finnish technology policy is still said to be too heavily influenced by input factors and too little by the utilisation of technologies. Health-care policy is a point at which integration of technology policy requires the fitting together of objectives, addressing the problems and understanding residing in the targeted policy sector. A fruitful innovation policy cannot simply be technology and industrial policy pursued in other societal domains without regard to their policy objectives. Horizontality needs to be more than a unilinear push of technologies, and a broader innovation policy must not underestimate the contradictions between sectoral policies. In health policy a two-directional horizontality has not been achieved. The question of a public good should be dealt with, if innovation policy objectives are to be connected to health policy objectives.

Conclusions and discussion

This contribution to the OECD/MONIT project discusses Finland's opportunities for pursuing a systemic and horizontal innovation policy. Attention to the various levels of horizontalisation shows the many contextual issues that frame the possibilities for adopting a broader innovation policy. Finland is an excellent model of a systematic and coherent adopter of the ideas of the knowledge economy. The picture becomes less distinct when an attempt is made to include issues that go beyond this model.

In OECD and EU member states, the knowledge economy assumes a cross-cutting setting of goals that are general enough to include both economic and social spheres and to neutralise conflicts of interest among various sectoral policies. Recent experience in Finland demonstrates that this view has significantly underpinned political choices. By pursuing a selective STI policy, the government has been able to implement most of its priorities. However, the radical change from one government ideology to another has also created contradictions among various goals.

In Finland's rapid move from a Nordic welfare state towards a European knowledge economy social issues were better integrated in the government's strategy during the former period than during the latter. At the same time, many economic issues that were previously inactive have developed rapidly in the new context. There are, however, tensions between STI policy and social and health policies, and the authorities are unsure about how to open public services for competition.

In Finland the national innovation system has been used as an agenda of political reform to advance the neo-liberal premises of market governance. In principle, from the viewpoint of the knowledge economy, the innovation system is coherent and horizontal. From a broader perspective, however, it seems one-dimensional and disorganised. The study shows that four types of concepts become evident when assessing the role of the innovation system and innovation policy in policy reform. Two are related to the traditional view of the innovation system, which tends to favour an authoritative mode of action. The third type regards innovation policy as only one policy among the others. Only the fourth emphasises a more systemic and horizontal approach.

The adoption of a systemic approach in innovation policy sets new requirements for legitimacy and expertise. The social sphere is new to technology policy makers, and even the concept of social innovation has to be clarified. When competences tend to be highly specialised, players outside the STI policy core are seen as incompetent and their mandates inappropriate. This becomes evident in the case of the Science and Technology Policy Council. Even though it has political power for STI issues, its wider political role is diffuse and its dual structure limits the possibilities for moving towards more horizontal action. Members have learned to discuss together but are unable to solve cross-sectoral issues. Many key policies are not even represented in the Council.

The Finnish corporatist mode of representation and negotiation is highly consensual and conflicts of interest are muted. This picture is, however, somewhat artificial owing to the lack of representation of many policies and fields of action. An increasingly acute problem is related to the issues of welfare services and ageing. These problems are discussed in STI policy but a much more horizontal approach is needed to solve them. The case of health policy demonstrates that if the standard premises of technology policy do not change, the expansion of innovation policy is not possible. Here the traditional policy of consensus comes close to a conflict of values.

It has been a surprise to Finnish decision makers that high investments in new technology do not resolve many issues related to globalisation and the functioning of markets. The unemployment rate is still high and the ICT sector has encountered market turbulence. This shows the need to pursue an integrated policy. Furthermore, all elements of a progressive policy cannot be taken from innovation policy. As long as sectoral policy making dominates, crossovers between policy areas encounter difficulties both of legitimacy and action. This conclusion is also relevant at the EU level, as its funding structure makes the integration of science and technology policies difficult.

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Chapter 6

JAPAN'S INDUSTRIAL TECHNOLOGY AND INNOVATION POLICIES AND THE EFFECTS OF "AGENCIFICATION"

Bunro Shiozawa
Former Deputy-Director General, Industrial Technology Policy,
Ministry of Economy, Trade and Industry (METI)

Tagui Ichikawa[1]
Director, Strategic Planning and Project Administration Division,
Director for R&D Project Evaluation Planning and Co-ordination,
New Energy and Industrial Technology Development Organisation (NEDO)

This chapter brings together two contributions on significant changes taking place in Japan's industrial and innovation policies. The first, by Bunro Shiozawa, former Deputy-Director General of Industrial Technology Policy at METI, provides a broad overview of these changes, most notably basic changes in institutional organisation, new priorities in innovation policy such as science-industry relationships, and development of cluster policies. The broader context of these changes are to be found in the apparent gap between investments in R&D and Japan's innovation capacity in terms of economic growth.

In the second contribution, Tagui Ichikawa, Director of the Strategic Planning and Project Administration Division and Director for R&D Project Evaluation Planning and Co-ordination at NEDO, discusses changes in the administrative structure of innovation policy since 2001 and the creation of independent administrative agencies. The special focus is on METI's two large agencies: the National Institute of Advanced Science and Industrial Technology (AIST) and the New Energy and Industrial Technology Development Organisation (NEDO). The philosophy and mechanisms of the IAAs are presented, and the effect of "agencification" on the process of innovation policy making and the performance of AIST and NEDO are analysed.

6.1. Japan's industrial technology policy

Introduction

Japan believes that R&D policy is a key to increasing national productivity and strengthening the national economy. Therefore, for some years the Japanese government has placed high priority on allocating government resources for R&D, to allow Japan to recover from the long stagnation of the 1990s and the beginning of the 21st century. Furthermore, Japan's labour productivity is expected to decrease, as the Japanese population will age at an unprecedented rate. Therefore, effective R&D activity and its use to sustain or increase productivity is an important long-term policy goal.

This first part of the chapter gives an overview of Japan's industrial technology policy, in which the Ministry of Economy, Trade and Industry (METI) plays a central role, along with general science and technology policy. The Japanese government places a high priority on the promotion of industrial technology, in parallel with the encouragement of basic science as a base for the sustainable development of the world and not Japan alone.

Overview of monetary resources for R&D

A brief overview of Japanese R&D is given before describing METI's industrial technology policy. Figure 6.1.1 illustrates Japan's R&D expenditures. Annual total expenditure for R&D in fiscal year (FY) 2001 was about JPY 16.5 trillion. Of this, about JPY 11.5 trillion went to industry and most of this amount came from industry itself. The government only allocated about JPY 160 billion to industry. This picture is very different from that of the United States, where about 25% of the federal government's funds (USD 19 billion in 2002) are for R&D conducted by industry. In terms of the ratio of government funds flowing directly to industry to the amount of money used by industry, Japanese government involvement in private-sector R&D activities is quite small among developed countries at 1.4%, compared to the United States (9.3%), Germany (7.4%), France (10.0%) and the United Kingdom (11.9%).

Science and technology policies and organisations

As part of the reorganisation of the Japanese government that took place in January 2001, the Council for Science and Technology Policy (CSTP) was established as the headquarters for national science and technology policy. This decision was taken because it was felt that many ministries and agencies had conducted R&D activities independently and had sometimes not worked in a cohesive and coherent manner. CSTP is tasked to oversee government-wide R&D policy measures and activities and to exert its leadership to co-ordinate related policy measures and activities when necessary.

Figure 6.1.2 presents the structure of the CSTP. The CSTP has 14 regular members under the leadership of the prime minister. The other members are: chief cabinet secretary; minister for science and technology policy; minister of education, culture, sports, science and technology; minister of economy, trade and industry; minister of finance; minister of public management, home affairs, post and telecommunications; and chairman of the Science Council, and seven members selected from academic and business sectors, who have distinguished scientific knowledge and technological expertise. These seven members are carefully chosen so that major science and technology areas, such as life sciences, information and telecommunications technology, nanotechnology, energy-

related technologies, and environmental protection and remediation technologies, are covered in a well-balanced manner.

Figure 6.1.1. Japanese R&D expenditures

JPY billions, FY2001

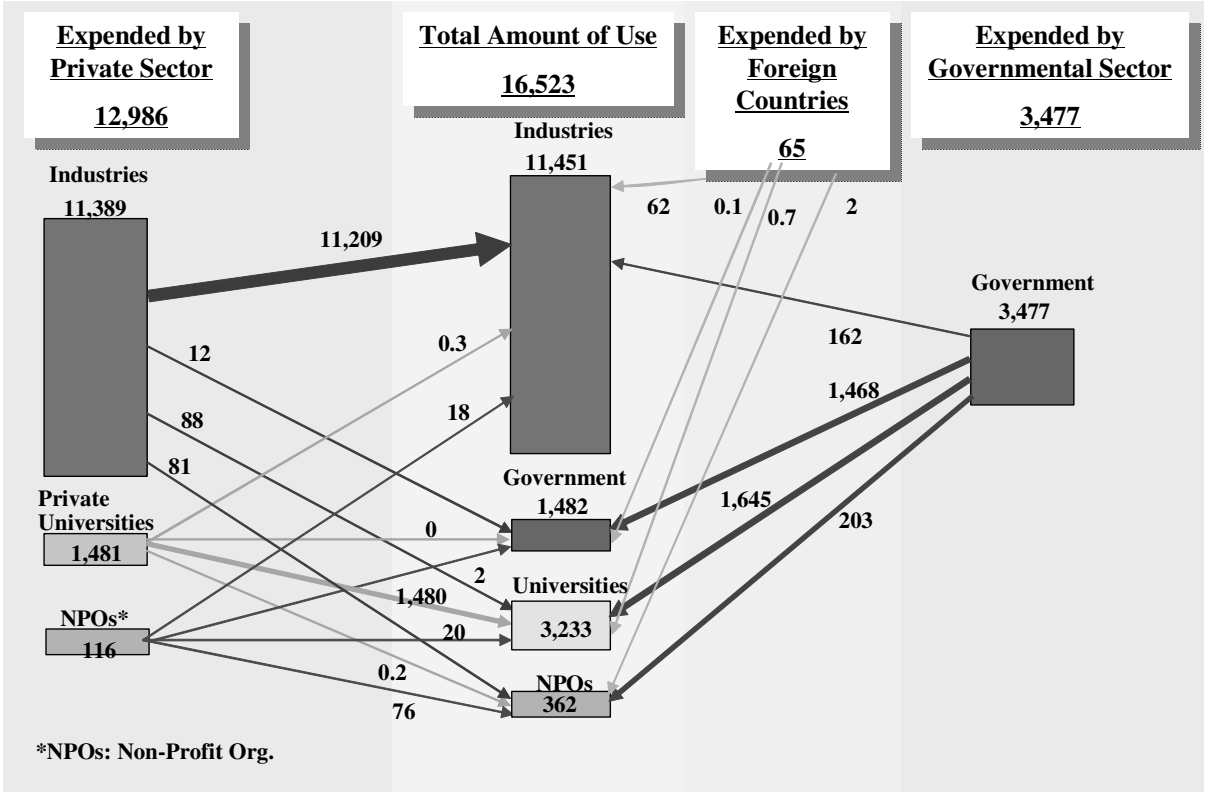


Figure 6.1.2. Council for Science and Technology Policy

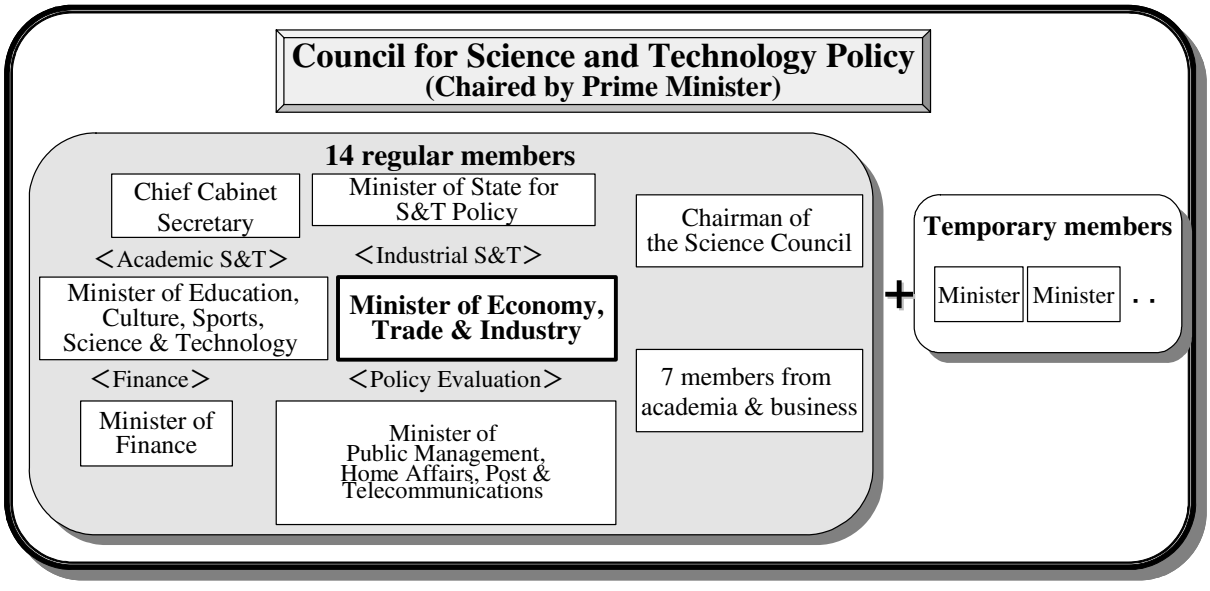


Figure 6.1.3 describes the Second S&T Basic Plan, which covers FY 2001-05. Its main features are as follows:

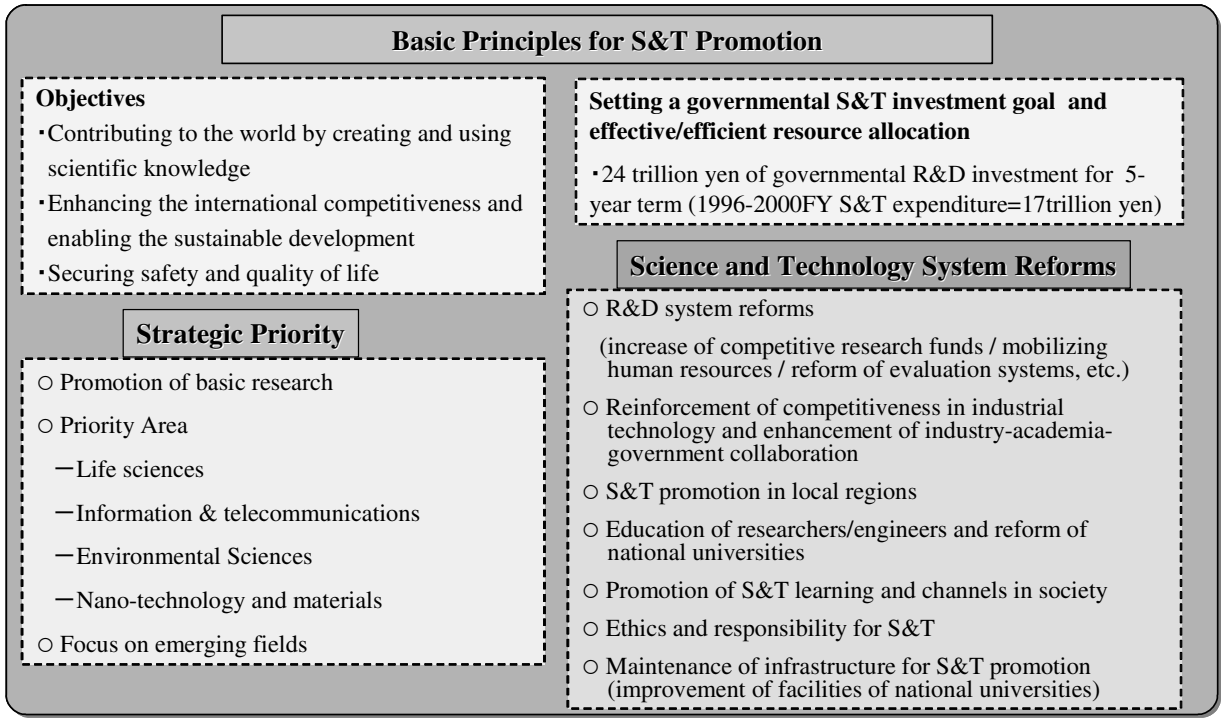
- The plan sets a governmental S&T investment goal. The government should make available a total of JPY 24 trillion in government R&D investments during FY 2001-05. This is a JPY 7 trillion increase over the R&D investments under the previous plan (FY 1996-2000). This investment goal was set so that the Japanese government would increase its S&T investment, in terms of its ratio to GDP, to that of other developed countries.
- The plan defines strategic priority areas for the government's R&D investments. They are: *i)* life sciences; *ii)* information and telecommunications technologies; *iii)* environmental sciences and technologies; and *iv)* nanotechnology and material sciences. In parallel with giving high priority to the promotion of basic science, the plan also stipulates, as an immediate policy goal, that policy priority should also be given to R&D projects that would help to strengthen the international competitiveness of industry and facilitate recovery from economic stagnation.
- The plan also identifies the need to reform the national innovation system in the following areas: carry out national university reform; make the work environment of researchers more competitive; enhance industry-university collaboration; and promote the development of local regions using local R&D potential as a driving force.

In this connection, it should be mentioned that from April 2004, all Japanese national universities change their way of operation to become independent agencies (see the second part of this chapter) which are required to operate, in principle, in a self-sustaining manner. Their operational independence is also enlarged. This is a great departure from the previous system, in which all funding for the national universities came from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), which also appointed all professors and staff. After April 2004, professors and staff of national universities become non-public-servant-type employees.

This change in the system takes place in response to questions about the present performance of the universities:

- Whether universities have generated sufficient output in relation to the large input they have had. (Universities receive about JPY 3 trillion a year from the government, research funding agencies and other sources.)
- Whether the working environment of the universities has been competitive enough to provide professors and staff with strong incentive to generate useful outcomes.
- Whether the universities have been sensitive enough to meet outside needs regarding their educational curricula and research themes.
- Whether the activities of the universities have been clearly explained to the public and the performance of the universities has been evaluated by others.

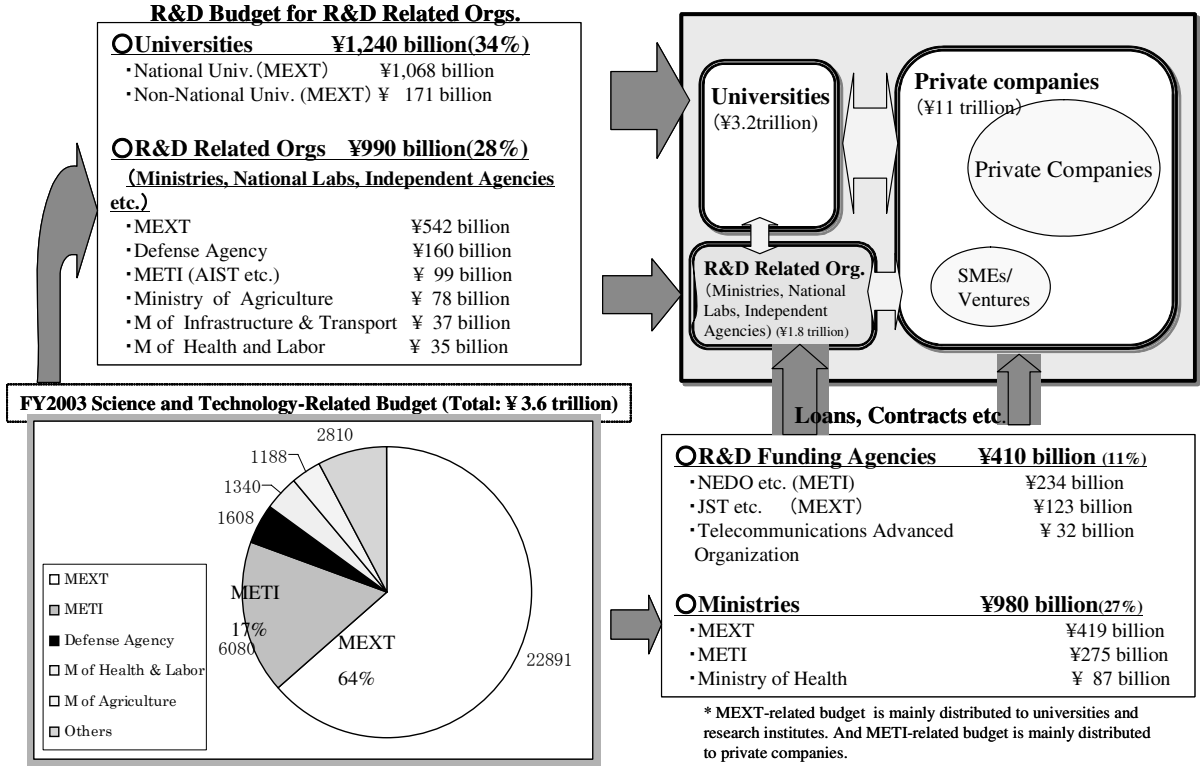
Figure 6.1.3. The Second Science and Technology Basic Plan



This institutional change is expected to lead universities to respond to outside needs in a more sensitive manner, as they will have more operational freedom in their activities. First, they become able to reorganise their departments and courses flexibly to meet such needs. Second, the change in status of professors and staff will make it easier for them to move into and back from the private sector. Such changes will also make the working environment of the university more competitive. And industry-academia collaboration will be further strengthened.

Figure 6.1.4 shows the Japanese ministries and agencies involved in science and technology policy and its implementation. In terms of the fiscal budget, MEXT has the largest share (JPY 2.3 trillion) among government ministries and agencies. Of this sum, JPY 1.2 trillion goes to universities from MEXT as annual grants to cover basic operating costs. In addition, universities receive about JPY 0.5 trillion a year from research funding agencies, such as Japan Science and Technology Corporation.

Figure 6.1.4. Role of ministries and agencies in the S&T policy and Its implementation, FY2003



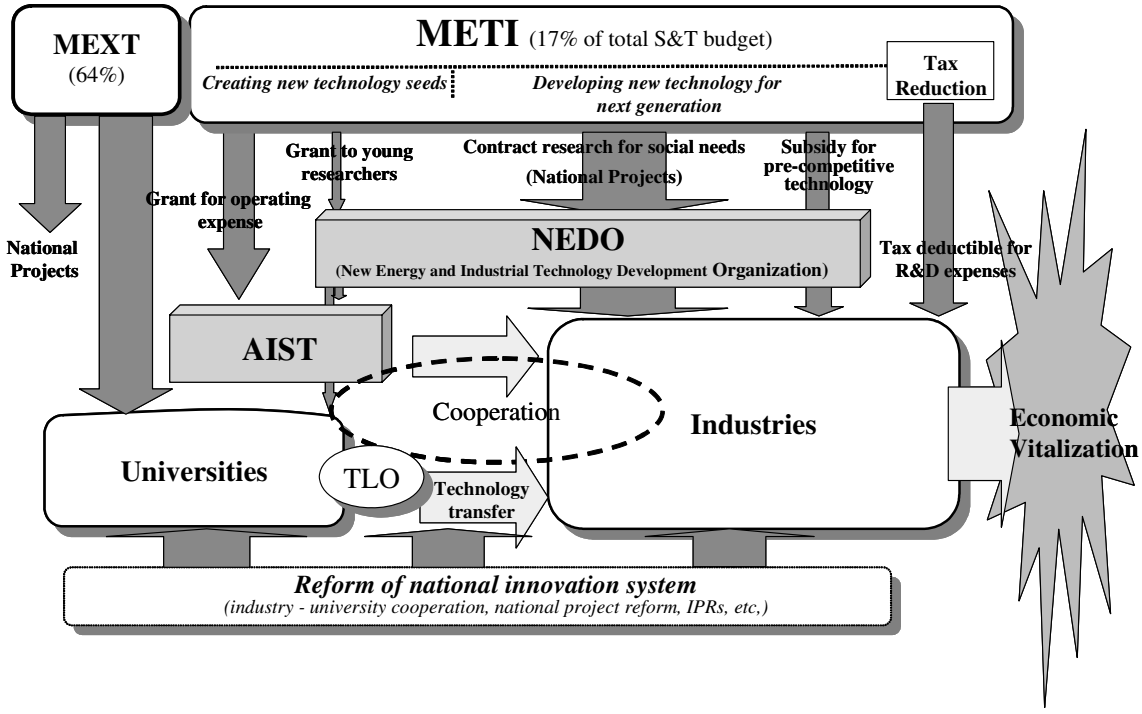
In terms of promotion of industrial technology, METI plays a central role. METI's science and technology budget is about 17% of the government's total science and technology budget.

The Defence Agency, the Ministry of Health and Labour, and the Ministry of Agriculture come next. Each carries out R&D in its primary area of responsibility by concluding contract research and providing grants or loans. The Defence Agency's R&D is in principle conducted as government procurement. It defines the specifications for its equipment and concludes contracts with private companies to purchase products and equipment. The Ministry of Health and Labour provides universities and other research institutions with about JPY 90 billion in grants to conduct clinical studies, like the National Institutes of Health in the United States.

METI's role in science and technology policy

Figure 6.1.5 illustrates METI's role. METI's science and technology budget is primarily used for seed grants to create new technology and to develop new industrial technology for the next generation.

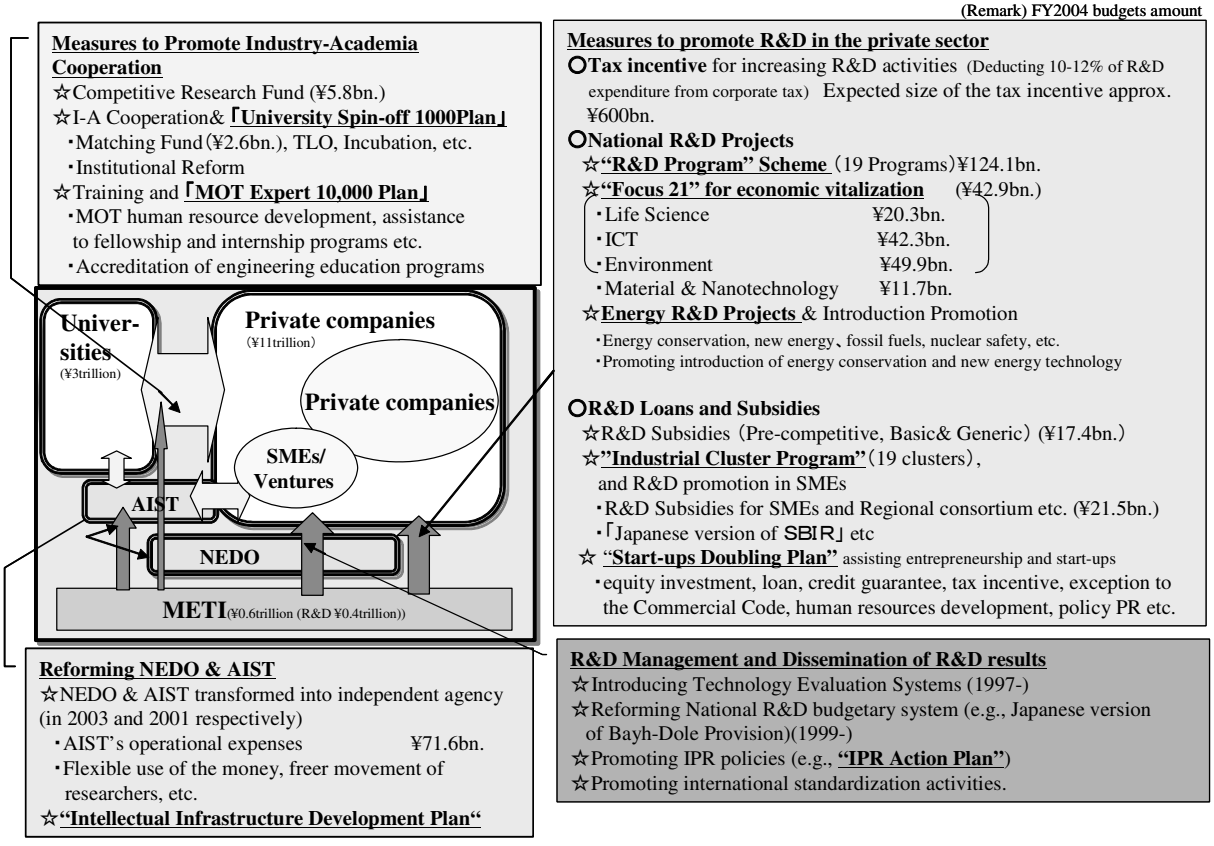
Figure 6.1.5. METI's role in science and technology



Most of the METI funds (about JPY 230 billion) go through NEDO (New Energy and Industrial Technology Development Organisation), which functions as a funding agency to support R&D in the area of industrial technology. According to the policy priorities set by METI, NEDO carries out industrial technology development either by concluding contracts with or by providing subsidies or competitive loans to private companies or research consortia consisting of private companies, universities and research institutions.

In addition to NEDO, AIST (National Institute of Advanced Industrial Science and Technology) is METI's R&D wing and undertakes hands-on research (about JPY 80 billion a year). AIST has more than 2 500 affiliated scholars and, when necessary, invites leading outside experts as visiting researchers to carry out advanced R&D. The research conducted at AIST is categorised as pre-competitive, but researchers engaged in R&D are encouraged to keep the actual output of the research in mind. The president of AIST, Professor Dr. Yoshikawa, the former chairman of the Science Council of Japan, describes this kind of research as "the second type of basic science". Figure 6.1.6 illustrates METI's industrial technology policy measures in more detail.

Figure 6.1.6. Overview of METI's industrial technology policy



Measures to promote private sector R&D

Several policy measures to promote private sector R&D are worth mentioning:

- In 2003, the Japanese government introduced a major tax reform to stimulate R&D. The basic design of the new tax system is to allow private companies to deduct 10% of the R&D cost-equivalent amount from the calculated corporate tax (up to 20% of the corporate tax). As the previous tax incentive for R&D activities was available only to companies in which R&D expenses increased from the previous year, the effects of this new system are expected to be considerable.
- METI runs 19 national R&D programmes. An R&D programme is a policy package consisting of several R&D projects on generic technologies and related policy measures, such as regulatory reform necessary to accommodate technological development or setting industrial standards to better disseminate the outcome of the R&D projects. The R&D programmes are organised and managed by NEDO, and private companies that wish to participate in the projects and have the technological capability to conduct R&D can do so. METI presently spends JPY 124 billion a year on these programmes, and most is allocated to the four national priority technology areas: life sciences, information and communication technology, environment-related technology and nanotechnology.

- In addition to the national R&D programme, METI provides the private sector with competitive loans and subsidies to encourage R&D on basic science and on generic and pre-competitive technologies.
- In order to revitalise local economies, METI encourages collaboration between universities and private companies in local regions in order to make effective use of technical discoveries made in the universities by providing competitive loans and subsidies as well as services through the eight local METI bureaus. These initiatives are called "industrial cluster programmes". So far, 19 programmes have been established in 19 regions and, through them, 200 universities and 5 000 private companies, mainly local ones, have formed collaborative relationships and networks.
- METI encourages new start-ups and entrepreneurs as well. This is an effort to reverse the trend in which the number of closures of private companies has surpassed the number of start-ups for some years. METI provides tax incentives, assistance in human resource development and competitive loans to this end.

Measures to promote industry-academia co-operation

In relation to the encouragement of new start-ups and the generation of new industry, METI has also in recent years given policy priority to the enhancement of industry-academia co-operation.

Until recently, Japanese universities have not been active in forming co-operative relationships with private companies. However, as the distance between science and industrial technology has narrowed (as in the case of biotechnology), and as even large private companies have found it difficult to generate new technological discoveries, industry has increasingly turned to universities as a critical source of new technology. Universities also have changed their attitude towards co-operation with industry, in part in response to public criticism of earlier attitudes in Japanese universities. More fundamentally, however, universities have come to recognise that the quality of their research and education will be improved by meeting the needs of society.

One of the concrete measures being implemented to strengthen industry-academia co-operation is the organisation of numerous government-sponsored gatherings, known as Industry-Academic-Government Collaboration Summits, on both regional and national levels. These summits stimulate the development of human networks among participants from relevant sectors, through face-to-face meetings. METI also encourages universities to establish a technology licensing organisation. A TLO can assist universities in filing patent applications in order to protect their intellectual property and they can facilitate technology transfer to industry on the basis of patents. In addition, METI helps to establish university spin-offs by preparing a matching fund for ventures to transform university discoveries into commercial products.

To stimulate Japanese companies to better utilise their technological discoveries, METI also asks universities to provide students with professional training on the management of technology (MOT). To succeed in business today, it is said that corporate managers need to have the skills and knowledge to manage the technology owned by a company, as well as general management qualities. However, few universities have such courses. This contrasts markedly with the United States which produces more than 10 000 university graduates in MOT every year. Therefore, METI is asking universities as well

as private professional training institutions to develop effective training curricula and encouraging them to set up new courses on MOT.

R&D management and diffusion of R&D outcomes

METI has also continued to be active in improving the Japanese innovation system. In 1999, the Japanese government decided to introduce a "Bayh-Dole provision" for all government-led R&D projects. The United States introduced the original Bayh-Dole provision in 1980. It allows private companies engaged in government-contracted research projects to own the intellectual property generated as a result of the research project. This provision has made research projects for government more attractive to private companies.

In order to make government R&D activities more effective, the Japanese government has promulgated a law and a directive obliging government ministries and agencies that implement R&D projects to evaluate the validity and effectiveness of the projects in the course of their execution. Depending on the outcome of the mid-course evaluation, the projects are either accelerated or reduced the following year.

METI has linked some R&D projects with standardisation activities so that their outcome can be disseminated more effectively.

Reforming NEDO and AIST

The innovation system relating to NEDO and AIST is presently changing as well (see the second part of this chapter). NEDO and AIST became independent agencies in 2003 and 2001, respectively, and efforts continue to be made to make the innovation system more effective and efficient. Their change of institutional status gives these institutions more operational freedom and therefore more flexible R&D project management, but requires greater transparency and increases their responsibility for project management. The R&D management system of NEDO is being changed so that R&D management will be free from the constraints of the budgetary system. For example, METI is planning to run R&D projects without a pause at the end of every fiscal year, and allow NEDO to call for new project proposals from industry at any time. This would not have been possible if NEDO had continued to be regulated by the annual government budget system applied to government-affiliated institutions (the previous status of NEDO).

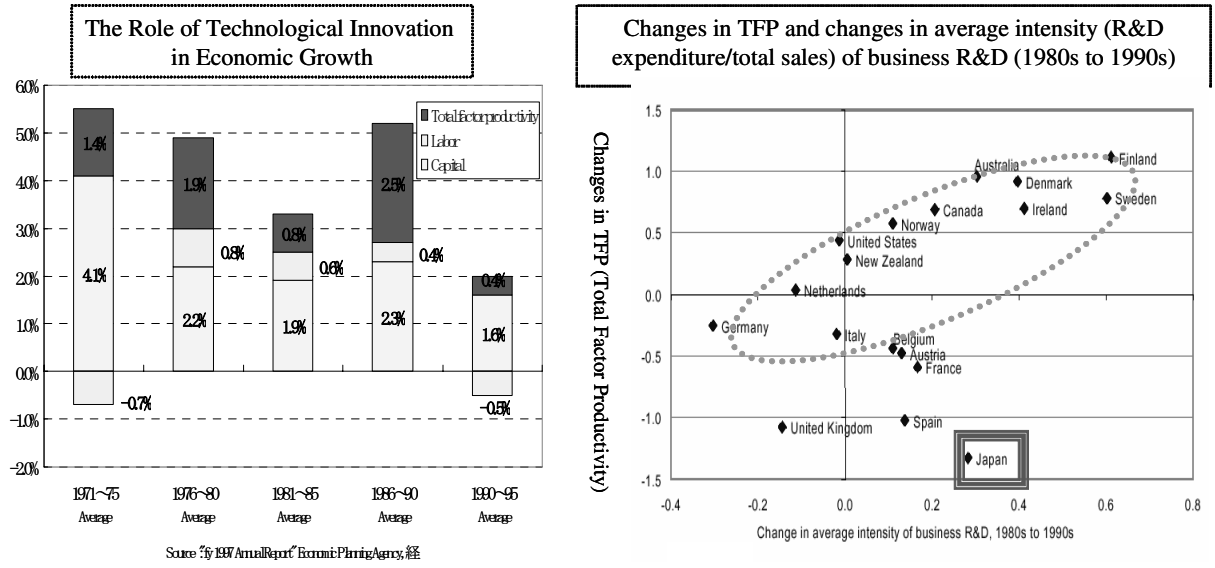
Problems and METI's present policy agenda

There are some concerns about recent trends in R&D and economic growth in Japan. As Figure 6.1.7 shows, technology contributed greatly to the economic growth of Japan in the 1970s and 1980s, and R&D expenditure by the Japanese private sector continued to increase in the 1990s, although the rise in total factor productivity (TFP) slowed considerably. When looking at the relationship between changes in TFP and the average intensity of private-sector R&D input (R&D expenditure/annual amount of sales), it is clear that R&D seems to have little effect on economic growth. (Recently, it might even be called negative.) Thus, there is concern that R&D activity does not seem to be functioning as an engine for the economic growth in Japan.

The messages contained in the two charts in Figure 6.1.8 are the outcome of the Swiss-based IMD's international competitiveness study. The messages are that although Japan's input to R&D activities is among the world's highest, it does not bear fruit and does not contribute to increasing national competitiveness. A careful look at the analysis

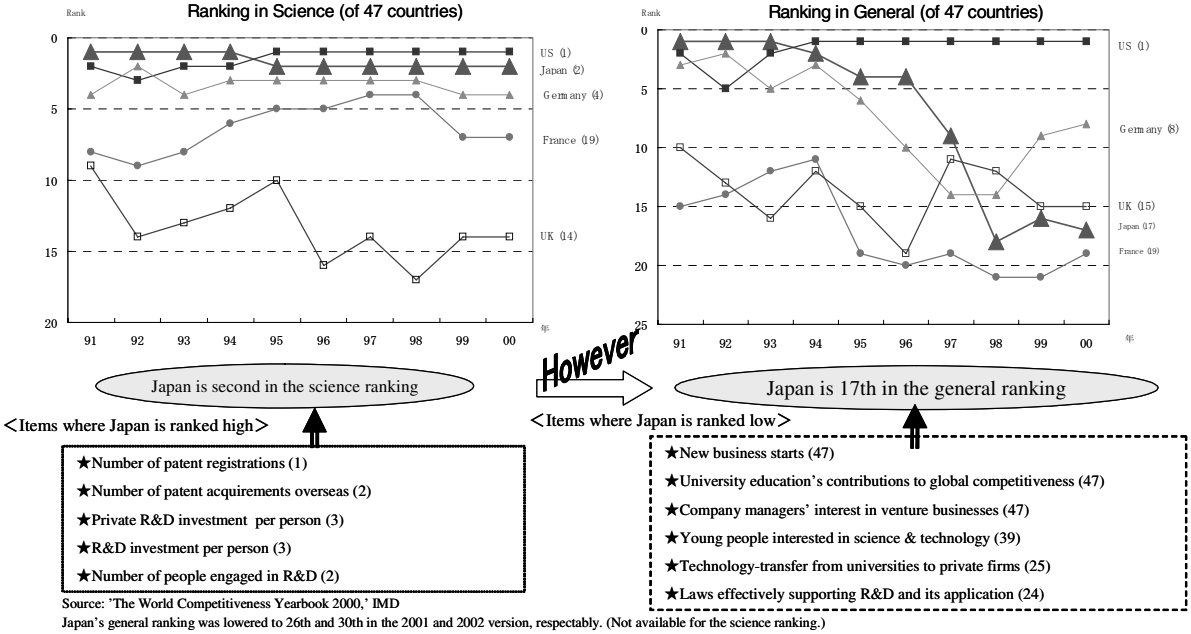
indicates that the cause of the problem may lie in the features of the national innovation system, *i.e.* the shortage of real experts, insufficient performance of researchers, and a poor institutional environment for supporting high-level and high-quality research work.

Figure 6.1.7. Gap between R&D and economic growth



Source: OECD

Figure 6.1.8 Gap between technological potential and competitiveness

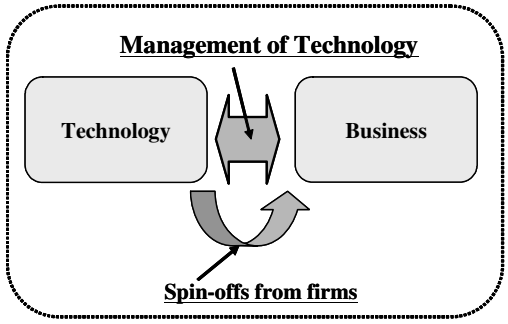


Source: 'The World Competitiveness Yearbook 2000,' IMD
Japan's general ranking was lowered to 26th and 30th in the 2001 and 2002 version, respectably. (Not available for the science ranking.)

This suggests that there may be systemic problems in the Japanese innovation system with respect to turning technological discoveries into commercially valuable technologies. The problem might be overcome by improving technology management in private companies, by encouraging spin-off start-ups from large companies so as to make full use of even small discoveries, or by promoting industry-academia co-operation by supporting the establishment of TLOs and encouraging university-created ventures (See Figures 6.1.9 and 6.1.10).

Figure 6.1.9. Reforming corporate innovation systems

Recognizing the private R&D is the most important part of national innovation system, recent innovation policy put an emphasis on reform of corporate innovation system, such as promoting MOT and spin-offs, so that technology and business can be linked closely…



Research on corporate innovation system

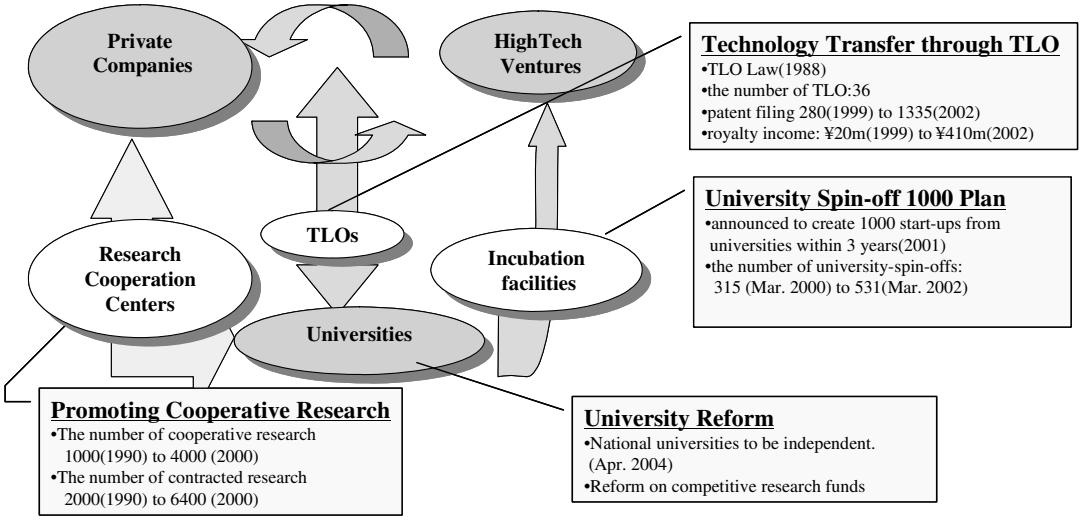
MOT Expert 10,000 Plan
•Foster 10,000 experts on Management of Technology within 5 years by assisting universities, etc. to make programs for training and education.

Promotion of Spin-offs from firms
•Promote spin-off ventures from firms in order to utilize the unused technologies, in suitable forms for the Japanese culture.

Corporate Innovation System Renaissance Project
•International research project on corporate innovation system through industry- academia cooperation.

Figure 6.1.10. Promoting industry-academia co-operation

As a reform of national innovation system, industry- academia cooperation has been a main issue for a couple of years. So far, 36 TLOs have been established and spin-offs from universities are promoted. The recent topic of interest is how the national university will change after transformed into independent agencis…



Technology Transfer through TLO
•TLO Law(1988)
•the number of TLO:36
•patent filing 280(1999) to 1335(2002)
•royalty income: ¥20m(1999) to ¥410m(2002)

University Spin-off 1000 Plan
•announced to create 1000 start-ups from universities within 3 years(2001)
•the number of university-spin-offs: 315 (Mar. 2000) to 531(Mar. 2002)

Promoting Cooperative Research
•The number of cooperative research 1000(1990) to 4000 (2000)
•The number of contracted research 2000(1990) to 6400 (2000)

University Reform
•National universities to be independent. (Apr. 2004)
•Reform on competitive research funds

Figure 6.1.11 illustrates the industrial cluster programmes. These programmes, as mentioned above, serve to shorten the distance between invention and commercialisation. Through such programmes, local linkages between universities, private companies and local governments in charge of technological promotion can be formed and strengthened. As noted above, 200 universities and 5 000 local companies have already established human and institutional networks. Such networks are expected to be an effective engine for the exchange of information and ideas, and thus are expected to facilitate the generation of new technologies and products.

Figure 6.1.11. Activating R&D activities in local area – industrial cluster programmes

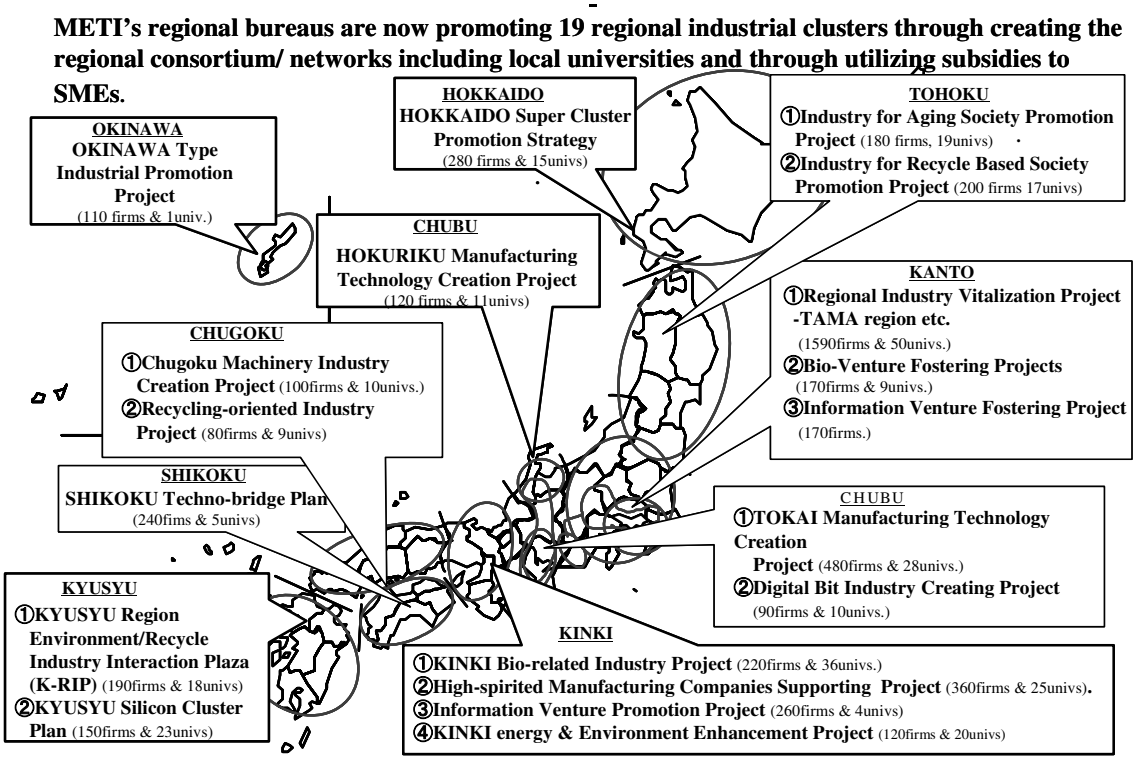
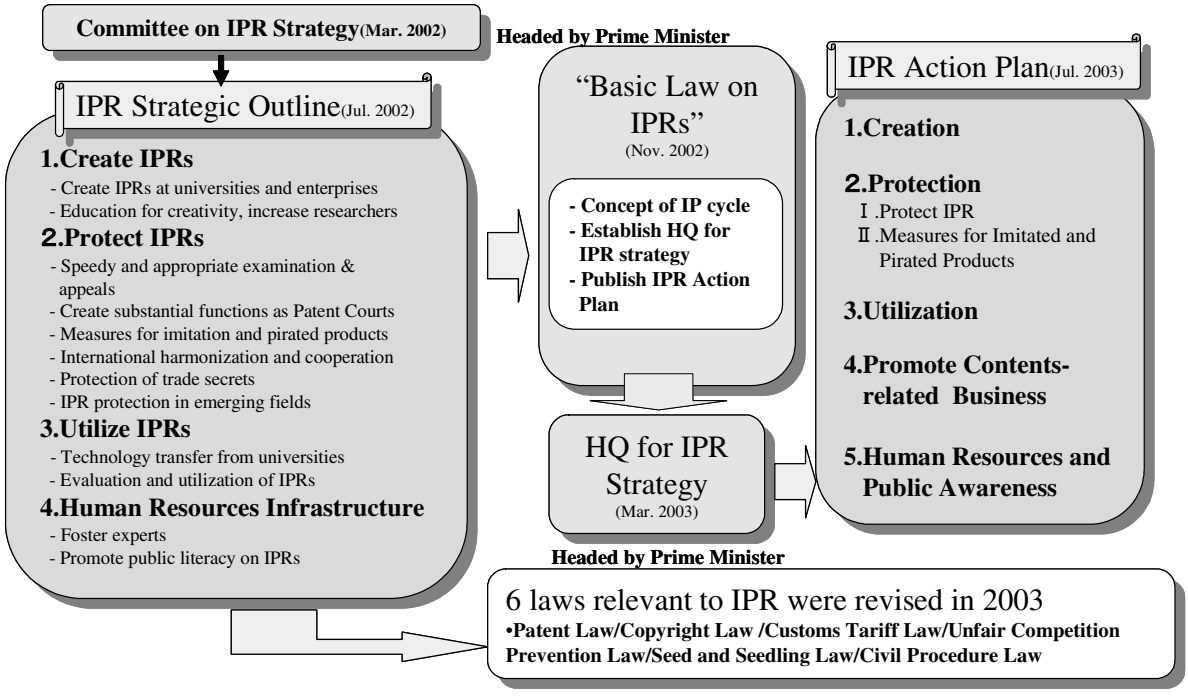


Figure 6.1.12 illustrates Japan's intellectual property rights (IPR) strategy. In order to generate better outcomes in terms of quality and quantity, management of the intellectual property that may be generated by R&D activities needs to be strengthened. With this in view, the Japanese government established the Committee on Intellectual Property Rights, headed by the prime minister, and developed the IPR Strategic Outline in July 2002. According to the policy direction identified there, the relevant laws were revised to strengthen the management of IPR. Also, the IPR Action Plan was developed to ensure effective and better implementation of these institutional reforms and improvements.

Figure 6.1.12. Intellectual property rights strategy

Issues on Intellectual Property Rights (IPRs) has been of interest at the Cabinet level in Japan since last year. The cycle of creation, protection and utilization of IPRs, including the measures against imitated and pirated products, are stressed.



Summary

This overview of Japan's science and technology policy, its framework, the role and functions of METI, METI's major policy measures to promote industrial technology, and recent topic and policy concerns about the Japanese innovation system is meant to serve as a basis for understanding Japan's science and technology policy.

6.2. "Agencification" and its effect on processes and performance: structural change in METI's innovation policy system[2]

Introduction

After World War II, Japan's economy and industry developed very rapidly and soon attained high economic growth. In this process, some point to the importance of the role played by the Japanese government, especially MITI (Ministry of International Trade and Industry, later METI: Ministry of Economy, Trade and Industry). Especially in the 1980s, when Japanese industries became very competitive and exports of high-technology products seemed to dominate world markets, MITI was "notorious" for its industrial policy and its VLSI project was cited as a typical success of industrial technology policy.[3]

However, views on MITI's in Japan's economic and industrial development are divided.[4] In addition, some note that its industrial policy played a lesser role in the1990s, when the economic bubble burst and Japan's growth fell sharply. MITI struggled to revitalise the economy and industry in the late 1990s, but did not seem successful at least in the short run.

Under these circumstances, MITI shifted its industrial policy towards innovation policy (see the preceding section) and the Japanese government placed high priority on science and technology (S&T) policy by allocating resources to R&D, with the view that technology and innovation are key factors for increasing national productivity and strengthening the national economy, and by reforming the institutions and the government funding process in order to make performance of R&D more effective. In this regard, one of the biggest reforms in terms of the institutional aspects of innovation policy is "agencification", the turning of government institutions into independent administrative agencies (IAAs).[5]

This section focuses on the "agencification" of two main players in METI's innovation system: AIST (National Institute for Advanced Industrial Science and Technology) and NEDO (New Energy and Industrial Technology Development Organisation). The next section discusses the history and role of METI in Japanese innovation policy and the role of national R&D projects in METI's innovation policy. The discussion them turns to the administration reform implemented in 2001 and the horizontal issues affected by the creation of the Council for Science and Technology Policy (CSTP). Then, the IAA system, which was established as a part of the administrative reform is described, and the extent of its effect on Japan's national innovation system is discussed. Next is examined the effect of agencification on METI's innovation policy system, with a close study of the case of AIST and NEDO. A conclusion discusses the effect of agencification on policy-making processes and performance.

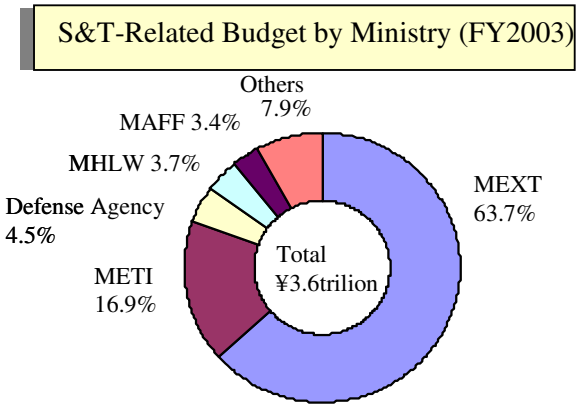
Background: METI's role in innovation policy and its history

Role of METI in Japan's NIS

Currently, the Japanese government spends about JPY 3.6 trillion (about USD 30 billion) and about 0.7% of GDP on S&T, most of it on R&D-related budgets. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) and METI share more than 80% of this amount and play the dominant roles (Figure 6.2.1).

Figure 6.2.1. S&T-related budgets, FY 2003

- MEXT is the largest S&T-related ministry in Japan. It was created through a merger of the former Ministry of Education (MOE) and the former Science and Technology Agency (STA). Its R&D funds consist of institutional funding to universities, especially national universities (around JPY 1.2 trillion), competitive research funds for basic research at universities (around JPY 0.3 trillion), large science projects such as space, nuclear, oceanic science (around JPY 0.5 trillion), etc.



- The Ministry of Economy, Trade and Industry (METI) is the second largest ministry in terms of S&T budget, but receives only 17% (around JPY 0.6 trillion). Most of its budget is spent for industrial development (innovation) and energy development.
- Other relevant ministries are the Defence Agency, the Ministry of Health, Labour and Welfare (MHLW), the Ministry of Agriculture, Forestry and Fisheries (MAFF), and the Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT). The shares of these ministries are 4.5%, 3.7% and 3.4%, respectively.

The above proportions are decided and co-ordinated by the Ministry of Finance (not only for R&D-related budgets), and the budget distribution among ministries has been stable for decades.

Comparing MEXT and METI, MEXT focuses on the promotion of science and basic technology, while METI is in charge of technology for industrial innovation and plays two roles through its innovation policy.

METI invests its R&D budget to support private firms, especially through national R&D projects linking firms and academia. METI's R&D budget is not very large compared to that of MEXT, and government support for private-sector R&D in Japan is also smaller than in other countries.[6]. However, government support for industries is not focused on R&D for defence, as in other countries, but on industrial innovation. Thus, METI's investment in R&D may play a key role in Japanese government support for innovation.

METI's other role is to create a suitable environment for technological development, that is, to reform the innovation system for economic development. This mission and tasks are clearly described in the new METI's establishment law (see Box 6.2.1).

Box 6.2.1. METI's mission
(excerpts from the law establishing METI)

METI's mission

- Development of the economy and industry, by enhancing private firms' economic vitality, by developing smooth economic relationships with foreign economies, etc.
- Securing a stable and efficient supply of natural resources and energy.

METI's tasks in industrial technology policy

- Creating a suitable environment for private firms' technological development (= reform of the innovation system).
- Promoting technology for mining and manufacturing industry (= industrial and energy technology), including implementing R&D and supporting R&D.

History of Japanese industrial technology policy and recent developments

MITI has played a leading role in innovation policy (industrial technology policy) in Japan since the end of World War II. Although its main focus has changed during the course of Japanese economic development, MITI has been involved in the formation of national R&D policy (see Box 6.2.2).

The changes are apparent in the so-called "national R&D projects" which were started in 1964. They were typically formulated as Large-scale Projects (industrial development), Sunshine Projects (new energy), Moonlight Projects (energy conservation), Next-generation Basic Research Projects (basic research), and so on. These were merged in the early 1990s and early 2000s.

In the latter half of the 1990s, as the economy continued to stagnate, the direction of industrial technology policy shifted to greater reliance on technology and innovation in order to revitalise the economy and industry. The Basic Science and Technology Law was enacted and entered into force in November 1995, giving the nation responsibility for formulating and implementing comprehensive policies with regard to the promotion of S&T. Based on the law, the First Basic Science and Technology Plan, covering fiscal year (FY)1996 to FY2000, was published in July 1996 with a target S&T-related budget of JPY 17 trillion over a five-year period. With this plan as momentum, the Japanese government steadily increased spending on R&D. The Second Science and Technology Basic Plan was approved by the Cabinet on 30 March 2001.

As R&D budgets began to increase, MITI's policy attention shifted from budget increases to reform of the Japanese innovation system, such as industry-academia co-operation, joint ventures, intellectual property rights (IPR) and so on. In this regard, MITI played a leading role by proposing laws relevant to innovation policy in almost every year, such as the TLO Law, the Japanese Bayh-Dole Provision, the Japanese SBIR Programme, and the Industrial Technology Enhancement Law. Most of the concepts stipulated in these laws had been implemented in the United States in the 1980s, and their aim was to create "exemptions" from rigorous regulations on government institutions such as national laboratories and national universities or government budgets (Table 6.2.1).

Box 6.2.2. Brief history of MITI's innovation policy, 1950s to early 1990s

1950s: Post-war reconstruction

Heavy and chemical industries were promoted as basic industries in order to reconstruct the nation. "R&D subsidies" were formally defined in this decade. Also, measures for controlled imports of technology were enforced in order to keep the national current account balance stable.

1960s: High economic growth

"The 1960s vision" published by MITI emphasised the nurturing of domestic technology. The system of "Large-Scale National R&D Projects" was institutionalised as a contract method and many projects were launched in order to establish national technologies. Also, R&D subsidies were strengthened for essential technology.

1970s: Diversification to environment, energy and welfare

MITI's "1970s vision" stressed "knowledge-intensive industries" like electronic equipment, while environment and energy issues became of interest for society. As for R&D projects, advanced technologies were pursued such as the VLSI projects launched in 1976, while the "Sunshine Projects" (R&D projects for new and renewable energy) and the "Moonlight Projects" (R&D projects for energy conservation) were launched in 1974 and 1978 respectively.

1980s: A technology-based nation

MITI's 1980s vision stressed that Japan's base as a nation should be technology and that unique and creative technologies should be pursued. Although the competitiveness of Japanese technology had attracted world attention by this time, Japan felt that its competitiveness was not based on technology it had created itself. Moreover, there was "free rider" criticism, especially from the United States: "Japan is free-riding on advanced technology developed by other countries and developing its strength in manufacturing technology" during the trade conflicts with the United States. In response to this criticism and recognising the need to promote creative R&D, the Japanese R&D budget shifted its emphasis to long-term research. "Next-generation Basic Research Projects" were launched in 1981 (after the VLSI projects). Moreover, international research co-operation, *e.g.* on the Human Frontier Science Programme (HFSP) in 1989 was promoted in order to make an international contribution with Japanese industrial technological capacity.

First half of the 1990s

METI's 1990's vision stressed a "global perspective", and the concept of "techno-globalism" was presented as a policy direction. Based on this, international collaborative research projects and dissemination of research results were promoted in terms of "industrial contribution". However, this kind of policy did not last long owing to the bursting of the bubble economy.

Timeline of national R&D projects

1966: Large-Scale Projects

1974: Sunshine Projects

1976: Medical & Welfare Instrument Projects

1978: Moonlight Projects

1981: Next Generation Basic Research Projects

1989: Global Environment Projects

1993: Industrial S&T Projects; New Sunshine Projects

2001: R&D Programme

Table 6.2.1. Innovation-related laws established by METI in the late 1990s

Law	Provisions
• Technology Licensing Office (TLO) Law (The Law Promoting Technology Transfer from Universities to Industry) (1998)	Support establishment of TLOs (support TLOs outside universities in order to escape regulations on national universities)
• Japanese Bayh-Dole Provision (as a part of the Law on Special Measures for Industrial Revitalisation (1999)	Made it possible for contractors to keep IPR resulting from national contract research (a measure to obtain exemption from national budget restrictions)
• Japanese SBIR Programme (as a part of the Law for Facilitating the Creation of New Business) (1999)	Provide greater opportunities for SMEs to get financial support for R&D
• Industrial Technology Enhancement Law (2000)	Allow researchers of national universities and institutions to work as executives of private enterprises (a measure to obtain exemption from the restriction on public officials) Reduce patent fees for universities, professors, creative SMEs, etc.

Reform of the innovation system involved not only deregulation but also extended to the use of government funding. Then R&D policy emphasis shifted to budget-related reform and efficient and effective use of budgets, through setting priorities and reform of organisational institutions.

- The prioritisation of government R&D funding was an important issue in the late 1990s. The Second Basic Science and Technology Plan, which took effect in March 2001, emphasised the four priority areas of life sciences, information technology, environment, and nanotechnology and materials, as well as an increase in the R&D budget to JPY 24 trillion over five years.
- Recognising that the relaxation of regulations was insufficient and that institutional restructuring was necessary to achieve efficient and effective budget use, "agencification" was introduced for most national public research institutes and many national corporations and national universities in 2001, 2003 and 2004, respectively, as explained below in detail.

After agencification was implemented, the interests of innovation policy shifted to policy packages on specific issues of importance for reform of the innovation system, such as the University Spin-off 1000 Plan, Start-up Doubling Plan, MOT Expert 10000 Plan, Regional Clusters Programme, and Intellectual Property Basic Plan.

Structural reform of the administration and "agencification"

Administrative reform – establishment of CSTP and reorganisation of ministries

Administrative reform in 2001

Large-scale administrative reform of the Japanese government system began in January 2001. The direct cause may have been a series of scandals involving public officials and increasing public distrust of the administration, but the fundamental background seems to have been the economy. In the latter half of the 1990s, the Japanese economy continued to stagnate and the government invested huge amounts of public money, for example for public works, to stimulate the economy. As this proved wasteful, public opinion began to fault the administration. Although public distrust focused

primarily on policies for public works, bank regulation and medical examinations, public opinion supported reform of all aspects of the administration.

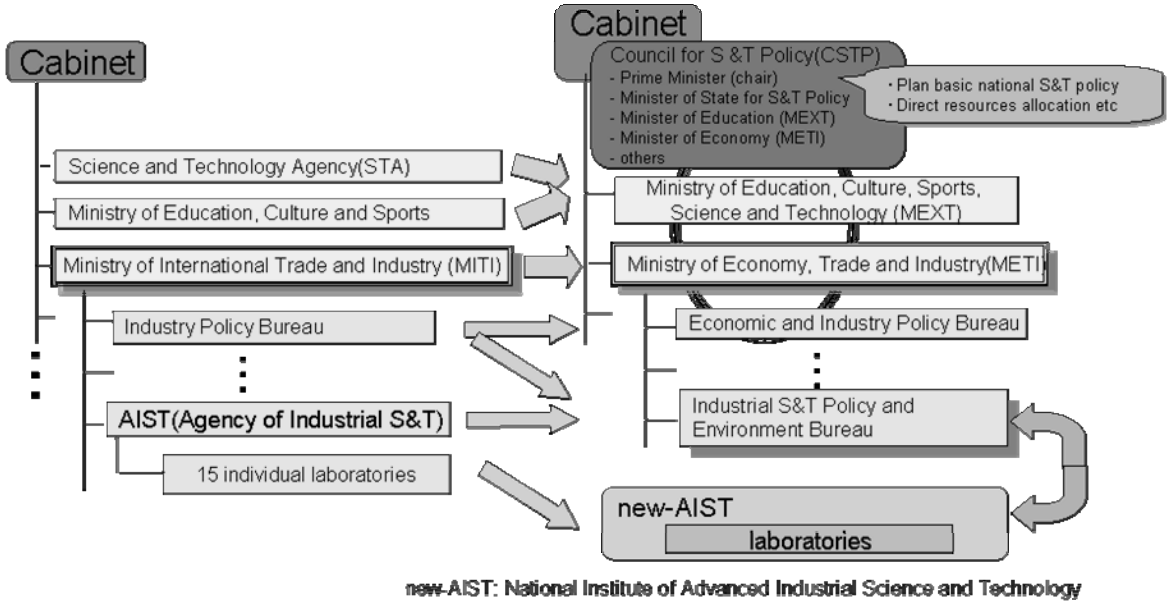
With negative public opinion as a background, administrative reform of the Japanese government became a main issue of the late 1990s. The discussions progressed as follows:

- In November 1996, the Administration Reform Committee was established in the Cabinet and headed by the Prime Minister. It held more than 40 meetings.
- In December 1997, a final report was published. It proposed three pillars: *i)* strengthening the Cabinet function; *ii)* creating new ministries; and *iii)* reducing administrative functions and making them more efficient (including the establishment of IAAs).
- Based on this report, "The Basic Law on the Reorganisation of Ministries of the Central Government" was passed by the Diet in June 1998. The Headquarters for Promoting Administrative Reform was established by the law and began to work on each ministry's establishment law and "The General Law on Independent Administrative Agencies". These laws were enacted in early 1999 and took effect in 2001.

For S&T policy, the former single layer of ministries was divided into three layers: CSTP, ministries and agencies (see Figure 6.6.2):

- At the Cabinet level, the CSTP was established as the headquarters for national S&T policy.
- Ministries were reorganised and merged into 12 ministries. For S&T policy, MOE and STA were merged into MEXT and MITI was reorganised as METI.
- National research institutes became IAAs.

Figure 6.2.2. Administrative reform, 2001



CSTP and ministries – horizontal issues

The CSTP was given three missions:[7] *i)* to research and consider basic policy regarding comprehensive and systematic promotion of S&T; *ii)* to research and discuss important issues concerning S&T, such as basic principles for allocation of budget resources, human resources, etc.; and *iii)* to evaluate nationally important R&D projects such as large-scale R&D projects.

CSTP consists of 14 regular members, six of whom are Cabinet members: the Prime Minister is its head, the Minister of State for S&T Policy is administrator and two ministers from the main S&T-related ministries, MEXT and METI. Other regular members are the Minister of Finance (budget) and the Minister of Public Management, Home Affairs, Posts and Telecommunications (public management). Other S&T-related ministers may attend council meetings on a temporary basis. There are also eight non-Cabinet members, currently six from academia and two from industry. As a result, Japan's CSTP is quite academic and science-oriented compared with other countries' equivalent bodies, which are more innovation-oriented.

Plenary meetings of CSTP have been held regularly on a monthly basis with the participation of the Prime Minister. Other than plenary meetings, expert meetings on important technology areas, expert meetings on S&T system reform and many other working group meetings have been held. Issues discussed include industry-academia-government co-operation, competitive research funds, IPR policy regarding universities and national research institutes and promotion of high-technology joint ventures. CSTP generally is powerful enough to take decisions on nationally important issues, but its administration does not seem to be competent to propose new policy. Therefore, meetings tend to discuss and co-ordinate proposals made by individual ministries, especially METI and MEXT, and to summarise reports on national S&T policy.

The birth of CSTP and the reorganisation of ministries has changed the behaviour of ministries and seems to have diminished "turf wars" between ministries. In the past, MITI and STA (and MOE) had a long history of quarrelling and competing over their respective jurisdictions.[8] For example, STA and MOE were not allowed to fund industry directly, while MITI was not allowed to fund universities directly. Such restrictions had begun to fade even before the new administration was established (in the late 1990s) as measures for academia-industry co-operation, such as the TLO Law, were taken. However, the creation of the CSTP and new ministries has changed the relationship between ministries dramatically. First, METI established a division for university collaboration while MEXT established a division for industry collaboration. Moreover, the existence of CSTP made turf wars meaningless because each ministry was able to propose issues relevant to other ministries at the CSTP. For example, many industry-academia co-operation measures have been proposed by both ministries on a competitive basis and the proposals have been discussed and co-ordinated by CSTP or other Cabinet bodies. METI proposed the "University Spin-off 1000 plan" in May 2001, while MEXT proposed "30 Universities COE Plan (later, renamed the 21st Century COE Programme)" in June 2001. METI also announced the "Industrial Cluster Programme", while MEXT announced the "Intellectual Cluster Creation Programme" in 2001. These programmes were authorised in the CSTP's report.

The merger of STA and MOE also seems to have affected the co-ordination of S&T policy. There had been quarrels and competition in the past between STA and MOE concerning jurisdiction over national research institutes and universities. After the merger, the research funding function for universities was merged with STA's funding

sections (bureaus), and the space-related research organisation of STA (national co-operation) and MOE (university-related organisation) were merged into a new IAA (JAXA).

"Agencification": establishment of independent administrative agencies

The background and mechanism of agencification

The administrative reform implemented in 2001 was not limited to the Cabinet and ministry level. Also proposed were the separation of the government's implementing sections and the creation of the independent administrative agency, the introduction of which was decided at the same time as the ministerial reform as a way to make government services more efficient. Based on "The General Law on Independent Administrative Agency" adopted in July 1999, individual IAA establishment laws were enacted and passed by the Diet in December 1999.[9]

The agency system establishes independent institutions by separating them from government bodies in order to achieve flexibility, while also giving proper incentives by shifting from an *ex ante* control scheme to an *ex post* evaluation scheme. The government services agencified are those that the government funds but which it does not carry out itself.

The aim of agencification is efficiency of government services. One of the reasons for inefficiency may be the fact that government organisations had no incentive to perform better, but there was also a recognition that government institutions (such as the budget system) were too restrictive to be flexible. For example:

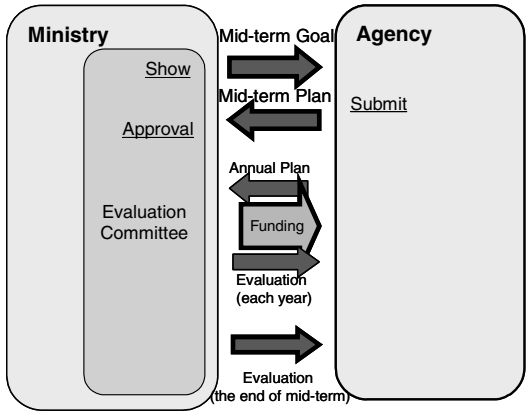
- The budget decided by the Diet each year must be used as decided and must be spent within the fiscal year. It is a complex matter to use a budget flexibly over a year.
- Internal organisational structures, and the number of employees and their salaries, are regulated by law and are difficult to change. Organisations cannot decide their organisational structure on their own.
- Projects tend to be evaluated only when requesting a budget. If the results of projects are not evaluated, it does not matter if a project succeeds or not.

Therefore, independence from the government in order to secure flexibility and a transition from intervention and control by the government in advance to evaluation after the fact became the basic principles of the new agency system. The actual system for an IAA is as follows (Figure 6.2.3):

- The competent minister of an agency establishes and publishes a "mid-term goal" for the agency for a three to five year period, which includes efficiency of business operation, qualitative improvement of services offered and accounting. Based on the goal, the agency submits a "mid-term plan" which must include measures to attain the goal. The plan must be approved by the competent minister.
- Based on the mid-term plan, the agency submits an "annual plan" and conducts its business on that basis. After the end of the year, the agency is evaluated by the IAA Evaluation Committee, which is established in the ministry.

- The agency receives an operational grant every year from the ministry for running its business. Its expenditure are not in principle controlled by the ministry, thus securing the agency's autonomy and independence. The agency may also obtain funding from other sources such as competitive funds or other subsidies from the government or contracts from industry.

Figure 6.2.3. Agency mechanism



- The performance of the agency will be strictly evaluated according to its mid-term plan at the end of the mid-term period. Based on this evaluation, the competent minister will take any necessary measures concerning the business of the agency, including making changes in the agency.

Employees of IAAs may be either public-official type employees or non-public official type employees.

Agencification in Japan's innovation system

In April 2001, 57 agencies were created. Although agencification is not limited to national research institutes or other R&D-related activities, the main target of agencification was national research institutes. In fact, out of 84 businesses that became independent in 1999, 56 were those of national research institutes, and about 33 agencies[10] out of the 57 that became independent in April 2001 were national research institutes.

Agencification will greatly affect the government innovation system. Most national research institutes were agencified in 2001 and separated from their ministry. The main national research institutes that became IAAs in April 2001 include AIST, NIMS and NARO (Table 6.2.2) In the case of METI, 15 research institutes were merged into one large research institute, and in the case of the Ministry of Agriculture, Forests and Fisheries (MAFF) and the Ministry of Land, Infrastructure and Transport (MLIT), many agencies were established as national institutes. The national research institutes that have not yet been agencified are those of the Defence Agency (DA) and some at the Ministry of Health, Labour and Welfare (MHLW).

Trends towards agencification have not been limited to the separation of government institutes (such as national research institutes) from government organisations. Since national corporations have also been the target of public criticism because of reported inefficiency and wasteful spending of public money, the Headquarters for Promoting Administrative Reform shifted attention to reform of national corporations after the agencification of government institutions:

- The Basic Law on Special Corporation Reform was enacted in June 2001 and the Headquarters for Promotion of Special Corporation Reform was established.
- Discussions were held and the Plan for the Disposition and Rationalisation of Special Corporations was published in December 2002, determining how each national corporation should be rationalised.
- Based on this plan, laws to revise each national corporation were proposed to the Diet, and as a result, most national corporations were to become IAAs while others were be merged into existing IAAs, mostly from October 2003 to April 2004.

As in the case of agencification of government bodies, national corporations to be agencified were not limited to R&D-related organisations. However, most S&T-related national corporations were agencified. Some of them, such as NEDO, JST and JSPS, function as R&D funding agencies. Others, such as RIKEN and NASDA, function as national research institutes. Small national corporations acting as funding agencies, such as TAO (Telecommunications Advancement Organisation), BRAIN (Bio-oriented Technology Research Advancement Institution) and OPSR (Organisation for Pharmaceutical Safety and Research) were merged into existing national research institutes or IAAs to conduct both intramural and extramural research. As a result, out of the current 107 IAAs, more than half are S&T-related at least in some sense. Remaining S&T-related national corporations that have not yet been agencified are those of nuclear-related organisations, the Japan Atomic Energy Research Institute (JAERI) and Japan Nuclear Cycle Development Organisation (JNC). Table 6.2.2 provides a list of the main S&T-related agencies.

In April 2004, national universities were also agencified. Their agencification was discussed at the time of administrative reform, but a conclusion could not be reached and was postponed to consider the special nature of universities. The report, *A New Image of National University Corporations*, was published in March 2002 and national universities were to be agencified on the basis not of the General Law of IAA but of the National University Corporation (NUC) Law. The law passed the Diet In July 2003 and took effect in April 2004.[11] The points of difference with IAA are as follows:

- Each national university was incorporated in order to promote competition with other universities.
- NCU will be evaluated not only by MEXT's NCU Evaluation Committee but will also be peer reviewed by a specialised agency (National Institution for Academic Degrees and University Evaluation [NIAD-UE]) from the point of view of performance of research and education.
- Each university can select a candidate for president to be appointed by the minister and each university can also submit its mid-term goal to be approved by the minister.
- A system for non-university personnel to participate in management and a non-public official type of employee status were introduced to make management flexible.

As a result, 99 national universities and 15 inter-university research institutes were agencified into 89 national university corporations and four inter-university research institute corporations. The total operational grant amounts to JPY 1.3 trillion.[12] Thus, agencification extends to almost all government S&T-related organisations, from national

research institutes, funding agencies of national corporations to national universities, and the total amount of S&T-related operational grants amounts to around JPY 2 trillion out of the JPY 3.6 trillion that constitutes the national S&T-related budget.

Table 6.2.2. Main R&D-related agencies

Ministry	Name of Agency	Grant
MEXT	○ National Aerospace Laboratory of Japan (NAL)[1]	-
	○ National Institute for Materials Science (NIMS)	16.3
	○ National Institute of Radiological Sciences (NIRS)	13.5
	○ National Research Institute for Earth Science and Disaster Prevention(NIED)	7.5
	◎ Japan Aerospace Exploration Agency (JAXA)	137.3
	● Japan Science and Technology Agency (JST)	94.7
	● Japan Society for the Promotion of Science (JSPS)	29.8
	● RIKEN	69.2
	● Japan Agency of Marine Earth Science and Technology (JAMSTEC)	30.7
METI	○ National Institute of Advanced Industrial Science and Technology (AIST)	68.2
	○ National Institute of Technology and Evaluation (NITE)	7.3
	● New Energy and Industrial Technology Development Organisation (NEDO)	172.7
	● Information Technology Promotion Agency (IPA)	5.3
MHLW	○ National Institute of Health and Nutrition (NIHN)	(1.0)
	○ National Hospital Organisation	52.1
	◎ Pharmaceuticals and Medical Devices Agency (PMDA)	10.0
MAFF	○ National Agriculture Research Organisation (NARO)[2]	-
	○ National Institute of Agrobiological Sciences (NIAS)	7.9
	○ National Institute for Agro-environmental Sciences (NIAES)	3.3
	○ National Institute for Rural Engineering (NIRE)	2.2
	○ National Food Research Institute (NFRI)	2.3
	○ Forestry and Forest Products Research Institute (FFPRI)	8.7
	○ Fisheries Research Agency (FRA)	15.2
	◎ National Agriculture and Bio-oriented Research Organisation (NARO)	36.0
MPHPT	○ Communications Research Laboratory (CRL) [3]	-
	○ National Research Institute of Fire and Disaster	1.2*
	◎ National Institute of Information and Communications Technology (NICT)	38.3
MLIT	○ Public Works Research Institute (PWRI)	4.7
	○ Building Research Institute (BRI)	2.1
	○ National Traffic Safety and Environment Laboratory (NTSEL)	1.7
	○ National Maritime Research Institute (NMRI)	3.1
	○ Port and Airport Research Institute (PARI)	1.6
	○ Electric Navigation Research Institute (ENRI)	1.8
ENV	○ National Institute for Environment Studies (NIES)	9.4*

Notes: The grant number is the budget for operational grant in FY2004 (billion JPY) (quoted from each agency's annual plan listed in each agency's HP). IAAs may obtain funding from the government not only in the form of an operational grant but also as subsidies or contract.

○ : IAA with national laboratory origin (most became independent in April 2001).

● : IAA with national corporation origin (most became independent in October 2003 or April 2004).

◎: IAA originating from merger of national laboratories (or its IAA) with national corporations.

1. Merged with NASDA and ISAS into JAXA in October 2003.

2. Merged with BRAIN into the new-NARO in October 2003.

3. Merged with TAO into NICT in April 2004.

Theory of agencification

The agency system was introduced, especially in the area of S&T, in order to offer government services more efficiently. However, the theory of agencification and its effect on efficiency has not been studied very much. The model for Japan's agencification was the United Kingdom's agency system but there are some differences. For example, a president is appointed by the minister in Japan's system, while a president can be selected in other ways in the UK system.

The aim of agencification is to achieve efficiency, but the separation of an entity does not always attain this goal. The principal–agency theory may be important in this regard. The theory describes the case in which:

- There is a contract between principal and agency. The two parties have different utilities.
- The contract is not perfect and there is an information gap between the principal and the agency. Usually, the agency has more information than the principal.
- Therefore, the agency may not work as the principal would like if it seeks to increase its own utility. However, the principal cannot evaluate the performance of the agency precisely because it does not have enough information.
- In order to enable the agency to work as the principal wishes, the principal may try to obtain more information. However, this involves monitoring costs to get information, and intervening in or controlling the agency may reduce the latter's flexibility and incentives.

The question then is the balance between monitoring costs and incentives. The more the principal tries to monitor performance and intervene in agency activities, the more the agency may lose incentives. The best solution may be to evaluate using a simple indicator that is important for the principal (that is, to make the utility of both parties the same) and to reduce the information gap between the two.

This principal-agency theory may apply to the system both before and after agencification. That is, agencification is a question of organisational borders: which is more effective in terms of principal-agency theory, the agency within the organisation of the principal or the agency outside the organisation of the principal?

- Inside the organisation, monitoring costs tend to be low because flows of information are relatively fluid. However, this method tends to weaken incentives unless organisation and personnel evaluation systems are carefully organised.
- Outside the organisation, incentives may be relatively easily defined because of organisational independence. However, monitoring costs may be high and it may be difficult to know how well the agency works for the principal.

In the case of government services, two additional points should be considered with respect to the above theory. First, separation from government bodies can give an organisation flexibility and make it efficient because it can be released from many government restrictions. Second, it may however be difficult to define a proper evaluation system since public organisations are not economic institutions, and their performance cannot be measured based on profit. Transition from *ex ante* to *ex post* evaluation is important in this regard, but without proper evaluation systems, separation may make it impossible for the principal to control the agency because of their different utilities.

Therefore, it can be assumed that agencification of government services may give an agency considerable flexibility, but that the question is the evaluation system and the balance of monitoring costs and intervention. Therefore, how are the utilities of the two to be harmonised? Is the mid-term goal, as contract, clear enough to correspond to what the principal wants the agency to do? How will the evaluation committee evaluate the performance and efficiency of the agency? Moreover, it may be difficult to monitor the agency simply by the evaluation committee. Then, how can the principal obtain information from the agency and intervene in its activities beyond its mid-term goal?

The effects of agencification on METI's policy-making processes

METI's innovation system and agencies

METI's innovation system

When METI was formed, its bureaus were reorganised and a new Industrial Science and Technology Policy and Environment Bureau was established to assume responsibility for innovation policy. The new bureau was established by merging the Industrial Technology Division of the old Industrial Policy Bureau, which was mostly in charge of innovation system reform, and the policy planning section of the Agency of Industrial Science and Technology (previous AIST), which was in charge of promotion of industrial technology. The implementing section of the previous AIST was separated into the new AIST.

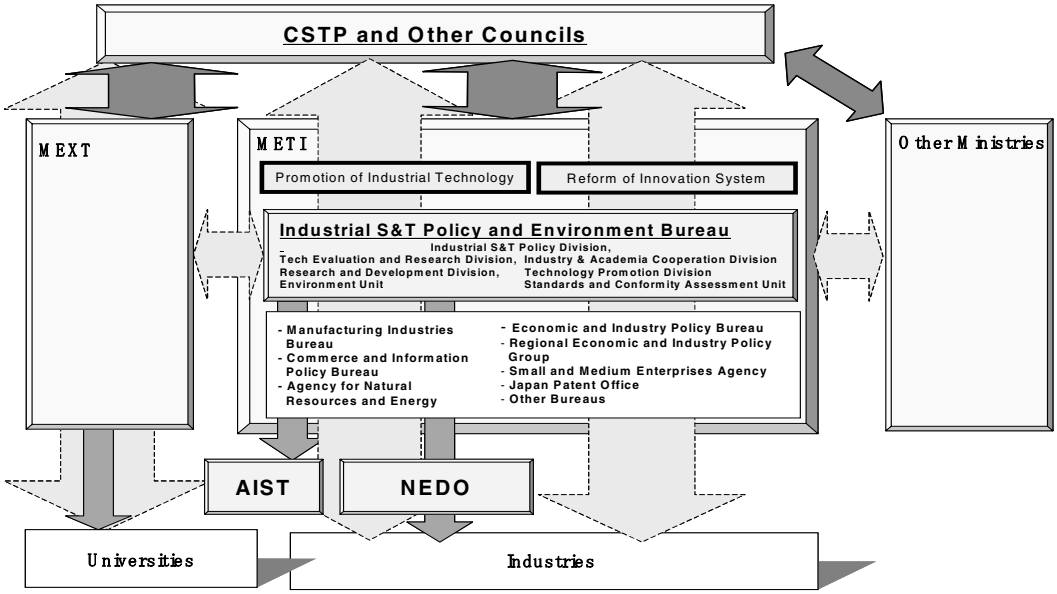
The new mission of METI in terms of innovation policy is to reform the innovation system and to promote industrial technology. The former includes:

- Industry-academia co-operation in co-operation with CSTP and MEXT.
- Promotion of joint ventures, in co-operation with the Small and Medium Enterprise Agency and the Economy and Industry Policy Bureau (New Business Promotion Office).
- Regional cluster promotion with the Regional Economy and Industry Policy Group.
- IPR policy development in co-operation with the Japan Patent Office and Economy and Industry Policy Bureau (IPR Policy Office).

These policies may be implemented government-wide as the creation of CSTP makes it easier to propose innovation system reform for discussion at the national level.

On the other hand, strategic funding for industrial technology is still a strong tool of innovation policy along with fiscal incentives for R&D. This funding policy, especially planning of national R&D projects, is typically developed in co-ordination with the Manufacturing Industry Bureau, the Commerce and Information Policy Bureau, and the Agency of Natural Resources and Energy.

Figure 6.2.4. Innovation policy system in and around METI



For the implementation of fiscal measures, AIST and NEDO are two important elements of METI's innovation policy system (Figure 6.2.4). METI's total S&T-related budget is around JPY 600 billion, but this includes funding not directly related to R&D. The distribution of METI's R&D budget, which is approximately JPY 400 billion, is as follows (Table 6.2.3):

- Around JPY 100 billion for basic technology and intellectual infrastructure such as biological resources/databases or chemical management databases. AIST and NITE are the implementing organisations.
- Around JPY 200 billion for industrial technology and new energy and energy conservation technology, mostly for funding national R&D projects. NEDO is the main R&D funding and management organisation, while IPA is in charge of software technology.
- Other R&D funds such as fossil fuel energy technology or nuclear safety (usually through the ministry or other agencies) or subsidies for SMEs and regional clusters (usually though METI's regional offices or other agencies).

National R&D projects in METI's system

National R&D projects play an important role in METI's R&D funding. In the past, METI targeted technology, planned projects and implemented them. However, as the number of projects increased, METI was unable to bear the cost of implementation and began to shift implementation to NEDO. Currently, most national R&D projects are managed and implemented by NEDO.

In 2001, METI introduced its "R&D Programme Scheme" so that national R&D projects can be managed more effectively and efficiently. Because of the large number of national projects (currently 200-300), projects tend to overlap and many have unclear aims – to develop technology for the sake of the technology. The new scheme, a project packaging scheme, packages related R&D projects and other measures into a programme

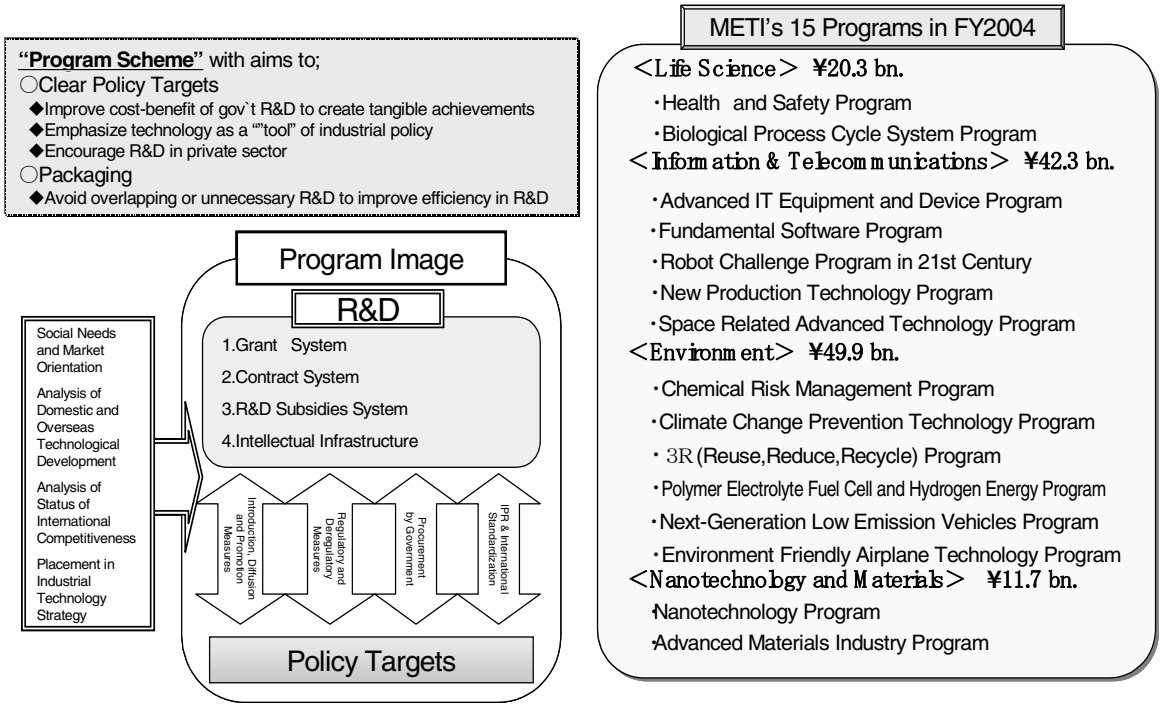
with clear policy targets. The concept of this scheme is based on the understanding that clear targets are necessary for the success of R&D projects, that technology and R&D are aspects of the project, but that other measures are also important for innovation, such as IPR and standardisation, procurement, deregulation and promotion measures.

Table 6.2.3. METI's R&D budget

	Agency, etc.	Content	Amount
Basic technologies (national laboratories)	AIST NITE	• Basic advanced technologies • Intellectual infrastructure	Ca. JPY 100 billion
Funding for industrial technology (including new energy, etc.)	NEDO	• Grant for universities • National R&D projects (industrial technology, new energy, energy conservation) • Subsidies for pre-competitive technology	Ca. JPY 200 billion
	IPA	• Software technology	
Funding for other technology (energy, SMEs, etc.)	METI, regional offices, other agencies, etc.	• Subsidies for SMEs, regional clusters, • Fossil fuel (exploration, etc.), nuclear safety, etc. • Others	Ca. JPY 100 billion

Currently, there are 15 programmes in four priority areas (Figure 6.2.5). In addition, five programmes were recently introduced in the following areas: new energy, energy conservation, electric power, fossil fuels and nuclear energy.[13]

Figure 6.2.5. R&D programmes



AIST/NEDO and the effect of agencification on the policy-making process

AIST and NEDO as agencies

AIST and NEDO are two agencies of importance for METI's innovation policy (Figure 6.2.6). They became agencies in 2001 and 2003, respectively. As METI had long been trying to make these institutions more effective and efficient, METI generally welcomed their agencification.

AIST (National Institute of Advanced Industrial Science and Technology)[14] had been a group of 15 national laboratories and one organisation[15] of the old Agency of Industrial Science and Technology of MITI and was reorganised as a single IAA in April 2001 and separated from MITI. The new AIST is now Japan's largest public research institute, covering almost all areas of industrial technology, with more than 2 500 researchers with PhD status and a budget for FY2002 of about JPY 68.5 billion. The research work conducted at AIST can be categorised as basic technology, but researchers engaged in R&D are encouraged to keep the actual output of the research in mind.

NEDO (New Energy and Industrial Technology Development Organisation) functions as a funding agency to support R&D in the industrial technology and new energy and energy conservation technology areas. NEDO was established as a national corporation in 1980 for the purpose of promotion of R&D and the introduction of new energy and energy conservation. In 1988, NEDO added industrial technology R&D to its functions and began to play a central role in implementation of national R&D projects in industrial technology and energy technology (new energy and energy conservation). It changed its status from a national corporation to an IAA in October 2003.

NEDO is now Japan's largest public R&D funding and management agency with about 1 000 employees and a budget in FY2002 of about JPY 250.1 billion. Within NEDO, funding and management of national R&D projects play an important role. National R&D projects are usually funded by concluding contracts with research consortia consisting of private companies, universities and research institutions such as AIST. NEDO also provides research grants for academia as well as subsidies for pre-competitive technology research by industry.

Changes in the policy-making process

The "agency system", introduced at AIST and NEDO, has affected METI's innovation policy-making process. Although both AIST and NEDO have applied the IAA system stipulated in the General Law of IAA, they differ in terms of their operations because R&D at AIST tends to be positioned more as basic research and laboratory-oriented, while R&D projects of NEDO tend to be policy-oriented.

Figure 6.2.6. Characteristics of AIST and NEDO

AIST (National Institute of Advanced Industrial Science and Technology)

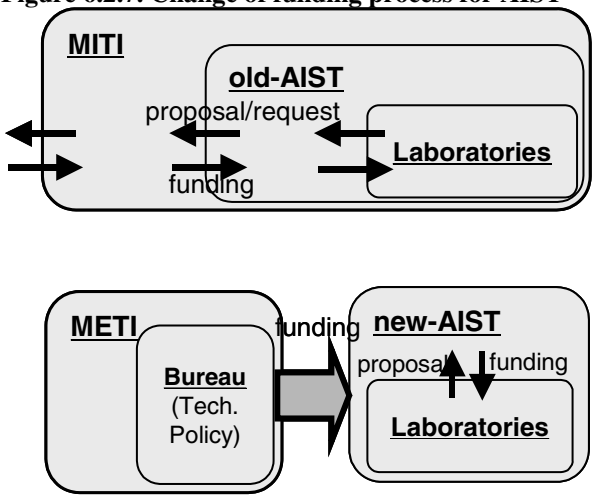
- Independent from METI in Apr. 2001 by merging 15 national laboratories, etc.
- Largest public research institute in Japan
  - about 2500 researchers (3200 employees) with 1100 researchers from firms and others,
  - budget (operational expense in FY2002): ¥68.4 bn.
  - has nation-wide network,
  - covers almost all areas of industrial technology (life science, IT, environment/energy, materials/ nanotechnology, geological surveys, standards/measurement, etc.)
- Focuses on advanced / fundamental (basic) technology with a clear scenario.

NEDO (New Energy and Industrial Technology Development Organization)

- Reorganized as an independent administrative agency in Oct. 2003
  - 1980 : Established (New Energy Development Organization)
  - 1988 : Added industrial technology R&D (renamed the "New Energy and Industrial technology Development Organization)
- Largest R&D funding/ management agency in Japan
  - about 1000 employees
  - budget : ¥250.1 bn (R&D ¥182.1 bn, new energy/ energy conservation ¥60.0 bn)
  - new energy/ energy conservation promotion and industrial technology R&D all areas
- Focuses on national R&D projects (contracted research), as well as research grants for researchers, subsidies for pre-competitive technology, and others

In the case of AIST, where R&D themes tend to be basic and often proposed by laboratories, the agency system seems to fit well. Before agencification, the budget request process was complex (see Figure 6.2.7). First, laboratories submitted proposals and requests to MITI, which then proposed and requested funding from the Ministry of Finance (MOF). MOF decided the next fiscal year's budget and submitted the proposal to the Diet. Appropriations were then decided and funding allocated according to the appropriation. Several procedures were involved and flexibility therefore was very limited.

Figure 6.2.7. Change of funding process for AIST

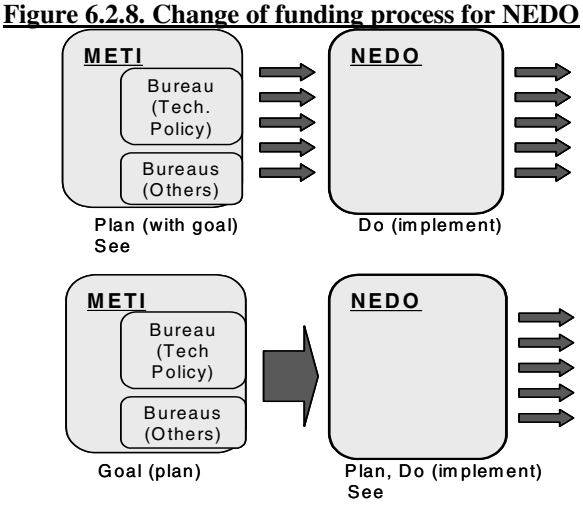


After agencification, procedures for budget requests at METI were greatly simplified and flexibility became possible. METI requests an R&D-funding budget for AIST (operational grant) from MOF and the operational grant is decided, by necessity from a policy point of view, by comparison with the amount of previous year.[16] This resulting amount is given to AIST and AIST can use the operational grant flexibly based on its annual plan or mid-term goal. Thus, METI no longer has to explain individual R&D themes to MOF, and METI's budgetary process has been greatly reduced.

In the case of NEDO, the situation is a little more complicated since it is usually METI that plans the R&D projects. Before agencification, METI planned each R&D project and requested the budget through collaboration with the related bureaus of MOF. After the appropriation, METI decided its basic plan and made a contract with NEDO for each project to allow NEDO to implement the project (such as public tender, contract with a consortium and project management). In that sense, NEDO was expected to do as METI wished, and there were no incentives to manage projects efficiently.

Since agencification, METI decides its mid-term goal and then provides the operational grant to NEDO (Figure 6.2.8). However, the difference with AIST is that METI aggregates each R&D project into a programme in order to show the need from a policy point of view[17] when it requests the operational grant from MOF. METI shows the list of projects to NEDO as well as the packaged R&D programme it publishes. Although NEDO may have flexibility in its use of the operational grant, it is expected to implement its R&D projects with this list as a reference, since NEDO, as documented in its mid-term goal, is expected to have a close relationship with the policy side. In that sense, METI's budgetary process has not changed very much; it no longer has to contract with NEDO for each project, but a list of projects still needs to be co-ordinated with MOF.

Figure 6.2.8. Change of funding process for NEDO



Given the operational grant, NEDO is expected to manage each project properly – to plan (by referring the project list of METI), do (implement) and see (evaluate) each project. Some flexibility in the use of an operational grant is given to NEDO in order to reflect the results of project evaluation. In that sense, NEDO is expected to play a role as an R&D project management organisation from the traditional role of R&D administration/implementation organisation.

Effect of agencification on performance

Evaluation results for agencies

As only a few years have passed since their agencification, it may be too early to judge R&D performance at AIST and NEDO. However, as measures taken by each agency so far indicate, both agencies have been trying to reform by taking advantage of the flexibility they are given, in order to achieve higher performance. These efforts can be observed in the results of evaluations made by the IAA Evaluation Committee each year (Table 6.2.4).

Table 6.2.4. Comparison of AIST and NEDO as agencies[1]

	AIST (from April 2001)	NEDO (from October 2003)
Characteristics	Research institute	Funding agency
Research	Basic research	National projects
Numerical indicators of evaluation	Number of papers Impact factor (IF) Number of patent licences Number of collaborative research projects, etc.	Proportion of successful projects Number of papers, patents Proportion of commercialisation Survey from users, etc.
Evaluation for FY2001	A (AA, A, B, C, D) • New organisation and personnel system have been introduced • The president announced a clear message to employees • Consciousness of employees to provide services to the public emerges	---
Evaluation for FY2002	A (AA, A, B, C, D) • Research improved both in quality and quantity because of top management • Numerical indicators increased satisfactory. Revenues also increased.	---
Evaluation for FY2003	A (AA, A, B, C, D) • Reform continued positively • Basic principle of research clarified and announced • Produced lots of excellent research results. Attained numerical indicators steadily.	A (AA, A, B, C, D) • Introduced advanced evaluation system. • Introduced flexible and efficient system ambitiously, including a multi-year contract and acceleration/cancellation system based on evaluation.

1. Data are from each agency's mid-term plan and results of evaluation by IAA evaluation committee.

In AIST's case, three years have passed since its independence, and its performance seems to have improved steadily, as can be seen from the fact that the IAA Evaluation Committee has evaluated the performance of the AIST highly (A in a scale of AA, A, B, C, D) for three consecutive years. The points that were evaluated highly in AIST's performance are:

- Top-down management: Organisational and personnel reform has been reinforced within AIST through top-down management; for example, a reserved and distributed fund of JPY 10.0 billion at the president's discretion, invited excellent outside researchers (top 16 centres of 32 centres), and evaluation of each research unit and suppression in case of poor performance. A clear message was communicated from the top. For example, the president published and announced the idea of "type-2 basic research" to all researchers and employees within the

organisation as well as to the public as a basic principle of basic research that the AIST should pursue. As a result, consciousness that their research results should be commercialised and applied to meet social needs has been raised among individual researchers. It can be said that the measures taken by AIST became possible because it became an independent entity with flexibility, separated from the government.

- Research results: AIST has identified and raised some quantitative indicators in its mid-term plan, such as the number of papers published, impact factor, number of patents licensed, number of collaborative research projects, and so on. After three years, the numbers shown in these indicators are increasing satisfactorily compared to the situation before the inauguration of the AIST as an IAA. For example:
    - Joint research projects 972 (FY2000) to 1 577 (FY2002).
    - Contracted research from outside: 3 (FY2000) to 131 (FY2002).
    - Royalty revenue (patents): JPY 42 million (FY2000) to JPY 307 million (FY2002).

AIST is now able to have more flexibility in terms of personnel status. A law to revise AIST's establishment law to change the status of AIST's employees from public officials to non-public employees passed the Diet this year. The reason for submitting the law to the Diet was that AIST thought that it should be a front runner in innovation system reform and as national university corporations changed the status of employees, the mood for change has improved and labour union opposition has weakened.

Compared to AIST, as only a year has passed since NEDO's agencification, it is difficult to assess the performance of the new NEDO. However, NEDO, also given incentives and flexibility, is now introducing flexible and efficient management systems that did not exist before. NEDO has declared in its mid-term plan two directions that it will follow: "NEDO with results" and "user-friendly NEDO".

- "NEDO with results": Setting of high quantitative targets based on ex post evaluations, and projects with less than a certain level of performance based on a mid-term evaluation will be cancelled. In order to do this, NEDO has introduced an advanced evaluation system and has established a mechanism to cancel and accelerate projects based on its evaluation results, which are highly regarded by an evaluation committee. There are also numerical targets for the number of published papers and patents, but it may be too early to assess performance in this regard.
- "User-friendly NEDO": Enabling multiple public tenders in a year and introducing multiple-year contracts for R&D projects. This was previously done through single-year budgeting. This became possible because of agencification and flexibility in the use of operational grants.

In contrast to AIST, NEDO is not always highly evaluated with regard to top-down management. This may reflect the fact that AIST can determine its research themes while NEDO's projects are ultimately decided by METI.

From these measures taken by the NEDO, the IAA Evaluation Committee ranked NEDO as A within AA, A, B, C, D for FY2003. Therefore, it can be concluded that agencification of AIST and NEDO are working positively so far, although the performance of R&D must be evaluated over the long term.

Discussions regarding performance

Agencification of AIST and NEDO has given positive results in terms of efficiency, through flexibility and incentives, and it can be concluded that agencification has had some success. However, as agencification is still at an early stage, more scrutiny in future years will be necessary in order to evaluate performance, and adjustments may be necessary to improve the system. Here, performance is discussed in terms of the balance between monitoring costs and the incentives for efficiency.

In the case of AIST, agencification has reduced paperwork between the principal (METI) and the agency (AIST) because they do not have to exchange information through budgetary processes. This gives AIST flexibility. However, it has also reduced the exchange of information between the two organisations, and the policy side has lost the chance to check and comment on the research at AIST. As a result, from the principal's point of view, some wonder if the research at AIST is useful to METI's R&D policy. AIST research may be basic in its general orientation, but there must be a scenario for industrial innovation which should match the policy side's scenario. In other words, the principal may lose monitoring capacity and thus sufficient control over the agency, although the efficiency effect is significant..

On the other side, the actual performance of AIST has been improving and researchers at AIST feel pressure to engage in "research for industrial innovation" rather than "research for research". However, as always happens, researchers tend to complain that the criteria for evaluation, such as the impact factor or the number of academic papers or patents, are not appropriate. Although it may be difficult to judge whether or not this complaint is justified, it may indicate the limitations of quantitative indicators. Moreover, as AIST promotes contract research from outside, it is now trying to get contracts from NEDO's national R&D projects, and through these contracts, AIST's involvement in METI's policy is increasing, paradoxically.

In the case of NEDO, agencification provided flexibility and incentives by releasing NEDO from budgetary restraint. However, for project making, though there is some flexibility, the changes are small. METI still is involved in the planning stage of each new project beyond its mid-term goal, and close information exchange between METI and NEDO continues as before. In that sense, there is a possibility that the principal still pays as high a monitoring cost as before, and because of its control, the agency may be losing a chance to be more efficient.

The reason why METI plans new projects is that METI knows the policy goals. However, this may involve two problems. The first is the relationship with the mid-term goal set by METI and new projects organised by METI. From NEDO's viewpoint, the selection of a project is a vital part of the project's success. As long as project performance is evaluated as the performance of NEDO, it is not surprising that NEDO is eager to be involved deeply in the selection of new projects. Recently, NEDO has struggled to propose new projects to METI and to ask METI to eliminate some unpromising projects proposed by METI or to shift implementation to METI at the time of budget requests. In other words, there may be a problem when NEDO's and METI's opinion of a project differ. For example, METI may think a project is necessary not

because the project is promising as R&D but because it is politically necessary or it is necessary at least in terms unrelated to the purpose of R&D. The root of the problem is the way METI views NEDO's mid-term goal when evaluating NEDO; the question will be whether METI really wants NEDO to improve the efficiency of projects as stated in the mid-term goal.

The second problem is related to the rationale of targeting policy itself, though it is rarely discussed in Japan. Economic theory says that support for R&D can be justified owing to its non-proprietary aspects and spillover effects. However, theory says that targeting technologies by the government may be ineffective because government possesses less knowledge/information than the market. Moreover, some observers point out that private firms tend not to propose their most important projects but propose second-best projects instead, indicating the existence of an information gap. The question then is whether METI or NEDO has more information on technologies when planning national R&D projects.

It may be true that METI has a long history of close relationship with industry and has maintained its project-making ability as the basis of the strength of its innovation system. On the other hand, NEDO has long been in charge of project administration, but so far without a close relationship with industry. However, NEDO may be in a position to have a closer relationship with industry than METI. Thus, some might think METI should indicate the target of the "R&D programmes" as its policy, while NEDO should plan new projects based on these targets, once it has gained enough ability, experience and history through trial and error.

Conclusions

METI has long been involved in the formulation of R&D projects. However, as R&D budgets increase and expectations regarding innovation policy rise, it has become more and more necessary to improve the efficiency and effectiveness of the system of institutional management. Under these circumstances, the "agency system" introduced for national research institutes and national corporations (AIST and NEDO for METI's innovation system), has made it possible to manage R&D projects more efficiently and effectively. Agencification clearly gave AIST and NEDO incentives to improve their performance by releasing them from government regulations, thereby enhancing their efficiency and flexibility. In that sense, the introduction of the agency system in AIST and NEDO seems to be successful so far.

However, this system has just been established, and to achieve more efficiency and higher performance, some adjustments may be needed. The question will be, according to the principal–agency theory: "How should the principal intervene when monitoring the activities of agencies so as to allow agency flexibility and attain policy goals." This means *i)* how to formulate the mid-term goal and its quantitative indicators; and *ii)* how to incorporate information exchanges/interventions, such as targets for R&D programmes. (In this regard, it should be kept in mind that interventions may cause problems if the mid-term goal is not met owing to the principal's intervention). The right balance between monitoring costs (intervention) and incentives (flexibility) will not be easy to find and will depend on the nature of the services. For example, in AIST's case, further monitoring and intervention by METI may be necessary as long as AIST plays a role in METI's innovation policy, while in NEDO's case, greater flexibility may be necessary in order to make national R&D projects more efficient. This balance of monitoring

costs/intervention and incentives/flexibility will need to be observed, and adjustments made as necessary.

In considering this balance, it should be kept in mind that the most important points might be to make the utilities of both organisations the same and to ensure a close relationship and co-ordination, as a way to deal with the information gap between principal and agencies in the principal–agency theory. Another premise of successful performance might be the improvement of agencies' abilities to gather the necessary information from industry and academia, and to manage projects.

Notes

1. Former Deputy Director, Industrial Science and Technology Policy Division, Industrial S&T Policy and Environment Bureau, Ministry of Economy, Trade and Industry (METI). The author would like to especially thank Tooru Anzawa, Chief, International Frequency Policy Office, the Ministry of Public Management, Home Affairs, Posts and Telecommunications (former Chief Assistant of International Affairs Office, Industrial S&T Policy Division, METI) for his assistance.

2. Based on "The Structure and Process of METI's Innovation Policy System" presented at the OECD's fourth MONIT Workshop, "Profiles, Structures, Processes and Institutions", held in Tokyo in March 2004. The views and opinions expressed are solely those of the author.

3. For the role of MITI, see, for example, Chalmers A. Johnson (1982), *MITI and the Japanese Miracle: The Growth of Industrial Policy1925-1975,* Stanford University Press. As for the VLSI and other projects, see Scott Callon (1995), *Divided Sun: MITI and the Breakdown of Japanese High-Tech Industrial Policy 1975-1993*, Stanford University Press.

4. For the cons, see, for example, Micheal E. Porter and Hirotaka Takeuchi (2000), *Can Japan Compete?*, Perseus Books.

5. The English translation of *dokuritsu-gyousei-houjin* varies: "incorporated administrative agency", "independent administrative institute", etc. Here, the term "agencification" is used to mean the reform of an organisation as an IAA.

6. According to OECD (2001), "The New Economy: Beyond the Hype", business R&D financed by government is less than 0.05% of GDP in Japan, while it is 0.27%, 0.14%, 0.14%, 0.13% and 0.09% in the United States, France, the United Kingdom, Germany and Korea, respectively.

7. See *www8.cao.go.jp/cstp/*

8. For example, see Callon, *op. cit*., Chapter Three "Turf Wars".

9. For details, see *Dokuritsu-gyousei-houjin seido kenkyuukai* [Study Group on IAA System], *"Dokuritdu-gyousei-houjinn seido no kaisetsu* [Commentary on IAA System] 2nd edition, Dai-ichi Houki (2002) (Japanese only)

10. The actual number depends on the definition of research institute.

11. For the NUC Law, *see www.mext.go.jp/english/news/2003/07/03120301.htm*.

12. This includes the operational grant budget for national university corporations, inter-university research institute corporations, the Institute of National Colleges of Technology (IAA), NIAD-UE, and others (FY2004). This amount includes the educational portion of the budget and thus does not always correspond to S&T-related budget of national universities.

13. Currently, there are 19 programmes in all, since the Polymer Electrolyte Fuel Cell and Hydrogen Energy Programme were included in the New Energy Programme.

14. The National Institute of Advanced Industrial Science and Technology Independent Administrative Agency Law defines the mission of AIST: *i)* research and development for industrial science and technology, *ii)* geological surveys, *iii)* measurement standards, and *iv)* technological application to the private sector.

15. Eight research institutes in Tsukuba (National Institute for Advanced Interdisciplinary Research, National Research Laboratory of Metrology, Mechanical Engineering Laboratory, National Institute of Materials and Chemical Research, National Institute of Bioscience and Human Technology, Geological Survey of Japan, Electrotechnical Laboratory, National Institute for Resources and Environment) and seven regional research institutes (Hokkaido, Tohoku, Nagoya, Osaka, Shikoku, Chugoku and Kyusyu). The Weights and Measures Training Institute was also merged.

16. Technically, an operational grant is usually calculated by the method of alpha, beta and gamma; that is, <next year's operational grant> = α(efficiency indicator)×β(deflator)×γ(policy indicator)×<previous year's operational grant>.

17. In the case of NEDO, the operational grant is calculated by the method of alpha, beta and gamma as explained above, but in actuality, METI and MOF co-ordinate the gamma number based on the list of projects presented by METI.

Part 2

INTEGRATING POLICIES FOR INNOVATION

Chapter 7

SHAKING UP THE DUTCH INNOVATION SYSTEM: HOW TO OVERCOME INERTIA IN GOVERNANCE

Patries Boekholt
Technopolis, The Netherlands

Pim den Hertog
Dialogic, The Netherlands

The organisation and governance of the Dutch innovation system has been under scrutiny. Given relatively deteriorating performance in science, technology and innovation (STI), existing innovation governance mechanisms are under discussion and new ones are being introduced. These changes are evolutionary rather than revolutionary as perceived policy challenges and the existing arsenal of policy responses evolve slowly. Path dependency also affects innovation policy making. This chapter summarises the lessons of four detailed case studies of innovation governance. They include the governance of the single largest contract research organisation (TNO), of the vast Economic Reinforcement Fund (ICES/KIS), the new type of governance exemplified by the Dutch Genomics Initiative, and innovation governance in the domain of information and communication technology/ information society (ICT/IS) policies. Together they provide the empirical basis for discussing the strengths and weaknesses of Dutch innovation governance.

Introduction

Innovation and innovation governance have become in the Netherlands, as in many other OECD countries, a popular topic. The growing awareness of the need to switch to an innovation-driven economy, recent sluggish economic and innovation performance combined with persistent societal issues have signalled the need for a new approach to innovation. Interestingly, an important part of the discussion concerns not innovation itself, but the ways in which it is governed. Although over the last decade the notion of national innovation systems (NIS) gradually entered innovation policy thinking, it is only quite recently that the effectiveness and efficiency of the organisation and governance of the Dutch innovation system has been under discussion and important changes are being made.

It is essential to understand the evolution of (or the path dependencies in) the current innovation policy mix in relation to the dynamics of the innovation system and the formal and informal policy processes that shape them.[1] Other, more specific questions that arise are: How coherent are these innovation policies? How is horizontal co-ordination of innovation policies shaped? What do effective processes of policy formulation, policy co-ordination and policy implementation look like? What role do monitoring and evaluation

– or broader strategic intelligence and policy learning – play? To address these governance issues four case studies were undertaken on typical elements of the Dutch innovation policy mix, focusing on various aspects of innovation governance (Table 7.1):[2]

- The evolution of the Economic Reinforcement Fund – (ICES/KIS or Bsik), a large-scale interdepartmental investment programme running since the early 1990s.
- The rationale and set-up of a new multidisciplinary Dutch Genomics Initiative, which in governance terms is also an innovation.
- The relationship between a number of ministries and the Netherlands Organisation for Applied Scientific Research (TNO), by far the biggest contract research organisation.
- Analysis of the development of information and communication technology/ information society (ICT/IS) policies in the Netherlands.

Table 7.1. Aspects of innovation governance addressed in the three in-depth case studies

	ICES/KIS	Genomics	TNO	ICT/IS
Agenda setting/prioritisation	X	X	X	X
Stakeholder involvement	X	X		X
Accountability			X	
Horizontal co-ordination in policy formulation	X	X	X	X
Horizontal co-ordination in policy implementation		X	X	
Policy learning	X		X	X

This chapter is structured as follows. First, the Dutch innovation system and its main actors in innovation governance are briefly described and a picture of overall STI performance is sketched out. The following section describes how policy challenges are identified by processes of agenda setting, prioritisation and stakeholder involvement. Next, co-ordination of policy formulation and implementation are examined. Then, three forms of policy learning – monitoring, benchmarking and evaluation; learning by experimentation; and learning through experience – are discussed prior to formulating a number of general conclusions on innovation governance in the Netherlands. The discussion draws upon the four case studies mentioned above.

Historical development of the science and innovation system and governance structure

National innovation systems, their institutional set-up and governance structures and models are path-dependent and have evolved over many years. This has led to persistent differences among countries and limits the straightforward transferability of policy practices from one country to another. In order to understand the Netherlands' present innovation policy and governance, some historical insight is necessary. The following short historical review of the Dutch S&T innovation system starts from a description of systems that are slowly moving closer together: the science and research system, which is shaped by science policy, and the applied technological development system, which is shaped by industry policy. In the past decade, these have evolved into an innovation system.

The science and research system

The history of the science system goes to the sixteenth century and the founding of the first Dutch university in Leiden in 1575. Today the Netherlands has a network of 14 universities which are distributed over eight of the 12 provinces. Today's governance of the university system, which has changed little since the 1950s, can be briefly characterised as follows:

- Individual universities have a large degree of autonomy. Collectively, universities arrange their quality control (education and research) through multi-annual peer reviews.
- The largest source of income (60%) comes from "first-stream funding", which consists of basic or core resources provided to universities as a block grant or lump sum by the government (Ministry of Education, Culture and Science) for education and research combined (Ministry of Economic Affairs and Ministry of Education, Culture and Science, 2004).
- The system has had a strong egalitarian ethos, with funding mainly allocated on the basis of the number of registered students, rather than on the basis of research efforts or quality. In recent years, a system that more prominently rewards scientific excellence has been debated, but has not as yet led to changes in the system. A relatively small share of research funding is allocated on the basis of competition and quality. The Innovation Platform (see below) has advised the introduction of a performance-based financing system.
- The Netherlands Research Council (NWO), which distributes competitive research funding on the basis of quality criteria (second-stream funding) provides approximately 10% of the academic funding. Funding is mostly allocated by science domain on the basis of bottom-up proposals. It therefore has limited influence on setting the academic research agenda. In the last few years the share of NWO's funding has been growing.
- As an applied research system had been set up alongside the university system, universities have had little reason to do contract research with third parties, in particular industry (approximately 7%). Therefore a strong culture of conducting contract research for external customers – and establishing bridges to industry – has not developed and Dutch university start-ups and research commercialisation activities have been quite rare.

The consequences of this university governance model affect the entire innovation system. Owing to a lack of central co-ordination or steering, there is a tendency for universities to duplicate research groups, leading to a fragmentation of efforts in many research domains, and few centres of excellence with critical mass. Measures such as the Genomics Initiative (see below) attempt to correct this.

The development of the Dutch non-academic innovation system stems from the 1920s and 1930s. As the Netherlands was a latecomer to industrial development, it was thought necessary to support it with applied research and technical support. To this end, dedicated research laboratories were set up outside the university system and under close government control. The first of these was the Water Management Institute, established in 1927. In 1930, the Dutch Parliament passed the TNO Act which regulates applied scientific research, and in 1932 the Netherlands Organisation for Applied Scientific Research (TNO) was established by law. TNO is in fact a large contract research organi-

sation, which provides a link in the innovation chain between fundamental research as a source of knowledge and practical application in the use of knowledge that can be commercially exploited.

The Dutch science research system was thus divided into an academic system that mainly dealt with fundamental, blue-sky research alongside its educational mission, and a semi-public contract research system, which conducted applied research for the government and industry. For decades, there were hardly any linkages between these two systems or mechanisms to transfer fundamental research results to the applied research organisation or vice versa.

The industrial and innovation policy system

Innovation policy evolved out of industry and sectoral policies that were a key element of economic policies in the 1960s and particularly the 1970s. However, the demise of traditional industrial policy, with a focus on support for declining sectors, came in the late 1970s and early 1980s when a number of major policy failures – closure of large companies despite considerable government subsidies – occurred. This paved the way for initiating a technology-oriented policy: instead of supporting individual companies or sectors, government support shifted to promoting strategic technologies.

Verhaar (2002) describes this initial mention of innovation in policy White Papers dealing with industrial and sectoral policies in the 1970s. Innovation policy as a separate policy domain came to the fore in 1979, with a White Paper on Innovation Policy, which came, remarkably, from the Minister for Science Policy and not from the Minister for Economic Affairs. Through this White Paper, a number of new policy instruments for innovation were introduced, mostly financial (subsidies, fiscal measures and risk capital funds), to reduce the risk for companies to invest in R&D. In 1981 the government invited an independent expert advisory committee chaired by a representative of the business sector to set the direction for future industrial policy. This independent committee was to have a large influence on transforming traditional industrial policy into innovation- and market-oriented policy.

Smits and Kuhlmann (2003) note that in the early 1970s the Netherlands had nothing resembling an explicit innovation policy. First attempts to develop an innovation policy were strongly supply-oriented and dominated by financial instruments for stimulating R&D. The policy was not very successful because R&D results were not used by firms and did not contribute to strengthening the competitive power of the Dutch economy. Therefore, the intermediary infrastructure was strengthened to help transfer these results so that firms would develop new products and services and to help ensure that new technologies also reached firms. This resulted in the development of policy instruments aimed at stimulating the mobility of researchers from academia to private enterprise and in the establishment of a network of 18 regional innovation centres.

In the early 1990s it became clear that policy could not be restricted to measures that simply encouraged the production and diffusion of knowledge. The mismatch between the needs of private firms and the knowledge being produced was apparent. Better interaction between the producers and the suppliers of knowledge was essential to cope with this problem.

This awareness was the start of the next phase in Dutch innovation policy: the user-oriented approach. In this phase, not only was the interface between the users and the producers improved, but the support infrastructure was also expanded by introducing new

and/or improved forms of strategic intelligence, more advanced risk capital schemes, a high-level electronic infrastructure, and other conditions that facilitated innovation in networks and systems. Given these developments, more and more actors were involved in the development and implementation of innovation policies and the need for instruments focused on the innovation system increased.

In most of the 1990s the dominant policy philosophy was to have a generic science and technology policy: government should not make choices and industry should be able to choose the technologies in which they invest. In the late 1990s and the early 2000s, this overall policy philosophy gradually changed, mainly because more and more actors became aware that companies were engaged in "short-termism" and were not investing sufficiently in the technologies of the future. Their research focus – if they had one – had become more and more applied. At the same time, research at universities was becoming more fragmented (partly due to constant budget cuts) and relatively few high-technology spin-offs and new ventures came out of Dutch universities and research centres. The Dutch position in the high-technology areas – life sciences, e-commerce, nanotechnology – that were considered the new growth areas was therefore relatively weak. The hands-off governance mechanisms and policy instruments proved insufficient to radically change the research agendas of the actors involved. However, a top-down governance model was not seen as the answer owing to an expected lack of commitment by the actors. "New" governance mechanisms were employed to reset these agendas: road maps facilitated stakeholder consultations, with the government's role mainly to ensure that industry and research would develop joint agendas instead of separate plans. The clearest example was the emergence of life sciences as a new territory for government intervention. The Dutch Genomics Initiative (see Boekholt and McKibbin, 2004a) is one of the largest technology-specific actions taken by the Dutch government in recent years.

A gradual closing of the gap between the two systems

Owing to the Dutch dual system, the gap between academic research and industrial needs was quite wide and incentives for the commercialisation of public R&D results were quite weak, compared with countries that lack the intermediary layer (*e.g.* the United Kingdom and the United States). Many Dutch innovation policy instruments can be seen as corrective measures:

- Collaborative research schemes which either provided incentives to academic researchers to develop a more applied research agenda (e.g. the IOP programme) or incentives to industry to outsource part of their R&D work to (academic) research organisations.
- Specific initiatives to encourage the involvement of small and medium-sized enterprises (SMEs) with public R&D organisations and graduates.

Owing to the vast intermediary layer of institutes, academia generally saw little need to divert efforts from its traditional mission: fundamental research and education. Therefore, in terms of policy integration, the attuning of science and research policy and industry-oriented innovation policy was, and still is, a major policy challenge.

A policy area in which this manifests itself quite clearly is support of university spin-offs and commercialisation of academic research. Only in the last few years have universities acknowledged that they could play a more active role in this area and that entrepreneurship does not necessarily conflict with academic missions. As the Ministry of Education, Culture and Science (OCW) takes an arm's-length approach to the manage-

ment of universities and no dedicated funding was made available, actions to support commercialisation of research (including intellectual property rights [IPR] strategies), set up incubators and create pre-seed funds were only taken at a small number of universities, usually at less than critical size. Again, corrective measures of the Ministry of Economic Affairs (EZ) (*e.g.* instruments such as Twinning, Technostarters) did not affect the missions, incentives and funding mechanisms of universities and the anti-entrepreneurial culture remained. It was only in a 2004 policy paper on technology start-ups (Ministry of Economic Affairs, 2004a) that a joint EZ-OCW strategy was announced to tackle the issue from both sides.

With the introduction of the broader concept of the knowledge economy, which has been pushed in public debate by the most recent government, issues regarding education and lifelong learning, the number of academic graduates (particularly in science and engineering), and the link between innovation and competitiveness have been made more explicit. There are several indications that the gap between science policy and innovation policy is closing and that joint policy development is on the increase, as two of the cases analysed confirm (Genomics Initiative, ICES/KIS).

The current innovation system and key actors

Innovation governance in the Netherlands is complex and involves many actors, funding mechanisms and interrelations. An overview of the key actors can be found in Annex 7A.1. Innovation policy is mainly the responsibility of the Ministry of Economic Affairs, which has five departments (Directorates General – DG). Through DG Enterprise and Innovation (which has responsibility for all matters concerning entrepreneurship, including applied and industry-oriented R&D and innovation policy instruments), the ministry seeks to strengthen the innovative capacity of the Dutch economy. The major issues in this respect are knowledge, technology, employment and innovative entrepreneurship. In 2003 the ministry allocated EUR 521 million in support of innovation and EUR 601 million for entrepreneurship (Ministry of Economic Affairs, 2004b). Its programmes are, for the most part, implemented by the agencies Senter and Novem. In May 2004 these two agencies merged to form SenterNovem. The fusion is intended to enhance support to industry. In the area of research NWO is an important agency (mainly academic basic research but increasingly applied research).

The Ministry of Education, Culture and Science also plays an important role in defining innovation policy, in particular regarding scientific research and education. Its mission is "to create a research climate that encourages optimal performance: producing science of high quality for the stimulation of wealth and well-being". In this capacity it is responsible for good operation of the research infrastructure, in terms of size, innovative capacity, quality and efficient use of resources. In 2004 the ministry allocated EUR 702 million for science policy. Implementation of OCW policy takes a hands-off approach using the various research institutes that fall under its remit. It does however make particular use of NWO, and of SenterNovem for programme implementation.

Knowledge and innovation are high on the policy agenda of many other ministries (Ministry of Education, Culture and Science, 2004). The Ministry of Transport, Public Works and Water Management is preparing a policy project on knowledge and innovation, and the project plan is currently being produced. The Ministry of Agriculture has invested in a dedicated research infrastructure mainly concentrated in Wageningen. The Ministry of Defence is carrying out a reassessment of the supply of knowledge. The focus

is on meeting the demand for knowledge by means of scientific R&D (with a ten-year horizon), available financing instruments, and international co-operation.

To summarise, the Dutch science, technology and innovation governance model (system) can be characterised as follows:

- There has always been a strong division of labour between science on the one hand and technology and innovation on the other, in terms of policy design, funding and research performers. Consequently, there are two different governance cultures. At different levels, these two spheres are gradually moving towards each other, and the Ministries of Economic Affairs and of Education, Culture and Science collaborated closely on the White Paper on Innovation Policy.
- A quite decentralised and fragmented science and research community is distributed among 13 universities, 18 KNAW institutes of the Royal Netherlands Academy of Arts and Sciences (KNAW), six NWO Institutes, five large technological institutes (GTIs), four technological top institutes (TTIs), 14 TNO institutes, and a number of state-owned research and advisory centres. The academic research system functions quite independently and has its own governance system, and a multitude of applied research centres receive funding from certain ministries and/or have a mission to find contracts in the market. The trend is to develop more public-private collaboration and use co-funding as a basis of finance.
- Ministries (EZ and OCW in particular) are using intermediaries to execute policy programmes. The recent merging of Senter (historically the front desk of EZ) and Novem (focused on environment and energy) has shown a move towards collaboration between the various parties to provide better support (and scientific links) to industry. Additionally, there has been a move towards the use of specially formed bodies to execute programmes in certain key technology areas. Examples are the Genomics and ICT/IS initiatives, which are an umbrella for activities of various ministries active in the subject areas.
- In spite of the complex set of formal linkages and funding routes, the system is one in which organisations and people deal with each other on an informal level quite easily.
- A new high-level advisory council, the Innovation Platform, with high-level representatives from research, industry and the policy arena and chaired by the prime minister, was launched in September 2003.
- A clear trend is the increased use of external bodies and committees to formulate and implement policy. If government itself, for whatever reason, is not willing or able to prioritise the innovation policy agenda, external support and advice are used to achieve co-ordination and coherence, *e.g.* frequent use of external committees, separate action programmes in which outsiders increasingly play a steering role, etc. This partly stems from the public-private partnership concept that has been in vogue since the mid-1990s.

Strengths and weaknesses of the Dutch innovation system

Vandeberg and den Hertog (2003) assessed the Netherlands for a set of indicators with respect to other MONIT countries (Figure 7.1). The assessment reveals that business R&D is weak in the Netherlands. In terms of business innovation, the country scores below the MONIT average on six out of the total of eight indicators. The only two indicators on which the Netherlands scores higher than the MONIT average are patents in triadic patent families and employment in high-technology services. At first glance, this seems to be in line with policy analysis that shows a preference for supporting innovation in the firm system (although this is not to say that supporting R&D in individual firms is the key to a better performance).

In terms of the second NIS building block – knowledge generation through education and research – the Dutch scores are again not very good, except for publications (which can be seen as an efficiency measure as well). To a certain extent, this can be seen as the result of past investments. The perceived problem of shortages of researchers is rightfully seen as one of the problems. What is less well flagged is that investment in basic research is far below average.

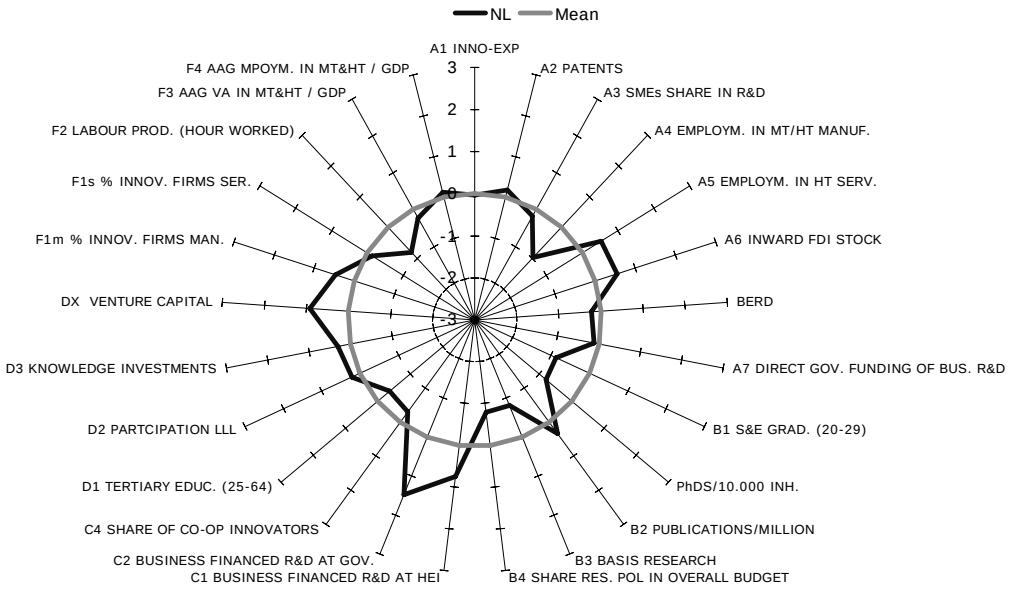
Although only a limited number of indicators were included for industry-science linkages, it seems that there is a Dutch tradition of businesses financing research at higher education institutions (HEIs) and government labs, while inter-firm co-operation is relatively less well developed. This raises questions about whether policy efforts should be aimed more at facilitating inter-firm co-operation among innovators (or raising the number of innovators) than at increasing industry-science relationships (ISRs). On the other hand, the fact that there is at least a financial link between innovating firms and HEIs and government labs does not necessarily mean that ISRs are effective.

The group of indicators that together make up the absorption capacity (including elements of demand, infrastructure and framework conditions) gives an indication of how well an economy and its working population is equipped to benefit from the move towards the knowledge economy. In this regard the Netherlands seems to score above average, except for the share of the labour force with tertiary level qualifications.

In terms of labour productivity growth, the Netherlands is mediocre at best. Analyses suggest that this is because economic growth in the 1990s was based on increased labour participation, rather than on innovation.

In terms of its innovation performance, the 2003 European Trend Chart Innovation Scoreboard shows that the Netherlands is above the EU15 average in level of performance but is in danger of losing momentum (its average trends lag behind those of other countries). The Netherlands performs relatively better than the EU15 on 17 of 26 innovation indicators, but only better on five of the 14 trend indicators.

Figure 7.1. STI performance of the Netherlands



Source: Vandeberg and den Hertog (2003).

The Dutch strength is human resources, in terms of its population with higher education and lifelong learning, although this contrasts with comparatively low growth in the number of science and engineering (S&E) graduates (-0.6% compared to the EU15). The Netherlands is the third highest performer of public R&D in the EU, although it shows a negative growth trend which is relatively higher than that of the EU. Business R&D (lower than the EU average) lags, and with a negative growth trend could become a serious weakness. The Netherlands does well in terms of knowledge production, with patent performance above the EU average. However, with a performance that is just above the European average for innovation by SMEs, and levels below the EU average for overall innovation expenditure, knowledge transfer appears weak. Low performance in high-technology venture capital and strong negative growth (–38%) in early-stage venture capital are also worrying.

An overview of strengths and weaknesses is given in Table 7.2 on the basis of a number of recent analyses covering recurrent issues. One influential report in 2002 came from the Bureau for Economic Policy Analysis (CPB), a government-funded intelligence office, *Pillars under the Knowledge Economy: Options for Institutional Renewal*. The report confirmed most of the strengths and weaknesses listed below.

Table 7.2. Strengths and weaknesses, opportunities and threats in the Dutch innovation system

Strengths	Weaknesses
• High percentage of knowledge workers • A good educated population on average • High employment share in high-technology services • High levels of lifelong learning • High quality of scientific research • Good (high-technology) patent performance	• Relatively low levels of public spending on R&D and education • Increasing premature school dropout – *i.e.* no follow through to higher levels (diplomas) • Negative trend in the level of early-stage venture capital • Lagging behind in business R&D intensity • Low levels of innovative entrepreneurship and activity in general • Financing of innovation • Insufficient exploitation of the potential of venture capital
Opportunities	**Threats**
• Good access to and use of ICT • Relatively high co-financing of public applied research by the business sector • High number of knowledge workers • A good (but according to the data in decline) investment environment • Good opportunities and culture to organise co-operation between public and private organisations	• Low number of S&E graduates • Growing shortage of knowledge workers, particularly scientists, technologists and R&D workers • Low levels of business R&D • Low levels of value added and employment in high-technology manufacturing • Insufficient use of results of scientific research • Interaction between knowledge infrastructure and the business sector • Costs of patents • Increase in foreign-based R&D by national firms

Agenda setting, prioritisation and stakeholder involvement

This section is concerned with how well the national governance system is able to analyse and identify the main problems and challenges that need to be addressed. It describes how priorities for action are chosen and which stakeholders are involved in the decision-making process. These elements of S&T governance reflect the ability and flexibility to address emerging needs and revise policy mixes or adapt governance mechanisms if required.

Identifying policy challenges

The Netherlands has quite a strong culture of using analytical tools to assess perceived policy challenges and strengths and weaknesses and of benchmarking its position against other countries. Particularly in recent years, various analytical studies have been made to align policy strategy and gradually policy instruments with the perceived challenges. These challenges are related to structural problems in the Dutch innovation system and governance structure. Challenges also derive from new technology and market developments in the global economy as well as demands made in an EU context (*e.g.* the 3% Lisbon target).

A number of influential expert reports have recently taken a critical look at the set of innovation policies. They have had an influence on the development of innovation policy in the Netherlands, but mainly on the core policies launched by the Ministries of Economic Affairs and of Education, Culture and Science. The Interdepartmental Study on

Innovation Policy (IBO, 2002) analysed innovation policy with a view to increasing the effectiveness of the policy mix. The report was produced by a mixed working party, which included external experts and civil servants from various ministries with the Ministries of Finance and Economic Affairs in the lead and an independent chairman. It is proving to be an important factor in changing Dutch innovation policies. Although actions to streamline the set of innovation schemes had already been set in motion, this approach is currently pursued more vigorously, and attention to monitoring, evaluation and indeed policy experiments and policy learning seems to be on the increase.

The IBO focused on the appropriate design and effectiveness of the direct and indirect innovation policies aimed at firms. It especially looked into:

- Goals and legitimacy of innovation policy (rationale).
- Current innovation performance of the Netherlands and trends in innovation and innovation policy.
- Effectiveness of current policies.
- Options to increase the effectiveness of innovation policies.

The study feeds the political discussion on innovation policies. Although it takes innovation system views as a point of departure, market and government failure and the trade-off between generic and specific instruments are central. It starts by outlining the concept of the dynamic innovation system and the need to ensure that the innovation policy mix addresses the weak points in the innovation system in a coherent way, taking into account the various innovation schemes aimed directly or indirectly at industry in a total of seven departments.[3]

Four categories of innovation policy (of the seven ministries most closely involved) and their development over time in terms of budget are discerned. Not coincidently, the four categories fit well into the typical NIS thinking. The study concludes (Table 7.3) that a relatively large part of the available budget is aimed at supporting knowledge creation in individual firms or public knowledge institutes and a plea is made to increase the diffusion component of the policy mix.

The study further concludes that current innovation policy is fragmented and not well co-ordinated among the relevant departments and that there is room for further streamlining. A plea is made for fewer (but larger) and more generic innovation schemes.

Table 7.3. Development innovation budget 1994-2002, current prices

	1994	1998	2002
I. Incentives firms	308 (36%)	621 (48%)	787 (51%)
• Fiscal	95	281	357
• Subsidies and loans	130	143	215
• Subsidies for co-operation	84	197	117
II. Co-operation	51 (6%)	164 (13%)	269 (18%)
III. Public research organisations	396 (46%)	405 (31%)	411 (28%)
IV. Diffusion	104 (12%)	103 (8%)	101 (7%)
Total	859	1 292	1 536

Source: IBO, 2002, p. 3.

As for the policy options, two points of departure are mentioned. First, policy incentives for innovation in firms stem not only from innovation policies, but from competition policy, patent policy, regulation, procurement policies, fiscal policy and the availability of knowledge workers. Second, efficacy of innovation policies can be increased by less fragmented policies and schemes, fewer and more generic schemes.

Finally, the study concludes that too little is known about the efficacy of the various instruments (and therefore policy has to deal with uncertainties), that more policy experiments and evaluations are needed, and finally that government-wide co-ordination of innovation policy is needed, *e.g.* by creating a high-level committee for science and technology policy. The main conclusions include:

- Importance of wider framework policies for supporting innovation. Policy incentives for innovation in firms stem not only from innovation policies, but from competition policy, patent policy, regulation, procurement policies, fiscal policy and the availability of knowledge workers.
- Streamlining of innovation support schemes, fewer, but bigger schemes of a more generic character.
- Support for knowledge creation in individual firms through the generic tax credit scheme (WBSO).
- Instead of support for individual firms and individual public research institutes, more emphasis on the utilisation and diffusion of public R&D.
- Improving the functioning of public research institutes for applied research (especially their bridging function between firms and universities).
- Need for more information on the effectiveness of innovation policy by formulating more clearly the objectives of individual schemes and performing policy experiments, and better interdepartmental co-ordination of policy making and policy implementation, *e.g.* by establishing the committee mentioned earlier.

Translating analysis into policy papers

The strengths and weaknesses presented above are reflected in the subsequent analysis in the White Paper of the Ministry of Economic Affairs (2003), *In Action for Innovation: Tackling the Lisbon Ambition*. According to this document, the Netherlands has the potential to achieve more growth through innovation than it currently does. In spite of its strong innovation base, the trend in a number of areas crucial to innovation are clearly negative, the country is losing momentum and has a number of persistent problem areas. The White Paper (Ministry for Economic Affairs, 2003) presents three main challenges for the future:

- The innovation climate not attractive enough. This is evident from the fact that corporate R&D intensity is low from an international point of view and declining. In addition, there is an impending shortage of knowledge workers.
- Lack of companies that innovate. Insufficient business activity is generated in the Netherlands. This is evident from, among other things, low R&D expenditure of new companies, the small number of spin-offs, and low levels of innovation in SMEs and the services sector.

- Insufficient focus and mass in research. The Netherlands does not exploit (new) innovative opportunities effectively enough. The underlying reasons are the lack of collaboration between the business sector and knowledge institutions, and the lack of clear and convincing choices. However the basis for a more innovation-driven growth process is good and the Dutch starting position is favourable.

In addition to a clear focus on the above issues, the government has also recognised that there are too many policy instruments. In recent years the number of instruments has been reduced and streamlined into a smaller number of more generic schemes. Studies such as those described above have influenced both the content and implementation of policy.

Making policy choices and choosing priorities

The policy agenda is formally defined through the annual budgetary cycle. Each ministry presents its annual budget, which sets out the broad policy lines and translates these into policy instruments. The broad policy lines usually refer to a recent White Paper that sets out the longer-term strategy and priorities. This budget is subsequently presented to parliament where it is usually accepted with various (minor) amendments. In practice, however, the policy agenda is continuously influenced by public debate, advisory bodies, independent stakeholder interventions and various governance structures that include stakeholder involvement.

There is not one dominant means of agenda setting in the Netherlands. Rather, a mix of approaches has been used at different times. There is a difference between dealing with agenda setting for new initiatives – *e.g.* the Genomics Initiative or the latest round of ICES/KIS investments – or for ongoing policy areas (*e.g.* mainstream innovation policy, policies for ICT/IS and TNO). The difference includes the way in which stakeholders are involved in the agenda-setting process.

As the Dutch innovation system is decentralised and fragmented, few organisations have the power, position and the willingness to act as agents of change. The Ministry of Education, Culture and Science has maintained a decentralised governance model, with very little steering of universities and public research centres from above. Research organisations have also become quite independent in defining their strategies and research investment plans. As funding through the NWO is relatively modest in terms of overall resources, its influence is limited, despite recent attempts to set up multidisciplinary research programmes.

The Ministry of Economic Affairs has initiated some large-scale changes, such as the Genomics Initiative. However, such actions have always been accompanied by new money. With the current budgetary constraints this is more difficult to achieve.

The role of the government is not just to steer, but also to create arenas in which to decide appropriate directions. A mechanism for setting broad national priorities in research and innovation is needed, but this requires governance mechanisms for strategic planning while mediating among the various objectives. An important initiative to create such a mechanism is the Innovation Council (Innovation Platform), created in September 2003, which is discussed in more detail below. At the end of 2002, a number of interesting points were made in a study by the Ministry of Economic Affairs (2002) about the Dutch institutes and how they can/should contribute to strengthen innovation. Two of the suggestions made in the report are:

- Forming of CWTI (Committee of Officials on Science, Information and Technology Policy), composed of high-ranking civil servants which prepares Cabinet decisions on innovation policy issues. The authors consider this an important step towards better co-ordination of science, technology and innovation policy. With an independent and powerful chairman, it would be possible to work towards the development of directives and a coherent STI policy vision.
- Upgrading of the Advisory council for Science and Technology Policy (AWT). In its current form, the AWT is unable to perform as a platform committed to high-level management of innovation policy. It was suggested to develop a body, similar to national science councils, where yearly assemblies, organised by the AWT, would include top people from industry and science, to determine which STI themes need support. A similar process is already in place for social policy between the Cabinet and social partners.

The case studies reveal a mix of agenda setting and prioritisation mechanisms. They are quite different in character and cannot be simply compared, as they range from a complete policy domain (ICT/IS), to a research organisation (TNO), to two R&D investment initiatives (ICES/KIS and the Genomics Initiative).

In the case of TNO, agenda setting in relation to TNO's research agenda is a rather diffuse process that is largely interwoven with the strategy and funding cycle. Although direct steering by government seems limited, this depends not only on the type of programme and the ministry, but also on the degree to which the government wants to use its financial power to steer. TNO has to cope with the different agenda-setting styles related to government funding, as government departments have not found a single coherent way of setting the TNO agenda. TNO has managed to stay relatively autonomous in drawing up its research agenda as far as its base funding is concerned. Most of the research agenda is set by its relationship with its private-sector clients. The government has regularly used external Committees of Wise Persons to advise on the positioning and direction of TNO.

In the case of ICT/IS policy, the agenda-setting process is not very clear-cut for various reasons. The ICT/IS agenda concerns in fact a collection of specific agendas. The ICT research agenda is built in a different way from the e-business agenda, the ICT in education agenda, or the e-government agenda and so on. It is quite hard to speak of an overall ICT/IS agenda. If there is one, it at most is a sum of various ICT agendas.

In the case of the Genomics Initiative, the agenda was set in a long and deliberate process with direct involvement of stakeholders (industry, research), and an external Committee of Wise Persons gave expert advice to the Cabinet to justify the large investment requested. The government departments played a facilitating role in setting the agenda, for instance by supporting a technology road-mapping exercise, and in preparing the political decisions taken at top level. This process led to a clear focus and concentration in research plans, which were subsequently filtered into even more focused research programmes through a competitive bidding process.

In the case of the ICES/KIS investment fund, the policy learning that took place mainly concerned the agenda-setting mechanism. In the first generation, the agenda was set by individual departments and each chose its own research theme and network of actors. The departments subsequently realised that this led to sub-optimal and sometimes ineffective R&D investments. The agenda-setting mechanism evolved over a period of eight to ten years into a lengthy filtering process that led from large cross-departmental

topics to multidisciplinary networks for conducting the work. It started from external studies based on stakeholder interviews to involvement of potential stakeholders in a competitive network-building process. An interdepartmental working group facilitated the process, various advising bodies were involved to carry out quality checks on the proposed investment projects, and an independent Committee of Wise Persons prepared the final decision and ranking of investment proposals (the agenda) to the Cabinet. The entire process took more than three years.

While these cases are quite different, there are a number of common patterns. The decision to ask Committees of Wise Persons for strategic advice or in some cases to make important investment decisions (Cabinets often follow their advice) may have some advantages:

- The decision-making process is depoliticised, e.g. parties' political agendas or departmental agendas are less in the foreground.
- The composition of the committees can reflect the various stakeholders.
- Governments can choose to take on board the advice and deter political conflict by referring to an independent expert view (or alternatively ignore the advice and take other policy implementation routes).

This agenda-setting mechanism may also have disadvantages:

- The work of such a panel is not under direct democratic control. Transparency of their working methods is therefore crucial.
- The outcome of such panels depends on the composition of the panels and the people who take part (experts also have their own agendas). The use of the same small set of Wise Persons on many occasions has been criticised.

A check on the use of these committees and a general way to improve the user orientation of innovation policies is to involve stakeholders in various phases of the policy process and in particular in the policy design phases. Table 7.4 summarises the ways in which stakeholders have been involved in the case studies reviewed.

Table 7.4. Stakeholder involvement in specific case studies

	ICT/IS	Genomics	TNO/GTIs	ICES/KIS
(Formal) involvement of stakeholders from the private sector	*Ad hoc* process (committees, etc.)	• Roadmap • Preparation Action Plan • Genomics Platform Advisory Board	Through contract research activities	• Theme development actions • Bidding consortia
Formal involvement of stakeholders from the public research sector	*Ad hoc* process (committees, etc.)	• Roadmap • Part of bidding consortia • Genomics Platform Advisory Board	Linkages mechanisms with universities	• Theme development actions • Bidding consortia
Involvement of Independent experts	In various advisory Committees and the *Regie-orgaan*	Committee of Wise Persons to advise Cabinet on credibility investment proposals	Strategic direction of TNO (various decades) Evaluation of TNO (2003/04)	Advising the Cabinet on selection and ranking of investment proposals

Stakeholder involvement has both positive and negative governance consequences. Table 7.5 summarises what can be learned from the case studies and the overall analysis of innovation governance in the Netherlands. Although the balance is in favour of the positive elements, government should take account of the negative aspects and build in checks against these.

Table 7.5. Lessons from stakeholder involvement

Positive aspects	Negative aspects
• Increases the user orientation of policies and consequently their effectiveness • Invites more transparency on the rules of the game • Depoliticises some contested decisions • Circumvents departmental turf fights • Facilitates networking process between different stakeholder groups	• Lengthens the decision-making process • Increases the transaction costs of policy making • Composition of stakeholder groups can be skewed in favour of certain interest groups or positions • Not subject to democratic supervision

Introducing a new horizontal mechanism: the Innovation Platform

One recent initiative to foster innovation and change how the Dutch innovation (policy) agenda is set was the creation of the Innovation Platform,[4] which is expected to develop concrete policy recommendations and to stimulate private initiatives to strengthen Dutch innovative capacity. This new governance mechanism is especially important in the first phase of the policy cycle, *i.e.* agenda setting, prioritisation and stakeholder involvement. The context in which the Innovation Platform emerged, its working methods and some reflections on introducing this new governance mechanism are sketched out below.

The Innovation Platform – much inspired by the Finnish Science and Technology Policy Council (STPC) – was established in reaction to a sense of urgency about the deteriorating Dutch innovation performance. A combination of poor performance against international benchmarks, an overall feeling that the current innovation potential was not being utilised to the full, pressure from various actors including industry to act, as well as the observation that the innovation system as a whole has grown too complex, all paved the way for establishing such a platform. Additionally and most importantly, there was political momentum to act, as innovation received top priority during the creation of the Balkenende II administration in the early summer of 2003. At a time of major cutbacks in expenditures, additional funds for innovation and education were included in the new coalition agreement. At the same time, of course, a major streamlining of the innovation policy mix and the corresponding institutional framework was already under way as were the preparation of new White Papers on innovation and science policy.

The membership of the Innovation Platform, which started officially on 1 January 2004, encompasses the Cabinet (Prime Minister, Minister of Economic Affairs and Minister of Education, Culture and Science), high-ranking representatives from business (six persons), higher education institutions and research and technology organisations (RTOs) (six persons) and independent experts (three persons). The Platform is not an official advisory committee, is not established by law and has – apart from a small secretariat – no budget. Its role has been described in terms of an icebreaker or an accelerator, reflecting its twin role of making fundamental proposals to change the Dutch innovation system and formulating what has been labelled as "quick wins". Apart from

setting the strategic agenda, small subcommittees are formulating brief and to-the-point proposals for breaking down what are perceived as typical barriers in the functioning of the Dutch innovation system. In 2004 three of these committees formulated fundamental and at the same time quite practical proposals on:

- Vocational training, mainly aimed at strengthening the links between businesses and education.
- Key areas, *i.e.* a bottom-up investigation of key areas, resulting in 50 concrete actions involving these areas of the Dutch economy.5
- Dynamising the knowledge-based economy through a portfolio of actions aimed at more focused investments in research and research facilities, organisational and institutional renewal (*e.g.* new type of university funding, redefinition of the implementation role of SenterNovem and Syntens, improving co-ordination of the central government regarding STI and expanding initiatives to revamp the innovation system such as leading technological institutes (see Box 7.1).

Box 7.1. Advice of the Working Committee on dynamising the knowledge and innovation system

A key outcome of the innovation platform so far is a concise report (Wijffels and Grosfeld, 2004) on three central causes of the lagging output of the Dutch knowledge and innovation system: lagging investments, an institutional context that slows innovation, and weak linkages between relevant players in the innovation system. Some key issues in the Dutch innovation governance discussion are addressed. The report observes that well-organised co-operation and efficient co-ordination of departments with a clear role in innovation and knowledge generation are lacking at both the strategic and implementation level. In this context, reference is made to the expression "horizontal governance" as used by the OECD. A package of measures is proposed to vitalise the overall knowledge and innovation system. The committee proposed among other things:

- A performance-based financing regime for universities to be introduced in steps over a number of years.
- Creation of two powerful implementation bodies in science and innovation, *i.e.* NWO and SenterNovem. Especially with regard to SenterNovem, the report argues that the implementation agency should have a larger role in policy design, as they have closer links to the target audiences. (Wijffels and Grosfeld, 2004, p. 19). This would imply that the agency should receive more resources for strategic intelligence.
- Decreased administrative burdens in universities and RTOs and key organisations such as NWO.
- More focus and mass in the public research infrastructure. A plea is made to reduce overlap and fragmentation and build more adaptive or learning capability into the system, for example through regular meta-evaluations.
- Better co-ordination of the currently departmentalised innovation policy. Suggestions include the creation of a Chief Scientific Officer reporting directly to the Prime Minister, creation of a Ministry of Science and Innovation, and enhancement of the strategic role of CWTI (which acts as the preparatory committee to the parallel Cabinet Council on Science, Information and Technology Policy) making it responsible for formulation of a government-wide (innovation) strategy, possibly by appointing an independent chairman.
- Continuation and extension of successful (and mostly new) examples of direct public-private linkages such as the Leading Technological Institutes Initiative and new forms of governance forms such as the so-called *Regie-orgaan* or platforms in which stakeholders are closely involved and in fact co-steer the prioritisation of research efforts in certain technology fields.

Committee work on the role of government in furthering innovation is still under way. In these subcommittees, outsiders who are not members of the Innovation Platform and the secretariat are involved.

In parallel, practical proposals or "quick wins" were presented. They include facilitating international mobility of knowledge workers, increasing the public-private exchange of researchers (Casimir project), introducing a scheme of so-called knowledge vouchers for SMEs,[6] formulation of a Memorandum of Understanding on IPR between firms and universities, and introduction of innovation officers, *i.e.* open office hours for SMEs as potential suppliers of large firms. Quite a number of these practical actions were formulated in an open process and key players were consulted in a two-month consultation round.

Some of the guiding principles of the Innovation Platform include its focus on the demand side of innovation, its readiness to select on the basis of excellence (contrary to the habit of not making very sharp selections in the Dutch governance culture or more egalitarian principles in which all actors get a piece of the pie), a preference for direct connections between knowledge supply and knowledge demand, and a simpler and more transparent organisation of the Dutch innovation system. Further, even for more long-term proposals, the issue of who does what and when is systematically raised and the follow-up of the actions is monitored. Finally, the Innovation Platform offers more room for bottom-up initiatives and for initiating experiments and pilots. Inn this way, the Innovation Platform plays a role in bringing about a change in the innovation culture.

In practice, the Innovation Platform is being invented along the way and its operations have been assessed quite critically from the start. A number of issues affect its functioning, and it is too early to judge whether it will be able to deal with these adequately in time. A few of these issues – which can be formulated as lessons as well – are as follows:

- After its formation, expectations were high and it took several months before the first of the Innovation Platform's actions were communicated. Although a quick-win track was established, the platform remains under pressure to make things happen.[7] Managing expectations and taking care of communications is key.
- It takes some time before the Platform's advice or suggestions are implemented by government or departments. The Platform itself – apart from the presence of important figures in the innovation arena, including two ministers and the prime minister – depends on others to take the advice on board and start implementing. Therefore, the link between advice and implementation is a critical success factor.
- A third issue that warrants attention is stakeholder involvement. Although the platform tries to involve many stakeholders, it is populated by respected and quite well-known individuals, mostly from well-established organisations. Membership is key, and if the platform were to move out of the narrowly defined STI realm, the participation of other sectoral departments that deal with innovation in their own domains should be considered. In fact, the Platform offers a tremendous chance for real horizontal innovation policies. In practice, however, some departments organise their own innovation platforms or versions of it, partly in an attempt to better connect to the Innovation Platform.
- Finally, there is a certain tension between the advisory role of the Innovation Platform – based on the high profile of its members more than on its official

status – and budgetary competence. In the coalition agreement, extra investments in education and innovation were announced, but the amount of free, *i.e.* non-earmarked, money available to invest in new initiatives is rather limited. Although funding is not the whole story, this has raised concern over how seriously the innovation challenge is taken. One could argue that closer direct involvement of the Ministry of Finance would have made sense.

Co-ordination of policy formulation and implementation

Raising the quality of the agenda-setting process, prioritisation and stakeholder involvement may contribute to improved governance of innovation. However, this alone will not ensure good governance of innovation. Agenda-setting processes and policy formulation need to be linked to policy implementation. This is essential for establishing coherent horizontalised innovation policies. The four case studies illustrate how inter-departmental co-operation may help achieve more coherent innovation policies.

The context for horizontalisation and coherence

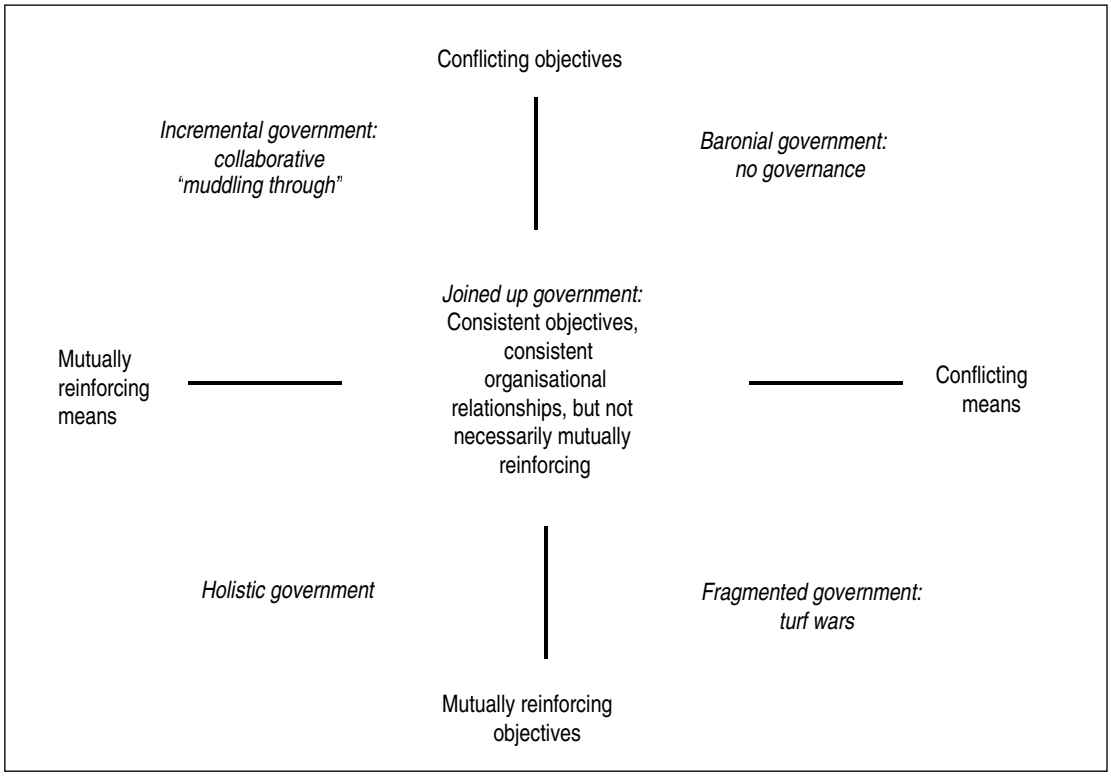
As innovation policy for innovation-driven economic development becomes a widespread policy concern in many ministries, the coherence of the objectives and instruments of various ministries becomes a central concern. The process of horizontal-isation reflects the tendency to integrate innovation policy concerns across policy domains. Horizontalisation is not a goal in itself but a characteristic of a policy system. It might be defined as the degree to which (in this case) innovation policy is guided by a comprehensive national strategy in which contributions from various sectors are linked to achieve policy coherence. In a study for the European Commission performed by Lengrand *et al*. (2002), this was referred to as third-generation innovation policy.[8] Here the issue is not whether this is a desirable and realistic concept for the entire policy agenda, as other societal priorities exist along with innovation. This section concerns the capability of the national Dutch policy system to generate coherent innovation policy.[9] It is argued that coherence is important for many reasons:[10]

- Coherent policies are more likely to be effective and more readily applied in a consistent and equitable way.
- Governments are increasingly faced with complex and difficult issues which may impact differently on different areas of society.
- Policies frequently have a range of objectives which cannot easily be reconciled and may be in conflict.
- Faced with greater accountability and challenge, through parliaments, civil society and the media, lack of coherence becomes apparent and results in uncertainty and loss of confidence.

In practice this means that policy domains with possibly different objectives need to find instruments to co-ordinate or even integrate policy making. This raises questions of policy aims and means and the degree to which these are in line. Figure 7.2 positions the possible relationships between goals and means in government policy. Perri 6 *et al*. (2002) observe that "objectives of policy may be in outright conflict, they might be consistent with another, finally they might actually be mutually reinforcing. Likewise this means the policy instruments and practical arrangements by which agencies pursue these goals may have some kind of relationship with one another." The various relationships

between objectives and means might result in various types of government: incremental government, baronial government, fragmented government, joined-up government and finally holistic government. The resulting matrix suggests that closer integration of policy domains and innovation as an integrator is more difficult if the policy domains' objectives are in conflict. For instance, the Health Department's objective to reduce the immediate costs of the national health sector may conflict with the Industry Ministry's objective to invest in R&D in medical technologies for the future. Or the Environment Ministry's objective to reduce levels of pollution from road transport may conflict with the Transport Ministry's objective to stimulate traffic control innovations to increase the mobility of road transport.

Figure 7.2. The relationship between goals and means



Source: Perri 6 *et al.* (2002).

The four cases analysed here can be positioned using this classification. The link between ICT policy and innovation policy (den Hertog and de Groot, 2005) may be best described as moving somewhere between "fragmented government" and "joined-up government", where policy objectives are not conflicting – and rather potentially reinforcing – but in practice the means to align objectives and create more leverage have not been deployed. The same holds true for the co-existence of innovation policy with science policy: whereas collaboration is implemented case by case, overall links are fragmented. However, between the latter policy fields there is a gradual shift towards more connected government, with increasing use of mutually reinforcing means, for instance in the approach to stimulating high-technology spin-offs from university research. TNO also shows signs of a connected government (den Hertog, 2004): although there are no deeply rooted conflicting objectives between departments dealing with TNO,

the means to reinforce the objectives of others are not deployed. The exception is the Genomics Initiative (Boekholt and McKibbin, 2004a) and the last generation of ICES/KIS (Boekholt and McKibbin, 2004b), which reveals micro-sized examples of holistic government: joint means – resources, agenda setting, procedures, etc. – are used to arrive at a higher goal for all departments involved. In these cases, the common objectives – reaching a critical mass of excellent research efforts in a limited set of thematic areas – were easily reconciled after agreement was found on allocating the means and the rules of the game.

Interdepartmental co-ordination in practice

Horizontal co-ordination is often needed to deal, for example, with the emergence of new technological opportunities. Arrangements to cope with these needs are therefore often rather specific, focused on the actors that need to be co-ordinated, rather than on a broader, general-purpose forum such as a standing interagency committee. In practice, specific co-ordination mechanisms tend to fall into the following categories:

- Cross-ministry/agency programmes.
- Inter-agency co-operation agreements.
- *Ad hoc* co-ordination.
- Use of planning processes and procedures that require co-ordination.
- Development of joint policy visions (possibly through high-level platforms).

An alternative to co-ordination is to build larger institutions that cover a broad range of players with wider responsibilities. This however is not always successful, as internal co-ordination of such a body can be troublesome owing to departmental loyalties or to problems of interaction with the different mindsets of other departments. In short, good co-operation does not come from physical proximity alone, members of overarching bodies must also learn to work together. Drawbacks of these co-ordination practices can be the high transaction costs for those involved.

The four case studies reveal various types of integration or co-ordination mechanisms (Table 7.6). The degree to which this results in coherent policies is considered below.

Table 7.6. Types of integration mechanisms used in the four case studies

Cases	Types of integration methods used
ICT/IS policy	• Joint White Paper between departments taking account of each other's strategies • *Ad hoc* joint National Action Plan of six departments • Interdepartmental co-ordination of high-level civil servants in CWTI
Genomics Initiative	• Joint venture between several departments in launching the initiative which is hosted by the agency of one department • Departmental budgets shifted towards central fund
ICES/KIS	• Interdepartmental working group sets rules of the game • Responsibility for thematic and investment choices shifted to external experts
TNO	• Interdepartmental working group at TNO • Annual budget and annual strategy cycles to which government must respond

ICT/IS policies

Over the years this policy domain has expanded considerably and now involves at least five ministries. The policy agenda has therefore broadened, from a science-technology agenda to an agenda involving societal and governmental transformation, with horizontalisation of content taking place almost along the way. However, horizontalisation in organisational terms is much slower. In the processes of agenda setting, policy formulation and evaluation, individual departments, rather than integrated programmes, dominate, as the relatively modest budget for interdepartmental programmes compared to the overall ICT/IS budget illustrates. In the case of ICT/IS, interdepartmental co-ordination is not systematic and there is a considerable gap between policy strategy and policy implementation.

Interdepartmental co-ordination takes place when a new overall ICT/IS White Paper is produced, as this offers a window of opportunity for change. An important part of the relevant negotiations takes place between policy makers of the departments that jointly compose these documents, who consult their constituencies and bring their wishes to the negotiating table. Further interdepartmental co-ordination takes place when problems noticeably exceed the responsibility of one department (and co-ordination is almost compulsory). In practice, there is only a small layer of truly interdepartmental ICT/IS policy that overlays a broad base of mainly departmental ICT/IS policies. This does offer some room for co-ordinated policy actions, but in practice it is departmentalised to some extent as well.

The implementation of ICT/IS policies in the Netherlands has a predominantly bottom-up character. Although much energy is invested in formulating an integrated strategy, individual departments involved in ICT/IS policies dispose of a good deal of autonomy in shaping and implementing policy. Because departmental territories are well fenced, possibilities for more integrated ICT/IS policies are limited. ICT/IS policies are optimised predominantly at the level of individual ministries as cross-departmental initiatives are laborious and require the sort of negotiations that most policy makers are not used to (or willing to enter into).

More recently new co-ordination and governance mechanisms and a generally more integrated approach have been called for and to some extent developed. New governance mechanisms are being introduced, such as *Regie-orgaan* ICT, which is composed of stakeholders and is responsible for research programming in the ICT field, and a rolling government-wide ICT agenda has been introduced. However, policy-making processes are quite slow because strategy formulation (and consensus seeking) requires lengthy consultation and discussions, in which many actors participate (without ensuring a truly integrated approach). Co-ordination and co-operation are considered when it is more or less compulsory or when other departments have a clear responsibility in a particular area. They are perceived to a lesser degree as a way of organising matters more conveniently or speeding up policy implementation.

For the ICES/KIS and the Genomics Initiative, interdepartmental collaboration has been the result of a policy learning process. The lesson of horizontalisation has been that interdepartmental collaboration takes time, as trust must be built among those involved. Rank does not seem to matter, but close contact with those who take departmental decisions is important.

The case studies show that collaboration is easier when there is no direct threat to departments' budgets. For ICES/KIS, additional money came from a specific fund. This was not the case for the Genomics Initiative, though individual departments offered additional budgets.

Another contributing factor to interdepartmental collaboration is the existence of a common adversary. In this case, the Minister of Finance proposed to sacrifice the fund owing to overall budget costs.

Expert committees can help depoliticise difficult interdepartmental policy choices, but they risk biasing the outcome of the process, particularly if the initiative's objectives are open to various interpretations.

The case of TNO

The co-ordination of policies towards the single largest semi-public contract research organisation in the Netherlands is not an easy task as the relationship between TNO and (various parts of) government is a complex one. The strategy cycle and the management of the financial relationship are among the most powerful mechanisms governing the relationship between TNO and the government. Another powerful, and typically Dutch, mechanism is government use of advisory committees as a way to propose changes in the position of TNO or redefine its relationship with TNO. Other structural mechanisms that affect the relationship between TNO and the government include the four annual (external) technology position audits, which include an element of self-assessment by TNO, and the structural management dialogue between the TNO Board of Management and responsible ministers or top-level officials. This dialogue has recently made use of a newly introduced set of indicators.[11]

Notwithstanding these governance mechanisms, interdepartmental co-ordination and coherence have not been fully achieved. All departments that have a stable relationship with TNO have developed their own guidelines for interacting with TNO. Over the years, the emphasis of the government's governance relationship with TNO has shifted to the Ministry of Education, Culture and Science. Only the Ministries of Economic Affairs and Defence have countered this trend to some degree by maintaining their specific governance structures in relation to TNO. The interdepartmental working group at TNO (IWT) could in principle be a way to achieve a co-ordinated and coherent government strategy towards TNO. In practice it functions more as a administrative co-ordination body than as a platform or strategic policy tool for setting the government agenda towards TNO. The IWT does not discuss the positioning of TNO or the themes that would benefit from an interdepartmental approach; IWT's behaviour is mostly non-interventionist.

TNO is not necessarily seen (at least not by all departments involved with it) as a central tool for innovation policy, but it is a relatively stable element in the Dutch innovation landscape (see Box 7.2). It is mainly the Ministry of Economic Affairs that sees the funding of TNO as an innovation tool. The governance of TNO still suffers from the fact that innovation and science policy are not well integrated. In fact the Ministries of Education, Culture and Science and Economic Affairs differ in their perception of the degree to which TNO should serve the goal of raising innovativeness. In a similar vein, sectoral departments mainly see the projects they fund through TNO as a way to realise specific goals in their domains rather than as an act of innovation policy.

Box 7.2. Why is TNO such a stable element in the Dutch innovation landscape?

Why is it that TNO, established in 1930, has managed to maintain a relatively stable position in the increasingly complex Dutch national innovation system and innovation policy mix and be in fact one of the key innovation policy instruments? Five factors play an important role.

First, the Netherlands has a long-standing tradition of institutionalised non-university public research. The part aimed at industry initially mainly targeted firms without any R&D capabilities. Since the late 1990s, it has also targeted the more innovative firms that could benefit from additional R&D. Since the early 20th century, the government has been in favour of a publicly funded applied science research organisation.

This was partly due to the second factor, the fact that TNO was established by law as an independent organisation with a rather broad goal. This not only gave TNO a lot of room to manoeuvre, but also protected it at times from sudden or whimsical government interventions.

A third factor is the fact that TNO has, by its scale and broad goals, the institutional and financial flexibility to adapt its operations, create new research activities and abolish outdated ones. There is also a well-developed adaptation capability within TNO, which includes the use of external criticism as a lever to bring about changes internally. TNO has also worked quite proactively towards a more structured process of agenda setting and the more recent trend towards accountability. At the same time, TNO was only recently subjected to external evaluation. At most its positioning within the wider knowledge infrastructure was questioned.

Fourth, TNO is acquainted with the world of science and innovation policy making. It invests in contacts with government and participates in numerous programmes, new network activities and large research programmes. It has managed to enter into partnerships or co-operate not only with universities, but also with potential new competitors in the (semi-) public knowledge infrastructure.

A fifth factor is TNO's very complex relationship with government. On the one hand, TNO is dependent on government for its base and target funding. On the other, TNO performs some public tasks and occasionally helps government streamline parts of the knowledge infrastructure. In the last decade TNO took over several smaller and larger knowledge institutes. Adding to the complexity is the fact that TNO and government do not have a clearly defined relationship but many relationships, as government has not managed to really develop a co-ordinated strategy towards TNO. This explains why various governance regimes co-exist and why, for example, the sheer existence of TNO has never been seriously questioned.

Source: den Hertog (2004).

Some overall lessons

The overview of cases shows that launching interdepartmental steering groups is not a guarantee that interdepartmental integration will actually work. The case studies indicate the following factors of success:

- There needs to be mutual agreement on objectives and a certain sense of urgency that departmental demarcations need to be overcome to achieve the common goal.
- The individuals involved and the building of trust among them as a group has considerable influence on the outcome.
- Rank as such does not seem to matter but interdepartmental representatives need room for manoeuvre in order to have some negotiating power.
- If the policy initiatives dealt with do not have major repercussions on the budgets of single departments integration is easier to achieve.

Nevertheless, interdepartmental working groups are only one mechanism for securing greater horizontalisation, and mechanisms such as platforms, expert committees and possibly high-level co-ordination from the Innovation Platform were just as effective in the Dutch context.

Policy learning

The analysis of governance in the Dutch innovation system and the four case studies have identified the following forms of policy learning: *i)* policy learning based on systematic monitoring, benchmarking and evaluation; *ii)* policy learning through experimentation (*e.g.* new types of instruments, partnerships, governance structures, etc.); and *iii)* policy learning through experience (learning by doing). Below, these three forms of policy learning are illustrated with observations derived from the case studies. Although each of these forms of policy learning can be discerned in the four cases, it is not possible to measure the impact of their effects on the development and improvement of policies.

Monitoring, benchmarking and evaluation

Monitoring and impact assessment are high on the policy agenda in the Netherlands. The publication in May 1999 of the Government Bill, "From Policy Budget to Policy Accountability" (VBTB), introduced the idea of making the relation between policy, impacts and funding more transparent. As a consequence, VBTB ministries are required to consider what they want to achieve, what they are going to do to achieve their goals, how to judge when policy is successful, and define budgets to reach these goals. In their 2002 budget proposals (presented in September 2001) ministries for the first time used this new approach. Furthermore ministries are required to report to parliament on these matters on a yearly basis. Each year in May the reports are discussed in parliament. From January 2002, ministries are also required to give more attention to policy evaluation.

To this end, the Ministry of Economic Affairs has developed a special monitoring and evaluation network. Until recently, it generally assessed the impact of instruments once every four years. Recently a monitoring system was developed, with a number of specific indicators, to make a more regular assessment of possible impacts and – if necessary – to adjust policy instruments. This approach also makes it possible to obtain more quantitative information about policy instruments and will help the ministry to develop a modern and effective range of instruments. According to the IBO report, a good percentage of the 50 instruments had been evaluated, and for most of those that had not, the measure was in its infancy (IBO, 2002, Appendix IV).

Intensified attention to this topic also led to a reconsideration of evaluation techniques. In the policy document "Monitoring and Assessing the Impact of the Economic Affairs Technology Instruments" (Ministry of Economic Affairs, 2001), the ministry formulated the following key actions:

- Assess the impact of the technology policy portfolio using an NIS approach. This means that each instrument should be considered in the context of the wider policy portfolio and the innovation system in which it operates. Synergy and interaction with other instruments should be taken into consideration.
- Put more emphasis on *ex ante* evaluations (what is likely to happen as result of introducing an instrument?) when considering the introduction of new policy instruments. This also includes formulating clear policy goals and alternatives.

- Allocate more effort to studies of bottlenecks in the innovation system and the wider international context in which innovation takes place.
- Allocate more effort to using econometric methods in evaluations and data collection.

The VBTB accountability system also has consequences for the way in which organisations receiving money from the government should account for their activities and expenditures. The Ministry of Education, Culture and Science is developing a set of relevant indicators with major research organisations, such as NWO and the Royal Netherlands Academy of Sciences, and the Royal Library. These indicators are to be the means for establishing a more transparent relationship of accountability between these organisations and the government.

However, the effectiveness of these evaluations depends on how they are used to improve the policy cycle. The ICT/IS case study indicates a very weak link between benchmarking and monitoring, on the one hand, and policy and especially the results of policy making, on the other. Benchmarking and monitoring are mostly used not for evaluation purposes or to analyse the impact of ICT/IS policies – which would require advanced evaluation studies – but to analyse the position *vis-à-vis* competing countries and to motivate adaptations to policy or intensify policy efforts that are mostly presented in separate policy documents. Policy design, monitoring and benchmarking and, where available, policy evaluations mostly take place separately.

There are several examples of evaluations of innovation policies that have led to alteration or even cancellation of policy measures, albeit mostly in uncontested areas where there was little political opposition. Although a real culture of monitoring and evaluation has only recently appeared and the effects will only be visible in the long term, one can observe that monitoring and evaluation lead to incremental changes to policy but not to completely new directions. Evaluations are mostly done on an individual instrument basis. Further, as three of the cases have dealt with relatively new policy areas or initiatives (ICT/IS, Genomics, ICES/KIS), evaluations have played a relatively modest role. However, there is an increased willingness not to perform isolated evaluations. The IBO meta-evaluation exercise of 2002 and the evaluation of the TNO bridging function in 2003-04 illustrate this observation.

As discussed above, many sources of strategic intelligence are used by policy makers to assess the strengths and weaknesses of the Dutch system. Nevertheless, the definition and discussion of the main problems in innovation policy may not parallel the actual formulation and implementation of innovation policy. As a result, policy makers may have to deal with current and future innovation challenges using yesterday's institutions and instruments. In the Netherlands, the major policy challenges for innovation policy making have been quite stable over the years (*i.e.* the definition of the problem changes only very slowly), so that the policy mix evolves slowly as well. If major changes occur in what is seen as the dominant problem (quite often due to special political or economic circumstances or both) and if this is combined with the (political) will or need to change the policy mix, a sort of window of opportunity emerges which allows for relatively fast changes in innovation policy. However, it often seems that either the challenges or the means are discussed independently, thereby leading to marginal changes and more short-term policy actions that do not radically change innovation policy or the measures employed. In other words, redefining the dominant problem and changing the policy mix are rarely combined.

As discussed above, the Dutch government launched a meta-evaluation of the entire innovation policy portfolio in 2002. The IBO report was mainly concerned with the functioning of the policy mix itself, particularly the appropriate design and effectiveness of direct and indirect innovation policies aimed at firms. The report concluded that innovation policy was fragmented and not well co-ordinated among the various departments. It also made a plea for further reducing the number of instruments.

The lack of knowledge about the effectiveness of most instruments and the need to improve the evaluation and monitoring of policies was acknowledged. The report stresses that policy incentives for innovation in firms not only stem from innovation policies, but also from competition policy, patent policy, regulation, procurement policies, fiscal policy and the availability of knowledge workers. Some of the recommendations of the IBO report were adopted by the government,[12] such as adaptation of the tax credit scheme (WBSO), improvement of the transfer of knowledge from public R&D to firms, and the decision to look closely at the non-university public knowledge infrastructure (TNO/GTIs).

Evaluation of the bridging function of TNO

In its relationship with TNO, the government uses various steering mechanisms that are to some extent accountability measures as well. The four-year strategy cycle, regular financial reporting and reporting on government-funded programmes and projects, *ad hoc* commissions that occasionally consider the positioning and funding of TNO, and annual reports that increasingly contain various indicators are all examples of implicit accountability measures. Further, TNO itself is quite proactive in providing information that may be seen as elements of accountability. For example, as part of its knowledge management, TNO organises so-called knowledge position audits (KPAs) in which the various (groups of) TNO technologies (to be reduced from 190 to 140 in the current strategy cycle) are evaluated by independent groups of international experts. These provide insight into the quality and market relevance of the technologies, and the audit results are shared with government through the interdepartmental working group at TNO.[13] Recently, TNO agreed to provide the government 19 accountability indicators on an annual basis. Only recently has TNO been subjected to regular evaluation. In 2003-04, an *ad hoc* advisory commission (*Ad hoc* Commission Wijffels) evaluated the bridging function of TNO and five other intermediary knowledge institutes (GTIs) in the Dutch knowledge infrastructure in combination with a self-assessment by TNO and GTIs.[14] The government had promised several times to evaluate these intermediary structures, and in 2003 the institutes were asked to perform a self-evaluation following a certain format. In the same year the Commission Wijffels was asked to reflect on these self-evaluations, to describe the changing context in which these institutes operate – especially in relation to their bridging function between more fundamental research and industry and society – and to advise on demand articulation, production, diffusion and utilisation of knowledge derived from fundamental and more applied research. The Commission concluded, among other things, that:

- The direct linkages between demand and supply of knowledge need to be improved and strengthened (p. 6).
- New direct linkages between actors have emerged and change the context in which TNO and GTIs operate, making the bridging function of TNO and GTIs as a metaphor obsolete (p. 7).

- A plea is made to improve demand-led steering of knowledge institutes. These need to be conceived as knowledge firms that are partly financed by government. In this context a distinction is proposed between the market function of TNO and GTIs (performing contract and project research for public and private parties) and the task function (long-term research programmes on themes selected by government). Included in the task function are much-needed knowledge investments for which no immediate and/or complete articulated market demand is available (basically financed by government, although forms of co-financing by industry are to be looked for) (pp. 9-10).
- A coherent, co-ordinated and strategic vision for the applied science knowledge infrastructure in the Netherlands is lacking (p. 8). It is advised to take the distinction between the market function and the task function of TNO and GTIs as a point of departure, to provide guidance in co-operation with industry and societal organisations regarding the direction in which the institutes need to develop; to subsequently provide TNO and GTIs with enough room to realise this ambition and to regularly evaluate the progress the institutes make and the knowledge contribution they provide (both from a societal and economic point of view) (p. 10).
- It is further advised to realise the proposed system changes within one year and to create a central co-ordination function within central government for implementing and monitoring these changes as well as manage the use of public funds for applied research. Ultimately the persistent use of demand-led steering and financing should result in a dynamic process of renewal and adaptation within the knowledge infrastructure at large (p. 14).

Learning by experimentation

Recent reports on Dutch innovation policy (CPB, 2002; IBO, 2002) have stressed the need to maintain experimentation, in parallel with the streamlining of existing policies. However, emphasis by the Finance Department and the parliament on immediate socio-economic effects and performance indicators, together with severe budget cuts, may discourage the launching of experiments in the near future.

The case studies on the Genomics Initiative and ICES/KIS (Boekholt and McKibbin, 2004a, 2004b) illustrate experimentation with decision-making processes (technology road mapping, new forms of stakeholder involvement) rather than new types of instruments, although the Genomics Initiative, set up as a platform where actors streamline their own R&D activities, was quite an innovative instrumental approach (and is being replicated in the ICT area).

A co-ordinating platform where stakeholders are given the responsibility to choose a limited number of focal areas for future research was a new departure in the Dutch governance system. It was a consensus-based decisions to divide funds among all actors without making clear choices. The government stepped back and accepted a facilitating rather than an agenda-setting role. The direct representation of industry together with academia in the decision-making process was also a new element in the Dutch governance landscape. The Genomics Initiative also showed that policy learning and developing new modes of governance does not occur as a result of a very structured and formal process, but is very much a tacit process between those directly involved on both the government and stakeholder side. At the same time this makes these processes, and

therefore the sustainability of the learning process, more vulnerable to changes of persons and positions.

In the realm of ICT/IS the importance of (learning from) experiments has been stressed. However, there is not yet a culture of real-time evaluation and swift adaptation to speed up the learning process. Experiments are not always treated as continuous and interactive learning trajectories. If problems arise during experiments, adaptations are only made after the formal evaluation or mid-term review is finalised. Finally, if an experiment or a new approach is successful, the approach may be copied, without always questioning whether it is the best solution or effective in terms of investing in learning (de Groot and den Hertog, 2004).

It seems that in recent years, with a clear regime of streamlining policy instruments and budget cuts, the room for manoeuvre to experiment with new measures or pilots has decreased, particularly in the innovation policy area. It may be that this will encourage more cross-departmental collaboration to join forces and resources for setting up experimental approaches.

Learning through policy experience (learning by doing)

Apart from the formal process of learning through evaluation and by experimental trial and error, another potential source of learning is through the experience of policy makers who have been closely involved in the evolution of innovation strategies and measures.

The case studies, and particularly ICES/KIS, show that an internal conviction on the part of policy makers that things should be done better, combined with external pressure (from stakeholders, the economic situation, performance of main competitors, technological progress, etc.) to "get it right" can lead to considerable changes in governance.

In the case of the ICES/KIS investment fund, the policy learning that took place mainly concerned the agenda-setting mechanism. An important aspect of the learning was the realisation that checks had to be built into the process to avoid the tendency to defend departmental turf. This was done by dividing the process of defining the rules of the game (by the Interdepartmental Working Group) and the actual decision-making process (delegated to an external committee) with inclusion of quality control (on scientific, socio-economic and management aspects) by other external bodies.

Concluding remarks and main lessons

This chapter shows that the perception of key innovation problems, the innovation policy mix, and innovation governance are for a large part path-dependent and rely on institutional structures and policy instruments developed over time. The TNO in particular shows how much history matters. Notwithstanding the importance of path dependency in Dutch innovation governance and the observation that policy responses to perceived challenges have been gradual rather than radical, Dutch innovation governance is in a state of flux. Partly owing to a well-developed strategic intelligence function, the Dutch innovation system and its governance are now subject to considerable change or at least more open to experimentation in the agenda-setting process, in the way stakeholders are involved in policy implementation, in processes of horizontalisation of innovation policies and the ability to learn from previous policies and processes.

The various case studies on which this contribution draws show that various approaches has been used at different times. A recent initiative to foster innovation and change the way the Dutch innovation (policy) agenda is set was the creation in September 2003of an Innovation Platform. It still is too early to judge whether the platform will be successful. Critical success factors include the way expectations (and hence communications) are managed, how well advice is transformed into practical policies to facilitate innovation, membership in the platform, and finally budgetary competence or at least the ability to make budget changes and invest in new initiatives. Likewise, the introduction of the ICT *Regie-orgaan* and the Dutch Genomics Initiative marks a change in innovation governance. Not only are stakeholders more explicitly involved but they also receive some discretionary power to act.

Co-ordination of policy formulation and implementation is relatively easier to accomplish in dedicated programmes and schemes such as ICES/KIS and the Genomics initiative. In a field such as ICT/IS where the policy agenda has broadened over a few decades from a science and technology agenda to encompass societal and government transformation issues, policy coherence is much harder to accomplish. Although much energy is invested in formulating an integrated strategy, individual departments involved in ICT/IS policies have a good deal of autonomy for shaping and implementing policy.

Table 7.7 summarises some strengths and weaknesses of innovation governance in the Netherlands identified in the four case studies. Some of the conclusions and observations made from the study of innovation governance in the Netherlands are summarised below.

Table 7.7. Strengths and weaknesses of the Dutch innovation governance

Strengths	Weaknesses
• Broad stakeholder involvement in early phases of the policy cycle • Shift towards creating networks of existing organisations instead of launching new organisations or structures • A strong culture of analysis and benchmarking of innovation performance • A streamlining of instruments has increased transparency • Willingness to experiment in policy • In cases where sense of urgency is felt: strategic choice for additional investments • Individual cases of good practice in interdepartmental integration	• Decision lead times are long, transaction costs of stakeholder involvement are high • Small number of key stakeholders with large influence in committees • Tendency for committee culture; publishing strategic documents but no implementation • Structural problems often only scratched on the surface • The function and effectiveness of some publicly funded actors remain outside the policy debate • Streamlining of instruments limits the room for experimentation • In many policy domains no strategic choices are made • No horizontalisation of innovation as an issue has evolved • Interdepartmental collaboration is in its infancy

Dynamism in the system

The Netherlands' innovation governance system has evolved slowly and adapted to external challenges but has seen no radical changes in the past decades. New requirements have, for the most part, been met by the addition of new actors to the institutional landscape; existing organisations have very rarely been abolished or merged. The level of ministerial departments responsible for innovation governance has remained relatively stable over the decades, although more departments are gradually playing a role. As the

institutional system becomes more complex, changes to the system have been slow and responsibilities fragmented. The co-ordination and consensus-building tradition has shown its limitations in the high transaction costs involved. Characteristics of Dutch innovation governance are the lengthy process of arriving at a decision and the difficulty of making choices – for instance deciding to be selective or to discontinue an initiative. Numerous intermediary organisations and structures have been added but the entire portfolio is not always cleaned up. The recent proliferation of platforms, networks and large research programmes makes this already complex system difficult to steer or change. Combined with a weak tradition of making hard choices, this means that considerable efforts are put into building agendas and co-operation to ensure that the various players receive a piece of the science, technology and innovation cake. Since the turn of the new century, this evolutionary pattern has been under discussion. The main governance solution that has been introduced is the Innovation Platform, which aims to suggest structural changes. It is still too early to decide whether it fulfils this role well.

Horizontalisation

With the responsibility of science, technology and innovation clearly located within the Ministries of Education, Culture and Science and of Economic Affairs, the horizontalisation of innovation as a key policy concept has been limited, although progress has been made for instance in the area of high-technology start-ups. Other ministries have minor investments in technological solutions to specific societal problems (*e.g.* defence, transport, health, environment and agriculture). Horizontalisation in the Netherlands has taken place on the agency level rather than on the policy level. Examples are the merger of Senter and Novem, the merger of Medical Science Council with the Heath Department Agency ZON. Nevertheless, the move towards more horizontalised innovation policies has not yet been made. This can to a certain degree be explained by the fact that the horizontal steering mechanisms needed for this – and the fact that current interdepartmental co-operation is not very easy to achieve – have not been identified. It is much too early to tell whether interdepartmental coalitions for government-wide innovation projects or involving outsiders with more executive powers in advisory committees will work. A period of experimenting and policy learning is probably initially needed. Dutch innovation policy might be characterised as joined-up government, where policy objectives are not necessarily conflicting but in practice the means have not been sufficiently deployed to align objectives and create more leverage.

Stakeholder involvement

The government has a strong tendency to use external experts and Committees of Wise Persons to give strategic advice or in some cases take important investment decisions. This has positive and negative aspects and the tendency to use the same Wise People in various committees may lead to a lack of new ideas. This point requires further debate, as it can be interpreted both as a sign that regular forms of policy making are inadequate to make important decisions or as a sign that policy making is becoming more open to stakeholders and therefore more demand-led. A new development in innovation governance is that external advisors are given more permanent tasks. The establishment of the Innovation Platform, chaired by the prime minister, is one example, and the ICT *Regie-orgaan* and the Genomics Initiative another. With the role of the government almost reduced to taking their advice seriously, these advisory bodies are gaining almost discretionary power. A weak point in the Dutch innovation system is the relatively low level of involvement of politicians in science, technology and innovation themes. The

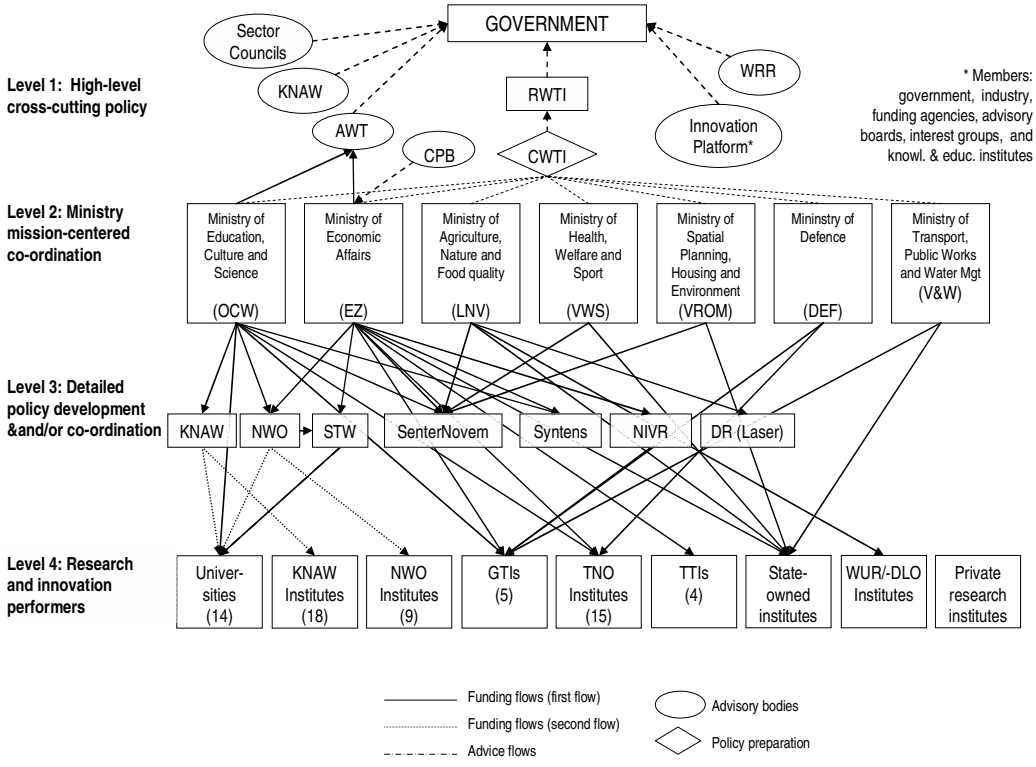
Innovation Platform, chaired by the prime minister, might change this, although so far the involvement of political actors has been limited.

Policy learning

The Netherlands has a high level of transparency paralleled by a growing culture of policy learning, which is systematised in the policy cycle through evaluations, monitoring and benchmarking. Policy learning not only takes place through formalised routes, however; the cases showed that learning by doing and learning by experimentation can also be powerful means of making changes.

Annex 7.A

OVERVIEW OF KEY ACTORS IN THE DUTCH INNOVATION SYSTEM



Notes

1. The study builds on two innovation governance studies for the Dutch Ministry of Economic Affairs and the Research Council of Norway that focus on the formal aspects of innovation governance as performed in a number of countries (see Arnold *et al*., 2003).

2. These were reported separately in Boekholt and McKibbin (2004a); Boekholt and McKibbin (2004b); den Hertog (2004); and den Hertog and de Groot (2004; 2005).

3. Ministry of Economic Affairs; Ministry of Education, Culture and Science; Ministry of Finance; Ministry of Transport, Public Works and Water Management; Ministry of the Environment; Ministry of Defence; and Ministry of Agriculture, Nature Management and Fisheries (LNV)

4. For more information on the Innovation Council, see *www.innovatieplatform.nl*.

5. In fact one could label this as a revamping of cluster policies in which clusters draw up an agenda and indicate where government could further facilitate these mostly competitive clusters. In a sort of beauty contest, all sort of clusters could apply for the status of key area which – in case this status is granted – would result in practical attention from government in dealing with quite specific barriers that hinder these clusters from becoming (more) competitive in their day-to-day operations.

6. A pilot scheme through which SMEs can buy EUR 7 500 worth of research time at a university or public research institute in order to apply knowledge in practice and help introduce an innovative product or service onto the market. The university or research institute can hand in the voucher at SenterNovem (and get paid). Applications were massive and the first 100 knowledge vouchers were in fact handed out in one day. For 2005, an extra 400 knowledge vouchers are foreseen.

7. Individual members of the platform stress, through interviews in major newspapers, the importance of implementation and practical solution instead of producing paper.

8. A core feature of third-generation innovation policy in their view is "that it places innovation at the heart of effectively all policy areas. This is not just to say that all policy areas need to be innovative (though they do – and in many cases there is considerable scope for technological innovation to support organisational and policy innovation). In addition it requires various policy areas to work strategically towards the Lisbon objectives, preferably taking innovation into account as a factor that is influenced by the policies and policy reforms that are being pursued."

9. As outlined in OECD (2005), p. 23, the concept of coherence basically has three dimensions, *i.e.:*
   - Horizontal coherence ensures that individual or sectoral policies build on each other and minimise inconsistencies in the case of (seemingly) conflicting goals.
   - Vertical coherence ensuring that public outputs are consistent with the original intentions of policy makers, and that policy objectives from the political apex are translated consistently down through lower governmental levels.
   - Temporal coherence ensuring that today's policies continue to be effective in the future by limiting potential incoherence and providing guidance for change (this relates to transition management).

10. Based on OECD (2005), pp. 22-23.

11. More incidental mechanisms that influence the relationship between TNO and government include *i)* regular contract research performed by TNO for various departments; *ii)* TNO and TNO researchers participating in various committees and advisory boards as well as various national and international R&D programmes; *iii)* incidental reports, for example by the Court of Audit.

12. Cabinet reaction, IBO technology areas, 7 October 2002.

13. Other tools that TNO mentions in this context (see *Strategy Plan 2003-2006*, p. 25) are client satisfaction and employee satisfaction audits as well as various kinds of quality audits (ISO, Sterlab, etc.). These contain elements which maybe used for accountability, but are, like the KPAs, in the first place performed for TNO itself and not primarily to account for the activities to government.

14. At the end of 2002, they jointly employed 6 800 full-time equivalent employees and their joint turnover amounted to EUR 680 million, see Ad hoc Commission Wijffels, 2004, p. 5.

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Chapter 8

GOVERNING FRAGMENTATION: THE CASE OF NORWAY

Svend Otto Remøe[1]
Prokontra AS/NIFU-STEP, Oslo

Norway's currently satisfactory economic situation is due to the sound industrial policies of the past as well as recent economic and fiscal policies. These have resulted in an export-oriented economy with substantial revenues from petroleum. The macroeconomic priorities and thinking have been both necessary and beneficial. However, the innovative capability of the Norwegian economy is far from perfect, and the Norwegian politico-institutional structure is ineffective in bringing about necessary institutional changes and establishing new priorities for more innovation-led economic development. This chapter discusses current challenges in the Norwegian innovation policy system, emphasising the inherent tendency toward fragmentation, low co-ordination among autonomous institutions and ministries, and short-termism in priorities. Recent efforts to promote more coherent or horizontal innovation policy have so far failed, mainly owing to a mismatch between the current system and the institutional system required by a coherent, horizontal innovation policy.

Introduction

During recent decades there has been an increasing trend towards globalisation of the world economy as flows of goods, services, capital and labour transcend national borders more easily and to a far greater extent than before. Further, economies have become more dynamic, with knowledge production and use, innovation and technology development playing a more important role in economic growth and restructuring. Hence, the call for more flexible economies.

Flexibility can take many forms. Owing to a greater focus on innovation and innovation systems and a break with the earlier linear model of innovation, knowledge and knowledge diffusion and use have become more important. The systemic or interactive model of innovation, currently broadly accepted as a representative picture of how the innovation-driven economy works, postulates the need for dynamic and flexible structures and processes that facilitate the diffusion of knowledge throughout the economy (OECD, 2002). However, path dependency often continues to influence the development of non-economic institutions which are not exposed to market forces. In other words, public institutions like governments, whose *raison d'etre* is different from that of commercial firms, change only slowly, if at all, and may thus be out of step with the need for flexibility and adaptation.

Attention to the need for governments to change and develop institutional capabilities and governance practices more in line with a dynamic, innovation-driven economy has recently increased. A third-generation innovation policy (building upon the first and the second as the linear and interactive models) is emerging, calling attention to institutional adaptation in the area of science, technology and innovation (STI) policy as well as to the need to develop innovation policy components across ministerial boundaries and thus redefine innovation policy as a horizontal policy area. By implication, this will require new government capabilities. The more an economy is in need of releasing lock-ins and developing new development paths, the more will be demanded of governmental institutions and policy making to accommodate these changes.

This chapter analyses the Norwegian governance system. Over the past three decades, the Norwegian economy has been quite successful, building on the development of a highly productive and innovative oil and gas cluster as well as macroeconomic policies that have ensured the effective management of financial assets. However, the structural bias of the Norwegian economy may challenge governance capabilities to promote more flexibility, new development paths and innovation. The chapter begins by describing current performance and policy challenges. This is followed by a discussion of the key characteristics of Norwegian governance. An analysis of the *modus operandi* of this system follows, built around a crude model of the policy cycle as constituted by agenda setting and prioritisation, co-ordination and implementation, and learning and evaluation. The analysis focuses specifically on some inherent structural characteristics of the Norwegian system, most notably the high degree of autonomy of Norwegian ministries, and shows that the system lacks capabilities for strategic, cross-ministerial and long-term policy making. This has been highlighted by the promotion of the government's plan for a coherent innovation policy launched in 2003.

Perceived policy challenges

A key task is to assess Norway's ability to respond to the challenges it faces. This has a lot to do with the ability to detect these challenges, understand them and translate them into a viable agenda for policy making.

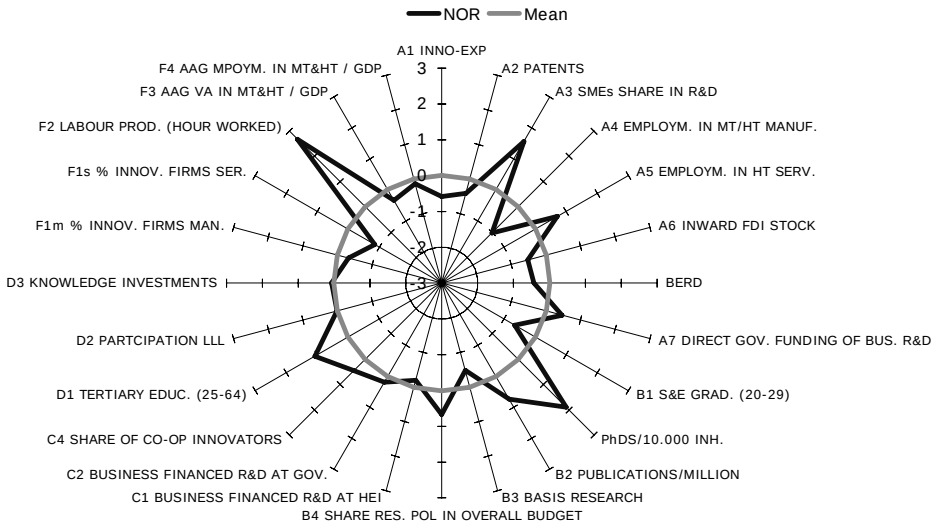
First, the performance of the national STI system is compared to an international average.[2] The results are shown in Figure 8.1. The circle depicts the average of all countries involved, while the irregular line illustrates how Norway scores relative to this average. The indicators are grouped: Group A covers innovation in the company system, B knowledge generation through the education and research system, C industry-science linkages, D absorptive capacity and F overall performance.

The picture reveals an interesting, albeit somewhat contradictory message. Norway scores relatively high on labour productivity, although this must be seen in relation to the large GDP, which also leads to lower GERD (gross expenditures on R&D) than would have been the case without the oil rent. More illuminating is the combined effect of high scores on tertiary education (without which knowledge investments would have been lower) and number of PhDs. This shows that Norway is an educated society with a great number of PhDs in the overall economy. On the other hand, the production of graduates in science and engineering (S&E) is very low, a recurrent theme in Norwegian debates. Taken together with the fact that BERD (business expenditures on R&D) is low, it seems reasonable to argue that Norway's significant investments in knowledge create a well-educated work force, but one which does not engage significantly in business R&D.

A closer look at the innovation-related indicators (A1-7) shows that patenting, employment in medium- and high-technology manufacturing, inward foreign direct investment (FDI) and BERD are all low. On the other hand, the share of small and medium-sized enterprises (SMEs) in R&D is high, as is employment in high-technology services and direct government funding of business R&D. This would indicate that employment in high-technology services is well developed, probably influenced by telecommunications. The other side of the coin is the relatively low share of innovative firms in services in general. The combination of low expenditures on innovation, low patenting, low FDI and low BERD is particularly worrying, as it conveys a message of low overall innovation activity and vitality in the Norwegian economy.

Norwegian R&D policy appears to have been strongly focused on direct support, with incentives for collaboration with research institutes and universities. This is linked to low levels of basic research and leads to the conclusion that public investments in knowledge are skewed towards higher education and applied, business-oriented support, while basic research and graduation rates in science and engineering suffer.

Figure 8.1. STI performance for Norway



The data in Figure 8.1 refer to 2000, before the introduction in 2002-03 of a system of tax incentives for R&D. Still, the picture should lead Norwegian policy makers to re-examine some emerging biases. While government activity is acceptable in several areas, areas to be rectified include those that seem to be linked to low levels of capability and attractiveness of Norwegian firms, notably employment and activity in business with higher levels of R&D (medium and high technology), production of science and engineering graduates, FDI, and innovation and R&D activity in the economy in general.

Furthermore, the perceived challenges include low R&D funding, an industry structure not conducive to future needs of the economy, lack of venture capital and lack of entrepreneurship (start-up of new firms with growth potential). There are also several other issues of importance. In particular, the lack of a coherent policy rationale and the

overall governance of the innovation policy area are major challenges. This leads to an awareness of problems linked to macroeconomic policy and its implicit dominance in the Norwegian policy environment. Lastly, there is a clear awareness of weaknesses in the core education and research system, including basic research and the role of the research institutes in the innovation system.

A general, long-term threat which provides a context for these perceptions is the future reduction of state revenues (often discussed as the "shark's jaw"). This structural threat was the main reason for the government's recent initiative to promote a "comprehensive (holistic) plan for innovation policy" (discussed below). In October 2003, the Norwegian government presented a plan entitled *From Idea to Value* (Ministry of Industry and Trade, 2003). Innovation policy should be embedded in a range of policy fields, not only in the traditional fields of industrial and research policy.

In sum, Norway's longer-term task will be to promote a structural change towards less dependence on oil and gas and more diversification and knowledge-based growth. This points to a transformation of the development path that has been successful over the past decades. A major question will be how well the institutional structure and policy making will accommodate this change, and whether the conditions for learning and adaptation are present in the existing governance system.

Governance in Norway

Historical development of the science and innovation system and governance structure

For practical purposes, the scope of discussion is limited to the past 15 years. However, given the major trends, the period after World War II can be roughly divided into to four phases: 1946 to the late 1970s; the 1980s; the 1990s; and recent developments. While the earlier stages were characterised by state involvement, traditional industrial policy aimed at protecting key industries, and promoting new industries through industrial R&D, the main thrust of policy was to adapt the linear model of innovation to fit the Norwegian industrial landscape of SMEs. This resulted in a relatively large R&D sector which was later privatised as independent R&D institutes (Hauknes and Wicken, 2003). The early 1970s developed what might be termed the most successful innovation policy in recent decades, the policy to promote a petroleum industry. With a great degree of state involvement a mix of initiatives was launched, with regulation of the continental shelf, tax systems, technology transfer and R&D, infant industry policies as well as a governance system very much geared towards learning and adaptation.

Towards the end of the 1980s, increasing dissatisfaction with the results of the policies for strategic technologies and with a technology-push orientation became evident, and the policies of that decade were reassessed. Although it did not represent a radical break with previous policies, the White Paper on industrial policy published in 1989 was felt to signal a new approach.[3] However, the 1990s saw the emergence of no coherent new strategy for industrial policy, and the decade was in general characterised by the lack of an overriding vision in this policy area.

The broader socio-economic background for a new industrial policy in the 1990s was a series of problems that occurred between 1986 and 1993 which politicians perceived as constituting a "crisis". This led to a departure from the "picking winners" strategy of previous decades (attempts to construct specific industrial structures as prerequisites for

industrial growth and competitiveness). The emphasis on a "best industrial structure" lost ground to new arguments in favour of broad innovation activities in various parts of the economy. These arguments were based on the view that policies should not be directed towards specific (and radical) structural changes, but towards improving productivity and diffusion of new technologies throughout the economy. Norwegian industrial policy studies submitted by the Aakvaag, Henriksen and (the first) Hervik Commissions – all in the latter half of the 1990s – attached importance to maintaining a broad perspective on innovation.[4]

Central features of the policies of the 1990s were a departure (at least rhetorically) from the "picking winners" strategy and an orientation towards a broader innovation policy in which "diffusion of technology" played a central role. The technology push of the previous decade gave way to arguments stressing the importance of client capabilities and network interactions. These arguments did not, however, generate an alternative "market pull" strategy. Rather, attention quickly turned to approaches in which network interactions were argued to be important. The decade was also characterised by institutional restructuring and continuing emphasis on SMEs and regional innovation policies.

A 1993 White Paper on research policy introduced innovation and systems theory to a larger audience and stressed the need for larger R&D investments.[5] However, it did not lead to a wide-ranging debate or to a substantial increase in national investments in R&D.

In the latter half of the 1990s, the financial strength of large companies once more became a political matter. Globalisation – and in particular the increased importance of multinational corporations (MNCs) in the global economy – raised the question of how Norwegian companies could compete with these in increasingly more open international capital and goods markets. The sale of the most successful Norwegian company of the early 1990s, Nycomed (pharmaceuticals), and the national symbol Freia (chocolates) to foreign competitors, as well as Kværner's decision to move its headquarter to London, triggered a discussion on how to maintain national control of the more important companies and be an attractive economy for MNCs. The argument for national control was the need to keep knowledge production and R&D in the country.

One of the political problems on the agenda in the middle of the 1990s was therefore to develop financially strong national companies and ownership. The state had become a major owner of Norwegian industry, controlling both big manufacturing industry, the banking sector and high-technology institutions. State ownership could be used to make sure that important industrial companies remained Norwegian. In addition, the government returned to the old policy of selecting some "national champions" that could help develop strong national ownership.

In the 1990s the global context of innovation policy came to the fore. At the same time, Norway had to resolve its problematic relationship with Europe. After Norway voted not to join the EU in 1994, a European Economic Area Agreement was put in place, between Norway and the remaining European Free Trade Association (EFTA) countries except Switzerland, and the EU. A major component of this collaborative agreement was participation in European R&D policy, or the Framework Programme. Norway's participation in this European system of knowledge creation and diffusion has been well received as an integral part of Norway's innovation or R&D policy.

Towards the end of the 1990s, political interest in innovation and R&D policies increased. While innovation and systems theory had been highlighted in a 1993 White Paper, there had not been an immediate breakthrough for this line of thinking or a substantial increase in national R&D funding. From the late 1990s, however, Norwegian policy makers have increasingly directed their attention towards matters such as increasing national investments in R&D; increasing commercialisation of research results; improving the quality of research and higher education; and stimulating network interactions. Recent years have also seen strong emphasis on regional innovation policies and substantial changes in both the organisation and content of innovation policies in general.

Furthermore, while the view that innovation results from interaction between several factors was explicitly upheld by the government-appointed Thulin Commission in the early 1980s, the linear model in fact continued to influence actual policies. That decade's focus upon generic technologies, as expressed in the "strategic technology areas", implied a technology-push approach to innovation and industrial development. It was not until the late 1990s that policies began to be substantially structured around innovation and systems theory and constituted breakthrough for "second-generation" innovation policy.

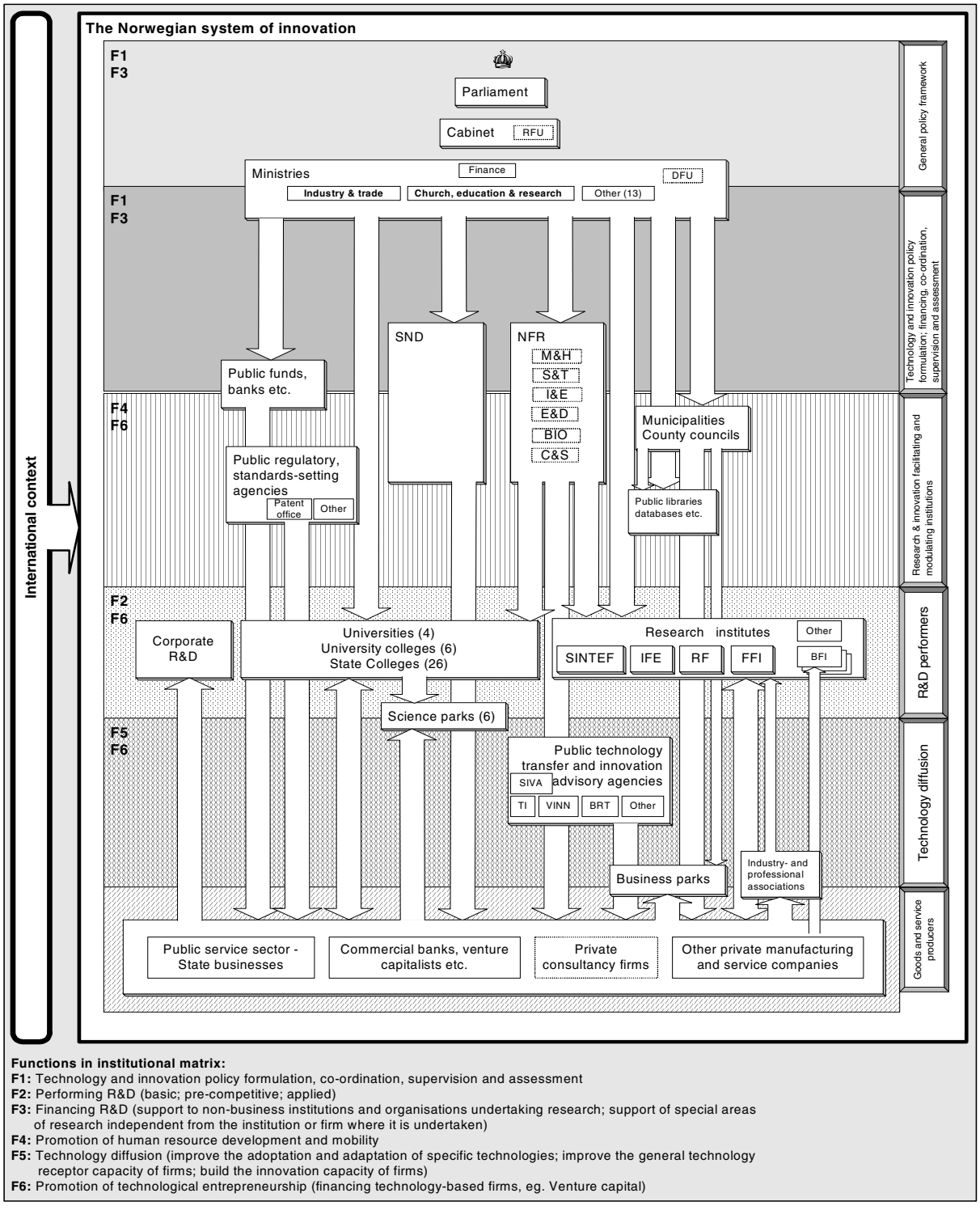
On the one hand, the past decades of successful build-up of an oil and gas industry have created a highly internationalised industry or cluster with a broad competence base. On the other hand, the policy challenge is less the extraction of petroleum resources than how to manage financial assets without crowding out resources for industrial development in the rest of the economy. The policy-making platform of "macroeconomic rationality" (Koch, 2003) has been particularly strong compared to other countries; it is based on the "iron triangle" of the Central Bank, the Department of Economics at the University of Oslo and the Ministry of Finance. The iron triangle started out as a strong element in labour party governmental planning, and it has increased its role in policy making with the stronger tendency to rely more on market solutions in recent years. Industrial policy as such has been more or less removed from the agenda to the benefit of a market failure approach, especially in capital markets. In the relationship between the state and the market, there is increasing emphasis on competition and privatisation. Industrially oriented policy is left to the Ministry of Finance (Moen, 2002). Moreover, the state's role is now characterised by state capitalism without strategy, except for selling state shares in major corporations (NOU, 2003:19).

The basic governance structure

The institutional structure of the Norwegian innovation policy system in 2002 is depicted in Figure 8.2. The main change since then has been a merger of three agencies related to industrial and innovation policy (see below). As such, this merger illustrates a main theme of this chapter: the Norwegian system's concentration on the agency level to accommodate perceived co-ordination needs originating at the top level. In parliament (*Stortinget*) the committees dealing most directly with innovation policy issues, mainly through the annual state budget and white papers, are:

- The Standing Committee on Science and Education *(Utdannings- og forskningskomiteen)*.
- The Standing Committee on Trade and Industry *(Næringskomiteen)*.
- The Standing Committee on Energy and the Environment *(Energi- og miljøkomiteen)*.

Figure 8.2. Policy-centred organisational map of the Norwegian system of innovation



Functions in institutional matrix:
F1: Technology and innovation policy formulation, co-ordination, supervision and assessment
F2: Performing R&D (basic; pre-competitive; applied)
F3: Financing R&D (support to non-business institutions and organisations undertaking research; support of special areas of research independent from the institution or firm where it is undertaken)
F4: Promotion of human resource development and mobility
F5: Technology diffusion (improve the adoptation and adaptation of specific technologies; improve the general technology receptor capacity of firms; build the innovation capacity of firms)
F6: Promotion of technological entrepreneurship (financing technology-based firms, eg. Venture capital)

Note: RCN and NFR = The Research Council of Norway.

Source: STEP.

There is no single parliamentary forum with innovation policy responsibility where such issues are focused upon and co-ordinated, although the Committee on Education, Research and Church Affairs handles broad R&D policy matters. Accordingly, the responsibility for innovation as well as R&D matters is divided among several ministries.

The sector principle and agencies

Norwegian policy formulation is based on the so-called "sector principle", meaning that each ministry is responsible for promoting and funding activities in its area. The sector principle is rooted in a system of highly autonomous and specialised ministries with a relatively weak function for the prime minister's office. This has some important implications for the governance system.

First, there is a strong and long-standing tradition of sector-oriented R&D and innovation funding policy, which means that each ministry has responsibility for funding research relevant to its objectives. This decentralised pattern of public R&D funding has recently been viewed as a major hindrance to overall harmonisation of Norwegian innovation policy efforts (Arnold *et al*., 2001).

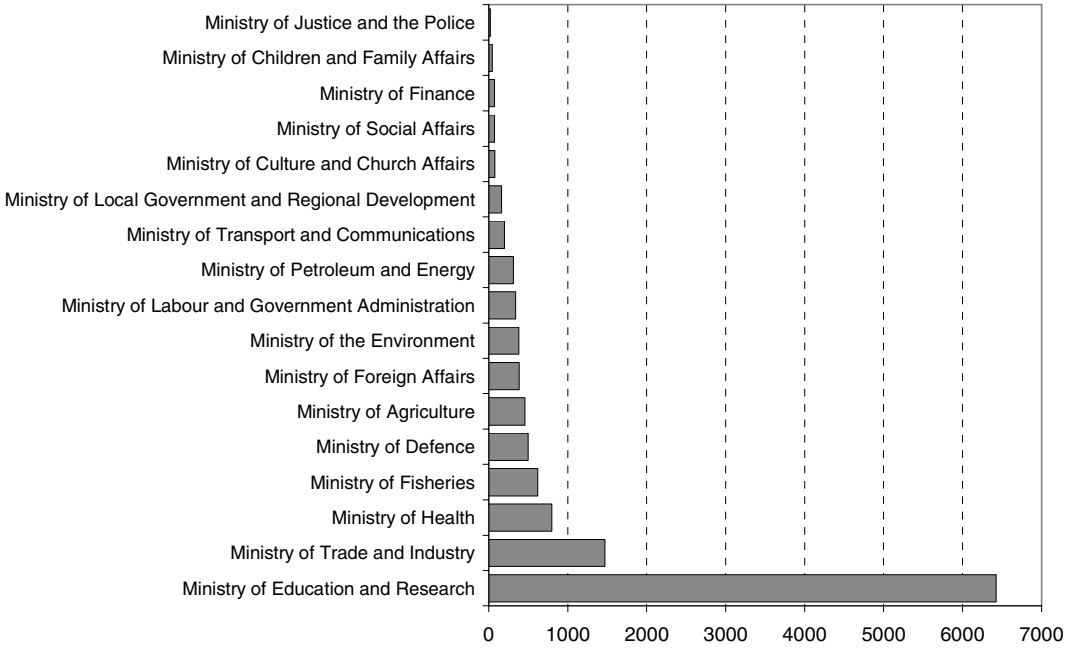
Figure 8.3 illustrates the sector-oriented character of public R&D funding in Norway. The most important ministries for S&T policies in Norway are the Ministry of Education and Research and the Ministry of Trade and Industry. However, other ministries, such as the Ministry of Health, Ministry of Fisheries, etc., are important funders of R&D performed by research institutes and the private sector. Several studies of the Norwegian innovation system conclude that better co-ordination between the Ministry of Education and Research and the Ministry of Trade and Industry could be achieved.

Second, the co-ordination challenges arising from this system are being met by an increasing tendency to reform or establish agencies responsible for implementing policy. This development is in line with key principles of new public management (NPM), with its emphasis on decentralisation and accountability. Agencies are expected to take on co-ordination tasks in the implementation process even though these tasks have their source in the ministerial structure. The key example is the Research Council of Norway (RCN) which was established in 1993 by merging Norway's five existing research councils. The Research Council has the main responsibility for co-ordination of national STI policies, despite the principle of sector-oriented R&D and innovation funding policy. Thus, the responsibilities that are distributed on the policy level are to be reintegrated on the implementation level.

In general, recent reforms have led to an increase in agencies and other institutions mandated with implementation of policy. A general assessment is that the prime minister's level has little power, the individual ministries much more so, and that the agency level has increased in authority and power owing to its position in the policy cycle. A recent study of power relationships in Norway concluded that even the recent reform of state institutions has been sectoral and uncoordinated (NOU, 2003:19).

Figure 8.3. Norwegian public R&D-funding by ministries, 2003[1]

NOK millions



Source: NIFU

1. Project assignments excluded.

Source:: NIFU.

A corporatist system in a macroeconomic environment

The above picture needs to be extended to include key relationships with stakeholders. In addition to the main institutional structure, Norway's governance system has generally been based on a tripartite relationship among the parties in the labour market and the state. In the context of innovation policy, it is fair to say that the corporatist system has been strong, but limited. Nordby (1994) states that the corporatist governance system in Norway rests on three pillars:

- The tripartite incomes policy, which is a division of labour between employers, trade unions and the state to ensure the competitiveness of Norwegian industry through moderate income settlements. This pillar also underlines that competitiveness has been conceptualised in Norway as low unit costs relative to competing countries.
- The second is referred to as corporatism under public management, a key mechanism for agenda setting and stakeholder involvement. It refers to the system in which organisations and individuals are invited to take part in commissions, committees, advisory boards, etc. These entities typically deliver their assessments and conclusions on specific issues in the framework of "public studies" (*Norges offentlige utredninger*, see section on policy learning below). An important aspect of this form of corporatism is that the "owner ministry" gives the mandate for the commissioned work. This represents a deeply ingrained tradition

in Norwegian public administration, the sector principle, which implies that each ministry has all relevant responsibilities for policy actions within its domain. Thus, the combination of sectoral ministries and this corporatist system may reinforce separations among policy domains. This system has initiated a great many reforms and major policy decisions in the innovation policy field, such as the recent tax refund system for R&D expenditures, the merger of five research councils into one in 1993, and benchmarking of Norwegian industry's competitiveness in 2002 (European Commission, 2002).

- The final pillar is often referred to as inner corporatism, which is linked to profession-based trade unions and their influence on public management (Moen, 2002).

Some key points of this brief description merit further comment. First, the committees and commissions referred to do not exercise any power in terms of decision making. Government, or the respective ministry, is free to accept, reject or change such proposals in preparing white papers or other documents for wider policy debate, as happened during the reform of the research council system. Hence, these structures should be seen essentially as stakeholder mechanisms.

Second, the sector principle has led to processes within what has been coined the "segmented state" (Egeberg *et al*., 1978) and "the negotiated economy" (Hernes, 1978), which implies a strong tendency towards uncoordinated but selective action *vis-à-vis* industries and interest groups. This is for example reflected in the traditional organisation of industrial policy whereby primary industries (fisheries and agriculture) still have their own ministries. This system results in an extremely skewed distribution of government support to industrial activity: of a total of NOK 18.5 billion in support in 1998, NOK 12.4 billion went to agriculture, NOK 4.8 billion to secondary and tertiary industries, and NOK 0.7 billion to industrially oriented R&D (Moen, 2002). Recently, an increasing tendency to implement reforms according to principles of new public management has led to what is termed a "fragmented state" (Tranøy and Østerud, 2001).

Agenda setting, prioritisation and stakeholder involvement

Governance of innovation includes the capability to identify challenges ahead for the national economy, formulate strategic visions for future development, and prioritise resources accordingly. Agenda setting and prioritisation are therefore key elements in the process of creating dynamism and inducing structural change when necessary. However, these processes do not take place in a vacuum. They are influenced by earlier agendas and priorities, inertia in building knowledge and preferences, with stakeholders often representing existing priorities and political and economic belief systems prevailing in the policy making system. The institutionalist approach taken in this analysis assumes that agendas and priorities are not the result of rational, explicit choices, but depend on a number of formal, informal, structural and cultural factors. The analysis aims at creating an understanding of how these influence outcomes in Norway's innovation governance system. The main message is that there are deep systemic factors behind the apparent lack of ability to formulate a consistent and comprehensive innovation policy agenda.

The politics of agenda setting

Agenda setting basically takes place at the political level. Although the term "political level" usually refers to politicians and political parties, patterns of tension and conflict typically cut through many layers and institutions.

Multidimensional tensions

A point of departure is the dominant notion of "macroeconomic rationality" alluded to above. Although this feature of Norwegian policy making has been present during most of the post-war era, particularly with the Keynesian economic policy of the 1960s and 1970s, it has become even more dominant over the past 20 years for two reasons: first, the petroleum sector has generated not so much energy as financial assets for the Norwegian economy. From early on, the challenge was perceived as avoiding the dangers of a "Kuwait economy", *i.e.* one deeply dependent on oil- and gas-based revenues and activities. The financial assets were therefore defined as oil and gas reserves and put aside as savings. Norway's strong community of economists has been a stronghold of competence and an asset for the management of these resources. Second, a cross-political preference for NPM became widespread over the past decade and a half, including a market-oriented focus in economic policy, privatisation of suitable public services, and a rigorous, even ideologised, view of the interface between the state and the market.

As new perspectives on innovation policy emerge, several lines of tensions become visible in the political and policy making system:

- The conservative party, *Høyre*, which currently leads the government coalition, is split between traditional or neo-classical economics and a more pragmatic stance. Still, innovation policy is a difficult issue for *Høyre*, as it challenges the role of the state in economics and politics.
- The labour party has tensions along the same lines, but they are less severe. The party also takes a more pragmatic view of the role of the state in the economy, in particular state ownership. The party is strongly linked to the trade union movement.

These tensions provide an essential background for understanding why a modern version of industrial and innovation policy is very difficult to achieve. They are reinforced by similar rifts in the civil service:

- There are strong tensions within the Ministry of Trade and Industry, essentially between the division for economic policy, which takes the neo-classical approach to economic policy, and the division for R&D and innovation, with a perspective more in line with the innovation systems approach and evolutionary economics.
- There are tensions between the Ministry of Trade and Industry and the Ministry of Local Government and Regional Development, in particular on the question of state vs. regional perspectives.
- The Ministry of Science and Education takes an ownership role for R&D policy and resists being (very) co-ordinated. This led, as in the case of the new Government Committee for Innovation Policy (RIU) to a lack of integration between R&D policy and innovation policy.

Hence, there are two dimensions of conflicts related to economic and innovation policy, on the one hand an academic-economic dimension, and on the other a political-economic dimension, both of which reinforce each other and make it difficult to achieve well-informed modernisation and renewal of the interface between economic and innovation policy.

Processes in parliament

As mentioned above, the parliament is the high-level body for policy formulation and therefore has an overall policy function. Some key mechanisms and processes are important for understanding the system.

First, the parliament has 12 standing committees. The rule is that the committees should have a reasonable workload, a rule that necessarily leads to trade-offs. For example, the Standing Committee on Science and Education (SCSE) has responsibility for the R&D budget. The Standing Committee on Trade and Industry (SCTI) has responsibility for three ministries (all industrial), and, according to the procedural system, leaves major R&D affairs to the former. These trade-offs are well illustrated by the treatment of the annual budget. The state budget, with its resource allocation and prioritisation, is the key vehicle for policy formulation. However, owing to the division of labour among the committees, a committee may not treat the entire budget for a sector. For example, the SCTI will not deal with the chapters of the budget for the Ministry of Trade and Industry that deal with R&D allocations for use outside that ministry (for RCN). Those chapters will be dealt with in the Standing Committee for Science and Education. This seems at face value to represent a failure of co-ordination, since R&D is an important aspect of industrial and economic policy. This seems even more the case, since the SCTI does not formally attach comments on priority for subsequent treatment by the SCSE, yet the SCSE is then responsible for preparing the discussion in parliament.

This cross-functional system could not operate without the co-ordinating role of party groups. Before preparing the final proposals for discussion in parliament, the issues are discussed broadly in the respective parties, allowing them to instruct or inform the committee delegates to vote or push for specific positions and priorities. Hence, the party groups operate as cross-references in the system. In other words, the organisation of parliament as such does not necessarily indicate how positions are formulated. The party machinery expresses opinions through the committees, which are not decision-making bodies in their own right.

These committees do not have joint meetings to better co-ordinate policy. On the other hand, some important cases may be treated in more than one committee, a matter that is decided by the presidency. Still, the committee system is vulnerable to the competence of party delegates and their level of information and knowledge. In addition, delegates, or members of parliament, may also act individually as allowed by the parties or individually according to specific procedures in the parliamentary agenda.

A co-ordination challenge also arises from the type of instruments in various ministries' portfolios. For example, the Standing Committee on Finance Policy (SCFP) discusses policies that are of key importance for the SCTI, but since the SCFP, through finance policy, handles all financial instruments, such as tax policy, it is extremely difficult to achieve coherent treatment *vis-à-vis* industry and innovation. Hence, the division of labour in parliament has multi-dimensional problems of co-ordination, first because various policy fields are distributed across committees according to the "fair

burden" principle, and second because the various policy instruments are distributed across committees.

This causes difficulties for a coherent and horizontal innovation policy, and a rational process thus depends on insightful processes in and among political parties and their delegates. The organisation of parliament is ill-suited to broader, strategic approaches in areas like innovation policy. In fact, if the government is to succeed in establishing a comprehensive innovation policy, it needs to be extremely sensitive to positions taken by the opposition in parliament to achieve negotiated outcomes.

Prioritization in R&D: the role of ministries and the RCN

As noted, the ministries have great autonomy.[6] They operate according to the principle of sector responsibility, and each ministry is responsible for its own R&D strategy according to its knowledge needs. Typically, the strategy includes a definition of the boundaries of responsibility and strategies for exploitation. The prioritisation processes take place without formal exercises like foresight. The main government priorities are typically spelled out in white papers, which replaces other strategic intelligence functions in the Norwegian system. These are general visions and objectives with no binding impact on yearly allocations, so that prioritisation is closely linked to the annual budget.

However, the system's main feature is earmarking, as ministries' prioritised allocations to RCN give very detailed instructions concerning the use of the funds. Six ministries provide the general funding base for RCN, which, together with financial means from the new Fund for R&D and Innovation, makes up 75% of RCN's financial base. The rest is provided by dedicated funds from 14 ministries, in many cases very small amounts (down to less than EUR 1 million). The RCN is therefore an implementing institution rather than the strategic institution it was meant to be. A recent study of the earmarking system highlights the fact that while the Norwegian governance system in general rests very much on NPM principles, the earmarking system is an evident contradiction.

> "Smaller spenders tend to discuss their funding of individual programmes. Rather than supporting various categories of activity, they treat RCN more like a supermarket, buying a packet of this here, a slice of that there – essentially for their own consumption. They are also much more likely to earmark within individual programmes, and these earmarks may relate on occasion to quite small amounts. From the allocation letters, it is clear that these earmarks represent a mixture of politically imposed requirements and ministries' needs for very specific pieces of research. In isolated cases, it seems that the level of control desired by the ministries is extreme." (Technopolis, 2003)

Several analytical points are also made concerning variation in behaviour:

- "The **purpose** of the funding – whether it is fundamentally paying for research to be done or whether it is paying for answers to the ministries' questions – or, in other words, whether the funding provides patronage or custom. Often, the two are not clearly distinguished.
- "The **scale** of the funding. Small funders trust RCN less and earmark more.
- "The **history** of the ministry. Those that have had sectoral research councils in the past still deal with RCN at a level of great detail.

- "Intensity of **political demands** of the sector. Some (such as regional development) are simply more prone to lobbying and political interference than others.
- "Variations in the degree of **personal interest and competence**, especially at the level of the responsible officers in the ministries." (Technopolis, 2003)

Hence the way priorities are made is deeply ingrained in the sector-based governance system and undermines broader strategic agenda setting for R&D and innovation policy. The control exercised may more readily be termed negative than positive, as it implies a significant weakening of the RCN's strategic elbow room and potential to achieve broader, long-term policy deployment.

State budgets and the role of the Ministry of Finance

The budget process and the Finance Ministry, mentioned above, are important components of innovation policy and deserve more extensive treatment, especially as the budgetary procedures changed recently and, contrary to expectations, gave more elbow room to the Ministry of Finance and less to sectoral ministries.

Given the lack of long-term budgeting, the annual state budget process becomes a key ingredient in the co-ordination of innovation policy. The process is best depicted by the R&D budgets; as noted above, each ministry is responsible for R&D for its domain. The process itself is overseen, if not steered, by the Ministry of Finance, whose role is to keep the budget decided by government.

The co-ordination of allocations for R&D and innovation was easier in the former system than in the current one. Formerly, the process started with the development of an adjusted budget based on the previous year's allocation adjusted by additional calculations. In addition, the various ministries presented new proposals, and the budgets were discussed in detail in government. Although this was generally a rather disorderly process, that was not the case for the R&D budgets (Olsen, 1997):

- Typically, an R&D "pool" emerged, that is, a total allotment for R&D.
- The proposals from ministries were then assessed against the pool.
- The Ministry of Science and Education proposed a solution for distribution across ministries, thereby taking on the role of a mini-Ministry of Finance. This was discussed and decided on in co-ordinating bodies like DFU and RFU (see below).

Hence, the system ensured reasonably coherent treatment of R&D budgets. This was helped by a 1989 decision to have 5% growth in R&D as well as a certain profile for these investments. R&D was given priority. This is no longer the case.

The current system, called framework budgeting, is organised through three governmental budget conferences. The first (the *Halvorsbøle* conference which takes place in March) includes the main priorities for the next year's budget based on proposals from ministries. In preparation for this conference, the Ministry of Finance issues so-called R-papers, basically a list of budget cuts to maintain a given budget balance. The interesting feature here is that, contrary to what one might expect, the Ministry of Finance does not cut the overall sum (in a framework mode) but specific lines in sectoral ministries' budgets. Hence, the Ministry of Finance is deeply involved in policy. The key player in this conference is therefore the Ministry of Finance. The outcome of the conference is a set of preliminary budgets and some proposals that are held against a "profile pool" of new initiatives.

Next is the adjustment conference in May/June. The ministries have by then allocated the budget posts and often proposed new ones. The Ministry of Finance is again the key player. Cuts are often suggested with reference to the budget balance. The third conference is set in August, and the profile pool is distributed.

The main conclusion in the present context is that the influence of the ministries responsible for R&D and innovation policy areas has been reduced, to the benefit of the Ministry of Finance. As R&D lost ground on the priority lists during the 1990s, it is now one of many areas that each minister must defend. Earlier, the overall pool received more strategic attention, including recommendations from other sources.

An interesting feature of the recent developments in the budget process is the erosion of long-term perspectives, most notably the disappearance of the traditional long-term programme issued by the Ministry of Finance. It is evident that this development also leads to greater degrees of freedom for the Ministry of Finance, as it assumes the strategic role for each year's budget.[7] It is also notable that the government as a collegium is weak *vis-à-vis* the Ministry of Finance. The government may communicate visions and strategies, *e.g.* on targets for reaching the OECD average on R&D investments. But the Ministry of Finance does not leave much room for such changes in priorities. A new government target is not sufficient, and is not seen as binding, if it is not backed by a formal government decision that makes sacrifices in other areas explicit. This was in fact the case in White Paper No. 39 on Research (Ministry of Science and Education, 1999), in which the investment target was extensively discussed. Rather than choosing a fluctuating target (the OECD average as a share of GDP), which had been a general target for some time, the government formulated a binding decision to raise R&D expenditures by 5% every year over a period of four years. This was largely followed up, and the logic is that the more expenditures are committed in this way, the less elbow room there is for the Ministry of Finance in the annual budget process.

Innovating new policies

Policy making often take place within a context of tensions between policy agendas or orientations. The short-term orientation of the prioritisation process through the state budget has led to some policy innovations that illustrate the governance dilemma in the Norwegian system.

An example is the development of the SkatteFUNN or the tax credit scheme (Box 8.1). The SkatteFUNN was seen as the main instrument to achieve the overall goal of reaching a level of R&D investment, measured as share of national GDP, equal to the OECD average within a five-year period. This goal, which had the support of the government parties as well as most parties in parliament, necessitated a rapid and substantial increase in R&D investments especially by the private sector. A tax credit scheme is less likely to be framed in budgetary terms than a subsidy scheme, and unrestrained use of SkatteFUNN by the private sector was considered a precondition for reaching the OECD average R&D level of investments.

Box 8.1. What is the SkatteFUNN?

SkatteFUNN is a tax credit measure for enhancing R&D investments in Norway.

- Small and medium-sized firms (SMEs) are the primary beneficiary of this measure and have the right to claim 20%of their expenses on internal R&D projects within a baseline of NOK 4 million each, or NOK 8 million if the R&D project involves collaboration with an approved R&D institution.
- From 2003 all businesses are eligible to receive tax credits.

The Research Council of Norway (RCN) has to approve the project as falling within the definition of an R&D activity.

Source: Kaloudis (2004).

There are reasons to believe that the real worry of the Ministry of Finance was that firms' statutory right to tax credits may result in a substantial (and in the worst case uncontrollable) loss of tax revenues. A subsidy measure, administered by RCN, could, if necessary, be controlled by defining a maximum upper limit to the SkatteFUNN in the annual budget. In other words, a tax credit scheme would escape the control of the Ministry of Finance. A subsidy scheme would have been easier to manage and to bring under the ministry's budgetary control if necessary.

To counteract tendencies to short-termism, "by-pass operations" have found new solutions. As the government in the 1999 White Paper on Research made a commitment to increase R&D expenditures by 5% a year, it set up a funding mechanism that got around the short-term prioritisation logic of state budgets. The solution was the Fund for Research and Innovation (generally known as the Research Fund) which was set up with a capital base of NOK 3 billion, whose earnings are to be used to fund research. The capital base has been increased in subsequent budget years. The fund also eventually replaced less stable research funding through a public lottery scheme.

In 2003 the fund was earning NOK 793 million on a capital base of NOK 15.8 billion. One-third is devoted to universities and colleges, and the RCN retains the rest (see below). Although the priorities change according to strategic decisions by the RCN, the research part of the fund is crudely allocated to the following priority areas (2002 numbers):

- Quality-enhancing initiatives (including centres of excellence) (NOK 175 million).
- Large, long-term initiatives or programmes (NOK 270 million), such as functional genome research, cross-sectoral competence areas, long-term programmes in petroleum research, material research, bio-spectre research, linguistics and technology, polar climate research, modernisation of the public sector, and basic diseases.
- Thematic priorities of the 1999 White Paper (NOK 58 million).

However, there are some difficulties with this new mechanism for increased long-term research priorities. First, the fund was meant to channel funding mainly to basic research which was seen as having been under-prioritised. Instead, it was increasingly used to finance another reform, quality reform in universities and colleges. Second, and this is less a problem than an illustration of the fund being used to solve later problems, the fund became the source of funding for the new centres of excellence, a scheme

initiated in 2002 to enhance scientific quality in selected areas. Third, and possibly the most interesting feature, the fund is managed by the RCN, and hence reinforces what some observers call the monolithic structure of research funding in Norway. In other words, when the fund was established, there was no policy to ensure funding diversity in the system, and the fund is generally subsumed under the RCN's priorities. Fourth, as the earnings from the fund are defined as part of the state budget and thus in the realm of the Ministry of Finance, there are some uncertainties as to whether the fund represents a source of fresh money (Sejersted, 2001).

A clash of paradigms? The new plan for comprehensive innovation

Responding to various pressures, the government set out in 2002 to develop an action plan for innovation policy. The initiative was motivated by two drivers in particular. First the government had been criticised for a lack of industrial policy and for relying on what many critics termed "old-fashioned", hands-off market-failure policy with no long-term plan for meeting the structural challenges facing the Norwegian economy in a post-petroleum era. Second, a key political challenge, often referred to as the "shark's jaw", was the future discrepancy between the flattening out and even reduction in state revenues from the petroleum activity and the increasing welfare expenditures to be met by the state. This section explores the emergence of this new agenda and the extent to which it is linked to subsequent stages of the policy cycle.

The perception of the external challenge to the Norwegian economy was mostly long-term and related to the widening divide between a long-term decline in petroleum revenues and an increase in expenditure on welfare. As the challenge is structural, the implication would be to identify a structural solution, such as science-based creation of new industries or long-term structural change. This did not occur: rather, the main focus was a shorter-term approach to industrial policy and job creation.

The general emphasis of the innovation plan was a long-term understanding of the global threat to Norwegian economy. The need to develop clear alternatives to the current dominance of the oil and gas sector predominated. However, the very process of formulating the plan (which had so many deficiencies that even the government later referred to it as only the beginning of a process) illuminates several systemic flaws from a governance point of view:

- **No analysis of the national innovation system.** Even though the document makes several references to properties of the Norwegian industry and innovation system, no comprehensive, theoretically informed analysis of the national system of innovation is presented. Instead, ad hoc references are related to specific problems, such as the lack of private investments in R&D, explained through imprecise references to industrial structure. This incremental approach may be expected, given the theoretical debates in the field of innovation policy which was, and still is, characterised by a conflict between innovation theorists and neo-classical economy theorists. Given this conflict, assuming an analytical point of departure for policy development was a lost option.
- **An eclectic operational approach.** The other option, which was chosen, was an administrative, eclectic approach. Horizontal or holistic notions of innovation policy feed into a general discussion of the framework conditions for Norwegian industry. On this basis, long lists of measures are presented. Several are quite similar to industrial policy discussions in general.

- **The definition of innovation policy is a contested area.** In the document, outcomes of conflicts with other sectors are referred to several times, as compromises of conflicting interests between innovation policy and other policy fields. These outcomes contribute to limiting the scope of innovation policy. They include:
  - R&D policy, where the importance of basic research and knowledge dissemination through education and the labour market is emphasised.
  - Regional policy, where the potential conflict between a research-driven innovation policy approach and regional spatial redistribution policy approach was emphasised.
  - Economic policy, as the document did not help to solve the inherent conflict in Norwegian economic policy between improving general framework conditions for industry through reducing public spending and public investments to break the spiral of reduced R&D investments that prevents new path creation.
- The new innovation policy represents a challenge to the existing policy-making paradigm for economic and innovation policy. The general arguments for R&D are well founded, but weakly linked to long-term structural choices. To some extent, two paradigms compete. First, the traditional, strong and well-founded paradigm of market efficiency and market failure, which implies a focus on framework conditions and an ideologically based, clear interface between the state and the market. It also implies a state that "gets out of the way" and interferes in markets only if these are distorted. Second, a more dynamic, long-term paradigm based on the presumed need to make choices concerning structural development, a flexible and pragmatic understanding of the interface between the state and the market, and integration of policy areas.

The contents of the plan aside, the very process of its formulation illuminates the structural challenges in the governance system. It attempted to push for a new agenda for innovation, one which would have been widely supported, but it essentially failed owing to a lack of correspondence between its implicit presuppositions on issues like the role of the state, knowledge about the innovation system, and mechanisms for integration across policy boundaries and those on which the current system is based.

Co-ordination of policy formulation and implementation

Two levels of R&D policy co-ordination: the role of RFU and DFU

R&D policy constitutes a core element of innovation policy. It is essentially cross-ministerial and long-term, and therefore subject to specific governance or co-ordination needs. In this context, two arrangements stand out as central to the co-ordination process. They are the government's research committee (RFU) and the ministries' research committee (DFU), and should be seen as a response to co-ordination needs arising from the following tasks:

- **White Paper on Research Policy.** Research policy is cross-ministerial. As described above, each ministry is responsible for research policy for its sector, on the assumption that it knows best the sector's long-term knowledge needs. These white papers are typically produced every four years (currently five) and involves an exchange of information, discussions and dialogue, and viewpoints from

people and organisations inside and outside government. The process is relatively open, typically includes inputs from stakeholders and experts, and might be seen as a functional alternative to research foresight which has not been conducted in Norway to any great extent for policy formulation purposes.

- **Annual state budget.** This involves co-ordination activities, especially when the budget increases, as the additional funds need to be prioritised and distributed across ministries. In this case, the Ministry of Science and Education proposes a possible distribution to the Ministry of Finance. In the case of no-growth or reduction, co-ordination is essentially done by the Ministry of Finance in its budget balancing activity.
- **Relationship to the RCN.** The RCN is funded by a range of ministries and the interaction between it and ministries needs to be co-ordinated (see, however, the above analysis of prioritisation).

RFU (the government's research committee)

This committee is central to overall political co-ordination of research policy. However, and this is a conflict between objective needs and political priorities, it is not institutionalised as such. Every government makes its own decision about the RFU, and one government (the Jagland government in the mid-1990s) chose to suppress it, having other solutions in mind that did not materialise). Hence, its mandate is general, and reinvented by every government. Its general task is to prepare research policy issues for discussion by the government. Its composition varies, depending on the importance given to R&D by each government, to personal interests of ministers, etc. The key ministries are always members. An interesting point is the current coalition government's decision to let fewer than half of the ministries participate, to avoid a (party-based) decision-making process ahead of the formal process in government as a collegium. The meetings are held according to need, typically between three and seven times a year. The Ministry of Science and Education is the secretariat and co-ordinates and prepares the agenda. It also co-ordinates inputs from other ministries.

The extent to which civil servants take part in these discussions varies. From a "back-up" point of view, one would expect this as a matter of course. However, for policy co-ordination to take place without representatives from the individual ministries with a strictly sectoral view, ministers often meet alone. This political, or supra-ministerial, function is similar to that of the committees of deputy ministers (see below). The RFU processes and performance vary, according to the importance attached to specific policy issues.

DFU (the ministries' research committee)

The DFU covers all ministries. It is not a decision-making body, and it is led by the Ministry of Science and Education. In earlier times, under a different state budget regime, there was close contact between the two levels of co-ordination. However, with the current framework budgeting, the two have largely been decoupled.

The DFU meets four to six times a year, participants are typically middle management, often one or two from each ministry, and the DFU is used as a reference group during the preparation of the White Paper on Research. The DFU is an important body for the Ministry of Science and Education as it helps fulfil the co-ordination function assigned to the ministry. In the structure of the Norwegian public administration, the DFU

co-ordinates the exchange of information among ministries and facilitates dialogue among them.

The DFU's structure includes in particular the two "camps" of industrial ministries, such as trade and industry, agriculture and fisheries, and welfare ministries, such as social affairs and health. The two camps have quite a different outlook on R&D policy and very different traditions and culture, so that their positions in the DFU are quite different. The Ministry of Science and Education has better relations with the industry ministries, which seem to have a clearer sense of R&D policy as a means to achieve political goals. There is no policy integration between the two camps, *e.g.* to let industrial R&D be better integrated in areas of health to enhance health technology and its development. Rather, such groups compete to some extent to have their priorities and views included in the white papers. For example, the recent White Paper on Research gave greater weight to industrial issues than to welfare issues. Additionally, bilateral processes take place between ministries; *e.g.* the ministries of Agriculture and of Fisheries are currently attempting to align their research policies.

An additional feature of the work of DFU is its working group. To allow for better continuity and to be better able to deal with key policy matters, DFU has also constituted a smaller working group of some eight ministries. It meets more frequently than the DFU, and focuses on policy issues arising from interaction with the RCN.

Committees of deputy ministers

On major cross-sectoral policy issues, the government acts to leverage the co-ordination of the issues at stake. It may organise the work in specific committees of ministries, like spontaneous RFUs. This was the response to the need for co-ordination arising from the effort to formulate a horizontal or coherent innovation policy in 2003.

A more dynamic co-ordination mechanism that is often put in place is the committee of deputy ministers (CDM). The Norwegian system has one minister for each ministry (the number and structure of which changes frequently, resulting in fragmentation), and two or three deputy ministers, each responsible for specific policy areas. The CDM is typically initiated on the basis of a governmental decision which formalises the selection of participating ministries, the mandate and the leadership. CDM has a key ministry as the "owner" which also serves as the secretariat. The CDM meets frequently, often once a week. Based on lessons learned, the following seem to constitute a reasonable assessment of conditions for a positive impact of CDMs:

- In case of difficult political questions (in particular in the context of a coalition government), these need to be clarified in the government itself, and the clarifications need to be included in the mandate, so that deputy ministers may more easily arrive at consensus.
- A dedicated leader with legitimacy *vis-à-vis* the others in the group.
- Ministerial ownership in the sense that ministries internalise the policy area.
- The deputy ministries need to behave like politicians and not as representatives or defenders of their sectoral interests. This also means that participating civil servants need to be restrained.
- Active participation is needed, and participation based on duty rather than ambition is detrimental.

- Well-known policy areas are better suited to this co-ordination mechanism, while new ones need time to mature and more substantial inputs to have an impact, as they may to a greater extent challenge the ministries' traditional policy priorities and values.

The government's Committee for Innovation Policy: a necessary addition?

One of the outcomes of the government's innovation plan issued in 2003 (according to some observers *the* major outcome) was the establishment of the Government's Committee for Innovation Policy (RIU). Given the perceived need to co-ordinate policies across policy areas, RIU was given a key role, and it is the strategic body for the government's strategy in this area.

RIU is basically conceived as an extended version of the RFU. While RFU is made up of five ministers, RIU has ten, including those of the Ministries of Health, Public Administration, Finance and Foreign Affairs. It is led by the minister for Trade and Industry. Its most striking feature is that it was organised as a separate institution and did not contain or reorganise RFU. Hence, RIU is a governmental paradox: it has broader responsibility than the RFU, but has no responsibility for the R&D part of the innovation policy, which is still a responsibility of the RFU. And RIU did not help to simplify the co-ordination of innovation policy; on the contrary, it was added to existing mechanisms.

As the RIU has just recently been established and has as yet no track record, a reliable assessment is not possible. However, two features of RIU may be highlighted, as they seems to resemble some important characteristics of the innovation plan itself.

- First, as in the RFU, the prime minister has no function, and there is therefore no "supra-ministerial" role that might provide perspectives beyond what each minister or ministry brings to the meetings.
- Second, to broaden the policy-making base, RIU is being extended to include external stakeholders from industry, labour, and science in what is termed the FIP (Forum for Innovation Policy). This is an open forum in which the prime minister may take part, and is further extended with new participants on a flexible basis. It meets twice a year, and its main function is to ensure a dialogue to improve the content and direction of the innovation policy. However, FIP is only an advisory body, and there is no obligation for the government to follow its advice and recommendations.

As a rather preliminary assessment, RIU is aimed at incremental co-ordination of the roles of the various ministries taking part in the innovation plan, and may thus serve important co-ordination functions. FIP is a useful way to provide a dialogue mechanism with stakeholders. However, while RIU includes the Ministry of Science and Education, it is still separated from the committee on R&D policy, which seems to be a structural weakness and unnecessarily complex. Further, the agenda of RIU does not compensate enough for the lack of structural focus in the innovation plan and the need to engage in broad and long-term prioritisation for structural change.

Policy learning: the production and use of policy relevant knowledge

Strategic intelligence

The Norwegian system does not use technology foresight as a means for obtaining forward-looking, strategic intelligence. Even though some socio-political traits seem conducive to such foresight exercises, notably an otherwise corporatist basis for dialogue and partnership, the political system has not embraced the foresight model as a broad, collective method of prioritisation and learning. This seems to be rooted in a lack of experience with a collective, expert-based process the outcomes and recommendations of which must be included in the government's policy making.

White papers

However, there are mechanisms that partly serve as functional alternatives, most notably the white papers and the way these are produced and used. In short, these are communications from the government to parliament on some key policy issue. As mentioned, innovation-related white papers are produced regularly in the case of R&D and less regularly on related issues.

What makes the white paper interesting from a policy learning perspective is that the process is quite open and based on inputs from a variety of inside and outside sources. The full cycle of producing a white paper typically takes one to two years. The white papers contain a factual description of areas under scrutiny and include broad assessments of developments, challenges and policy options. The government often makes extensive use of expertise, *e.g.* the RCN, but increasingly also other sources, such as stakeholders (*e.g.* the Norwegian Business Association). Experts often participate, indirectly or directly, in providing updates on specific issues, reflections on complex topics, and summaries of relevant research.

White paper are important documents, although they vary in quality, comprehensiveness and ambition. Hence, some of them, including in the R&D and innovation policy domain, have a standing as reference documents even if parts of the proposals are not followed up for political reasons.

Commissions and hearings

In line with Norway's committee-based corporatist model, important and abundant work is done by commissions (a term used for short-term taskforces or committees). On several complex policy issues, like the reform of the RCN and the tax credit scheme for R&D, both discussed above), such commissions are set up with a mandate given by government or a minister, with participation typically based on a mix of stakeholders and independent expertise.

As with the white papers, the work of the commissions is open. Their work is typically published in the series of public documents called "Norwegian Public Studies" (NOU). This practice implies complete transparency, and the independent advice of the commission is fully public.

Two related policy learning processes are attached to these commissions. First, governments do not adopt their advice as such, but often launch a white paper that presents the government's own assessment as well as a proposal to parliament. Second, and before this takes place, the study is publicised to target audiences with invitations to respond with comments and proposals.

It is important to note that the link between these commissions and subsequent white papers or even governmental decisions is rather weak. Governments may or may not adopt the views of the studies and may reject partly or fully their recommendations. Still, they are important institutions for policy learning, particularly since they are open and inclusive.

Evaluation practices

If the strategic intelligence function of the system is limited to two, albeit rather well-functioning institutions (white papers and commissions and hearings), evaluation in the context of innovation policy is very broad and comprehensive. Further, the evaluations undertaken are linked to a relatively large sector of social science research institutes and other research-based consultancies. These are indirectly an extremely valuable part of the policy learning system, and in Norway, unlike most other countries, policy learning rests on an active exploitation of the research community.

For practical purposes it seems fair to divide the practice of evaluation into institutional evaluation and programme evaluation. These are discussed separately below.

Institutional evaluation

A comprehensive evaluation practice aims to assess and develop innovation-related institutions. Crudely speaking, institutions are evaluated in terms of agencies and performers:

- **Agency evaluation.** This takes place when a ministry intends to consider reform of its agencies. The evaluation of the RCN is one example, the evaluation of the State Fund for Regional and Industrial Development (SND) is another. In the first case the evaluation contract was given to foreign expertise, with a Norwegian subcontractor for technical assistance and data collection. Agency evaluations are only launched at times of specific change or controversy and are not a regular practice.
- **Performer evaluation.** Research institutes and other knowledge institutions are regularly evaluated as part of their contractual relationship with the RCN. The RCN has within its mandate the responsibility to manage the sector via a system of basic funding and strategic institutional programming, and regular evaluations, typically every five years, are carried out by a broad, often international, panel. These evaluations are conducted in a learning rather than a control mode, implying that the institute (or university, etc.) in question is expected to act on the recommendations set forth in the evaluation and comply with the expectations of the RCN. Thus, evaluations are carried out within the framework of improvement as an imperative in the contractual relationship between the institution and the RCN.

Programme evaluation

Programme evaluation is the core business of Norwegian evaluation practice. The centre of this activity is the RCN (and to a lesser extent other agencies that run programmes, like the SND). The basis of this activity is accountability, as the funder is expected to generate reliable knowledge about the use of public funds.

Programme evaluation is conducted on a regular basis, primarily as *ex post* evaluation once a programme has ended. Programmes, whether research programmes or innovation-related programmes, typically last five years and are managed by a programme committee made up of a mix of stakeholders and professional expertise. This committee manages the programme according to a mandate supplied by the administration of the RCN. The mandate is used as a point of reference for the evaluation.

While the RCN, rather than the programme committee, launches a programme evaluation, the situation is different for monitoring. Monitoring on the programme level is usually decided and carried out by the programme committee as a way to ensure learning within its management task. Hence, monitoring is not a regular activity.

Evaluation in the RCN

When the RCN was established in 1993, one of the ten tasks assigned to it was to "implement and follow up evaluation of research and research institutions". After its reorganisation in 2004, this item still exists, albeit changed to the shorter "ensure evaluation of Norwegian research". An evaluation strategy was developed and endorsed by the RCN board in 1995. It was ambitious and stipulated that the resources devoted to evaluation in RCN should be raised from 0.22% (1994) to 1-2% of the total budget, in line with international practice.

The strategy was comprehensive, but not followed up. Currently, the RCN has no overall budget for evaluation, and over the years the responsibility for conducting evaluation has been delegated to the divisions and their need for evaluations of programmes and research institutions. This does not mean that evaluation is neglected. On the contrary, it is pervasive, and as seen above, widely used. The apparent problem is that the strategy endorsed in 1995 was never followed up as a RCN-wide mode for learning and development. In particular, this concerns the need for a comprehensive, strategic evaluation of the RCN's overall fulfilment of its goals and its performance of its role. This was among the issues presented in the strategy, but it was not implemented. Neither was there a follow-up on the strategic need to create a central R&D evaluation budget for evaluation across divisions. Rather, the yearly evaluation plan resembles a bottom-up assembly of evaluation projects by the various divisions. In sum, and confirmed by the evaluation of the RCN, the strategic approach to evaluation is missing, a point that has weakened the strategic role RCN might have had, and would have helped it fulfil another statutory task: giving advice to government on R&D policy.

However, a number of activities and improvements have been initiated over the years, some of which are briefly discussed below as examples of a practice that seems to be the mark of the RCN: operative evaluation of programmes and institutions:

- As RCN has the responsibility of governing the framework conditions for the research institute sector through basic funding, it has developed a set of criteria for performance of research institutions that are evaluated every five to six years. These institutional evaluations are basically oriented towards development rather than control.
- A forum for the evaluation of strategies and instruments for industrial development (EVA forum) has been in place since 1994. This forum aims at contributing to learning and improvement of the knowledge base for evaluations and their practical use. Several ministries participate together with RCN, the Norwegian Business Association (NHO), Innovation Norway, etc. Recently the Ministry of

Research and Education has cut its participation, as has the NHO, seemingly an indicator of loss of relevance. However, the State Accountancy system has shown interest and participates.

- A modular system of data collection and analysis (ProVis) has been established, improving the database for evaluation of results, effects and impacts in and among firms participating in the RCN's programmes.

These examples illustrate that evaluation activities exist, but, as the evaluation of RCN by Technopolis confirms, they are very decentralised, with too little attention to this function as a strategic learning tool, and evaluation results that are little used for institution-wide learning and role development.

Some notable changes may be under way. With the recent reorganisation of the RCN, initiatives have been introduced to re-establish evaluation as a centralised, strategic tool to enhance knowledge production and use for policy development. With the simpler organisational set-up of the RCN, such a strategic function should be within reach.

Towards a comprehensive innovation policy?

Recent efforts by the Norwegian government to formulate a coherent or comprehensive innovation policy plan have highlighted structural challenges in the governance system. The independent and highly autonomous ministerial system and the sector principle of ministerial responsibility for R&D and other matters, creates a distributed responsibility for innovation-related matters but fails to serve as a basis for collective action. Increasing short-termism adds to the fragmentation, and the agency level is constantly challenged and reformed to compensate for inherent co-ordination failures in the policy system itself.

The Norwegian system is relatively well equipped with governance capabilities for static, short-term coherence. There is extensive short-term co-ordination, effective *ex ante* evaluation practices are abundant, and prioritisation of long-term investments in the education system for human capital conducive to the nation's need for technology development and competence has been a decade-long challenge.

There is a great need to develop institutional capabilities that pull disparate parts together into a long-term, coherent policy. While there is an obvious need for sound macroeconomic management, there is increasing need for leadership that can formulate consistent agendas and integrate innovation policy into a newly defined policy for broad, sustainable industrial development. It is particularly important to leverage the capacity for authoritative agenda setting through an improved strategic body of policy makers and stakeholders, to ensure that the co-ordination and integration between innovation policy and other policy areas is greatly improved, and that mechanisms for evaluation and learning are put to more strategic use than they are today.

Two underlying features seem to influence the current situation. First, in the context of a strong macroeconomic rationale in Norwegian policy making, there is a high degree of ideology in the definition of the relationship between the state and the market. In other words, the trend towards privatisation and a smaller state is largely guided by ideology. Second, the economic dominance of policy making, good as it is in many respects, is based on a single rationale, *i.e.* a policy is only effective if geared towards a single objective and not "contaminated" by other objectives. In sum, these two points make it difficult to achieve integration of policy areas and promote a more pragmatic role for the

state as innovation policy becomes the key impetus for a modern industrial policy. It will take a reflective and learning-oriented governance system to induce changes in such political and cultural factors.

Notes

1. This chapter is based on the collaborative work reported in Remøe *et al*. (2004).

2. Based on "Benchmarking National Research Policies: The Impact of RTD on Competitiveness and Employment (IRCE)", EU Commission, STRATA-ETAN Expert Group, 2002.

3. White Paper No. 53 (1988-1989), "On Industrial Policy" (*Om næringspolitikk*).

4. Aakvaag Commission, The Challenge – Research and innovation for new growth (*Utfordringen – Forskning og innovasjon for ny vekst*), report prepared by a commission appointed by the Ministry of Industry and Energy, 1996; NOU, 1996:23, Competition, competence and environment (*Konkurranse, kompetanse og miljø*); NOU, 1997:27, Cost-benefit-analyses (*Nytte-kostnadsanalyser*).

5. White Paper No. 36 (1992-93), "Research for the Community" (*Forskning for fellesskapet*).

6. It is said that a main reason stems from the period under Danish rule, when the Danish king was afraid of possible opposition from a strong prime minister and government, and hence ensured to weaken the office of the prime minister and made the ministers autonomous and divided (a version of the well-known principle of divide and rule).

7. An interesting inconsistency in this case is that the ministry demands from the municipalities a four-year budget plan, while their revenue largely comes from the government, and the government budget is decided on an annual basis, even though long-term allocations are typical in the welfare sector.

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Chapter 9

THE END OF AN ERA? GOVERNANCE OF SWEDISH INNOVATION POLICY

Jennie Granat Thorslund, Lennart Elg and Patrik Sandgren
VINNOVA

Sweden's success as an industrial nation was built on a small number of highly successful "flagship" industries, often in close co-operation with public-sector customers, and based on a long-standing consensus between industrialists and a – most often – Social Democrat government. Today these firms have outgrown their national foundations, and each aspect of their value chains is subject to international competition. This changes the role of government R&D policy, as Sweden has to compete globally for investments in R&D (and production). This implies a stronger focusing of R&D efforts, as well as the capability to refocus rapidly as priorities change.

A second policy challenge is to build the foundations for new, high value-added businesses. This requires a much broader and systemic innovation policy approach. Some early steps have been taken in Sweden, through a bottom-up regional development policy, the creation of a "ministry of growth" and an agency for innovation systems, and a national innovation strategy.

Introduction

To describe the governance and horizontalisation of the Swedish innovation policy, this chapter draws on several sources: interviews with actors in the innovation policy system,[1] an earlier project aimed at improving understanding of strengths, weaknesses and policy challenges in the Swedish national innovation system (Marklund *et al*., 2004) and an analysis of relevant policy papers and similar documents.

Theoretical approach

The case for public innovation policy is founded on a theory of system failure. It takes the view that policy needs to respond to capability, institutional, network and framework failures rather than to market failures as in the neoclassical view. According to this approach, it is the relationship between science, society and business that sets the conditions for innovation policy.

The term "governance" has recently been extensively used in innovation system theory because of its connotations (Borras, 2003). Governance concerns all organisations since one of the main problems for all organisational units is the distribution of power. A structure able to cope efficiently with a complex environment requires a high degree of

specialisation. The more specialised an organisation, the more difficult it is to get access to the information needed to make good decisions and foresee the consequences of actions. The challenge is to find an acceptable organisational form that has the capacity to handle prevailing and upcoming challenges in a flexible manner.

Governance of innovation concerns the roles played by the various actors in the innovation system, how the rules of the game work, how decisions are taken and how changes take place. The term has also been used to address a special way of governing, where the boundaries between politics and administration are erased and political will is carried out by means chosen by bureaucrats (Technopolis, 2002).

Emerging governance schemes are a consequence of changing conditions and ways of coping with challenges. The task of co-ordinating, or of bridging the gap between science and innovation, between different ministries, between policy and other stakeholders is an important issue for all European governments. From a Swedish point of view, it is of special interest to study co-ordination mechanisms since it has been observed that "smaller countries are better capable of governance change and systematic approaches" (Fraunhofer Institute, 2002).

Since the theoretical concept of governance has numerous aspects and perspectives (Yi, 2003; Dixon, 2003) this chapter concentrates on a few components, which have been identified as important from an analytical perspective and fit within the MONIT framework. These are:

- The structure of government.
- The identification of actors involved in decision making.
- The mechanisms used to determine direction and prioritisation as well co-ordination.
- The identification of driving forces in terms of changes, strengths and weaknesses.
- The identification of evaluation practices, learning mechanisms and measures of performance.

A formal description of established procedures and formal organisational charts never reveals the full picture. For instance, much of the interaction between key actors and stakeholders takes place informally and cultural and historical path dependency therefore needs to be taken into consideration. Nevertheless, the backbone of each and every governance model is the way in which organisations are structured and given decision-making power (formal rules) and resources (Technopolis, 2002).

This chapter first summarises the historical development of the Swedish innovation system up to 2001 and the founding of VINNOVA, the Swedish Agency for Innovation Systems, and points out key historical challenges, describes the main policy paradigms and maps the performance of the science, technology and innovation (STI) system. The overall focus is on public policy and its implementation. Next, recent developments and key actors are described to provide an outline of the current innovation system, with a focus on the organisational settings of the Swedish model for policy making and the current governance structure in Sweden. The discussion then turns to current STI policy and key policy strategies and challenges. The following section examines the foundation for Swedish agenda setting as well as mechanisms for prioritisation and stakeholder involvement and draws attention to some emerging trends. Co-ordination mechanisms for

policy formulation and implementation are described next, with a focus on horizontalisation of national policy and monitoring of current mechanisms. Policy learning is then discussed in terms of accountability, benchmarking and strategic intelligence. A final section provides an overview of the strengths and weaknesses of the governance system in order to map what can be learned from the co-ordination of policy issues in Sweden.

Historical development of the science and innovation system and the governance structure

Sweden's science and innovation system and its governance structure have been shaped to a large extent by history. The term "innovation policy" has only recently appeared in official documents.[2] However, as long as Sweden has existed as a nation, the crown has shown an active interest in improving manufacturing and trade, perhaps more to expand the tax base than out of concern for the welfare of its subjects.

When Sweden became a major military power in the early 17th century, German and Walloon artisans were given tax privileges to settle in Sweden, in order to establish the most modern mining and iron-making production technologies. In 1651, the National Board of Trade was established to promote "trade, shipping and manufactures". This government institution still exists, and over the years, institutions such as the Patent Office and the Swedish Bureau of Statistics have been spun off from it.

The rise of Swedish industry

The rise of Sweden as an advanced industrial nation occurred in three phases: a phase of entrepreneurial expansion from the middle of the 19th century until World War I, a period of concentration in the interwar years, and a period of international expansion and rationalisation after World War II (Giertz, 2002).

Entrepreneurial expansion

The first phase was preceded by several important institutional changes. The monopolies of craft guilds and a number of other trade regulations were abolished, limited liability companies with tradable stock ownership were allowed, and banks were permitted to set their own interest rates. The government also embarked on an ambitious programme of infrastructure investments: railroads, telegraph lines and finally electrification.

During this period, a number of manufacturing companies were founded which still form the backbone of Swedish industry: SKF, Ericsson, Alfa Laval, ASEA, etc. By the turn of the century Sweden had the ingredients of a successful entrepreneurial economy: a number of growing manufacturing companies, business angels and a banking system able to finance further expansion.

As a consequence of industrialisation, the period from 1870 to World War I saw a broad expansion of scientific institutions in Sweden (Eriksson, 1978). Research excellence became important in the appointment of professors, and the first industrial laboratories were established. State institutions such as the Swedish Meteorological and Hydrographical Institute and the Swedish Geological Survey were established.

Interwar concentration and a growing consensus

World War I was followed by a deep economic depression. Many entrepreneurs lost control of their companies to banks and other financers. This led to a wave of restructuring, which increased productivity and exports. The stock market crash of the early 1930s led to another round of ownership concentration, with a focus on rationalisation and expansion of existing businesses, rather than the creation of new business opportunities.

The Social Democrats, who were voted into power in 1936, saw efficient production and competitive exports as a necessary foundation for their ambition to increase living standards and build a welfare state. This shared interest between big business and the Social Democrats, including the labour unions, paved the way for a Swedish consensus which lasted until the 1960s.[3] This consensus was strengthened by the country's isolation during World War II.

The need to develop domestic capabilities during wartime isolation also played a role in setting up the Technical Research Council in 1942. Other influences were Bernal's philosophy about "the social function of science", and organisational developments in a number of other countries, most importantly the UK Department of Scientific and Industrial Research (DSIR).

One reason for separating governance of research from the universities was to provide a mechanism for taking account of industry's views on priority setting (Nybom, 1985). This organisational solution set the pattern for the expansion of research funding in other fields. It is perhaps ironic that the research councils are seen today as a guarantor of academic freedom and the bastion of mode I research.

Strong infrastructure investments by the government also contributed to close relations between Swedish public utilities and manufacturing firms, sometimes including joint long-term R&D. Such "development pairs" included the Swedish Power Authority and ASEA, Swedish Rail and ASEA, and Swedish Telecom and Ericsson. Indeed, this interaction between public-sector users and private industry accounts for a major share of the impressive growth of large firms and private R&D spending in Sweden. There was also a strong political belief that only large firms had the capacity to invest enough in R&D (*LO Samordnad Näringspolitik*, 1961).

Post-war boom

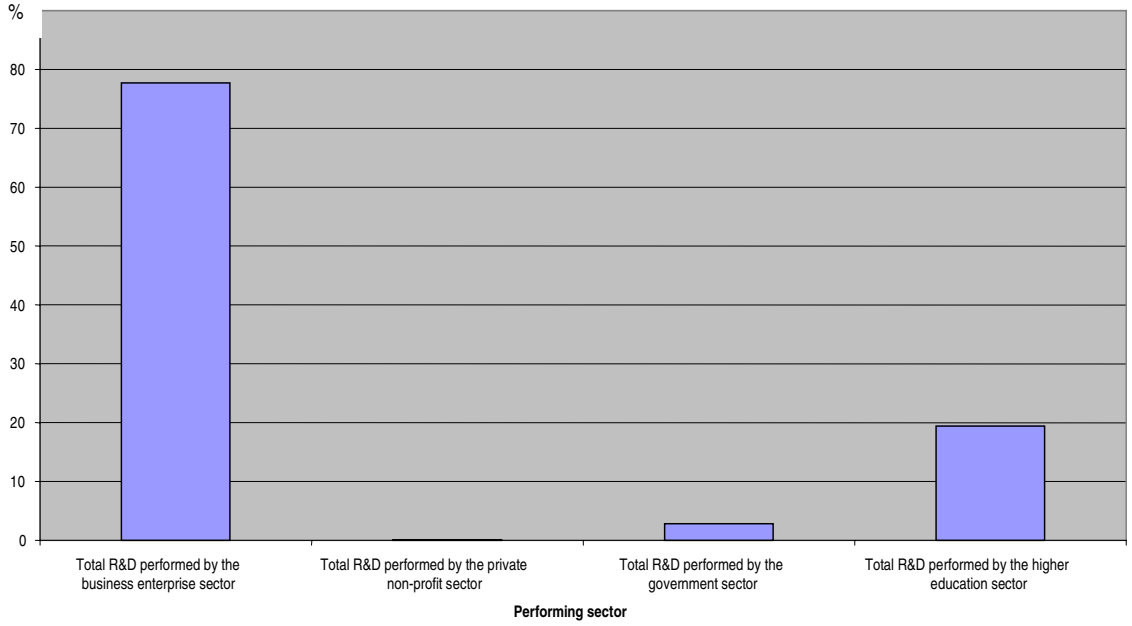
Swedish industry was well poised to take advantage of the post-war "boom". Exports and world market shares grew rapidly during the 1950s and 1960s. In return for rapidly increasing real wages and full employment, Swedish unions were ready to accept continuous restructuring and rationalisation of industry.

The other side of the bargain was that the owners of industry accepted high rates of taxation, although there were warnings already in the 1960s that this reduced risk taking. This was not seen as a major problem at the time, as the apparently stable business environment of the post-war boom put the emphasis on internal efficiency – doing things right – while the question of strategic direction (doing the right things) seemed comparatively unproblematic. In sum, policy makers adopted the views of the old Schumpeter but found the young Schumpeter's destructive entrepreneur harder to accept.

This Swedish model's finest hour came after World War II. Sweden's industrial capacity was intact as Sweden had stayed out of the war, and it was specialised in the kind of investment goods that were needed in large quantities to rebuild war-torn Europe.

A hidden cost was a culture that did not emphasise entrepreneurship. The best and the brightest aimed for a career in big business, and a combination of low corporate taxes and high personal tax locked capital into existing firms. Big firms were able to finance further expansion, but little risk capital was available on the open market.

Figure 9.1. R&D in Sweden by performing sector, 2001



The success of big business also meant that there was little apparent need for innovation policy, which may explain the strong hold the linear model retains in the Swedish debate. The Swedish R&D system is also markedly split up, with strong universities, industrial R&D concentrated in large firms, and a very small sector of user-oriented research institutions (Figure 9.1). Large firms translated complex application problems into discipline-based research – and training – internally and this has meant less need for bridging institutions.

As the pace of industrial restructuring accelerated in the early 1970s, the Swedish consensus started to disintegrate. How to provide social stability in an era of rapid restructuring became a major political issue. In a less stable environment, strategic choices to "do the right thing" become relatively more important than internal efficiency (doing things right), but it is not clear that this was understood at the time.

An early sign of a more activist industrial policy was the creation of a new Ministry for Industry in 1969, which was followed by several organisational changes. A number of government-owned companies were merged in a conglomerate with 30 000 employees directly controlled by the new ministry. The former Technical Research Council, and several small agencies concerned with exploitation of research results, support to

inventors, etc., were merged into the STU, the National Board for Technical Development. A government-owned development corporation, SUAB, was loosely patterned after the United Kingdom's NRDC. It is interesting that the government bill setting up STU in 1968 refers to the "linear model of innovation" as outdated. The new ministry was soon deeply involved in structural crises in a number of traditional, small-scale industries. Industrial policy became more a matter of "saving jobs" than of building the foundation for new job creation.

The impact of the 1973 oil crisis was masked for a short while, but by 1975, a number of large industries showed structural problems, with declining productivity and real wages. Two major studies, one by the Boston Consulting Group and another by the Royal Swedish Academy of Engineering Sciences, stressed that the crisis was indeed structural and a major contributing factor was Swedish industry's tardiness in introducing new, more knowledge-intensive products and processes.

The early 1990s saw a shift in economic policy thinking, from a focus on speeding up structural renewal to a focus on removing obstacles to growth (Pierre, 2004), owing to increased scepticism about the capacity of government policy to influence economic growth. In theoretical terms, the policy rationale shifted from "market failure" to "policy failure".

In late 1992, a severe financial crisis, set off by a real estate bubble, put strong pressure on the government budget. It also led to low economic growth in the early 1990s and a sharp increase in unemployment.

During the 1990s, many of Sweden's flagship industries became foreign-controlled through mergers or acquisitions: ASEA became part of ABB, Volvo Cars, the automobile part of Volvo, was bought by Ford, Saab Automobile was acquired by General Motors, Astra became part of Astra Zeneca, and Pharmacia merged with Upjohn. In terms of technical and scientific capability, the outcomes have been mixed. Astra Zeneca has expanded R&D in Sweden, while Pharmacia's (now Pfizer's) presence has been reduced significantly. In the case of Volvo, resources have increased, but with a more focused R&D mission, with corporate responsibility for safety issues. Whatever the volume of R&D, with corporate control outside Sweden, it is likely that opportunities for future diversification are more limited. So far there has been little debate about the national implications of these developments (see below).

Venture capital and the creation of new business

As indicated above, the needs of new, fast-growing businesses have not been a high priority for policy makers on either side of the political fence. The Social Democrats have looked to the old, large firms as "cash cows" to finance an expanding public sector. The (rare) non-socialist governments have been preoccupied with making the tax system and other regulations simpler and more transparent, and have not focused on the special needs of new businesses.[4] Another reason may be that Ericsson's rapid expansion in the 1990s concealed fundamental structural problems and created a false sense of security.

In the first half of the 20th century, Swedish innovations were mainly in mechanical engineering, with reasonably long product life cycles. This meant that new businesses could be successfully started and grown with traditional means of financing: bank loans, retained earnings, etc. Before the era of high taxation in Sweden (around 1970) there was also a reasonably well-functioning system of "informal venture capital", wealthy industrialists who were prepared to reinvest some of their wealth in interesting new projects. In

the 1970s, rising taxes – and a more radical political rhetoric – induced a number of potential business angels to settle abroad (Penser, Rausing, Kamprad, etc.).

In the wake of the crisis of the 1970s, and the ascent of Silicon Valley, there was a period of political interest in the role of new technology-based firms in renewing industry and taking innovations to market. This interest was strengthened by the first debate about "jobless growth". The large companies that survived the crisis did so to a large extent through relentless cost-cutting and a focus on "core business". From the late 1970s a number of initiatives were introduced to support new technology-based firms but most were severely underfinanced, and there was little overall co-ordination.

The combination of low corporate taxes and high personal income taxes has made it more attractive to retain earnings and reinvest them in existing businesses. As a result, successful new firms were soon absorbed by large multinationals. However, radical innovations with rapid product life cycles appear more likely to flourish when capital is allocated in an open market for venture capital. Statistics indicate that Sweden has a well-developed venture capital market. However, the firms included in these statistics are largely owned by institutional investors and have focused on management buy-outs. The ownership structure makes them too risk-averse to engage in early-stage financing.[5] Pierre (2004) notes that the combination of high personal taxes and subsidies to small firms has led to a system that seeks to reduce risks rather than rewarding risk-taking.

Between Humboldt and the entrepreneurial university

Swedish universities – and policy makers – have traditionally subscribed to a strong Humboldtian ethos. The role of universities was to educate impartial civil servants, as well as priests and lawyers. What are perceived as short-term utilitarian concerns have not been allowed a legitimate role in setting research priorities.

The technical universities, on the other hand, started as practical craft schools, with close ties to industry. They were only relatively recently admitted into the academic family. The Royal Institute of Technology only appointed its first full professors in 1920, a century after the school was founded, and doctoral degrees in engineering were first awarded in 1930. Academic respectability did not come without a price: a decreasing share of teachers had any industrial background, as academic achievement became the primary qualification.

At the same time, these Humboldtian values have come under pressure from practical realities (Deiaco *et al.*, 2002). The growing cost of "big science" requires justifying costs not only in academic terms. The increasing importance of cross-disciplinary and multidisciplinary research, whether in the form of problem-oriented "mode 2" research or the merging of previously separate academic fields of study, is not easy to accommodate in a university with strong disciplinary boundaries. The increased role of external financing also means that leadership or authority does not automatically follow the formal hierarchy. Entrepreneurial researchers with skills in raising external financing and mobilising research teams can challenge the established leadership.

Slow start for a systems perspective on innovation

Internationally, the early 1990s saw a rise in interest in a systemic view of innovation policy, through the early work by the OECD on national innovation systems, Michael Porter's work on the role of clusters, etc. Swedish academics played an important role in developing the field (Bengt Åke Lundvall, Charles Edquist, Bo Carlsson, etc.) with a strong tradition going back to Erik Dahmén's concept of development blocks.

Still, these developments had little impact on the Swedish policy debate at the time (Eklund, 2004). Traditional, neoclassical economists, which focus on market failure explanations, have always strongly influenced Swedish policy makers. Also, from 1991 to 1994, the main policy concern of a non-socialist government was deregulation.

One of the last acts of this government was to dismantle the so-called "wage earners' funds" set up by a former Social Democratic government.[6] SEK 10 billion (EUR 1.1 billion) from these funds were used to set up a number of independent foundations to fund research, the largest for "strategic" research in science and technology. These foundations have become significant actors in the Swedish research system, so that a significant share of funding is beyond political control.

Towards a systemic innovation policy

Starting around 1995, the Ministry of Industry has gradually shifted focus from "growth policy" to "innovation policy" and a more systemic approach. In 1996-97 attempts were made to formulate a "co-ordinated growth policy" (not yet innovation policy), inspired by the OECD's "Technology – Economy – Productivity" project, which would also have involved the Ministries for Labour and for Finance. In the end, however, the attempt was abandoned.

At the same time, regional policy was being reshaped. The basic idea was that regional policies should be adapted to local needs (and local perception of needs). Regional actors were encouraged to formulate regional development agreements setting out how available resources should be prioritised. The first round of such agreements took place in 1997-98.

In 1998, the Ministries of Industry, Employment and Communication were merged. At the time it was described as a growth policy measure, but it is also consistent with a more long-term process of breaking down barriers between policy areas.

At about the same time as the new regional policy, there was increased interest in the role of the entrepreneur (not just "small firms"), inspired by research on entrepreneurship.[7] More attention was also being focused on innovation issues, but these were still largely understood in a narrow sense as dealing with inventors.

The birth of VINNOVA

In 1999, an official inquiry on the future organisation of research funding ("Research 2000") suggested that the only legitimate role for government was the funding of academically excellent "mode 1" research through research councils or commissioning research in areas where government was the end user. This caused some concern among actors with a stake in "mode 2" research: strategic research, industry-university interaction, etc.

Following the report, an organisation committee was set up by the Ministry of Education. The Ministry of Industry set up a parallel committee on the funding of industrially relevant research. The committees agreed that there was a legitimate need for both basic and user-driven research. However, since the issue was research funding, the mandate of the committee was limited to this area. As a result, the former National Agency for Industrial and Technical Development (NUTEK) was split up, without any further analysis. The focus was on how to create a more effective R&D financing system, with room for internal renewal.

The concept of innovation systems was mentioned in the brief, but with no deep analysis of the implications. However, owing to the interest of its organising committee, VINNOVA was set up with a strong internal commitment to the innovation systems concept but with weak links to other areas of innovation policy.

An overview of the current innovation system and the key actors

As mentioned, the concept of innovation policy was essentially absent from Swedish political rhetoric until the beginning of the new millennium, although the importance of innovation and production of new knowledge for economic growth have been widely recognised. In the absence of an explicit innovation policy, the political agenda has developed along two different lines, one for growth policy and another for research policy, with innovation somehow lost in a no man's land between them.

This development is partly a manifestation of the distribution of responsibilities between the Ministry of Industry, Employment and Communication and the Ministry of Education and Science and the different government agencies under their respective authority. Policy co-ordination has been more obvious within each of the two aspects of the policy agenda than between them. Increased co-ordination of growth policy was manifested in the merger of three ministries into the Ministry of Industry, Employment and Communications (Ministry of Growth) in 1999. In 2000, the Minister of Education and Science was made responsible for overall co-ordination of research policy. A year later there was a major reorganisation of the organisational structure for public funding of research and technical development (RTD), as well as the support structure for business and regional development (Dreborg *et al*., 2001).

During the latest years, there have been indications of a move towards increased and more efficient co-ordination. The concept of innovation systems in general, and national innovation systems in particular, also entered the industrial, research and economic policy debate and policy thinking towards the end of the 1990s. The reforms of RTD and growth policies can be seen as expressions of a move towards a national innovation policy (Marklund, 2000), explicitly manifested in the establishment of VINNOVA. Also, in 2004 a national innovation strategy for Sweden was presented, stressing the importance of a broad approach to innovation[8] (see below).

The discussion about what to include in the term "innovation" has nevertheless continued. Interviews with sources at the ministry level indicate that, already during the preparation of the document, the strategy began to have an impact, as civil servants from different ministries began to discuss issues related to innovation.[9]

Efforts related to economic growth included dialogue with stakeholders during autumn 2003 and spring 2004. The Minister of Finance is responsible for issues related to economic growth. Interviews with ministry staff have brought out the importance, but also the attendant difficulties, of having the Ministry of Finance involved in a process that

may cause relocation of budgetary resources. The budget process also has important implications for horizontalisation as it allocates priorities. However, the Ministry of Finance has not been involved in the work on the Innovation Strategy. As the ministry seeks to limit all types of expenditures, it is natural for other ministries not to involve it before presenting a concrete and attractive proposal. One interviewee with good knowledge of the budget procedure stated that if an innovation strategy is to have an impact, it must receive new resources. In this perspective the strategy has not yet been a success.

In any case, economic growth is currently on the public agenda. Actors at all policy levels are discussing issues such as outsourcing, entrepreneurship, gender equality and work-related absenteeism. Concepts such as innovation systems and clusters are also increasingly accepted by researchers and industry as well as politicians. While it is not enough to have a common world view, the power of a shared vision should not be underestimated. Changes in values can in fact be an important catalyst for the radical change the Swedish system needs in order to establish a new paradigm for innovation.

The Swedish model of policy formulation

The government structure is based on a clear division of labour between policy-formulating ministries and implementing agencies. In this, Sweden differs from most other European countries, which have chosen to integrate the public administration as a part of the ministerial structure, thereby making it responsible to and under the direct command of a single minister. The absence of formal ministerial rule in Sweden restricts a minister's power to micromanage the administration.

The Government Offices

The role of the Government Offices focuses, in broad terms, on five areas: to draw up proposals for new directives and laws; to create a national fiscal budget; to handle issues related to the public administration and its development; to appoint public officials; and to handle crises and states of emergency.

The size of the Government Offices has varied over time and includes at present approximately 4 500 persons of whom around 135 are political appointees. Since 1997 the Government Offices is a single authority, headed by the prime minister. In organisational terms it can be divided into two specific parts: The Prime Minister's Office and the ministries.

The Prime Minister's Office

During the last few years the Prime Minister's Office has taken a more explicit role as leader in political as well as administrative issues that require co-ordination and integration across policy areas within the Government Offices. A visible sign of this is the fact the Prime Minister's Office has a minister for policy co-ordination, who assists the prime minister in co-ordinating the government's business.

The ministries

As of October 2004, there were ten ministries in the Government Offices, all with responsibility for a specific sphere of Swedish society. In terms of number of employees, the range is broad, with only 90 at the Ministry of Culture and over 1 500 at the Ministry for Foreign Affairs. Each ministry is headed by a minister and even though each has a

separate and autonomous administrative structure, each is also part of the Swedish government. However, not every minister is head of a separate ministry.

The agencies

For almost 200 years, Sweden has built its national administration on semi-autonomous agencies. Ministries employ only a small percentage of the civil servants in the central administration; the majority serve at the agencies. Besides the agencies, there are also state-owned companies and public enterprises and foundations. The agencies' role as semi-autonomous actors is due to:

- The absence of ministerial rule. A minister cannot make decisions on his own, since most decisions are to be taken collectively by the government.
- The fact that the government has no right to interfere with decisions made by agencies regarding the application of established laws.

Following the reorganisation in 2000 of the structures for public funding of RTD and for support to business and regional development, the new structures are intended to enable more focused public efforts in areas of strategic importance, greater efficiency and better adaptation to the needs of target groups. Another possible outcome is that a smaller number of organisations will create a structure that is more transparent and lead to increased co-ordination, both between ministries and agencies and between the different agencies (OECD, 2002, pp. 181-207).

Focus in the innovation governance system

Sweden's governance system is geared to a high level of commitment to science and research. Horizontal co-ordination is achieved partly by the Ministry for Education and Science which has responsibility for co-ordinating research across ministries, and partly through a large number of formal and informal co-ordination mechanisms at ministry and (especially) at agency level. The responsibility for co-ordination gives the Ministry for Research and Education a strong position, although it is restricted to research policy and does not include innovation policy.

Boekholt *et al*. (2002) conclude that a weakness of the Swedish research system is its poor links to innovation, which appear to be partly due to the governance model. One explanation is the fact that Sweden has separate governance structures for science and research policy and for industrial policy. Furthermore, the report states that the key characteristic of Swedish innovation and research governance is its essentially hands-off character with regard to the ministries.

Does the Swedish model work?

An extensive investigation of the Swedish governance structure in 2003 called explicit attention to the fact that the Swedish model, in international comparison, showed particular strengths, especially the dualism between ministries and agencies. The investigation stressed the high level of competence and flexibility within the public administration and the nearly negligible bureaucracy (SOU, 2003). Persson (2002) notes that even though the ministries, organisations and personnel have differences, there is, all in all, a striking working capacity and loyalty within the Government Offices. As soon as the board has decided, each of the ministries seems to be a reliable machine.

To sum up, it is not the structure for co-ordination and integration that plays the most significant role. Just as important is the degree of dedication and as commitment that can be established among the actors. Ideally, this commitment is connected with extra resources for co-ordination, since all types of collaboration require resources.

Position of STI policy and key policy strategies

Policy challenges and policy mix

In spring 2002 the government initiated a process of formulating an innovation policy, which calls for integrating parts of industrial policy and research policy. It also calls for integration of departments within the Ministries of Education and Science and of Industry, Employment and Communication, as well as between the two ministries. Interviews with concerned stakeholders showed that the view of what innovation policy is and interpretations of its importance differ widely even within the same ministry, from an innovation policy that relies heavily on research to an innovation policy that includes a regional, an entrepreneurship and an individual perspective.

Interviews carried out for this study also show that views differ on the importance of innovation policy as a regular policy area. One concern about horizontal innovation policy is that it will be too broad, and not focused enough to address weaknesses in the system. The interviewees agree that Sweden needs to address strategic issues relating to innovation and renewal and to take knowledge creation in the system into account, but views differ on how this strategic work should be structured.

Swedish research policy has emphasised the traditional market failure position that the government's primary responsibility is to support "fundamental" research, while industrial policy has emphasised general economic conditions, entrepreneurship, etc. There are separate mechanisms for co-ordinating research policy and industrial policy across ministries, but no institutional settings to handle a coherent joint innovation policy.

The strategy, "Innovative Sweden", was officially launched in 2004, and is used here to identify what the government considers the most important policy actions for innovation policy. The strategy included four priority areas for efforts and measures: a sustainable knowledge base for innovation; innovative industries; innovative public investments; and an innovative population. Each area has several sub-areas and can best be summarised in the overall vision of the strategy:

> "Our vision is for Sweden to be Europe's most competitive, dynamic and knowledge-based economy, and thus one of the world's most attractive countries for investment by large and small knowledge-based enterprises. World-leading knowledge will flourish in a number of priority research areas. Well-developed interaction between the research community, the public sector, industry and trade unions will guarantee the large-scale transformation of knowledge into goods and services. Both traditional and new industries will be permeated by the capacity for renewal. Business product development will be extensive and rapid and innovative people will see to it that both existing companies and the new emerging companies grow. Public investment will be an engine for innovation and growth. Sweden will have the world's highest educational level, it will be best in the world at making use of the skills of its population and it will have a working environment that encourages women's and men's initiative and skills development. The points of contact with the surrounding world and between the various

sectors of society will be well developed. Swedish society will combine economic development, social welfare and cohesion with a good environment."

The vision is closely related to the goals of the Lisbon agreement, which are currently used by the Swedish government as a driving force for implementing innovation-enhancing reforms (see Annex 9.A1 for an overview of the goals listed in the strategy). Each government agency is expected to translate the strategy into more concrete goals within its own area of responsibility. The strategy's aim is to use current resources more effectively to stimulate innovation.

A couple of months before the Innovation Strategy, a study of the Swedish national innovation system was published (Marklund *et al.*, 2004). The study identifies as a general challenge improvement of the impact of internationally favourable input conditions on the long-term innovation, economic and job creation competitiveness of the Swedish economy. According to the study, these challenges need to be addressed in a national innovation policy strategy. Such a strategy would not only need to address the right issues, it would also need to design and establish an implementation strategy that cuts across different administrative policy areas and bodies at both the national and regional levels and generates synergies. The major policy challenges related to innovation were grouped in four categories.

- Start-up, innovation and growth in knowledge-intensive SMEs.
- Improved supply, use and mobility of human resources.
- New regime for user-producer public-private partnerships.
- Increased volume and impact of mission-oriented research.

Relation to the international arena

In the globalised economy, national policy must of course be formulated in a context that is wider than the national viewpoint. This broader context has implications for policy formulation– and needs for co-ordination – at several different levels. This issue can be discussed from three different perspectives:

- First, learning from how other countries approach similar issues, through policy analysis, imitation, etc.
- Second, parts of innovation policy making have moved from the national to the international arena.
- Third, the industries that are expected to benefit from innovation policy are increasingly parts of international groups or networks.

Policy analysis, benchmarking, etc.

International policy interest in innovation systems finally had an impact with the creation of VINNOVA in 2001. The concept of innovation systems was mentioned in the ministry's brief to the organising committee but gave no clear guidelines. However, the chairman of this committee wanted to accomplish more than a simple rationalisation of existing structures, and was provided with briefing material prepared by the predecessor organisation's policy analysis staff, based both on contacts with the policy research community and the OECD's work on national innovation systems. The creation of an "agency for innovation systems" was only the first step in a learning process, and the

management and staff are still trying to come to grips with what a systemic role means, both internally and in dialogue with the ministry.

Most of the interviewed ministry staff stressed that there was not enough time for systematic policy learning. OECD publications are mentioned as a major source of international comparisons. As part of the preparation for major government bills, *ad hoc* efforts are often initiated, mainly by commissioning special reviews, study missions to other countries, etc.

Fashion – or policy imitation – should not be underestimated as a driving force in policy development. The fact that a number of countries have produced innovation strategies in recent years was mentioned in interviews as one reason for the Swedish innovation strategy.

At the same time, the processes leading to these strategies have created a growing realisation among EU countries that current regulations on R&D support are based on outdated economic theory and need to be updated. A current TAFTIE project is addressing this issue.

A European innovation policy?

Sweden appears to have some way to go before it fully embraces the concept of a common European Research Area. Swedish participation in the European Framework programmes is most often discussed in financial terms – whether Swedish researchers get their "fair share" of funding, etc. According to one interviewee, Commission statements, such as the "Action plan for innovation", have limited impact as they are perceived as watered-down compromises and are not linked to any decision-making processes. According to this view, documents like the Barcelona declaration, which has a hard, measurable target, and is linked to future decisions about the 7th Framework Programme, are more likely to have an impact on member countries' actions. Participation in ERAnet is likely to create a broader understanding among actors in national support agencies of the international perspective and its implications for national programmes.

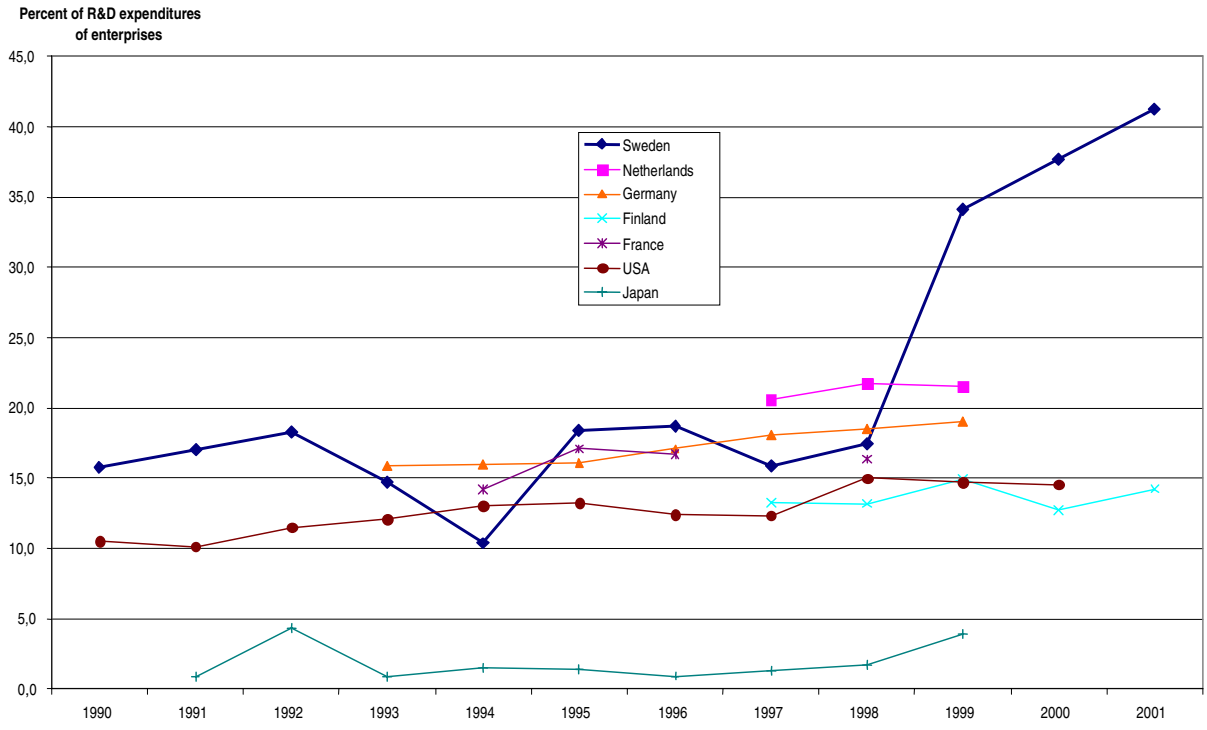
Internationalisation of industry and private R&D

As noted above, Sweden has been home to a disproportionate number of large multinationals, which account for a large part of Sweden's industrial R&D, and national policy has very much been adapted to supporting these firms. During the last decade, a number of these firms have become part of foreign-owned groups.

Data on internationalisation

Sweden had the second highest level of foreign acquisitions in the OECD area for the period 1996-2002, second only to Luxembourg. Acquisitions reached a peak in 1999, at close to USD 60 billion, compared to a "normal" level of below USD billion (Strandell, forthcoming). This is mainly the result of the Swedish flagships, Astra and Volvo Cars, becoming foreign-owned. These are also two of the most important R&D performers in Sweden. As a result, the share of business-sector R&D performed by foreign-owned firms more than doubled in 1999, to more than 40% (Figure 9.2). In 2003, 10 077 foreign-controlled firms employed 564 200 staff in Sweden, or 23% of total business-sector employment.

Figure 9.2. R&D expenditure of foreign affiliates as a percentage of R&D expenditures of enterprises, 1990-2001



Source: OECD AFA database and ITPS, 2004.

Contrasting case studies

It is interesting to contrast Pharmacia's merger with Upjohn and Astra's merger with Zeneca, which affected Sweden's two largest R&D performers in the biomedical field. Although Pharmacia's 1995 merger with Upjohn looked good on paper, it turned out to be a classic case of how not to complete a merger.[10] Three very different corporate cultures (Swedish, Italian and American) were maintained in separate regional subsidiaries, with headquarters on neutral ground in a fourth country (United Kingdom). The company was in serious trouble when the new CEO, Fred Hassan, forced strong centralisation in order to unify the corporate culture. Both corporate and R&D headquarters were moved to a new location in New Jersey.[11] For Sweden, this centralisation has meant that staff has been cut from about 5 800 in 1997 to 3 300 in 2003, with a significant share of the reduction in R&D.

The merger of Astra and Zeneca in 1999 appears to be a merger of two companies with more compatible corporate cultures (The FOTON project, forthcoming). In this case, the corporate headquarters were located in the United Kingdom, and R&D headquarters were located in Sweden. The largest product division, cardiovascular, is also located in Sweden. The Swedish part of AstraZeneca has increased by about 4 000 employees since the merger (about 1 300 in R&D) and several billion SEK have been invested in new laboratories.

Policy implications

The role of national innovation policy changes as a result of globalisation. Instead of supporting national flagship industries or projects through subsidies, national procurement, etc., governments now need to compete for investments by providing an attractive environment for innovation, R&D and production, to companies that can choose among a number of location options. In this sense, national policy has come closer to the traditional role of regional development policy.

Instead of providing a national industry with "good enough" competence in all areas, today's attractive environment must provide competence that is competitive at the global level in at least some areas, as well as a skilled and flexible workforce. Given limited R&D resources, this creates a need for a stronger focus, which implies a degree of risk taking, as other options are abandoned.

The attractiveness of an innovative environment is determined both by its structural capital, in terms of R&D infrastructure, skills base, etc., and in terms of how responsive these resources are to industry's needs. A problem for policy makers is that the "hard facts" of investments in R&D, etc., are easier to demonstrate and measure than the infrastructure's responsiveness and flexibility.

Relation to regional policy

The field of regional policy has changed markedly in Sweden during the last 20 years, from top-down state intervention to a multitude of decentralised, bottom-up, regional and local policies, based on each region's conditions. This new "regional development policy" also means that traditionally separate policy areas tend to get mixed, as barriers between sectors are slowly broken down.

For more or less a half century, Sweden was characterised by an institutionalised model of co-operation (between the state and a few privileged organisations). The actors were mainly a few large organisations, largely from the labour market, and a prerequisite for the model to function was the fact that their different interests could be represented through (a few) well-defined organisations (Edlund, 2001).

The policy of regional development in the 1970s focused on the further development of Sweden as a industrial manufacturing nation. One important feature of this policy was to support sparsely populated regions with growth problems, by equalising development of these regions. Compensation and redistribution became attributes of this policy as was systematic relocation of government offices away from Stockholm. The directives and strategies of regional policy, however, remained in the hands of the national government.

In contrast to the old corporatist model, the regional development policy of the late 1990s is characterised by decentralisation of power and responsibility from the national to regional and local levels. Much of the new policy concentrates on the so-called "regional growth programmes" (RTP).[12] The ultimate goal of these strategic action plans is to create the foundations for continuous sustainable development in three dimensions: economic, ecological and social:

- The economic aspect of growth focuses on the importance of progressive development of GDP.
- The ecological aspect of growth focuses on the view that today's generation cannot leave environmental problems to be dealt with by future generations.
- The social aspect of growth focus on quality of life and general welfare.

Even though the ultimate goal of regional policy is to achieve growth at the national level, the primary measure of its effects will be at the regional level, especially in terms of gross regional product.

While there are many ways to achieve economic growth, several actors have chosen to approach the overall goal by:

- Creating attractive environments for current as well as future enterprises by establishing knowledge resources (universities) within the regions.
- Complementing a biased industrial structure by active support of diversification.
- Securing a good supply of a qualified labour force.
- Contributing to strategic co-operation between individual enterprises (business to business), and between enterprises and universities.
- Encouraging discussion between employers and employees of how to improve business activities, working conditions and other related issues.

For each area for which packages of RTP measures are planned, a strategic action plan must also be formulated, which should include concrete actions to achieve economic growth, founded on an integrated SWOT (strengths, weaknesses, opportunities, threats) analysis and benchmarking with similar regions.

Partnership is an essential ingredient of the RTPs. Constellations of partnerships and networking have emerged as key concepts in Swedish discussions of regional development. It is striking that the traditionally dominant role of the Swedish state has diminished and that the current regional development policy can be described as a complex constellation with actors from several sectors and different policy areas. The partnership model is seen to have four main advantages (Edlund, 2001):

- **It creates synergy.** By using a network approach in which different views and competencies are actively mixed, it is possible to create a unit of outcome that is far larger than the simple sum of the different parts. In this way, it is possible to achieve a qualitative leap by creating innovative solutions in addition to ordinary value added.
- **It creates active learning.** By bringing together actors with different competencies, it is possible to establish a situation in which they can learn from each other. It is for instance possible for a public organisation to push a private company into a more "social" approach, at the same time as it is influenced by a more market-like view.
- **It pools available resources.** By bringing together different actors. it is possible to raise more money by pooling resources to have a larger budget. For example, if a public partner and a private business set up a joint venture, they can, in addition to using their own resources, apply for resources to the Swedish state or the EU and obtain a total budget much larger than if they had worked in isolation.

- **It creates flexibility.** By using temporary formations, the partnership can adapt to a fluid and complex reality since it avoids institutional (organisational) barriers that threaten to slow decision making and hinder action.

At this point, few of the RTP partnerships have been systematically evaluated, and there is a general lack of knowledge concerning the performance of the new regional development policy. At the moment, only temporary conclusions can be drawn. However, they offer some interesting observations.

The first is that the current policy is more about strengthening the different regions' capabilities and promoting efficient use of existing resources, than about bringing in additional resources from the outside. While the old corporatist model was intended to erase differences between regions, the current development policy is focused on exploitation of the differences between the regions. As a consequence, the development policy must be devolved to the regions and be based on knowledge about specific capabilities and strengths.

Second, in comparison with the old corporatist model, the new policy has a stronger focus on private business actors in terms of small and medium-sized companies (SMEs). The active involvement of SMEs is a major change, as the main focus of the corporatist model was on big companies.[13]

Third, even though partnerships involve discussions and negotiations, they are not intended to be an instrument for greater democracy. In fact many public-private partnerships, at the local as well as the regional level, have seriously blurred the line between politics and the market. This is problematic from a democratic perspective, as responsibility becomes harder to assign.[14] There is also a risk of small groups exercising undue influence, which might result in a conflict between the public interest and that of small pressure groups (Edlund, 2001).

Fourth, although the government has instructed them to increase co-operation and co-ordination, national agencies and other actors still participate in RTPs from the perspective of their ordinary rules and regulations. National agencies are still ruled by instructtions from ministries and by funds allocated for special purposes in the national budget, so that agencies have strong ties of loyalty to specific sectors and to the partnerships. This has turned out to be a source of conflict.

Fifth, it has proved to be quite a challenge to achieve more efficiency and better output by bringing together actors from various political areas and sectors. The nature of the process, however, makes the absence of an optimal outcome quite logical. The RTP process is based on learning, and the idea is that the structure of the partnership is to develop gradually and improve continuously.

Agenda setting, prioritisation and stakeholder involvement

An agenda is a vital part of every social system. An agenda makes it possible to prioritise the problems facing a society. In a world of scarce resources, prioritisation is necessary since it is not possible to confront all problems simultaneously.

Policy formulation as an evolutionary process

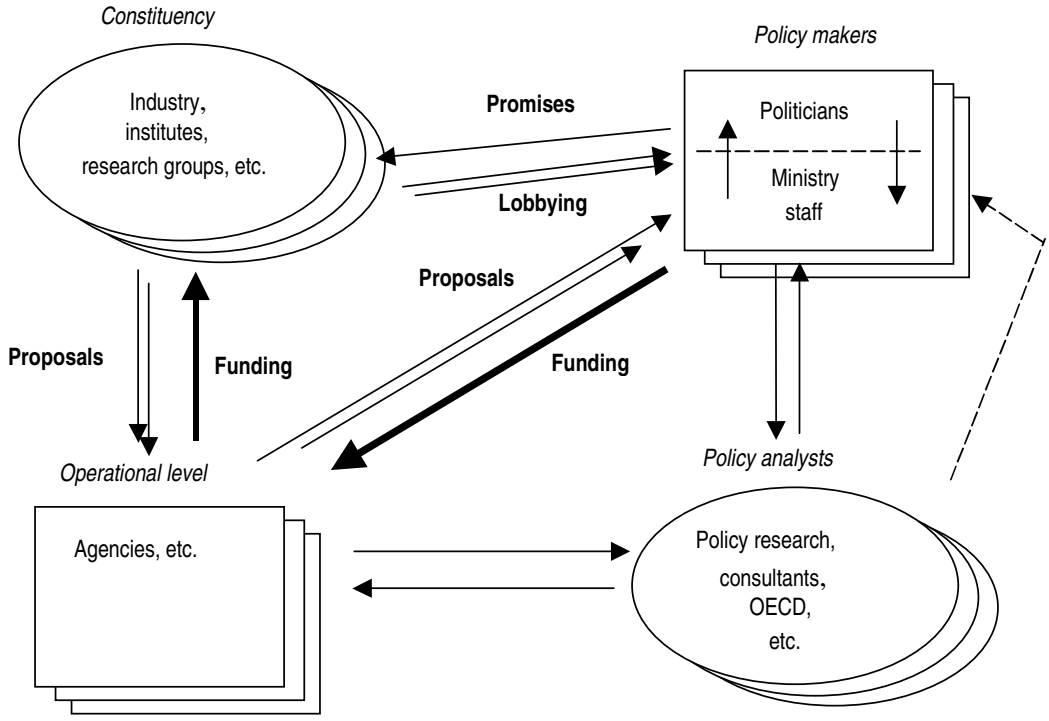
Generating alternatives and proposals for the policy agenda can be compared to a process of biological evolution, *i.e.* a selection process in which some ideas or proposals are developed while others are discarded (Figure 9.3). During this process, ideas are confronted and combined in various ways. The stock of ideas changes occasionally through the appearance of new elements, but more often by a simple recombination of previously existing elements (Kingdon, 1984).

Strategic action by political actors and public opinion can influence ideas and change their meaning. Kingdon (1984) points especially to the influence of policy entrepreneurs, defined as "advocates who are willing to invest their resources – time, energy, reputation, money – to promote a position in return for anticipated future gain in the form of material purposive, or solitary benefits". Policy entrepreneurs can be found at almost all policy levels and may be elected politicians, researchers, lobbyists or journalists. All entrepreneurs have their issues and solutions, so-called "pet ideas", which they bring to the policy community by pushing their concerns about certain problems higher on the agenda, softening up the system and trying to establish connections. At some point, a policy window opens and offers an opportunity to launch a new deal. It is at these critical junctures that problems, solutions and the political streams can be brought together in order to create a change. Policy entrepreneurs must therefore seize opportunities to "develop their proposals and then wait for problems to come along to which they can attach their solutions, or for a development in the political stream like a change of administration that makes their proposals more likely to be adopted".

The relative role of different types of policy entrepreneurs varies depending on how issues appear on the political agenda. As innovation policy was not a high priority in Sweden until recently, there was a lot of scope for policy entrepreneurs "inside the system". During the late 1990s, information technology was a "hot topic", and because politicians had little experience and there was no obvious central point in the policy system, the field was wide open for "private" policy entrepreneurs.

The system is characterised by competition at all levels, for attention, power and resources between policy areas/issues, between alternative solutions/actors and between policy paradigms.

Figure 9.3. An evolutionary model of policy formulation



Source: Lennart Elg, VINNOVA.

Policy paradigms

The role of policy analysis is conventionally described as providing factual evidence to support decision making. However, this requires an agreed intellectual framework or policy paradigm. An equally important role of policy analysis is to promote a specific way of looking at an issue. Ideally, a specific paradigm advances because it provides more interesting questions or more fruitful recommendations. In real life, the volume of analysis based on a specific paradigm can determine how policy questions are framed.

Policy developments are not always deliberate and often happen as "spillovers" from processes of other agendas. For example, the creation of VINNOVA was not the result of a strong political will to set up an innovation agency based on an innovation systems perspective. The new Ministry for Industry, Employment and Communication was not necessarily set up because of a perceived need to integrate these fields, but was part of a more general ambition to lower walls between policy domains, in order to make the government organisation more flexible.

The Swedish model of agenda-setting

In Sweden the most influential policy entrepreneurs have been members of a few organisations with close relations with the business community and the labour market.[15] Through an institutionalised corporatist arrangement these groups have been heavily involved in the national policy process over the past 80 years. This has created a situation in which organisations with special interests have been given a platform that has provided a means to influence the government's agenda setting and ensure that political action is

coherent with the public interest. The arrangement reflects a core value of Swedish politics, *i.e.* that those directly concerned by a decision should be able to influence it (Öberg, 1997, pp. 1 and 11).

In the corporatist arrangement, the leadership of organisations plays a key role as policy entrepreneurs. In addition to representing the organisations, they influence public opinion and "anchor" agreed decisions.

The involvement of stakeholders started as a way to counter distrust of the public administration. The government was convinced that without a legitimate governance structure, a desired outcome would be much harder to achieve – and this irrespective of whether the civil servants or the politicians had made rational decisions (Petersson and Söderlind, 1992).

Rothstein (n.d.; 1995) identifies four reasons why Swedish organisations have chosen a corporatist model. The reasons can be summarised as:

- **Influence.** In order to promote the interest of the members, *i.e.* to influence public decisions that concern the members. It can be hard for an organisation to explain to its members why it has turned down an offer to participate in public decision making.[16]
- **Information.** In order to get access to information that might be of great importance for the members or the cause of the organisation.
- **Monopoly.** In order to avoid competing with other organisations. If an organisation turns down an offer to join a government body, the offer may go to some other organisation.
- **Quality.** In order to get a "brand". To be an official organisation has an important symbolic value. Recognition by the state gives a signal to the public that the organisation represents the cause it proclaims.

To summarise, representation of an organisation in the public administration strengthens the organisation's potential to influence, sometimes even to become independent of its members. Theoretically, the Swedish corporatist model is not based on bargaining but on a vision of sensible decision making, in which arguments, experience and solutions in favour of the objective public interest will prevail.

The Rhen-Meidner model

An important corporatist arrangement was the implementation of the Rhen-Meidner model.[17] This model, supported by the labour movement as well as employers, was based on four main ingredients which, taken together, were hoped to result in the renewal of Sweden's industrial structure. The first was to maintain strict control of national monetary policy in order to limit excess profits and inflationary pressures. The second was a commitment from the government to implement countermeasures whenever policy would tend to create unemployment. The third was the implementation of measures to increase mobility of the labour force, in order to avoid bottlenecks for expanding competitive firms and to counter rapid salaries increases. The fourth ingredient was a principle of equal salary for equal work. Regardless of location, all firms were obliged to pay the salary agreed upon by the central labour market organisations (Eklund, 1996, p. 287; Björklund, 2000, pp. 336-340).

Flexible enough for big changes?

The idea of letting organised interests influence policy was not questioned for nearly 50 years, and for a long time there was hardly any substantial criticism of the corporatist model in the media, by the public or the policy agenda. The involved parties saw the corporatist order as natural, and proposals to initiate new constellations with stakeholders were continuously formulated by both right-wing and left-wing politicians (Öberg, 1997, pp. 21-22 and 51).

In the middle of the 1980s, the system came under fire. Criticism peaked in 1992 when the parliament decided that all appointments in the public administration were to be held as a personal mandate. In other words, appointments were no longer reserved for the most influential organisations. The decision to abolish the corporatist model had been preceded by a decision by SAF to withdraw from all governmental bodies. SAF also launched a lavish publicity campaign of which the explicit aim was an end to Swedish corporatism (Öberg, 1997, pp. 53, 61; SAF, 1991). The decision by SAF and by the government has its explanation in eight overlapping socio-economic trends that came to the fore in the late 1970s (Micheletti, 1994, pp. 154-163).

The collapse of the Swedish model's power structure. Corporatist arrangements worked well as long as economic blocks were easy to define and constituted a political foundation by dividing social relations into categories of work and capital. The labour unions in particular became, over time, more and more heterogeneous. The pluralism of opinions and an increasing lack of discipline among union members (to moderate their opinions) led to internal disputes and from time to time broke down a previously united external front.

A general downturn for consensual decision making. Corporatism and consensual decision making have always been complements. A decision-making model based on consensus is a means of establishing political agreement among all, or the most important, stakeholders. This model stands in strong contrast to a democratic model based on numerical strength where a majority decides. A democracy is compatible with pluralism, *i.e.* a spectrum of ideas and opinions. "Decorporatisation" can in this respect be explained by the fact that consensual homogeneity among the most influential policy entrepreneurs has weakened since the end of the 1970s.[18]

The problem of governance. The state appreciated the involvement of organisations when it helped to improve conditions for governance and the implementation of policy decisions. Politicians began to question the involvement of stakeholders when it became harder to reach agreements. The Ministry of Finance was among the most vocal critics. A breaking-point occurred in the early 1990s when this ministry managed to block the participation of traditional policy entrepreneurs in a number of investigations concerning renewal of the system for governing agencies, reform of the national tax system and renewal of industrial policy (Öberg,1997, p. 55).

The problem of responsibility. The problem of public responsibility under a corporatist regime received attention as new public management (NPM) theories became established in Sweden in the late 1970s. Supporters of NPM started to discuss responsibility for public agencies and their decisions. Members of the privileged organisations began to question why they had to take responsibility for governmental decisions. The organisations (mainly SAF) proclaimed that they were held hostage by the government representatives in the corporatist bodies and forced to sanction decisions that were not consistent with their organisational viewpoint.

A new economic paradigm. Since World War II, the economic paradigm in Sweden had been based on a Keynesian model with full employment as an explicit goal. Labour market organisations had been recognised as key actors in this model. Structural problems during the 1970s catalysed liberalisation of the economy, which took off in the 1980s. At the same time, the key ingredients of economic policy changed. In the new economic model the need for corporatist arrangements was reduced, and more trust was put in market forces and the correction mechanisms of the invisible hand.

New political actors and methods. The corporatist model functioned smoothly as long as there were no doubts about which interests (organisations) deserved recognition. In reality this meant that only a few centralised large organisations could claim the right to influence and receive institutionalised power. Up too a certain point, these established organisations could absorb, and claim to represent, new ideas but, as time passed, the situation became blurred. Since the beginning of the 1970s many new groups have been created and demand more influence. These groups mainly represent a single issue, such as the environment, the struggle for peace, antifascism, etc., and have chosen to challenge the established structures by using unconventional methods like direct action, demonstrations and civil disobedience.

The wave of globalisation. The development of information and communication technology, deregulation, the privatisation of public property and the closer integration of European countries have also put the Swedish model of corporatism under pressure. There is, among politicians, a general feeling that they are gradually losing control over the forces that affect the national economy. When new forces rule, there is less need for the old masters.

The shrinking time horizon and the blurring of policy areas. The time frame during the old corporatist era was built on a general acceptance that investigations required both time and resources. Special "long-term investigations" were frequently organised in many policy areas. During the 1970s the traditional ministry borders started to be a hindrance rather than a functional division, largely owing to the development of information and communication technology. Since then the rate of conversion of policy areas has increased, resulting in a situation where many issues must be handled simultaneously within a very limited time frame (Jaffee, 2001).

This section has attempted to illustrate the ongoing transformation in the Swedish model. The shift in the governance structure away from the traditional Swedish model has no simple explanation, since it involves several factors and is an ongoing process. The most common explanation is that the characteristic features of the Swedish model have been closely related to the industrial economy. The development of a post-industrial society, where services and knowledge are driving forces, generates new requirements. Even if some mechanisms were easily combined in the past, there have always been tensions among different parts of the Swedish innovation system, and these seem to have become more important.

Co-ordination of policy formulation and implementation

Horizontalisation

A study by Technopolis (2002, pp. 18, 54), links Sweden's relatively low growth rate of GDP to the Swedish governance system, which seems to lack the co-ordination and integration mechanisms necessary for a successful innovation policy. Several policy areas have great importance for innovation. Innovation policy can be defined as "the entirety of

all public initiatives regarding science, education, research, technological development and industrial modernisation, overlapping also with industrial, environmental, labour and social policies" (Fraunhofer Institute, 2002). Public innovation policy is furthermore defined as "policy aimed to strengthen the competitiveness of an economy or of selected sectors, in order to increase societal welfare through knowledge creation and economic success" (*ibid.*). These definitions fit the definition of innovation policy currently adopted by the Swedish government. In the recent Swedish Innovation Strategy (2004:36, pp. 13, 43), eight policy areas were explicitly identified as the basis for innovation policy, and the strategy identifies as a priority task to develop forms for co-ordination and integration among education and science policy; industrial policy; foreign trade policy; policy concerning regional development; transport policy; policy concerning information and communication technology; defence policy; and environmental policy.

Co-ordination mechanisms

All decisions by the Swedish government have to be decided as a unit (*i.e.* collective decision making). In other words, all the ministers in the Cabinet must formally agree before a decision can be settled. Several forms of common preparation have been set up to make sure that policies are coherent and backed by the entire government. Each issue is the responsibility of the ministry identified with that issue. This ministry is required to contact all concerned members of the Cabinet or state secretaries for consultation and common preparation (Statsrådsberedningen, 2002).

Several ministries have special procedures for this work, and lists of contact persons are continuously circulated within the Government Offices in order to ensure smooth communication. There is a general concern that common preparation of an issue should be done as early as possible, and that the Prime Minister's Office should be regularly informed. How this common preparation is carried out in practice, *i.e.* by oral or written consultation or both, how agreements are documented, how many persons that are involved, etc., are handled on a case-by-case basis.

Co-ordination in practice

Co-ordination of policy has been a problem for a long time, but the problem is accentuated when Sweden is ruled by a coalition government. Several models of co-ordination have been tested, among them special councils for co-ordination,[19] regular meetings for planning, a leader troika and the establishment of an "inner cabinet". None has however resulted in radical improvement of the governance structure, and current research on the public administration reveals that overall co-ordination within the Governments Offices remains weak. There are several reasons:

- One is the fact that the prime minister, in his role as the head of the Government Offices (as a collective unit), does not have enough resources to dismiss repeated demands from individual ministries.
- The Ministry for Finance makes budget allocations based on political judgements. When it comes to distribution of resources, individual ministries eventually fight each other since there is a ceiling on overall public expenditures.
- Ministry leaders struggle to establish an image of a powerful and dedicated leadership, and want to show staff that the ministry's proposals receive a good reception from the government and approval in parliament. This can lead to a situation in which ministries have their private agendas and are loyal only to the

Minister of Finance (in order to get budget allocations) and the Prime Minister's Office, rather than to the Government Offices as a collective unit (Molander, 2002).

Co-ordination at the ministerial level takes place in many different forms. Common preparation is mentioned as an important way to create co-ordination, but negotiation is another aspect of co-ordination of Swedish innovation policy. As soon as different actors have been brought together to co-ordinate their activities, negotiations become the prime mechanism. Interviews with involved stakeholders reveal as a negative consequence that actors actively restrict their sharing of useful information in order to achieve a better bargaining position. Beside ordinary negotiations, there are currently no good mechanisms to handle conflicts of interest in the co-ordination of innovation policy.

At ministerial level, co-ordination is handled by the politically appointed leadership in quite diverse ways, but interviews indicate that the use of *ad hoc* groups and temporary constellations has been accepted as a functional way of working. This requires civil servants to have well-developed social networks and good personal knowledge of each individual in their network.

A specific co-ordination mechanism related to innovation policy is the arrangement that makes the education minister responsible for all matters of research policy across ministries. Interviews emphasise that the arrangement's importance for co-ordination is very dependent not only on the Ministry of Education and Science, but also on the personal capacity and interests of the current minister.

High-level strategic co-ordination

The relationship between ministers (including political advisers) and ministry staff can be an additional cause of conflict. Political demands can sometimes be difficult to combine with the requirement of coherence and transparency in public decisions. Civil servants at ministries have a knowledge advantage in most issues, which might be used to influence the direction of government decisions. Studies made at Swedish ministries reveal however that public servants show a surprisingly strong loyalty towards their ministers and are well aware of their ministers' views. There is therefore reason to believe that they adjust their proposals to fit ministers' agenda.

In consequence, expert knowledge and consistency are considered more important than co-ordination, change and continuous development. In the absence of external pressure, politicians and civil servants have a common interest in not raising questions that disturb the current framework and normal order (Molander, 2002, p. 93).

In 1998 there was a major reorganisation of Swedish ministries to reduce compartmentalisation, among other things. One of the main objectives was to break down, through co-ordination and integration, sectoral boundaries between some areas closely related to economic growth and innovation (Government Offices, Regeringsförklaring 1998-10-06). With the new innovation strategy, the Ministry for Industry, Employment and Communication (MIEC) can be said to share with the Ministry of Research and Education responsibility for the Swedish government's innovation policy.

It is quite obvious that Swedish administrative traditions create opportunities as well as obstacles for organisational development. It is therefore not surprising that the government, when establishing MIEC, was convinced that a new policy for economic growth would not be achieved under the existing model, since its most distinguishing characteristic seemed to be a high degree of rivalry and segmentation. The creation of

MIEC should also be seen in the context of an overall desire to unify the Government Offices, even though this meant moving away from the Swedish model of small ministries. According to the minister of policy co-ordination this was a price worth paying since each ministryhad previously relied on its own culture and work procedures, something that the government "wanted to put an end to since it is one government, one Government Offices, it is one agency. And in that perspective, it has a value of it own, so to say, to shake up the structure."[20] This can be seen as a further step in the reform labelled "A Single Government Offices" (*Ett RK-reformen*) which was implemented in 1997. Besides merging the Government Offices into one agency, the reform encouraged personnel mobility in order to break down barriers and create a single culture at all ministries.

In retrospect it is quite clear that the creation of MIEC was not intended to implement a new policy for economic growth and innovation, but was more of a way to find the new work procedures needed to develop a new policy. This is particular striking considering that MIEC was organised with separate units in accordance with the areas of the former ministries.

The idea of creating larger ministries as a way to solve problems for co-ordinating cross-sectoral policy issues is not new in Sweden. It was discussed extensively during the 1980s by the so-called "Ferm group", which stressed among other things that the Government Offices could not be seen as "the ideal place to develop politics" (Larsson, 1986, p. 287), that the organisational structure was too focused on traditional rule-based governance and administration, and that, in addition, it actively resisted renewal. Relations between ministries were furthermore described as negotiations more than collaboration (*ibid.*). Similar opinions have since been continuously expressed, but like the Ferm group proposals, they have been rejected.[21] The argument has been that the ministers heading a "super-ministry" would be too powerful compared to the government as a collective unit, and that this power would be gained at the expense of the minister of finance and the prime minister.

Policy learning

All ministry staff interviewed stressed the importance of "on the job" learning, and confirmed a general lack of routines for structured policy learning.

Accountability

There is a system in place for setting agency goals and for reporting back. However, there is some doubt whether these performance reports give sufficient information for effective follow-up. Finland is mentioned as a country with more stringent reporting requirements, although doubts have been expressed as to whether meaningful quantitative performance indicators could be defined. A special problem is that these requirements are formulated through a negotiation process between parts of the ministry with different views. In the case of VINNOVA this has resulted in reporting requirements that do not reflect an innovation systems perspective.

Evaluation/monitoring

Sweden has a strong tradition of *ex ante* evaluations, in the form of white papers, committee reports, etc., which often precede new schemes: "We look at every detail before we launch a new scheme, but do not come back and check if things turn out as

intended. We are not good at terminating processes which go off in the wrong direction." On the other hand, *ex post* evaluations are mostly limited to specific programmes, with few evaluations – and thus apparently little demand for them – at the policy level. A prerequisite for such evaluations is of course that targets have been defined in a measurable way. Contrary to Norway, for instance, ministries have no internal evaluation capacity, and so depend on external experts: "Most of the outcome is decided by the choice of evaluators."

Learning by experience

All ministry staff interviewed considered "on the job" learning most important. Drafting a government bill automatically has an element of policy learning. To be consistent, ministry staff need to refer back to, and understand, earlier policies. Frequent informal meetings between ministry staff and agencies are also important and provide more learning than the formal reporting systems. In Sweden, experienced staff often remain in the policy system for a significant part of their career. Mobility inside the policy system is an important way of spreading knowledge. The other side of this coin is that projects are often initiated by individuals who are well versed in an area, so that there is little accumulation of structural capital.

Good practice/benchmarking and transnational learning

The Ministry of Industry, Employment and Communication has, since 2000, regularly conducted benchmarking studies of Swedish industrial policy. The latest study was published in December 2003. The Swedish government does not monitor innovation policy developments in other countries on a regular basis. *Ad hoc* surveys may be carried out in relation to government bills concerning innovation and innovation systems. An example is Government Bill 2000/01:2 on R&D and co-operation in the innovation system, which includes a section on innovation policy in other countries. The section is very general, however, and as the international comparisons are based on policy trends, rather than specific measures, it is difficult to talk about policy learning. A statement from the bill illustrates the vagueness: "Many countries aim their measures towards increased co-operation between different main figures in the innovation system."

Awareness of the need to learn from other countries exists at both policy and programme level. However, there are many constraints on trans-national policy learning. Lack of time for such activities among civil servants in ministries is one important constraint. Swedish ministries are comparatively small in an international perspective and civil servants find it hard to find time for such learning. The type of policy setting in a country can be another constraint. A growing interest in trans-national policy learning is visible, nonetheless, at both ministerial and agency levels. Policy learning is to a large extent *ad hoc*, and there are no mechanisms for systematically scanning other countries for information about technology/innovation developments, except for the Institute for Growth Policy Studies (ITPS), which has science and technology offices in Washington, DC, Los Angeles, Tokyo, Beijing and Brussels. The Ministry of Education makes yearly study trips abroad, and the staff exchanges experience with ministries and agencies.

Agencies under the ministry are mentioned as an important source of information about policy developments in other countries, both on an *ad hoc* basis, and through specific studies commissioned by the ministry. The ministry and VINNOVA co-operate in following analytical work at the OECD.

International learning at the agency level

At the agency level, where most programmes are designed and run in Sweden, the use of foreign experience when creating new programmes probably depends on the programme's budget and significance. The extensive VINNVÄXT programme became a flagship programme for VINNOVA as a new agency. It marked a new approach to funding research, as well as a way to profile the agency. In this programme, trans-national policy learning was very important for creating and developing a new and unique programme mode. In the programme declaration of 2001, it is stated that "experience derived from and research carried out in the course of a large number of international programmes have indicated a number of critical factors and attributes which characterise successful growth regions. To ensure that VINNOVA's regional programme is successful, these characteristics have been used as the basis for the design of the programme."[22]

Other ways to learn from the experience of other countries include the involvement of policy makers in trans-national networks aimed at innovation policy learning and implementing policy co-operation with other countries.[23]

Strategic intelligence

Lack of capacity for collecting external knowledge, owing to time constraints, is mentioned as an obstacle for obtaining strategic intelligence. In order to alleviate this, the Ministry for Industry and Trade has recently established a long-term studies unit with a staff of 14.

Obstacles to policy learning

As mentioned previously, the small size of ministries, and the lack of time for such activities among ministry staff are seen as the most important constraints to policy learning. A second obstacle is the lack of a common understanding of the issues, both between ministries and between different parts of a specific ministry. This appears to be reinforced by a culture that rewards staff more for pushing their own areas of responsibility than for contributing to the whole. The main reward for ministry staff is more responsibility and more resources for "their" field.

A specific obstacle to developing a systems perspective in the ministry is that competence is strongly tied to the areas in which the ministry has specific programmes. There is a strong focus on issues concerning SMEs, while big firms appear mainly as nodes in supplier networks. Outside SME issues, the Ministry for Industry and Trade has special programmes for specific industries – steel, forest products, etc. – usually from a regional/old industries perspective. There has been no platform for developing competence about the long-term needs of large R&D-intensive firms. At the same time, issues raised by firms like Astra often lie outside the domain of the ministry, such as parallel import of prescription drugs, competition from generic drugs, the competence base, availability of skilled personnel, etc.

Strengths and weaknesses of the governance system

An early report for this project noted that: "A major challenge for Sweden is to reach consensus on the need for an innovation policy or an innovation policy strategy and to co-operate to develop and implement such a strategy. The interviews conducted in this study show that the opinion of the importance of an innovation policy as a regular policy area differs. An apprehension about a horizontal innovation policy is that it will turn out to be

too broad and not sharp enough to address weaknesses in the system. The interviews show that Sweden needs to address strategic issues concerning innovation and renewal that take into account knowledge generation in the system, but views differ on how this strategic work should be structured."

Since then, there have been several new developments in Swedish innovation policy. In autumn 2003, the government presented a programme of ten initiatives for economic growth. Efforts relating to economic growth also included dialogue with stakeholders during autumn 2003 and spring 2004. At the end of June 2004, the Minister for Industry and Trade together with the Minister for Education and Science presented a national strategy for innovation. The strategy clearly stressed the importance of a broad approach to innovation policy.

These developments mean that the authors' perspective has changed. Today, Sweden has an innovation strategy but it is too new to judge its future impact.

Lessons learned about co-ordination of Swedish innovation policy

Co-ordination of Swedish innovation policy is a complex issue. At the ministry level, the question of co-ordination is handled by the politically appointed leadership in quite diverse ways, but *ad hoc* groups and temporary constellations have proven to be effective.

Responsibility for the co-ordination of innovation policy is not handled only at ministry level. It is frequently delegated to agencies and other actors. As a consequence, all actors (public servants as well as other actors) must put a lot of effort into creating networks and using them effectively to understand the concerned actors and the issues at stake.

Several interviewees stressed these notions and also pointed to the fact that a vital part of the Swedish innovation system is a general awareness and understanding of ongoing activities within the system. Without such knowledge the potential for synergies as well as the prerequisites for basic and functional co-ordination are seriously hampered. This however can also be seen as a potential weakness for Swedish innovation policy co-ordination, if tacit knowledge of the system and network connections are concentrated in a few individuals.

Interviews with ministry staff disclosed in addition that the co-ordination model is not very effective at keeping long-term processes ongoing and focused. The model also depends on a labour market in which the same persons hold positions for quite a long time. This is a logical consequence of the institutional structure, since too much flexibility and mobility undermine possibilities for creating reliable relations (trust) and continuous voluntary co-operation.

Negotiation is another aspect of the co-ordination of Swedish innovation policy. As soon as different actors are brought together to co-ordinate their activities, negotiation becomes the prime mechanism. Since different actors have different desires and follow different governmental instructions, conflicts can seldom be totally avoided. Interviews revealed that actors actively restrict their sharing of useful information in order to achieve a better bargaining position.

Furthermore, the Swedish "principle of organised disobedience" may reinforce the potential for conflict. In Swedish organisations, participants are generally not afraid to have deviant opinions or to conduct work in ways other than instructed by superior authorities. Even though this is a source of conflict, it also makes it possible for ideas

from all hierarchical levels to have a substantial impact or to be further developed. Actors in Sweden are used to working in groups and to achieve high value-added solutions by the extensive use of compromises (Ellgren and Åsgård, 2000, p. 171; Government Offices, 2004, p. 3)

Beside ordinary negotiations, there are currently no good mechanisms for handling conflicts of interest in the co-ordination of innovation policy. Trust has proved to be very important, since it has the potential to conquer many of the obstacles that emerge when reliable and functional formal structures are missing. A general lesson is also that co-operation and co-ordination need to be demand-driven. A policy without commitment from stakeholders will eventually be both inefficient and fail when implemented (Statskontoret, 2004).

To sum up, the current structure of co-ordination in Sweden's innovation system, all in all, allows for much recognition of stakeholders and a broad approach to innovation policy. There are however some challenges with respect to co-ordination. Some of these challenges are due to old institutional structures and sectoral traditions, and efforts to overcome these barriers must be cautious. A too centralised approach to co-ordination of innovation could create a situation in which the term is used in an even more diffuse manner, as an all-embracing goal without real substance. Such a co-ordination policy might be a toothless political symbol rather than the sharp tool currently needed to achieve real improvements.

The end of an era?

The globalisation of industry has had a strong impact on Sweden, because of its historical reliance on a small number of highly successful "flagship" industries. Sweden has, with good reason, taken pride in the number of Swedish corporations among the Fortune 500. However, these firms have outgrown their national foundations, and each aspect of their value chains is open to international competition.

This changes the role of government R&D policy. The task can no longer be seen as supplying a small number of national flagship firms with R&D competence that is "good enough" to cover all their needs. Instead, Sweden will have to compete globally for new R&D (and production) investments and needs to be world class in at least some areas. Can this be achieved without both more strongly focused R&D efforts and the capability to refocus rapidly as priorities change? Even if Sweden succeeds in retaining successful large firms, their future growth will not necessarily result in new jobs, since many operate in relatively mature sectors where relentless rationalisation is the way to profitability.

For this reason, a second policy challenge is to build the foundations for new, high value-added businesses. This requires a much broader and systemic innovation policy approach. Some early steps have been taken in this direction, through bottom-up regional development policy, the creation of a "ministry of growth" and an Agency for Innovation Systems, and the Innovation Strategy.

The good news is that growth and innovation are clearly on the political agenda. An innovation systems view is also taking hold, even if what it means in practice is still unclear. The process leading to the Innovation Strategy involved the science and industry ministries, but not the Ministry of Finance. The Innovation Strategy has since been adopted by the government as a whole, as a guiding framework for further action. A first concrete result of the strategy appeared in March 2005, when the government published

its research policy bill for 2006-08. Several proposals address issues raised in the Innovation Strategy:

- Priorities include biomedical and technical research, as well as sustainable development, with an ambition to focus resources on centres of excellence.
- Industrial research institutes are given increased resources, to make them more competitive in a globalised market and to provide better linkages between SMEs and the research infrastructure.
- Universities are required to produce action plans for commercialisation of research results, and a national infrastructure is set up to assist this.
- Increased use of public-private research partnerships are expected to increase both co-operation and personnel mobility between industry and universities.
- A specific programme is targeted on automotive applications of telematics, with expected results in terms of the environment, road safety and commercial opportunities. This should be viewed in light of the importance to Sweden of the automotive industry.

None of these proposals is revolutionary in itself. What is new is a stronger emphasis on the need for better linkages, based on an innovation systems perspective.

Annex 9.A1

"INNOVATIVE SWEDEN" – AN OVERVIEW

Knowledge base for innovation

Ensuring that Swedish education and research are world-class

- Create a school that gives everyone basic skills.
- Promote good mathematical skills and an interest in studies in science and technology.
- Promote lifelong learning.
- Ensure internationally competitive higher education institutions.
- Encourage international student and researcher mobility.
- Continue to invest in research and research training.
- Strengthen industrial research institutes.

Concentrating efforts in Swedish profile areas

- Prioritise strategic areas in research and the business sector.
- Increase interaction between research, industry and the public sector.
- Promote regional specialisation in combination with national priorities.

Seizing the opportunities presented by globalisation

- Promote good language skills.
- Promote establishment of Swedish business in strategically important markets.
- Promote Sweden's attractiveness as a co-operation partner for R&D.
- Attract foreign direct investment and top skills.
- Ensure an internationally competitive corporate tax rate.
- Develop the image of Sweden as a country of innovation.

Innovative trade and industry

Strengthening the innovative capacity of existing small and medium-sized enterprises

- Strengthen strategic collaboration between enterprises.
- Strengthen co-operation between company networks, higher education institutions and research institutes.
- Develop support for product development and design.
- Develop production technologies and production systems.
- Encourage SMEs to invest in R&D.
- Promote the capacity of SMEs to operate internationally.

Increasing the commersialisation of research results and ideas

- Transform research results and ideas more effectively into businesses and enterprises.
- Increase financing at early stages of business and company development.
- Design workable ground rules and promote the use of intellectual property protection.
- Create sound conditions for competition that favour the growth of new enterprises.

Innovative public investment

Using the public sector as an engine for sustainable growth

- Ensure that publicly financed activities contribute to creating products and services for export.
- Make use of the industrial and technological potential of the defence and security sector for civil applications.
- Develop more forceful, demanding public procurement.
- Develop regulations that force the pace of renewal.

Promoting renewal and efficiency in the public sector

- Operate public services more effectively and innovatively.
- Develop new solutions to meet the needs of society.

Developing infrastructure that promotes renewal and sustainable growth

- Develop effective systems for transport and logistics.
- Increase mobility in and between local labour market regions.
- Develop an IT infrastructure for the future.

Innovative people

Stimulating entrepreneurship and enterprise

- Promote positive attitudes towards entrepreneurship.
- Secure a simple and expedient regulatory framework that facilitates enterprise.

Making the most of people's skills

- Develop working organisations that encourage renewal.
- Make better use of everyone's skills.
- Increase mobility between the business and academic communities, the public and private sectors.

Source: "Innovative Sweden: A Strategy for Growth through Renewal" Stockholm, 2004, DS 2004:36. The Ministry of Industry, Growth and Communications and the Ministry of Education and Research.

Notes

1. The interviews were conducted in early 2004, when the Innovation Strategy process was still under way, and preparations for the 2005 research bill were at an early stage.

2. The first official use of the term was in Government Bill 1999/2000:71, *Vissa organisationsfrågor i näringspolitiken* (Some organisational matters in industry policy). The first serious discussion appears in Government Bill 2001/02:2, *FoU och samverkan i innovationssystemet* (R&D and collaboration in the innovation system), which gave the mandate to set up VINNOVA.

3. Since 1936, Sweden has only had a non-socialist government between 1976 and 1982 and between 1991 and 1994.

4. Interview with Lennart Ohlsson, 22 September 2004.

5. Interview with Lennart Ohlsson, 22 September 2004.

6. The wage earners' funds were union-controlled investment funds, financed by a tax on so-called "excess profits" in industry. The funds were established in 1984 by the social democratic government and designed to increase employee influence. In 1992, the funds were dissolved and the capital was used to form foundations with the aim to strengthen Swedish research and competence. The wage earners' funds should not be confused with pension schemes – the two are unrelated.

7. In particular the work of Per Davidsson at the Jönköping Business School.

8. "Innovativa Sverige", Ds 2004:36, Stockholm, 2004.

9. For a good description of the performance of the whole Swedish national innovation system, see Marklund *et al.* (2004).

10. Interview with Fred Hassan, President and Chief Executive Officer of Pharmacia Corporation, quoted in *Outlook Journal*, January 2001.

11. Before the merger, Upjohn was located in Kalamazoo, Michigan.

12. In an early phase the RTPs were based on voluntary participation under the label "Regional Growth Agreements". From 2002 participation is mandatory for all regions.

13. This was a result of the structure of ownership in the Swedish business community. The large industrial groups have traditionally dominated organisations that represent employers.

14. Negotiations in which all actors should be represented at the same level make it hard to allocate responsibility.

15. There is reason to believe that policy entrepreneurs without representation in the corporatist bodies have had little chance of influencing the public agenda setting (Öberg, 1997, pp. 14-15 and 17).

16. Rejecting representation in a government body also leads to a situation in which the government can protect itself from criticism by arguing that the organisation was offered participation but refused.

17. The foundation for the model was, in addition to the "Sjöbaden spirit", the so-called "Harpsund's democracy", a label for regular meetings between the parties of the labour market and the government, at the prime minister's residence, to discuss and agree on the direction for economic policy in Sweden without interference from the parliament (Micheletti, 1994, p. 157; SOU, 1999:121, p. 27).

18. A clear indication of the abolishment of a common vision for society, as well as the end of the culture of conflict avoidance, is the sharp rise in reservations and conflicting views in governmental inquiries.

19. Councils for co-ordination were used during the right-wing coalition governments of 1976-1978, 1979-1981 and 1991-1994. The current Office for Sustainable Development within the Prime Minister's Office, established by the social democratic government in 2003, works in the same way.

20. Pär Nuder, Minister for Policy Co-ordination, quoted in an interview of 16 August 2001 with T. Persson, PhD, at Uppsala University.

21. Examples of inquiries published during the 1990s that contain proposals to merge ministries in order to achieve better co-ordination are: The REGINA-investigation (1992) and the ELMA-investigation (1995). For more information see: Statsrådsberedningen, "The Government Offices organisation m m", Dnr FK 386/96, Förvaltningskontoret, 1996.

22. Regional growth through dynamic innovation systems, Programme description as a basis for internal support and decision-making, 20011219. According to the programme description, the following points represent its most important characteristics:

- A shared strategic concept/vision for the region within one profiled field, which is considered to have realistic growth potential.
- A joint regional leadership that can support, promote, co-ordinate and develop strategic alliances, which will put the strategic concept into practice.
- Identification of facilitators and allowing them the space to work.
- Knowledge of business and development logic within the specified growth area.
- A credible development strategy, with priority areas for action that can bring the innovation system up to an internationally competitive level. This must be based on an analysis of the region's current situation in relation to the specified growth area.
- The creation of a geographical "hub", where players are in close proximity to one another in geographical, linguistic and social terms, is important for the development of innovative capability.
- The advance of existing/potential development and knowledge environments in accordance with the strategic concept. This applies in particular to relevant research skills.
- Research-based knowledge is a central factor in ensuring competitiveness in many growth areas.
- Creating learning environments and situations on the basis of a carefully planned strategy and learning resources.
- Strong commitment from companies.
- Long-term thinking over a period of at least ten years.

23. One example of such policy co-operation is found in the Öresund region, which includes eastern Denmark and southern parts of Sweden. Strengthening this co-operation is on the regional policy agenda of both the Danish and the Swedish governments. The Ministry of Science, Technology and Innovation in Denmark and VINNOVA of Sweden are jointly responsible for the Öresundskontrakt initiative, which promotes common R&D projects between companies, universities and research institutions from both sides of the Öresund strait. Northern Sweden and northern Finland comprise another area where cross-border co-operation in promotion of innovation activities is increasing in importance.

Until 2003 VINNOVA in Sweden and Tekes in Finland co-administered a technology programme called EXSITE (Explorative System-Integrated Technologies). Participants were universities and research institutions. For each Swedish project, there was a corresponding project in Finland. Tekes, VINNOVA and the Research Council of Norway (RCN) are now planning a new Finnish, Swedish and Norwegian technology programme that could be launched during 2005.

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Chapter 10

FRAMEWORKS FOR HORIZONTAL INNOVATION POLICY IN NEW ZEALAND

Julian Williams[1]
Ministry of Research, Science and Technology

This chapter describes overarching frameworks and the associated private-sector task forces to guide innovation policy. Current public policy emphasises active facilitation of the innovation system by the government and encourages collaboration among participants, owing in part to the view that innovation occurs within a complex system of actors and resources. In New Zealand, the government is a key investor and participant in this system.

The historical and economic context helps define the innovation policy mix. New Zealand is a small open economy for which export competitiveness is crucially important. Primary sector producers – the farms – and associated industries constitute its base, which is complemented by firms adopting and adapting foreign and domestic innovation, typically at a small scale.

The Growth and Innovation Framework (GIF) is a fundamental framework and the focus of this chapter. Its aim is economic – to enhance sustainable economic growth rates through innovation. Under GIF, private-sector advisory taskforces recommended ways for innovation policy to enhance the economic performance of key sectors across the economy as a whole. The government acted on many of the recommendations.

By articulating and enabling coherent policy settings across the innovation system, the strategic frameworks provide a platform for change and adaptation in the economy in the long term.

Introduction

This chapter describes the New Zealand government's strategic policy frameworks to support sustainable economic development through innovation. It focuses on one key framework – the Growth and Innovation Framework (GIF).

The fundamental policy challenge for sustainable economic development has historically been to raise the long-term competitiveness of the economy by: *i)* raising the export value of primary production; and *ii)* assisting firms to develop and take up new technology to produce new high-value outputs.

Current innovation policy challenges are best seen in the context of the fundamental challenge of sustainable economic growth. In turn this challenge is addressed to an innovation system that is itself shaped by historical, institutional and cultural influences.

The strategic frameworks are guiding new policy initiatives to help the innovation system address socio-economic development. By articulating and enabling coherence among policy settings across the innovation system, the strategic frameworks provide a context in which the innovation system itself – including its institutions, people, policy and governance arrangements – can change and adapt in the long term. The success of these frameworks will be seen through such change, because it is through adoption and absorption of innovation that the economy will achieve the sustainable economic transformation that it seeks.

The MONIT project is concerned with understanding the dynamics and effectiveness of policy making systems.[2] New Zealand offers the simplicity of a small country model together with complexities that often go unexplained in large country systems.

Using information from publicly available studies commissioned by the government and other sources, this chapter describes the historical development of the strategic frameworks and then describes the main challenges for innovation policy and the New Zealand innovation system. After the strategic frameworks are described, the chapter concludes by describing the co-ordination of private-sector taskforces established to advise on growing key industry sectors.

Historical development of the science and innovation system and governance structure

It is helpful to set the historical context for the government's strategic frameworks and its current style of public management. It is characterised by the concern of successive governments that the settings of the New Zealand economy, together with management of public resources, support efficient and sustainable economic development. In the 1980s, this concern led to a minimalist role for the government in the provision of public goods and services. In the early 2000s similar concerns led to a more active role of government in policy action. By the early 2000s, the government's innovation policy was characterised by active government facilitation and partnership with participants.

Reforms of the 1980s led to new institutional and public management governance structures based on paradigms like public choice and agency theory that emphasised market-failure approaches for the government's role in a wide number of policy areas.

From about 2000, the government sought to transform the economy by enhancing innovative activity. In large part it desired better outcomes for socio-economic development through innovation. It led a new approach that emphasised integration and co-ordination of actors and institutions in the innovation system, together with active stimulation in areas in which the innovation system was unable to function effectively.

This systemic approach to innovation policy sees innovation occurring within an interdependent set of actors, institutions and resources across public and private sectors. Only some of these interactions are appropriately dealt with using a market-failure paradigm. The remainder are complex, involve many different interests and require decisions that affect future generations. The government's new approach represented a

marked departure from the market-failure and agency style approaches to policy intervention.

In a context of sustainable economic development, innovation policy is set within overarching policy frameworks designed to address goals for economic growth, environmental, social and education policies. These frameworks emphasise coherent policy action as well as co-ordinated interaction of all actors and institutions across public and private sectors.

Since 1999, the key frameworks and policy paradigms[3] that underpin innovation policy are: the government's goals; the Growth and Innovation Framework (GIF); the Sustainable Development Approach (SDA); the Tertiary Education Strategy (TES); and key strategies of the ministerial policy portfolio areas of: research, science and technology; economic, industry and regional development; and tertiary education.

The economic growth focus of GIF fits together with the social and environmental priorities of the Sustainable Development Approach. The Tertiary Education Strategy enables the tertiary education system to be able to respond to the priorities of GIF.

A brief economic history[4]

The government's interest in innovation to enhance New Zealand's future economic growth typified historic policy initiatives to raise the value and diversity of New Zealand's exports and create cost-saving efficiencies in order to remain internationally competitive.

Over the early part of the post-World War II period, the New Zealand economy grew at about the same rate as other OECD countries. However, following declines in commodity prices for wool, red meat and dairy products, New Zealand's volume-based GDP grew about 1% a year more slowly than the OECD average. Between 1965 and the early 1980s, the economy diversified from its traditional pastoral products to encompass a much wider range – horticulture, fish, wood products, energy-related products, light manufactures and tourism.

Using 1990 as a base, calculations of GDP per capita relative to the OECD average show that while in the 1950s, New Zealand measured 120% of the OECD average, it fell to 99% in 1966; to 84% in 1979; to 87% in 1985; and to 79% in 1992. Easton[5] opines that " whatever the details, it is clear that New Zealand's poor relative growth performance occurred in the period from the mid-1960s to the late 1970s…. That is not to say that there were no economic difficulties in the early 1980s. But relative growth performance was not one of them."

From the late 1970s, the economy expanded faster than the OECD average – this was the period of oil price hikes affecting global economic growth rates. Energy-led industrialisation in New Zealand prompted construction of hydro-electric generation and deep sea gas production. In the late 1970s calls for "more-market" policy mechanisms emerged.

High double-digit inflation rates in the 1970s continued into the 1980s, compounded by fiscal and monetary management. A very large budget deficit funded by government bonds at controlled interest rates devalued with inflation and led to an unsustainable policy stance.

Prior to this, from 1935 to 1949, a Labour government set in place an economic and administrative mechanism of high government intervention. The system endured with minor changes until the reforms of the 1980s. The government exercised control over significant assets and other resources through ownership and regulation. In the latter stages of the period from 1960 to 1984, successive National governments brought in market liberalisation measures.

In July 1984 a Labour government commenced an era of massive regulatory and financial reform to create a more open and competitive environment for New Zealand enterprises. The underlying concept was that freeing the economy would create cost-saving efficiencies. In addition, New Zealand enterprises could respond more flexibly to profitable opportunities on local and international markets if these opportunities were not clouded by import protection and export subsidies. From the 1980s, successive governments subjected the role of government to strict scrutiny. Many government corporations and services became corporatised and then privatised. In the same vein, to create efficiencies in the public sector, government service provision, in areas such as health, education and welfare, was aligned along agency styled "purchaser-provider" principles (see below).

In a move away from these principles, a new government in 1999 set a new course for public policy that emphasised a more active role for government in stimulating social and economic activity. The course was set in place with widespread consultation and a call for participation from all sectors and interest groups. This initial approach led to a number of frameworks to guide the content and direction of new public policy.

An outline of public management reform[6]

Central to issues of governance in the innovation system are issues around the effectiveness of the public service bureaucracy. Fundamentally, this is due to the long-term and diverse roles that the government plays in the innovation system. Perhaps unsurprisingly, therefore, over the past 20 years, the government's style of innovation system management changed in tandem with the public policy reforms.

From 1984 to the early 1990s, New Zealand's public sector underwent massive structural, organisational and management changes. At the central government level these included: the corporatisation and subsequent privatisation of state trading activities; the introduction of a new financial management regime; major changes to the machinery of government; a new system of appointing and remunerating senior public servants; substantial cuts in various government programmes; significant changes to public-sector industrial relations practices; a growing emphasis on biculturalism and employment equity; and a much greater concern with accountability and performance assessment.

These reforms were motivated in part by orthodox economics[7] as well by political ideology of the "New Right" or "Chicago" approach. Typically, this approach highlighted a minimalist role for government intervention and only then when a market failure could be identified. There were calls for greater accountability and improved efficiency in the performance of publicly owned assets. Consistent with this approach, three[8] conceptual frameworks guided the reforms:

- Public choice theory, according to Downs (1957), Buchanan and Tullock (1962) and Olsen (1965), among others. This says that voters can be like consumers who may articulate their desires for public policy.
- Agency theory, according to Jensen and Meckling (1976) and Williamson (1975) in a wider context than the firm (Gorringe, 1987). This has public management centred on an interrelated array of performance contracts between people.
- Property rights theory, according to Coase (1960), Demetz (1967), Posner (1986) and the related transaction costs theory of Williamson (1975, 1985). These centre on the idea that beneficial and detrimental externalities of people's actions in society can be paid for (compensated for) by assigning property rights (obligations) to those affected.

These frameworks dominated the public policy of a range of governments from the mid-1980s until the late 1990s.

Under these frameworks, important public institutions in the innovation system – the nine publicly funded Crown Research Institutes (CRIs) – were established from a few larger government departments as corporate entities with both commercial and non-commercial objectives. As providers of research, they were separated from the institutional managers of research funds (currently, the Foundation for Research, Science and Technology; the Health Research Council; and The Royal Society of New Zealand) and both were separated from the newly formed Ministry of Research, Science and Technology for strategic policy making. Some commentators believe the increase in boundaries caused by this separation was not helpful, despite the efficiency gains made. In this period, university research priorities were largely determined autonomously by each institution.

To assist innovating firms, government programmes for business assistance were largely limited to support with regulatory issues, defined by market failure paradigms. Technology New Zealand was a notable new programme in the late 1990s. In line with prevailing policy principles, it did not provide subsidies for firms' research, but aimed instead to enhance firms' abilities to perform R&D.

The Growth and Innovation Framework[9]

In 1999, in line with its new approach to public management, the new government put in place new policy to stimulate the innovation system. This policy drew in part on the emerging view that innovation occurs within a system of actors, institutions, resources, investors, etc. The participants seek market and non-market outcomes, over the short and long term. The government is an important actor in the New Zealand innovation system, and the explicit recognition of non-market outcomes provides a closer fit with reality than viewing these in terms of failures (market failures) in the market-based model. The new policy was influenced by concepts of "national innovation systems" emerging in the 1990s in international forums.

In New Zealand, the government is a leader if only because it is the largest investor in innovation through: *i)* research, science and technology; *ii)* tertiary education; and *iii)* support for trade and enterprise. In addition, in many cases, the government is the only organisation of sufficient scale to address many long-term and complex innovation issues. In its leadership role, the government set about a process of consultation that drew

together the various players in the innovation system to develop a shared view of the role of innovation in sustainable economic development.

In June 2000, the government established the Science and Innovation Advisory Council (SIAC), comprised of independent private-sector individuals to provide independent, high-level advice on innovation issues to the prime minister. Subsequently, the government commissioned a number of reports by SIAC, private-sector consultants and government agencies which consulted a wide range of interested people across the country on how best to: develop the talent base for the economy; attract appropriate foreign direct investment; develop the innovation system; build a more socially inclusive economy; ensure social development is appropriately incorporated and measured; and ensure a sustainable development approach to policy development and implementation.

The government encapsulated this learning into a framework called the Growth and Innovation Framework for transforming the New Zealand economy into one that would be more innovative, more confident and more flexible, and able to compete successfully on the international scene. GIF set a direction for the government to follow, together with a vision for all New Zealanders. It encapsulated this direction in an overall aim to raise New Zealand's raise of economic growth relative to other OECD nations. That aim is to return New Zealand's per capita income to the top half of the OECD rankings and maintain that standing.

Coherent policy development processes

Contemporaneous with its development of GIF, the government sought in 2001 to improve the coherence of policy development and co-ordination. It requested a four-month review of the functioning of central government, including previous research, interviews and focus groups, with available statistics *(www.ssc.govt.nz)*. The advisory group concluded that improvements were desirable in three areas: integrating service delivery across multiple agencies; addressing fragmentation of the state sector and improving its alignment; and improving the systems by which state servants are trained and developed. The government's subsequent decisions mapped out a programme of improvement, to be implemented over several years.

The advisory group recommended more interagency co-operation, including addressing some problems that emerged from the separation of policy and service provision in the 1980s. It recognised that those reforms had led to a proliferation of agencies and caused a lack of policy coherence across government, in some cases from excessive emphasis on the vertical accountability of agencies.

In part as a response to the agency-style reforms of the 1980s, the advisory group called for greater use of networks and more emphasis on policy outcomes in public accountability. Importantly for provider agencies – including those that deliver research funding and business assistance services for the government – the report saw a need for greater clarity in the nature of their relationships.

The new approach to policy development supported coherence of outcomes across policy domains and the more participatory governance arrangements sought by GIF. In return, GIF, together with SDA and TES, reinforced the government's new approach to policy development and implementation, including: fostering closer linkages between the public and private sectors, at both the national and regional level; and providing opportunities for better co-ordination and alignment of policy development and implementation

by departments and delivery agencies, helping to break down perceived silos in the public sector.

Policy challenges and actors in the innovation system

In the context of the government's aim to support sustainable economic development, the key challenges for innovation policy in New Zealand are to raise the long-term competitiveness of the economy by raising the export value of production and assisting firms to develop and take up new technology to produce new high-value outputs. While it has high priority, this context is not the only one for New Zealand's innovation policy.

This section describes the types of policy domains relevant to innovation policy and the entities in the innovation system that help it respond to policy challenges. These are shaped in large part by historical and cultural influences. It is important to understand the policy domains that respond to these challenges. Relevant policy domains are research and development, human capability development, firm assistance and regional development.

People, institutions and firms combine to implement innovation policy, and it is helpful to understand their places in the innovation system, their interactions, and how innovation policy affects their current state and future development.

Frameworks to support coherence of innovation policy

New Zealand's current priorities for innovation policy are mainly expressed in terms of research and development, economic development, regional development and tertiary education.[10] At the very least, innovation policy needs to be horizontally coherent across these domains. At the same time, people and institutions as diverse as scientists, venture capitalists, local government officials and university professors need to understand and communicate the meaning of innovation policy for their own work and be able to exercise responsibility for a particular part of the innovation system. Innovation policy needs to be vertically coherent for these people to act effectively.

In some cases, the New Zealand innovation system lacks people (such as business advisors), entities (such as research consortia) or resources (such as venture capital funding) to function effectively. Often, these are only available in thin markets. Sometimes lack of historic demand has led to a lack of supply. In both strategic and operational policy domains, to help enhance horizontal and vertical coherence, new institutional forms were established to fill recognised gaps in New Zealand's national innovation system.

Examples include the Growth and Innovation Advisory Board to provide independent advice and New Zealand Trade and Enterprise (NZTE) for policy implementation. The TES helps express tertiary education policy priorities and thus supports the horizontalisation of innovation policy. Its delivery agency, the Tertiary Education Commission, is a new organisation whose task, in this context, is to set a long-run strategic direction for tertiary education policy. The government has recently formed an advisory group on enhancing workplace productivity which consists of participants from the public and private sectors.

Public-private interests in innovation policy

Only some of the outcomes of innovation policy are reflected in profits of private-sector firms. Some are delivered in open markets and some are non-market outcomes, in the sense that markets may not exist, or that they are delivered over the long term or by a series of complex market and non-market interactions. In New Zealand, one example is the beneficial role of publicly performed R&D in adding value to primary production, which is of crucial importance to a nation whose economy and history it continues to dominate. Another is enhanced opportunities for export firms due to networks and linkages between education providers and firms that facilitate more innovation under regional development programmes. Recent years have seen the government adopt a more active role in facilitating such outcomes in the innovation system. In such cases, it is difficult to quantify the benefits, especially the non-commercial ones, since the so-called spillover effects of innovation policy are understood to diffuse across communities and endure for many years.

Collaboration between the public and private sectors is seen as a way to enhance opportunities for both public- and private-sector participants. This is important for understanding the challenges for developing appropriate governance structures for the innovation system. The government's new innovation policy addressed these challenges by encouraging "partnerships" between participants, for example with research consortia. As in the commercial world, the partnership concept is flexible enough to encompass different purposes (*e.g.* some private and some public), while still demanding commitments (*e.g.* in terms of resources and investment). In addition to enhancing flexibility, the collaboration and linkages of a partnership also produce economic and social synergies, without compromising the independence and competitiveness of participants. Examples of the partnership model for governance extend from consultation on high-level sector strategies, to participation in regional development networks, to formal research consortia agreements.

Historical and cultural influences

Support for innovation in two areas (primary producers and small firms) has historically influenced the style and concentration of innovation in the economy. Both continue to influence innovation policy, through the challenges they present.

New Zealand's primary production sectors contribute over 60% of the country's annual merchandise exports of about NZD 30 billion. Indeed, private-sector farms and other primary producer enterprises, such as the processing industries associated with them, dominate the New Zealand economy. It is these industries, and businesses associated with them, *i.e.* the farms rather than the firms, that have exploited much of the long-term primary sector R&D by publicly funded research organisations. Consequently, compared with other OECD countries, New Zealand has a higher proportion of expenditure on R&D for technology for primary producing industries.[11] This indicates the importance of publicly funded R&D for the productivity of the key productive sectors that underpin the nation's economic activity.[12] Many CRIs also deal with environmental innovation, including the uptake of environmental research results by public agencies.

The farms of New Zealand are complemented by a population of firms characterised by a small proportion of large businesses (500 or more employees) compared to other countries. Consequently, there are few examples of truly large-scale private-sector R&D, but many New Zealanders have produced world-leading small-scale innovation. Further,

New Zealanders perceive themselves as successful in adopting foreign technologies and adapting them to new conditions.

Foreign-sourced technologies are important for innovation in New Zealand. In order for domestic firms to harness them, they need the appropriate absorptive capacity. This can be a particular challenge in the absence of supportive local large-scale R&D multinationals.

While it is difficult to compare enterprises in different economies, there is no convincing evidence that New Zealand firms are less innovative than firms in other countries. This is consistent with the notion that innovation opportunities are plentiful everywhere and entrepreneurs in any location will exploit the unique competitive advantages that each nation offers. The difference appears to be the relative impact of New Zealand's innovation. The picture that emerges is one in which the innovation efforts of firms are not translated into high value-added outcomes.

This is somewhat supported by the observation that foreigners are able to add proportionately more value than New Zealanders to many New Zealand-originated products, prior to their point of sale. Some observers see this low impact as arising from the fact that New Zealand firms undertake informal or incremental innovation, rather than radical innovation or formal R&D. Other observers see New Zealand firms as relatively weak at commercialising and taking ideas to market. This is a particular challenge since many markets are distant and diverse. It is also a crucial challenge given the nation's reliance on export revenue.

The business environment

For many years, one priority for innovation policy has been to encourage business investment in R&D in order to increase firms' ability to add value to export products. By many measures, New Zealand's level of business investment in R&D as a proportion of GDP is low compared to other OECD countries. The cause is not fully clear. A common understanding is that the historical dominance of primary industries and their reliance on publicly funded innovation has led to a relative lack of private-sector investment in R&D. This may also contribute to the observed low-value outcomes for innovation in non-primary production as well as the limited ability to develop channels for new innovative products and services.

In addition to these historical and cultural characteristics, New Zealand's business environment is characterised by: high cost of capital compared to the United States; domestic savings rates below the OECD average; a lower ratio of capital to labour ("capital shallowness") compared to countries such as Australia; less favourable business tax regimes compared to some competing countries in some sectors; and less developed and thin capital markets.

Factors unrelated to New Zealand's innovation system – such as country risk premiums for capital and availability of investment and savings instruments –undoubtedly affect this environment. A recent study of New Zealand business practices and performance[13] suggests that both debt and equity finance is reasonably accessible in New Zealand. However, the results do raise some issues in relation to accessing capital at certain stages of development. OECD evidence on measuring regulatory friendliness to innovation (focusing on mechanisms that govern the development and trading of products and services) suggests that New Zealand has a relatively innovation-friendly regulatory climate.

Inter-firm networks and other co-operative arrangements offer several benefits, such as development of collective skills, market information and suppliers, increased flexibility and pressure to innovate. Such arrangements help small firms to overcome scale and cost disadvantages when exporting. There may be aspects of the New Zealand environment that impede co-operative arrangements between businesses, and between firms and other entities. Some suggest that these include concerns about the legal limits to co-operative behaviour, the geographical isolation of firms (both within New Zealand and globally), and the small scale of businesses, sectors and markets.

Public research organisations

The main providers of publicly funded research are the nine publicly funded Crown Research Institutes, eight universities, research associations and a few large corporations. Ultimately, most end-users of CRI research are small farm enterprises. The CRIs have traditionally supplied strategically important R&D which farms have translated into higher productivity output and higher economic growth. CRIs have also developed new technologies for industrial applications. One priority of innovation policy is to support this strategically important research. Part of this policy is concerned with the content and part is concerned with the coherence and functioning of the institutional arrangements.

CRIs also have a important role in supporting the diffusion of new technology across the innovation system because much of New Zealand's innovative capacity is in public research institutes. The CRIs and universities tender for research funding, together with private-sector providers and therefore the process is contestable. Research funding is aligned to the government's strategic priorities for research. While the current contestable funding regime means that the government's investment priorities can be quickly implemented, it may also lead to volatile and uncertain funding for some areas of research. This can present risks for long-term planning. Some commentators fear that the emphasis on contestability may have led to a fragmentation of effort and undermining of capability – including loss of top-class research teams that are difficult to replace – particularly in some areas of strategic research.

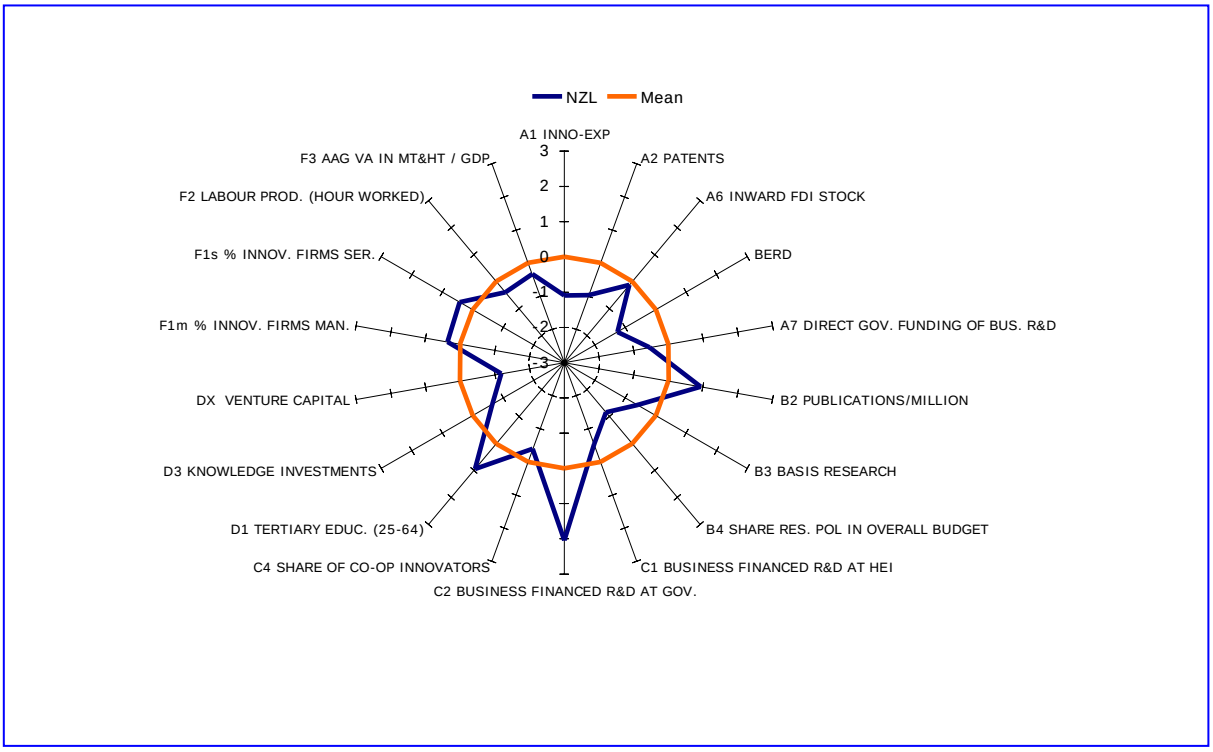
National innovation system indicators

Figure 10.1 gives an overall picture of New Zealand's innovation system as compared to the group of other countries covered by the MONIT survey. It is interesting to show how they illustrate the policy challenges discussed above.

Patent numbers per capita appear relatively lower than for other countries. Many studies of larger innovation systems that connect patent numbers with innovative activity and economic growth are not directly applicable to smaller economies such as New Zealand. Factors such as firm size, industry concentration and patent intensity for the research areas prevalent in New Zealand all contribute to a complex picture. It is not clear that patent numbers per capita are unusually low after taking these factors into account. At the very least, low patent numbers per capita are consistent with a relatively low proportion of business investment in R&D to GDP, and a limited presence of large-scale R&D firms, among other factors.

There is a relatively higher percentage of business-financed R&D activity performed by the public sector than in the other countries, coupled with a robust demand for innovation in the manufacturing and services sector. This is consistent with the picture of New Zealand firms, which are no less innovative than in other countries, although they face a relatively lower level of private-sector R&D that is appropriate to their needs.

Figure 10.1. The relative performance of New Zealand



This result, together with a relatively higher supply of published research per capita than other countries, as well as a robust supply of new science and engineering graduates, may be consistent with a demand-side effect due to the limited capacity of firms to conduct their own R&D. If so, policy initiatives to address firms' limited absorptive capacity for innovation will be important.

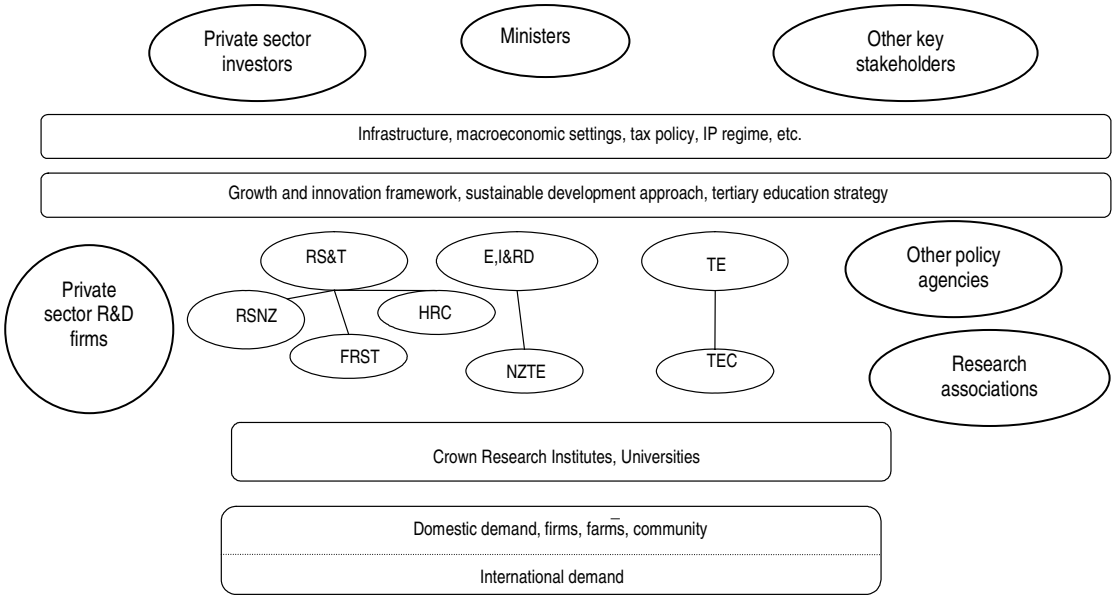
New Zealand's innovation system

New Zealand's innovation system can be simply pictured in terms of public and private investors, institutions, enterprises (firms and farms), researchers and end-users who seek public-good and private-sector outcomes, which include economic growth; enhanced health; social cohesiveness; a sustainable natural environment; and profits for investors. These actors operate within a context of regulations and infrastructure. Public-sector activity is guided by overarching frameworks.

Figure 10.2 illustrates, though not to scale, the important role played by public funding, public institutions and public policy in the innovation system. Another key attribute is the relative importance of international to domestic demand for New Zealand outputs. This highlights the crucial role of international linkages in the New Zealand innovation system, both for channels to market and for inward conduits for new knowledge and technology. Notably absent is the presence of many large R&D firms. This underscores the significance of the CRIs and universities as the large-scale sources and diffusers of innovation, especially to private-sector firms. Key actors in research institutions and leading innovative firms set new directions for investment in innovation. New policy for the innovation system includes the creation of E,I&RD (economic, industry and regional development), NZTE, TEC, GIAB and the taskforces, among other

institutional changes. This reflects the magnitude of institutional change required by the new approach in order to stimulate the innovation system to address the policy challenges.

Figure 10.2. The national innovation system



Strategic policy

In New Zealand the government has a leadership role in supporting innovation, because it is the main investor in research, provides infrastructure, and sets strategies and priorities that influence the whole innovation system. It sets innovation policy priorities in three key ministerial policy portfolio areas of: research, science and technology (RS&T) *(www.morst.govt.nz)*; economic, industry and regional development (E,I&RD) *(www.med.govt.nz)*; and tertiary education (TE) *(www.tec.govt.nz)*. Other portfolio areas also contribute to innovation policy and to policy work to help the GIF and SDA frameworks to work across all portfolio areas.

The Ministry of Research, Science and Technology has a mission to "inspire and assist New Zealanders to create a better future through research and innovation". It works on policies and programmes that build capacity and capability in the science system and contribute to its integrity and interconnectedness. These initiatives build knowledge and encourage private-sector R&D and illustrate long-term concern for the environmental and social well-being of New Zealanders.

The Ministry of Economic Development seeks a business environment that promotes a higher rate of sustainable income growth for New Zealanders. It works on policies and programmes to promote private-sector investment, increase productive employment and generate higher revenues and incomes. Agencies governed by independent directors and

accountable to ministers through their ministries have responsibility for allocating funds to meet the strategic priorities.

The Ministry of Education's Tertiary Education Strategy seeks a more collaborative and co-operative tertiary system, able to contribute to New Zealand's national goals and more closely connected to enterprise and local communities. The strategy is designed to help improve the quality of research capability and knowledge and ensure that the tertiary education system contributes effectively to economic growth and social development.

Though separate in their corporate structure, ministries are actively aware of across-government interaction when developing their medium-term plans for policy activity, as seen in the corporate documents called "Statements of Intent".

Investing in innovation

Ministries are mostly concerned with strategic policy development, while specific "purchase agents" allocate funding to policy priorities for each policy area. Each purchase agent operates with wide discretion under the auspices of the relevant ministry. In recent years, initiatives have aimed at better co-ordination of the activities of purchase agents within each ministry and across government.

For RS&T, the agencies are: *i)* the Royal Society of New Zealand (RSNZ); *ii)* the Foundation for Research, Science and Technology (FRST); and *iii)* the Health Research Council (HRC). For E,I&RD, the main agency is New Zealand Trade and Enterprise (NZTE). For TE the main agency is the Tertiary Education Commission (TEC).

RSNZ, FRST and HRC invest funds in R&D through competitive tendering rounds. The agencies are also guided by a set of operating principles that: align investment with the policy priorities; seek collaboration with appropriate agencies for effective investment; invest to support innovation capabilities; involve end-users and providers in investment strategy planning; increase international connections; and develop effective evaluation processes.

NZTE is focused on providing services for firms, regions and industry sectors. These are advisory, training, facilitation and network services for: firms starting up (*e.g.* incubator facilities); firms wishing to grow further (*e.g.* high-growth exporters); foreign investors (connecting investors with domestic firms); business partnerships (*e.g.* clusters and export networks); industrial capabilities networks (access to government tenders for products and services); and developing positive attitudes for entrepreneurship. It also manages regional development programmes (*e.g.* for major strategic initiatives).

TEC is concerned with implementing the government's Tertiary Education Strategy, which *i)* funds research according to performance criteria and *ii)* supports centres of research excellence.

Providing the research

The main providers of research are the nine CRIs, eight universities, private-sector firms and research associations, in which research leaders and business leaders are important.[14] The CRIs, universities, research associations and firms tender for contestable public research funding and obtain revenue from private sources. Universities also obtain research funding directly from the government. The publicly owned CRIs are managed as efficient businesses with public-good objectives. The government uses an operating framework for CRIs, to give them specific directions for particular priorities. In general,

CRIs balance public-good objectives and commercial objectives. Their scale, expertise and networks provide excellent opportunities for developing and exploiting new technology.

Tertiary education research constitutes about 30% of the research carried out in New Zealand and is provided mostly by universities. Most of the health research is performed by university medical schools. All universities have technology development offices for commercialising research. Many support incubators and earn income from royalties on intellectual property rights. Some spin-off and start-up activity occurs.

Private-sector firms play a key role in developing and commercialising technology to create value-added products and processes. Primary products dominate New Zealand exports and strongly influence the type of R&D demanded in New Zealand. As a result R&D has provided important technologies to keep primary production highly efficient.[15]

A number of emerging private sector research firms compete, together with industry-owned organisations and private research institutes, with CRIs and universities for research funds.

End-users

Global connectedness is of crucial importance to New Zealand. Because of its small population base, its innovation markets are international, as are its primary product markets. Primary producers, such as farms, fisheries and forestry companies, are significant consumers of local technology. For example, agricultural productivity[16] has improved substantially over the last 15 years as a result of technological change, effective targeting of investment, cost cutting and efficiency gains, and scale economies through the expansion of the average size of farms and orchards.

Infrastructure

New Zealand has a highly productive developed market economy, with stable institutions, high levels of employment and active networks of businesses and service providers. The government has policies in place to support infrastructure in the innovation system, including by: reducing regulatory compliance burdens; improving the taxation regime for R&D; revising patent laws; supporting early stage seed and venture capital markets; and establishing high-speed Internet technology for research networks.

A ministerial group was established to consider and develop the government's policy and response in relation to infrastructure issues.

GIAB and the taskforces

In 2002, the government established a Growth and Innovation Advisory Board of leading business people to provide independent advice to the prime minister and senior economic ministers on how the government can strengthen its growth and innovation policy programme. GIAB has produced independent reports on key issues including New Zealanders' attitudes towards growth and innovation, the state of infrastructure and enhancing agribusiness opportunities.

The government also established four private sector taskforces in May 2002 to prepare reports on how to stimulate growth from innovation in the four targeted innovation areas of: *i)* biotechnology; *ii)* information and communications technology; *iii)* design; and *iv)* screen production.

A strategic response

The strategic response of the government to innovation policy challenges was to establish new policy that reflected a combination of active stimulation of the innovation system (*e.g.* creation of the Venture Investment Fund and the Pre-seed Accelerator Fund), encouragement of collaboration between public and private sector groups (*e.g.* creation of public-private partnerships in research consortia and the Major Regional Initiative programme), and integration and co-ordination of policy development and implementation (as evidenced in recent annual budget initiatives and budget speeches of the Minister of Finance).

This is demonstrated by its action in: setting innovation policy as a key goal; establishing overarching frameworks for policy; active engagement with the private sector; encouragement of their participation; and establishing new policy initiatives combining the outcomes of the foregoing actions.

Innovation policy as a government goal

Innovation policies across government are guided by the government's six paramount goals:

1. Strengthen national identity and uphold the principles of the Treaty of Waitangi.[17]
2. Grow an inclusive, innovative economy for the benefit of all.
3. Maintain trust in government and provide strong social services.
4. Improve New Zealanders' skills.
5. Reduce inequalities in health, education, employment and housing.
6. Protect and enhance the environment.

Innovation priorities are largely embraced by goals 2, 4 and 6.

Grow an inclusive, innovative economy for the benefit of all:

- To develop an economy that adapts to change, provides opportunities and increases employment, and while reducing inequalities, increases incomes for all New Zealanders.
- To focus on the Growth and Innovation Framework to improve productivity and sustainable economic growth.

Improve New Zealanders' skills

- To foster education and training to enhance and improve the nation's skills so that all New Zealanders have the best possible future in a changing world.
- To build on the strengthened industry training and tertiary sectors to ensure that New Zealanders are among the best-educated and most skilled people in the world.

Protect and enhance the environment

- To treasure and nurture our environment with protection for ecosystems so that New Zealand maintains a clean, green environment and builds on its reputation as a world leader in environmental issues. Focus on biodiversity and biosecurity strategies.

GIF and SDA and TES

Within the context of the government's goals, priorities for innovation policy are strongly influenced by three overarching long-term challenges that extend "horizontally" across many policy areas.[18] These are: the Growth and Innovation Framework 2002; the Sustainable Development Approach 2003 (see *www.beehive.govt.nz/hobbs/30199-med-susined-developm.pdf*); and the Tertiary Education Strategy 2002 (TES) (see *www.minedu.govt.nz*).

In addition, innovation policy priorities are indirectly influenced by policy priorities in areas such as social development, care for the natural environment, and labour market policy. For example, the government's "Workplace Productivity" initiative is partly concerned with enhancing innovation in the workplace.

The Growth and Innovation Framework

GIF is not itself a strategy, but an overarching framework for enhancing economic growth. It allows policy makers to perceive challenges across many different strategies and policies, in terms of economic growth. It gives coherence to many different policies by emphasising their role in innovation. It requires vertical coherence in the sense that the impact of one policy often depends on the impact of another which it follows or precedes. Many different policies are needed in sequence to achieve economic growth.

While there are many challenges for the innovation system, the main challenge that GIF addresses is an economic one. It is to improve New Zealand's long-run competitiveness and to return New Zealand's per capita income to the top half of the OECD rankings and maintain that standing.

GIF has two key aspects: strengthening existing foundations in macroeconomic settings, social cohesiveness, health, education and innovation; and focusing on four main challenges to build effective innovation. These challenges are: to enhance the existing innovation system; to develop, attract and retain people with exceptional skills and talents who are able to innovate and contribute to increasing overall productivity; to increase the nation's global connectedness; and to target innovation areas that can impact across the economy. Initially it defined these as biotechnology, information and communication technology, design; and screen production. Current policy instruments target many of the perceived challenges.

The Sustainable Development Approach

SDA helps to guide economic growth along sustainable pathways. It does not seek a target (as GIF does), as much as a way of working and thinking differently about development. It asks policy makers to find innovative solutions for policies in social and environmental terms. The perceived challenge is to implement policies in an innovative way to preserve sustainability and natural capital. SDA is concerned with current policy actions that will affect future sustainability. Coherence across time is particularly

important for SDA. SDA is consistent with Agenda 21 of the Rio Earth Summit, which focuses on pressures on the environment, communities and the economy. It recognises that at the global level and in New Zealand, innovative solutions by the public and private sectors are needed to deal with the complex issues involved.

SDA addresses four themes: looking after people; taking the long-term view; taking account of the social, economic, environmental and cultural effects of our decisions; and encouraging participation and partnerships. Its programme of action aims: to make adequate, clean freshwater available for all; to ensure the delivery of energy services to all classes of consumer in an efficient, fair, reliable and sustainable manner; to ensure that cities are healthy, safe and attractive places where business, social and cultural life can flourish; and to ensure all children and young people have the opportunity to participate, to succeed and to make contributions that benefit themselves and others, now and in the future.

The Tertiary Education Strategy

The TES is concerned with a wide range of post-school education and training and includes universities, polytechnics, government programmes and industry training organisations. Like GIF, TES is not a rigid strategy but a flexible framework to develop better tertiary education outcomes as well as a mechanism for steering education providers. It recognises that its effective implementation will require partnerships between government and a wide range of stakeholders, including the education sector, together with regions, industries and communities. Successful implementation will also require co-ordination across a number of government portfolios, departments and agencies, particularly between Education, Research, Science and Technology, Social Development, Health, Maori Affairs, Pacific Island Affairs, Economic Development, Labour and Employment.

TES sets priorities for tertiary education, including links with other relevant government strategies. One dimension of TES is concerned with strengthening research, knowledge creation and uptake for the knowledge society. It recognises that research and innovation are key drivers of modern economies, and that the broader application of new knowledge will enable the achievement of social, environmental and infrastructural goals.

GIF and SDA and the shaping of priorities

Both GIF and SDA affect priorities across a range of policy areas. Consequently, they link priorities for innovation policy with priorities for other policies. This ensures coherence between innovation policy and other policies that are not exclusively innovation-focused.

In policy terms, implementing GIF and SDA is a very important challenge because it will help ensure horizontal policy coherence across economic, social and environmental policy domains. Horizontal coherence is implicitly desired since the government seeks to achieve an inclusive, innovative economy for the benefit of all.

GIF is not exclusively concerned with innovation; for example, it is also concerned with macroeconomic settings. Similarly, innovation policy priorities are not exclusively focused on economic growth. Better health, improved understanding of culture, social development and enhancing the environment are other policy priorities for innovation.

SDA shapes the way policy decisions are made. Its focus is on sustainability[19] and positive outcomes over the long term, not only in economic, but also in social, environmental and cultural terms. SDA seeks to strengthen government operations by

applying a set of guiding objectives and principles across the government sector. In this effort, the government seeks a partnership with other sectors and enterprises. SDA complements GIF. It aims to ensure that the quality and durability of economic growth improve the socio-economic well-being of all New Zealanders and the environment, now and for the future.

Co-ordination and learning

While the GIF, SDA and TES frameworks originate from the government, they seek widespread participation and co-ordination of all stakeholders, with a significant amount of consulting and learning among all participants.

For the GIF framework, the government commissioned taskforces led by the private sector to report on ways to enhance innovation across their respective sectors. The government weighed the recommendations, assessed its current policy initiatives and in some cases implemented new policy to support the taskforces' recommendations.

This section describes the co-ordination of public and private views, and initial learning from the process. It also outlines the government's response, encapsulated in specific action-oriented initiatives, funded through the annual budgets. It concludes with an observation, in a regional development context, that autonomy, capability and scale are key challenges for innovation policy implementation.

In summary, the process led to sector-specific growth strategies. This demonstrated that the private sector had an explicit role to play in strategic decision making on the future of innovation in New Zealand. Subsequently, the government has supported industry-led bodies that oversee the future development of the relevant sectors.

The GIF taskforces and the taskforce reports

Consistent with a GIF theme to strategically focus resources in important sectors, the government established four private sector taskforces in May 2002 to develop sector-specific strategies in biotechnology, information and communication technologies (ICT), screen production and design. These sectors were chosen for their high growth potential and because they have horizontal-enabling impacts across the economy. The rationale for focusing resources was to create critical mass, scale (in order to compete globally) and specialisation.

The taskforces were asked to report to ministers on the actions needed to stimulate growth in their respective sectors and how to optimise the multiplier effect and productivity gains of each sector as a horizontalisation enabler. While their recommendations were sector-specific, common themes that emerged for improvements to the innovation system included the need for: stronger networks; improved evaluation statistics and performance measurement; greater public awareness of the sectors; more skilled workers, both present and future, with greater emphasis on professional training in commercial and entrepreneurial skills; access to finance; and easier regulatory compliance.

The government's response to the taskforces' reports, together with its existing policy initiatives, established a comprehensive portfolio of innovation policy across many policy areas. The response envisaged substantial co-investment and collaboration of public and private sectors.

Representation in the GIF taskforces

In general, taskforce members were typically regarded as *i)* leaders in their respective industries; *ii)* strategic thinkers, focused on future trends and international opportunities; *iii)* experienced business people with an understanding of innovation and business growth processes; and *iv)* people who appreciate the wider cross-sectoral significance of their respective industries. It is clear that the taskforces were to be driven by private-sector actors, rather than through a public-private mix.

The taskforce on the biotechnology sector reflected the composition of the emerging biotechnology sector, with a strong focus on international business acumen. The ICT taskforce was drawn from people in the private sector with strong commercial experience and a track record of ICT business development. Membership in the design industry taskforce was drawn from the principals and senior executives of design-focused companies and the principals of leading design houses. The design schools were also represented. Members of the screen production taskforce came from the private and state-owned enterprise sector and included the heads of all the leading production houses in the NZ film and television industries and the chairpersons of the post-production, independent film and commercials industry groups. Maori language film production and broadcasting production interests were also represented.

The taskforces' mission[20]

In addition to looking at vertical growth potential, the taskforces were asked to recommend ways to increase the horizontal-enabling impacts of their respective industries across the economy. While screen production, ICT and biotechnology looked at this issue, their reports focused mainly on ways to maximise vertical growth of the sectors. The design strategy, on the other hand, is entirely about the horizontal impact of design, and is directed at significantly increasing the use of design by New Zealand businesses in general to create sustainable competitive advantage. For screen production, the reported horizontal impacts were largely intangible and said to revolve around raising the profile and enhancing recognition of New Zealand internationally (with flow-on benefits for instance to tourism) and knowledge about themselves among New Zealanders.

With ICT, the government has implemented a wide range of initiatives in recent years, directed at supply and demand for ICT, including the e-commerce and e-government strategies and Project Probe (regional broadband rollout). An important issue for the taskforces was whether *additional* policies were required to build on these initiatives, in particular to maximise potential productivity gains.

While the biotechnology taskforce noted the potential productivity gains that could be realised by applying biotechnology to primary production and processing industries, their proposed framework and roadmap of actions did not focus on this horizontal-enabling aspect. Although not a taskforce, the GIAB commissioned a report entitled *Contribution of the Land-based Industries to New Zealand's Economic Growth*, which proposed that New Zealand's success in biotechnology would come from leveraging knowledge and critical mass in the existing industrial base.

What the taskforces found

A set of common themes emerged from the issues raised in the individual taskforce reports. These themes mirror the GIF themes of: *i)* strengthening the economic foundations; *ii)* enhancing innovation; *iii)* supporting global connectedness; and *iv)* increasing skills and talent.

The emphasis on the role of networks in underpinning growth is arguably the most significant outcome of the taskforce projects. This re-emphasises the government's message of greater connectivity between the private sector and the sources of public knowledge, skills and intellectual property. All of the taskforces highlighted the need for clusters and strengthened networks: *i)* within the sector; *ii)* between the sector and government; *iii)* between the sector and education providers; and *iv)* with better linkages nationally and internationally.

All of the taskforces proposed establishing an industry-governed body to oversee the implementation of their sectoral growth strategies and sought funding from the government to assist in establishing these entities. The industry bodies are important from two perspectives: the need to develop co-ordination and leadership capability in these emerging sectors, and the intended focus of the industry bodies on supporting their entrepreneurs and driving the achievement of growth targets.

The taskforces recognised that businesses need to adopt a global perspective early in their development. They highlighted the need for better-equipped and commercially oriented managers with the appropriate skills to "go global". In addition, a robust global network was seen as necessary to stimulate the flow of international investment and to achieve critical mass and world-class specialisation.

The ICT and biotechnology taskforces placed high priority on improving the alignment and timeliness of statistics for their sectors. In particular, they recognised the need to measure inputs and outputs in order to monitor progress towards their growth targets and to highlight areas of concern that could be addressed by government and/or industry sector action.

Greater public awareness of the industry sectors and their contribution to economic growth was called for. Suggested action included actively raising business awareness of the role of design in innovation, increasing public understanding of biotechnology, and promoting ICT as a rewarding career to secondary school students.

All taskforces saw the need for an appropriately educated and skilled workforce to fill the jobs that exist and will be created. They recommended that tertiary education providers improve their co-ordination with industry sectors to ensure that they are producing appropriate numbers of graduates with relevant skills for industry.

Several taskforces found that tertiary education providers were not producing enough graduates with the quality or quantity of skills required to meet their needs. All of the taskforces identified the need for more commercial and entrepreneurial skills in order to ensure that more companies can become successful global enterprises. They placed high priority on active development of commercial and entrepreneurial skills among decision makers in business through greater emphasis on business skills in professional training, for example through applied courses, mentoring and other knowledge-sharing mechanisms.

Immediate and potential future gaps in the workforce were identified by some of the taskforces. For example, critical skills shortages currently exist in electronics and production engineering in the ICT sector. Recruitment from overseas was advocated by the ICT sector, while the biotechnology sector identified a gap in the current funding sources available to attract and retain the best talent, and sought financial incentives to help facilitate New Zealand's chances in the global biotechnology skills market.

The taskforces called for research on future skills requirements and availability within their sectors to enable both the industry sectors and the government to be more proactive in responding to issues regarding the availability of appropriate skilled resources within the sectors.

They also called for modifications to tax laws and compliance regulations to enable easier access to finance and global connections, as a way to retaining and attracting key talent and removing barriers to rapid growth. There was a call for simplicity and transparency in the tax area as well as changes that would assist in facilitating the rapid growth of New Zealand-based companies.

The government's response

The taskforces helped to increase engagement between the private sector and the government. Their reports were an invaluable roadmap for use by government and industry to strengthen the sectors and form active economic development policies. As well, they acknowledged the central role of the industry in the success of the growth strategy.

Many of the taskforces' recommendations were already being addressed with existing and planned government work programmes. This meant, in some cases, endorsement of the policy direction and, in other cases, new policy directions.

Since 2000, the government has given effect to GIF through a number of new policies and programmes in annual budgets. Many of these have benefited greatly from the impetus provided by the taskforce reports; these include initiatives to help clarify the taxation regime and to accelerate commercialisation by public institutions. A summary of these can be found in a publication entitled *Growth through Innovation: Progress to Date*.[21]

Horizontal and vertical co-ordination – the case of innovation in regional development

It is useful to conclude this chapter with a report on challenges for implementing innovation policy in a regional development context. Horizontal coherence and vertical coherence and their role in enhancing innovation policy are demonstrated through the major regional initiatives (MRIs). MRIs are set in the context of regional development programmes called regional partnership programmes (RPPs). They typify the government's active role in the innovation system. New Zealand Trade and Enterprise funds activities that build the economic capability of New Zealand regions. Through the regional partnership programme for regional development, it funds regional development in three stages: strategic planning, capability building and major regional initiatives.

The MRIs are intended to build the innovative capacity of regions in order to enhance economic growth in the regions. Each initiative is funded up to NZD 2 million. Funding is for specific initiatives and MRIs connect firms, tertiary institutions, research institutions and regional government through partnerships. Examples of MRI themes include: tourism, seafood, broadband, film and wood processing.

After two years of programme experience the government reviewed the RPPs and the MRIs (see *www.med.govt.nz/irdev/reg_dev/rpp/final/final.pdf*). A number of general observations provide valuable insights into the coherence of national innovation policy when implemented at regional level. The review concluded there was a role for central government in co-ordinating policy implementation. For example, given New Zealand's size, geographically dispersed population and many small firms, the central government may have a role in co-ordination of interdependent economic development activities and processes. At the regional level, problems of size and distance from major markets are also a concern (paragraphs 45 and 46 of the review).

The review found that the RPP is delivering regional outcomes on national policies (vertical coherence) by enabling local (horizontal) co-ordination addressing the collaboration and co-ordination of successful regional economic development (paragraph 55). The pilot evaluation showed both a strategic regional focus (vertical coherence) and increased collaboration between groups (horizontal coherence) on regional projects (paragraph 57).

In respect of the MRIs, a continuing tension was observed between "bottom-up" processes around development of a MRI project and national economic development objectives (*e.g.* alignment with GIF sectors) (paragraph 76). The review concludes that in the long run, more autonomy at the regional level may be appropriate, but this has to be carefully balanced with existing capability and scale. In many respects, the three challenges of autonomy, capability and scale reflect important challenges for the coherence and governance of innovation policies across other policy domains.

Conclusions

It is useful to see the common findings of the sector taskforces as lessons about the innovation system. These can be placed in an historical and cultural context. If the overarching frameworks are to be effective in helping the innovation system adapt and change, they should address the lessons learned in addition to other issues. This section looks at the frameworks in this way, in particular the GIF, and draws some conclusions about their potential to enhance governance of the innovation system.

All taskforces emphasised needs for: clusters and strengthened networks across public and private sectors; an industry-led body for implementing sector growth strategies and fostering leadership; capable commercially oriented managers with appropriate skills to participate globally; an appropriately educated and skilled workforce to fill the jobs that exist and that will be created; and education providers that co-ordinate with industry.

These shortcomings arose in part from the 1980s reform and may have existed earlier. The policy paradigms of that period limited public policy action to creating supportive macroeconomic and microeconomic settings for growth. Despite the resulting successes, the reforms contributed to: *i)* changes in the ways public research organisations interacted with other enterprises; *ii)* a market-failure policy paradigm for government participation in the innovation system; *iii)* minimal provision of programmes to support business development; *iv)* a laissez-faire approach to developing connections between entities such

as firms and education providers; *v)* education providers without a shared strategic direction.

In some respects the government's GIF framework remedies these shortcomings in the innovation system. It explicitly recognises that productivity gains for the economy and society can be expected from harnessing innovation. The innovation system is therefore a prime instrument for enhancing economic growth. Policy to enhance it is properly seen as an active and integral part of the economic growth process. In this respect, GIF sets a direction for policy.

The GIF framework is active across diverse long-term and short-term policy areas. It recognises the need for policy action across public and private sectors and for these to engage in a partnership for action. Such collaboration is also intended to develop a shared understanding of strategic directions for public policies and of investment decisions by public and private enterprises. This has resulted, for example, in determining a focus for GIF, initially on key industry sectors. To enable this collaborative approach, new institutions have been created, such as NZTE, which fosters initiatives such as clustering of existing firms, incubating new firms, supporting high-growth firms and supporting regional growth with innovation initiatives. The style of public management that seeks greater integration of policy development and implementation is conducive to such collaboration. The GIF framework thus facilitates participation and co-ownership in innovation outcomes.

Under the Tertiary Education Strategy and the Strategic Development Approach, publicly funded agencies now seek strategies targeted at meeting the expected future demands of industry and the community.

By setting directions and enhancing collaboration, all strategic frameworks, like GIF, seek to improve governance of the innovation system, to help it adapt and change. A further lesson from the regional development case study is that issues of autonomy, capability and scale are likely to be challenges that these strategic frameworks must overcome.

Notes

1. Views expressed are not necessarily those of any government department or ministry. Any errors are attributable only to the author.
2. As compared with the work on national innovation systems which focused on the dynamics of innovation systems.
3. Government strategies, such as the Employment Strategy, and the regional development policies have been emphasising innovative behaviour as important for enhancing productivity.
4. See B. Easton (1997), "In Stormy Seas: The Post-War New Zealand Economy", University of Otago Press, Dunedin, New Zealand.
5. *Ibid*., p. 25.
6. This information is taken from "Economic and Other Ideas Behind the New Zealand Reforms", by B. Easton at *www.eastonbh.ac.nz*; and Reshaping the State, New Zealand's Bureaucratic Revolution, J. Boston, J. Martin, J. Pallot and P. Walsh (eds.), Oxford University Press, Auckland, 1991.
7. Easton opines: "The reforms might be called the application of 'economic rationalism' which Michael Pusey defines as the 'doctrine that says that markets and prices are the only reliable means of setting a value [for public purpose] on anything, and…that markets and money can always, at least in principle, deliver better outcomes than states and bureaucracies'".
8. See note 6.
9. See *www.gif.med/govt.nz*
10. Through the government's Employment Strategy and, more recently, through workplace productivity initiatives, labour policy is also incorporating innovation policy.
11. This is often reflected in low R&D intensity for New Zealand, but high productivity gains.
12. See "R&D in the Economy", *www.morst.govt.nz/?CHANNEL=POLICY+DISCUSSIONS&PAGE=Policy+discussions*
13. Knuckey *et al*. (2002), "Firm Foundations", Ministry of Economic Development, New Zealand.
14. Research associations are funded by the private sector and the community. See *www.morst.govt.nz.*
15. The New Zealand pastoral farming sector, for example, shows many desirable features of innovation systems – high absorptive capacity, high rates of innovation, sophisticated technology learning systems, rapid diffusion of new knowledge, and widespread use of benchmarking.
16. MAF (2003) "Contribution of the Land-based Primary Industries to New Zealand's Economic Growth", p. 5, Ministry of Agriculture and Forestry, Wellington, New Zealand.
17. The principles of the Treaty of Waitangi are largely about a "partnership" approach to social and economic development between the indigenous Maori people and other people.
18. Horizontal government policy frameworks exist for other priorities, such as reducing inequalities in social sector policies.
19. Sustainable Development for New Zealand (2003), Department of Prime Minister and Cabinet, p. 9.
20. *www.med.govt.nz/irdev/econ_dev/growth-innovation/overview-cross/cabinet/overview/index.html*.
21. Ministry of Economic Development, February 2005, Wellington, New Zealand.

Chapter 11

GOVERNING INNOVATION POLICY: THE AUSTRALIAN EXPERIENCE

Mel Timpson and Nathan Rudder
Department of Industry, Tourism and Resources

In the last four years, the Australian government has released two major statements on innovation, *Backing Australia's Ability: An Innovation Action Plan for the Future* (2001) and *Backing Australia's Ability: Building Our Future through Science and Innovation* (2004). These statements are the Australian government's strategies to promote three key aspects of the innovation process, namely, research and development (R&D), commercialisation and skills development. These statements are used to showcase Australia's advances in the area of innovation policy and outline the government's future strategy for facilitating innovation in the Australian economy.

This chapter discusses how Australia's economic and political structures have shaped, and continue to shape, innovation policy. It examines the influence of past science and industry policies on current innovation policy. The horizontal and vertical integration of Australia's innovation policy is addressed, as well as the challenges that face integration of innovation policy in view of the nature of Australia's political structure.

The Australian economy and political structure

Overview

The Australian economy has enjoyed a long period of stable growth. The OECD has stated:

> "In the last decade of the 20th century, Australia became a model for other OECD countries in two respects: first, the tenacity and thoroughness with which deep structural reforms were proposed, discussed, legislated, implemented and followed up in virtually all markets, creating a deep-seated "competition culture"; and second, the adoption of fiscal and monetary frameworks that emphasised transparency and accountability and established stability-oriented macro policies as a constant largely protected from political debate. Together, these structural and macro policy anchors conferred an enviable degree of resilience and flexibility on the Australian economy. The combination resulted in a prolonged period of good economic performance that shrugged off crises in its main trading partners as well as a devastating drought at home. The short-term outlook is for continuing strong growth of productivity and output, low inflation and budget surpluses accompanied by tax cuts." (OECD, 2004)

The Australian government continues to design policies to support and maintain this positive economic environment, accounting for both the advantages and disadvantages of the Australian economic context.

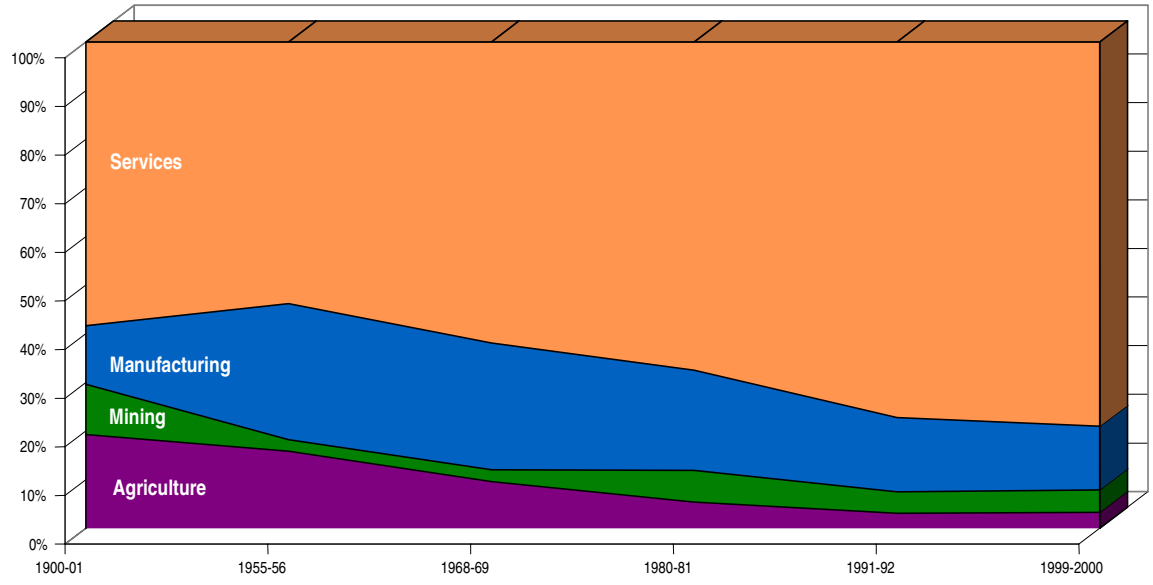
The economic context

Australia is a small country (19.7 million people), with a relatively isolated domestic market (Japan, the largest export market, is over 7 000 km away). The cost of trading with major international markets can be a key barrier for Australian businesses. Scale, visibility and remoteness also affect Australia's capacity to attract foreign investment, including R&D investment by large international companies (Australian Government, 2003, p. 2).

Industry structure in Australia is characterised by a large number of small to medium-sized enterprises (SMEs). Approximately 96% of all Australian businesses are "small". This affects innovation policy, as there is less R&D in small businesses than in larger companies. For example, 20 large multinational companies have a company R&D budget larger than total business expenditure on R&D in Australia (Australian Government, 2003, p. 2).

Figure 11.1 shows the composition of Australian GDP over the last century. As can be seen, the greatest growth has occurred in the services sector.

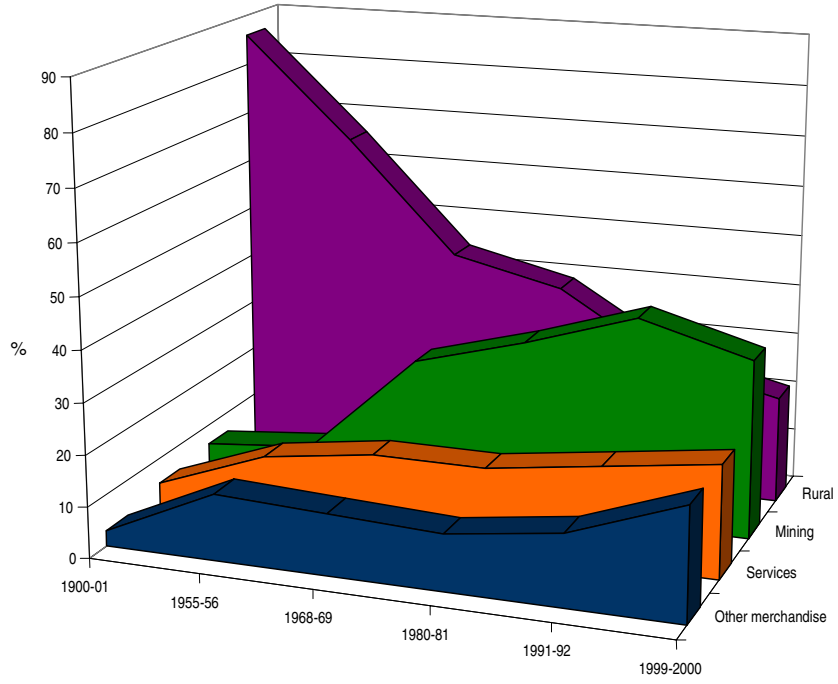
Figure 11.1. Composition of Australia's GDP, 1900–2000



Source: Australian Government (2003), p. 29.

Figure 11.2 shows how the composition of exports has changed over time. Australia has seen a decline in the proportion accounted for by rural exports, but still relies on the primary sector for export income.

Figure 11.2. Composition of Australia's exports, 1900–2000



Source: Australian Government (2003), p. 30.

According to the Australian Bureau of Statistics, using different measures from Figure 11.2, the most significant exporting industries in 2004 are manufacturing (40% of the value of goods exports), mining (31%) and wholesale trade (20%).[1] While manufacturing is the largest export sector, reliance on the primary sector, especially mining, is still high, as simply transformed manufactures comprise a significant part of manufacturing exports (*e.g.* metals). While elaborately transformed manufactures have grown rapidly in recent decades, growth has been from a low base.

Government policy has been to encourage leveraging from existing strengths in these traditional industries and to develop new high-profit, high-growth industries in order to support a higher Australian standard of living (Australian Government, 2003, p. 2).

Political structure

Levels of government

There are three levels of governance in Australia. The Australian Constitution (section 51) specifically outlines those areas for which the Australian government has responsibility. Powers that do not fall within these areas remain vested in the parliaments of the six states and two territories that make up the Commonwealth of Australia. Each state and territory has a parliamentary structure generally similar to that of the Australian government and each develops its own policies for governance. Where Australian government and state laws are inconsistent, the Australian government takes precedence to the extent of the inconsistency (section 109).

The third level of government is local government. This is established through state government legislation and as such, its powers and responsibilities vary according to jurisdictions. Typically, local government policy relates to building regulations for domestic dwellings, municipal services, etc.

At the federal level, Australia has adopted a Westminster style of government comprising the executive, the parliament and the judiciary. Its model of governance is broadly similar to that of the United Kingdom, with an executive accountable to the parliament. Australia has two houses of parliament, the House of Representatives and the Senate. The judiciary interprets the laws made by the parliament as well as the common law formulated by the courts. Government is formed by the party/coalition with a majority in the House of Representatives, and the leader of this party/coalition is generally the prime minister.

Executive power is formally vested in the Queen and exercisable by the governor-general. However, in most instances the governor-general is bound to act on the advice of current ministers of the government. Hence, in practice, the prime minister and his/her ministers exercise executive powers. The Cabinet is the key decision-making body of the government and comprises the prime minister and senior ministers. The prime minister chairs the Cabinet and most of its committees.

Ministries and policy portfolios

Ministers and parliamentary secretaries are appointed under the Australian Constitution to administer departments. While all ministers and parliamentary secretaries are members of the ministry, they do not have the same level of responsibility. The portfolio minister is the senior minister and he/she generally determines the division of responsibilities within the portfolio. The portfolio comprises a government department (which usually shares the name of the portfolio) together with separate agencies that have a specific focus on matters relevant to the portfolio. As in the United Kingdom, most portfolios have junior ministers and parliamentary secretaries with responsibility for particular areas of a portfolio. The composition of portfolios has varied over time depending on the preferences of the prime minister.

There are three "central" departments within these portfolios; Prime Minister and Cabinet (PM&C), Treasury and Finance and Administration. PM&C is the central policy agency that co-ordinates advice to the prime minister and to the Cabinet across government. The Treasury has broad responsibility for economic policy and revenue (including taxation), while the Department of Finance and Administration has broad responsibility for government expenditure and the operations of the Australian government.

These central departments are involved in the final stages of all policy development, and are sometimes involved at an earlier stage. As these departments are led by the prime minister, the treasurer and the minister for finance and administration, their involvement in policy is critical. They have a broad perspective with respect to the government agenda, and when assessing policy proposals they ensure that the policies complement wider government policy objectives and are consistent with fiscal and economic priorities, etc.

In the general area of innovation policy, most policy development has been undertaken by portfolios with specific innovation-related policy responsibilities. In *Backing Australia's Ability: Building Our Future through Science and Innovation* (2004) (henceforth "2004 Innovation Statement"), these were primarily the Departments of Education, Science and Training; Industry, Tourism and Resources; and Communication, Information Technology and the Arts. The Departments of Health and Ageing and Agriculture, Fisheries and Forestry were also involved.

The horizontal interaction between all these departments of the Australian government occurs through formal and informal mechanisms. Some of the more formal mechanisms are ministerial level committees, such as the Science and Innovation Committee (see below). Less formal mechanisms include interdepartmental committees in which members from each department discuss in an open forum issues surrounding innovation policy development and implementation. Also, combined taskforces can be established to undertake across-government activities, as occurred for the mapping of Australian science and innovation in 2003. This research led to a report (Australian Government, 2003), which assisted in the development of the 2004 Innovation Statement and continues to contribute to innovation policy development. Informal mechanisms are relationships among officers in the various departments which enable telephone calls and e-mail to become effective means of communication.

To date, innovation policy has been developed by each government (Australian and state/territory) relatively independently. However, there are formal and informal structures for liaison between the levels of governments on innovation policy and these are increasingly used (see below).

The electoral cycle is very important in policy development. The Australian government is elected for three years,[2] but the date of elections is not fixed and is chosen by the current government. Thus, the average duration of Australian governments is less than three years. This cycle can directly affect the formulation of policies as elections may alter the direction of a policy as a result of input from the campaign process.

There is no provision in the Constitution on how policy is to be implemented in Australia. Instead, Australia takes a flexible approach to policy implementation, allowing for many different approaches. Implementation can occur through legislation, ministerial guidelines, regulations, an information campaign or any combination of the above.

Recently the implementation of some programmes has been co-ordinated through the establishment of a specialised implementation team within the central department PM&C. This team influenced the implementation of the 2004 Innovation Statement and is discussed in more detail below.

History and process of policy development

Overview of the history of innovation policy development in Australia

The history of Australian government support for science, technology and industry is discussed as background to the development of its current innovation policy.

Science and research institutions

The Australian government has a long history of involvement in science research. Australian government commitment is demonstrated through its support for university re-

search, the establishment and ongoing support of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other public research organisations.

CSIRO is a large, government-funded institution that conducts research across a broad range of industry and scientific areas. In 1916, it began as the Advisory Council of Science and Industry and was the first step towards creating a "national laboratory" to give scientific research a national standing.

The CSIRO has changed over time. Its initial focus was agricultural industry, but it now has 20 research areas, including agribusiness, health, environment, natural resources, ICT, manufacturing, services, sustainable minerals and energy. It is a key institution in the innovation system and a large, multidisciplinary R&D organisation distinct from the university system. There are many links between CSIRO and industry, and while CSIRO continues to promote transfer and use of its public good research, the organisation now has a stronger focus on commercialisation of its research.

The Australian research system includes a number of medical research institutes, often associated with universities, and public research institutes established and funded by state governments.

Science policy has had a presence in various government structures. For example, a Department of Science and Education was established in 1966. Since then, a specific science policy function has continued to exist in various forms.

Policy relating to research in the higher education sector has traditionally been separate from science policy and located in the education portfolio, which is responsible for university teaching and research policy.

The government has also maintained high-level advisory committees that provide information and advice on the advancement, development and practical application of scientific knowledge.

The Australian Science, Technology and Engineering Council (ASTEC) was established as a statutory authority in 1979. ASTEC provided independent advice to the government on a wide range of policies and programmes related to science and technology, among others on: the advancement of scientific knowledge; the development and application of science and technology to promote the national well-being; the adequacy, effectiveness and overall balance of scientific and technological activities in Australia; the identification and support of new ideas in science and technology likely to be of national importance; the practical development and application of scientific discoveries; the fostering of scientific and technological innovation in industry; and the means of using resources more efficiently through science and technology.

ASTEC was empowered to operate by conducting inquiries, gathering information, engaging consultants, appointing committees and producing reports for the government. Its particular advantages were its independent status, its broad and longer-term perspective and its links to the science and technology community and to industry.

Alongside ASTEC, the Science and Technology Statement in May 1989 established: the Prime Minister's Science and Engineering Council (PMSEC); the Co-ordination Committee on Science & Technology (CCST); and the position of chief scientist, separate from the chair of ASTEC. All these entities were initially located within the Prime Minister's Department, but in 1996 they were transferred to the then Department of Industry, Science and Technology. At that time, the chief scientist position became part-time and

was combined with that of chair of ASTEC. In 1998, ASTEC was abolished, and the other two entities have continued.

In 1997, the PMSEC became the Prime Minister's Science, Engineering and Innovation Council (PMSEIC). It is a high-level committee of ministers and other representatives, chaired by the prime minister. It discusses major issues for science and innovation and it meets twice a year with the following terms of reference:

- To advise on important issues in science, technology, engineering and relevant aspects of education and training, including as they relate to economic growth, employment creation, the development of new industries and the sustainable development of new resources.
- To examine the contribution of science, technology and engineering to the innovative capacity and economic and social development of Australia.
- To enhance awareness in the community of the importance of science, technology and engineering for Australia's economic and social development.
- To examine Australia's science and engineering resources and the effectiveness of their organisation and utilisation.
- To examine Australia's science and engineering infrastructure and the effectiveness with which it achieves the application of science and technology in the economic and social development of Australia.[3]

When the prime minister announced the new council, he stated:

> "To underpin its advisory role, the new Council will be given resources to examine Australia's science and engineering capabilities and the effectiveness of their organisation and utilisation. The non-ministerial members will constitute a standing committee of the Council, and will oversee and contribute to studies and research aimed at improved understanding on these issues.
>
> "New research work will be initiated by the Prime Minister's Science, Engineering and Innovation Council and carried out by its members. The government recognises the value of a strong source of independent advice on issues in science and technology, and the standing committee will retain ASTEC's capacity to undertake work on its own initiative, as well as work selected by the government."[4]

The PMSEIC continues today as described above. Projects are nominated by members of PMSEIC; working parties are established to undertake the project. They report at the following PMSEIC meeting, usually six months later. The outcome of each project is primarily the sharing of science and innovation developments to a high-level information-sharing forum.

The Co-ordination Committee on Science and Technology is a discussion forum for Australian government departments and agencies with interest and expertise in science and technology (S&T). It facilitates networking and the exchange of information and promotes strategic thinking and co-ordination of activities in S&T areas. It meets three times a year.

Government financial support for science and research

Funding support provided by the Australian government for science and innovation is shown in Figure 11.3. Most is for research in universities (higher education research). Major federal research agencies include entities like the CSIRO and the Australian Nuclear Science and Technology Organisation (ANSTO). S&T support includes competitive grants for health and medical research through the NHMRC, competitive grants for university research through the Australian Research Council, funding for co-operative research centres, and grants for rural-related research and development. Innovation support is addressed in more detail below.

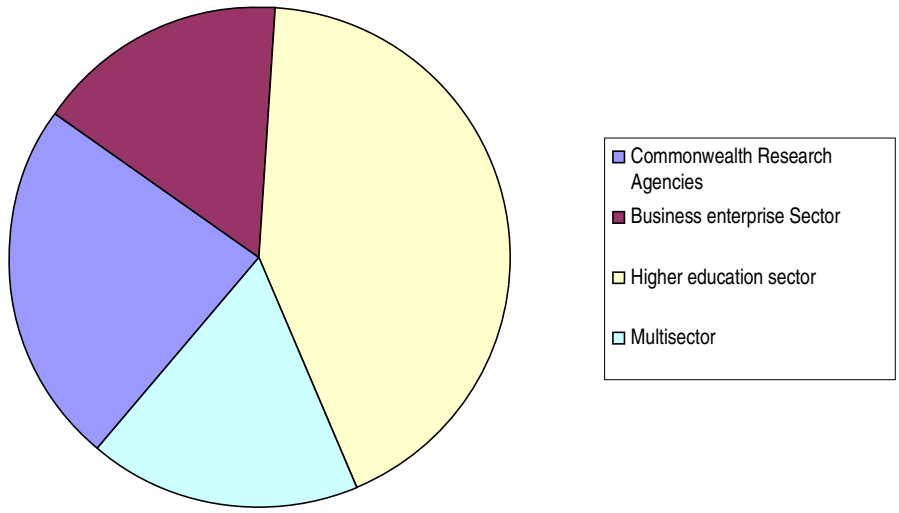
For 2004-05, total Australian government support for science and innovation is AUD 5 342 million. Table 11.1 shows the distribution of the Australian government funding support according to sectors of performance.

Table 11.1. Australia government support for science and innovation, 2004-05

Intramural expenditure on science and innovation		
Major federal research agencies	AUD 1 261.8m	24%
Extramural expenditure on science and innovation		
Business enterprise sector	AUD 872.6m	16%
Higher education sector	AUD 2 275.0m	43%
Multisector	AUD 932.6m	17%

Source: Australian Government 2004-05 Science and Innovation Budget Tables, DEST.

Figure 11.3. Government support for science and innovation



Source: Australian Government 2004-05 Science and Innovation Budget Tables, DEST.

Industry

For much of the 20th century, Australia had an interventionist industry policy. The government used import tariffs, quotas and subsidies to protect Australia's industries. This protectionist policy regime assisted the development of Australian industry in the early part of the century and continued after World War II (Brennan and Pincus, 2002).

The later part of last century saw a shift in economic theory to market-based economics. Multilateral agreements such as the GATT (General Agreement on Tariffs and Trade) and later the WTO (World Trade Organisation) started a shift away from protectionist policies towards the adoption of free markets. Australia, however, retained protectionist policies, and by the early 1970s had rates of protection as high as or higher than those of any other developed country (Brennan and Pincus, 2002). This resulted in higher-priced imports, uncompetitive domestic markets, and substantial pressure from other GATT countries that had begun to reduce their tariffs.

In 1973, the government introduced a 25% across-the-board tariff cut. Job losses in the more heavily tariffed industries were blamed on the tariff cut and made the tariff reform programme unpopular. Further significant changes to Australian industrial policy did not take place until the 1980s when the government introduced a number of microeconomic reforms.

Although there was a consistent policy direction, tariff reform took place on a largely sectoral basis. This allowed a measure of flexibility in dealing with the issues faced by different industries in Australia, while still pursuing an overall policy direction. Alongside the tariff rollbacks, the government instituted a number of other micro-economic reforms, most noticeably in the areas of the labour market, financial markets, infrastructure, taxation and competition (Department of Foreign Affairs and Trade, 2000). These reforms facilitated the efficient production of goods and services in the economy, making businesses more competitive both domestically and internationally.

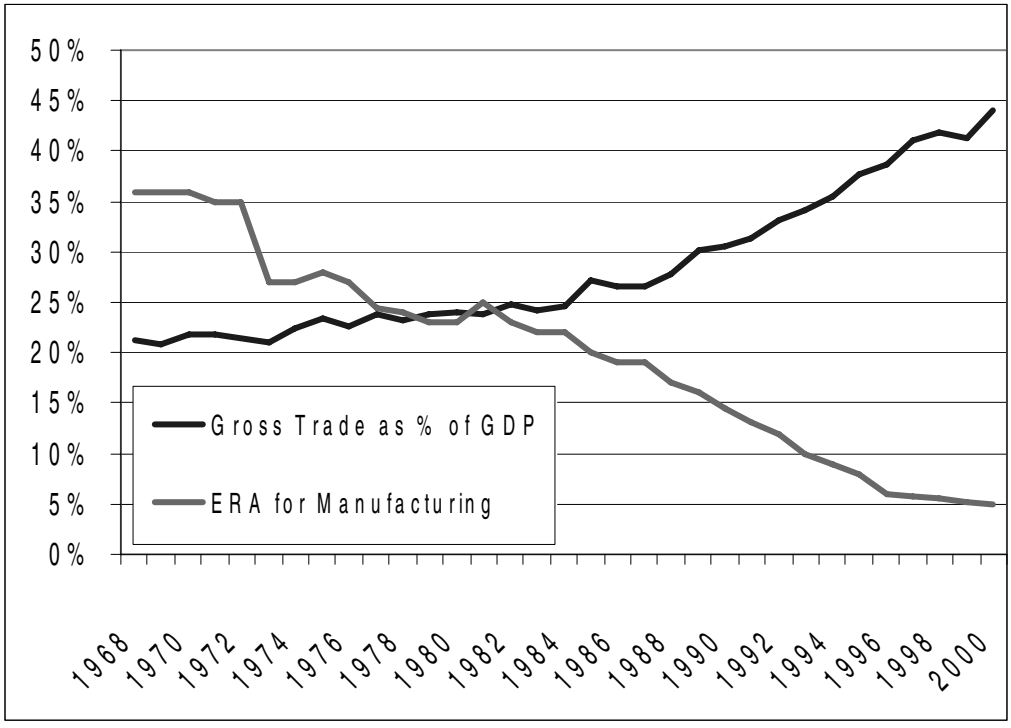
As noted above, the Australian market is relatively isolated. The government has established an agency, the Australian Trade Commission (Austrade), to assist firms wishing to compete on the international market. It helps companies win overseas business for their products and services by reducing the time, cost and risk involved in selecting, entering and developing international markets.

Figure 11.4 shows the reduction in the effective rate of assistance (the net value of assistance – including tariffs, quotas and other non-tariff barriers – to industry expressed as a proportion of value added by industry). It also depicts the increase in trade that has occurred since Australia adopted a more liberal industry policy.

Significant privatisation and deregulation have also taken place since the 1990s, particularly among government monopolies, in areas such as energy and telecommunications. This structural change also involves removing barriers to competition in areas traditionally owned and controlled by the government.

Currently, Australia has a very open and liberal industrial environment by international standards. Many sectors of the Australian economy that were previously controlled by the government are now privately operated. As Figure 11.5 show, Australia has dramatically decreased its trade barriers over time. In fact, Australia now has lower trade barriers than the United States and the European Union (WTO, 2002, 2004).

Figure 11.4. Effective rate of assistance to industry and gross trade, 1968-2000



ERA = effective rate of assistance.

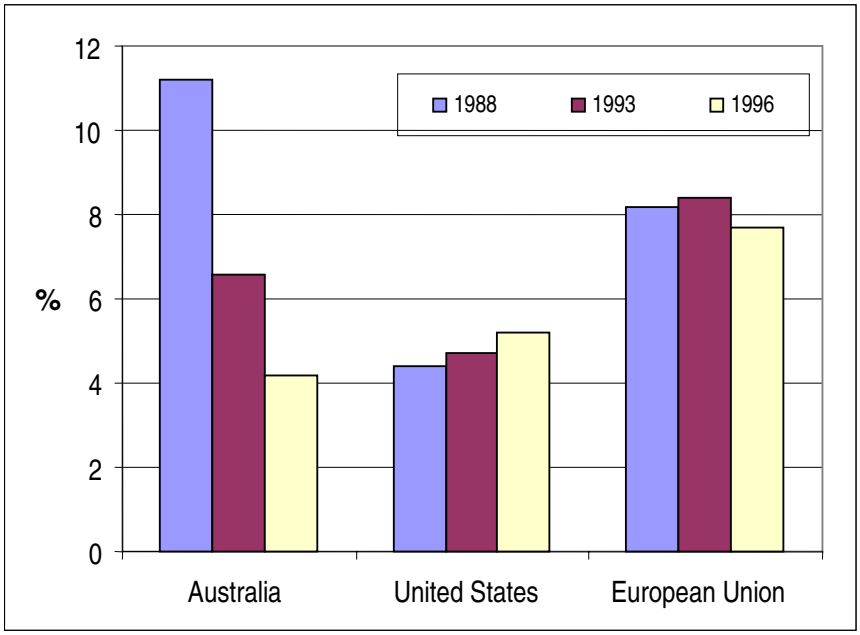
Sources: ABS, Australian System of National Accounts, Cat. No. 5204.0, various years. Industry Commission, Assistance to Agricultural and Manufacturing Industries, Information Paper, 1995. Productivity Commission, *Trade & Assistance Review,* various years.

Australia has consistently experienced strong GDP growth for more than a decade and has successfully weathered both the Asian financial crisis of the late 1990s and the global downturn of the early 21st century. Owing to a successful combination of macro-economic fundamentals, microeconomic reforms and carefully targeted government intervention, Australian industries are well placed to compete in the global marketplace. Innovation by firms will play a role in continuing these successes.

Innovation

Innovation policy has been an explicit element of policy development for at least the last 20 years (the earliest record of a focus on innovation in a portfolio by a senior minister is 1984). Innovation policy was seen as so integral to industrial development that it was a major focus of the industry policy statement of 1997, *Investing for Growth* (Australian Government, 1997). Even though this was an industry policy statement, it was instrumental in developing future innovation policy statements.

Figure 11.5. Australian, EU and US tariff rates, 1988, 1993, 1996



Source: OECD, *Indicators of Tariff and Non-Tariff Trade Barriers*, Paris, 1997.

In developing the *Investing for Growth* statement, three reviews were undertaken on:

- Support for business to stimulate growth: *Going for Growth* (Mortimer, 1997).
- Structural adjustment to capture the most benefit from the increasing ICT sector: "A National Policy Framework for Structural Adjustment within the New Commonwealth of Information" (Cutler, 1997).
- How to position the Australian economy to profit from this ICT growth: *The Global Information Economy* (Goldsworthy, 1997)

While the statement focused on microeconomic reform, consistent macroeconomic management and trade performance, it also placed significant emphasis on innovation. Following implementation of the industry policy statement, the government identified a need for greater emphasis on innovation. In 1998 the government, upon re-election, said it would undertake:

> "A detailed stock take and evaluation of Australia's national system of innovation is required if we are to set the agenda for the future and develop policies to promote higher living standards."[5]

This led to a National Innovation Summit in February 2000, where over 500 representatives from business, research and education, and from Commonwealth, state and territory governments came together for the first time to discuss the Australian innovation system and recommend action to strengthen outcomes. This led to the development of the 2001 *Backing Australia's Ability* Innovation Statement (hereafter "2001 Innovation Statement").

Backing Australia's Ability, 2001 and 2004

The two innovation statements

The two innovation statements arose in quite different ways. The 2001 Innovation Statement began with the setting of the MONIT agenda, and the 2004 Innovation Statement arose from evaluation and learning (see Figure 11.7 below). Both coincided with an electoral cycle, as both were announced early in an election year. This also meant both statements aligned with the budget cycle discussed above.

2001 Innovation Statement

Setting the agenda

The National Innovation Summit in 2000 was the culmination of eight months of lead-up work, involving six working parties responsible for developing material for discussion at the summit. The working parties were titled: Human Dimension; Industrial Innovation; Innovation and Incentives; Institutional Structures and Interfaces; Managing Intellectual Property; and Resource and Infrastructure Consolidation and Co-operation. The working groups consisted of industry representatives, academics/researchers and government agencies. State government representation and consultation across Australia were key features of the process. Never before had such consultation and information collection occurred in the lead-up to science and innovation statements.

Over 150 recommendations emerged from the two-day summit. In response, the prime minister announced the establishment of an Innovation Summit Implementation Group to prioritise the outcomes and to advise government on options available for future policy. The group had a cross-discipline and industry membership.[6]

Concurrent with the activities of the Innovation Summit Implementation Group, the chief scientist (who provides advice on science, technology and innovation issues to the prime minister and ministers) was asked to review the capabilities of Australian science.

These recommendations were assessed by government through a process chaired by the Prime Minister's Department, with the Industry Department playing the lead role and involving other relevant policy departments. The Cabinet agreed on the proposed package, and this led to the 2001 Innovation Statement and a budget of AUD 3 billion, the largest single commitment to innovation by any government of Australia.

The process leading to the 2001 Innovation Statement was unique because all key stakeholders were involved, aware of the importance of strong innovation policy and contributed positively to the process.

Implementation

The 2001 Innovation Statement included the establishment of a Science and Innovation Committee (SIC) to oversee the implementation of the 2001 Innovation Statement. The committee is comprised of: the prime minister; the minister for industry, tourism and resources (formerly the minister for industry, science and resources); the minister for education, science and training (formerly, the minister for education, training and youth affairs); the minister for communications, information technology and the arts; and the minister for finance and administration. The committee's major focus was to oversee the implementation of the programmes in the 2001 Innovation Statement. It did not meet

regularly and its contribution to the 2004 Innovation Statement was overtaken by the normal budget process.

Evaluation

Government programmes have evaluation schedules that are an integral part of programme delivery and are usually identified with pre-determined milestones. In 2003, as part of the lead-up to the 2004 Innovation Statement, most innovation programmes announced in the 2001 Innovation Statement were evaluated.

When the evaluations were completed, the ministers responsible for innovation were asked to collaboratively develop a single package within broad parameters identified by SIC, including proposed funding. This was subsequently considered in the context of the government's 2004 budget deliberations.

2004 Innovation Statement

The timing of the 2004 Innovation Statement provided stability and certainty of funding for research and industry stakeholders (funding for most programmes has been committed to 2010-11). It was specifically designed to build on the 2001 Innovation Statement (*e.g.* research infrastructure), and some specific gaps were addressed, such as commercialisation. Between the two statements, policy responsibility for innovation statements moved from the industry portfolio to the education portfolio.

There was a marked difference in the approach to developing the 2004 Innovation Statement. There was no national consultation or working groups. This was largely due to the relatively short period of time since the 2001 Innovation Statement. Thus, the 2004 Innovation Statement adjusted existing programmes and introduced some new ones, without substantially affecting the themes and outputs of the previous one.

Just prior to the 2004 Innovation Statement, the higher education sector had gone through a substantial policy reform exercise (relating to education rather than research),[7] while industry had been adjusting to a new taxation regime.[8]

Setting the agenda

The 2004 Innovation Statement reflected a number of developments that further defined the direction of innovation policy. The government took the lead in announcing a "mapping" of Australian science and innovation activity in 2002 and several policy reviews:

- Review of closer collaboration between universities and major publicly funded research agencies.
- Evaluation of the knowledge and innovation reforms (these were 1999 reforms to research funding and teaching arrangements in the higher education sector).
- The National Research Infrastructure Strategic Framework[9] (investigation of the research infrastructure).

The review process was somewhat similar to that used for the industry policy statement *Investing for Growth*. It focused on specific topics rather than general consultation. Consultation with the public took place through submissions to the reviews and a number of meetings.

Describing and assessing Australia's science and innovation activities by mapping the strengths, weaknesses, complementarities and areas of possibly greater co-operation between layers of government led in 2003 to *Mapping Australia's Science and Innovation*. The report was developed with some stakeholder consultation including industry, the research communities and state governments (Australian Government, 2003, Appendix 1).

Implementation

In 2003, the Department of PM&C instituted a new approach for the whole of the Australian government under which selected new programmes would develop detailed implementation strategies. This new oversight process was initiated to ensure that programme objectives would be met in a timely and effective way. An important feature of the implementation of all industry innovation programmes is extensive consultation about programme design and pilot testing of new application forms, for example, to ensure that the programme is delivered effectively.

Because departments of the Australian government are all located in Canberra, face-to-face meetings (interdepartmental committees) are easily arranged. This makes possible effective discussions and facilitated the development of both innovation statements. There is also regular interaction with state and territory government bodies involved in innovation policy development. This environment ensures that duplication is minimised and that complementary programmes are managed by the state and territory counterparts.

Stakeholders in the Australian innovation system

Like other countries, Australia's innovation system has a diverse range of stakeholders. Figure 11.6 shows the nature of consultation and government structures involved in developing policy. Important actors in the Australian science and innovation system include nodes of R&D activity, funding bodies, facilitators and regulators.

Figure 11.6 also depicts the organisations that play a major role across both public and private sectors and across Australian government, state and territory jurisdictions. It sets these in the context of a broader set of institutions which underpin science and innovation, namely: product, labour and capital markets that shape demand for science and innovation and influence the capability to supply them in terms of finance and skilled labour; Australia's trade and investment links with the rest of the world; and public awareness and attitudes.

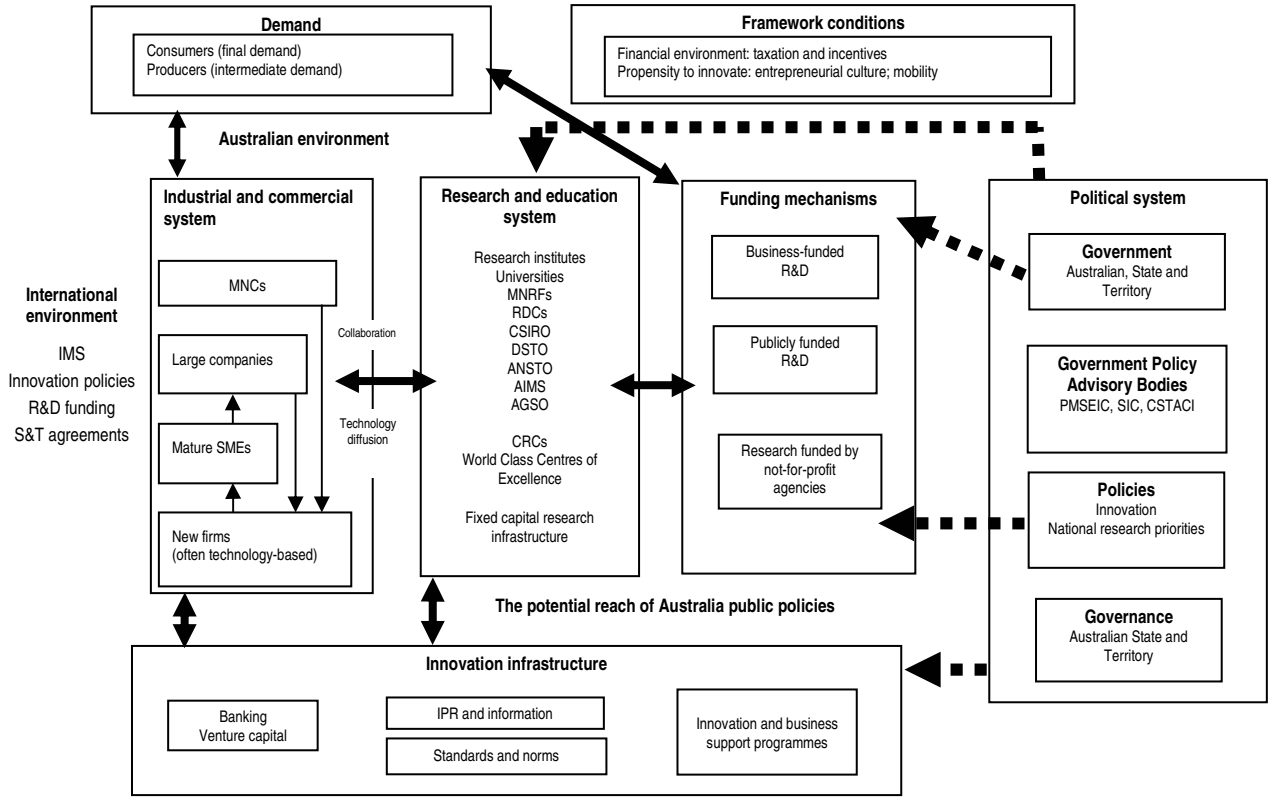
In Australia, research stakeholders, such as universities and public research organisations, have well-organised lobbies and a high level of co-operation that enables them to engage effectively with departments on the policy debate. The active participation of the research sector has definitely influenced the development of innovation policy in Australia.

While industry also has business associations that engage with departments on policy issues, the Australian economy has a large number of small businesses, and it is difficult to present the many and diverse views of these constituencies.

Australian government institutional structures

The Australian government has formal institutional structures. These structures assist in setting the agenda for policy well as evaluating the success of individual programmes and policy objectives.

Figure 11.6. Australia's innovation stakeholders



Evaluation structures

The Senate has an opportunity, twice a year, to ask departments and bureaucrats about the administration of their programmes. It does so through the budget process, as estimates of government expenditure are referred to Senate legislation committees as part of the annual budget cycle. This opportunity to examine the operations of government plays a key role in parliamentary scrutiny. This process involves all Australian government departments. It assists in the vertical integration of policies, as government departments become aware of each other's activities, if they are not already.

In addition to the Senate evaluation process, nearly all programmes have an evaluation schedule built into their design. Most are evaluated every three years, with a focus on whether the policy/programme is still appropriate, whether it has been effective in achieving its goals, and whether it has been delivered efficiently.

As mentioned previously, nearly all programmes delivered as part of the 2001 *Backing Australia's Ability* were evaluated in 2003.

Public/private partnership institutional structures

Publicly and privately funded research institutions in Australia play an important role in developing and implementing innovation policy. For example, the research and development corporations are rural research funding agencies that invest in agricultural R&D. The corporations are funded jointly by agricultural producers through industry levies and the Australian government. This model has been operating since 1989.

Another public/private partnership model used by the Australian government to identify and develop policy for industries is the "action agenda" process. It helps industry and government to work together to realise opportunities and overcome impediments to growth in specific industries. The agendas are driven by industry, with government providing a facilitation role in addressing a range of whole-of-government issues, including innovation, investment, market access and development, regional development, education and training, environmentally sustainable development, workplace relations and regulatory reform. The action agenda process commenced in 1997, and currently 33 agendas have been completed, are operational or in development. There is no single action agenda model. Each is developed in a way that is appropriate to the needs and characteristics of a particular sector.

Once an industry is selected for an action agenda, the Strategic Industry Leaders Group is formed to guide the process and provide strategic direction and input. Work begins on a strategic review of an industry's competitive position in a global context, with its particular strengths and weaknesses as well as opportunities and threats. Working groups then analyse individual issues and develop recommendations on what needs to be achieved to improve business practice and industry competitiveness.

A critical step in each sectoral action agenda is to prioritise the tasks industry and government must undertake to achieve targeted outcomes and assign responsibility for them. Action agendas take a whole-of-government approach and provide a framework for co-ordinating and integrating a range of government policies. Action agendas are not just about identifying problems and opportunities. They seek to develop practical solutions and ensure results are achieved. In general the action agenda development phase aims to be completed within 12-18 months, with an implementation phase of three years to achieve its goals.

State and Australian government infrastructures

As described earlier, the Australian governance system has three tiers. The development of integrated innovation policies has involved consultation with the state and territory governments. This type of integration is vertical, as it is across areas of government.

There are mechanisms for consultation with states and territories through co-ordination forums such as the Commonwealth, State and Territory Advisory Council on Innovation (CSTACI). In 2000, the Council was established by industry ministers across Australia and comprises senior representatives of each Commonwealth, state and territory industry department, and a representative from each state and territory innovation council or equivalent. The Australian government chief scientist is also a member of CSTACI.

CSTACI has the advantage of reducing the burden of physical distance between state and territory governments, as officers meet face to face twice a year to discuss innovation policy. This interaction can lead to less formal mechanisms of co-operation on innovation policy via telephone and e-mail between CSTACI meetings. Experience to date has been very positive about this co-operation and there is anticipation of a more strategic approach in the future.

There is also the Council of Australian Governments (COAG), whose members are the premiers of the state governments, chief ministers of the territories and the prime minister. Its role is to initiate, develop and monitor the implementation of policy reforms that are of national significance and require co-operative action by Australian governments (for example, national competition policy, water reform, reform of Commonwealth and state/territory roles in environmental regulation, the use of human embryos in medical research, counter-terrorism arrangements and restrictions on the availability of handguns).

Issues for COAG may arise from: deliberations of ministerial councils (councils of the Commonwealth and state and territory government ministers); international treaties that affect the states and territories; or major initiatives of one government (particularly the Australian government) that affect other governments or require their co-operation.

Outputs from the statements

The 2001 Innovation Statement included the establishment of new programmes (*e.g.* the Biotechnology Innovation Fund and the World Class Centres of Excellence programme) and the enhancement of existing programmes (*e.g.* co-operative research centres and Australian research competitive grants).

It also initiated new policy development processes (*e.g.* the identification of national research priorities). In the science capability review, *A Chance to Change*, concern was expressed that "Australia cannot be number one in every field, because of its size, but we can expect to have a real impact in a number of fields where we have built up our capabilities" (Batterham, 2000, p. 59).

The development of national research priorities involved consultations with the community. The priorities identified are broad-based, thematic and multi-disciplinary in nature, addressing areas of strength, opportunity or need in Australian research. They contribute to horizontal integration as various initiatives now follow a set of shared objectives. The four national priorities are: an environmentally sustainable Australia.;

promoting and maintaining good health; frontier technologies for building and transforming Australian industries; and safeguarding Australia.

Lessons learned

This section discusses some of the lessons learned, the reasons why Australian policy follows varied development paths, and possible areas of improvement for the future.

Measurement of innovation policy

Mapping Australian Science and Innovation made the following observations:

- Australia makes a significant contribution to world science relative to its size.
- Australia has a solid presence in some emerging science and technology fields.
- Outputs and outcomes from research are difficult to measure but it is clear that the results of public good research are being utilised.
- Businesses have performed well in the take-up of developed technologies, especially ICT.
- ICT investment has been coupled with organisational innovation, especially in large firms.
- Australia has an intellectual property (IP) protection framework which is among world's best practice.
- Universities and government research organisations face a range of IP issues in relation to identifying, protecting and commercialising their research.
- In the business sector, patenting is becoming less important as a pathway to market.
- Collaboration has grown within the research sector and between researchers and business.
- Australia has a base of broad skills for science and innovation.
- Education systems are increasing their focus on developing students' innovation skills.
- In general, Australians have positive attitudes to science and the benefits of science and technology are subject to scrutiny.
- Government-financed expenditure on R&D is high by international standards.
- States and territories have taken a range of initiatives to strengthen science and innovation in their jurisdictions.

The report also identified areas requiring attention, including:

- Business innovation involving R&D and development of new technology remains low by international standards.
- Notwithstanding increased investment by business and government, investment in the development of strategic ICT capability is low.

- Australia's commercialisation record has improved over time, but remains low compared to other countries and is uneven across research sectors.
- Challenges remain in fostering science and innovation collaboration and linkages, especially between publicly funded research providers and industry.
- Australia's research infrastructure is under pressure in terms of investment and maintenance, and in terms of leveraging access to international research infrastructure in an environment of increasing scale, costs and technical complexity.
- There are gaps in data in several areas which need to be addressed to support future policy making.

Some of the areas requiring attention are being supported by the two innovation statements. Because it is only three years since the implementation of the 2001 Innovation Statement, it is too early to expect major changes. Nevertheless some adjustments have been made as a result of the individual programme evaluations undertaken in 2003, and the various reviews to ensure the 2004 Innovation Statement addressed identified areas of ongoing need.

The recent Survey of Innovation in Australian Business (2005) has been a major step in assembling data about innovation activities in business. The 2001 Innovation Statement initiated regular surveys.

With increased focus on implementation, there has been increased attention to the development of key performance indicators for all innovation programmes. These will ensure that the impact of new programmes can be regularly monitored in terms of outcomes. An issue of interest is whether consistent indicators can be identified across the range of different programmes.

Integrated state and Commonwealth policy

Australian state governments operate many innovation programmes. For example in 2000-01 state governments spent AUD 943.6 million on R&D (2.9% of their total tax revenue) and the Australian government spent AUD 1.4 billion (0.8% of its total tax revenue).[10]

Because state governments develop their innovation policies and programmes independently of the Australian government, this might be expected to lead to some duplication. In recent years, a number of states have named chief scientists. However, since the 2001 Innovation Statement, states and territories have been designing their programmes mindful of the Australian government policies. As a result, their programmes address gaps not covered by national programmes, are tailored to fit national initiatives, and/or provide support for their firms and institutions to get better access to national programmes.

There has been a focus on increasing integration of the Australian and state governments in recent times. In 2004, the publication *Connecting Government: Whole-of-Government Responses to Australia's Priority Challenges* emphasised the need to increase links between state and Commonwealth governments. It states that the public "expect government to take full advantage of technology to do business better. There is now more expert and informed scrutiny of government, making the public more quickly aware of any approaches that appear to conflict." This, combined with budgetary pressures, is driving a whole-of-government approach to policy.[11]

Co-operation between and within government at all levels has received high-level recognition. The Secretary of the Department of PM&C, the most senior public servant in Australia, stated in 2003:

> "One of the regular messages that I convey to Australian public servants is that we need to take a whole-of-government approach to public policy issues. On many of the issues we address, an effective whole-of-government approach cannot be limited to Commonwealth agencies but necessarily includes their state and territory counterparts."

Given the success of existing mechanisms in positively influencing innovation policy development, it is likely that in the future, the Australian and state governments will increase liaison and consultation on innovation policy issues. This will be supported by continuing efforts to improve governance structures over time.

Developing the 2001 and 2004 Innovation Statements

In 2001, the Innovation Statement was a bringing together of some 150 recommendations across Australia – it was a data-gathering and prioritising exercise. In 2004, the Innovation Statement was more about building on the structure identified three years earlier and providing long-term consistency for research and innovation planning. In both processes, however, there has been a focus on evidence. The approaches taken have to be strongly supported by both qualitative and quantitative analysis.

If the Australian experience is plotted, it is possible to see how different approaches were utilised at different times. The 2001 Innovation Statement was developed from the National Innovation Summit and focused research papers, while the 2004 Innovation Statement used focused research papers and a "mapping" of the innovation system which identified gaps not currently or sufficiently addressed in the 2001 Innovation Statement and programme evaluations. As Figure 11.7 shows, Australia commenced development of the 2001 Innovation Statement at the agenda setting point, but commenced the development of the 2004 Innovation Statement at the evaluation point. The 2004 Innovation Statement built on the success of the 2001 Innovation Statement and attempts to address identified gaps.

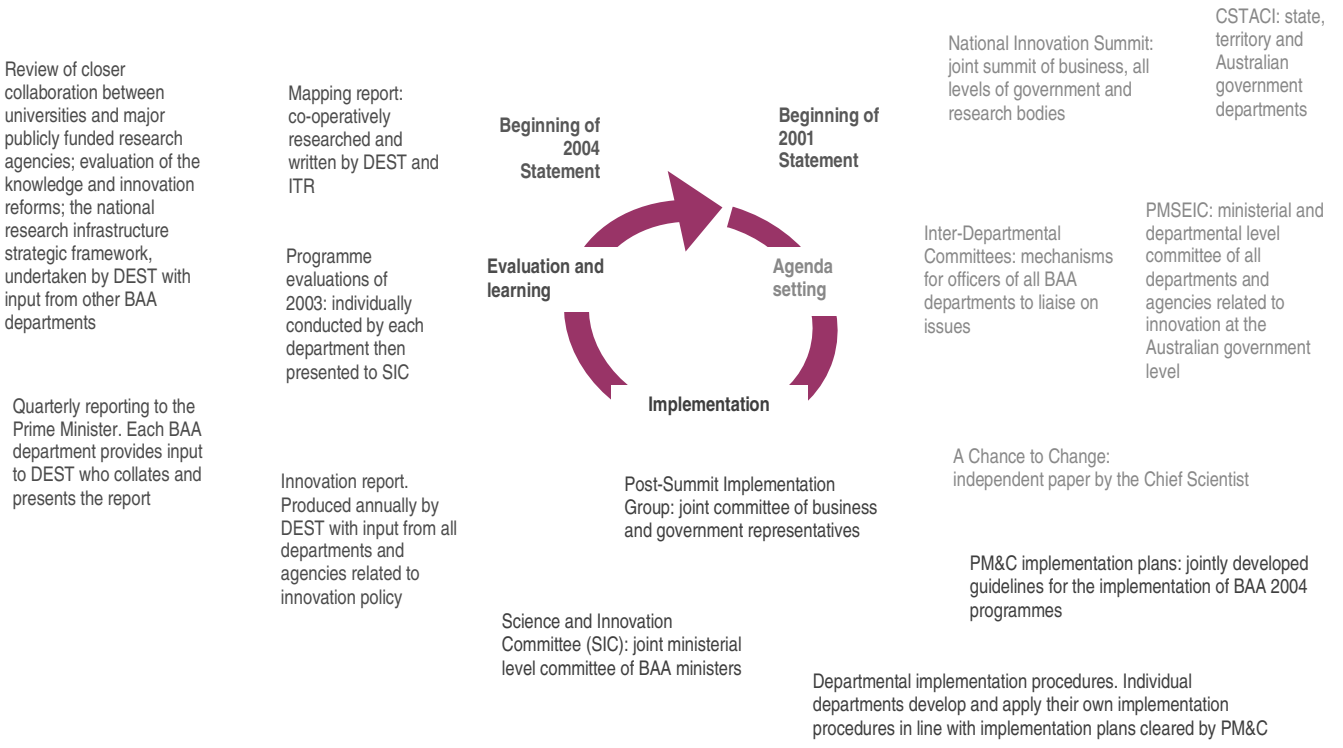
Issues arising for Australian governance

Long-term strategy

Unlike some other countries, Australia does not engage in systematic long-term strategic planning or foresight activity for its innovation system. However, in the early 1990s ASTEC did undertake scenarios in areas such as ICT and biotechnology. Historically, Australia has avoided top-down direction setting in the research sector, with a preference for allowing organisations to exercise considerable autonomy in deciding what research to pursue.

Historically, research funding was provided with little centralised direction as block grants to research institutions and universities. In recent years, the proportion of project-specific contestable funds through the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) has grown relative to block funding. However, these contestable funds are not allocated strategically, but on the basis of competitive project quality, open to research from all fields.

Figure 11.7. Australian innovation policy development and the MONIT cycle



Australian innovation policy prefers market-driven prioritisation to a "picking winners" approach. Historically, government experience in picking winners, in technologies or industries, is mixed at best. Although Australia has some industry- and technology-specific innovation programmes, these have been established to address identified market failures (*e.g.* the Pharmaceutical Partnerships Programme addresses the inability of pharmaceutical multinationals to claim the Australian R&D tax concessions). Also, the industry action agenda process is a powerful mechanism to assist in identifying industry needs; most have identified ways for improving innovation.

The recent establishment of Australia's national research priorities, which apply to all publicly funded research agencies plus the ARC, the NHMRC and other agencies allocating government research funding, is a move towards more strategic direction. It will be interesting to see how this initiative develops. At this time, the priorities do not apply to industry innovation programmes such as the R&D Tax Concession of the new Commercial Ready programme.

Political cycle – temporal coherence

Theoretically, Australia's short electoral cycle could lead to short-term policy making. To implement a long-term strategy in Australia requires bipartisan support. Currently, a change in senior minister may result in changes in policy development and/or implementation. Departmental structures may alter after each election, even if there is no change of government, and this can affect implementation of policies. However, the establishment of a central Cabinet Implementation Unit in 2003 has reduced such changes to some extent.

The long development and implementation timeframes for the 2001 and 2004 Innovation Statements are unusual. At the end of the 2004 Innovation Statement (to 2010-11), there will have been two, and possibly three, federal elections. This unusually lengthy period demonstrates the importance that the government accords to innovation for long-term growth.

In reality, there has also been relative stability in the makeup of governments. The current government was first elected in 1996 and has just been re-elected. The previous government governed from 1983 to 1996.

Horizontal coherence

Australia seeks horizontal coherence in policy development through the existing institutional structures. These include the Cabinet process in which senior ministers discuss and decide policy. There are interdepartmental committees, state and Australian government committees and advisory committees (*e.g.* PMSEIC). There is also general recognition by policy makers and ministers that the Australian innovation system is complex, multifaceted and interlinked and that policies that affect aspects of the innovation system cannot be developed in isolation.

These processes make possible the discussion of policy development. When setting the agenda for innovation policy in particular, Australia's National Innovation Summit identified issues relevant to all the elements of the innovation system and linked all stakeholders with the policy development process. While this did not occur for the 2004 Innovation Statement, there were targeted consultations plus reviews, evaluations and the mapping exercise that allowed for identifying gaps in the innovation system that the second statement was able to address.

In summary, Australia has generally been successful in developing horizontal coherence in its innovation policy.

Vertical coherence

Vertical coherence is maintained through relatively stable portfolios. The Industry Department has maintained strong depth of knowledge in all aspects of industry and innovation policy. The education portfolio has also maintained similar depth in relation to public-sector research. Vertical coherence is also maintained through the funding bodies that provide competitive funds for research. Thus, entities such as the ARC and the NHMRC are long-term bodies for assessment.

Australia has institutionalised the process of evaluating its innovation policies and programmes. Most programmes and policies are evaluated every three years, generally by an external party. These reviews/evaluations contributed to modification or increase of programmes for innovation in the 2004 Innovation Statement. It was difficult to evaluate the 2001 Innovation Statement in its entirety as it had not run long enough to draw meaningful conclusions.

Notes

1. International Trade in Goods and Services, Australia 2003 International Accounts and Trade Feature Article – Australia's Exporters, 2002-03, Australian Bureau of Statistics.

2. Section 28 of the Constitution states "three years from the first meeting of the House and no longer, but may be sooner dissolved by the Governor General".

3. *www.dest.gov.au/science/pmseic/default.htm*

4. *www.pm.gov.au/news/media_releases/1997/science.htm*

5. "Making Industry Stronger", Coalition Election Statement, 1998.

6. *Innovation: Unlocking the Future: Final Report of the Innovation Summit Implementation Group,* August 2000.

7. Higher Education Support Act 2003, *http://scaleplus.law.gov.au/html/pasteact/3/3633/top.htm*

8. The introduction of the goods and services tax in 2001 and the abolition of the wholesale sales tax.

9. *www.dest.gov.au/highered/research/index.htm*

10. ABS figures, catalogue 8109.0 and 5506.0.

11. *www.apsc.gov.au/mac/connectinggovernmenti.htm*

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Chapter 12

TOWARDS A THIRD-GENERATION INNOVATION POLICY IN FLANDERS: POLICY PROFILE OF THE FLEMISH INNOVATION SYSTEM

Jan Larosse
Scientific Advisor, IWT (Flemish Innovation Agency)

The Flemish innovation system has emerged from the decentralised Belgian science and innovation system. After the devolution of power to the regions for most legal competences in sciences and technological innovation and the subsequent establishment of key institutions and instruments to enhance interaction among the innovation actors, conditions were ripe for constituting an autonomous Flemish innovations system in the 1990s.

Flemish S&T policy aims to catch up and achieve the EU 3% target and respond to the challenges of restructuring the Flemish economy in the global arena. To fully implement a third-generation innovation policy, which emphasises the integration of policy domains, these efforts have to involve the construction of new governance structures that support strategic convergence and interactive policy development. This chapter looks at formalisation of the policy cycle as a key governance issue for strategic innovation policy in Flanders.

Introduction

The policy framework of national innovation systems (NIS), which received a strong impulse from conceptual work of the OECD, now serves as an international reference for policy development. The MONIT project has stressed the importance of innovation governance – the organisational framework for the role and involvement of all actors – for fully exploiting the powerful leverage of systemic approaches to innovation policy. The horizontal integration of innovation policy and other policy domains, as studied in this project, is key to third-generation innovation policies. This is because policy integration is a necessary component of a systemic innovation policy that mobilises all resources and puts innovation on the agenda for all policy domains that articulate societal demands.

The Flemish innovation system has emerged as the result of the decentralisation of the Belgian innovation system in successive waves of transfer of political power to the regions. Innovation governance in Flanders has inherited some features of the Belgian model but has been shaped mainly by the construction of new institutions. Flanders is moving towards a third-generation innovation policy, starting from a technology-push model in the 1980s, moving to full-scale stimulation of science and innovation in the 1990s, and now towards a further integration of policy domains.

Flemish S&T policy has pursued a catch-up process with respect to R&D. However, the growth of the Flemish innovation system has also demonstrated divergent dynamics which have created a mismatch between scientific and industrial specialisations. This is a specific small-country problem, because globalisation is influencing the different components of the system in different ways. The challenge for managing the innovation system as the most important way to ensure the economic and social welfare of Flanders is to combine the forces of globalisation with regional path dependencies to develop existing and new clusters of specialisation that are competitive and respond to widely shared social priorities.

Governance of innovation is therefore at the heart of economic and social renewal in Flanders. The Pact of Vilvoorde (2001) laid the foundations of a new social contract for the 21st century, in line with the EU Lisbon targets, to be among the leading knowledge economies. The Innovation Pact (2003) specifies the commitment of innovation actors to a knowledge-intensive economy and society, with the adoption of the 3% target. Recently, several strategic platforms (poles of excellence) were set up to stimulate research and networking in domains that are important for future growth. The new Innovation Platform for Environmental Technology strongly emphasises co-ordination of departments and their policy instruments, on both the supply and the demand side of the new environmental technologies market.

While the agenda setting for innovation policy in Flanders contributes to new innovation governance, policy development itself needs to undergo renewal to be able to aid the transition to the new knowledge economy. However, underdeveloped policy planning and strategic intelligence for policy making are obstacles to the government's ability to act as a catalyser of all actors in the policy arena to effect this transition.

After summing up the main conceptual elements that underpin the discussion of the governance issue, a descriptive analysis of the dynamics of the Flemish Innovation System is presented. On the basis of selected performance indicators of the innovation system, represented in a spider plot, a SWOT (strengths, weaknesses, opportunities, threats) analysis shows the mismatch between Flanders' economic and scientific-technological specialisations. The Flemish paradox is that successful R&D centres and successful innovative clusters are poorly linked. This is particularly important in view of the role of horizontal policy governance in improving the performance of the innovation system.

The perceived challenges for policy development are examined next. Recent manifestations of deindustrialisation (in particular the closure or scaling down of automotive construction plants, which were the strongholds of post-war economic development in Flanders) and of delocalisation (extending from mass-production plants to the competence centres of some multinational enterprises) have had a great impact on public opinion and political debate. They give more urgency to the proclaimed transition to a new knowledge-based economy and put pressure on innovation policy to operate this structural renewal.

A rapid overview of the historical evolution of the Flemish innovation system makes clear the extent of the challenge. Its foundations were laid in the 1980s with the socio-political mobilisation of the first Flemish government for a Third Industrial Revolution in Flanders (DIRV). This intensive campaign to promote new science-based industries differentiated Flemish industrial policy from federal policies aimed at rescuing the old smokestack industries. After two decades of successes and failures, the limits of the

knowledge-push strategy can be seen in the proliferation of poles of excellence. The mix of bottom-up and top-down policies has no consistent strategic framework.

The different institutional reforms that successively devolved new competences to the regions are intertwined with the evolution of different generations of policy regimes in Flanders.

- First-generation innovation policy (dominance of the linear model) coincided with the DIRV technology-push.
- Second-generation innovation policy (the maturing of the interactive model) resulted in the Innovation Law of 1999 that provided a legal framework for extending R&D policy to an integrated innovation policy.
- Third-generation innovation policy (emergence of a holistic model) is announcing by the shift of focus from S&T objectives to horizontal strategic objectives such as sustainable growth.

The actual governance of innovation in Flanders is characterised by an important role for universities and intermediary organisations which need to be aligned towards the establishment of a common vision. If the Flemish innovation system is to effectively support a new economy, it must have a governance structure able to match effectively the competences of the strategic actors: universities, which process knowledge, and firms, which create value added. Innovation policies and sectoral policies (economy, transport, environment, energy, health, etc.) can mutually reinforce each other if better co-ordinated. In particular co-ordination with other horizontal policies as sustainable development or an information society is vital for the overall coherence of the Flemish innovation system.

Governance challenges are discussed in a final section. Government is a strategic actor in co-ordinating different social and economic sectors. So far this co-ordination – in the form of consecutive top-level conferences (Pact of Vilvoorde, Innovation Pact, Entrepreneurship Conference) – is more punctual than structural. A more reflexive governance structure with a higher degree of formalisation of the policy cycle is needed. The establishment from 2005 of the integrated Administration for Economy, Science and Innovation must be a turning point in the build-up of capabilities for strategic policy development.

A systemic approach to governance

The NIS approach

The systemic approach has become the predominant policy paradigm in science, technology and innovation (STI) policy making.

The innovation process is now recognised as an interactive process in which different types of interconnected actors and institutions engage in the production, diffusion and use of new, economically useful knowledge. This process provides the elements and relationships which – located within the borders of a country – constitute its national innovation system (OECD, 1999, 2001a, 2001b). The system approach is well-suited to help policy makers deal with such dynamic and complex processes as innovation, by focusing on the relationships between actors and on the knowledge flows in the system.

The NIS approach has contributed greatly to bringing innovation to the top of policy agendas that were previously dominated by traditional macroeconomic themes of non-inflationary growth. In the EU countries the 3% objective of Maastricht for achieving budget control now has been matched by the 3% Barcelona objective of increasing innovation investments to become the leading knowledge economy.

This system approach is still very young. The challenge is to derive more operational guidelines from the NIS approach to conduct successful innovation policies. In fact, policy practice often seems to run ahead of theory in terms of developing new ways to capitalise on the interactive nature of the innovation processes. In the OECD TIP Committee, which had an important stake in the elaboration and diffusion of the new policy framework, steps are taken to give the approach more operability and focus, in particular concerning the institutional preconditions of governance for improving the performance of innovation processes, in order to reap the full benefits of the knowledge about the functioning of innovation systems.

Management of the policy cycle

The focus here is on the issue of governance[1] in the area of innovation policy. The term "governance" refers to decision-making processes which are broader than the exercise of authority by political and administrative bodies. Governance involves expression of the interests of all actors in the organisation of the policy domain on a national as well as a sectoral level, including interaction with other policy areas. Governance takes a normative, multi-actor and multi-level perspective, which accommodates the dynamics of innovation, on the management of the innovation system. Because the specific institutional architectures of national systems of innovations determine their international competitiveness, innovation governance is becoming more and more a focal point of policy development.

Institutional reforms have been a continuous preoccupation of policy makers in Belgium, but this preoccupation was driven by concerns other than improving governance for innovation and structural renewal. As a result, not all opportunities were taken to break with inherited structures and traditions in the process of defederalising innovation competences. In addition, only implementing administrations were regionalised; the Planning Bureau remained a federal body. The governance structure of the young Flemish innovation system is incomplete. Especially from the point of view of management of the NIS, strategic innovation policies are lacking. The need for better administrative policy was a focal point in the latest reform of public administration started in 1999.

The OECD MONIT project addresses the general challenges for countries that are willing to undergo the transformation required for strong horizontal policy integration. In particular it wants to contribute to analysis of national capabilities in the strategic management of a coherent innovation policy. This concerns mainly the organisation of the policy cycle, from agenda setting to evaluation of the effectiveness of policies.

The four-stage stylised representation of the policy cycle in Table 12.1 (which brings together well-known elements of the innovation policy literature) makes it possible to distinguish the different functional specialisations that are needed to manage the policy cycle. In practice, the sequence of these stages and assigned instruments is not linear, but it is useful to make these distinctions in order to understand the opportunities for policy integration between different policy domains in different stages of the policy cycle.

An understanding of systemic policy coherence requires analytical tools of strategic intelligence[2] to support decisions, but methods of consultation and co-ordination are even more important.

Table 12.1. The organisation of the policy cycle

Phases in the policy cycle	Process management capabilities (participative instruments)	Strategic intelligence capabilities (analytical instruments)	Organisational levels
Policy preparation	Agenda setting Consultation	Foresight	Policy arena (advisory boards)
Policy formulation	Prioritisation Making choices	Scenario analysis Bench-marking Cost-benefit analysis	Ministry
Policy implementation	Translation into programmes Portfolio (policy mix) management Administrative co-ordination	Programme design Monitoring	Agencies
Policy evaluation	Learning by doing Learning by interacting Learning by learning	Evaluation of effects and effectiveness	Strategic intelligence departments External consultants
Ex post *Ex ante*		Impact assessment Technology assessment	

Coherence

The aim of the NIS approach is to increase and accommodate the dynamism of the economic and social system by improving the processes through which policies are developed. The role of innovation governance, as the institutionalised process of policy making, is to ensure policy coherence to improve the performance of the national innovation system. Policy coherence can be differentiated along three dimensions:

- **Vertical coherence**: the degree of correspondence between goals and instruments, policy making and policy implementation in the domain of innovation itself.
- **Horizontal coherence**: the consistency between further goals and current targets of different policy domains and their potential for integration.
- **Temporal coherence**: the modulation over time of short-term and long-term objectives, the mutual fit of current policies and perceived challenges.

Together, the three dimensions define a dynamic interplay of policy dimensions in the innovation system. Incoherence and mismatch are more the rule than the exception because of uneven developments in a dynamic system, but the aim of systemic policy coherence is effective management in an evolving context. It does not exclude conflicts, because actors are heterogeneous and have different problem and perceptions, values and interests, but imposes a normative model of consensus seeking through convergence of the strategies of the actors in the innovation system. System analysis, in particular on the bottlenecks for dynamic adaptation processes, is a prerequisite for policy coherence.

The concept of transition management[3] emphasises in particular the challenges from more radical shifts from one systemic constellation to another, such as the structural change in the present industrial economies towards knowledge economies. Innovation policies need to be coherent with a future-oriented strategy on the structural level and guided by strategic aims that are horizontal for the whole of society and policy. Strategic innovation policy is a part of this bigger programme of socio-economic change, but at the same time one of its most important drivers.

The specific organisational structure of a country's innovation governance is the expression of the national capacity to manage the national innovation system. Because the institutional setting of the NIS largely determines a country's adaptive capacity and competitive advantage, governance is of strategic importance. This study, on the policy profile of the Flemish innovation system puts forward the thesis of a structural mismatch. This mismatch is the fruit of uneven developments in the science and economic systems in which policy choices play a role. Flemish scientific and economic successes are conditioned by different international settings and will not easily combine without efforts towards strategic convergence among local actors. Third-generation innovation policy[4] is about this necessary policy integration. Cluster governance – organising networks of matching industries, research infrastructure and policy support to enhance the competitive strongholds – is the appropriate governance level to achieve this kind of strategic matching.

Overview of the Flemish innovation system

A decentralised Belgian innovation system

Belgium has an extremely decentralised innovation system. There is no hierarchical relation between the federal and the regional institutional level. There is horizontal division of competences between Belgian governments that co-operate on an equal footing. An inter-ministerial conference and co-operation agreements ensure co-ordination of S&T policies.

Innovation policy as such is a regional competence, but some important framework conditions (social security, fiscal policy, market regulations) are federal. There are also international S&T programmes such as space research. In Belgium, horizontal policy co-ordination to stimulate innovation therefore takes place between the different governments. Because most of the relevant competences (education, research, innovation, economic stimulus) has been at the regional level since the end of the 1980s, new autonomous regional innovation systems have emerged, along with new institutions.

The devolution of competences has not yet come to an end. In 2001 agricultural policy (including sectoral S&T policy) was regionalised. In general Belgian policy makers strive to recombine competences into homogeneous competence packages. The new Flemish government has announced in its Government Agreement of 2004 its decision to take further steps in this direction.

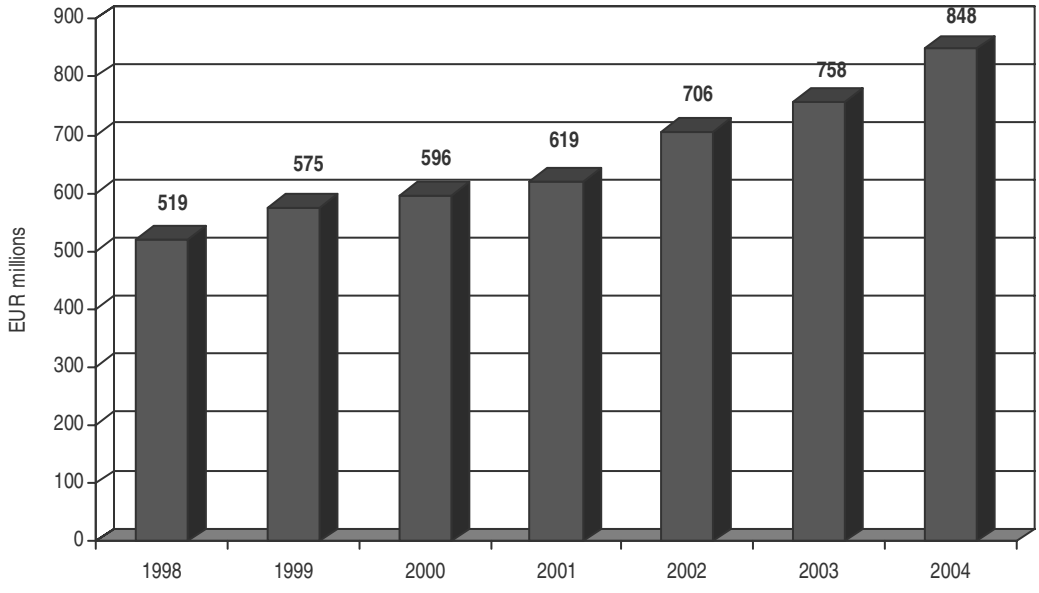
An autonomous Flemish innovation system

Two main occurrences marked the organisation of an autonomous innovation system dynamics in Flanders:

- The first was the establishment in 1991 of IWT as the Flemish government agency for the promotion of science and technology in industry. It quickly became the centrepiece of technological innovation policy as the one-stop shop for financial support to business R&D.
- The second was the adoption by the Flemish parliament in 1999 of an Innovation Law that formally marked the transition of the regime for government support from R&D support to innovation support. The IWT was thus formally assigned the mission of promotion of innovation through science and technology, and the role of co-ordinator of the stimulation of innovation by intermediary agents (from professional organisations) who were given resources to construct new bridging institutes between science and industry and promote networking between innovation actors.

These elements are the basis of the self-organising dynamics of a system that is composed of new institutes but has also recombined them with existing Belgian institutes, such as the collective centres that have been set up since 1947 by industry federations to provide technological services to their members. This chapter looks at the coming to maturity of this new autonomous system in the context of the federal Belgian state and the transition to more advanced governance models.

Figure 12.1. Increasing public funding of R&D in Flanders



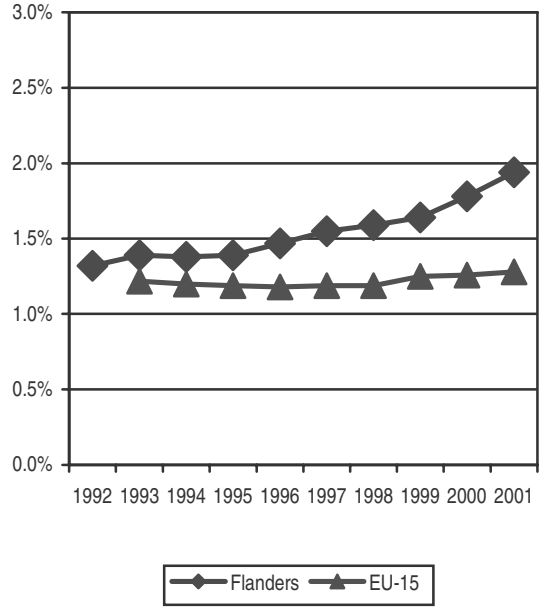
Restructuring of the Flemish innovation system

Statistical analysis of the young Flemish Innovation System (FIS) is hindered by a lack of regionalised and time-consistent indicators. However, the main input indicator, R&D expenditures, reveals a catch-up trend. In the last decade the FIS evolved from a position below the EU average to a position above the EU average, because Flemish R&D expenditures rose significantly while the overall international trend was towards stagnation.

One important growth source was increased effort by the Flemish government. It doubled the S&T budget in the last decade and committed to the EU 3% target with further increases of the public R&D budget up to 1% of GDP. The government sector is not a very important R&D performer, although the government-funded research institutes IMEC, VITO and VIB play an important role in the FIS. The universities are the main beneficiaries of public funding; direct public funding of business R&D is less than 5% of business R&D.

The business sector has been the most important driver of the development of Flemish R&D expenditures. Between 1995 and 2001 in particular the rise of R&D expenditures in Flemish companies was among the highest in Europe (Figure 12.2). In 2001 this amounted to 1.9% of GDP or nearly three-quarters of gross R&D investments. As in smaller regions, R&D activity is very much concentrated in a small group of top performers (the top ten are responsible for more than 50% of business R&D). Therefore the level of business R&D in Flanders is fragile, since most big R&D spenders also depend on foreign headquarters for strategic decisions.

Figure 12.2. R&D expenditure in Flanders, 1992-2001



R&D statistics also reveal a growing number of small R&D actors. This phenomenon is consistent with another positive indicator on the output side. According to the Community Innovation Survey (CIS) the percentage of innovating firms among SMEs in the period 1998-2001 was among the highest in Europe with 57%. It thus appears that at the turn of the century important parts of the Flemish economy started shifting their competitive strategy from capital intensity to knowledge and innovation intensity. Flanders has an open economy which is very sensitive to competitive pressures. Competition on costs, by improving labour productivity, an area in which Flemish companies are strong, is increasingly supplemented by innovation-led growth.

The business cycle upswing at the end of the 1990s supported the increase in investments, but the following downturn severely affected this first push of R&D investments according to recent findings. For the region's high-cost economy, there is no turning away from restructuring towards a more knowledge-intensive economy and a more dynamic innovation system.

Comparative performance of the Flemish innovation system

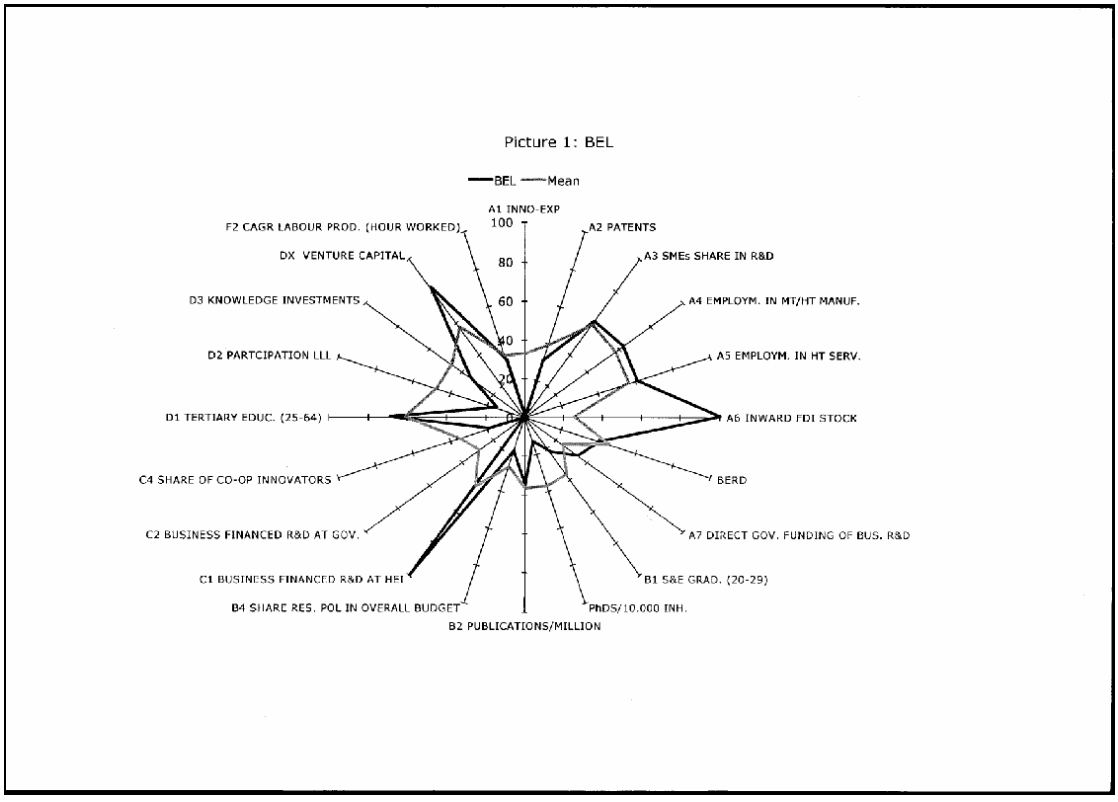
Since complete figures for Flemish innovation performance are yet not readily available, Belgian data must be used as a proxy for the evaluation of performance of the Flemish innovation system (which represents two-thirds or more of most values). The FIS in general outperforms the BIS.

The comparative performance profile is analysed with a common set of indicators organised in a spider diagram (Figure 12.3), which compares Flemish performance to the average performance of the dozen countries participating (lighter of the two lines) in the MONIT exercise. The indicators are well balanced between the different components of the innovation system: the company system, the education and research system, industry-science linkages and absorption capacity.

The graph depicts a generally average performance for the FIS on most indicators (with Belgian indicators coinciding with the MONIT countries' average). Patent applications per million inhabitants are a little below the EU15 average in 2001. Although the range of internationally comparable indicators is limited, the outliers help to give an initial view of the FIS:

- **Positive outliers**: foreign direct investment (source of international spillovers in embodied technology); business financed R&D in higher education institutes (bridging science to industry through contract research); venture capital as percentage of GDP (source of innovation financing).
- **Negative outliers**: business-financed R&D in public research institutes; innovation expenditure as a percentage of total turnover (input indicator for innovation efforts); percentage of innovators with co-operation in innovation (importance of external knowledge sourcing); science and engineering graduates and PhDs (human resources); participation in lifelong learning.

Figure 12.3. Indicators for Belgium compared to the MONIT average



A brief SWOT analysis

Although the figures need to be used with caution because of statistical problems, a consistent picture can be derived.

Strengths

The presumed strengths are fragile. Foreign direct investment is still strong because Flanders has a very open economy with an export/GDP ratio of 110%, due for the most part to multinational production plants working for the European market. This is the exogenous growth development strategy that has been successful for many years but is slowing down.

On the other side of the development spectrum is the upsurge of venture capital funds in Belgium (70% of Flemish origin) in the 1990s, thanks to the pioneering work of GIMV, the Flemish public venture capital company that became the biggest early-stage venture capital fund in western Europe. The venture capital market was meant to be the leverage for endogenous growth in technology start-ups but was severely hit by the recent dotcom crisis. The bankruptcy of the leading Flanders-based speech technology company LHSP was traumatic: most newly established venture capital funds ceased operations. In 2000 early-stage venture capital investments rose to 0.107% of GDP (compared to the 0.075% EU15 average); in 2003 it dropped to 0.014% of GDP (compared to 0.021% EU15 average). A new programme (Arkimedes) of the Flemish government (leveraged by a fiscal stimulus for private investors that invest in venture capital funds) is meant to

revitalise the venture capital sector. However, the capital market in Flanders will remain too small for growth companies with international aspirations.

The business sector is a very heterogeneous actor in innovation with many opportunities for growth through investments in knowledge. Although business R&D is rising continuously (up to 1.9% of GDP), it is a concentrated phenomenon. This is also the case for firms engaging in research contracts with universities.

Because IMEC (with over 1 200 researchers and nearly half of its budget in contract research) and VIB (the Flemish Biotechnology Institute with over 700 researchers and important contract research) have been counted as interuniversity research centres instead of public research centres, the statistics on business financing of higher education institutes and public research institutes level off when counted according to internationally comparable standards. Universities still acquire a comparatively large part of private financing because of budget restrictions in the 1980s and early 1990s. Contract research is an important source of knowledge transfer. But Flanders' average output and outcome performance indicates that there is a gap between excellent research and internationally competitive industry that needs to be filled.

Weaknesses

Education levels are high in Flanders (81.3% of those aged 20-24 have at least finished secondary school and there is a high share of tertiary-level graduates). However the percentage of S&E diplomas and PhDs is quite small. This is a challenge if the R&D system needs to expand strongly to meet the 3% target. Lifelong learning is also a problem: although the Flemish indicator is better than the Belgian, it is still below average.

A still greater challenge is the low level of certain innovation indicators, according to CIS 2 statistics. But the latest CIS 3 figures put Flanders at the top among EU countries, with below-average expenditure on innovation (3.6% of total turnover). It is not clear whether this is due to flawed statistics or to immature innovation behaviour. But low average expenditure may indicate that many firms have reached the limits of the capital-intensive growth strategy (which put Flanders in the lead for labour productivity: 20% above the EU average per man-hour) and switched to a more knowledge-intensive strategy, but still at a (too) modest pace. These innovators generally do not have a strong technology profile but are mainly driven by market demand (reactive strategies) and such investment is fragile.

Very worrying is the weak connectivity of the innovation system: only 26% of Flemish innovators in the last CIS survey co-operated with other firms or institutes.

Opportunities

Flanders has a diversified industrial base and a trained workforce with good absorption capacity for all kinds of new activities. Its central location also offers one of the main opportunities for the development of new activities (*e.g.* in logistics). The importance of Brussels as international service centre is increasing. This also offers an opportunity to develop new value chains.

Public policy is also conducive to knowledge intensification. The Flemish government has initiated some strategic projects in this area: the establishment of the broadband provider Telenet; strong investments in e-government; and recently the creation of a platform for interactive digital television with the potential to generate new

multimedia services. Opportunities for strategic innovation policy are there, but choices need to be more focused.

Threats

High labour costs (among the world's highest) constitute a structural handicap for the Flemish economy and innovation system. This is partly due to investment in a strong social safety net. In a globalising economy Flanders suffers from the delocalisation of cost-sensitive activities. The combination of relevant location factors – labour costs among them – has to be attractive to draw economic activities. Because innovation offers a better competition strategy to preserve Flanders as a location for international players, innovation policy will play an increasing role. Recent political debate about economic renewal has shifted from innovation to creativity as a notion that distinguishes a more technology-focused approach from a broader strategy to create value by a wide range of specialised knowledge activities – such as design (*e.g.* the Antwerp fashion industry) – where Flanders has growth potential. The danger in widening the scope of stimulation activities is loss of focus.

Creativity is needed in industrial policy, but for many years the topic has not been on the policy agenda. The complexity of Belgium's institutional system is a threat to a consistent industrial policy (for example export promotion is not easily transferable to the regional level). Another is the weakness of policy development (*e.g.* lack of research departments in economic and S&T administrations), and the resulting lack of knowledge for policy development is a major threat to the development of the innovation system as a whole.

Conclusions

The Flemish economy is trapped between the slowdown of the old exogenous growth path and a still weak endogenous growth strategy. It has accumulated a wide industrial base and scientific potential and can count on strong location advantages. But innovation policy has to better identify Flemish strengths in science and industry which can serve as the basis for new growth strategies that replace strategies that rely on capital intensity and now destroy jobs.

Transition problems

The Flemish economy is a very diversified, open economy that is changing quickly under the pressure of globalisation. Globalisation has led to unsynchronised developments that generate a widening gap in the innovation system between science and industry.

To simplify, the overall performance problem of the FIS can be summarised under two headings: innovation without (enough) R&D and R&D without (enough) industrialisation.

Innovation without (enough) R&D

Antwerp's petrochemical cluster, the second biggest in the world, depends on continuous infrastructure innovation to fully internalise production synergies. However, most plants have little in-house R&D. The world's leading carpet cluster in Flanders has been successful because of process innovation and new designs but has no R&D. The beer cluster counts hundreds of innovative enterprises along with the world's largest

brewery which excels in market innovation, but they are not R&D-intensive. A cluster of Flemish firms dominates the European market in frozen vegetables, again without R&D. Automotive assembly is another example of a competitive activity thanks to automation and logistic innovations (conveyer parks), but R&D is limited and not decisive in the performance of assembly plants. These competitive strengths have been developed with different styles of innovation that are not strongly dependent on science-based R&D in Flanders. To secure their future this situation will have to change. But knowledge development and R&D play different roles. Innovation policy is opening up to non-technological aspects of technology development, but lacks good perception of the different needs of different styles of innovation.

R&D without (enough) industrialisation

Flanders has invested heavily in development of new technologies. IMEC for information and communications technology (ICT) and VIB for biotechnology are internationally competitive research institutes, but have so far generated little new industrial activity. The number of spin-off companies is rising but most are (and remain) very small. Attempts to bring an ICT industry to Flanders failed. The pharmaceutical biotechnology field is one of the world's best performers in publications and patents, but domestic industrial use is minor. Industrial biotechnology is much weaker.

The Flemish version of the European paradox is the rather weak connection of the science base with the leading technology firms in Flanders that have sufficient R&D to absorb new breakthrough technologies (*e.g.* in materials technology or mechanics, the leading technologies according to Flemish innovation surveys). The plastics and machinery industries are important technology sectors that might benefit from stronger interaction with the science base. Another system failure is the lack of spillovers of knowledge and technology competence from existing technological industry to new ventures (corporate spin-offs).

The region's economic structure is still very diversified but is quickly narrowing in size and in terms of competitive specialisations. Strategic innovation policy has to inventory the innovation potential that has been built up from different sources, taking this into account.

Most important R&D performers are subsidiaries of foreign multinationals but have a certain degree of decision power that may be leveraged for the Flemish innovation system, depending on their position in the group. The integration of Flemish firms in global strategies has been enhanced, at the cost of regional autonomy, leaving only Flanders' position as a worldwide competence centre as leverage. The remaining indigenous technology firms have become niche players after multiple reorganisations. Industrial newcomers are scarce and appear in specialised niches in capital-intensive business-to-business process industries or as suppliers for private labels.

Too little is known about the pervasive changes in the economic fabric into a service economy and the implications for innovation policy. The software sector is visible but software developers often have to be regarded as part of broader clusters (*e.g.* financial services, e-security) which are not analysed in depth. However, without analysis of the economic transformations that are driven by other kinds of organisational innovation it is difficult to apprehend the role of R&D.

The mismatch between research and economic specialisations can be a temporary transition problem if new research-based industries can be built from the ground up. The problem is more structural if scientific and economic resources are not combined efficiently in dynamic synergies. Innovation is most successful at the frontiers of knowledge and experience. The innovation system has to be better tuned to existing competitive clusters and develop roadmaps to possible futures. Innovation policy has taken the path of developing new technologies from the university knowledge base, but has recently started to invest in new poles of excellence which are stimulated by strategic R&D actors in industry.

Turning challenges into governance

Perceived challenges

Policy discussions in Flanders are dominated by themes that appear on the agenda in other mature industrial countries, but with a specific flavour.

Employment

Flanders has one of the world's highest productivity levels in output per hour worked, thanks to process automation. But this is not a safeguard when industries are restructuring, as in the European automotive industry. A Renault plant was closed in 1996 and an even more important downsizing of a Ford plant in 2003 has had a traumatic impact on public opinion. Flanders has the world's highest production of cars per inhabitant. The prospects for future work for the low-skilled part of the population seem gloomy. The Belgian labour market is polarised between a large, well-trained segment and a large segment with little education. Public debate focused first on labour costs, although labour only represents 5-7% of the costs of those cars. Other plants in Belgium are doing very well thanks to productivity and location advantages as well as organisational innovation. The automotive crisis is one of overcapacity and has hit the less popular brands first. There is only replacement production in western Europe, and new types of mobility will emerge. While maintaining a strong position in this mature and stagnating market – the Flanders Drive platform wants to anchor constructors in innovative local suppliers networks – sustainable economic growth will only come from new activities. Some think that industry will become as marginal as agriculture and that the future is only in services. Some believe that industry and services in a networked economy will blend in the organisation of product-service systems that provide solutions. The Flemish industrial problem is perceived as a lack of entrepreneurship to create new solutions and start new firms. New firm creation is an important indicator. The next important problem is that few companies go for growth strategies and that growth companies that come to a certain threshold do not find enough funding in local capital markets to finance growth. Because the Flemish financial system is too weak to support endogenous growth, employment is strongly influenced by global market developments. Policy makers can only try to tie it as much as possible to dynamic local innovation clusters.

Globalisation

A new international division of specialisations threatens not only low-skill labour. High-skill labour and knowledge workers are also replaceable. Job cuts by Siemens in its Atea competence centre for telecommunications and the closure by Philips of its interactive audio competence centre in Hasselt in 2002 suddenly revealed that knowledge workers' jobs are not secure from delocalisation. Globalisation is reshuffling the cards, and countries with few decision centres are more vulnerable. Strengthening the position of local actors for investment and increasing attractiveness for FDI are the objectives. This demands a redefinition of Flanders' competitive positions.

Structural change

While many agree that Flanders has to move towards a knowledge-intensive growth model and develop new value chains, the required strategy is not clear. Structural changes and choices to be made are not a theme for policy making but something that happens as a side product of choices by innovative actors. System failures on the level of mismatches, incomplete clusters and weak linkages are not yet analysed as major handicaps for new economic activities. On the microeconomic level, the emphasis is on general framework conditions for start-ups and, more specifically, the commercialisation of knowledge from universities. There is little analysis of the existing Flemish industrial potential with a view to its future contribution to sustainable growth. Cluster initiatives of a different sort (technology valleys, poles of excellence) have been strongly supported since the 1990s, but there is no explicitly strategic cluster policy. However, networking is increasingly considered as an important feature of innovation management.

Another important debate concerns the implementation of the Kyoto Protocol and sustainable development in general. Many doubt that the decision to close nuclear power plants is irreversible because structural alternatives are not clear. Flanders also has the highest concentration of chemical industry, which is highly energy-intensive, in Europe (with 2.8% of population, 8.5% of turnover is created in Belgium). Stimulation of technological innovation in energy and environmental domains to support sustainable development is on the policy agenda.

Belgian and Flemish policies are very much determined by EU policies and regulations. The endeavour to develop a programme of long-term change (following the Lisbon strategy) was reaffirmed in the Pact of Vilvoorde between the government and the social partners in 2003. The first of 21 objectives for 2010 is to become a learning society with at least 10% of the population in lifelong learning programmes. Innovation targets (higher part of turnover in new products and services, doubling the number of start-ups) have become an inherent part of an overall socio-economic programme.

Administrative modernisation

A final challenge for system innovation in managing the transition to the knowledge economy is the role and organisation of government itself. The public sector is under pressure to cut back to its core business (the public sector is relatively small), but social demands are rising (aging population). Government, and politics in particular, are suffering from a crisis of confidence that heavily handicaps the ability to take long-term strategic decisions. Regionalisation has not really changed the public's negative perceptions. Administrative modernisation has been a tool of the new Flemish ministries to increase the performance of the administrations, but has not really changed the balance

of power with the ministerial cabinets that conduct policy in practice. According to the principle of the primacy of policy, put forward by the previous government, the power of consultation bodies – composed of representatives of stakeholder organisations – would also have been limited (most of the policy intelligence is there). But in practice these institutional mechanisms are pervasive.

The Better Administrative Management campaign (BBB) of the Flemish government that started in 2000 has not yet ended. The final step in the process is the reorganisation of the administration in 13 ministries – one of them a new Ministry of Science and Technological Innovation – with a new division of tasks between policy-preparing administrations, policy-implementing administrations and supporting structures.

The biggest challenge for government and administrations – to act as an intelligent partner in the knowledge society – remains to be tackled. Therefore, investment in strategic intelligence for the innovation system is a precondition for making the transition to a knowledge-intensive governance system. At the moment knowledge-intensive administration is only on the agenda for operational tasks (*e.g.* e-government).

The increasing complexity of governance and the emergence of new networked management styles make some hierarchical models obsolete and push administrative reform further to support better policy co-ordination. On the other hand, greater flexibility and deregulation are required (*e.g.* to promote start-ups) and thus a more restricted role for government. Furthermore, the redistributive role of government is challenged: the reform of the tax regime and social security is a matter of public debate, which is linked to job creation (*e.g.* ceilings on employers' social contributions for knowledge workers) but also to the creation of a new financial basis for the welfare state (shifting away from labour). The overall coherence of governance is not clear. Much depends also on the co-ordination of Flemish and federal policies and governance structures. Decentralisation is not yet complete.

Policy (mix) evolutions

S&T policies have evolved in time spans of about a decade along with the evolution of the economic and political system and of policy thinking. The evolution of policy models from the linear to the systemic innovation models has been reflected in the changing policies in Flanders that respond – mostly through learning by doing – to the need to find the appropriate development model for the region.

The 1960s

After the creation of the European common market in 1958 Flanders became the European hub for many multinational production plants in new medium- or high-technology industries (automotive, electronics, petrochemicals). FDI was the motor of economic expansion, which was supported by an expansion policy (1958) that encouraged capital widening (with embodied technology). The central location, the multilingual, well-trained – at the time rather cheap – labour, and the openness to foreign capital in company law were the main assets that made the region attractive.

In a small, open economy, innovation policy for this type of development amounts essentially to a supply policy (with the education system as main asset) to create a good breeding ground for such exogenous growth.

The 1970s

In Belgium the energy crisis had a serious impact on the traditional industries that had made Belgium a leading economic power in the first Industrial Revolution (steel, coal mines, textiles, shipyards). Government heavily supported these national sectors, but the "backing losers" approach discredited industrial policy. The regions increasingly drifted apart because of different rates and directions for development, since most of the pre-war industries were in the Walloon region and the post-war industries in the Flemish region. The failure of the Belgian financial holding structures to adapt had less impact in Flanders because of its SME economy.

The 1980s

After the establishment of the first regional government with limited competences, the Flemish minister-president launched the DIRV campaign, a daring technology-push strategy, to differentiate Flemish regional development policy clearly from federal economic policy. The regional investment fund GIMV was also created at that time. A first generation of university spin-offs was launched, and IMEC was created and became the largest independent research institute in microelectronics in Europe. In 1989 science and technology policy was transferred to the regions.

The 1990s

A Ministry of Science and Technology was created under the minister-president who also managed the Ministry of Economics. He launched a catch-up programme for R&D spending in industry with large thematic programmes (microelectronics, biotechnology, new materials). IWT was created as an autonomous technology agency. His project to introduce cluster policy as a new economic development policy for Flanders failed because the spirit of co-operation has not yet gained enough ground. The management of the Ministry of Economics was transferred to another minister and the integration of economic and technological innovation policy ceased. R&D policy evolved into broader innovation policy, and the 1999 Innovation Decree introduced a new legal framework with new categories of support for innovation in SMEs, interface services for universities that promote spin-offs, and networks of co-operation among innovative firms.

The immaturity of cluster policy is illustrated by the continuing opposition in current political discourse between bottom-up and top-down policy, so that government lacks the capacity to choose content. Clusters should not be selected and labelled by government, but cluster organisations supported by the actors themselves should propose projects for innovation stimulation (if they meet quality standards). The opposition blocks a real debate about the necessity and possibility of a strategic innovation policy (making choices to invest scarce resources in domains with sufficient critical mass).

Another debate, which is linked to the problem of establishing and maintaining in Flanders economic decision centres that can take an option on the future, concerns the question of how to maintain important existing firms in Flanders and promote indigenous growth enterprises. Anchoring international competence centres in networks has become a systematic strategy (*e.g.* Flanders Drive, the platform for innovative automotive suppliers, was created to embed foreign-based constructors in a performing network of suppliers).

Creation of spin-offs by universities – and start-ups in general – has become a signpost for the new entrepreneurial drive in innovation policy. Because the big financial holdings were Belgian or foreign, the Flemish strategy was to boost a Flemish venture capital market (with the privatisation of GIMV) to create leverage for this endogenous growth. But the Lernout & Hauspie failure to build a world leader in ICT with Flemish roots hit the private venture capital market hard.

After 2000

The recent period witnesses a phase of consolidation and maturation of the FIS, and a wide range of instruments have been deployed by IWT to support the innovation chain (including support to technology diffusion, innovation in SMEs, network creation). In the government period 1999-2004 competences for innovation and research were reallocated to different ministers linked to the economy and education. Emphasis was shifted to reinforcing academic research because growing dependence on contract research for funding of regular staff threatened the capacity to excel in fundamental research.

Although actor-driven policy development is the guiding principle, the borderline between *ad hoc* industrial policy is thin in Flemish policy making, *e.g.* when the government selects new technological poles of excellence that are administered by IWT. Strategic initiatives by the government have little legitimacy and are always *ad hoc*. The creation of a second telecommunications operator and the promotion of broadband in the 1990s (Telenet), and, more recently, experimentation with interactive digital television by the public broadcaster (e-VRT), have proven to be good choices. This last initiative was clearly facilitated because the same person was responsible for the Ministries of Media and Technological Innovation. A new policy mix of bottom-up and top-down instruments is in the making.

The last period of the previous government witnessed a real boom in new strategic initiatives to use substantial investments in knowledge platforms to anchor groups of companies. After Flanders Drive in 2002, a series of poles of excellence were launched in 2003 and 2004: The Flemish Institute for Logistics; IncGeo (Incubation point Geo-Information); Flanders' Mechatronics Technology Centre (FMTC); Institute for Broad Band Technology (IBBT); Environmental Technology Platform; Flanders' Food; Flanders' Materials Centre; Design and Product Development; Flanders District of Creativity.

The lack of early-stage capital for radical innovators is a pressing issue, and calls for a new GIMV (after the privatisation of the old one) are increasing. A new public holding (PMV) is given the task of operating an Innovation Fund. A new support scheme to bring more private money to venture capital funds through tax deductions (Arkimedes) is to be implemented.

The European 3% target has given new impetus to the Flemish catch-up effort. The Innovation Pact, formally concluded in March 2003, engages all actors in the innovation system to reach this 3% target. Government – still underperforming in the financing of R&D compared to the business sector – will increase its budget every year by at least EUR 60 million. Progress will be evaluated against an innovation norm that differs among actors. An Enterprise Conference in November 2003 to mobilise all social partners for the improvement of the region's competitive position stated the need for an integrated policy to fit economic policy with innovation policy, labour market policy, infrastructure policy, environmental policy, fiscal and regulatory policies. Fiscal support for R&D departments was put on the agenda.

A new leap forward to put innovation policy at the service of sustainable growth is now possible. After the recent warnings given by the closure of production as well as engineering departments of multinationals, employment, competitiveness and environmental sustainability are becoming the clear objectives of innovation policy to catalyse the emergence of a new economy. Therefore a third-generation innovation policy has to be designed. The challenge is to anchor firms and employment in a well-performing innovation system: improving connectivity (co-operation and cluster policy in well-chosen niches) and systemic coherence (policy integration) will be the key. But the development of the capacity for strategic decision making is an important feature of governance in this transition.

Evolution of governance

Flanders does not have a tradition of strong government. The social partners are closely involved in policy development (SERV, the main think tank for economic policy, is operated by employers and labour organisations). Policy formulation and policy implementation are largely mediated by stakeholders.

In this respect the Flemish innovation system has inherited a number of institutional characteristics from the Belgian innovation system. The 1947 De Groote Law set up an obligatory contribution system for all firms in specific industrial sectors (metals, textiles, construction, diamond) to support collective centres set up by business associations to do applied research and problem solving for their members (also state-financed). This model has been replicated in different forms up to today. In general the Belgian state organised little public research and the research of public companies, such as railways or telecommunications, was outsourced to national champions in the private sector. Defence was rather weak and development of new equipment went abroad in exchange for economic compensation in production facilities. Nuclear energy has received much attention since the 1950s (VITO was a spin-off from the Study Centre on Nuclear Energy), and space research has received since the mid-1980s a yearly subsidy of about EUR 150 million for participation in the European Space Agency (with limited Belgian spin-off). The Belgian state relied on the capital holding groups for long-term investment, but when the holdings collapsed in the 1980s (destroying large parts of the R&D assets of its components, *e.g.* ACEC), the only remaining long-term research structure was university-based research.

In the Flemish institutional set-up, universities are influential actors, in part because the political emancipation of Flanders was to a large extent a cultural movement that crystallised in these universities. The main research institutes (IMEC, VIB, IBBT) have an inter-university structure – the latest initiatives are virtual and do not have their own research labs. This is why the selection of scientific specialisation in the Flemish innovation system is exclusively researcher-based and driven by performance in publication rather than innovation. However, universities are becoming important industrial players that develop their own strategies through patent portfolio management, research contract policies and recently the attribution by the government of an Industrial Development Fund for strategic research based on university priorities.

Another element that determines governance is the small number of local MNEs, none of them large enough to dominate the policy agenda. This is why business associations play an important role (as service providers for their members). Since the 1950s, they have organised collective research centres in traditional sectors, which mainly provide technical assistance, and they are a role model for initiatives in new domains. In

the past, strategic decisions by foreign MNEs, rather than Belgian and Flemish S&T policies, strongly influenced the structure of economic specialisation .

Innovation governance in Flanders is biased towards research actors and intermediaries that play an increasing role in the operation of the innovation system, in particular in linking the research potential and the economic potential. The new VIS scheme to promote innovation by co-operation has more than 180 innovation advisors in the field (compared to 50 at IWT). The recent boom in poles of excellence, whose management is demand-driven, adds a new decentralised layer to the system, increasing its complexity.

There is no direct institutional link between innovation policy and economic policy. This is illustrative of a general feature of governance structures in Flanders, which are quite vertical. Stimulation policies are not administratively co-ordinated by the government; intermediaries channel the different policy instruments to their members. Innovation policy is mainly resource-driven (providing budget increases that afterwards have to be allocated, subject to interest-group pressures).

The capacity of the innovation system to respond to new challenges is determined by this science-driven and intermediary-driven governance structure. This bottom-up policy was set by the previous government and leaves responsibility for making choices to research and business actors. The convergence of the strategies of complementary actors remains the major challenge.

Improving the supply of valuable scientific-technological outputs is not enough if the problem is to achieve a better match between actors or sectors in the innovation system. The supply orientation of the Flemish innovation system recalls the period when this was the mainstream model. The regionalisation of Belgium created an opportunity to reconstruct and modernise the institutions of the innovation system. The result was a more streamlined structure (with IWT as one-stop shop for industry). But because this took place when policy models were changing from first-generation to second-generation innovation policies, the new set-up has characteristics of both.

The DIRV approach, which emphasises basic research of an international level in the new generic technologies and the creation of spin-offs, reflects first-generation (linear) innovation policy, which assumes that economic performance follows research performance. This approach still dominates large areas of the Flemish innovation system, while the general governance structure has shifted to second-generation innovation policy, which is no longer technology-focused but makes economic and social outcomes the objective and requires an interactive organisational model to create the conditions of success. IWT has evolved from a purely technology-push subsidy instrument to a stimulator of technological innovation. It finances near-risk capital, stimulates networking and co-ordinates intermediaries. This shift of focus can be seen in the change of its name from Institute for the Promotion of Science and Technology in Industry to Institute for the Promotion of Innovation by Science and Technology in the 1999 Innovation Law. These new roles are not yet fully implemented because new capabilities are necessary.

Governance challenges

Further development of the governance structure is subject to learning cycles that still largely coincide with changes of governments and ministers. A qualitative change towards a third-generation innovation policy can be perceived in new operations in the system which are difficult to pursue because governance is still inadequate. The govern-

ment installed in summer 2004 can make substantial contributions to strengthening innovation governance, but significant steps towards third-generation innovation policy governance have to be taken.

First, general acceptance of the systemic approach to innovation policy has to be institutionalised through the integration of technological innovation policy into a broader innovation policy. An integrated innovation policy calls for a co-ordinated process of policy design, policy implementation and policy evaluation in the departments concerned with the stimulation of innovation, entrepreneurship, investment and trade. The new government has realised an important precondition by bringing the Ministry of Science and Technological Innovation and the Ministry of Economy under one ministerial responsibility.

Second, innovation policy has to be integrated with all sectoral policies, and these have to make innovation a clear objective on their agenda, if governments really want to achieve the Lisbon target of transforming their countries in competitive knowledge societies. In a recent government declaration, reference to multi-sectoral "horizontal innovation policy" is made in the sections concerning energy policy and agricultural policy.

Third, the scope of innovation policy has to be expanded from economic goals to other types of policy goals, not as constraints on growth but as part of a coherent social mission with a long-term development perspective. Sustainable development, as a combination of economic, social and ecological goals, is such a policy. The Pact of Vilvoorde is a first sketch of such a new long-term growth path. This type of multi-sector, multi-goal innovation policy can only be achieved by new types of horizontal policies and governance structures. In the government declaration this multi-goal policy is called "inclusive policy". The first challenge is to make the Environmental Technology Platform (MIP) operational as a governance structure for this new policy orientation.

Fourth, the national and international dimensions of innovation governance have to balance the growth potential of local interactions with those at global scale and with specialisations. The Flemish innovation system has to position its comparative strengths in the wider European Research Area and international networks of knowledge regions. Flanders is too small to be excellent in a wide range of research and innovation activities. Clusters and innovation networks do not stop at a country's borders. Therefore, national governments have to co-operate in the development of innovation governance. Flanders has developed centres of excellence that are too big for the region, but also has innovation activities that are difficult to match with excellent research in Flanders. International governance of innovation can pool resources and stimulate an international division of labour based on dynamic comparative advantages.

The institutionalisation of new policy models needs a period of transition in which good management, making its strategic objectives clear, can make a difference in streamlining institutional developments. In the past, the centralisation of different competences in one (ministerial) body was a way to spur co-ordination. The fact that media policy and innovation policy were the responsibility of the same minister has certainly stimulated developments such as the establishment of a Broadband Institute and the important investments for the development of interactive digital television. The (re)creation of a Ministry of Sciences and Technological Innovation will not solve the co-ordination problems with the Ministries of Economy and Education (or others), in the absence of a broader vision of the future of the Flemish innovation system. The challenges are significant. The large investments of past governments and the still more

ambitious efforts announced by the present one present important risks with regard to the absorptive capacity of the Flemish innovation system. The present functioning of administrations creates a bottleneck for this increase in the size of the budget. The proliferation of new initiatives supported by intermediaries risks causing institutional blockage of the system. Accountability and strategic management needs to be strengthened.

The first step therefore is better support of the policy cycle in the allocation of this funding. The 1999 Innovation Decree announced the instauration of a five-year planning cycle that is still to be implemented. Horizontal co-ordination will be one of the main tasks of the Administration of Sciences and Innovation. But the political legitimacy of putting innovation high on the general policy agenda depends on political vision and the role of policy makers as catalysers of a new social consensus.

Realisation of horizontal policies must therefore rely on the governance of vision and long-term strategy, an important role of policy preparation. In Flanders most of this second-order governance or strategic intelligence is weak or non-existent. However, there is a practice of social consensus building and institutional flexibility (reforms) that is an important point of departure for creating new communities of practice in horizontal policy.

Conclusion

This chapter argues that changes in the governance of the Flemish innovation system are a necessary precondition of a shift towards third-generation innovation policies. The drivers for change in the governance of the Flemish innovation system are:

- A vulnerable competitive position as a small open economy (location as a knowledge economy; international position in niches).
- Strong integration in the EU (adoption of EU Lisbon target).
- Emergence of more and more cross-departmental challenges (sustainable development).
- Increasing overall budgetary pressure (need for selectivity) and public responsibility (need for evaluation) combined with a strong budget increase for science and innovation.
- Problem of synergies with other Belgian governments on the federal level (better use of tax policy, of Brussels' service functions).

The imbalances in innovation performance – mismatches between the education system and new technology development on the one hand and existing economic specialisations on the other hand; the walls between the Ministries of Economy, Innovation and Science, and Education – require better horizontal co-ordination to strengthen the innovation system. A strategic innovation policy is being set up by the Flemish government through different channels (strengthening existing public research institutes, developing a new strategic basic research programme, establishing new poles of excellence). Therefore capabilities for horizontal innovation policy development are central (Box 12.1). The self-management capacity of the innovation system needs to be improved on the basis of better feedback (retrospective and prospective evaluation of the mechanisms).

Box 12.1. Horizontal innovation policy: types of policy development

1. Internalisation of innovation objective in sectoral policies (*e.g.* test of regulations; public procurement that stimulates innovation).

2. Co-ordination of sectoral policies (*ex post* operational convergence): portfolio management of existing instruments that are better matched and packaged.

3. Integration in common policy (*ex ante* strategic convergence): design of a policy mix targeted to common objectives for all of government (*e.g.* new social contracts linking innovation and sustainable development).

A more effective innovation system cannot be obtained through the kinds of self-organisation of interested parties that have operated until now, because these often cannot operate effectively on the important second-order effects of local actions (like spillovers and synergies in non-core areas that nowadays constitute the largest part of the social return to innovation investments). A support system for decision-making for strategic actors (and in particular for government as catalyser of the system) is a necessary condition for co-development of strategic third-generation innovation policies. Therefore, distributed strategic intelligence is key to the governance of third-generation innovation policy. Strategic policy integration cannot be operated on an *ad hoc* basis but needs a network of standing support organisations.

The multiplication of conferences on strategic choices for Flanders (Pact of Vilvoorde, Innovation Pact, Enterprise Conference) is another indication that *ad hoc* construction of a new consensus has its limits. A more systematic reflection on future options is needed. This is not the task of a central bureau of future choices but an organised process of achieving strategic convergence among the different actors that is governed by a set of complementary institutions and supported by specific instruments for innovation systems management.

At the moment different nodes of this network are present but cannot fulfil their role of strategic intelligence in the policy cycle in the absence of a mission and co-ordination. The present advisory board for S&T policy (VRWB) has been assigned the role of Strategic Advisory Board of the new ministry and already invests in capacity for foresight studies. The Flemish parliament established an Institute for Technology Assessment (VIWTA) in 2002. Recently, the new Support Points programme for policy-oriented studies has started, with two support points in the fields of S&T indicators and of entrepreneurship and innovation. They complement the intelligence already present at the administrations (Monitoring Unit AWI, IWT Observatory, the Unit for Innovation and Entrepreneurship, etc.) which needs to be strengthened further to be able to internalise research results from national and international networks. A next step is to link those units at different administrative levels into an innovation policy support network that enables information and knowledge flows for decision support in strategic innovation policy development. Based on experience in Flanders and abroad, the following matrix (Table 12.2) provides an overview of the conditions needed for this distributed strategic intelligence to function, according the type of co-ordination needed on different levels. The coherence of strategic intelligence emerges from the interplay of all these conditions:

Table 12.2.

GOVERNANCE at the level of:	Typical organisational form of co-ordination	Policy instruments	Strategic intelligence
Social actors (Consensus building)	Innovation Conference	Strategic Innovation Programme (Innovation Pact)	Foresight/road mapping
Political actors (Strategic board)	Innovation Council	Innovation Action Plan (Policy Declaration)	Evaluation and policy design
Administrative actors (Co-ordination in the field)	Innovation Network	Innovation implementation planning (Management contracts)	Monitoring

Line 1 of the matrix. On the broadest level of social consensus a future strategy is shared (for the FIS as a whole or for particular sub-systems). A well-prepared Innovation Conference can create sound foundations for long-term commitments following a process of convergence among the strategic actors and exchange of scenarios and options on a more regular basis.

In Flanders the first foresight exercises are starting; some sectoral roadmap exercises have been successful. But top-level conferences seldom use such intelligence.

Cluster platforms of different kinds (poles of excellence, thematic innovation co-operation projects) that mobilise the actors for strategic co-operation are an organisational level particularly well-suited for integrating such exercises into innovation practice.

An Innovation Platform with leaders from the business and research communities can play an important role in making choices. The success of the Finnish Innovation Council has inspired other countries (recently the Netherlands) to establish a similar body. The federal government in Belgium has done the same (with a lower profile).

Line 2 of the matrix. On the basis of this process of convergence, all decision makers on the political level with authority in the relevant policy domains have to be involved in the organisation of the five-year policy cycle of the Innovation Plan, to be presented to the parliament (according to the Innovation Law of 1999). The plan has to steer policy instruments in a co-ordinated way. The policy design has to build on thorough evaluation of the effectiveness of instruments and actions. This is a strategic capacity that has to cope with the challenge of evaluation policy mixes and systemic impacts.

Evaluation in Flanders is still weak but can be upgraded in the follow-up of existing long-term projects such as the Innovation Pact, the international benchmarking of knowledge regions or the structural underpinning of the new programme on poles of excellence.

Line 3 of the matrix. On the level of administrative co-ordination and implementation of policies in co-operation with all intermediaries, an Innovation Network among all innovation support actors has already been set up by IWT. It can develop into a system of management information to support and monitor innovation activities. Direct information exchange between different administrations is also to be institutionalised to enhance co-ordination.

The Flemish innovation system has matured thanks to the government's dynamic innovation policy which already has developed some features of third-generation innovation policy. To make the transition to a knowledge-driven economy, a strategic innovation policy is needed to ensure coherence among the activities of the actors in the innovation system and redirect economic specialisations. Formalisation of the policy cycle is a key problem for innovation governance in Flanders. The development of capabilities for strategic intelligence and interactive policy making in innovation governance are part of the evolution to a knowledge-based society.

Annex 12.A

INSTITUTIONAL MAPPING OF THE FLEMISH SCIENCE AND INNOVATION SYSTEM

The science and innovation system in a small open economy such as Flanders (see Figure 12.A.1) is subject to important pressures from the international environment. Knowledge suppliers, research institutes and business R&D are constrained in their decisions by the dynamics of economic globalisation and internationalisation of R&D where multinational enterprises (MNEs) and international centres of excellence in science co-determine the development of local specialisations. International regulations by bodies as the European Union increasingly determine national regulations. The Lisbon strategy is the strategic framework for Flemish policy makers too. The EU Framework Programme for Research sets standards for national S&T policies. Demand conditions are another determining influence on the direction (public missions, consumer tastes) and organisation (articulation of intermediate demand in client-supplier networks) of R&D and innovation in Flanders.

The science and innovation policy domain is marked by the history of institutional reforms that has divided powers between federal and regional governments in Belgium.

- The federal government with the Ministry of Economic Affairs controls fiscal policy for R&D and has a role in certain international research domains, such as space research. PODWB is the federal administration for science policy.
- The Ministry of Science and Technological Innovation (ST&I) in the Flemish government organises horizontal innovation policies through inter-cabinet negotiations with colleagues. AWI is the policy administration for science and innovation; IWT and FWO are the main agencies for support to applied and fundamental research. They have to co-ordinate with other administrations like EWBL for the economy, and with other public bodies like PMV, the public holding company that manages mechanisms for stimulating venture capital, and VAO (GOM), the agency that is the front office for government support to enterprises.
- The Flemish parliament has recently established its own Institute for Technology Assessment (viWTA) to support social debate on technology and society. The councils or strategic advisory boards represent the stakeholders in each policy domain: VRWB for S&TI policy, SERV for economic policy at large. Stakeholder organisations are also much involved in long-term social contracts such as the Pact of Vilvoorde and the Innovation Pact. IWT has a special role in co-ordinating the intermediary organisations that rely heavily on these stakeholders in an innovation network (VIN).

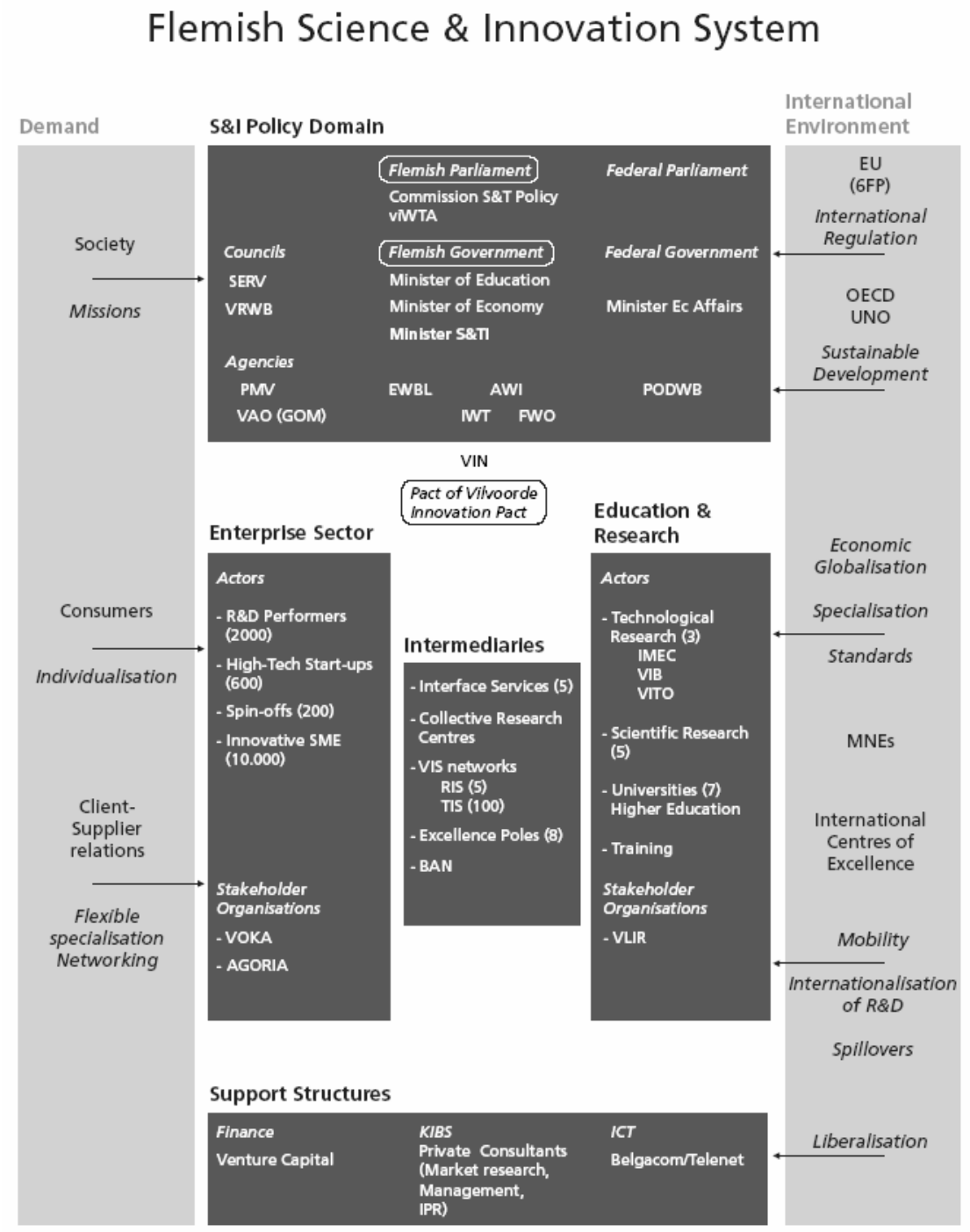
The sector of education and research institutions is dominated by the seven universities (with research efforts concentrated in a few) which have formed alliances with the higher education institutions. VLIR is their representative organisation. The public research institutes are strategic actors in the technology domains of materials and environmental technologies (VITO), biotechnology (VIB) and microelectronics and nanotechnology (IMEC). There are also five smaller institutes in different scientific research domains.

The enterprise sector is a differentiated sector, including from the point of view of R&D and innovation potential. Besides the limited group of 2 000 permanent R&D performers, there is a large target group of about 10 000 innovative firms that are technology-intensive in different degrees. Research-based start-ups (created largely in the 1990s), of which university spin-offs are a part, are estimated at 600. VOKA (the general federation of Flemish enterprises) and AGORIA (the federation for the technology enterprises) are the representative bodies for enterprises in Flanders, in addition to branch organisations.

Intermediaries have a role as bridging institutions, facilitating knowledge transfer between public research and business, but also and increasingly within the business and research sectors. They depend heavily on government support. Collective research centres have been set up by the traditional sector organisations for research and technological support since the late 1940s. They have served as role models for other collective research on a non-profit basis but also for the poles of excellence that are strategic (demand-driven) initiatives of the Flemish government in such new areas as: broadband, mechatronics, logistics, food technology or environmental technologies. This type of collective organisation is also inspired by the network model of (smaller) initiatives supported in the IWT programme for innovation co-operation (VIS): thematic innovation co-operation (TIS) or regional innovation co-operation (RIS). The different business angel networks have been merged into one scheme (BAN).

The support structures provide a general infrastructure in finance and ICT. Liberalisation is also affecting this infrastructure. Competition between the regional telecom provider Telenet (set up by the Flemish government) and the national incumbent Belgacom has spurred penetration of broadband. Knowledge-intensive business service providers (KIBS) are acknowledged to be a second knowledge infrastructure, in addition to the public knowledge infrastructure, because of their growing role in the diffusion of non-technological knowledge.

Figure 12.A.1. Flemish science and innovation system



Notes

1. The concept was originally used by specialists of medieval English society, which was characterised by co-operation between the different sources of power (church, nobility, merchants, peasants, etc.). During the 1980s the World Bank took up the concept of governance to describe the way power is exercised in the management of a country's economic and social resources. At the heart of discussions about governance are terms such as responsibility, information, transparency, the rule of law. Governance does not refer to political power in the strict sense. It is not the art of administration at a given level of power, but the art of co-ordinating administration between different territorial levels. *www.solagral.org/publications/pedago/mondialisation_1999/version_gb/glossary.htm*

2. Strategic intelligence in the context of innovation governance is the decision support mechanism for innovation policy to identify sources (technology assessment, foresight, evaluation, benchmarking), build links between sources, improve accessibility for all relevant actors (clearinghouse) and stimulate the development of the capacity to produce strategic information tailored to the needs of the actors involved (Kuhlmann *et al.*, 1999).

3. According to the MONIT project proposal, "Transition management is here understood as the ways in which more complex changes are managed through comprehensive policy packages and their strategic implementation. This includes the ways in which innovation policy institutions learn and the way in which governance structures renew themselves." The concept of transition management is used in a systemic sense in the management of structural transformations in complex systems. It is derived from population dynamics (demographic transitions) and applied to system innovation in technology regimes for sustainable development (Rotmans *et al.*, 2001).

4. "Third-generation innovation policy" is an expression that was introduced in a study entitled *Innovation Tomorrow*, funded by the Enterprise Directorate-General of the European Commission and published in 2004. It argues that a "third-generation" innovation policy, which recognises the centrality of innovation to all policy areas, is key to increasing the innovation performance of today's economy. As opposed to earlier generations of innovation policy, based on the linear, research-dependent perception of innovation, and the current generation which supports the systemic nature of innovation, this third generation would reflect the horizontal nature of innovation and the need for innovation to become an integrated dimension of traditional policies.

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