VISION ERA•NET

SHARED KNOWLEDGE BASES FOR SUSTAINABLE INNOVATION POLICIES

Policies for Open Innovation:

Theory, Framework and Cases

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> 'You see, Charlie,' he said, 'not so very long ago there used to be thousands of people working in Mr. Willy Wonka's factory. Then one day, all of a sudden, Mr. Wonka had to ask every single one of them to leave, to go home, never to come back.'
> 'But why?' asked Charlie.
> 'Because of spies.'
> 'Spies?'
> 'Yes. All the other chocolate makers, you see, had begun to grow jealous of the wonderful candies that Mr. Wonka was making, and they started sending in spies to steal his secret recipes'.
>
> Roald Dahl, *Charlie and the chocolate factory,* 1964.

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SUMMARY

Introduction (chapter 1)
Open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively. Open Innovation has so far been mainly discussed at the organizational level. For policy makers, the role of governments in a world of Open Innovation is still uncharted. Commissioned by VISION Era-Net, we developed a framework to identify the most important policy guidelines related to Open Innovation. We applied the framework in three Era-Net countries (The Netherlands, Flanders (Belgium) and Estonia). This was done to assess which guidelines are already present in current policy mixes, and to learn which ones could be developed. Our five research questions were:

1. What are the key dimensions of Open Innovation?
2. Why is it legitimate to develop policies for Open Innovation?
3. What policy guidelines can be derived from Open Innovation theory?
4. How are these guidelines reflected in the current policy mixes of the three selected countries?
5. From a comparison between these countries, what are best practices and what can be learned?

The project consisted of an extensive literature review, interviews with policy makers and innovation experts, and consultation of other sources including policy reports and databases.

Open Innovation (chapter 2)
Open Innovation assumes that enterprises can and should use external ideas as well as internal ideas, and internal and external paths to market, to discover and realize innovative opportunities. The Open Innovation model can be compared with the traditional, closed model in which enterprises generate, develop and market their own ideas, usually organized in an internal R&D department. This closed model has become outdated due to increased mobility of workers, better education, growing presence of venture capital, increasingly shortened product life cycles, growing competition, and wide availability of knowledge from multiple sources. In the Open Innovation model, enterprises can still initiate and nurture innovations within the borders of their organizations, but they may also draw on alternative pathways to bring ideas to the market and to benefit from external knowledge.

We suggest that in a world of Open Innovation, policies must be aligned with the behavior of innovating enterprises and/or the external conditions which motivate enterprises to practice Open Innovation. As key behavioral aspects of Open Innovation we identified:

- Networking. Networks allow enterprises to rapidly fill in specific knowledge needs. They may also be a source of new business partners to commercialize internal knowledge.
- Collaboration. Collaboration is more formal and systematic than networking. Its advantages are similar, i.e. collaboration partners may be sources of ideas and knowledge, or partners to commercialize internal ideas.
- Corporate entrepreneurship. Enterprises can benefit from purposive inflows and outflows of knowledge by means of venturing activities, including intrapreneurship,

external participations and the creation of spin-offs.
- IP management. In the open model intellectual property (IP) is managed proactively. Enterprises can acquire external IP to fuel their research engines, and they can profit from their own, unused IP by licensing it to others.
- R&D. The open paradigm does not imply that internal R&D is obsolete. Internal R&D can still be a source of better performance like it was in the old days. It also increases absorptive capacity to better benefit from external sources.

Besides, we identified three major external conditions which trigger enterprises to engage in Open Innovation:
- Large stock of basic knowledge. One of the trends that induced Open Innovation is a wide availability of knowledge throughout society. An important condition for Open Innovation is that this situation is preserved and possibly expanded.
- Highly-educated and mobile labor force. Both will increase knowledge spillovers between organizations. Besides, high-quality education improves enterprises' absorptive and collaborative capacities.
- Good access to finance. The availability of external financing is another condition enabling enterprises to practice Open Innovation. Especially small, challenging enterprises need external finance in order to realize their innovative ideas.

Legitimization (chapter 3)

In order to justify policies for Open Innovation, a key question is if the traditional legitimization arguments of spillovers, system failures and market failures are still applicable. Our brief answer is 'yes'. Firstly, Open Innovation dictates that organizations make better use of their knowledge. When organizations open up their innovation processes, more knowledge spillovers can be anticipated. Secondly, Open Innovation is closely related with the systems of innovation literature. An overview of the similarities between both literatures is shown in table S1. These overlaps suggest that system failures are also applicable to legitimize Open Innovation policies.

table S1 Similarities between the Open Innovation and systems of innovation literatures

Open Innovation literature		*Systems of innovation literature*
Enterprises obtain better results if they open up their innovation processes, i.e. involve the world outside.	↔	Innovation is the result of complex and intensive interactions between various actors.
Innovation is no longer the domain of the internal R&D department; traditional stage-gate models provide an incomplete picture of how innovation should be organized.	↔	The linear model in which knowledge-related activities are divided in supply and demand does not hold any longer.
Enterprises can benefit from purposive inflows and outflows of knowledge. Knowledge spillovers offer opportunities and are not just a threat.	↔	Knowledge spillovers are essential for the functioning of the innovation system, and are very much desirable.
Enterprises need both internal innovation competences (other than R&D) and competences to connect with external parties in order to be successful.	↔	The functioning of innovation systems can be hampered by capability and network failures.
As enterprises increasingly depend on external sources, infrastructural arrangements (e.g. IPR) and other framework conditions become more important.	↔	The functioning of innovation systems can be hampered by institutional and framework failures.
Increased mobility of labor and presence of a trained labor force are important trends that eroded the closed innovation model.	↔	Human and social capital provide the oil necessary for lubricating the innovation system.
If the innovating enterprise cannot internally benefit from its innovations, maybe others can.	↔	The social benefits of innovation exceed those of the individual innovating actors.

Market failures provide another argument. Some market failures will admittedly diminish in a world of Open Innovation. Examples include failures like indivisibility and uncertainty, i.e. Open Innovation stresses external collaboration, implying a diminished burden on innovating enterprises and better opportunities to spread risks. Other market failures will however be more severe. Here, one should think of appropriation problems and asymmetric information. Open Innovation was partly born because enterprises cannot keep their knowledge behind doors. Such a world is characterized by abundant information and a central role for IP.

We remark that despite these similarities, Open Innovation is not identical with previous policy theories. Most important is that Open Innovation focuses on what enterprises do. In contrast, the systems literature for example analyzes industries and countries, and regards innovation as a highly-interactive process, but it tends to ignore how enterprises behave. Open Innovation thus opens up a black box by focusing on the behavior of innovative actors. As a consequence, policies for Open Innovation will partly overlap, but not be identical with policies prescribed by traditional legitimization theories.

Framework for policy assessment (chapter 4)

We identified seven policy areas which are most relevant for Open Innovation: research and technology development (RTD), interaction, entrepreneurship, science, education, labor markets and competition policies. Table S2 shows the framework we propose to identify guidelines for policymaking.

table S2 Framework to identify Open Innovation policy guidelines (simplified version)

Policy areas	***Enterprise behaviors***			***External conditions***		
	Networking	…	R&D	Stock of basic knowledge	…	Good access to finance
RTD Policy						
…		GUIDELINES			GUIDELINES	
…						
…						
Competition policy						

The columns of the framework summarize what Open Innovation basically implies, i.e. behaviors of enterprises and external conditions triggering Open Innovation. The rows contain the above-mentioned policy areas. In the cells of the framework, we identified 21 guidelines for policy making. All guidelines are briefly discussed hereafter.

RTD policies

Policies to stimulate private RTD efforts have a long tradition, and in most countries, they are still at the heart of innovation policy mixes. We propose four relevant guidelines:

I Financial incentives. Financial incentives, such as tax credits and subsidies, are still important. They increase enterprises' R&D efforts and their absorptive

capacities.

II High-quality IP systems. Intellectual property is very much needed because the applicability of trade secrets has diminished. High-quality IP systems enable inward and outward licensing of technologies.

III Support standards. The open paradigm is characterized by increased vertical specialization and widely distributed knowledge. This hampers industrial standard settings processes. Such environments need more public support.

IV Support user innovation. Users are a 'hidden' group of R&D-performers which is badly captured in regular innovation statistics. They develop innovations to satisfy their own process-related needs, and they induce significant knowledge spillovers.

Interaction-oriented policies

This category entails policies to facilitate linkages in the innovation system, thus aiming to favor an interactive environment. We identified five policy guidelines:

V Develop skills. Governments can support enterprises' networking, collaboration, corporate entrepreneurship and IP management skills by providing information, best practices and consultancy services.

VI Stimulate interaction. It is of great importance that innovating actors are able to find each other and are capable to work together. Policies should support self-organization of collaborative partnerships rather than directive actions.

VII Enhance technology markets. Secondary markets for technologies are important for Open Innovation. Policies are needed to create the right framework conditions, e.g. systems for IP valuation and licensing, and to visualize supply and demand.

VIII Use go-betweens. Go-betweens or intermediaries can function as matchmakers, bringing parties together to exchange knowledge, receive feedback, or achieve transactions. Go-betweens can play important roles in the management of networks, collaboration or IP management.

IX Back up clusters. Innovating enterprises will find most external knowledge in locally embedded regional clusters. Governments may back up emerging clusters with developmental programs to support networking and collaboration.

Entrepreneurship policies

Entrepreneurship policies aim for the creation, survival, growth and transfer of private enterprises. We found three relevant guidelines:

X Support corporate entrepreneurship. Only a small part of the business population practices corporate entrepreneurship. Policy makers may trigger and support venturing, intrapreneurship and spin-off creation in incumbent enterprises.

XI Access to finance. Policy makers can offer a variety of interventions to secure innovating actors' access to finance, including subsidies, guarantees and matching funds, but they can also aim for private investors.

XII Back up challengers. Policy makers should enhance the entry and survival of new enterprises, in particular high-tech start-ups. Their vitality infuses greater dynamism into the economy and triggers incumbent enterprises to be innovative as well.

Science policies

Science policies help to maintain a strong public knowledge base. Scientific knowledge should also be diffused to private enterprises. We found four policy guidelines:

XIII Appropriate funding. One policy issue of great importance is substantial public

funding of scientific discovery in order to maintain the stock of knowledge in society.

XIV Balanced incentives. Policy makers need to be concerned with how publicly funded researchers are evaluated and awarded. Nowadays, they are mainly assessed on scientific performance which may hamper their valorization behavior.

XV Focus on excellence. Governments need mechanisms to allocate scientific research funds according to criteria of excellence, including both scientific performance and aspects of valorization.

XVI Organized diffusion. Many countries have problems with valorization. Such imbalances can also be addressed with public-private partnerships, intermediaries and technology transfer offices.

Education policies

Education is very important as it helps to develop and maintain a sufficient supply of well-qualified employees. Two directions for policymaking include:

XVII General stimulation. Developing and maintaining a skilled labor force requires governments to deliver and implement high-quality education at all levels. This would also include post-graduate training and 'life long learning'.

XVIII Entrepreneurship education. Entrepreneurial activity is another driver of Open Innovation. Increased entrepreneurship can be reached through specific education, for example by teaching entrepreneurial competences.

Labor market policies

Labor market policies determine the size and flexibility of a country's working population. We identified two guidelines:

XIX Aim for flexibility. Related to issues of creating a skilled labor force, are policies that facilitate worker mobility. Rules for hiring and firing employees should for example be a simple as possible.

XX Enable knowledge migration. Another opportunity is to benefit from knowledge workers from abroad. Knowledge migration is not a social threat, but rather an opportunity to enhance the quality of the current labor force.

Competition policies

Competition policy is also instrumental for the application of the open paradigm. Policies to stimulate the functioning of markets are indirectly supportive. We propose:

XXI Stimulate competition. Open Innovation can be successful only when markets for innovation resources work well. Policy makers should break down barriers to access markets, fight against cartels, and thoroughly analyze intended mergers.

Case studies (chapters 5, 6 and 7)

We applied the framework with its policy guidelines in three VISION Era-Net countries: the Netherlands, Flanders (Belgium) and Estonia. More specifically, we assessed to what extent current policy mixes reflect the Open Innovation guidelines, and what seems to be missing. For each country an inventory of policies was made, starting with the most recent country reports of the INNO-Policy TrendChart (www.proinno-europe.eu). We also studied a significant amount of policy notes, reports and action plans and interviewed policy makers to further complete the inventories. Results are summarized in table S3.

table S3 Presence of Open Innovation policies in three countries*

Policy areas/ guidelines		*The Netherlands*	*Flanders (Belgium)*	*Estonia*	*Overall Conclusion*
RTD policy					
I	Financial incentives	++	++	+/++	++
II	High-quality IP systems	+	o	o	o
III	Support standards	o	-	-	-
IV	User innovation	-	-	-	-
Interaction policy					
V	Develop skills	o	+	o	o
VI	Stimulate interaction	++	++	+/++	++
VII	Enhance technology markets	-	o	-	-
VIII	Use go-betweens	+	+	o	+
IX	Back up clusters	++	++	o/+	+/++
Entrepreneurship policy					
X	Support corporate entrepreneurship	-	-	o	-
XI	Access to finance	++	++	+	++
XII	Back up challengers	++	+	+	+
Science policy					
XIII	Appropriate funding	+	+	o	+
XIV	Balanced incentives	-	o/-	o	o/-
XV	Focus on excellence	+	+	o	+
XVI	Organized diffusion	++	++	o/+	+/++
Education policy					
XVII	General stimulation	+	+	+	+
XVIII	Entrepreneurship education	+	o	o	o
Labor market policy					
XIX	Aim for flexibility	+	o	+	+
XX	Enable knowledge migration	+	-	o/+	o
Competition policy					
XXI	Stimulate competition	++	+	++	++

* -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

Discussion (chapter 8)

From our findings the following conclusions are drawn. Firstly, current policies already contain many good elements. The Open Innovation model does not completely upset traditional policymaking, i.e. common rationales to legitimize policy interventions, including spillovers, system failures and market failures, still apply. We anticipated that current policy mixes would already reflect many aspects of Open Innovation, and indeed, evidence from the three case studies confirmed this presupposition. Open Innovation guidelines which are well present include policies to offer financial R&D incentives, to stimulate interaction between actors in the innovation system, to better secure innovating enterprises' access to finance, and to generally stimulate competition (table S3). Other guidelines which are frequently found are support for regional clusters and to organize the diffusion of scientific knowledge (for these latter guidelines Estonia is catching up).

Secondly, Open Innovation inevitably broadens the scope of policymaking. The proposed framework prescribes that Open Innovation is influenced by a rather broad set of policy areas, also outside the traditional domains of RTD and interaction-oriented policies. The

open model stresses a need to also include remote policy areas such as labor markets and education. It will be a challenge for policy makers to develop truly lateral policies and to find out how to effectively influence all policy areas.

Thirdly, Open Innovation obviously requires more than financial instruments. Our case studies contained numerous examples of subsidies, grant and guarantee schemes. The establishment of such support packages may however weaken the incentives for regulatory reform (e.g. of educational institutions). It seems that alternative policies such as information services and legislation issues are relatively scarce. Developing these would bring more balance in current policy mixes.

Open Innovation offers some new guidelines which are relatively untouched in current policy mixes. We find that opportunities for new policies are most present in the areas of user innovation, technology markets, corporate entrepreneurship in incumbent enterprises, balanced (career and work) incentives for scientific researchers, and standard setting processes (see table S3).

This study obviously had its limitations. Some of them bring along opportunities for future research. We first stress that the proposed guidelines are derived from previous work on Open Innovation, and as such, they will not capture all of today's popular policy issues. The proposed framework and guidelines will mostly be regarded as a source of inspiration and reflection, rather than an integral blueprint for policymaking. It is a question how important Open Innovation thinking should be to guide policymaking. Especially in developing countries there may be other priorities for policymaking due to the relatively modest absorptive capacity of incumbent enterprises and under-developed innovation institutions. In such countries it would probably make sense to start with the relatively simple guidelines in our framework, e.g. to develop basic innovation and interaction skills, rather than starting with more sophisticated interventions to enhance technology markets or to stimulate corporate entrepreneurship. Future work should explore if there is an optimal sequence in how to adopt various Open Innovation policy guidelines, and if the proposed framework needs to be refined for this purpose.

In the context of our case studies, more suggestions for future research directly follow from where our efforts necessarily stopped. To enable stronger conclusions, case studies should be done in more countries. Future cases could also be developed in a more quantitative manner by investigating and comparing how much money governments spend on specific guidelines. Another issue is that the cases focused on national policies only. One should however realize that some policy guidelines need to be picked up in an international context (e.g. our guidelines of high-quality IP, support for standards and to enhance technology markets). Future work should shed a light on the subject of globalization and optimal levels of policymaking, i.e. which policies can be best offered at national or international levels, or combinations of the two.

Finally, we concluded that Open Innovation asks for adaptations in remote policy areas, such as labor markets and education, and this undoubtly tough to realize. For future work, it is very essential to identify effective structures to influence remote policy areas and to effectively govern and integrate policies for Open Innovation.

1. INTRODUCTION

Motivation

In the spring of 2003, *Open Innovation: The New Imperative for Creating and Profiting from Technology* was first published by Henry Chesbrough. It coined the term Open Innovation and explained its application to managerial problems. The Open Innovation model is opposed to the closed model, which has worked well for many enterprises for most of the twentieth century. The closed model is based on the view that enterprises must generate and develop their own ideas in order to innovate and remain competitive. However, the days when enterprises could simply close the doors to their laboratories to protect their knowledge are long past. Enterprises can no longer afford to keep their doors closed to the innovations of others, to external knowledge or to external information workers. The closed model has been challenged by growing mobility of highly experienced and skilled people, growing presence of private venture capital, increasingly fast time to market for many products and services, growing competition from foreign businesses due to ongoing globalization, and a wider stock of knowledge from various sources. As a consequence enterprises must open their doors; it is widely believed that the era of Open Innovation has arrived (Chesbrough, 2003).

If pressed to express its definition in a single sentence, Open Innovation is 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively' (Chesbrough, Vanhaverbeke & West, 2006: p. 1). The Open Innovation model implies that enterprises can and should use both internal and external ideas and knowledge to advance their innovation processes. It also implies that internal ideas can be taken to the market through external channels (e.g. spin-offs, external licensing of intellectual property) to generate additional value. This new paradigm inspires enterprises to find the most appropriate business model to commercialize new products or services, regardless whether that model exists within the enterprise or must be sought externally.

One challenge is that Open Innovation so far has been mainly discussed at the enterprise level, i.e. how enterprises can organize their innovation processes to benefit from opening up. For policy makers the role of governments in a world of Open Innovation is still uncharted. Therefore VISION Era-Net, a collaborative network of nationally leading innovation policy organizations, has launched a research program on 'Collaborative and Open Innovation: Future challenges for national innovation policies in the emerging European Research Area'. The overall goal is to expand perspectives on Open Innovation in various national innovation systems. More specifically, in 2007 researchers were invited to develop proposals to study the impact of Open Innovation on national and European innovation policies and to develop recommendations to innovation policy makers on how to respond. This challenge has also been taken up by a consortium of researchers from the Netherlands, Belgium, Estonia and the United States. In the current report we offer a framework which contains guidelines for policymaking, and we apply this framework in three countries to assess the extent in which current policy practices match with the principles of Open Innovation. It is anticipated that this work will support and inspire future policy efforts in interested countries.

Objective and research questions

The current project identified what policies are desirable to stimulate and support enterprises' innovation practices in a world of Open Innovation. Our most important objective was to develop a theory-driven, conceptual framework that identified:

- critical dimensions of Open Innovation
- desirable policy guidelines to support Open Innovation
- why it is legitimate to support Open Innovation.

As an empirical exercise we confronted the framework with the current policies in the Netherlands, Flanders (Belgium) and Estonia. In so doing we assessed to what extent the principles of Open Innovation are incorporated in the policies of these countries. It is anticipated that this exercise will inspire policy makers to explore and develop new policies, and that it will be an example for policy makers in other countries to apply the framework by themselves. The project thus gives an overview of relevant policy issues to support Open Innovation, how this can be legitimized, and – for three countries – what policy aspects could be further developed.

To realize these objectives we formulated five research questions:

1. What are the key dimensions of Open Innovation?
2. Why is it legitimate to develop policies for Open Innovation?
3. What policy guidelines can be derived from Open Innovation theory?
4. How are these guidelines reflected in the current policy mixes of the Netherlands, Flanders (Belgium) and Estonia?
5. From a comparison between these countries, what are best practices and what can be learned?

Methodology

The project consisted of an extensive literature review, interviews with policy makers and innovation experts, and consultation of other sources including policy review reports, notes and databases. The project entailed two stages. To answer research questions 1-3 we started with studying the current literatures on Open Innovation and legitimization of innovation policies. Based on the literature on Open Innovation and related research topics, an initial framework and policy guidelines were developed. Next, various experts on Open Innovation and innovation policymaking were interviewed to obtain feedback and comments, and to assess the practical applicability of the framework and guidelines. Based on their feedback we refined the framework. The interviews not just focused on the Era-Net representatives in the funding countries, but we also contacted policy makers in other countries. In the second stage we confronted the framework with the situation in the Netherlands, Flanders (Belgium) and Estonia (for research questions 4 and 5). We assessed to what extent current policies reflect the guidelines for Open Innovation policymaking and what seems to be missing. We also consulted a number of policy makers in the various countries for more specific information. Based on country-specific information a comparative analysis was performed in order to draw final conclusions. An inventory of all reviewed literature and reports is given in annex I. For an overview of the interview partners, we refer to annex II.

Outline

In order to identify relevant guidelines for policymaking, chapter 2 first defines and describes Open Innovation. We distinguish between the behaviors of enterprises, i.e. what are enterprises doing when they practice Open Innovation, and external conditions which refer to external trends or erosion factors triggering enterprises to adopt the

open model. Next, chapter 3 discusses why it is legitimate to develop policies for Open Innovation. We argue that previous theories to justify innovation policy interventions, including spillovers, system failures and market failures, are very well applicable. The report proceeds with chapter 4 in which we propose a framework to identify specific guidelines for policymaking. We propose that Open Innovation asks for more than traditional policies such as stimulating research and technology development (RTD) and inter-organizational networking. We identify 21 guidelines for Open Innovation policymaking and explain how these guidelines are connected with various enterprise behaviors and/or external conditions.

Subsequent chapters describe our case study findings in the Netherlands (chapter 5), Flanders (Belgium) (chapter 6) and Estonia (chapter 7). It is analyzed what guidelines are already present, and which ones are missing and may be in need of development. The analysis focuses on the national level, assuming that the most important policies and significant budgets are distributed at this level. Finally, chapter 8 contains a benchmark exercise in which the policy practices in the three countries are compared in order to draw conclusions. This chapter ends with our general conclusions, implications for policy makers, and a discussion of limitations and suggestions for future research.

Some a priori remarks are the following. Firstly, our framework and policy guidelines are derived from Open Innovation theory. We explore the consequences of Open Innovation for policymaking by developing specific policy guidelines, to enable (future) assessments of how current policies reflect the principles of Open Innovation. As we limited ourselves to previous work on Open Innovation, the proposed framework and guidelines do not contain all current topics in innovation policy. Secondly, it is assumed that the open model is a useful paradigm to organize innovation processes, and that private enterprises should in general adopt its principles in order to become more successful innovators. Admittedly, there are examples of industries where the closed model is still prevailing, for example nuclear reactors and aircraft engines (Chesbrough, 2003). Likewise, in consumer electronics some enterprises have adapted an open strategy while others (e.g. Samsung) are still successful with closed innovation models. We here mention that a large and ever increasing share of the business population today benefits from organizing their innovation processes in an open way. We refrain from a discussion of the empirical evidence for this supposition, but rather refer to existing work (e.g. Chesbrough, 2003; Chesbrough, Vanhaverbeke & West, 2006; De Jong, 2006; OECD, 2008).

2. OPEN INNOVATION

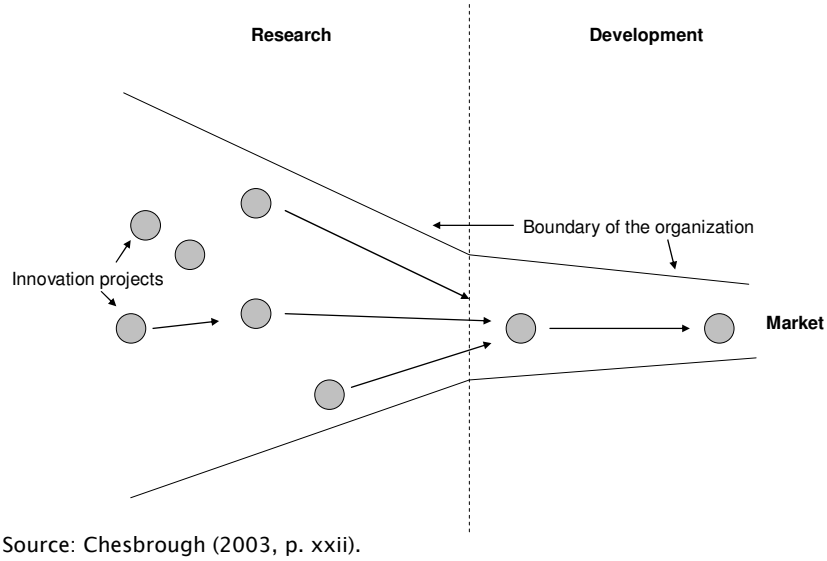
2.1 Rise of the open paradigm

Closed paradigm

By coining the Open Innovation model, Chesbrough (2003; 2006) has brought to the surface why former leading multinationals like Philips, Xerox and IBM did not manage to obtain full credits from their massive R&D expenditures, and why relatively new-born enterprises like Intel managed to grow rapidly in the past decades. We have witnessed a paradigm shift in how enterprises develop and commercialize innovations. The view behind the 'old' closed innovation model is that successful innovation requires control. It supposes that enterprises must generate their own ideas and then develop them, build them, market them, distribute them, service them, finance them, and support them on their own. This closed paradigm counsels enterprises to be strongly self-reliant, because one cannot be sure of the quality, availability, and capability of others' ideas. The dominant logic behind closed innovation was internally focused: enterprises invested in innovation, which led to many breakthrough discoveries. These discoveries enabled those enterprises to bring new products and services to the market, to realize more sales and higher margins because of these products, and then to reinvest in more internal innovation, which led to further breakthroughs. And because the intellectual property (IP) that arises from this internal innovation was closely guarded, rivals could barely exploit these ideas for their own profit (Chesbrough, 2003).

For most of the twentieth century this paradigm worked well. It was closely linked to mass-production and the rise of consumerism, both feeding on strongly integrated enterprises and markets. Most extant theories of managing innovation are built on the closed conception. Examples include the stage gate process, the product development funnel or any innovation pipeline model found in scholarly textbooks. As shown in figure 1, projects enter on the left at the beginning, and proceed within the enterprise until they are shipped to customers or users on the right. The innovation process is designed to weed out false positives, projects that look initially appealing, but later turn out to be disappointing (Chesbrough, 2003). Indeed, as mass markets were the dominant type of markets, it was only logical that such innovation structures emerged – killer applications promised to wipe out competition and enable monopolistic rents.

figure 1 The closed paradigm to manage innovation



Source: Chesbrough (2003, p. xxii).

Shift to the open paradigm

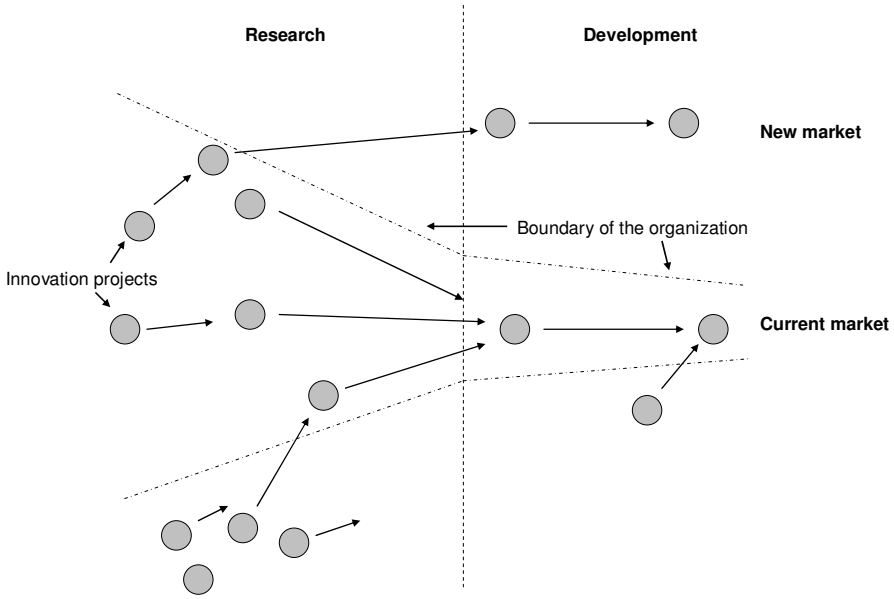
The closed model has been eroded for several reasons or trends (Chesbrough, 2003). One is that the mobility of highly experienced and skilled people has grown rapidly in the past decades. When knowledge workers leave a company after working there for many years, they take a good deal of knowledge with them to their new employer. A related reason is that many people nowadays obtain better college and post-college training. This allows knowledge to spill over to other enterprises much better than before. A further factor is the growing presence of private venture capital to support innovations. This enables many more individuals and small enterprises to initiate and organize innovations on their own. Other erosion factors include the increasingly fast time to market for many products and services (decreasing the shelf life of specific technologies), growing competition from foreign enterprises due to ongoing globalization, and a wide availability of knowledge from multiple sources such as universities, specialized suppliers, engineers, designers, inventors and knowledge brokers. Besides, the evolution of many formerly mass-markets into multiple niche markets, and the rise of more tailor-made products in general, is another trend that has made the closed model obsolete.

Due to these erosion factors the closed paradigm has become increasingly outdated. When R&D workers for example realize fundamental breakthroughs, it is no longer self-evident that their employer is the one to benefit. If their employer does not pursue or support their discoveries in a timely fashion, R&D workers could pursue the opportunity on their own by starting their own business. As a consequence, the organization that originally funded the discovery does not automatically profit from its R&D investments. Probably the most illustrative example is Xerox' Palo Alto Research Centre (PARC). Many great IT innovations were initiated at PARC, but Xerox managed to benefit from only a fraction of them due to their internally focused business model (Chesbrough, 2002).

Open innovation is a paradigm that assumes that enterprises can and should use both external and internal ideas and paths to the market, when enterprises look to discover

and realize innovative opportunities. The open paradigm assumes that internal ideas can also be taken to markets through external channels, outside the current businesses of the enterprise, to generate value. This paradigm is illustrated in figure 2.

figure 2 The open paradigm to manage innovation



Source: Chesbrough (2003, p. xxv).

In figure 2 ideas can still originate inside the enterprise, but some of those ideas may seep out, either in the early and later stages of the innovation process. One potential alternative for internal development is a start-up, often staffed with some of the enterprise's own personnel. Other leakage mechanisms include selling ideas or prototypes, and external licensing. Ideas can also start outside the enterprise and move inside later. As the figure shows, there are a great many potential ideas outside the enterprise. Although the open model still weeds out false positives (now from external as well as internal sources), it offers a broader range of alternatives to benefit from innovation, and it also enables to recover false negatives by acquiring them later, i.e. projects that the company might have missed initially, or that did not seem to be promising (Chesbrough, 2003). We remark that the innovation literature, including many textbooks, has already identified openness and specifically sourcing external knowledge as an important mode to speed up the innovation engine of enterprises. What is new however is that the open model also stresses that brilliant ideas can be exploited outside the organization ('inside out'), and that an integral use of purposive inflows and outflows of knowledge and resources results in better innovation performance. The trend in many industries towards opening up innovation processes cannot be denied; it has become more important in recent years in both multinational, large enterprises (OECD, 2008) and small and medium-sized organizations (De Jong, 2006).

2.2 Key characteristics

We suggest that any policy to stimulate or support Open Innovation must be aligned with either how enterprise organize their innovation practices, or with external conditions triggering Open Innovation. One important element of our framework is therefore the behaviors of enterprises: what are they doing when they practice Open Innovation? Besides, the ability and necessity of enterprises to practice Open Innovation depends on a number of external conditions, including the availability of a substantial stock of basic knowledge, a highly-educated and mobile labor force, and good access to finance. We propose that governments can also trigger and support enterprises by stimulating that these essential external conditions are well-organized. Hereafter, we elaborate on the key characteristics of Open Innovation. One remark is that our selection of key characteristics is inevitably simplified, i.e. we restrict ourselves to keep the policy framework and guidelines simple and applicable.

Enterprise behaviors

We distinguish five behaviors that capture most of what enterprises do when they practice Open Innovation:

1. Networking
2. Collaboration
3. Corporate entrepreneurship
4. IP management
5. R&D

Ad 1. Networking

Networking includes all activities to acquire and maintain connections with external sources of social capital, including individuals and organizations[1]. The Open Innovation literature has repeatedly stressed the benefits of networking as a source of new knowledge (outside in) and to commercialize internal knowledge (inside out) (e.g. OECD, 2008; Chesbrough, Vanhaverbeke & West, 2006). Open innovation is almost by definition related to the establishment of ties of innovating enterprises with others. Networks allow enterprises to rapidly fill in specific knowledge needs without having to spend enormous amounts of time and money to develop that knowledge internally or acquire it through vertical integration. Similarly, networks are a source of new business partners to commercialize new products ideas or prototypes which would otherwise stay 'on the shelf'. Networks may also evolve into formal cooperation projects which is one of the other key characteristics of Open Innovation (see hereafter).

In the broader innovation literature many authors have also proposed that enterprises should and actually do exploit external knowledge. Kline and Rosenberg (1986) identified that the innovation process is interactive within the enterprises and among the different actors in the enterprise's environment. They also argued that the process of mission-oriented R&D will be initiated only if the enterprise cannot find the technical solution in the existing pools of knowledge inside or outside the enterprise. In the current business environment enterprises need to contact other actors in the innovation system to discover opportunities, obtain new knowledge or resources, to develop and absorb new technologies, commercialize new products, or simply to stay in touch with

[1] Networking is distinguished from cooperation. We consider cooperation to be more of a formal nature, i.e. more systematic, profound, and focused on specific purposes such as innovation projects.

the latest technological or market developments. Enterprises are working more and more as part of broader networks to create customer value (Vanhaverbeke, 2006).

Relevant network partners include customers, competitors, suppliers, consultants, engineers, industrial associations, universities and other public research organizations, governments and non-profit intermediary organizations (De Jong & Hulsink, 2005). For innovation purposes, a common thought is that optimal network configurations contain both wide ties and deep ties. Deep ties enable enterprises to capitalize on its existing knowledge and resources. They are the result of an organization's strong network position that allows it to tap into key resources for innovation. Wide ties, on the contrary, enable enterprises to find yet untapped opportunities, knowledge and resources. They enable enterprises to explore. Enterprises need to combine deep and wide ties to profit from their external relations (Simard & West, 2006).

Perhaps the simplest source of innovation is to imitate a competitor: such free riding on the product and market investments of rivals is a common way for enterprises to overcome risks related to a first mover strategy (Lieberman & Montgomery, 1998). The work of Von Hippel (2005) stresses that users are also important sources of innovation. Users may have specific process needs, and these may drive them to significantly adapt machines and equipment in order to make these solve those problems. Suppliers in turn may benefit from these adaptations. In general, failure to consider users' constrains and requirements in the design of innovations often leads to difficulties in their commercialization (Cooper, 2003).

Ad 2. Collaboration
Formal collaboration for specific innovation purposes is another behavior that is beyond doubt an essential element of Open Innovation. In small- and medium-sized enterprises (SMEs) innovation collaboration has in fact in long lasting tradition; such enterprises lack the resources to fund innovations by themselves, and they cannot maintain large innovation portfolios to spread their risks (Nooteboom, 1994; Vossen, 1998). In larger enterprises external collaboration projects have increased too (Chesbrough, 2003; De Jong, 2006; OECD, 2008). R&D alliances between non-competing enterprises have for example become a popular vehicle for acquiring and leveraging technological capabilities. In addition, enterprises increasingly team up with competitors to share R&D costs and associated risks. Because of the fact that enterprises can get locked in innovation networks, it is important to search for optimal network configurations (Gomes-Casseres, 1996; Rowley, Behrens & Krackhardt, 2000) which implies that they increasingly innovate with competitors. Another trend is that more enterprises enter into research collaborations with universities. Without inputs from academic research many innovations could not have been realized or would have come much later. Scientific results brought about increased sales and higher research productivity and patenting activity for enterprises (Cohen, Florida, Randazzese & Walsh, 1998). Ever more university research projects are partly funded by private enterprises to benefit from knowledge spillovers (Colyvas, Crow, Gelijns, Richard, Nelson, Rosenberg & Sampat, 2002).

For larger enterprises, the development of knowledge bases in a growing number of countries has incited them to set up different forms of collaboration with external innovation partners abroad in order to source foreign knowledge in centers of excellence around the world (OECD, 2008). As markets open up, multinational enterprises have become more mobile and increasingly shift their innovative activities

across borders, in reaction to differences in location factors (including costs and human capital) between countries.

Users are another network partner where enterprises increasingly collaborate with. Conventional market research methods appear not to work well in the instance of many industrial goods and services (Von Hippel, 2005). As mentioned above, interaction with users can provide missing external inputs into the learning process which the enterprise itself cannot (easily) provide (Von Hippel, 2005). More recently, enterprises facilitate users to co-develop products or technologies, such as in open source software (Henkel, 2005; Hienerth, 2006). Enterprises may benefit from user-initiated innovations by actively collaborating with them, i.e. by decreasing the need to generate and evaluate ideas or concepts, by reducing R&D and commercialization costs and by accelerating the involvement of customers into their own product development and commercialization process. Enterprises may also proactively support their users to further develop their products by offering toolkits and other materials to trigger their innovative efforts. They may also be active in creating and supporting communities of users to identify and exploit new opportunities. Henkel (2005) argues that enterprises (adopting open source strategies) may make their technology available to the public in order to elicit development collaboration, but without any contractual guarantees of obtaining it.

Ad 3. Corporate entrepreneurship
In the closed paradigm, ideas, technologies and other kinds of knowledge could easily remain 'on the shelf' for a long time, waiting for internal development. Alternatively, its research proponents could decide to leave the enterprise and develop their ideas on their own. Except for networking and collaboration, Open Innovation implies that enterprises can choose alternative entrepreneurial strategies to commercialize internal knowledge, and also to benefit from external knowledge. Corporate entrepreneurial activities include corporate venturing, intrapreneurship, and spinning off new ventures (Chesbrough, 2003).

Corporate venturing implies investments in new or existing businesses. It is usually done by large enterprises, investing in start-ups or small, rapidly growing businesses. Corporate venturing enables the recovery of innovations that were initially abandoned or that did not seem promising. Enterprises may create corporate venturing programs to invest in start-ups and other businesses to keep an eye on potential opportunities (Chesbrough, 2006). Another option for enterprises to become more innovative is to encourage their employees. Many practitioners and scientists, also outside the field of Open Innovation, endorse the view that innovation by individual employees is a means to foster organizational success (e.g. Van de Ven, 1986). Work has become more knowledge-based and less rigidly defined and specified. In this context, employees are regarded as being important to realize innovations. Intrapreneurship can be promoted in various ways, for example by investing in employees' ideas and initiatives, creating autonomous teams with dedicated innovation budgets, or stimulating employees' external work contacts in order to enhance opportunity exploration. Suggestion schemes such as idea boxes and internal competitions are also options to stimulate intrapreneurship (Van Dijk & Van den Ende, 2002).

Enterprises also increasingly commercialize their internal knowledge outside the borders of their own organizations (OECD, 2008). Spinning off is somewhat different from spinning out, as spinning off is characterized by no further stakes of the parental organization. The motives for spinning off are merely financial rather than strategic, i.e.

when the in-house developed technology does not fit well with the current business/technology portfolio, but it can alternatively earn revenue by being sold to a third party (OECD, 2008). Several large high-tech enterprises spin off or spin out new ventures because the business idea does not fit into their existing business model. This is another reason why larger enterprises tend to increasingly link up with start-ups. The potential value for such new businesses is enormous. Chesbrough (2003) illustrated that at Xerox, the market value of eleven projects that became new ventures (mostly initiated by former employees who decided to start on their own) exceeded that of Xerox by a factor of two. Smaller organizations also significantly invest in setting up new businesses to make the most of their internal knowledge or ideas (De Jong, 2006).

Ad 4. IP management
Open innovation implies that valuable ideas can come from inside or outside the organization, but also that these ideas can be marketed via internal or external pathways. The new paradigm considers external ideas and external paths to market as important as internal ideas and internal paths to market in the earlier era. As a result of these in- and outflows of ideas, intellectual property (IP) plays a crucial role in Open Innovation (Chesbrough, 2003; 2006). IP can be obtained by applying for patents, trade marks or copyrights, or alternatively new knowledge can be kept secret (this latter option is however more difficult as the world of Open Innovation is characterized by high labor mobility). In the closed paradigm enterprises would control their IP in such a way that competitors could not benefit. Prior theories of innovation treated IP as a byproduct of innovation, and its use was primarily defensive. This would enable enterprises to practice their (internal) technologies without being blocked or held up by external IP, and to prevent their rivals from benefiting from their innovative efforts.

In the open model enterprises manage their IP proactively. They need to access external IP to speed up and nurture their own research engine. At the same time, they also profit from their own, unused IP when other enterprises with different business models find profitable, external paths to the market for ideas. Thus, an alternative that is becoming more prominent is licensing-out to external partners who can use the technology in exchange for paying royalty fees. In Open Innovation proactive IP management becomes a critical element since IP flows in and out of the enterprise on a regular basis (Chesbrough, 2006).

Proactive IP management is possible only when markets for technology licensing are to some extent developed, i.e. IP may be traded only if relevant enterprises are able to find each other. Different studies have suggested that markets for technology licensing have become larger and are still growing (OECD, 2008). Patent licensing revenues have been estimated to have risen in the United States from $ 15 billion in 1990 to more than $ 100 billion in 1998, while experts estimate that revenue could top $ 500 billion annually by the middle of this decade (Rivette & Kline, 2000). A recent Japanese survey indicates that inward licensing revenues increased from JPY 230 billion in 1994 to JPY 360 billion in 2001, while outward licensing jumped from JPY 170 billion in 1994 to JPY 420 billion in 2002 (Motohashi, 2005). The incidence of technology licensing is concentrated in specific industries, including chemicals and pharmaceuticals, electronic and electrical equipment, industrial machinery, equipment and computer industries (Anand & Khanna, 2000). Differences exist also between smaller and large enterprises. Data show that smaller enterprises are more likely to license their internally developed technologies. This is related to their lack of complementary downstream assets and the smaller risk of the licensee becoming a potential competitor (Arora & Fosfuri, 2003).

Ad 5. R&D
The open paradigm has introduced alternative pathways for enterprises to benefit from innovation. This however does not mean that internal R&D has become obsolete (Chesbrough, 2003; 2006). Internal R&D is also important in the new imperative, although not dominating it, for two reasons. First, R&D can still be a source of better performance like it was in the old days. Many enterprises still perform R&D to develop new products, bring them to the market, and make a profit. Second, R&D is necessary to obtain and maintain the absorptive capacity that is needed to tap from external sources (cf. Cohen & Levinthal, 1990).

Absorptive capacity is defined as an organization's ability to value, assimilate, and apply new knowledge. Antecedents are prior-based knowledge as well as communication skills. Absorptive capacity is a reason for enterprises to invest in R&D instead of simply buying the results (e.g. patents). Internal R&D teams increase the absorptive capacity of an organization (Zahra & George, 2002). In this context, Rosenberg (1994) asked the question why enterprises would conduct basic research with their own money anyway, and answered that such research will enhance enterprises' ability to use and absorb external knowledge. Or in the words of Chesbrough (2006: p. 34): 'You cannot be an informed consumer of external ideas and technology if you don't have some very sharp people working in your own organization. Not all the smart people work for you, but you still need your own smart people to identify, recognize, and leverage the work of others outside your company'.

For multinational enterprises R&D is believed to be an increasingly global phenomenon, as enterprises seek to locate their R&D activities in the presence of highly skilled personnel, and close to highly renowned universities and private R&D laboratories and potential partners. Recent empirical evidence shows that the top-700 R&D spending multinationals have increasingly invested in R&D outside their home country, in line with the growth in the global supply of science and technology resources (OECD, 2007). On the contrary, small enterprises tend to stick to their direct environment and search for collaboration partners at a close geographical distance (De Jong, Braaksma & Jansen, 2007).

External conditions
The following external conditions are identified, representing the key sources of capital necessary for innovation:
6. Large stock a basic knowledge
7. Highly-educated and mobile labor force
8. Good access to finance

Ad 6. Large stock of basic knowledge
One important trend that disqualifies the closed innovation model is that the production and dissemination of knowledge has considerably intensified and cannot be kept behind the doors of enterprises' R&D departments. As a consequence enterprises increasingly tend to refrain from investments in basic, fundamental knowledge. The new division of labor between industries, governments and academia will witness less basic research done in private organizations. The strength of diffusion mechanisms implies that industries can no longer be expected to underwrite the bulk of the costs of early-stage research (Chesbrough, 2006). Enterprises will increasingly look outside the borders of their organizations for knowledge that is available elsewhere in society. An important

external condition for Open Innovation is therefore that a large stock of basic knowledge should be available, and it should be well accessible.

Public science already supports the productivity of private science in multiple ways. Industry researchers across many industries rely on universities for research findings, instruments, experimental materials, highly trained human capital, and research techniques (Cohen, Nelson & Walsh, 2002). It provides benefits including keeping abreast with basic research, gaining access to the university researchers' expertise, and receiving general assistance with problem-solving (Rappert, Webster & Charles, 1999). The successes and failures from basic research at universities provide information useful for guiding applied research in the direction of most promising opportunities, avoiding unfruitful areas, thereby increasing the productivity of applied research. Access to a stronger knowledge base facilitates more efficient and effective search for new innovations by internal researchers (Cockburn & Henderson, 2000).

Ad 7. Highly-educated and mobile labor force
A highly educated and mobile working population is major condition enabling enterprises to practice Open Innovation. As discussed above, one important trend that eroded the closed innovation model is that the mobility of workers has intensified in the past decades (Chesbrough, 2003). This has significantly decreased the odds for effective knowledge protection via trade secrets. As knowledge can flow through people moving between organizations, labor mobility enables or even forces enterprises to open up their innovation processes. That is, an individual's stock of knowledge, experience, skills, and connections are brought to an organization at the time of hiring (Simard & West, 2006). Whenever workers leave they take their knowledge with them to their new employer, and this especially applies to their tacit knowledge which is considered most important for innovation (Polanyi, 1967; Boschma, 2005). Labor market mobility is also an important source of network ties between organizations (Cohen & Fields, 2000); these informal ties are a source of human and social capital for organizations (Porter, 2004; Murray, 2002). In all, labor mobility induces knowledge spillovers between enterprises.

A related trend that stimulated Open Innovation is that many people nowadays obtain much better college and post-college training. The availability of qualified human resources is becoming a more global phenomenon, with supplies from emerging countries becoming more important (OECD, 2008). Highly educated labor forces allow knowledge to spill over to other enterprises as well, for the very reason that education strengthens the absorptive capacity of organizations (cf. Cohen & Levinthal, 1990; Zahra & George, 2002).

Ad 8. Good access to finance
Innovation requires the acquisition and recombination of resources. Usually they must be financed in advance (Tidd, Bessant & Pavitt, 2001). The financing process can and does include financing by the enterprise itself, but external investments may be also needed. External financing can take a variety of forms, including equity investment, debt financing, asset-based financing, or grants from governments and not-for-profit agencies. Sources of external financing can range from friends and relatives, business angels, venture capitalists, banks, governments, and even public (stock) markets (Shane, 2003).

The acquisition of external financing is inherently difficult, as most innovations are characterized by uncertainty and asymmetric information, and they may need to be developed in particular quantities or scale sizes in order to be successful. For this reason, the closed innovation model predicts that larger organizations are more likely to develop innovations, as they are better able to finance innovations by themselves. This proposition has in fact been empirically demonstrated in the innovation in small enterprises literature (e.g. Nooteboom, 1994; Vossen, 1998).

A further trend that has eroded the closed innovation model factor is the growing presence of private venture capital to support innovations (Chesbrough, 2003). Besides, as a result of prosperity growth many individuals in developed countries, i.e. consumers, entrepreneurs, managers, etc., dispose liquid assets to finance others' innovative efforts. Many more individuals and small enterprises are able to initiate and organize innovations on their own. Individuals may for example just start up a new company to pursue opportunities which their employer did not like. In all, the availability of external financing is another condition that enables enterprises to practice Open Innovation.

3. LEGITIMIZATION

3.1 Spillovers, market and system failures

A pragmatic argument to develop policies to stimulate and support Open Innovation is that innovation contributes to enterprises' productivity and economic growth. Previous studies have repeatedly demonstrated that enterprises' innovative efforts and outputs are positively related to business performance indicators, including productivity and growth (e.g. Crépon, Duguet & Mairesse, 1998; Van Leeuwen & Klomp, 2006). In this context, the European Commission has recently published new guidelines for policy interventions directed towards research, development and innovation (European Commission, 2006a). The Commission requires as a minimum that any policy intervention should have an additional effect, that is, policies should truly influence the behaviors of beneficiaries or result in better external conditions. This criterion of additionality is in fact a necessary, but not a sufficient condition to justify policy interventions. In a neoclassical economic view, markets should be allowed to do their work of achieving optimal allocative efficiency. As markets can be anticipated to result in optimal outcomes, it is quite generally accepted that policy makers should refrain from intervention unless they have good reasons to do so. In the context of innovation policy, two of such well-known reasons are *market failures* and *system failures*. These failures also apply to the Open Innovation model and will be further discussed in this section. We will however first discuss the nature of *spillovers*, which is another frequently mentioned reasons to justify innovation policymaking.

Spillovers

A key argument in any legitimization of innovation-related policies is that the social benefits of innovation exceed the benefits of individual, innovating actors (Gustafson & Autio, 2006). It is not just the beneficiaries of innovation policies who will profit, for example by applying for subsidies or consultancy services. Due to their increased innovative efforts spillovers are likely to occur. This implies that external actors, who initially did not invest or innovate at all, also benefit from enterprises' innovative efforts. Various types of spillovers are knowledge-, network- and rental spillovers (Jaffe, 1996a; Griliches, 1992):

- Knowledge spillovers appear when knowledge that is developed by one actor becomes available to others, for example due to workforce mobility, publications, informal contacts or reverse engineering of products. These other parties may get inspired by or use this knowledge to initiate and implement their own innovations.
- Network spillovers imply that technologies, which are developed in separate contexts, appear to be complementary. A frequently mentioned example is the IT industry in which the development of hardware, software and IT services goes hand in hand. Here, enterprises see their potential revenues increase because of complementary innovative products.
- Rental spillovers relate to improved price-quality ratios for customers or users. Product innovation for example improves the quality of products, while the innovating enterprises usually do not manage to raise their prices to fully appropriate the rise in quality. Likewise, process innovators do not always manage to grasp all cost reductions of process innovations.

Due to the existence of spillovers the economic effects of innovation policy exceed the impact of just the beneficiaries. More innovation is expected to result in a better economic performance and increased welfare for a much larger group of actors, including other private enterprises and consumers.

Market failures

In the neoclassical economic theory, the main orientation is one of 'laissez faire'. Markets should be allowed to do their work of achieving optimal allocative efficiency, with incentives from competition, and the focus of policy is on the reduction of barriers to entry, growth and exit, in competition policy. In such a perspective, the main rationale for government intervention is market failures. Market failures are said to be present when markets result in suboptimal outcomes, i.e. enterprises under-invest in innovative activities which results in a welfare loss. This argument has been proposed decades ago (e.g. Arrow, 1962; Nelson, 1959) and is still relevant today (e.g. West, 2006). If the decision to innovate is left to private enterprises only, their innovation expenditures will be too low from a social point of view. This is for various reasons (Gustafsson & Autio, 2006; Hauknes & Nordgren, 1999; Chaminade & Edquist, 2006):

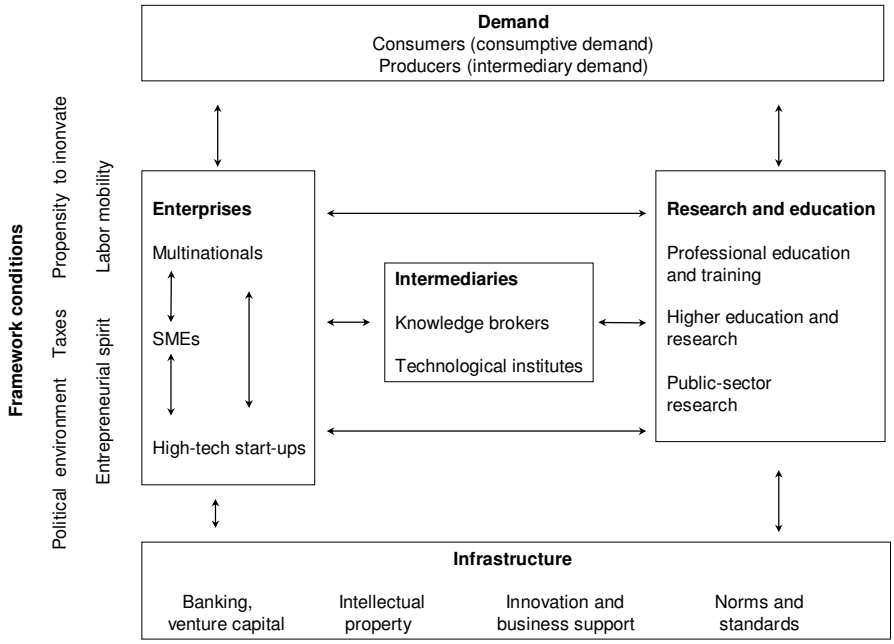
- Lack of appropriability. Enterprises are usually unable to fully appropriate the benefits which can be derived from innovations. In the words of Teece (1986: p. 285): 'It is quite common for innovators – those who are first to commercialize a new product or process in the market – to lament the fact that competitors/imitators have profited more than the one first to commercialize it'. This means there is a decreased incentive for innovative activities. Enterprises' decision to innovate is influenced by estimates of private revenues, but the above-discussed spillovers are not taken into account. Market processes will usually results in suboptimal levels of innovation expenditures.
- Uncertainty. Innovation is surrounded with risks. Uncertainty refers to the impossibility of knowing a priori the outcomes of innovation processes and associated risks. It is quite common for innovations to fail as a result of technical problems or consumers' unwillingness to buy. Enterprises are in general reluctant to invest in innovation even if the expected value of their investments is slightly positive but uncertain. This especially applies to small enterprises. Unlike large organizations they are unable to compensate risks by maintaining large innovation portfolios (Vossen, 1998; Nooteboom, 1994).
- Indivisibility. Innovation can be pretty demanding in terms of monetary investments, e.g. some innovations demand significant investments in machines, equipment or marketing efforts. Again, such expenditures are usually better fundable for large enterprises. Besides, enterprises sometimes need an initial investment to build and maintain a stock of knowledge required for innovation. There is a minimum scale of knowledge needed before any new knowledge can be created: that is, new knowledge is created on the basis of an existing pool of knowledge (inside or outside the organization).
- Asymmetric information. Due to asymmetric information private enterprises sometimes find it hard to find and/or persuade investors of the potential of their innovative ideas. For the same reason, innovating enterprises may not be able to find and recruit technical staff. Asymmetric information implies that the distribution of innovation resources in society is inadequate. As a consequence, valuable innovation projects are not implemented.

Market failures have been most commonly evoked as justification for policies such as subsidizing R&D, promoting basic research at universities and creating intellectual property rights.

System failures

Over the past fifteen years, there has been a major shift in the understanding of the relationships between research, innovation and socio-economic development. Drawing on the work of innovation doyens such as Nelson (1987; 1993), Lundvall (1992) and Freeman (1995), the concept of national innovation systems has emerged. An innovation system can be defined as 'all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations' (Edquist, 1997). The innovation systems literature poses a different view on how innovations come into being. Rather than postulating innovation as a linear process – a common representation in neoclassical economics – it is proposed that innovation is the result of complex and intensive interactions between end users, enterprises, knowledge suppliers and intermediary parties (Arnold & Kuhlman, 2001). This process is influenced by infrastructural arrangements (such as the availability of finance, standards and legislations) and other external conditions including entrepreneurship and labor mobility. An example of a national innovation system is shown in figure 3.

figure 3 A National Innovation System model



Source: Arnold & Kuhlman (2001).

In the systems view, single-factor explanations (such as technology push or demand pull) have largely disappeared. With the realization that knowledge users are also producers, and vice versa, the idea of analytically partitioning knowledge-related activities into supply and a demand sides has broken down (O'Doherty & Arnold, 2003).

Instead, it is now widely recognized that economic growth and social well-being are founded on well-functioning 'innovation systems', in which all actors need to perform. Both nodes and flows are important in innovation systems, since knowledge diffusion and spillover processes, combined with excellent absorptive and learning capacities among actors in the system, are key aspects of such systems. Accordingly, identification of bottlenecks is of primary importance, because these can hamper the functioning of the system as a whole (O'Doherty & Arnold, 2003).

In comparison with market failures, the notion of system failures also rests on the assumption that the social benefits of innovation are bigger than the benefits for individual innovating actors. A central supposition is that under-investment in innovation is not exclusively caused by poorly functioning markets, but can also be influenced by so-called system failures. Bottlenecks or other impediments to the operation of innovation systems can constitute crucial obstacles to innovative efforts, growth and development. There are four broad types of system failures (O'Doherty & Arnold, 2003; Gustafson & Autio, 2006) that can legitimize policy interventions:

- Capability failures. There may be crucial parts of the innovation system that are underdeveloped. This refers to the fact that key organizations in innovation systems, such as private enterprises, public research organizations, educational institutes or venture capitalists, may be weakly developed in terms of innovative abilities. This type of failure also includes inadequacies in potential innovators' ability to act in their own best interests.
- Network failures. These relate to problems in the interactions among actors in the innovation system. Relationships between organizations in innovation systems are not self-evident and may need to be triggered and supported. Inter-organizational collaboration, for instance, is often risky and frequently fails. When missing or badly managed, knowledge will not be exchanged, inter-organizational learning will come to a halt, and investment opportunities will not be realized.
- Institutional failures. Institutions are 'sets of common habits, norms, routines, established practices, rules or laws that regulate the relations and interactions between individuals, groups and organizations' (Edquist & Johnson, 1997). In innovation systems examples of important institutions are patent laws, as well as rules and norms influencing the relations between universities and enterprises, to mention only a few. Institutional failure relates to a disability to (re)configure institutions so that they work effectively within the innovation system.
- Framework failures. Effective innovation depends partly upon regulatory frameworks, health and safety rules, etc. as well as other background conditions, such as the sophistication of consumer demand, culture and social values.

System failures are most commonly used to justify policies such as connecting innovation actors and supporting incumbent enterprises' development of innovation strategies.

3.2 Application to Open Innovation

In order to legitimize policy intervention, the key question is if the arguments of spillovers, market and system failures also apply in a world of Open Innovation. We conclude that this is true. Compared to the era of closed innovation, policy development is probably just as necessary. In the remainder of this section we first provide a general discussion why Open Innovation policies are justified. Next, we elaborate on specific

enterprise behaviors and external conditions, and why it would be legitimate for policy makers to aim for these in particular.

General discussion

In general, Open Innovation dictates that organizations make better use of their knowledge. In the closed paradigm knowledge could remain unused very easy, but when enterprises open up their innovation processes more spillovers can be anticipated. From the perspective of the innovating enterprise, managerial studies have long regarded spillovers as a negative phenomenon (Chesbrough, 2003). The open paradigm however proposes that enterprises can also benefit from spillovers by acquiring external knowledge, or by deliberately outsourcing internal knowledge. In a way, increased spillovers suggest that there is less need for policy intervention. We do however believe that in a world of Open Innovation, policy interventions are at least as important as they were in the old days, and they might even have become more important.

The Open Innovation model is closely related to the systems of innovation approach. Both strands of literature have been developed in different disciplines (managerial versus economic), but their similarities cannot be denied. An overview of the similarities of both literatures is shown in table 1.

table 1 Similarities between the Open Innovation and systems of innovation models

Open Innovation *(e.g. Chesbrough, 2003; Chesbrough, Vanhaverbeke & West, 2006)*		*Systems of innovation* *(e.g. Edquist, 1997; Lundvall, 1992; O'Doherty & Arnold, 2003)*
Enterprises obtain better results if they open up their innovation processes, i.e. involve the world outside.	↔	Innovation is the result of complex and intensive interactions between various actors.
Innovation is no longer the domain of the internal R&D department; traditional stage-gate models provide an incomplete picture of how innovation should be organized.	↔	The linear model in which knowledge-related activities are divided in supply and demand does not hold any longer.
Enterprises can benefit from purposive inflows and outflows of knowledge. Knowledge spillovers offer opportunities and are not just a threat.	↔	Knowledge spillovers are essential for the functioning of the innovation system, and are very much desirable.
Enterprises need both internal innovation competences (other than R&D) and competences to connect with external parties in order to be successful.	↔	The functioning of innovation systems can be hampered by capability and network failures.
As enterprises increasingly depend on external sources, infrastructural arrangements (e.g. IPR) and other framework conditions become more important.	↔	The functioning of innovation systems can be hampered by institutional and framework failures.
Increased mobility of labor and presence of a trained labor force are important trends that eroded the closed innovation model.	↔	Human and social capital provide the oil necessary for lubricating the innovation system.
If the innovating enterprise cannot internally benefit from its innovations, maybe others can.	↔	The social benefits of innovation exceed those of the individual innovating actors.

In a general sense, the complementarities between both literatures imply that the earlier discussed system failures can also be used to legitimize policies for Open Innovation. The open paradigm implies that enterprises need to develop their internal competences (e.g. corporate entrepreneurship) as well as their ability to source external knowledge (by means of networking, collaboration, etc). Besides, as enterprises increasingly depend on purposive inflows and outflows, external innovation infrastructures and conditions are very essential. The similarity between the enterprise behavior and external

conditions on the one hand, and the system failures on the other hand – related to capabilities, networks, institutions and framework conditions – is evident. As policy makers increasingly use the innovation systems literature to guide their policymaking efforts, current policies of EU countries may already reflect many aspects of Open Innovation. In this context, the OECD (2002) claims that European countries have gone through major changes in their innovation policies: 'The traditional focus on direct support to R&D has been reduced and more attention has been given to improving market and systems mechanisms for sustained innovation performance' (p. 55). The systems failure argument has been evoked to justify a broad and diffuse range of interventions designed to address inefficiencies in innovation systems (OECD, 2008). One important and well-known example that has been frequently used to justify innovation policies is the lack of actor interactions and functions bridging knowledge production and use (European Commission, 2004). In all, we anticipate that current policies already reflect many recommendations that can be derived from the Open Innovation literature (but as our results in the next chapters show, there are also opportunities for improvement).

Market failures provide another argument for Open Innovation policies. We believe that market failures still apply because markets are needed to exchange knowledge between actors in the innovation system (OECD, 2002). Admittedly, some market failures will diminish. This probably applies to the failures of indivisibility and uncertainty. Open Innovation stresses the importance of external collaboration, implying that groups of enterprises can operate on a larger scale, and Open Innovation offers alternative pathways to benefit from knowledge. It implies diminished burdens on individual innovating enterprises, and offers better opportunities to spread their risks. On the other hand, lack of appropriation and asymmetric information become more severe due to Open Innovation. Due to labor mobility, enterprises can rely no longer on trade secrets to appropriate their knowledge. Besides, the open paradigm is characterized by more innovation actors and a more widely distributed stock of knowledge. In such a complex and sometimes confusingly organic world, the problem of asymmetric information will certainly not diminish.

As both literatures are to some extent similar, one might be tempted to conclude that Open Innovation has nothing to add to current discussions on innovation systems and related policymaking. We here however argue that the Open Innovation literature is *complementary* to the innovation systems literature. A main distinction is that Open Innovation has been identified from a managerial perspective and has so far been studied mainly at the organizational level (Chesbrough, Vanhaverbeke & West, 2006), while the systems literature was developed in an economic, industrial context (OECD, 2008). The systems literature views innovation as a social process with a multitude of interactions between different parties. Innovations result from interactive, open processes of development and learning across organizational boundaries as they largely arise in interplay with other sources of knowledge (Lundvall, 1992). While the literature on innovation systems considers enterprises as black boxes, the Open Innovation model opens up these boxes and reveals what is inside. This connects Open Innovation to a recent debate on the modes of innovation that enterprises adopt. It has recently been demonstrated that enterprises may use various modes to innovate, i.e. not just by the production and use of codified scientific and technical knowledge (the Science, Technology and Innovation mode) but also by an experience-based mode based on Doing, Using and Interacting (Jensen, Johnson, Lorenz & Lundvall, 2007). Open Innovation thus adds to the innovation systems literature (and related debate on

policymaking) by detailing what happens in the 'nodes' of innovation systems. As our discussion in the next sections will demonstrate, Open Innovation also offers some new policy guidelines.

Specific enterprise behaviors and external conditions

The remainder of this section provides a more detailed discussion on how policy interventions directed to the key characteristics of Open Innovation, i.e. enterprise behaviors and external conditions, can be legitimized.

1. Networking

To successfully embrace the Open Innovation paradigm, enterprises must develop their competences to identify, assimilate, and make use of external knowledge and ideas. Whenever these competences are inadequately developed, policies can be developed to stimulate and support enterprises' networking skills. Such policies can be justified with the systemic arguments of capability and/or network failures. Capability failures demand that policies are developed to increase the capacity of enterprises and other potential innovators to absorb and apply externally-generated knowledge. Network failures require that innovating actors are supported to interact with others actors in the innovation system (O'Doherty & Arnold, 2003).

2. Collaboration

Policies which aim to stimulate and support (formalized) collaboration can also be legitimized with the arguments of capability and network failures. A major and increasingly common feature of all innovation systems is that innovators rarely innovate on their own (Edquist, 1997). This is especially true in modern economies, which increasingly produce complex product systems, and where detailed producer-user interaction is a prerequisite for success (OECD, 2008). Constant collaboration with enterprises and other external partners leads to continuous learning and better exploitation of available knowledge. Collaboration also provides a pathway to overcome the market failures of indivisibility. In fact, for SMEs collaboration is a widely recognized strategy to obtain a minimum scale necessary for innovation (Vossen, 1998).

3. Corporate entrepreneurship

Capability failures also justify that governments may intervene to stimulate corporate entrepreneurship. As many enterprises are unwilling to even consider corporate entrepreneurial activities, they apparently have poorly developed competences to act in their best interests. According to Chesbrough (2006: p. 31-32) a common problem encountered in enterprises which could outsource their knowledge is the thought that if one cannot find a profitable use for a technology himself, no one else will either. Chesbrough uses the term 'not sold here', implying that enterprises usually think that if they do not sell a technology themselves, no one should (p. 32). Besides, if such organizations do start with entrepreneurial activities, there is a problem with finding suitable partners and to transfer knowledge effectively. There is a market failure due to asymmetric information as potential users can perceive that the outsourcing enterprise would only offer technologies it finds worthless. Due to such considerations there will be an under-investment in entrepreneurial activities such as spin-offs, spin-outs and participations.

4. IP management

Some well-known market failures induce governments to offer intellectual property systems. Society benefits from brilliant innovations of the actors in the innovation

system, as long as those actors reveal their innovations so that spillovers can occur (Chesbrough, 2006). To compensate for the market failures of indivisibility, lack of appropriation and uncertainty, governments offer various forms of intellectual property rights, including patents, copyrights and trademarks. It is however a fact of life that much of this protected knowledge remains unused. This creates a welfare loss (O'Doherty & Arnold, 2003). From a social point of view, patents and other forms of intellectual property must be revealed and applied as much as possible (O'Doherty & Arnold, 2003). It is therefore also legitimate for governments to interfere in the process of diffusion of intellectual property. Stimulating and enabling proactive IP management (i.e. technology licensing) provides one option to get a flow of knowledge going, but it seems to be hampered by various market and system failures, including inability to appropriate the benefits of innovation, asymmetric information, and capability and network failures (e.g. Fabrizio, 2006).

5. R&D

Policies aiming for R&D are traditionally legitimized with arguments of market failure (Nelson, 1959; Arrow, 1962; Chaminade & Edquist, 2006). Systems failures are however also relevant. R&D determines not just innovative ability, but also the ability to capture and apply external knowledge, i.e. its absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002). Absorptive capacity is key to the understanding of learning-related processes within innovation systems. Enterprises must do enough R&D to be economically dynamic and to have the absorptive capacity to conduct a professional dialogue with and learn from their external environment. Seeking out and making effective use of external knowledge thus requires enterprises investing in building internal research expertise (Fabrizio, 2006). This implies that stimulating R&D with policy measures is also valid from a systems of innovation perspective.

6. Large stock of basic knowledge

Open innovation implies that enterprises increasingly outsource their fundamental research. Rather than maintaining an internal R&D department, enterprises seek to connect with publicly funded universities and other public research organizations to obtain new fundamental insights (Fabrizio, 2006). This calls for governments to maintain a high-quality public stock of knowledge. Besides, enterprises' ability to draw from public sources can be hindered by institutional and network failures. Many universities seem for example primarily focused on developing new fundamental knowledge, rather than diffusing this knowledge to the broader society. Besides, public-private collaborations are hampered by bottlenecks such as cognitive and cultural distances between collaboration partners (De Jong et al., 2007).

7. Highly-educated and mobile labor force

As discussed earlier, a well-educated and mobile labor force is major aspect of Open Innovation. High-quality, mobile human capital is considered to be the cement that connects various innovating actors, that holds the innovation system together, and that ensures that spillovers can occur (O'Doherty & Arnold, 2003). System failures related to institutions and other framework conditions may however be an impediment. Successful innovation systems provide wide access to good quality education and training, rather than focusing on the education of small elites. Besides, conditions dictated by labor market policies may unnecessarily diminish the mobility of the labor force. There is a role for governments to ensure that the external condition of a high-quality, mobile labor force is well organized.

8. Good access to finance

Governments may also interfere with the financing of innovations; such policies can be justified with arguments of market failure. From the point of view of the innovating enterprise, regardless of the type, source and amount of external financing, two basic characteristics of the innovation process influence the resource acquisition process: uncertainty and information asymmetry (Shane, 2003). Innovation is a process in which enterprises identify innovative opportunities to recombine resources to create future value. To discover such opportunities, enterprises must possess idiosyncratic information or beliefs. Potential financiers would not make their money available at a price that would permit any profit if they held the same information or beliefs as those that seek their money. Moreover, innovative opportunities are uncertain because resources must be obtained and recombined before the output of the recombination is known. Due to this information dispersion and uncertainty, two of the market failures we discussed earlier on, innovating enterprises find it difficult to acquire the resources needed to pursue them. Governments may intervene by – for example – providing subsidies or guarantees.

4. FRAMEWORK FOR POLICY ASSESSMENT

4.1 Relevant policy areas

Understanding innovation as an open process, in which enterprises seek purposively for inflows and outflows of knowledge, has implications for the design and implementation of any kind of policy to support innovation. From the literature on Open Innovation and innovation policy (e.g. AWT, 2006; OECD, 2002; Chesbrough, 2003; Chaminade & Edquist, 2006; O'Doherty & Arnold, 2003; Chesbrough, Vanhaverbeke & Cloodt, 2006) we have identified a list of policy areas which are influential and that need to be addressed:

A. Research and technology development (RTD) policies (comprise most traditional policy interventions to stimulate private enterprises' research and technology development efforts)
B. Interaction-oriented policies (trying to assure a continuous flow of ideas and to facilitate linkages in the innovation system, thus aiming to favor an interactive environment)
C. Entrepreneurship policies (aimed at the creation, survival, growth and transfer of private organizations)
D. Science policies (to support the development and diffusion of scientific knowledge)
E. Education policies (to develop and maintain sufficient supply of well-qualified employees)
F. Labor market policies (to encourage employment, labor mobility, labor relations and social security)
G. Competition policies (to enforce the functioning of markets).

This classification is, of course, somewhat arbitrary. Research and technology development (RTD) and interaction-oriented policies could be combined in a single category of innovation policies. For Open Innovation both aspects of innovation policy are however important, and we therefore chose to discuss them separately.

After confronting the key characteristics (behaviors, external conditions) with the identified policy areas, table 2 shows our proposed framework to identify policies for Open Innovation. It matches various policy areas with the key enterprise behaviors and external conditions. Whenever relevant, the cells of the framework contain guidelines for policymaking. The framework presented here is based on the previous literature on Open Innovation and our prior knowledge about innovation processes and its determinants. An initial version has been discussed and modified with selected innovation and policy experts (annex II).

In all we have identified 21 policy guidelines. While acknowledging that the framework is potentially subject to revision as our knowledge about Open Innovation increases, we anticipate that the guidelines listed below are the most important ones to facilitate and support the new paradigm.

table 2 Framework with Open Innovation policy guidelines

Policy areas	*Enterprise behaviors*					*External conditions*		
	1. Networking	*2. Collaboration*	*3. Corporate entrepreneurship*	*4. IP management*	*5. R&D*	*6. Large stock of basic knowledge*	*7. Educated and mobile labor force*	*8. Good access to finance*
A. RTD policy	Financial incentives	Financial incentives		High-quality IP systems Support standards	Financial incentives High-quality IP systems Support standards Support user innovation	Financial incentives Support user innovation		
B. Interaction policy	Develop skills Stimulate interaction Use go-betweens Back up clusters	Develop skills Stimulate interaction Use go-betweens Back up clusters	Develop skills Enhance technology markets	Develop skills Enhance technology markets Use go-betweens				
C. Entrepreneurship policy			Support corporate entrepreneurship Access to finance		Back up challengers	Back up challengers		Access to finance
D. Science policy						Appropriate funding Balanced incentives Focus on excellence Organized diffusion		
E. Education policy			Entrepreneurship education				General stimulation Entrepreneurship education	
F. Labor market policy							Aim for flexibility Enable knowledge migration	
G. Competition policy				Stimulate competition	Stimulate competition			Stimulate competition

4.2 Research and Technology Development

Policies to stimulate private enterprises' research and technology development efforts have a long tradition, and in most countries, they are still the core of the innovation policy mix. We identified four guidelines which are desirable in a world of Open Innovation. Each policy is discussed hereafter; we also discuss for which behaviors and external conditions they are most important.

I. Financial incentives (cells A1, A2, A5, A6)
Most governments stimulate private enterprises' R&D with financial incentives. Such incentives can be provided as tax credits (an amount of money that beneficiaries may directly deduct from their total tax dues), tax allowances (an additional deduction in which beneficiaries can deduct R&D expenditures at a rate greater than 100%) or direct subsidies (Nill, 2005). Any financial incentive has a multitude of design options; policy makers need to decide what R&D-expenditure are eligible (e.g. all R&D-expenses, wage costs only, how to deal with investments in real estate), if the incentive will be based on either volumes or incremental expenditures (i.e. will beneficiaries be compensated for all expenditures or just the additional expenditures beyond a threshold), what groups will be targeted (e.g. extra incentives for SMEs or start-up enterprises), the size/attractiveness of the incentive, and its implementation scheme, e.g. do requests need to be made in advance, how to apply, and what administrative burdens are acceptable (Nill, 2005).

In a world of Open Innovation, financial incentives for R&D are still important. The increased policy focus on improving interactions within the innovation system should not lead to a neglect of more traditional R&D policy goals, especially the need to ensure an appropriate level of investment in knowledge by the private sectors (OECD, 2002). It is evident that financial incentives are not just related with enterprises' R&D efforts (cell A5 in table 2), but also with their networking and collaboration competences (cells A1 and A2). As mentioned above, R&D directly relates to enterprises' absorptive capacity which is key to the understanding of learning-related development processes within national innovation systems. Enterprises must initiate enough R&D to be economically viable and to have sufficient absorptive capacity to communicate and collaborate with public research institutions, universities and other external sources of knowledge (O'Doherty & Arnold, 2003). Finally, as knowledge tends to spill over to other innovating actors, stimulating R&D will enhance the stock of basic knowledge that is available in the innovation system (A6).

II. High-quality IP systems (A4, A5)
Intellectual property rights (IPR) can be motivated with the same arguments of market failure: without IPRs enterprises will under-invest in innovation. IPRs are an incentive for private R&D, as they to stimulate more fundamental research activity (Greenhalgh & Rogers, 2007). In a world of Open Innovation, intellectual property is probably even more important than it was in the days of the closed paradigm. In the United States, IPRs date back to the Constitution of 1787, which calls on Congress 'to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries' (West, 2006). One can argue that IPR has become more important, as labor mobility and modern IT developments

(the Internet) have diminished enterprises' possibilities to use trade secrets as a protetion mechanism.

Intellectual property systems can be designed with patents, copyrights, industrial designs and trade marks. A robust system for intellectual property rights, with a high level of legal certainty and low transaction costs, is crucial for Open Innovation. It is not self-evident that countries' current IP systems meet these conditions. Patents for example have been reproached to be granted too frequently and to be unclear, creating uncertainty and high transaction costs (AWT, 2006). They are most effective as a protection mechanism for inventors when imitation is easy and low-cost, and when first mover advantages are not important (Encaoua, Guellec & Martinez, 2006). In all, Open Innovation demands to further develop transparent, predictable and widely understood IP systems (Chesbrough, 2003).

In table 2, high-quality IP systems are relevant not just to stimulate enterprises' R&D efforts (cell A5), and also for their ability to proactively manage their intellectual property (A4). To enable proactive IP management some information exchange is necessary between buyers and sellers. These two parties always have conflicting interests: buyers want information to assess the value of the technology, while sellers must be concerned about providing too much information so that buyers can invent around and bypass the seller. High-quality IP systems potentially solve this 'information paradox' (cf. Arrow, 1962) because it can protect an organization's ideas while they are disseminated in search of a market. IP is thus valuable in both shopping innovations, and also allowing them to be licensed (West, 2006; Chaminade & Edquist, 2006). At first glance, stronger IP systems are indeed associated with more Open Innovation, because strong IP establishes a willingness to out-license and promote vertical specialization (Gallini, 2002: p. 141). High-quality IP systems enable enterprises to safely offer their knowledge to external parties (OECD, 2008). On the other hand, we do not plea for excessive IP protection, as this may actually have anticompetitive effects. Other regulatory goals can override IP enforceability, for example, state labor laws to stimulate inter-organizational mobility of knowledge (Gilson, 1999).

III. Support standards (A4, A5)
Compatibility standards are the shared language that technologies use to communicate with one another (Simcoe, 2006). They are used to govern the interaction of products and components in a technological system, so that network spillovers can be realized more efficiently. Today, standards are particularly important in ICT industries, where there are large number of interdependent suppliers and a very rapid pace of technological change. Former research concluded that when markets face a major disruption, there initially is intense competition between technologies, while later a single dominant technology emerges as the industry standard. The process is known as the 'standards war', and the list of well-known examples includes VHS versus Betamax in video recording, and Apple versus Windows in operating systems (Tushman & Anderson, 1997; Simcoe, 2006). As an alternative to war, standards can be obtained by Standard Setting Organizations (SSOs). Most SSOs are voluntary associations with no power to enforce the technical rules they produce. However, because these groups operate in industries where the demand for coordination is high, SSOs can have considerable impact on the rate and direction of technological change – primarily through their influence on the bandwagon process that leads to the adoption of a particular technology as the industry standard (Simcoe, 2006).

The rise of the Open Innovation model has led to an increase in industrial standard setting processes. Due to the open paradigm there is an increase in the number of technology developers who specialize in specific parts of a technology's development funnel, and no longer necessarily bring technologies to the market by themselves. This is in contradiction with the closed model in which enterprises were involved in all stages of the funnel. Such enterprises were usually eager to support open standard setting processes as this would enlarge the market potential for new products. The open paradigm is however characterized by increased vertical specialization, i.e. for some enterprises technologies are end-products from which money must be made. Such enterprises have fewer incentives to cooperate on standards. They would rather adopt a closed standard if that would allow them to capture more revenues (Simcoe, 2006).

Policy makers need to be aware of these changes. In highly disintegrated markets with vertical specialization, it requires more efforts to arrive at uniform, open standards. In such environments participating enterprises and SSOs will probably need more public support. Standardization processes should be open, transparent, impartial, and be attended and supported by all stakeholders (Van Elk, Van der Horst, Oudmaaijer, Overweel & Telussa, 2006). One critical success factor is that there should be consensus between all parties concerned. This means that all stakeholders should be able to access the drafting of standards. Participation of SMEs is however rather low. They are often not aware of what is going on in standardization processes and of its consequences. This factor, and the specific constraints of SMEs in terms of human resources and finance, legitimizes policy interventions to involve SMEs (Van Elk et al., 2006). By supporting standard setting processes, innovating enterprises are more able to proactively manage their IP (A4) and focus their R&D (A5).

IV. Support user innovation (A5, A6)
Von Hippel's (2005) identification of users as sources of innovation sheds an evident but new light on why actors in the innovation system perform R&D. Enterprises do not only invest in research and development to develop new products. They may also do it because of unfulfilled process needs, i.e. when they need specific machines, equipment, software or other tools for which no supply is available. Estimates of the share of enterprises innovating for a user perspective, i.e. developing or significantly modifying machines, equipment, software or other tools, range from 10% to 40% (Von Hippel, 2005). Users are a group of R&D-performers that is often overlooked, and it seems that they do represent a relevant part of private enterprises' R&D-expenditures (NESTA, 2007). Thus, they are a relevant source of R&D-activity (cell A5) and besides, as many user-developed innovations spill over to other users and suppliers, user innovation also enhances the stock of basic knowledge (A6).

Policy makers can do a number of things to stimulate user innovation. For example, users sometimes encounter obstacles when they innovate within open-source communities. For instance, they might be sued by suppliers as they can violate intellectual property rights, despite exercising full open access and operating on a non-profit basis. This is most common for digital products in the creative sector, when users use copyrighted samples and fragments. Governments could investigate if these barriers can be removed or reorganized in such a way that suppliers' incentives to invest in R&D are not diminished (AWT, 2006). The increasing importance of open-source innovation requires new thinking about access to knowledge. Governments should account for the fact that most user innovations are developed to solve specific problems, not to conquer a new market and other economic benefits. Besides, in comparison with traditional R&D

activities user innovations tend to be developed more closely to the market. This implies that traditional support mechanisms such as financial incentives will probably not work as they must be anticipated to disturb market processes. Government support should focus on suitable external conditions, e.g. support technology platforms, user communities, and repositories for intellectual commons, which can be facilitated by investments in strong ICT infrastructures (OECD, 2008). Policies should also account for the fact that most users innovate because they are intrinsically motivated to do so. Policies can account for this intrinsic motivation by offering recognition and fame, for example via awards and open competitions (AWT, 2006).

4.3 Interaction

This category entails policies to facilitate linkages in the innovation system, thus aiming to favor an interactive environment. We identified five guidelines which are especially relevant for enterprises to practice Open Innovation.

V. Develop skills (cells B1, B2, B3, B4)
External network management is one of the roles in innovation management which have become more important. Policies should be developed to trigger and help individual enterprises to assess and improve their network management skills and competences. This is instrumental for a range of enterprise behaviors including networking (B1), collaboration (B2), corporate entrepreneurship (B3) and proactive IP management (B4). It enables enterprises to find and benefit from external sources, to enter into alliances, to in-source or outsource technological knowledge, and to start up new ventures. In order to do this, enterprises require a number of skills. They need strategic-alliance-forming skills and models for collaboration. They also need the capacity to manage the internal organization in such a way that it is suitable for Open Innovation and to manage their employees so that they are able to innovate with other parties (AWT, 2006).

Governments can play a role by fostering knowledge development and competences in these areas, by providing information, and by popularizing models and best practices (AWT, 2006). They may also finance consultancy organizations which provide enterprises with advice and information. Such services should be tailor-made and provided by experts with domain-relevant knowledge and skills in order to be effective. Consultancy services can be offered by either publicly funded organizations (e.g. Chambers of Commerce, regional public agencies) or private enterprises (Chaminade & Edquist, 2006). Specialized consultancy enterprises are normally classified as Knowledge Intensive Business Services (KIBS), a service sector that is rapidly growing (Howells & Tether, 2004).

VI. Stimulate interaction (B1, B2)
Developing relations with other parties is a basic requirement for Open Innovation. The innovation systems literature supposes that successful innovation is not only influenced by innovating actors, but also by the connections between them. The interactive and reciprocal nature of innovation implies that this interaction can be targeted as well as the actors in the innovation system (Chaminade & Edquist, 2006). Thus, policies should also focus on the connections between them. Such policies are primarily supportive to develop enterprises' networking and collaboration behaviors (but probably also beneficial for corporate entrepreneurship and IP management behaviors).

Governments should not attempt to be the main architect of networks and collaborations, but could play an important role in helping their self-organization. For interaction to occur it is of great importance that innovating actors are in a position to enter into networks or collaborations; that they are able to find each other and have the capabilities and assess to effectively work together. Sometimes the government needs to help enterprises, especially small and medium-sized ones, to cross a threshold – for example, by orchestrating a meeting or, on their request, fostering partnerships (AWT, 2006). Policies to support self-organization are preferred rather than directive actions. Programs can better be organized as competitions and provide mainly management, administrative and organizational support (OECD, 2002). Another key element is that successful networking or collaboration requires trust between partners, and trust requires time. Supportive policies should therefore be implemented and evaluated in a medium-term perspective (minimum 3-5 years), which implies stable funding and institutional settings. Frequent changes in policy goals, competing or poorly coordinated initiatives and unstable financing of programs are even more detrimental to network-oriented policies than they are to research and technology development policies in general (OECD, 2002).

One area where government policies can be more proactive relates to public-private interactions. Most interaction between organizations involved in innovation processes occurs spontaneously when there is a need. The activity of (re)combining knowledge – from any source – into product and process innovations can be largely carried out by private enterprises (Chaminade & Edquist, 2006). However, when universities or public research organizations are involved, such relations are coordinated only to a limited degree by the market mechanism. Besides, public-private relations are hampered by problems of cognitive and cultural distance (De Jong et al., 2007). This linkage activity can be addressed in different ways. As information and matchmaking interventions are usually not enough, grants to set up collaborative partnerships can also be used. Besides, regulatory actions can be taken to create incentives for the diffusion of knowledge (see hereafter).

VII. Enhance technology markets (B3, B4)
Various authors have described that secondary markets for technology are emerging. Arora, Fosfuri and Gambardella (2001) use the term 'intermediate markets' to refer to markets that emerge after technologies have been created, but before they are converted into applications. The emergence of such markets is characteristic for the open paradigm (OECD, 2008). In the closed model enterprises had to take their new discoveries to the market by themselves because there were no others that could do the job. In the open model, as knowledge is far more widespread, there are many enterprises with potential ways to exploit specific knowledge, and no organization can hope to realize the full potential of their knowledge on their own. This creates secondary markets where knowledge is traded (Chesbrough, 2006). Initial empirical evidence for the emergence of secondary markets has recently been provided by Chesbrough and Diminin (2005). They find that in the past twenty years the share of reassigned patents has steadily grown.

Secondary markets for innovations are still in an embryonic stage. One of the most critical limiting factors is the lack of information about the extent and terms of trade. Markets require information in order to function well, and much of the requisite information needed for coordinating market exchange of innovation is not yet available. How much technologies are licensed and what amount of money is involved, is for

example nowhere reported and tracked (Rivette & Klein, 2000). Other hampering factors include how technologies can be valued. In this context, there have been initiatives in the past, for example in the late 1990s of the United States (Chesbrough, 2006: p. 14-15). A wave of consulting practices emerged to help organizations to value their IP and prepare it for sale. Most of this work ended in disappointment. An obvious logical gap was the lack of a two-sided market for IP. It takes buyers as well as sellers to create a market. The value of IP was not determined from the point of view of a willing buyer, but just the viewpoint of an eager seller.

By creating external conditions in support of technology markets, governments can boost opportunities to find external applications for internal knowledge, i.e. to practice corporate entrepreneurship (B3) and to proactively manage IP (B4). A first necessary ingredient is that intellectual property systems must be well developed and can be enforced, or private enterprises would not be willing to share their inventions (as discussed above). Another intervention would relate to the provision of market information by developing information standards for IP licensing and associated trade, by making the supply and demand for technologies more visible, and by developing know how to value technologies once they are located (Chesbrough, 2006).

VIII. Use go-betweens (B1, B2, B4)
Go-betweens or intermediaries can function as matchmakers, which try to bring parties together to exchange knowledge, receive feedback, or achieve a transaction. In contrast to agents, they may help shape the terms of a transaction and, in some cases, even take a position in the transaction to help bring it about. Unlike agents, their allegiance is not exclusively with a single client; they are supposed to be independent and to also care about their exchange environment (Chesbrough, 2006).

Go-betweens can play important roles in the management of networks, collaboration or IP management (B1, B2, B4). Except for matchmaking and support to negotiate and work out contracts, they may also offer arbitration or intermediation in case of conflicts. This is one role that merits special attention; go-betweens can be highly effective to resolve problems when something goes wrong (Nooteboom, 2008a). In case of public-private interactions, go-betweens can be even more prominent. They can look after the implementation of innovative activities; such services are usually provided to private enterprises that have only moderate levels of absorptive capacity and who would typically find it hard to deal directly with universities or other sources of scientific knowledge. Go-betweens can help to bypass the cultural and cognitive problems that (small) private enterprises face in doing business with universities and publicly funded research institutes (De Jong et al., 2007).

Go-betweens may be found at both public and private organizations, including banks, industry associations, knowledge transfer agencies, lawyers or private consultants. They may be the same organizations as those providing consultancy services to develop enterprises' networking skills (as discussed above). Governments can actively fund go-betweens and define the conditions for their activities. From a policy perspective, go-betweens or intermediaries have four roles in order to be effective (Chesbrough, 2006). First, they must help to shape the definition of the problem to be solved. Second, they must establish a process that protects confidential and proprietary information. Third, they must develop credible evidence to document their value to the parties involved, both during the transactions and afterwards. Fourth, they must help develop both sides of the market, to create greater liquidity of transactions and elicit a wider variety of

possible future solutions (which in turn requires that go-betweens must be connected to a large and diverse pool of knowledge providers).

IX. Back up clusters (B1, B2)
Open innovation entails that organizations increasingly depend on external knowledge supplies. The bulk of this knowledge is locally embedded in so-called regional clusters. Clusters are defined as networks of interdependent enterprises, knowledge-producing institutions (universities, research institutes, technology-providing enterprises), intermediary organizations (e.g. providers of technical or consultancy services) and customers, linked in a value-added creating production chain (Roelandt & Den Hertog, 1999). The concept of clusters goes beyond that of organizational networks as it captures all forms of knowledge sharing and exchange. Clusters are actually very similar to the concept of innovation systems, i.e. the national innovation system model can also be applied at the level of industries, regions, or combinations of the two (Chaminade & Edquist, 2006).

The concept of clusters brings in a regional dimension for policymaking. Governments may back up emerging clusters to enhance the innovativeness and economic growth in particular regions and industries. Regional clusters are important as the effect of networks on innovation is magnified by geographic proximity (e.g. Boschma, 2005). The effectiveness of Open Innovation strategies of organizations is believed to be strongly related to the presence of regional innovation systems. These regional differences can also explain why some regions are much more successful in attracting multinationals ensuring a steady flow of knowledge workers and related business activity. Examples are Silicon Valley, Helsinki's and San Diego's telecommunications clusters, biotechnology in Boston, and ICT clusters in Cambridge, to mention only a few (Vanhaverbeke, 2006). Governments may therefore initiate developmental programs to support innovation, networking, collaboration and joint research programs in particular sectors and regions.

4.4 Entrepreneurship

Entrepreneurship policies aim for the creation, survival, growth and transfer of private enterprises. Entrepreneurship is a consequence of individuals' entrepreneurial behaviors, defined as the discovery, assessment, organization and implementation of opportunities (Shane, 2003). Individuals are believed to be entrepreneurial if they undertake something new, or are persistent and proactive in realizing this. We found three guidelines that will support the application of Open Innovation practices.

X. Support corporate entrepreneurship (C3)
It seems that most enterprises do not realize that alternative strategies can be conducted to commercialize internal knowledge. A recent study by the OECD (2008), mainly among multinational and large organizations, shows that while such organizations are very aware of the importance of using external knowledge sources, and spend time to organize purposive inflows, their awareness of and investments in potential outflows is still limited and needs to be improved. Likewise, a survey of Dutch SMEs revealed that although enterprises increasingly practice corporate entrepreneurship activities, a large majority of the respondents does not benefit from these possibilities (De Jong, 2006). A first challenge for policy makers is to raise innovating actors' awareness of corporate entrepreneurial strategies such as corporate venturing, intrapreneurship and spin-offs. Such awareness can be triggered in various

ways, e.g. via sharing information on models and best practices, and by consultancy services on key aspects of strategy, management, organization, finance and risk management.

An alternative way for enterprises to become more innovative is by encouraging its employees. Most enterprises already regard an internal innovative culture as very important (OECD, 2008). This innovative culture needs to be present and operative at every level of the organization, implying that all employees are expected and encouraged to look for opportunities to improve and to innovate. As indicated above, intrapreneurial behavior can be triggered and supported via information and consultancy services. Other options for corporate entrepreneurship relate to venturing and spin-off activities. Here, it probably helps if enterprises first develop an overall strategy on how to benefit from knowledge (cf. Chesbrough, 2006). The strategic capacity of enterprises is a prerequisite for innovative performance in general. It can be developed through targeted support programs aiming at raising the enterprises' ability to place innovation decisions and competencies to strategic ends. This has been done in many countries using external advisors, e.g. Norway's BUNT program and New Zealand's Current Position Analysis Program (AWT, 2006).

XI. Access to finance (C3, C8)
One trend driving the rise of Open Innovation is the growing presence of external finance to develop innovations, so that individual entrepreneurs and start-ups and other challenging organizations can finance their innovative ideas. Venture investing was for example until recently almost exclusively done by specialized funds, but large organizations have started venturing activities as well (Chesbrough, 2006). For smaller enterprises venturing is probably a more risky endeavor, and they will find it more difficult to persuade external financiers.

Policy makers can focus on three areas to secure innovating actors' access to finance. Relevant policies relate to the functioning of capital markets, providing direct subsidies, and providing cheap money loans or guarantees. Direct subsidies have already been discussed as part of the RTD policies (see above). As an alternative, finance can be made accessible in the form of seed capital, guarantees or matching funds (Chaminade & Edquist, 2006). Well functioning capital markets that allow for corporate venturing and exits on secondary markets are probably most important to enable Open Innovation strategies (OECD, 2008). It is recommended to create institutions to channel financial resources to promising new ideas and business models (Chesbrough, Vanhaverbeke & Cloodt, 2006). Policymakers should stimulate private investors including banks, venture capitalists and business angels. Such investors are best able to judge if any opportunity is worth pursuing, as they supply capital to promising opportunities only. Competition enables a diversity of innovation approaches to be funded, and elicits greater investment in governance by the suppliers of this capital. Also, these owners will be able to adapt much more readily to new information than public servants. If Open Innovation is about discovering viable innovative opportunities, the capital markets must be open as well, so that multiple experiments are funded, and markets can dictate the winner.

XII. Back up challengers (C5, C6)
One important role for policy is to enhance the entry and survival of new enterprises by facilitating and supporting entrepreneurship. In particular high-tech start-ups can be anticipated to bring along radical, disruptive innovations (cf. Schumpeter, 1934).

Governments should try to stimulate and back up those entrepreneurs who challenge the status quo. It is recommended that policy makers should resist the temptation to rely solely or primarily upon their biggest enterprises to lead innovation efforts in the future. Instead, they also should seek to cultivate and strengthen their small- and medium-sized counterparts. Their vitality will infuse greater dynamism into the economy, resulting in more basic knowledge (C6), and, as those enterprises that survive will embody new combinations of knowledge, and new business models to commercialize that knowledge, they will also spur greater R&D-efforts from the largest ones (C5). Small, challenging enterprises provide large organizations with demonstrations of the commercial viability of new approaches to commercializing ideas. Incumbents will respond to the demonstrated success of new enterprises far more rapidly than they would to any government program targeted to support them (Chesbrough, Vanhaverbeke & Cloodt, 2006).

Policies can be designed as extra financial incentives in support of RTD. Tax incentives for example are in some countries more generous to start-ups (Nill, 2005). A more 'all-inclusive' intervention is to develop programs for high-tech start-ups, including commercial and university spin-offs. Such programs may also be designed as incubator services. Incubating activities include services like seed capital, provision of access to facilities, consultancy and coaching, supporting network activities, and administrative support for new innovating efforts. In recent years, incubation activities have mainly been carried out in science parks. That this activity has become partly public has to do with the uncertainty characterizing early stages of the development of new products, which means that markets do not operate well in this respect (Chaminade & Edquist, 2006).

4.5 Science

Science policies, that is, how universities and public research organizations are funded, assessed, managed and controlled, help to create and maintain a strong public knowledge base. From the literature and interviews we identified four policy guidelines.

XIII. Appropriate funding (D6)
In the open paradigm private enterprises move away from basic research towards short term, application-oriented R&D. At the same time big corporate laboratories (like Bell labs, Philips NatLab), where many innovations have been diffused out since 1960s, are downsized (Chesbrough, 2003). Indeed, recent studies have demonstrated that private enterprises increasingly outsource fundamental research to rather focus on development activities (e.g. EIRMA, 2003; 2004). The closed paradigm featured one important attribute that Open Innovation lacks. The earlier model generated many new long-term discoveries and inventions, primarily in the central R&D laboratories of large enterprises. In the open paradigm, it is not obvious whether such basic research will continue or not, because it is less clear that there will be a private return on these fundamental investments (West, Vanhaverbeke & Chesbrough, 2006). This implies that seed-corn for longer-term innovations needs to be provided elsewhere in the society (e.g. by universities).

One policy issue of great importance is generous public funding of scientific discovery in order to maintain the stock of knowledge in society (Chesbrough, 2003). Private organizations can no longer be expected to finance much fundamental, basic research.

There is a role for governments to ensure that basic research activities are well funded. One should be cautious with substituting public finance with private investments (Fabrizio, 2006; AWT, 2005). In general, university research is more basic in nature and of larger impact than private research, as basic research relatively often considers disruptive discoveries (Trajtenberg, Henderson & Jaffe, 1997). The norms and practices associated with the 'open science' nature of academic research provide incentives for a strong public knowledge base, because the reputation-based reward system, associated priority claims, and reviews by peers support rapid disclosure and broad dissemination of research output with other scientists. This system avoids excessive duplication of research efforts, promotes information sharing, and allows the development of a strong public knowledge base from which following public and private researchers can draw (David, 1998). On the contrary, private funding is associated with a decline in free knowledge spillovers. Private funding often comes with restrictions or expectations of exclusivity (e.g. West, 2006; Fabrizio, 2006). As long as such funding is additional, there is probably no harm, but one should be cautious that private funding is not at the expense of public resources. In this respect, it is striking that university research is increasingly co-funded by private organizations. The overall importance of industry funding has been increasing over time (e.g. Jaffe, 1996b).

XIV. Balanced incentives (D6)
Universities can play a key role in uncovering new basic ideas and knowledge for the society. In practice, university employees are generally assessed on scientific output and education performance. Scientific progress in particular provides them with the best career opportunities. University employees generally lack the incentives to put their basic knowledge into practice, i.e. to spend time on valorization. This deprives universities of the knowledge that comes from working closely with industries, and from acquiring a deep understanding of industrial problems. When faculties are to select their next research initiatives, they do so in ignorance of what burning issues need to be solved in many areas. An unintended effect is that the current incentive structures inhibit the diffusion of knowledge in society. The abundant knowledge landscape that is attainable when people and ideas move freely throughout the society becomes more barren, and isolated to narrow pockets of knowledge, when ideas and people are not free to move (Chesbrough, Vanhaverbeke & Cloodt, 2006).

Policy makers should be concerned with how university employees are evaluated, and what they would naturally do to develop their careers. The financing, management and control and universities probably also needs elements which trigger employees to invest in valorization of scientific knowledge. Developing such non-traditional, more 'horizontal' steering incentives involves tackling the entrenched positions of certain scientific establishments - for example, by addressing the counter-productive culture of many European universities which assigns high status to the production of knowledge and no status to knowledge use, incremental development and creative imitation (OECD, 2008). This problem of balanced incentives probably also applies to other publicly funded research organizations. Changes to regulations and new incentive mechanisms are recommended to balance the investments of universities and public research organizations in basic research, education and valorization.

XV. Focus on excellence (D6)
Creating a strong public knowledge base requires more than just generous funding. As important as the amount of money provided by governments for research, is how this money is spent (Chesbrough, Vanhaverbeke & Cloodt, 2006; AWT, 2005). Mediocre

science does no one any good. Governments need mechanisms to allocate scientific research funds according to criteria of excellence, which can be realized by linking research performance to financial incentives. Researchers who do good work could be more eligible for research funding ahead of researchers whose work is not as good[2]. This would imply that research grants are not offered as lump-sums, but contingent on output criteria (e.g. counts of publications in peer-reviewed journals) and visitations.

Another policy issue is how 'excellence' should be defined, i.e. in a narrow sense by focusing on just scientific performance, or broadly by also including aspects of valorization. The interplay between science and industry suggests that policy makers should promote finance mechanisms that also stimulate valorization, and that would stimulate recombining new and existing ideas. This suggests that for at least part of their research, universities should actively seek to incorporate participation from the outside world, e.g. from high-tech and KIBS enterprises, in the programming, conduct and application of research output. Relevant indicators should also account for the impact on society of university research output, e.g. by measuring professional publications, lectures, participation in non-scientific networks, or cross-references in private enterprises' patent applications. In each case, funding should be based on objective and a priori defined indicators to prevent undesired side effects such as administrative burdens and friendly turns.

XVI. Organized diffusion (D6)
Many countries have problems with the valorization of basic knowledge, that is, managing the flows of knowledge between publicly funded universities and research institutes, and private organizations. This phenomenon is well known as the 'European paradox' implying an excellent performance on fundamental research, but too few practical applications of this knowledge by developing new products (Deuten, 2007)[3]. Such imbalances need to be addressed. The previously mentioned guidelines to balance incentives and to focus on excellence implicitly contain elements to improve valorization, but policy makers can do more. First, it should be ensured that all publicly-funded research output becomes widely available. Without dissemination private enterprises and other researchers may lose the opportunity to build on those ideas in their own businesses. This restricts the flow of knowledge, and reduces the multiplier effect that arises from the use and re-use of ideas in a wide array of situations, often in areas never envisioned by those who made the discoveries (Chesbrough, 2003). Second, valorization could be stimulated with public-private partnerships (as discussed above) or creating technology transfer offices which could conduct an intermediary role.

A related issue is whether and how the government should assign IP rights to the results of research that the government itself funds. In the United States, for example, the Bayh-Dole Act of 1980 allowed universities to file for patents on results of publicly-funded research. These patents are owned and then licensed by the university, in hopes to compensate declining revenues from other public sources of income (e.g. Fabrizio, 2006; West, 2006). Some evidence indicates that a few top universities have been able to profit from this institutional experiment. However, many university licensing programs appear not to cover their own costs. More importantly, recent empirical work

[2] The Research Assessment Exercise in the United Kingdom provides one example of this can be done, but there are no doubt alternatives systems.
[3] We remark that this paradox does not apply to all research areas. In medical research for example fundamental and applied research are linked very directly.

suggests that public licensing programs slow down the diffusion of basic knowledge (Chesbrough, 2003). Granting universities with IP rights is usually defended by arguing that it will motivate them to pay attention to knowledge diffusion, and that it stimulates private enterprises to proceed with university research as IP creates opportunities for exclusivity (Fabrizio, 2006). Major disadvantages are however that university licensing raises the price of external innovations used by enterprises, and slows down and decreases knowledge spillovers. Fabrizio (2006) notes that the transaction costs of dealing with universities' technology transfer offices means that, even IP that is available for licensing, it becomes less accessible, and that researchers involved in diffusion are more secretive in sharing their knowledge to protect its proprietary value. University licensing also limits the number of enterprises willing to utilize university research in their own innovations (Fabrizio, 2006).

4.6 Education

Education policies are at the heart of a public policy that intends to stimulate Open Innovation. It helps to develop and maintain a sufficient supply of well-qualified employees. We here discuss two general directions for policymaking.

XVII. General stimulation (E7)
To foster the creation and diffusion of high-quality knowledge within society, the function of a society's educational system is an essential element of policymaking (Chesbrough, Vanhaverbeke & Cloodt, 2006). The cement that holds together innovation systems is the human and social capital that they incorporate. The role of education and learning in stimulation innovation should receive much emphasis (O'Doherty & Arnold, 2003). First and foremost, education is associated with a high-quality labor force, one of the major conditions of Open Innovation (cell E7 in table 2). Highly educated labor forces allow knowledge to spill over to other organizations, and increase enterprises' absorptive capacity. This also applies to the recruitment of graduates by incumbent enterprises, which is probably one of the main mechanisms for valorization of fundamental knowledge (De Jong et al., 2007). Finally, better education will strengthen many of the behavioral aspects of Open Innovation, including networking and collaboration competences, corporate entrepreneurship, the ability to license technologies, and to perform R&D (not shown in table 2).

Developing and maintaining a skilled labor force requires governments to deliver and implement high-quality education at all levels, i.e. primary, secondary and tertiary education. Besides, as populations age and the half-life of training shortens, policy makers will need to address post-graduate training and 'lifelong learning' of a society's human capital as well.

XVIII. Entrepreneurship education (E3, E7)
Individuals' entrepreneurial activity is another driver of Open Innovation. The core of entrepreneurship consists of combining resources to exploit opportunities (Shane, 2003), thus individuals' entrepreneurial behavior can be anticipated to create more connections and additional flows in the innovation system. In our framework, entrepreneurial activity is beneficial for many of the identified behaviors, but it seems most relevant for corporate entrepreneurship (remind that employees' intrapreneurial behaviors are an important aspect of this). Besides, when all individuals in a society would be entrepreneurs, this would imply a high-quality and more mobile labor force

which is one of the key external conditions of Open Innovation. Previous work has demonstrated that entrepreneurs with high education levels are more likely to survive, grow, and realize innovations (Shane, 2003). It is also believed that increased levels of entrepreneurship can be reached through entrepreneurship education, that is, by teaching students how to be entrepreneurial (European Commission, 2006b). Most education however prepares students to become an employee. Education on entrepreneurship is something that policy makers should (further) develop.

In doing so, policy makers should account for some rules of thumb. Firstly, learning about entrepreneurship through lectures, reading texts and analyzing cases limits the creativity and lowers the risk attitude of would-be entrepreneurs, and fails to mimic the real world. Education should rather account for the fact that entrepreneurs learn from experience and are active learners. Mentoring or coaching from people with business experience can be a basic element in all entrepreneurship training (Bird, 2002). Secondly, fostering entrepreneurial mindsets of young people and develop their entrepreneurial competences can be done at all levels, from primary school to university. Entrepreneurship can be integrated into curricula either as a horizontal element in all fields of study (for instance in primary and secondary education) or as a subject in its own right (especially in higher education) (European Commission, 2006b). Finally, the scope of entrepreneurship education is much wider than training on how to start a business, as it includes the development of personal attributes and horizontal skills like creativity, initiative and self-confidence (Bird, 2002).

4.7 Labor markets

Labor market policies determine the size and flexibility of a country's working population. We identified two relevant guidelines.

XIX. Aim for flexibility (F7)
Related to issues of creating a skilled labor force, are policies that facilitate the mobility of that labor force. Measures that increase mobility of people across institutional and industrial boundaries will reinforce innovation, since many of the most important discoveries and innovations today are taking place at the boundaries between knowledge domains (O'Doherty & Arnold, 2003). Besides, labor mobility induces knowledge spillovers. Pensions, health care and other aspects of compensation today are typically tied to being employed, and this effectively constrains mobility. Making these portable rather than severing their tie to specific employers would enable workers to better seek out the best opportunities to utilize their skills (Chesbrough, Vanhaverbeke & Cloodt (2006). Likewise, in some countries rules for hiring and firing employees are unnecessary complex and restrictive. Such rules could be simplified; the open paradigm pleads for lowering barriers for labor mobility. This also includes liberalization of competition clauses that limits employees to be active in the same area of expertise, i.e. to be recruited by rivals. Governments may offer or popularize models for labor contracts to limit the use of such mobility restrictions.

XX. Enable knowledge migration (F7)
Another opportunity to realize a high-quality labor force is to benefit from other countries' working populations. Knowledge migration should not be regarded as a socially undesired phenomenon. From an Open Innovation point of view, it provides opportunities to directly enhance the quality of the current labor force. Immigration of

knowledge workers will be necessary in Europe in the next decades also because of the aging population. Older workers will retire and cannot be sufficiently replaced by highly-educated younger people. Many countries have made substantial efforts to lower the barriers to the mobility of highly skilled personnel through more conducive immigration regimes and the simplification of immigration procedures. Migration of highly skilled and temporary immigrant workers and students may also be promoted by providing incentives such as preferential income taxes. In some countries specific policies towards repatriation (of nationals working abroad), retention and connection of talent have been set up (OECD, 2008).

4.8 Competition

Competition policies are also instrumental for the application of the open paradigm. Policies to stimulate the functioning of markets, including the enforcement of competition, legislation to limit cartels or to prevent abuse of dominant market positions, are all indirectly supportive. We propose a single, general guideline.

XXI. Stimulate competition (G4, G5, G8)
In Open Innovation, enterprises interact with other parties in the knowledge landscape to obtain inputs for their innovation processes. Coordination is accomplished by the market mechanism, with accompanying phenomena such as price-fixing, contracts and negotiations. Markets provide valuation mechanisms for innovation resources and efficient channels for resource flows (OECD, 2002). Open innovation can be successful only when markets for innovation resources work well (AWT, 2006). Competition policy probably correlates with all characteristics of Open Innovation, i.e. all enterprise behaviors and external conditions. In table 2 we have just sketched the most obvious ones: markets for licensing IP (G4), markets for finance (G8), and a connection with R&D (cell G5, as competition can trigger enterprises to invest more). For the latter, R&D probably benefits more from competition based on product differentiation, rather than from price competition. In case of heavy price competition a caveat is that enterprises will economize on their innovation budgets (Nooteboom, 2008b). Too much competitive pressure on price may eliminate the resources and the slack needed for innovative activities in individual enterprises.

5. THE NETHERLANDS[4]

In this chapter the policy guidelines of the preceding chapter are confronted with relevant policy interventions in the Netherlands. We assessed to what extent current policies reflect the guidelines for Open Innovation policymaking and what seems to be missing.

5.1 Introduction

Innovation and the knowledge economy are among the pillars of the current Dutch government policy (Coalition Agreement, 2007). Although the Dutch economy is recently doing quite well, innovation is still considered to be important for sustainable growth. In the past twenty years the Netherlands has witnessed a favorable GDP-growth in comparison with the EU and OECD averages (Gelauff, Klomp, Raes & Roelandt, 2004; Deuten & De Heide, 2006). The main growth driver has been a sharp increase in labor market participation due to the so-called 'Dutch model' (characterized by low costs and wage restraints). The limits of this factor driven economic growth, however, are expected to be reached in the near future, partly because of the aging population. To realize sustainable growth, labor productivity must increase, and innovation is regarded to be key to this. In order to create innovation driven economic growth, the Dutch government concluded that it has to strengthen its innovation system (De Boer & Van Steen, 2006; Deuten & De Heide, 2006).

The innovative performance of the Netherlands can be regarded as good based on different indicators: high quality of output of scientific research, high level of patenting, high share of financing of public research by private enterprises, and high use of ICT and access to its applications. There are however hampering factors that weaken the innovative performance. In this context a number of challenges can be identified (Deuten & De Heide, 2006; Deuten, 2007; De Boer & Van Steen, 2006). Firstly, it is widely believed that private investments in R&D and innovation must be substantially raised. Especially private expenditures on R&D lag behind compared to other EU and OECD countries. There may also be a problem with the financing of (early stages of) innovation. The levels of early stage venture capital available are still higher than the EU-average, but trend figures show a much stronger negative growth than the European average (Deuten & De Heide, 2006; Boekholt, 2007). A second challenge is that there is an increasing shortage of highly educated people, especially in science and technology (De Graaf, Heyma & Van Klaveren, 2007; De Boer & Van Steen, 2006). Besides, too many students drop out of higher education before graduation. The Dutch share of higher education graduates is also not among the highest in the OECD (Deuten, 2007). Together with the aging population, this results in a lack of trained people to create knowledge, and to apply existing knowledge in the production and use of new products and services. Another challenge is caused by limited interaction between the actors in the Dutch innovation system. The low level of interaction impedes valorization of the output of the Dutch research infrastructure (De Boer & Van Steen, 2006). A final

[4] We are grateful to Luuk Klomp and Nora van der Wenden (Ministry of Economic Affairs) for their review and comments on the draft of this case study.

challenge is that entrepreneurship is hampered by various bottlenecks, including contradictory and unnecessary regulations and high administrative burdens (Deuten & De Heide, 2006). As a consequence, innovative entrepreneurial activity is too limited. Given these challenges, we anticipate that current Dutch policy measures will very well reflect some of the Open Innovation guidelines, e.g. to stimulate private R&D, interaction between the actors in the innovation system, entrepreneurship, and higher education in science and technology disciplines.

As a consequence of the above-mentioned challenges, the Dutch innovation policy mix is under almost continuous revision. As for innovation policies in a narrow sense – related to RTD and interaction – the mix has recently been re-organized and simplified into a basic package and a program-based package (Deuten, 2007; De Boer & Van Steen, 2006). The basic package consists of generic measures such as R&D tax credits, consultancy services and seed facilities, primarily aimed at SMEs. The program-based package contains instruments aimed at specific key areas which are believed to be of strategic importance for the Dutch economy, including water management, high-tech products, chemicals, and food and flowers. This package is used most often by larger enterprises.

5.2 Overview of policy measures

In order to judge if and how much current policies reflect the Open Innovation policy guidelines, we made an inventory of Dutch policies which are most relevant (see table 3). To develop this inventory we started with the most recent country reports of the INNO-Policy TrendChart (Deuten & De Heide, 2006; Deuten, 2007) and the overview of innovation policies published at www.proinno-europe.eu. As the TrendChart is limited to innovation policies in a narrow sense, i.e. mainly capturing RTD, interaction-based and some entrepreneurship policies, we also studied a significant amount of policy notes, reports and action plans. Besides, we interviewed policy makers and representatives of advisory councils to further complete our inventory (see annex II). Details of the Dutch policy measures are presented in annex III.

Before we elaborate on table 3, a few remarks must be made. For pragmatic reasons we had to confine ourselves to prevent too much detail. As the Netherlands has a mature innovation governance system with many actors, and a wide array of policy initiatives, table 3 is probably still incomplete. For some the policy areas, especially the ones which refer to the external conditions of Open Innovation (i.e. education, labor market and competition policies) we had to limit ourselves to the most important examples. Nonetheless, we anticipate that the overview includes most relevant issues, and more importantly, that more details would not affect our conclusions. Another issue is that for convenience of presentation, we sometimes merged policies into broader categories. One example is the New Entrepreneurship Action Program. It contains dozens of initiatives, all related to support and stimulate start-up enterprises. It would simply be too much to discuss these in detail. For the same reason we sometimes included institutions which are responsible for specific innovation policies (e.g. the Netherlands Patent Office). Finally, in the right-hand column an overall conclusion is drawn on the presence of Open Innovation thinking in the current policy mix. We remark that these conclusions are mainly based on the number of relevant policies and an (implicit) judgment of their scope (also see annex III). The overall assessment does not evaluate the effectiveness of current policymaking.

table 3 Inventory of Open Innovation policies for the Netherlands

Policy areas/ guidelines		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17	#18
		WBSO – R&D promotion act	SBIR – Innovation procurement	Innovation Performance Contracts	Innovation Programs	IOP-LTI – Public private partnering	OCNL – Netherlands Patent Office	Patent information project	NEN – Standard Setting Organization	Standards Awareness Project	OASE – Open Source Software	Syntens – Intermediary organization	ROMs – Regional development agencies	Innovation vouchers	RAAK – Public private partnering	Peaks in the Delta	Innovation credit	TechnoPartner	BBMKB – SMEs credit guarantee
RTD policy																			
I	Financial incentives	x	x	x	x	x										x			
II	High-quality IP systems						x	x											
III	Support standards								x	x									
IV	User innovation										x								
Interaction policy																			
V	Develop skills											x							
VI	Stimulate interaction			x	x	x						x	x	x	x	x			
VII	Enhance technology markets																	x	
VIII	Use go-betweens											x	x						
IX	Back up clusters				x											x			
Entrepreneurship policy																			
X	Support corporate entr.																		
XI	Access to finance												x				x	x	x
XII	Back up challengers	x	x														x	x	x
Science policy																			
XIII	Appropriate funding																		
XIV	Balanced incentives																		
XV	Focus on excellence				x	x													
XVI	Organized diffusion				x	x								x	x	x		x	
Education policy																			
XVII	General stimulation																		
XVIII	Entrepreneurship education																		
Labor market policy																			
XIX	Aim for flexibility																		
XX	Enable knowledge migration																		
Competition policy																			
XXI	Stimulate competition																		

table 3 Inventory of Open Innovation policies for the Netherlands (continued)

Policy areas/ guidelines		#19	#20	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30	#31	#32	#33	#34	#35	Overall assessment *
		Venture capital scheme	New Entrepreneurship Action Plan	Lump-sum research funding	NWO funding	Incidental research funding	Technological institutes	STW - Technology foundation	Leading Social Institutes	Opportunity Zones	Valorization grant	Technological Sciences Platform	Lectureships	Project Learning and Work	Entrepreneurship Edu-cation Action Program	Casimir - Mobility scheme	Knowledge Migration Desk	NMa - Netherlands Competition Authority	
RTD policy																			
I	Financial incentives																		++
II	High-quality IP systems																		+
III	Support standards																		o
IV	Support user innovation																		-
Interaction policy																			
V	Develop skills																		o
VI	Stimulate interaction																		++
VII	Enhance technology markets																		-
VIII	Use go-betweens																		+
IX	Back up clusters																		++
Entrepreneurship policy																			
X	Support corporate entr.																		-
XI	Access to finance	x																	++
XII	Back up challengers	x	x							x									++
Science policy																			
XIII	Appropriate funding			x	x	x	x	x											+
XIV	Balanced incentives																		-
XV	Focus on excellence				x	x	x		x										+
XVI	Organized diffusion					x	x	x	x	x	x		x			x			++
Education policy																			
XVII	General stimulation											x	x	x					+
XVIII	Entrepreneurship education														x				+
Labor market policy																			
XIX	Aim for flexibility															x			+
XX	Enable knowledge migration																x		+
Competition policy																			
XXI	Stimulate competition																	x	++

* -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

RTD policies

In the Netherlands, policies to stimulate private enterprises' research and technology development efforts are in effect for decades. Hereafter we elaborate on the main RTD policies and to what extent they reflect our related guidelines (I – IV).

I. Financial incentives

The Dutch government has identified private R&D expenditures as a main challenge (De Boer & Van Steen, 2006). The total financial efforts of Dutch enterprises in R&D are stagnating. Private R&D-spending is relatively low in international comparisons, i.e. about 1% of GDP (Boekholt, 2007). Besides, about half the private expenditure on R&D is done by the seven biggest enterprises of the Netherlands (De Boer & Van Steen, 2006). The Dutch government has therefore implemented a range of instruments addressing the investment levels on R&D. Examples include the following measures:

- R&D promotion act. The main policy measure to stimulate private R&D is the WBSO, a tax credit for R&D. With an annual budget of € 425 million, the WBSO is the flag-ship of the Dutch innovation policy mix. It consists of a contribution to the wage costs of R&D workers in the form of a reduction of payroll tax and social security contributions, or an increase in the tax deductions available to self-employed persons. This tax credit is popular among both SMEs and large enterprises. A recent evaluation has demonstrated that the WBSO indeed increases private enterprises' R&D expenditures, especially among small enterprises and self-employed (De Jong & Verhoeven, 2007). The WBSO will therefore be expanded in the forthcoming years, i.e. its budget will be increased to € 540 million in 2011.
- SBIR Innovation procurement. The SBIR program is inspired by the United States scheme of the same name. It stimulates SMEs to develop innovations via governmental procurement procedures. In these procedures it is required that Dutch government organizations spend a fixed percentage of their R&D budgets to SMEs to develop innovative products or processes.
- Innovation performance contracts. These are grants for collective agreements by groups of SMEs, a coordinating body (mostly an industry association) and the Ministry of Economic Affairs, for additional innovation efforts.
- Innovation programs. These are significant grants for large-scaled collaborative innovation efforts by private and public organizations in 'key areas' which are believed to be important for economic development. Dutch multinational enterprises usually play a key role in these programs.
- Peaks in the Delta. The main Dutch policy intervention to back up strong regions with the potential to be internationally competitive provides significant funding to collaborations of private and public organizations.

Most of these measures are financed by the Ministry of Economic Affairs, the main governmental actor responsible for industry oriented R&D policies (Deuten & De Heide, 2006)[5]. There are also other ministries providing financial incentives, but only for R&D within their specific policy domains. The Ministry of Transport, Public Works and Water Management for example finances innovation activities on five themes (traffic, logistics, aviation, water and construction). The Ministry of Health, Welfare and Sport also funds research efforts in its field of interest. In all, the Dutch policy system offers many

[5] The WBSO is offered in close cooperation between the Ministries of Economic Affairs and Finance as it is a fiscal measure.

financial incentives which (also) stimulate private organizations' research and development efforts.

II. High-quality IP systems
Open Innovation requires transparent, predictable and widely understood IPR systems, as well as good enforcement systems in case of infringements (Chesbrough, 2003). Dutch policy makers seem well aware of this message. As a consequence Dutch policy makers put much effort into influencing the European IPR system. IP is an international topic, and the scope for national initiatives is limited. Recently the so-called London protocol has significantly simplified the problem of language issues in international patenting. Most European countries now accept the English language as an alternative to file their patents. This reduces the need for translations.

The general tendency of IP policy in the EU has been to offer ever greater protection for IPRs (Hölzl, 2007). The harmonization of IP across the EU has been clearly upwards, reinforcing the rights of the IP holder, based on the common belief that stronger IPRs are better suited to foster innovation. Legislative changes have made IPRs easier to enforce, broadened the scope of patentable innovations, and lengthened the period over which many IPRs may be granted. This trend is illustrated by the index of patent strength of Park and colleagues (Ginarte & Park, 1997; Park & Wagh, 2002). The index is based on an assessment of five elements of patent regimes: 1. Coverage (subject matter that can be patented), 2. Duration of protection, 3. Enforcement, 4. Membership in international patent agreements, and 5. Restrictions on the use of patent rights. In both the USA and Europe, patent strength has increased since 1980. As the Netherlands has been mainly followed and harmonized with European legislative changes, the Dutch patent system is probably characterized by a similar trend.

A recent evaluation by KPMG (2006) showed that the Dutch patent system is fairly effective in terms of simplicity, cost and procedural time. Applicants were satisfied with the issue of protection, especially in comparison with the European patent system which is marked by much larger administrative burdens. Despite the trend towards increased patent strength, it thus seems essential to further streamline the European patent. A related issue is that an enforcement system at the European level is still missing. Patent conflicts now need to be settled by national agencies. Dutch policy makers strongly favor the rise of a single enforcement agency.

In the Netherlands, there have also been specific policy interventions to improve the transparency of IP systems, especially for SMEs. These policies have been implemented by the national patent office OCNL. This organization provides information and offers various training courses to assist enterprises to obtain patents. OCNL was also responsible for a patent information project, which stimulated SMEs' awareness of patent information as a source of innovation opportunities. Another issue is that very recently, the Dutch patent application system has been revised. In the future patent maintenance fees will be limited in the first few years, and significantly increased after an initial period (of seven years). This change better reflects that patents should be easy to obtain, but when they do not pay off after some time, they should disappear. In all, policies to ensure high-quality IP seem reasonably present. Opportunities for improvement probably need to be picked up at the European level.

III. Support standards
Like intellectual property rights, standards do not stop at the borders of countries – today even less than ever before (Van Elk et al., 2006). Indeed, by far the majority of standards in the Netherlands have been developed at a European or global level (Van Klaveren & Oostdijk, 2004). At the global level, the most important standard setting organizations are IEC (electronics standards), ITU (telecommunications) and ISO (other standards). At the European level, important organizations are CENELEC (electronics), ETSI (telecommunications) and CEN (other). In the Netherlands, industrial standard settings processes are organized and supported by the standard setting organization NEN. It organizes and supports the development of national standards, and disseminates and publishes both national and international standards to private enterprises and other users.

As standardization is an international topic and the result of a bottom-up process that can primarily be left to market forces, attempts of Dutch policy makers to intervene in standard settings processes are relatively scarce. In a recent survey to collect best practices in standardization policies throughout Europe, Van Elk and colleagues (2006) found only two interventions done by the Dutch national administrations. Besides there were two more interventions done by the national standardization organization (NEN). A best practice however was the so-called Standards Awareness Project. It aimed to increase the know-how of SMEs on standards, and their participation in standard setting processes (Van Klaveren & Oostdijk, 2004). Measures to support standardization varied from publications, workshops and seminars, training, provision of standards at reduced rates, and subsidies for entrepreneurs to participate in standard setting committees.

In all, it seems that Dutch efforts to support standard setting processes in and by commercial businesses are relatively modest. For the public sector policy makers' attention seems much bigger, as there are multiple policies to stimulate the use of uniform and open standards for ICT applications there (Ministry of Economic Affairs, 2005; 2007). One must however keep in mind that, as standard setting processes are primarily an international phenomenon, the Dutch government has decided to leave cross-border issues to the European level (Ministry of Economic Affairs, 2005). Opportunities to do more would probably be limited to encouraging participation of 'weak market parties' such as SMEs. Frequently mentioned instruments here include advice, information and educational support services (Van Elk et al., 2006). These services also seem important to stimulate a broad involvement of stakeholders such as industrial associations (Van Klaveren & Oostdijk, 2004).

IV. Support user innovation
Dutch policies to support user innovation are absent. Recently the Dutch Advisory Council on Science and Technology suggested to develop policies in this area (AWT, 2006), but there has been no follow-up so far. There are however a few initiatives to support the development and diffusion of open source software, a subject that is related with user innovation (Von Hippel, 2005). One example is the so-called 'open supply of software expertise' (OASE) project, in which SMEs were encouraged to develop and apply open source software. Another issue is that the Dutch government is very eager to stimulate the use of open source software in the public and semi-public sector (Ministry of Economic Affairs, 2007). Recently, it has launched an action plan 'the Netherlands in Open Connection' which stimulates ministries and other public organizations to purchase and use, or develop and disclose open source software.

One reason for the scarce attention of policy makers might be that support for user innovation is believed to disturb market processes too much. Policy makers should however be aware that user innovation is not about innovating enterprises involving their users in product development processes. User innovation describes the phenomenon that users primarily innovate to satisfy their own process needs, i.e. to improve their own processes rather than to conquer new markets. Moreover, many users are willing to share their innovations for free. User innovation induces significant knowledge spillovers, but these may be hampered by a lack of interaction with other users or unfavorable external conditions. As discussed in the theory section, support measures should focus on these conditions rather than providing financial incentives, e.g. by supporting technology platforms, user communities and repositories for intellectual commons, or by organizing awards and open competitions.

Interaction-based policies

Limited interaction between the actors in the innovation system is another challenge that Dutch policy makers have picked up (De Boer & Van Steen, 2006; Deuten, 2007). In recent years many policies have been implemented to improve collaboration between innovation actors in general, and to stimulate public-private interaction in particular. These measures now make up a significant part of the innovation policy mix. Hereafter we discuss if and how current policy measures reflect the relevant Open Innovation guidelines (V - IX).

V. Develop skills

The Dutch policy system contains few measures to trigger and support individual enterprises with their interaction skills and competences. In terms of the system failures that we discussed in the theory section, Dutch policies usually aim for network failures. They facilitate innovation actors to connect, and to trigger interaction between them. Capability failures, i.e. the ability of innovation actors to collaborate with other parties and to absorb external knowledge, are targeted less often. This seem to apply not just to policies at the national level, but also at the regional/provincial level. Most policy interventions are restricted to activities that involve finance and direct stimulation of collaboration (e.g. Augusteijn & Erken, 2006: p 56).

There are however exceptions. Syntens is a publicly funded intermediary organization that aims to increase the innovative ability of SMEs, and that actively connects SMEs with other innovation actors such as commercial consultants, engineers, public research organizations and higher education institutes. It offers services on three themes: technological innovation, ICT development and adoption, and organizational innovation. The core of its services is to inform and coach entrepreneurs to develop and implement innovation strategies. One unique feature is that Syntens offers tailor-made support, i.e. individual entrepreneurs are visited and supported in their own environment. In doing so Syntens effectively helps SMEs to develop their interaction and innovation skills. Syntens has local offices in all provinces/regions of the Netherlands, and receives significant funding including an annual lump-sum of € 32 million. This enables Syntens to serve about 16,000 SMEs every year (De Jong & Roelofs, 2007).

In all, policy makers could pay more attention to the development of enterprises' interaction skills. A recent survey in the southeast of the Netherlands showed that especially for young and small enterprises, private suppliers of services to develop skills are only of secondary importance. Young and small enterprises are willing to hire accountants and lawyers, but these are commissioned for other purposes than the

development of interaction skills. Public business services providers should be a gateway to private services providers (Augusteijn & Erken, 2006).

VI. Stimulate interaction
Policies to directly stimulate interaction are very present in the Netherlands. Our overview (table 3) contains no less than eight relevant policy measures, reflecting that this policy guideline is well covered. The innovation policy mix firstly offers financial incentives to stimulate applicants to connect and interact. Innovation performance contracts for example are agreements between 15-35 SMEs and a coordinating body that acts for the group (usually an industry association) about an extra effort in innovation. The Ministry of Economic Affairs provides grants to initiate and execute these innovative efforts. Even more popular are subsidy arrangements to stimulate public-private interactions (AWT, 2007a). Examples include

- Innovation programs (significant grants for large-scaled collaborative innovation efforts of private and public organizations in 'key areas' which are believed to be important for economic development)
- The IOP-LTI scheme (subsidies for collaborative innovation programs involving multiple applicants, also meant to stimulate interaction and ensure that fundamental research efforts account for the needs of businesses)[6]
- Innovation vouchers (small grants for SMEs that can be spend at universities and other public research organizations)
- The so-called RAAK scheme (grants to strengthen the connection between vocational education institutes and SMEs by offering support for collaboration projects to create and diffuse knowledge)
- Peaks in the delta (the major Dutch program in support of strong regions, enabling clusters of public and private organizations to develop innovative projects).

These measures all enable applicants to self-organize with whom and how they will interact. It is quite popular among Dutch policy makers to design policy measures in such a way that innovation actors can express their demands and be pro-active in finding suitable partners, without being forced in specific directions. This is most evident in the innovation voucher scheme that basically allows SMEs to ask (innovation) questions to anyone as long as it is a public research organization.

Other relevant policy interventions are the interaction-based services offered by publicly funded intermediary organizations. Syntens for example spends considerable time to organize meetings to inform entrepreneurs on specific innovation themes and to connect them with each other. Likewise, regional development agencies are active in various lagging regions of the Netherlands. One of their activities is to organize meetings and to get (joint) innovation processes going.

VII. Enhance technology markets
In the theory section we discussed that secondary markets for technology are in a very embryonic stage. This hampers the opportunities for enterprises to proactively manage their IP. So far, they have not been much policies to enhance technology markets. The national patent office OCNL for example carefully records who owns patents, but there is no information recorded on patent trade. Similar with most other European countries, efforts of policy makers are focusing on patent strength. The current policy mix deals

[6] The IOP-LTI scheme has recently been terminated as an independent policy measure. The scheme and its resources have been merged with the innovation programs. Also see annex III.

primarily with the legislative part of IPR, and sometimes services are provided to assist innovating enterprises in the early stages of IPR development such as application procedures and prior art searches (Radauer, Streichler & Ohler, 2007). There is barely attention for the acquisition of existing IPR or the actual usage and exploitation of IPR, which would be more in line with Open Innovation.

In all, the IPR system is very much focused on patent applications and how to obtain information from the patent literature. It hardly touches on the subject of IP management and licensing. One notable exception in the Netherlands is the TechnoPartner program, which aims to realize more and better technology-based start-ups through the creation of a better climate inside and outside publicly funded research organizations. One of its services is the so-called 'patent facility' in which technology-based start-ups can license patents to developed new products. This facility helps enterprises to acquire external IP rights and thus helps to create technology markets.

It seems that there are many opportunities for policy makers to further enhance technology markets, a conclusion that probably applies to many countries. As IP is an international issue, policies to develop technology markets will probably have to be picked up at the European level. Such policies are legitimate as they induce knowledge spillovers and improve the effectiveness of the current IPR system in a variety of ways. Technology markets would reduce the amount of wasteful R&D duplication by encouraging faster diffusion of patented knowledge, they would encourage specialization in R&D as complementary knowledge can be licensed in, and they would increase the incentives for innovation, as revenues can be generated even for innovations that are not used in-house (Hölzl, 2007).

VIII. Use go-betweens

The Dutch innovation policy mix funds two intermediary organizations trying to connect private enterprises with other actors in the innovation system. As discussed above, Syntens is an intermediary organization that is funded to increase the innovative ability of small- and medium-sized enterprises. The core of its services is to inform and coach entrepreneurs to develop and implement innovation strategies. It also frequently provides matchmaking services, i.e. enlists universities, vocational training institutes or other commercial enterprises to support innovation processes. Thus, Syntens is a major go-between that helps to connect actors in the innovation system.

Regional development agencies ('ROMs') stimulate tentative innovation projects by providing seed capital, by participations, and by matchmaking activities. This is all done to enhance regional economic development. In the Netherlands ROMs mainly operate in lagging regions in the North, East and Southern part of the country. There are sometimes also financed by local governments such as municipalities (Augusteijn & Erken, 2006). ROMs also have an explicit role in the development of business parks, as the shortage thereof is identified as a bottleneck for attracting and expanding business activities. Finally, there are of course many private organizations who (implicitly) function as go-betweens, including accountants, consultants, financial institutes and other network partners. A recent survey however showed that especially young and small enterprises are not inclined to enlist private suppliers (Augusteijn & Erken, 2006). Private suppliers are not supported by the Dutch government, but rather Syntens and the ROMs are required to meet specific criteria to prevent that their activities would interfere with those of commercial innovation consultants (e.g. De Jong & Roelofs, 2007).

Syntens is for example not allowed to assist entrepreneurs in the implementation phase of the innovation process.

IX. Back up clusters
Many examples can be found of cluster-oriented innovation policies. The major regional economic policy is the so-called 'Peaks in the Delta' program. Until recently Dutch regional economic policies mainly focused on a catch-up drive for deprived regions. Peaks in the Delta however indicates a clear shift in the core philosophy. The focus has shifted to capitalizing on existing strengths. In effect, the Ministry of Economic Affairs proposes not to automatically transfer funds to less favored regions, but instead challenges all regions to develop promising innovation strategies. Peaks in the Delta only supports those regions with the capacity to develop into internationally competitive innovation 'hot spots' (Van Giessel, De Heide, Den Hertog, Van der Veen & Te Velde, 2007). Within selected regions, a limited number of key areas have been identified. The aim is to boost specific aspects of innovation processes in these areas by means of professional training, technology transfer, encouraging start-ups and knowledge networks. This is put into practice by stimulating the development of local and regional innovation networks involving enterprises, the knowledge infrastructure and public authorities. The Ministry of Economic Affairs provides subsidies which must be matched with local public resources and private money.

Another significant part of the current policy investment is related to innovation programs, aimed at specific key areas of strategic importance for the Dutch economy. In collaboration with the Ministry of Economic Affairs, actors within a specific key area (e.g. water management, high-tech systems) define and organize an innovation program, i.e. their research and innovation objectives, allocation of financial resources, and formulation of projects supporting the program objectives. After approval of the program, the government provides tailor-made support, including subsidies, with the help of various instruments clustered within a so-called program-based package of policies (De Boer & Van Steen, 2006; Deuten & De Heide, 2006). The innovation programs are an answer to the policy challenge to create more 'focus and mass'. This implies that it is believed that the Dutch economy cannot excel in all areas, but rather a focus on key areas (such as food and flowers, chemical products and water management) must be made. In practice most innovation programs have a regional dimension.

Entrepreneurship policies
The development of a competitive entrepreneurial climate is among the priorities of the Dutch Ministry of Economic Affairs (Deuten, 2007). Innovative entrepreneurial activity is regarded to be too modest. Therefore policies have been developed to stimulate the creation, growth and transfer of private enterprises (e.g. Ministry of Economic Affairs, 2003; 2006). We hereafter discuss to what extent these policies correlate with the Open Innovation guidelines X – XII.

X. Support corporate entrepreneurship
There are no policies in the Netherlands which explicitly support incumbent enterprises' corporate entrepreneurial activities (such as spin-offs, participations, venturing or intrapreneurship activities). One policy intervention slightly touching the subject is Syntens, the publicly funded intermediary organization for SMEs. Syntens provides entrepreneurs with consultancy services to develop and implement innovation strategies. One can anticipate that for a subset of these entrepreneurs, corporate entrepreneurship activities will be considered and implemented. Another related policy area is a range of

measures initiated by the Ministry of Economic Affairs (2003) to support the growth of incumbent enterprises. These policies however mainly deal with removing obstacles and growth barriers (Van Giessel et al., 2007). Policies to inform incumbent enterprises on the possibilities of corporate entrepreneurship, and to trigger and support them, do not seem to be present. One could provide models and best practices, and consultancy services on key aspects of strategy, management, organization, finance and risk management. It would be a challenge to raise innovating actors' awareness of corporate entrepreneurial strategies as an opportunity to benefit from purposive outflows of knowledge.

XI. Access to finance
While policy attention for corporate entrepreneurship is low, the opposite applies for policies to secure access to finance. This is a frequently mentioned hampering factor believed to impede many innovative efforts (De Boer & Van Steen, 2006). The financing issues for innovating enterprises, and young research-intensive SMEs in particular, are dominated by the worldwide reality of an existing 'financing gap' (De Heide, 2006). In the Netherlands access to finance is dealt with by mobilizing private funds and by major public financing. To mention only the most important examples, the Dutch policy mix contains the following measures:

- Innovation credits. These are temporary subsidized loans for SMEs to initiate and implement innovation projects with relatively high risks. These credits should be repaid as soon as the development phase has been completed.
- SMEs credit guarantee scheme. This scheme stimulates the provision of credit by private financial institutes. It ensures that they are compensated for a part (but not all) of their credit in case an innovating SME fails to succeed.
- Venture capital scheme. A fiscal facility for business angels and informal investors to invest in new businesses (up to eight years old). In the direct variant of the scheme, taxpayers can lend money to starting entrepreneurs, and in the indirect variant, they can invest money in an officially recognized venture capital fund, which, in turn, finances starting entrepreneurs.
- TechnoPartner. A broad support program to realize more and better technology-based start-ups. It contains partial grants and guarantees, i.e. a seed facility to promote and mobilize the Dutch venture capital market. Via small business investment companies, investment funds are created. TechnoPartner also offers a guarantee label which enables applicants to obtain bank credits more easily.
- Regional development agencies ('ROMs'). These agencies stimulate tentative innovation projects by providing seed capital and participations.

There are also recent initiatives to introduce so-called micro-credits: small loans for nascent entrepreneurs to overcome initial barriers in the early life of their new business. The Ministry of Economic Affairs has recently launched a centre of expertise (www.microfinanciering.com) and initiated pilot programs. Another very relevant example is the Dutch tax system, which offers a range of advantages for those who start a business or provide venture capital to start-up entrepreneurs. Examples are tax deductions for new self-employed and for those who provide seed money to other entrepreneurs.

XII. Back up challengers
The Dutch government is very active to support new and challenging entrepreneurs. This becomes most evident from the New Entrepreneurship Action Plan, aiming to improve the quantity and quality of start-ups in the Netherlands. The plan entails a

range of activities such as information services, loan guarantees, reduction of administrative burdens, etc. There are however more relevant policies. Given that R&D-performance in large enterprises is generally sound, SMEs are the main target of government efforts to raise R&D-levels (cf. Guy, 2007). This is seen in many financial incentives and other measures to secure access to finance. These usually contain special facilities for small and challenging enterprises. Most of the financial R&D-incentives that we discussed previously give extras or explicitly aim for start-ups and SMEs. This applies to the WBSO (fiscal R&D-tax credit which gives a larger tax deduction for start-ups and small enterprises), SBIR (scheme to positively discriminate innovating SMEs in public procurement procedures) and the innovation credit (subsidized loans to develop new, high-risk products, processes or services). Besides, there are the SME credit guarantees and venture capital schemes. These focus on small and start-up enterprises only.

There are also policies focusing explicitly on high-tech start-ups. We already mentioned the TechnoPartner program. Its objective is to realize more and better technology-based start-ups, through the creation of a better climate inside and outside publicly funded research organizations. To achieve this it provides various facilities including grants, seed capital, credit guarantee labels and incubation services. Another example is a pilot to create so-called 'opportunity zones'. In these zones incubation services for starting high-tech enterprises are offered, including housing, coaching and assistance in the application of subsidies, licenses and permits. At the moment four opportunity zones are piloted (around the three technical universities in the Netherlands, and in the business park Avantis in the province of Limburg).

Altogether, Dutch policy makers seem well aware of the importance to back up entrepreneurs who may challenge the status quo. Despite that there are many relevant policies, foreign experts recently noticed that the number of high-tech and fast-growing start-ups is still too modest, particularly in emerging technology areas (Boekholt, 2007). They were of the opinion that efforts to stimulate start-ups in emerging areas could be further increased, for example by means of knowledge brokering and incubation facilities. Indeed, these services are relatively scarce among the examples we discussed above.

Science policies

Maintaining a good science base is regarded as another challenge to keep the Dutch innovation system up to date. Recently foreign experts considered it as a threat that new R&D investments of domestic enterprises are not placed in the country, but in other parts of the world instead (Boekholt, 2007). This confirmed a relative 'urgency' of maintaining a good science base for the future development of the Netherlands. Although most indicators show that the science base of the Netherlands is above or close to average (De Jonge & Berger, 2006), a need to strengthen the science base was recognized (Guy, 2007).

XIII. Appropriate funding

The Dutch science base is maintained by universities and other public research organizations. There are 14 public universities and eight (related) medical research centers (De Jonge & Berger, 2006). Universities are financed from three sources (De Boer & Van Steen, 2006). Firstly, there is public formula funding that is provided as a lump-sum. It goes directly to universities. Secondly, there is public funding that is distributed by NWO, the Dutch scientific research council. NWO is an independent administrative

body that acts as a funding agency for the Ministry of Education, Culture and Science. It provides grants for excellent research and for research equipment. The distinctive feature of the second source of funding is that it is usually based on competition; applications are awarded drawing on peer reviews of scientific quality. Thirdly, universities obtain private money for commissioned research or education activities.

Other public research organizations are technological institutes and other publicly funded research centers (De Boer & Van Steen, 2006; De Jonge & Berger, 2006). Technological institutes are financed with public money to stimulate the application of fundamental knowledge by doing applied research. The largest institute is TNO, the Netherlands Organization for Applied Research. It is active in a limited number of areas which are believed to be most relevant to society (including quality of life; defense, security and safety; science and industry; built environment and geosciences; and information and communication technology). Besides, similar technological institutes active in aerospace, water management, hydraulic engineering, maritime research and energy research. Technological institutes obtain their means from similar sources as discussed above: lump-sum, program-based and private funding. Finally, there are a couple of dozens of other research centers in various disciplines, some of them tied to the research council NWO and others to the Royal Academy of Science (KNAW). The Dutch scientific research infrastructure outside universities entails many organizations and is in fact well developed in comparison with other OECD countries (De Boer & Van Steen, 2006; De Jonge & Berger, 2006).

In absolute terms, the amount of lump-sum funding has been constant over the past decades. Taken as a percentage of total received funding, it has however declined at the expense of NWO and private funding (De Jonge & Berger, 2006). As discussed in the theory section, this is fairly positive from an Open Innovation point of view. Especially competition-driven funding (as provided by the NWO) helps to achieve excellent scientific research. A remark however is that the trend towards higher shares of competition-based public funding and private funding could be too much. To obtain these funds, universities usually must bring in additional sources from their lump-sum funding, a system called 'matching'. Increased matching obligations leave them with little room to allocate expenditures on truly fundamental projects, and this may be at the expense of the long-term stock of basic knowledge (AWT, 2005). In a world of Open Innovation, this is something to monitor closely. Appropriate lump-sum funding of fundamental research should be guaranteed, as research lines take time to mature and successful high-impact research cannot hardly be predicted in advance (Chesbrough, 2003). In this context, the so-called Knowledge Investment Agenda (which is influential in the current government policy related to knowledge and innovation) recommends that more should be invested in fundamental research (Innovation Platform, 2006). In the past few years Dutch politicians did invest more in basic knowledge, but the bulk of these extra investments were incidental, i.e. extra funds for scientific research were usually financed from extra revenues obtained from the Dutch natural gas reserves.

Summarizing, the Dutch scientific infrastructure seems reasonably well developed in terms of funding structures and numbers of public research organizations. International benchmarks show that the country is doing well despite that investments are not among the highest on all indicators (De Jonge & Berger, 2006). A point of attention is that the increased competition and demand-driven nature of funding may cannibalize long-term, high-risk fundamental research (cf. AWT, 2005).

XIV. Balanced incentives
A well-developed stock of basic knowledge is not enough: fundamental knowledge must diffuse to other innovation actors and be applied in new products and processes. In the Netherlands there is a concern that the science base is not enough oriented to the needs of industry. Resolving the dilemma is problematic because there is no strong endorsement of the 'third way' within universities, i.e. universities prefer to stress their traditional roles of teaching and research rather than assume much responsibility to form links with, or to support, industry in the task of valorization (Guy, 2007: p. 10). Indeed, the core philosophy of the Dutch government is that universities and other public research organizations need a large degree of autonomy to ensure 'pure and unbound scientific research' (Ministry of Education, Culture and Science, 2008: p. 71). In practice, universities use their autonomy to primarily focus on doing fundamental, scientific work, and to organize education. Valorization of fundamental knowledge is recognized as important, but still insufficiently translated into action (AWT, 2005; 2007b).

So far there are not many incentives for individual scientific researchers to spend time on valorization. The Ministry of Education, Culture and Science intends to stimulate and change intellectual property regulations to allow researchers to appropriate a larger share of the IP from their research. This incentive has been proposed earlier on (e.g. De Boer & Van Steen, 2006), and in fact, the current Higher Education Act already allows universities to give their employees a share of their patents' revenues. Balanced incentives are, however, not just a matter of finance. In the theory section we already discussed that one can doubt if university IP improves valorization (Fabrizio, 2006). Rather, in scientific climates non-financial incentives are probably more effective. Researchers are extremely sensitive about their status in the scientific community and the judgment of their peers. Besides, researchers' career opportunities nowadays still depend most on their scientific performance, and to a lesser extent the quality and output of their education activities, while valorization mostly does not count at all.

The Dutch Advisory Council on Science and Technology recently recommended that valorization should become a part of the strategic agendas of universities and research institutes, and that employees of these organizations should be explicitly stimulated and rewarded for valorization behavior (AWT, 2007b). This is actually common in most countries, i.e. career promotion mechanisms and salary regulations generally provide no incentives and actually discourage collaborative research with industry. CREST (2006) therefore recommended that there should be career and financial rewards for researchers linked to knowledge transfer activities. This recommendation seems applicable to the Netherlands as well.

XV. Focus on excellence
A strong public knowledge base requires not just funding and balanced incentives, but also a continuous focus on excellence. With 'excellence' we mean both scientific excellence and attention for valorization. In this context, Dutch policy makers strive for 'focus and mass' in public research efforts. We already discussed that the Dutch funding system is marked by increasing shares of competition-based public funding (distributed by the research council NWO) and private funding. The distinctive feature of NWO funding is that it is mainly based on competition between various applicants. By increasing the share of NWO funding the central government is able to influence

competition and quality aspects, and thus to create more focus and mass in scientific research (De Jonge & Berger, 2006; Boer & Van Steen, 2006).

Except for the Ministry of Education, the Ministry of Economic Affairs is also involved to achieve more focus on excellence in public research. There are multiple policies to realize focus and mass and valorization of fundamental research. Evident examples are the following:

- In the past five years there have been many incidental research subsidies for basic research in key areas, mostly financed from the Dutch natural gas reserves.
- In the section on interaction policies we already discussed that the Ministry of Economic Affairs supports collaborative innovation programs which are initiated by public research organizations and private enterprises. These policy measures are organized around specific key areas (e.g. water management, high-tech products, chemicals, food and flowers) and also help to create focus and mass.
- The technological institutes, which are primarily financed to stimulate the application of fundamental knowledge, increasingly receive program-based funding rather than lump-sums. Program-based funding inevitably drives research efforts towards more direct and useful applications and helps to bring focus and mass.
- A relatively new policy measure is the so-called 'leading social institutes'. Leading social institutes are virtual organizations. Grants are given to private enterprises and public research organizations that are willing and capable to participate in strategic research programs.

We conclude that many initiatives are taken to ensure that Dutch basic research focuses on excellence. However, we also identified points of criticism that may be useful to further develop the policy mix. Firstly, the Netherlands has a strong tradition of science assessments and self-evaluations of universities and public research organizations, but these exercises are not used as criteria for the overall science funding system and thus, these evaluations do not help to create excellence (Boekholt, 2007). Secondly, Dutch policy to stimulate excellence are sometimes blamed for a lack of long-term vision and coordination (AWT, 2007a). Most policy incentives were provided on an incidental basis and changed many times. In this respect some wonder if any real choices have been made as far as focus and mass is concerned (Van Giessel et al., 2007). Thirdly, a recent trend however is that in its new strategic policy agenda, the Ministry of Education, Culture and Science (2008) has announced that the NWO funding will be increasingly tied to individual researchers' bottom-up proposals, and will be distributed based on outstanding scientific quality. As this will diminish resources for specific key areas, there is a danger that focus and mass in research will decrease.

XVI. Organized diffusion

Netherlands is one of the countries which suffers from the 'European paradox', i.e. great fundamental research output, but not enough application of this knowledge in new products and processes (Carey, Ernst, Oyomopito & Theisenset, 2006). For this reason a plethora of policies are implemented to organize the diffusion of knowledge (De Boer & Van Steen, 2006). Our overview (table 3) contains the following relevant policies (most of them have been discussed before):

- Innovation programs: Grants for collaborative innovation networks of public and private organizations in selected key areas.
- Innovation vouchers: Small grants for SMEs that can be spend on research at universities and other public research organizations.

- RAAK scheme (Regional Attention and Action for Knowledge innovation): Financial support for collaboration projects in the areas of knowledge creation and valorization between SMEs and higher vocational education institutes.
- Peaks in the Delta: Supports regional clusters by means of grants. It fosters interaction between innovation actors and stimulates public-private partnerships in selected key areas.
- TechnoPartner program: Aims for more and better technology-based start-ups. The program offers grants, seed capital, guarantees and a patent facility.
- The past five years have witnessed many incidental research subsidies for universities and public research organizations, usually with the requirement that private enterprises should be involved in the research.
- STW Technology foundation: This foundation is a part of the research council NWO. It finances research projects based on two criteria: high scientific quality and being directed towards practical application simultanuously.
- Leading social institutes: virtual organizations of public and private partners to organize diffusion of scientific knowledge for a limited number of themes with high relevance for society.
- Opportunity zones: In these zones special facilities are offered to start-ups and high-tech SMEs.
- Valorization grant: Enables researchers at universities to apply for a grant to create a spin-off from a public knowledge institute.
- Lectureships: Lecturers are employed at higher vocational education institutes. They are appointed to create knowledge networks with regional businesses, with a special focus on SMEs.
- Casimir mobility scheme: Subsidizes the mobility of researchers to enhance knowledge flows between publicly funded research organizations and private enterprises.

Another example includes the so-called 'social innovation programs'. These are very similar to the innovation programs described above, except that they explicitly focus on developing innovative solutions for social problems (related to health, safety and environment issues). These new types of innovation programs also stimulate public-private interaction by providing subsidies. In all, there are many relevant policies. This leads some to regard the current policies as too fragmented. This has motivated the Ministry of Economic Affairs (2008) to announce a further streamlining of the number of policy measures, and to simplify their application procedures.

Education policies

Most policy makers agree that the Dutch education system delivers too few graduates in especially science and technology. The total number is only 60% of the EU average (Deuten & De Heide, 2006). Several industries face problems to attract highly qualified personnel. This hampers innovation in enterprises and harms the competitive position of the Netherlands. Addressing the demand or shortage of human resources is an urgent but difficult task, because the demographic situation in the Netherlands will cause an extra outflow of science and technology workers into retirement in the near future. It is now discussed to what extent current policies reflect the guidelines XVII and XVIII.

XVII. General stimulation
Compared to the average of the OECD and EU countries, Netherlands inhabitants are relatively well educated. The share of highly educated inhabitants, as well as the share of people with at least secondary education, is above average (OECD, 2006). According to the OECD definitions, total expenditures on education by the Dutch government are € 26,654 million euros. In both absolute and relative terms, public education expenditures have risen in the past five years, e.g. as a percentage of GDP education expenditures have increased from 4.5% (in 2000) to 5.1% (in 2005) (Ministry of Education, Culture and Science, 2007: p. 33). These expenditures are however lower than in countries like the US, Canada, Switzerland and the Scandinavian countries (OECD, 2006). While in 2005 education expenditures were 5.1% of GDP, the average for all OECD countries was 5.5% (De Jonge & Berger, 2006).

The Dutch government is very much aware of the crucial role of (in particular) tertiary education in the transition to a 'knowledge society' (De Jonge & Berger, 2006). Improving the quality and level of higher education is actually one of the pillars of the current Dutch government policy (Coalition Agreement, 2007). In general, the government dedicates extra resources to reduce the number of drop outs, to improve training quality, and to better connect the education system with the business society (Ministry of Education, Culture and Science, 2008). To secure the innovative capacity of the Netherlands in the long term, the government considers that it is essential to have more people starting a study and finish it. Within a broad action program the government introduced specific measures aimed at increasing the number of students in science and technology (De Boer & Van Steen, 2006; Deuten, 2007). Examples of these measures include:

- Technological sciences platform ('platform betatechniek'). The Dutch government has installed this platform to promote courses in science and technology. The platform develops activities in primary, secondary and tertiary education, and it conducts a number of projects in the field of tertiary education and innovation; both in promoting the image of technology and stimulating regional action plans.
- Lecturers. The Ministry of Education, Culture and Science has financed hundreds lecturers at the higher vocational education institutes. Lecturers are the counterpart of full professors in universities. There are appointed to create knowledge networks with regional businesses, and stimulate applied research activities to foster valorization and to enhance the quality of vocational education by means of (research) apprenticeships.
- Project learning and work. This project stimulates lifelong learning activities by employers and their organizations, trade unions, governments and citizens.
- Recently, in June 2007, the government announced the establishment of a new taskforce on 'technology, education and labor market', with a leading role for private enterprises, to better address the shortage of students in science and technology (Deuten, 2007).

In sum, investments in education (and in tertiary education in particular) are relatively modest compared to other OECD countries. Nevertheless the Dutch system is performing among the best in international benchmarks. The quality of Dutch education can be characterized as good value for money (De Jonge & Berger, 2006).

XVIII. Entrepreneurship education
Policy makers and stakeholders generally agree that entrepreneurship is not yet properly integrated in the Dutch education system. A recent survey among primary, secondary

and tertiary education institutes demonstrated that with only a few exceptions, entrepreneurship education is lacking (Overdiep, Van Rooijen, Slijp & Vos, 2008).

The government has launched an action program on entrepreneurship and education. The objective is to stimulate citizens' entrepreneurial attitude and to develop their entrepreneurial competences. This action program aims for more attention for entrepreneurial competences in the curricula of schools and universities, to promote entrepreneurship among teachers, and to create enterprising educational institutions. This is done by information and promotional activities, road shows ('entrepreneurs in classrooms'), apprenticeships for teachers in business, developing and implementing performance criteria to assess the entrepreneurial content of current curricula, and stimulating education institutes' incubation services.

Labor market policies

Labor markets are an aspect of Open Innovation policymaking that is probably most remote from traditional innovation policy. Like in other countries, it is the domain of trade unions, employers' organizations, large enterprises, the government and the national Ministry of Social Affairs and Employment. In order to change labor market policies, (open) innovation and industry competitiveness are just a subset of the arguments to influence political decision-making.

XIX. Aim for flexibility

Current Dutch legislation on recruiting and firing employees prohibits employers to terminate contracts without prior consent from the director of their region's Employment Services Authority. Such consent demands that detailed employee files must be recorded, a demand that most entrepreneurs fail to meet. Failure to obtain such consent entitles the employee concerned, provided they invoke the invalidity of their dismissal within a time limit of six months and declare themselves prepared to continue performing the work specified under the contract, to apply to the courts for continued payment. The employer may however also adopt the alternative of applying direct to the courts for judicial rescission of the labor contract. In the latter case, redemption money has to be paid. In case of employees with excellent track records and/or long tenures, redemption sums can increase to multiple annual salaries.

In the Netherlands, there is currently a heavy discussion on the flexibility of labor market regulations. Employers' organizations have forwarded that at the moment firing employees is too expensive. Especially the huge sums of redemption money that need to be paid is perceived as a hampering factor. On the other side, trade unions continuously reply that the labor market is already very flexible, and that the current compensation system would increase flexibility (as employees would litigate only for symbolic reasons to secure their compensation). Trade unions also point to the current labor supply, which is increasingly scarce. In such a labor market most employers do not want to fire employees but (should) rather do their best to recruit and train their workforce. The Minister of Social Affairs and Employment has recently proposed to allow employers to sack their employees without permission of their region's court or Employment Services Authority. The proposal would restrict the redemption fee to one month of salary for each year of tenure, with a maximum of € 100 000. As the current Dutch government is however far from unanimous on the subject, the discussion is now stuck in the middle (and not much is anticipated).

Other aspects of labor market policies are subject to policy discussions too. There is a continuing debate on the validity of mobility restrictions in labor contracts. Employers increasingly include conditions that restrict their employees to make career moves to competing enterprises, or to accept new jobs within a particular geographical range. Dutch legislation and jurisprudence regards mobility restrictions as part of collective labor agreements as invalid, but on an individual basis, employers can still negotiate mobility restrictions with their subordinates (Venbrux, 2008).

Finally, there are dedicated policy instruments to increase labor market flexibility and the supply of science and technology workers. One example is the Casimir scheme (named after a former head of R&D of Philips, Netherlands' largest multinational enterprise). The main objective is to increase public-private mobility of researchers and to enhance exchanges of researchers between public research organizations and private enterprises, and vice versa. In all, it is difficult to take a final stand on how flexible the Dutch labor market is and if policies to increase flexibility are sufficiently developed. The answer would depend on one's political preferences.

XX. Enable knowledge migration
In the past years the Dutch government has paid special attention to the accessibility and attractiveness of the Dutch labor market for foreign knowledge migrants. The main policy action was to simplify and streamline administrative procedures to enter the country. For this purpose the Dutch Immigration and Naturalization Service ('IND') has created a knowledge migration desk. After the relevant employer has registered, applications for foreign knowledge workers are processed in two weeks. This service is eligible for all private enterprises and education institutes. Specific requirements include a minimum pay (for knowledge workers at private enterprises) and the exclusion of specific professions (e.g. religious predecessors).

A related issue is the migration of foreign students rather than knowledge workers. Foreign students are an important future source of knowledge, research and labor supply. So far the Netherlands had relatively modest success in attracting foreign students. The government has initiated a number of policy instruments to change the situation (De Jonge & Berger, 2006). Tuition fees for foreign students will probably be lowered, and administrative procedures to reside in the country will be simplified. Besides, research talented foreign students are increasingly attracted with scholarships, and the foreign network of Dutch government offices that support knowledge migration will be expanded (Deuten, 2007).

Competition policies
Until the European harmonization in 1992, the Netherlands had a reputation for being a 'cartel paradise'. Former Dutch legislation tolerated behaviors of incumbent enterprises that would by-pass competition. In the past fifteen years this has dramatically changed. Dutch policy makers, especially at the Ministry of Economic Affairs, have been very active to introduce and supervise competition. It is still among the main objectives of the Dutch Ministry of Economic Affairs.

XXI. Stimulate competition
The scope of policy notes, reports and documents on Dutch competition policies is to large for the current case study. The website www.rijksbegroting.nl, which reveals all budgets of the Ministry of Economic Affairs, shows a plethora of instruments, action plans, legislative designs and subsidies to government bodies responsible for aspects of

competition. Dutch policies to stimulate and secure competition are well developed. We here confine our discussion to the most important supervising body on competition, which is the Netherlands Competition Authority (NMa). This body was founded in 1998 with the mission to enforce fair competition in all industries of the Dutch economy. It is an autonomous administrative agency financed by the Ministry of Economic Affairs. Its main enforcement powers are laid down in the Competition Act. The NMa explores and fights against illegal cartel activities. Besides, it imposes sanctions for infringements of the competition law such as abusing a dominant market position and it assesses merger proposals to avoid the emergence of concentrations obstructing the proper functioning of markets.

One remark is that the Competition Act allows a few exemptions from the cartel prohibition, as 'trivial undertakings, agreements, concerted practices or associations of undertakings in which no more than eight undertakings are involved and in which the combined turnover of the undertakings does not exceed € 4.54 million, have been exempted from the cartel prohibition' (Glerum-Van Aalst & De Putter, 2008). This implies that effectively, by far most innovation cooperation activities are not hampered by competition regulations.

5.3 Conclusions

The Dutch policy system already offers a wide range of policies related to Open Innovation (table 3). Given the main challenges that Dutch policy makers have identified to boost the performance of their innovation system, i.e. private enterprises' R&D, supply of highly educated workers, interaction between innovation actors and little entrepreneurial activity, and their overlap with many of the key enterprise behaviors and external conditions in our framework, this is not very surprising. Policy guidelines which are already quite well represented in the current policy mix include:

- Financial incentives for private enterprises' R&D. These have a long tradition and are generally characterized by good accessibility, low administrative burdens, and special facilities for SMEs.
- Stimulate interaction between innovation actors. In recent years many policies have been developed to improve collaboration between innovation actors. These measures now make up a significant part of the innovation policy mix.
- Back up clusters. Regional economic policy now actively invites collaborative networks of private and public organizations to pro-actively develop and implement innovation plans in selected key areas.
- Access to finance. Lack of finance is widely recognized as a hampering factor for innovative entrepreneurship, and many policies (e.g. guarantees, subsidies, credits) are offered to provide relief.
- Back up challengers. Dutch policy makers are well aware that innovation support is most needed for small challenging enterprises, especially in high-tech industries.
- Organized diffusion. Policies to stimulate valorization of fundamental knowledge from public to private organizations are probably the most developed aspect of the current policy mix.
- Stimulate competition. In the past fifteen years many policies have been introduced to supervise and secure competition in all industries.

Of course, one must keep in mind that the simple occurrence of policy measures in specific areas tells us nothing about their effectiveness; this is beyond the scope of the current case study.

Our inventory also suggests a number of guidelines for which policy makers in the Netherlands so far have no or only slight attention (table 3). The policy mix might become more balanced if these guidelines would be developed by means of new policies. In this respect the challenge would be to develop or stimulate policies to

- Support standards. For standard setting processes, it seems that policies can be expanded, especially to better involve 'weak market parties' such as SMEs and high-tech start-ups. Policies related to standard setting processes should however probably be picked up at the European or global level in the first place.
- Support user innovation. This is still an uncharted area of policymaking. User innovation policies should first and foremost focus on the right external conditions, e.g. by supporting technology platforms, user communities and repositories for intellectual commons, rather than providing financial incentives which would probably disturb market processes too much.
- Develop interaction skills. The Dutch policy system contains few measures to trigger and help incumbent enterprises to assess and improve their network management skills and competences. Most of the current interaction policies focus on network failures ('connecting innovation actors') while capabilities failures are only slightly touched upon.
- Enhance technology markets. Dutch IPR policies mainly focus on how to apply for patents and how to obtain information from the patent literature, a feature that is probably shared with many other countries. The subjects of IP management and licensing of technologies are only barely covered. Like support for standard settings processes, this guideline must probably be picked up at an international level.
- Support corporate entrepreneurship. Corporate entrepreneurship is main feature of Open Innovation that current Dutch policies do not cover very directly. Policies could be developed to inform and support private enterprises' to develop alternative strategies to benefit from their knowledge, i.e. by means of spin-offs, participations, venturing or intrapreneurship activities.
- Create balanced incentives in scientific research. Although much is done to create focus and mass in scientific research, and to stimulate valorization, a hampering factor is that scientific researchers' career perspectives still depend on their scientific output and, to a lesser extent, their performance in education. Career opportunities may need to be better and more directly linked with valorization activities.

We here remark that Open Innovation theory, i.e. what businesses do when they innovate in a world of Open Innovation and what external conditions are most influential, is no blueprint to select and develop new areas for policymaking. A more detailed discussion of recommendations to policy makers follows in chapter 8.

6. FLANDERS (BELGIUM)[7]

This case study has been written with the help of Steven Peleman, Triple Helix Technology Intermediates, Antwerp, Belgium.

6.1 Introduction

Belgium is a federal state composed of regions. In practice both the national and regional governments are central actors in the innovation system. It is not a system where the national government coordinates and decides on a national policy framework that each region then fine-tunes to its own needs. On the contrary, all three regions (Flanders, Wallonia and Brussels-Capital) have substantial autonomy to develop and implement their own policies. Additionally, the national government offers innovation- and related policies. Due to the regional differences the current policies and governance structures are too distinct from one another to apply the Open Innovation policy assessment framework to the whole country. We therefore focus on the Flemish case only. Private enterprises in this region are most influenced by the Flemish and Federal Belgium policies. At the political level, it is the Ministry with the competence for economy that is most influential for innovation matters. Our inventory will therefore primarily focus on the policies of these government organizations at the federal and regional (Flemish) level.

The central location of Belgium in Europe and the presence of the EU and many other organizations in Brussels, predict that the region is wealthy and can realizes healthy economic growth. In practice, things are however a bit different. There are many economic indicators signaling that the economic engine is sputtering. Amongst other factors, lack of innovation and entrepreneurship are two important reasons explaining the slow down of economic growth. The country has a poor reputation in early-stage entrepreneurship (Bosma, Jones, Autio & Levie, 2007) and it is ranked as an 'innovation follower' in the European Innovation Scoreboard of 2007. Its innovation performance is just above EU-average. Inward foreign direct investments have come to a standstill indicating that the country is not that attractive anymore for foreign investors. Most national and international forecasts predict that future economic performance cannot be sustained at sufficient rates to avoid public deficits. Most analysts agree that in order to keep public deficits under control while maintaining a high-quality system of social protection in the face of an ageing population, there is a need for considerably greater investments in innovation. Both the federal and Flemish authorities have therefore identified innovation as an important determinant to secure future growth (European Commission, 2007).

Given this outlook, the Flemish government has formulated a relatively distinct and clear approach to its innovation policies. It has set a number of goals and quantitative targets for 2010, including to double the percentage of high-growth medium-sized enterprises, to be among the most competitive locations for foreign companies (investment quote should be in the top 5 of all EU-regions), to double of the number of start-ups from

[7] We highly appreciate Peter Spyns for his feedback on the initial version of the Flemish case study.

Flemish knowledge institutes and universities, and to realize 25% of turnover by Flemish companies from new products and services. As for the federal government, it has little experience with proactive innovation policies, but it did initiate changes in the fiscal system to stimulate innovation and R&D by means of a series of additional or revised reductions in tax and social security contributions for enterprises and their employees (European Commission, 2007).

The most recent INNO-Policy TrendChart report (European Commission, 2007) identifies three medium-to-long term challenges that Belgian national and regional authorities would need to address. Firstly, although the Belgian education system is performing well, there is evidence for an innovation skills mismatch. This issue is increasingly identified as a bottleneck in the Belgian innovation system, notably by enterprises and their representative federations. The number of science and engineering graduates for example is characterized by a marginally positive trend, but its growth is lagging with the EU trend (Belgium currently stands at 88% of the EU-25 average). There is a need to encourage higher numbers of young people to attend courses in the fields of science, technology and engineering, and also in related areas like industrial design and innovation management. Secondly, there is a challenge to preserve the country's good position to attract and retain innovative enterprises. Belgium in general, and Flanders in particular, has long benefited from significant inward investments by (foreign) enterprises undertaking industrial research and innovation. Thirdly, there is a need to boost entrepreneurship, especially the rate of creation and growth of high potential knowledge-intensive enterprises. Boosting entrepreneurship is a key element of the national Lisbon Reform program with a commitment of the national government to significantly reduce the number of days needed to start a business. In this context, although much has been done to foster valorization of the scientific research base, the promotion of knowledge-intensive start-ups is still regarded as a main challenge. These three challenges are recognized by the governments of all Belgian regions as well as by the federal authorities.

6.2 Overview of policy measures

In table 4 we present an initial overview of policy measures which are most relevant in the Flanders context. It has been based on the INNO-Policy TrendChart (European Commission, 2007), additional policy reports and documents, and discussions with local innovation policy experts (see annex II). The inventory contains both Flemish and national Belgian measures influencing enterprises' Open Innovation behaviors and/or external conditions facilitating Open Innovation. For details of these measures we refer to annex IV. We also note that the same disclaimer applies as in the Dutch case. We were not able to take stock of all relevant policy documents, but rather limited ourselves to the most important ones.

table 4 Inventory of Open Innovation policies for Flanders (Belgium)

Policy areas/ guidelines		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17	#18
		Tax exemption for researchers employed by enterprises	SME Program	Knowledge transfer in strategic areas	Research mandates	Poles of Excellence/ Centers of Excellence	Strategic Basic Research – SBO	Action Plan for Science Information & Innovation	Growth subsidy	TETRA Fund	Financial support for industrial estates and science parcs	VINNOF	Industrial Research Fund– IOF	Entrepreneurship Action Plan	NRC Fund	ARKimedes	Win-win loan	Young Innovative Companies	One-off Innovation Premium
RTD policy																			
I	Financial incentives	x	x								x				x		x		x
II	High-quality IP systems																		
III	Support standards			x															
IV	User innovation																		
Interaction policy																			
V	Develop skills	x												x	x				x
VI	Stimulate interaction			x	x				x	x									
VII	Enhance technology markets								x	x									
VIII	Use go-betweens																		
IX	Back up clusters										x			x	x				
Entrepreneurship policy																			
X	Support corporate entr.																		
XI	Access to finance		x						x			x		x		x		x	
XII	Back up challengers													x			x	x	
Science policy																			
XIII	Appropriate funding				x	x	x						x						
XIV	Balanced incentives				x														
XV	Focus on excellence			x		x							x						
XVI	Organized diffusion				x	x	x	x		x			x						
Education policy																			
XVII	General stimulation							x											
XVIII	Entrepreneurship education																		
Labor market policy														x					
XIX	Aim for flexibility																		
XX	Enable knowledge migration																		
Competition policy																			
XXI	Stimulate competition															x	x	x	

table 4 Inventory of Open Innovation policies for Flanders (Belgium) (continued)

Policy areas/ guidelines		#19 Applied Biomedical Research with a Primarily Societal Finality	#20 Flemish Cooperative Innovation Networks – VIS	#21 University interface services	#22 Tax deduction for R&D investments and patents acquisition	#23 OPRI-DIE – Office for Intellectual Property	#24 R&D projects of companies	#25 Tax deduction for increase in R&D personnel	#26 Tax deduction for patent income	#27 R&D Tax Credit	#28 Mentorship Programs	#29 Hercules Foundation	#30 Special Research Funds	#31 Flemish Young Enterprises – VLAJO	#32 Methusalem	#33 Odysseus	#34 Economy-Education Bridging Projects	Overall assessment*
RTD policy																		
I	Financial incentives				x			x	x	x								++
II	High-quality IP systems			x		x			x	x								o
III	Support standards																	-
IV	Support user innovation																	-
Interaction policy																		
V	Develop skills	x	x								x							+
VI	Stimulate interaction	x	x								x							++
VII	Enhance technology markets				x				x									o
VIII	Use go-betweens		x	x							x							+
IX	Back up clusters	x																++
Entrepreneurship policy																		
X	Support corporate entr.																	-
XI	Access to finance																	++
XII	Back up challengers																	+
Science policy																		
XIII	Appropriate funding	x	x				x					x	x		x	x		+
XIV	Balanced incentives																	o/-
XV	Focus on excellence														x	x		+
XVI	Organized diffusion		x	x			x										x	++
Education policy																		
XVII	General stimulation													x				+
XVIII	Entrepreneurship education			x							x			x			x	o
Labor market policy																		
XIX	Aim for flexibility																	o
XX	Enable knowledge migration																	-
Competition policy																		
XXI	Stimulate competition																	+

* -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

RTD policies

The Gross Expenditure on R&D (GERD) for 2005, i.e. including both private and public R&D expenses, is € 3.569 billion. There has been a decrease in GERD between 2000 and 2004 but expenditures for R&D on the rise ever since (Steunpunt O&O-indicatoren, 2007). Private companies are still responsible for most of these expenditures with 68% in 2005. Higher education expenditure was only responsible for 19% of the total GERD in 2005. R&D-expenditures represent 2.09% of the Flemish gross regional product, with 1.46% of this expenditure by private enterprises and 0.63% public expenditures. Of course, looking at expenditures is only one way of analyzing investments in science, technology and innovation. For the analysis of public spending, it is also useful to look at reserved or planned budgets, as they reflect more in detail what lines of policy are involved. The Horizontal Budget Program Science Policy for example distinguishes three major components: R&D, Education and Training (E&T), and Scientific and Technological Services (S&T). Between these components, we see a clear trend. In 1996 the shares of R&D, E&T and S&T were respectively 49%, 47% and 4%. In 2007 the R&D component has risen to 61.3%. E&T accounts for 33.8% of the planned budget and S&T for 5% (Steunpunt O&O-indicatoren, 2007). In Flanders there are numerous policies to stimulate private enterprises' research and technology development efforts. There is some overlap between Belgian and Flemish policy financial incentives to stimulate private R&D investments. We hereafter elaborate on the main RTD policies and categorize them according to the guidelines I – IV.

I. Financial incentives

The innovation performance of enterprises is contingent on their financial investments. The European commission has set the ambitious Lisbon objective of 3% of the GDP spent on R&D. The private sector should realize two thirds of these investments. In order to stimulate enterprises to invest in R&D, governments give all kinds of financial incentives to lower their R&D-costs. Financial incentives are to a large extend the responsibility of the Federal government, but the Flemish government offers additional measures to stimulate R&D. Examples include:

- R&D tax credits for R&D-labor costs. The main policy measure to stimulate private research and technology activities is a tax credit for R&D. Belgium has set up an attractive scheme for partial tax exemption in favor of employers who employ or hire new researchers (see policy measures #1 and #25 in annex IV). This is usually to the benefit of larger companies with formal R&D labs, but also young innovative SMEs can profit from special tax exemptions on the labor costs of researchers (see #17).
- Both the Belgian and Flemish governments also intend to reduce the investment costs of development programs with subsidized loans for expensive R&D-investments. examples are the Belgian tax deduction on tangible and intangible assets (#22) and the Flemish NRC Fund to alleviate the cost of research in high-tech sectors like aerospace (#14).
- Tax deductions are also applicable to patents acquisitions (#22) or patent income (#26). We consider this to be interesting, i.e. a smooth and inexpensive transfer of knowledge between different enterprises is one crucial element of Open Innovation.
- Most financial incentives are focusing on science-based research and technological innovations. We discovered only one measure (#18) that is also eligible for non-technological innovations. Reducing the costs of creative employees is probably not yet a priority, although design, creativity and new business model innovations are as important as technological innovations in most industries. This is especially the

case for SMEs who have not enough financial means to in-source this type of resources.

Another observation is that, although most current financial incentives are focused on individual enterprises, there are also policy measures targeting public-private interaction. Especially the linkage between universities and private enterprises is a main objective of policy makers. We come back on this issue when we discuss guidelines V-IX (see hereafter).

II. High-quality IP systems

In scientific work, patents and publications have long been used as common metrics of successful innovation, but this view has increasingly been criticized because companies with large patent portfolios have not always been able to translate their technological superiority into market leadership. In the context of Open Innovation, IP ownership is no longer a necessary requirement to introduce innovative products in the market. Enterprises can license or sell technology they do not use to expand the markets for external use of their innovations. On the other hand, enterprises can develop new products and obtain market leadership without having developed their own IP. In Flanders we find some tax deductions to bring down costs for licensing external technology and to enhance profitability from patent income. IP policy is in the first place a responsibility of the Belgian Government. The Office for IP ('Belgische Dienst voor Intellectuele Eigendom') exercises a traditional role of administering IPR, but it is also active in supporting innovation policies. Firstly, it intends to increase access to the sources of technical and strategic information contained in patents, and secondly, it conducts awareness-raising activities in the field of IPR.

The Flemish government is also stimulating the use of IP especially among small enterprises and in traditional industries; IWT, for instance, regularly organizes training sessions on how to use patent databases and it recently organized a campaign to inform small enterprises how to protect their ideas and how to use externally developed IP. However, there is still a lot to improve. First, patents remain expensive for many innovation actors, and enterprises in low- and medium-tech industries do not have the required skills in-house to tap effectively into externally developed IP. The major problem is that IP protection should not be enforced at the Belgian but at the European level. The European IP system is however (perceived to be) expensive and the enforcement of patent protection ineffective because of differences in national patent systems. We remark that the EU proposed an uniform community patent as early as 1974, but after decades this uniform patent is still not implemented (Economic Council of Finland, 2006).

III. Support standards

Standard setting is important as a lever to develop new businesses and to realize increased division of labor, i.e. vertical specialization in specific parts of innovation trajectories. This in turn offers new opportunities for specialized small enterprises. Furthermore, standards speed up innovations in many industries and they may strengthen the Single European Market by reducing technical barriers. As Flanders is a fairly small region it does not have a leading role in international standard setting processes. Actually, the same applies to the whole country of Belgium. Both Belgian and Flemish policies to support standard setting processes are relatively scarce. Technical standards have to be developed and executed at the European level. However, Flemish policy makers can offer advice, information and educational support to stimulate a more

active stance of smaller enterprises vis-à-vis the use of technical standards. Small enterprises can gain a lot in using technical standards strategically into their products.

IV. Support user innovation
Flemish policies in support of user innovation are non-existent. Although different types of IWT measures cut across the value chain, and these are typically supporting initiatives where users play a major role in the innovation process, the focus is still on producer-based innovations, so it is fair to say that user innovation is not explicitly on the radar of Flemish policy makers. Most scientific experts will agree that (lead) user innovations are important. Von Hippel (2005) provided ample evidence that communities of users can play a decisive role in the development of radical innovations. In a similar vein, lead-users in a business-to-business context are crucial in pulling through highly successful innovations. User innovations may not have a prominent role among policy makers in Flanders for a number of reasons. Firstly, user innovations are usually driven by process needs rather than new technologies or market considerations. As innovation policy is still highly concentrated on stimulating scientific discoveries, technological innovations and product development, user innovations have not been targeted in the past. Second, user innovations originate among users, i.e. enterprises and consumer households, rather than universities and R&D labs. This requires a different way of thinking about government support which may still be dominated by technology push perceptions of investments in science and technology that should induce new products.

Interaction-oriented policies
Open innovation is by definition about interaction between partners in a broader innovation system. Flemish policy makers have picked up these challenges as they acknowledge that cooperation between actors in the Flemish innovation system is currently insufficient. Therefore, there has been growing attention for policy measures to stimulate interaction between different innovation actors in an effective way. These measures now make up a significant part of the policy mix supporting the innovation system in Flanders and they constitute one of the cornerstones of an innovation policy which is compatible with our guidelines V - IX.

V. Develop skills
Interaction with other players in the innovation system can help some organizations to develop new skills. Although large enterprises also learn from their interactions with other organizations, the Flemish government has mainly focused its (innovation) policy measures on individual entrepreneurs, start-ups and SMEs (e.g. #14 and #28 in annex IV). It is interesting to observe that the Flemish government is not focusing only on innovation, but also on entrepreneurship and general management skills that are crucial for the survival and the success of a new businesses. Although there might be a myriad of policy measures to help entrepreneurs, the government also has made efforts to integrate it in a 'client friendly' way. VLAO is an organization that acts as a front-office towards these enterprises and guides them through the multitude of policy measures from which they can benefit when they start-up an enterprise or intend to strengthen their competitive position by increasing its innovation capability. The innovation advisors of IWT have a similar role to play in case young or small enterprises intend to innovate.

VI. Stimulate interaction
Numerous innovation cooperation networks can be found in the Flemish innovation landscape in order to bring innovation actors in contact with each other around different

types of innovation projects (e.g. #3, #19 and #20 in annex IV). It is mainly the portfolio of policy instruments of the IWT that stimulates interaction between different innovation actors. The VIS-program ('Vlaams Innovatie Samenwerking') stimulates the coordination of innovation activities in Flemish companies with financial support of the Flemish government. IWT selects projects and programs that are submitted by networks of companies. Some projects bring together SMEs, others bring together large and small enterprises (mentorship programs, see #28 in annex IV). The interesting point is that these networks can grow bottom-up by an initiative of one of the partners. IWT provides the conditions under which these networks can be subsidized. Another example is the TETRA-fund of IWT (#9). This program is easily accessible for starting research groups and for companies which are not yet acquainted with innovation. The program contributes to networks of companies and tries to establish long term cooperative agreements between companies.

Interaction between enterprises should not only be centered around technology. Open business models (Chesbrough, 2006) shows that the commercially interesting innovations are not necessarily scientific breakthroughs are technology based innovations. A stronger orientation towards non-technological innovations would be welcome. Sources of non-technological innovations can be emphasizing design and lifestyle, new business models, service oriented innovations, etc. Therefore, it is interesting to mention that the Flemish government is slowly developing a broader focus on design and creativity with initiatives like 'Flanders District of Creativity' and 'Design Flanders'.

VII. Enhance technology markets

One of the major insights of Open Innovation is that companies may win from an increased specialization of labor. The specialization of labor has been extensively described by Arora and colleagues (2001). They describe the process where (newly established) enterprises specialize in a particular part of the value chain which has previously been taken care of by a vertically integrated organization. In many cases, this specialization of labor takes the form of technology providers or technology service enterprises. A technology market emerges when increased numbers of specialized actors are willing to sell their technologies. In the theory section we discussed that markets for technology are so far only developed in an embryonic way. We did not find any policy measures in Flanders which directly focus on the development of technology markets. Indirectly however, there are a few policy measures reducing the costs of IP acquisition (see #22 and #26).

Current policies (Federal government) deal primarily with legal aspects of IP and services to assist innovating entities in searches and application procedures. As a result, no attention is paid to the acquisition of externally developed IP and its commercial use in within new business models. Hence, IP policy is still oriented towards who owns patents and not about the economic potential to trade patents. Patent trade has been common among large companies (e.g. licensing and cross-licensing agreements), but it is fairly new to small enterprises and many enterprises in low- and medium tech industries. The recent surge in trading patents is facilitated by specialized intermediaries in the marketplace, not by the innovation policies in European countries (see also the next section on go-betweens).

VIII. Use go-betweens
The Flemish government has established a number of intermediaries who are important to bring innovation partners together. The Flemish innovation network (VIN) is an important initiative to get smaller enterprises in touch with experienced innovation partners that can help them. The network combines expertise of different intermediate organizations or centers which can offer expertise to Flemish companies. Network members are organizations which are involved in one or more projects from the so-called VIS programs (#20). The latter stimulates innovation activities of networks of Flemish businesses with financial support of the Flemish government. VIN also coaches and gives advice to these companies in order to increase the chance of successful innovations. More than 500 people from over 100 organizations offer a broad pallet of expertise to support private innovation initiatives.

The interface-services of universities (#21) can also be considered as a go-between. They attempt to bring together scientists and commercial parties, with the objective to create value from these new technologies. In sum, the Flemish government certainly stimulates cooperation through go-betweens. However, one might also be critical as these organizations are led by civil servants and bounded to Flanders. Searching locally for solutions in a global economy might be a better strategy.

IX. Back up clusters
Cluster-oriented innovation policies in Flanders have received quite some attention in the past. Today we implicitly find a cluster-oriented approach in the VIS, TIS and competence pole projects of the IWT. Clusters also receive attention because of specific key areas of strategic importance for the Flemish economy, for example the aerospace industry (#14) or because of market imperfections in particular industries leading to suboptimal levels of R&D expenditures (e.g. biomedical research, #19).

Policy attention for specific industries or related sets of industries might be interesting from an Open Innovation point of view because cluster policies should per definition pay attention to the networking among its innovation players. Clusters allow policy makers to focus on particular industries or sectors that have the potential to lever the growth in other industries. Especially, when a core of competitive enterprises and research institutes create a local ecosystem with a strong potential it is worthwhile strengthening this cluster. Similarly, when an existing cluster faces new competitive challenges (e.g. because new, foreign competitors flood the market) enterprises can regain competitiveness by appropriate innovation policies. Finally, focusing on clusters also prevents that public money is not scattered over too many small projects. Flanders is a very small region and can only excel in a few key technological areas. However, there are also drawbacks related to backing up clusters. Focusing on clusters might draw the attention away from other technological opportunities. It is not clear in advance -when policy makers have to make decisions about technologies that only will be introduced in the market in the next five to ten years – which technology will be successful. Technological and market uncertainty are enormous in pre-competitive research phases, and it is by no means clear that backing up clusters will lead to economic success in the future.

Entrepreneurship policies
International reports consistently demonstrate that Belgium (and Flanders) has a bad track record in early stage entrepreneurship (Bosma et al., 2007). Consequently, both the Flemish and federal government consider the development of a competitive

entrepreneurial climate as one of its priorities. There are a number of reasons why the economy has not enough innovative entrepreneurs. It can be partly explained by people's attitudes towards risk, rigid labor markets, the current educational system, absence of role models, and more (Hinoul, 2005).

X. Support corporate entrepreneurship
There are no policies in Flanders that explicitly support enterprises with corporate entrepreneurship, i.e. to our knowledge there are no policies to trigger or support private enterprises' spin-offs, venturing or intrapreneurship activities. Although there are quite some incentives to spin-off ventures from universities (see hereafter), comparable measures for business spin-offs are absent. A Dutch report (Braaksma, De Jong & Clarysse, 2005) found convincing empirical evidence that spin-offs of commercial organizations are much more prevalent, i.e. there are three to four times as many than academic spin-offs. Besides, business spin-offs appear to perform better in terms of survival, growth and financial performance.

The Aho report (European Commission, 2006c) argues that policy makers 'should recognize that large enterprises are essential for the innovation system. The recent trend of concentrating resources on SMEs ignores the natural ecology of industry'. A recent international meeting of both small and large enterprises from 18 European countries, organized by the Dutch Chair of EUREKA, issued a statement saying that small enterprises thrive in the slipstream of large enterprises and that both groups prefer to work within the same initiatives. A neglected target group is the medium-sized enterprise above the SME threshold. This group probably has the greatest potential for growth in R&D spending but has also been struggling in recent years (European Commission, 2008).

XI. Access to finance
Belgian and Flemish policy makers pay lots of attention to ensuring that small enterprises and start-ups have sufficient access to finance. This is a frequently-mentioned bottleneck which is believed to impede many innovative efforts. The financing issues for innovating enterprises, and young research-intensive SMEs in particular, are dominated by the worldwide reality of a 'financing gap' (De Heide, 2006). In Flanders access to finance is dealt with in various ways. Examples include:

- VINNOF (#11). Subsidized loans to finance pre-seed and seed phases of enterprise formation. In order to guide innovative start-up companies to private capital, VINNOF was set up. Aim of the fund is to provide financial means to young, innovative enterprises to transform their ideas or technologies in business plans.
- Entrepreneurship Action Plan (#13). This program supports entrepreneurship in a broadly manner. It offers a support mechanism called BEA (budget for economic advice) for training, advice, knowledge and mentorship, amongst others.
- ARKimedes (#15). The Flemish government provides fiscal incentives to mobilize private capital of individuals. This capital is then used to match private venture capital. In this way the available venture capital is doubled with limited costs for the government.
- Win-win loan (#16). The Flemish Government provides fiscal incentives for business angels who want to invest in start ups.

Besides, the Belgian tax system offers a range of advantages for both large and small enterprises willing to invest in researchers, research equipment, an intellectual property. In general, financing a start-up has become easier in the last five years. However, the

Flemish government (but this is also the case in the rest of Europe) neglects medium-sized enterprises above the SME threshold.

XII. Back up challengers
The Flemish government is very active to increase the number of start-ups and it tries to persuade individual citizens to become entrepreneurs. Policymakers not only want to increase the number of start-ups, but they are also preoccupied to bring down the number of bankruptcies (usually within three years after establishment) by investing in coaching interventions.

However, entrepreneurship policy in Flanders is not cross-linked with policy targets to stimulate innovation by increasing competition. The latter can be realized by improving the environmental conditions for SMEs and start-ups in the economy. Presence of SMEs implies also increased competition and forces larger enterprises to be more innovative or less complacent. Moreover, small enterprises provide large companies with demonstrations of the commercial viability of new approaches to commercializing ideas, and their success confronts incumbents with hard facts that they have ignored so far. Incumbents will respond to the demonstrated success of new enterprises with new combinations of knowledge far more rapidly than they will to any direct government program targeted to support them. Competition will not come necessarily from local SMEs because the Belgian economy is too small. Challengers will come more likely from abroad, which implies that the openness of the economy is a strong driver for innovation for local enterprises.

Flemish policy makers have spurred entrepreneurship in several interesting ways (e.g. #17 and #13 in annex IV), but they have largely neglected that in particular SMEs and start-ups may challenge the status quo. Especially, fast-growing start-ups, particularly in emerging technology areas are interesting challengers. According to the GEM report (Bosma et al., 2007), Belgium has insufficient innovative entrepreneurs. In our opinion, this implies that the government should not actively stimulate innovative entrepreneurship but also reshape the overall economic conditions under which entrepreneurship (also foreign owned companies) can flourish.

Science policies
As will be explained hereafter, the overall quality of Belgium's science base is good in comparison with the European average. Nevertheless, although quality is there, quantity may be lacking. Many national and international studies have already indicated the urgent need for more basic and fundamental research and certainly also for more Flemish scientists, researchers and engineers (Memorandum – Science and Technological Innovation 2004-2010, VRWB). Apart from the structural complexity that typically characterizes Belgium, with its communities, regions and its federal level, the responsibility for Open Innovation-related policies is also shared by two or more independent ministries (the Flemish Ministry of Economic Affairs, Scientific Policy and Innovation, the Flemish Ministry of Education, the Flemish Ministry of Labor, and the Federal Departments of Justice and Finance). It is considered crucial to integrate the different policies based on a clear road map for innovation (European Commission, 2007).

XIII. Appropriate funding
In Flanders, the landscape of science, technology and innovation contains many publicly funded actors. First of all, there are currently six universities. Their responsibilities are

to provide scientific education, to define and execute scientific research and to provide scientific and technological services to society as a whole. Together they account for 85% of the Flemish scientific publication output. Different channels were created to finance their research, because in addition to the normal operational allowances of € 633 million in 2007, their capacity to finance scientific research has been reinforced with the Special Research Funds (#30), FWO Flanders (€ 113.8 million budgeted in 2007 and € 117.2 million in 2008) and specialization scholarships offered by IWT (€ 24.25 million in 2007), to promote fundamental research even more. Besides these mechanisms, the Hercules Foundation (#29) was created to finance medium- and heavy research infrastructure investments, and via FWO Flanders two 'excellence programs' were initiated. The Odysseus program (#33) was created to get top researchers back to Flanders. The Methusalem program (#32) attempts to provide excellent researchers with significant and stable research funding. Even though quality is still very much the focus of Flemish universities, their output levels are becoming increasingly important as the financial means of the Special Research Funds (#30) is allocated on the basis of publication- and citation output.

Furthermore, the Flemish government finances four large, strategic research centers on which an amount of approximately € 100 million is spent every year. Additionally, there are five smaller but related research centers, and there are the innovation oriented platforms or the so-called 'competence pools' like Flanders Drive and Flanders Mechatronics (#5). Another type of actor includes higher education institutions ('hogescholen'). These can rely on the so-called TETRA-fund (#9) which stimulates to valorize technological knowledge and to keep these institutions exposed to the beneficial effects of technological developments. Additionally, the Industrial Research Fund (#12) for associations can also support and determine these institutions' role in applied research.

Some actors are crucial in structuring and implementing funding processes. Examples are IWT Flanders, FWO Flanders, the Hercules Foundation (#29) and the Special Research Fund (#30), which all have very specific tasks and responsibilities in redistributing financial support to the fore-mentioned actors. Additionally, EWI is part of the Flemish Government and provides integral support for the economic, scientific and innovation policy of the Flemish Government. In all, Flemish policy makers pay much attention to the funding of public research organizations and offer a variety of funding mechanisms.

XIV. Balanced incentives

Historically universities focus on their primary role of knowledge creation. The Flemish authorities have recently introduced multiple policies to stimulate and support knowledge valorization. These incentives are discussed at guideline XVI on organized diffusion. Here, the focus is on policy incentives to trigger valorization behavior 'inside' of universities and other publicly funded research organizations. In Flanders, such attempts are still scarce. The research mandates schemes, which provide finance for researchers' efforts to valorize scientific knowledge, provide one example on measures to directly intervene with individual behavior (see #4 in annex IV). University cultures are however still focused very much on scientific excellence, a feature that is shared with most other countries (CREST, 2006). It also seems that institutional legislation and procedures hamper individual valorization behavior. For example, Flemish university professors are civil servants and accordingly subjected to strict prohibitions on working with and for private enterprises as long as they receive civil servant salaries. These prohibitions deprive universities of the knowledge that comes from working closely with

industry, and from acquiring a deep understanding of industrial problems. When universities select their next research initiatives, they do so in ignorance of what burning issues need to be solved in many societal areas. Hence, the creation of a solid bridge between the academic world and the companies seems necessary. Some initiatives have started to close to gap, i.e. universities and other higher education institutes on the one hand and private companies on the other hand are fostered to connect with each other by measures such as TETRA-funds (see hereafter when we discuss guideline XVI).

XV. Focus on excellence

In an increasingly global world it is important to have a strong focus on excellence. Universities and research centers that develop leading edge technologies are recognized as center of excellence and can therefore attract the best scientists, engineers and corporate clients from all over the world. Focusing on scientific excellence has important implications for small regions like Flanders. As a critical mass is needed, the government needs to concentrate its scientific budget on limited, strategically well defined disciplines. It also implies that these centers have to theme up with other, internationally leading universities and research labs in Europe and the rest of the world. Although the Belgian educational system has been praised worldwide, we find that the best Flemish university (Catholic University of Leuven) is ranked only 58th in the list of European Universities and 186th of the universities worldwide (www.webometrics.info/top500_europe.asp). The UK, Sweden, Switzerland, Germany and Finland are doing much better. As a result, the Flemish government needs increased focus on creating and sustaining excellent research. We note that the funding of Flemish science is increasingly competition-based. There have multiple policy initiatives focusing on excellence, including the following examples:

- The program on knowledge transfer in strategic areas (#3) is designed to support and strengthen scientific capability in high technology areas that are more than ever vital in effectively meeting the major societal challenges.
- Odysseus (#33) is an initiative of the Flemish government to give top researchers who built their career abroad the chance to come to Flanders to continue their work there in the best possible circumstances (academic staff, research infrastructure, etc.).
- Methusalem (#32) is designed to provide top researchers at Flemish universities with longer term and contineous financing, rather than the standard procedure of project-based funding. The latter, traditional system has more than once terminated promising research projects before their final stages.
- The Hercules Foundation (#29) is a government agency, created to finance the purchase and exploitation of medium to heavy research infrastructure for strategic basic research in all scientific disciplines. It can be used to create centers of excellence when expensive infrastructure is determining the minimum efficient scale of a world-class research center.

In sum, the Flemish government has recently taken some interesting initiatives to guarantee that the Flemish research base is more focused on excellence in a limited number of areas. However, the ranking of the Flemish Universities shows there is still a long way to go. A first point of criticism is related to the lack of results based evaluations of academic personnel in Flemish universities, if we compare them for instance with prominent Dutch universities. Second, Flemish universities are still too much in competition with each other rather than with foreign universities. Competition in science and technology is a battle on a worldwide scale. As a result, Flemish

universities should benchmark with prominent universities abroad and cooperate in networks with these universities in order to profit from their participation in worldwide networks of centers of excellence.

XVI. Organized diffusion
The Flemish authorities are very active to enhance valorization of scientific knowledge. Several programs that focus on the diffusion of scientific insights and technological developments at universities and research labs towards technology users are present. We enumerate some of these programs, without being exhaustive:

- So-called interface services of universities (#21) are try to commercialize intellectual property of the five universities by outward licensing and by establishing spin-offs.
- The VIS program of IWT (#20) intends to optimize knowledge exchange between knowledge centers and Flemish companies, in particular SMEs, by increasing awareness, improving access to technological knowledge and supporting implementation of knowledge in enterprises. The VIS-program targets intermediary organizations active in the support of technological innovation, and supports collective research, technological services, sub-regional innovation stimulation, thematic innovation stimulation, and feasibility studies to prepare collective innovation initiatives.
- The program to stimulate knowledge transfer in areas of strategic importance (#3) intends to spur knowledge transfer in particular technology areas between universities and industrial centers. The Program aims to stimulate the transfer of knowledge and research results to all socio-economic sectors, enabling them to make the most of available opportunities according to their needs.
- Action plan for Science, information and innovation (#7) is an initiative to popularize science, technology and technological innovation through a yearly action plan on Science Information and Innovation.
- More examples include the Industrial Research Fund (#12), TETRA (#9), excellence centers (#5) and SBO-projects (#6) which are all designed (or include elements) to stimulate knowledge valorization. Another example is the intellectual property rights framework, which guarantees that the IPR from academic research and inventions goes back to the university.

Most of these initiatives can be considered as external stimuli for interaction between partners along the technology life cycle; universities (scientists) and other high education institutes, with research labs and enterprise that translate scientific ideas and new technologies into new products and profitable business opportunities. The creation of the Industrial Research Fund for example finances mandates or projects aimed at transferring knowledge to enterprises. Similarly, the centers of excellence are important actors in organizing diffusion of technologies, as they usually start from specific business problem statements rather than scientific challenges. These centers originated mostly from professional federations to focus on applied and industry-oriented research. All these diffusion-oriented policies indicates that Flemish government currently attaches much attention to science and new technologies. At the same time, these programs reveal the government implicitly assumes that valuable innovations are science or technology based. New designs, experiences, or business models are also valuable sources of commercially valuable innovations. As a result, scientific breakthroughs or technology based innovations are interesting but not the only sources for new business creation. A stronger orientation in the direction of non-technological innovations would be welcome.

In all, we feel that a lot has happened in Flanders to overcome traditional hurdles in the area of promoting science, technology and innovation. Perhaps the amount of channels or support mechanisms is still too high and there might still be a divide between those who know their way in the science, technology and innovation landscape and those who do not. Either way, the gap is closing and the spectrum from basic research to commercial valorization has been tackled in terms of funding, support structures and easily accessible points of contact. The next thing to do, probably, consists of expanding the scale, promote social inclusion for all mechanisms in function of their target groups and align academic and entrepreneurial activities in such a way that they can compete with the technology valleys or corridors of the US.

Education policies

Open Innovation is based on the ubiquity of knowledge. Therefore, the educational system in a country is crucial for its potential to generate a knowledge economy where people can learn and adapt itself to a continuously changing global environment. The quality of the educational system in Flanders has always been at a high level, but this asset did not result in a leading economic position in the EU. As a result, the Flemish government is aware of the challenge to make current human capital economically more productive.

XVII. General stimulation

The Belgian and (since 1989) Flemish Education system has always been among the best in the world, as has been shown in many international studies (Vandenbroucke, 2008). With 83.7% of the Flemish students (i.e. in the Flemish Region) between age 20 and 24 having a secondary education degree, Flanders fell only just below the European target of 85% for 2003, but in 2000 Flanders was already second best in Europe for the 22 year old with 86.9% having obtained a secondary education degree (in comparison with the European average of 75.5%). Looking at the results of Flemish students in an international context, the PISA 2003 results show first of all a sharp rise in performance between 2000 and 2003 on mathematics and scientific literacy. The fairly large variation is mainly due to the rather large group of top performers. About 34% of the Flemish students reach the top 2 skill levels in mathematical literacy as compared to 15% for an average OECD country. Flemish education policy is currently focusing on four important areas:

- improving the transition between education and the labor market
- equalizing financial support for the entire educational spectrum
- reinforcing the ability to create and implement proper policies for schools and institutes
- offering teachers an attractive and motivating job perspective.

Primary and secondary education cycles form the basis upon which future excellence can be built. For that reason, it is considered not only necessary to make ensure that all young citizens get fair chances, but also that young and smart children are challenged and inspired to create eager minds (which are desperately sought for the higher education and research communities). To boost the Flemish economy three related but distinct policy dimensions have been formulated (Vandenbroucke, 2008), including scientific excellence, innovation and entrepreneurship. The latter two dimensions are relatively absent in the education system in Flanders. Special attention is given now to alleviate these shortcomings.

XVIII. Entrepreneurship education

It is fair to claim that entrepreneurship is so far not properly integrated in the Flemish education system. In comparison with the Dutch educational system, Flemish schools are not structured in an adequate way to stimulate entrepreneurship. There is a growing awareness among policy makers that entrepreneurship should be encouraged at very young ages and, as a consequence, 'teaching' entrepreneurial attitudes should be a priority of primary, secondary as well as tertiary education institutes. Entrepreneurship also becomes more prominent in all kinds of training programs. Recently, these have been a number of interesting initiatives:

- The Flemish government has launched an action program on entrepreneurship (#13). One part of this action plan offers the possibility to have life-long learning vouchers to subsidize education for employees and entrepreneurs.
- University interface services (#21) increasingly offer possibilities for potential start-up managers to follow training sessions. They also offer services to help managers of start-ups to set up their business.
- Mentorship programs (#28) are another initiative in which experienced managers of large enterprises guide entrepreneurs in setting up and professionalizing their businesses.
- Finally, bridging projects between education and business (#34) support collaborative projects between educational organizations and enterprises to stimulate entrepreneurship both for children and adolescents.

Although these initiatives demonstrate a growing awareness of policy makers for entrepreneurship, it may still be better anchored in the Flemish educational system as current are probably too ad-hoc and small to close the 'entrepreneurship gap' of Flanders versus leading countries in Europe and the United States.

Labor market policies

Enterprises nowadays increasingly experience the hardship of finding appropriate resources on the labor market, certainly when a specific skill set or knowledge workers are required. This so-called scarcity paradox is visible in the immobility of Belgium's active labor population. Instead of matching Flemish vacancies with unemployed talent from the Brussels region or Wallonia, the French region is inviting Flemish companies to move to Wallonia. Anyhow, even if there was a regional equilibrium, the Belgian labor market is extremely immobile. For instance, between 2001 and 2002 only 7% switched jobs. The most notable transitions occur between unemployment and work and between education and work. Transitions from unemployed or employed people to entrepreneurship are very rare. Obviously, people prefer stability and job security. No doubt the biggest problem for the Belgian (and Flemish) labor market today is the aging population with 26% of the population being older than 65 by the year 2030. In order to finance the public social security system, this means that by 2030 there will be 2.3 (labor) active people per individual older than 65 years, compared a ratio of 4 to 1 today. Social inclusion with respect to the labor market is therefore crucial, but is not considered to be enough. Economic migration might be an alternative solution.

Innovation and entrepreneurship are the most important driving forces for the Flemish economy. Yet, reading through all policy related documents and looking at all relevant policy programs, innovation and entrepreneurship are all too frequently depicted as nice to have and marginally implicated, whereas they should lie at the very basis of many initiatives. As far as the labor market is concerned, the Minister of Labor has indicated in his policy letter 2008 that more synergies between the labor market, education and

entrepreneurship will be sought. Syntra Vlaanderen will investigate the desirability and feasibility of reinforcing internship policy for entrepreneurial education. Other projects are the Action Plan Entrepreneurial Education, the Bridging Projects and the 'Entrepreneurs Class Week' of the Koning Boudewijn Foundation. Finally, the Ministry of Labor is also working to support socially responsible entrepreneurship and social innovation.

XIX. Aim for flexibility
Mobility on the labor market is a prerequisite to stimulate Open Innovation, but today's pensions, benefits, health care, and other aspects of compensation today are typically tied to employment, and this effectively constrains mobility. Making these portable, or severing their tie to a specific employer, would enable workers to seek out the best opportunities to utilize their skills.

Like in other countries, policy discussions concerning labor market regulations are the domain of trade unions, employers' organizations, large enterprises, governments and the national Ministry of Social Affairs and Employment. In order to change labor market regulations, innovation and industry competitiveness are just a subset of the arguments to increase flexibility, and for some parties involved these arguments are certainly not those with the most weight on the agenda. The Belgian (and Flemish) labor population is strongly focused on the preservation of acquired rights, job security and stability. Yet, many enterprises are nowadays confronted with ever shorter business cycles and accelerated erosion of existing business models causes anyone with a shred of creativity to pose a real threat to large established companies (Peters & Waterman, 1988; Hamel, 2002). Agility, quick response times and above all flexibility are considered essential elements guiding labor market regulation. Unfortunately, it seems to be very difficult to change labor attitudes and policies, even if this jeopardizes social welfare in the long run.

We recommend Belgian and Flemish policy makers to tackle issues dealing with the setting in which innovation has to take place. They will have to do this together and across the boundaries of departments, ministries or political convictions. Social inclusion is noble, but in a system that creates too little economic value through innovation, all socially included will end up being poor. In short, to benefit from Open Innovation, to which everyone agrees that this is absolutely crucial, Belgium and Flanders must get a flexible, open and dynamic labor market with freedom for the individual and the individual company.

XX. Enable knowledge migration
The population in Flanders is aging very rapidly. Shortage on the labor market will increase in the next five to ten years, and labor shortages will be general rather than occasionally and specific for very specialized jobs (Vanhaverbeke, 2007). For migration policies so far not much has changed, although the current Federal government intends to change this policy. Basic options to reach a solution include (combining the first two options would seem most feasible):

- drastically increase the participation rate
- attract labor supply from other regions.
- look for another type of regional economic policy which takes into account that the economic growth can only be realized with a rationalized supply of workers.

Policy makers can change immigration policy to attract more labor supply from abroad. Activating excess labor supply in Brussels and Wallonia might be a first way to alleviate the problem. However, past experience learns that labor in Wallonia does not commute to jobs in Flanders – even within a commuting distance of only 50 kilometers. Changing the mobility of Walloon employees might be difficult in the future too, since Walloon policy makers assume another strategy: if there is a labor shortage in Flanders, Walloon policy makers will invite Flemish enterprises to migrate to their region by attracting them with cheap supply of industrial estates. They bet on the mobility of Flemish enterprises towards Wallonia, not on the labor mobility of Walloon labor towards Flanders. As a result, there are no Belgian solutions for the labor shortage in Flanders. Moreover, similar shortages on the Dutch and German labor market will only aggravate the situation. As a result, there is a strong need for economic immigration policies to attract workers from abroad. Commissioning foreign labor implies a complete reorientation of the Belgian immigration policy that is now based on political arguments. Attracting labor from Eastern Europe is one possibility, and indeed, experiences from the past with former enlargements of the EU (Spain, Italy and Greece) learn that there is indeed an immigration wave of jobseekers from those countries in the first three years after EU-enlargement. As the economies of new member states however develop, most of the migrants return to their country of origin because jobs become also available there. Migrants from Eastern Europe are therefore a temporary and no permanent solution. If one wants to attract labor in the long run, policy makers should set up an economic immigration policy to attract labor from around the world. Such policies are currently for example installed in Australia and Canada.

Evidently, all the above also applies to researchers and other knowledge workers. Flanders needs more researchers and has to ensure that these researchers are of exceptional quality. This means first of all that more talented Flemish researchers should be pursued to develop their careers also in corporate environments. After all, Belgium has committed itself to achieving the 3% target in R&D. Nevertheless, having enough Flemish researchers will not be sufficient Apart from infrastructural requirements and structural aspects that facilitate actually finishing doctoral projects and delivering top quality results, it is crucial that Belgian and Flemish knowledge institutions are sufficiently exposed to top international talent. In order to attract the inspirational contribution and knowledge influx effect of foreign top researchers and academics coming to Flanders, the Flemish Government has created the Methusalem and Odysseus programs (see #32 and #33). These mechanisms are designed to provide an appropriate setting for top researchers.

Competition policies

Competition policy cannot be considered solely from a Flemish or Belgian perspective, i.e. the European harmonization in 1992 lifted competition policies to a European scale. However, there are still quite a number of national rules and policies that shape competition, leading to increased fragmentation of product markets in Europe. Among different types of policies that might interfere with competition in product markets, we mention labor markets, social security and environmental protection as important policy areas having an impact on competition.

XXI. Stimulate competition

Open Innovation requires that competition is intensive enough. If there is strong competition within industries, incumbent enterprises will be better motivated to find ways to exploit their ideas as much as possible. If society grants enterprises too strong

property rights to their ideas, though, and accordingly allows monopolies and cartels to arise and to endure in its product markets, then the Open Innovation process may break down. Monopolists and oligopolists will then hoard their ideas and technologies, to exclude them from rivals and other enterprises so that they cannot be used in different environments.

Belgian policies to stimulate competitiveness and secure competition are well developed and work closely in relation with the European antitrust authorities. From an Open Innovation perspective it is however important to also consider competition as a way to secure a flow of ideas and technologies between organizations. As a result, we have to see competition policy not only from a product market perspective but also how it has its impact on technology transfers. In this context IP policies directed towards smaller enterprises are important, and in Flanders policy makers are taking some measures to stimulate SMEs to better use IP protection (e.g. #23). Another aspect is support for new, challenging enterprises (see guideline XII discussed above which is reasonably present). Next, stimulating competition by encouraging access to external R&D for SMEs can help them to strengthen their competitive position. Finally, tax reductions for SME when they hire engineers or license patents are interesting to speed up technology generation and adoption in smaller enterprises. Such policy measures to strengthen indirectly the competitiveness of SMEs are not completely absent in Flanders but they seem not substantial and coherent enough to stimulate SMEs to develop own R&D or tap into external technology sources as a driver for their future growth.

6.3 Conclusions

In our search we identified 34 policy measures that can be linked to the guidelines for Open Innovation policies, are presented in chapter 4 of this report. Our first conclusion is that the Flemish (and Belgium) policy system already contains a broad range of policies which impact Open Innovation practices in enterprises, and external conditions favoring such practices. As a result, the scope of the current policy mix seems not a problem. Many of the guidelines that we derived from Open Innovation theory are already tackled (either explicitly or implicitly). Policy guidelines which are well developed are the following ones:

- Financial incentives for private R&D. These have a long tradition and are generally characterized by good accessibility. Some are specially targeting SMEs.
- Stimulate interaction between innovation actors. The Flemish government has developed a whole range of policy measures to ensure collaboration between innovation actors. Collaboration is both horizontally (e.g. collaboration between SMEs) as well as vertically (i.e. networks over the technology chain going from science to the commercial launches of new products). IWT plays a crucial role in this area. These measures now make up a significant part of the innovation policy mix.
- Back up clusters in and across industries. Flemish policy makers actively stimulate collaborative networks of private and public organizations to pro-actively stimulate scientific and technological developments in particular, strategically important areas.
- Access to finance. Financing entrepreneurial activities are widely recognized as an important factor to stimulate innovation (a problem in this area might be that there currently is a multitude of policy measures without much coordination. Also remark that entrepreneurship is in some cases related to policy measures

focusing on science and technology development but it seems that the connection needs to be strengthened to be optimal).

- Back up challengers. Support for start-ups and spin-offs are strongly emphasized by the Flemish authorities.
- Focus on excellence. There has been a tradition in Flanders to focus on excellence – see for instance the international success of IMEC. Recently the Flemish government has taken some measures to attract international top researchers and stimulate top researchers in a structural way beyond the project level financing.
- Organized diffusion. Valorization of fundamental research knowledge from public to private organizations has been a priority for the Flemish government in the last years. This topic receives extensive attention of policy makers (although observers feel that there is still room for improvement).
- Stimulate competition. The openness of the Belgian economy has always been one of the major factors ensuring competition on the domestic market. Policies are aligned and in majority transferred to European authorities. Besides, by stimulating the establishment of challengers the government is creating indirectly a more competitive environment.

The overview of the Flemish (and Belgian) policies also reveals some areas in which policies are not or only slightly present. We conclude that the most important challenges are:

- Support technological standards. Standard setting processes are important since they allow new types of specialization of labor which, in turn, can generate Open Innovation dynamics in different industries where SMEs and start-ups can seize new business opportunities.
- Support user innovation. In Flanders this policy area is clearly not developed. User innovation may at best be implicitly present in the current policy mix, i.e. lead users can be involved in networks that connect players over the technology chain. Current policies however do not account for basic elements of user innovation, as user innovations are motivated by process-related hampering factors, rather than market opportunities.
- Enhance technology markets. Current intellectual property policies are still very traditional. They focus on how companies can apply for patents and how they can search for prior art in patent databases. IP management has a totally different role to play in Open Innovation compared to the typical defensive role it plays in a closed innovation setting. We did not detect any policies in Flanders (or Belgium) with a pro-active focus on the new role of IPR in open innovation practices of companies. The government could for instance play a more prominent role in setting the rules for co-ownership of IP that results from joint innovation efforts between different organizations. Furthermore, governments can facilitate the emergence of secondary markets for technology. The presence of secondary markets multiplies the number of ways enterprises can use technologies. It also fosters specialization among enterprises, since one enterprise will specialize in developing the IP , while another has the assets to leverage the innovation (cf. Chesbrough, 2006).
- Support corporate entrepreneurship. Corporate entrepreneurship has been a central theme in the books of Chesbrough (2003; 2006), but the Flemish government is so far not very active in this area. University spin-offs have received most attention, while corporate spin-offs, which outnumber university

spin-offs, receive scant attention. The government can better account for how businesses grow and when different partners play a complementary role in this process, i.e. universities, start-ups, large enterprises with corporate venture activities, and venture capitalists cooperating to bring new technologies to the market.

- Balanced incentives. Although we have encountered many policy measures to stimulate valorization of knowledge from public to private organizations, most of these measures attempt to stimulate knowledge diffusion from the outside, i.e. by providing financial incentives. Policy initiatives which target the career incentives of individual researchers are far more scarce.
- Labor market and knowledge immigration. Innovation policies cannot be developed independently from labor market policies. Most innovation activities require direct involvement of highly-educated staff. Flanders (Belgium) experiences already for a decade labor supply problems in an increasing number of jobs. Knowledge workers get scarce and this will become worse in the future because of the ageing population. It seems that migration policies are in need of innovation.

There are some clear overlaps with the presence of the Open Innovation guidelines in the Netherlands, but we save this discussion for the discussion section (see chapter 8). We want to finish this conclusive section with two important remarks on the current policy mix. Firstly, there is a multitude of policy measures, and this may give the impression that Flanders already offers balanced policies which are well aligned with the principles of Open Innovation. We remark that the mere existence of policies does not imply that there is sufficient coherence and covering. Policies cannot be considered in isolation. The strength of the Open Innovation policy guidelines, as offered in this report, stems from the alignment and integration of several guidelines into a broader and coherent framework. In Flanders, labor policy is currently about employment, competition policy about antitrust rules, and IP policies about protecting innovators, etc. Secondly, Belgian's current political landscape is very complex with its communities, regions and its federal state structure. As a consequence, Open Innovation-related policies require coordination and integration of different policy areas probably even more than in other countries. The policy framework offered here prescribes that all measures should be intertwined into a coherent framework. Independent ministries will accordingly need to coordinate their activities. It is crucial to integrate the different policies based on a clear road map for innovation. As a result, implementing an overall Open Innovation policy in Flanders will require new ways to coordinate across institutional layers. In this way, the Belgium constitution seems to be a serious barrier to implement an innovation policy compatible with the policy guidelines presented here.

7. ESTONIA[8]

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7.1 Introduction

The Open Innovation paradigm can be interpreted as bringing enterprises and entrepreneurs at the, or back to, the centre of innovation and innovation policy-making. It can be also interpreted as reflecting a change from a more stable and closed logic of innovation towards a more dynamic and open context requiring greater flexibility and openness from entrepreneurs (Chesbrough, 2003). The strategic capacities of enterprises and their abilities to change corporate and innovation strategies are preconditions for successful Open Innovation. Without capable enterprises that can absorb Open Innovation policies the implementation of these policies would seem to be inherently programmed to face significant challenges. In this light, analyzing the Estonian enterprise sector may provide insight into the main innovation policy challenges, both specific to the enterprise sector and to the innovation system as a whole.

A recent research—viewed from the perspective of research, development and innovation—concludes the following with regard to innovation capacities of the Estonian enterprise sector (Gabrielsson, Kalvet & Halme, 2007: p. 19-27):

- Experts provide an assessment that there are some 50 (almost) world-class research-intensive companies in Estonia. According to data from the Archimedes Foundation (2007a), there are 43 Estonian companies that have successfully coordinated or partnered their projects within the Sixth European Union Framework Program for Research and Technological Development (FP6) for the period 2002-2006. Most of these companies belong to a wide range of sectors, namely: information and communications technology, electronics, biotechnology, energy, environment, nanotechnologies, and the chemical industry in general.
- The number of internationally competitive companies with limited research but strong development capacity is estimated to be between 150 and 200. This estimate comes from different experts and is grounded in empirical evidence. Statistics Estonia (2005) reports that there are 204 companies with R&D costs that have more than nine employees. The Community Innovation Survey (CIS4), on the other hand, reports that there are 39 companies with R&D costs of 5-10% of turnover and an additional 99 companies with R&D costs up to 5% of turnover that are co-operating with R&D institutions. From another perspective, the Archimedes Foundation (2007a) reported that there were 89 companies applying for FP6 funding but that were unsuccessful. These companies are mostly from the following sectors: information and communications technology, financial intermediation,

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electronics, chemical industry, manufacture of transport equipment, dairy industry, and manufacture of metals as well as non-metallic mineral products.

- It can be assumed that there are some 1,500 competitive (growing enterprises) with limited development and no research capacity. According to CIS4, there are 1 342 exporting innovative companies with more than 10 employees (2002-2004). In addition, there are companies that currently focus on the Estonian market, but about to break into the world market; thus, we have enlarged the group by some 150 companies. These innovative and exporting companies can be found in all economic sectors (for an overview of the innovation performance of various economic sectors in Estonia, see Viia, Terk, Lumiste, & Heinlo, 2007).

In sum the number of enterprises at the centre of Estonian innovation system is small (i.e. less than two thousand). Economic specialization is generally concentrated on the low-end parts of the scale-intensive and supplier-dominated industries (Tiits, 2007; Arengufond, 2008).

According to the CIS4 by Viia et al. (2007) 'similarly to the previous survey, one third (34.8%) of the innovating enterprises in 2002–2004 had cooperation agreements for joint innovative activities with other enterprises and institutions. This indicator is high, nearly twice as high as the EU average of 19% recorded in the CIS3' (p. 39). Clients and customers dominate as co-operation partners referring to active networking for active monitoring of (dynamic) markets. However, collaboration with other enterprises is low and is discouraged by possible threat of losing their positions (innovations mostly practiced are easy to imitate by competitors). In addition, companies tend to compete within the Estonian market that is rather small (Jürgenson, Kalvet & Kattel, 2005). Collaboration with public research institutions is generally considered as insignificant (Jürgenson et al., 2005; Viia et al., 2007: p. 40). Thus, innovation costs and risks are not actually shared between different innovation actors.

The creation of fundamental knowledge both in private and public sectors is also below EU averages as shown by low R&D expenditures and patenting (see table 5).

table 5 Estonia in the European Innovation Scoreboard

	Year						
	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Public R&D expenditures	0.53	0.46	0.46	0.46	0.49	0.52	0.50
relative to EU	83	71	71	70	74	81	77
Business R&D expenditures	0.17	0.14	0.24	0.22	0.27	0.34	0.42
relative to EU	14	12	20	18	23	29	36
EPO patent	8.4	10.6	10.5	7.8	15.5	--	--
relative to EU	7	8	8	6	12	--	--
USPTO patents	5.0	0.7	0.7	1.9	0.0	--	--
relative to EU	8	1	1	4	0	--	--

Source: European Innovation Scoreboard (2007) Database.

Looking at the legitimization of policies in Estonia since the 1990s, the country has generally been following a neo-liberal 'laissez-faire' market failure-based argumentation. The move to a market economy meant heavy reliance on market mechanisms, 'getting the state out of the economy', rapid and large-scale privatization, free trade, and liberal investments laws. Since Estonia joined the European Union, the state has gradually moved towards acquiring a more active role in economic

development (Tiits, Kattel, Kalvet & Tamm, 2008). Due to Estonia's recent transition, the following unique characteristics stemming from its socio-economic development context have to be considered:

- Firstly, in assessing the state of the art of different policies or policy measures it has to be taken into account that Estonia as a transition state has gone through rapid development of its basic institutions and specific policies. The development of different policies – whether general institutional development policies or specific ones – can be grouped into two general timeframes:
  a) From the restoration of its independence in the early 1990s to the mid-1990s, the main concentration of Estonian policies was related to basic institution-building and the development of the structures of the state (see, for example, Aslund, 2002; Randma-Liiv, 2005). In the context of transition, this has often implied lack of coordination and synergies between policy fields that the Open Innovation context would require;
  b) Since the mid-1990s, there has been more emphasis on 'fine-tuning' or seeking qualitative improvement of government policies and interventions. More emphasis had also been put on developing coordination capacities to achieve more effective horizontal policies (like innovation policy). Yet, this has been challenged by the general socio-economic developments, external shocks (e.g. Russian crisis), and political instabilities (Aslund, 2002; Randma-Liiv, 2005).
- In addition to nation-state policies, the pivotal influence on Estonian policy-making has been the accession process to the EU. The general conditions of accession, the EU's regular progress reports, pre-accession funding, among others, have all influenced the policy-making context of accession countries like Estonia (for innovation policy related argumentation, see Piech & Radoševic, 2006). On the one hand, this has created a context where most policies and strategic plans had to take into account conditions set by the EU. On the other hand, financing possibilities and conditions provided by the EU and its financing schemes have to be considered as well.
- This has resulted in 'wave-like' surges in the development of policy measures. Innovation policies have like many other measures (e.g. policies related to the labor market and basic knowledge) been developed in the context of the EU's Structural Funds – during the first period of financing (2004-2006) as well as the current period (2007-2013). On the one hand, this should offer opportunities to assess the impacts of different measures and develop coordinated policy changes at the end of one financing period and before the start of subsequent ones. On the other hand, as most innovation policy measures have been in operation for a short periods of time, even mid-term evaluations have been difficult or too premature to carry out (Polt, Koch, Pukl, Wolters & Truco, 2007; Technopolis, 2006). Thus, the current policy-making context may have lacked opportunities for policy analysis to develop more coordinated and 'fine-tuned' policy measures for the new financing period.

Our results presented hereafter are, to our knowledge, the first attempt to analyze the Open Innovation paradigm and relevant public policy context in a developing country. Thus, the indicative results may offer insights for future research in the fields of Open Innovation and innovation policy.

7.2 Overview of policy measures

Hereafter two tables are presented showing innovation policy tools for the periods 2004-2006 (table 6) and 2007-2013 (table 7).We remark that there are only a few impact assessments and evaluations of the 2004-2006 policies (especially from an Open Innovation point of view) while most 2007-2013 measures are still in their design phase. In all, the analysis and the subsequent indication of the extent in which current policies reflect the principles of Open Innovation are based on fragmented data collected from existing legislation, public sources, policy plans, interviews with experts, and also largely based on our prior experience and knowledge.

In our analysis of the policies and programs for the period 2007-2013, it has been our conscious attempt to refrain from normative assessments (based solely on our own interpretation of policies and measures that are not supported by information from other sources, experts, etc.). Thus, if there is not enough official information on the programs available, we have not offered any final assessment and have only provisionally indicated (with the '?' sign in the figures below) the potential relevance of the programs for the Open Innovation policy guidelines.

Both tables include the most relevant programs and projects the government has initiated. For example, for the sake of having a comprehensible overview and analysis we have not included basic legislation. Nevertheless, their general impact and relevance is taken into account when drawing conclusions. We hereafter discuss – drawing on interviews, other sources and our own desk-research – the extent to which specific policy areas are infused or in line with the principles of Open Innovation. Details of all presented policy measures are revealed in annex V.

table 6 Inventory of Open Innovation policies for Estonia in 2004-2006

Policy areas/ guidelines		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
		R&D Financing Program	Competence Centers Program	Estonian Patent Office	Enterprise Incubation Program	Estonian Centre for Standardization	Spinno Program	InnoAwareness	Innovation Audit Program	Enterprise Estonia – support organization for enterprises	Training Scheme	Mentoring/ Counseling Program	KredEx – credit and guarantee organization
RTD policy													
I	Financial incentives	x	x										
II	High-quality IP systems			x	x		x						
III	Support standards					x							
IV	User innovation												
Interaction policy													
V	Develop skills						x		x		x	x	
VI	Stimulate interaction	x	x		x		x			x			
VII	Enhance technology markets												
VIII	Use go-betweens		x		x					x			
IX	Back up clusters		x		x								
Entrepreneurship policy													
X	Support corporate entrepreneurship							x			x	x	
XI	Access to finance									x			x
XII	Back up challengers	x			x				x			x	
Science policy													
XIII	Appropriate funding												
XIV	Balanced incentives						x						
XV	Focus on excellence		x										
XVI	Organized diffusion		x				x						
Education policy													
XVII	General stimulation												
XVIII	Entrepreneurship education							x					
Labor market policy													
XIX	Aim for flexibility												
XX	Enable knowledge migration												
Competition policy													
XXI	Stimulate competition												

table 6 Inventory of Open Innovation policies for Estonia in 2004-2006 (continued)

Policy areas/ guidelines		#13	#14	#15	#16	#17	#18	#19	#20	#21	#22	
		Export Plan Program	Start-up Program for Enterprises	Centers of Excellence Development	Research Funding Schemes	Archimedes Foundation	Development Programs Vocational and higher education and R&D institutions infrastructure	INNOVE - Lifelong Learning	Program for educational system providing labor market flexibility, lifelong learning, access	Program for equal labor market opportunities	Estonian Competition Authority	Overall assessment *
RTD policy												
I	Financial incentives											+
II	High-quality IP systems											o
III	Support standards											-
IV	Support user innovation											-
Interaction policy												
V	Develop skills											o
VI	Stimulate interaction			x								+
VII	Enhance technology markets											-
VIII	Use go-betweens	x										o
IX	Back up clusters											o
Entrepreneurship policy												
X	Support corporate entrepreneurship											o
XI	Access to finance		x									+
XII	Back up challengers		x									+
Science policy												
XIII	Appropriate funding			x	x	x	x					o
XIV	Balanced incentives			x	x							o
XV	Focus on excellence			x	x	x						o
XVI	Organized diffusion											o
Education policy												
XVII	General stimulation							x	x			+
XVIII	Entrepreneurship education								x			o
Labor market policy												
XIX	Aim for flexibility									x		+
XX	Enable knowledge migration									x		o
Competition policy												
XXI	Stimulate competition										x	++

* -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

table 7 Inventory of Open Innovation policies for Estonia in 2007-2013*

Policy areas/ guidelines		##1 National Technology Programs	##2 Cluster Program	##3 R&D Financing Program	##4 Investments in New Technology	##5 Competence Centers Program	##6 Estonian Patent Office	##7 Enterprise Incubation Program	##8 Estonian Centre for Standardization	##9 Spinno+ Program	##10 Science and Technology Parks	##11 Cooperation with Universities	##12 Innovation and Entrepreneurship Awareness Program	##13 Enterprise Estonia – support organization for enterprises	##14 Innovation Vouchers	##15 Training Program (incl. training services)	##16 Information Gateway for Entrepreneurs	##17 Mentoring/Counseling Program
RTD policy																		
I	Financial incentives	?		x	x	x												
II	High-quality IP systems						x	?		?		?						
III	Support standards								x									
IV	User innovation																	
Interaction policy																		x
V	Develop skills									x		x				x		
VI	Stimulate interaction	?	?	x		x		x		x		x		x	?			
VII	Enhance technology markets																	
VIII	Use go-betweens					?		x						x			?	
IX	Back up clusters	?	?	?		?		?										x
Entrepreneurship policy																		
X	Support corporate entr.												x			?		x
XI	Access to finance													x				
XII	Back up challengers							x										
Science policy																		
XIII	Appropriate funding										x							
XIV	Balanced incentives									x								
XV	Focus on excellence					x												
XVI	Organized diffusion	?				x				x					?			
Education policy																		
XVII	General stimulation																	
XVIII	Entrepreneurship education												x					
Labor market policy																		
XIX	Aim for flexibility																	
XX	Enable knowledge migration																	
Competition policy																		
XXI	Stimulate competition																	

table 7 Inventory of Open Innovation policies for Estonia in 2007-2013 (continued)*

Policy areas/ guidelines		##18 Estonian Development Fund	##19 KredEx - credit and guarantee organization	##20 Export Support Schemes	##21 Services for Foreign Investors	##22 Foreign Representative Offices	##23 Mobility Program	##24 International Cooperation Networks	##25 Start-up Programs and Loan guarantees	##26 Centers of Excellence Development	##27 Research Funding Schemes	##28 Archimedes Foundation	##29 Infrastructure development program for R&D and higher education institutes	##30 INNOVE - Lifelong Learning	##31 Programs to develop R&D human resources	##32 Lifelong Learning Programs	##33 Estonian Competition Authority	Overall assessment **
RTD policy																		
I	Financial incentives																	++
II	High-quality IP systems																	o
III	Support standards																	-
IV	Support user innovation																	-
Interaction policy																		
V	Develop skills																	o
VI	Stimulate interaction					x	?	?							?	?		++
VII	Enhance technology markets																	-
VIII	Use go-betweens	x		?	?	x												o
IX	Back up clusters																	+
Entrepreneurship policy																		
X	Support corporate entr.	x																o
XI	Access to finance	x	x	x					x									+
XII	Back up challengers			x					x									+
Science policy																		
XIII	Appropriate funding										x	x	x					o
XIV	Balanced incentives									x	x							o
XV	Focus on excellence									x	x	x						o
XVI	Organized diffusion						?			x								+
Education policy																		
XVII	General stimulation											x		x	?	?		+
XVIII	Entrepreneurship education															?		o
Labor market policy																		
XIX	Aim for flexibility															x		+
XX	Enable knowledge migration															x		+
Competition policy																		
XXI	Stimulate competition																x	++

* As some policies are still designed, '?' indicates estimated relevance. ** -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

RTD policies

As a general remark, policy-making and implementation is arranged through *agencification* – i.e., the policies are implemented through independent agencies (e.g. Foundation Enterprise Estonia, Foundation Archimedes, Foundation Innove) while policy development is carried out by small ministerial departments. Since most of these policy measures are in the grant/subsidy form, the implementation of these measures is greatly dependent on the agencies' capacities of the agencies. Yet, studies on these agencies suggest that the operational problems are rather significant (e.g. Tavits & Annus, 2006). Prior evaluations of the Estonian RTD policies have indicated that the administrative capacities of ministries are not sufficient for developing cutting-edge innovation policy measures (Polt et al., 2007; Technopolis, 2006). A majority of the Estonian innovation policy measures, especially the ones directed towards private sector organizations, are largely financed through the EU's Structural Funds. These finances have substituted public sector investments (Masso & Ukrainski, 2008; Polt et al., 2007; Technopolis, 2006).

Earlier evaluations of the innovation policy measures (e.g. Technopolis, 2006) have also confirmed the conclusions of this research that the 2004-2006 measures were absorbed dominantly by public sector organizations and were used mainly for infrastructure and preparatory activities to increase the capacities of the organizations for further implementation of more sophisticated measures. Basically, in the design of the measures, a linear approach to innovation was utilized. This was reinforced by the failure to implement national technology programs that could have offered more specialization and holistic approaches to innovation policy (Masso & Ukrainski, 2008). The technology programs are also planned in the current 2007-2013 framework, but their relevant impact still cannot still be fully predicted.

The 2007-2013 measures seem to offer more possibilities (both in terms of more finances and more programs) for supporting to support private sector RTD activities (extending the subsidies for SMEs and their RTD activities, etc.) and the efficiency of the policies could be enhanced by the national technology programs, if they are implemented. Mainly due to the lack of administrative capacity and limited human capital, majority of the most policy measures are still developed.. One major problem area that the interviews with different policy makers revealed is the lack of coordination between different public sector organizations. The problem does not seem to be as severe concerning the cooperation between ministries, but between ministries and their subordinate agencies and between different agencies it is – the reasons being, for example, that different organizational cultures create fundamental obstacles for policy coordination. In essence, this complicates the possibilities of having more systemized and coordinated instruments like efficient cluster or technology programs. Yet, the Open Innovation context and also a more systemic approach to innovation would clearly require this because the scope of the policy areas relevant for innovation is to be widened.

I. Financial incentives

In general, knowledge creation by the Estonian private sector, when measured in terms of business R&D expenditures, is low compared with the EU average and most concentrated in the sectors of computer activities, chemical industry, financial intermediation, and manufacture of electrical and optical equipment (Statistics Estonia, 2008).

Estonian RTD policies belong mainly to the competencies of the Ministry of Economic Affairs and Communications (MEAC) and the Ministry of Education and Research (MER) that account for the vast majority of public expenditures to stimulate private enterprises' R&D (Technopolis, 2006). Since Estonian innovation policy measures do not include any taxation policy options, most support is provided through direct funding (e.g. grants/subsidies). The tables show that financial incentives are the locus of RTD policy measures, while other policy guidelines are not, if at all, followed. During the past years there has been a shift towards increasing the role of the MEAC in financing RTD policies – this implies that there is a potentially ongoing shift from more research-centered policies towards innovation related policy measures (Polt et al., 2007; Technopolis, 2006).

II. High-quality IP systems
In the context of this guideline, except for basic legislation and institutions for IP management (e.g. Estonian Patent Office), not many explicitly developed policy measures can be distinguished (Radauer et al., 2007). Policy measures like the Spinno Program and the Enterprise Incubation Program may have some impact on IP development, but these programs have multiple goals and IP management cannot be viewed as central in either of them. As has been elaborated in the theoretical part of this study and also in other case studies, IP management increasingly becomes a global policy issue. This implies that the role of small and developing states may rationally be limited to copying or adopting global/international policies.

III. Support standards
In terms of support standards, it has to be taken into account that the basic institutions (e.g., Estonian Centre for Standardization) and legislation are present. Estonia, however, lacks sufficient capacities to be an active and influential participant in the international standard development processes. Thus, the centre is mainly concerned on national standardization processes as well as on mediating the international standardization trends to the Estonian context. It can be argued that the size of the Estonian economy and market, as well as the global impact of Estonian enterprises, are relatively small for its economic actors to be aptly described as 'standard takers'.

IV. Support user innovation
There are no Estonian policies that can be identified as explicitly supporting user innovation in the sense of the policy assessment framework.

In sum, the Open Innovation framework to analyze policy measures implies the following guidelines: financial incentives, high quality IP systems, supporting standard setting processes, support user innovation. It can be said that the most developed policy measures in Estonia are limited to the provision of funds. The impact of the R&D grant scheme applied to Estonia (2004–2006) has been evaluated and the main conclusion was that while the projects supported were generally considered as successful in the development of technology, most of them failed to deliver economic returns. There are still instances in which collaborations between R&D institutions and enterprises influence the priorities for further research activity of R&D institutions; and because of this, more attention is paid to cooperation projects with enterprises. All in all, the total number of enterprises supported has been rather small compared to the total number of enterprises in Estonia (Jürgenson, 2007).

Interaction-oriented policies

Some of the experts interviewed indicated that limited collaboration and interaction between different parts of the innovation system is one of the main challenges that Estonian innovation policies would need to address (Masso & Ukrainski, 2008; Polt et al., 2007; Technopolis, 2006). This is especially relevant in the case of interaction between science and industry (Huisman, Santiago, Högselius, Lemaitre & Thorn, 2007). Yet, the current structure of Estonian enterprises (for instance, in terms of their position in international value chains) also makes interaction between companies rather challenging because a majority of the companies lack in-house R&D capacities and are also competing on a small local market, reducing their willingness to collaborate (Tiits, 2007; Kattel & Kalvet, 2006). Earlier evaluations have concluded that, in this context, public policies should focus on alleviating entry barriers faced by most enterprises in engaging in collaborative activities, and especially on enhancing the capacities of SMEs to engage in R&D – firstly, by supporting SMEs to employ researchers and R&D personnel to have capacities for internal and collaborative R&D; and, secondly, by measures such as vouchers for SMEs and human mobility programs (Polt et al., 2007). In the context of the guidelines V-IX (develop skills, stimulate interaction, enhance technology markets, use go-betweens, back-up clusters), it is clear that developing skills and especially stimulating interaction have been at the centre of policy measures for both the 2004-2006 and 2007-2013 periods.

V. Develop skills

The content of policy measures to develop skills has so far been less advanced compared to specific network management capabilities that the Open Innovation context emphasizes. Most Estonian companies first require training and counseling related to, among others, in-house strategic management, product and process development, and entering foreign markets, before it is possible to discuss internationalization and networking strategies (see Huisman et al., 2007; Kattel & Kalvet, 2006).

VI. Stimulate interaction

In defining policy measures to stimulate interaction, it can be said that this has mainly been part (during the 2004-2006 period) of larger policy measures that had multiple goals (e.g. Competence Centers Program, Spinno Program, R&D Financing Program). Softer long-term goals like stimulating interaction in general seem to be overwhelmed by more quantitative and measurable goals that can be explicitly presented in performance indicators and target measures. This is the reason why the general impact and scope of these policy measures cannot be easily presented. Failure to introduce national technology programs is another example of the inability to introduce wide scale measures to bring about closer interaction between more partners than merely companies and R&D institutions that are directly supported by the larger programs indicated above. The 2007-2013 period has a potential to provide a new context for developing general interaction. But this potential can only be harnessed in case the National Technology Programs (in strategically important high-tech fields) and Cluster Programs (in more traditional sectors) are implemented as planned, i.e. to explicitly target cooperation between enterprises and universities.

VII. Enhance technology markets

So far, there are no policies found to enhance technology markets. However, as has been indicated by the Open Innovation literature itself, technology markets as such are still in its emerging phase. Hence, this guideline seems potentially most relevant to

economies that are competing in the high-end of innovative and technology-intensive markets. The priorities and capacities of the Estonian economy are elsewhere – as also reflected in limited current patenting activity. The development of technology markets may be an issue that needs specific policy only after, and if, the restructuring of the economy has been achieved.

VIII. Use go-betweens
There is limited practice and public sector support for using go-betweens. This may be the result of the local business culture reflecting the general lack of trust and need to cooperate, and a low tradition of consultation between public and private actors and within the private sector itself. There are only few private sector consultancies that effectively act as go-betweens since its required concepts and relevance for the Open Innovation paradigm are not that widely known. Accordingly, public policy support for private sector intermediaries seems to be weaker compared to the support given to public sector organizations. The most promising institutions could be science parks, university technology and innovation (technology transfer) centers as potential actors providing intermediation facilities (Polt et al., 2007). Yet, these institutions carry out multiple roles that might supersede intermediation. Due to the above-mentioned agencification, it is unlikely that government agencies like Enterprise Estonia can at the moment take on this role because the main task of the agencies is to manage the finances of innovation policy programs. A potential intermediary or visionary organization to lead the way and link different parts of the innovation system could be the Estonian Development Fund.

IX. Back up clusters
The Majority of Estonian innovation policy measures have been general in nature. There has not been much prioritization or explicit definition of key economic areas that would need concentrated and preferential support. In addition, some of the programs (e.g. the Competence Centre Program and the Enterprise Incubation Program) implicitly represent policy goals that could support clustering, however in these cases the specific cluster development goals are always part of a broader set of policy goals. Thus, without explicit impact assessments it is difficult to assess whether the cluster support measures have had considerable importance and impact next to other, broader policy measures. One of the main changes in the 2007-2013 period is the increasing emphasis to enhance policies that can back-up clusters. There are expectations that such cluster development will motivate more (high-)technology-intensive enterprises to participate in policy programs. The explicit Cluster Program is intended to be oriented towards traditional sectors, while the National Technology Programs seem to be rather broad in scope.

Entrepreneurship policies
There have been several relevant policy measures developed during both periods (2004-2006 and 2007-2013), including the InnoAwareness Program, Counseling/mentoring services, Innovation Audit Program, Incubator Services, and Training Scheme. In addition, the period 2007-2013 is intended to further develop some of these programs and to introduce perspectives of more internationalization and export-oriented entrepreneurship, i.e. programs that aimed to increase the role of entrepreneurship as a core value in society and to develop entrepreneurial capacities of companies, mainly SMEs.

X. Support corporate entrepreneurship
Corporate venturing, spinning off, spinning out, and using patents are innovation activities which are generally more common to large enterprises. In Estonia, the frequency of such activities is very low. Due to the dominant position of foreign direct investments (FDIs) in the Estonian economy many of these enterprises are foreign-owned, working based on global production network models. Thus, the practice of corporate entrepreneurship, as defined in our framework for policy assessment, is rather exceptional.

As for the guideline to support corporate entrepreneurship, it seems that for both the periods 2004-2006 and 2007-2013 measures are concentrated on developing entrepreneurship based on the current advantages and potential of companies (i.e. to firstly achieve the necessary upgrading to decrease entry barriers to R&D collaboration and higher exporting capacity). Accordingly, there is not much emphasis put on policy objectives such as corporate venturing and intrapreneurship. Since one of the deficiencies of Estonian enterprises has been low capacity and willingness to develop long-term strategic plans – especially strategies relevant to upgrade and benefit from knowledge (see Tiits, 2007) – it may be a reasonable policy option to first concentrate on increasing the strategic capacities of companies through Counseling/Mentoring Services, Innovation Audit Services, etc.

XI. Access to finance
The guideline to secure better access to finance emphasizes the need to develop and broaden the scope of – as well as the need to increase the awareness of and access to – external financing possibilities. In the case of Estonia, private venture capital systems are not functioning on a scale comparable to more innovative and advanced economies (Lange, De Bruin, Kleyn, Favalli, Muñoz & Di Anselmo, 2004). Policy emphasis has been on more public sector-led support activities, e.g. R&D Financing Program (discussed also under RTD policy area) and Start-up Program for Enterprises. The 2007-2013 policy perspective continues and broadens the scope of relevant policy measures – the Estonian Development Fund, extended start-up program (including the start-up loan guarantee) as well as other programs aimed at increasing the export capacity of Estonian enterprises (export plan, export marketing measures, etc.). In general, the context to support access to external finance may be too much public sector dominated (or one-sided) to complement the ideas of the Open Innovation paradigm in terms of having flexible enterprises with flexible financial and managerial strategies that can help to increase enterprises' absorption capacity of new innovative ideas and technologies.

XII. Back-up challengers
Closely related to the former guideline are policies to back up challenging enterprises, i.e. supporting innovative high-tech start-ups and SMEs. Relevant Estonian policy measures (e.g. the Start-up Program and Export-Support Schemes) are clearly directed towards supporting the emergence, development, growth and upgrading of start-ups and SMEs. Yet, the measures have so far been rather universal – that is to say, as opposed to technology-intensity and innovativeness of the companies their general export, sustainability and growth potential have been the main emphasis of the policy measures. Thus, these measures have a more direct impact on restructuring the economy and developing competitiveness and entrepreneurship, before the transformation from closed to open innovation can be discussed as a relevant context. It may be possible that the planned National Technology Programs can, in the long term, lead to more concentrated policy measures. Moreover, the measures for the period

2007-2013 seem to have more attention placed on internationalization activities that may in the long-run stimulate international competitiveness of Estonian enterprises.

Science policies

The Open Innovation context emphasizes the need for ample fundamental knowledge to be available at and accessible to the environment where enterprises act, network, and collaborate. To this end, our proposed framework gives four policy guidelines, including appropriate funding, balanced incentives, focus on excellence, and organizing diffusion. We remark that a core trend in the Open Innovation context (and policy framework) is the move away from private sector funded R&D towards more public provision of basic science. But in the context of the CEE countries, due to Soviet legacies, the R&D system is already based on strong, even dominant public provision of science and education by public universities and R&D institutions (Huisman et al., 2007). Thus, the main challenge is not to simply transform the institutional set-up and division of roles in the system, but to tackle one of the main innovation obstacles, i.e. to achieve more coherent development of scientific activities according to societal and economic needs and increasing the absorptive capacity of the industry for making better use of their results (Masso & Ukrainski, 2008; Huisman et al., 2007).

In this light, the proposed guidelines in the policy assessment framework have to be assessed in a different perspective. The guidelines are still relevant, but need to be interpreted in a different vein with much more emphasis on achieving better complementarities between different sectors. On the one hand, this can be achieved through sufficient public sector finance and support for providing basic knowledge (e.g. by financing public R&D institutions, funding R&D activities of private sector institutions). On the other hand, small transitions states like Estonia may have too limited resources and capabilities for catching-up and thereafter competing with more developed R&D and innovation environments (Polt et al., 2007). This might imply that small transition states would need thorough international R&D policies developed for importing up-to-date knowledge from abroad and employing it in a sustainable manner for national or local economic development. This is a strategy partly pursued by private companies that lack internal R&D capacities, but the current low absorption capacity of majority of the companies (as well as the society as a whole) diminishes the sustainability of prioritizing this approach as opposed to building general scientific capacities (Polt et al., 2007). At the same time, there are also threats that too much dependence on international contexts (e.g. through dependence on EU's Framework Programs for financing) and criteria of excellence, among others, may inhibit the progress towards better compatibility between science and the needs of the society.

XIII. Appropriate funding

Empirical data shows that the Estonian research system is not strong in international comparisons. In 2006, total spending on R&D was 1.1% of GDP while the EU-15 average was 1.9%, and EU-27 was 1.8% (Eurostat, 2008). Although R&D spending has increased considerably over the last years, such an increase is largely attributable to inflows of Structural Funds to Estonia.

In the current context of Estonian science and education policy, there is a need for coordinated science policies in a broad sense, e.g. to target the right problems in terms of infrastructure development (much of the current public policy support financed through EU's Structural Funds is directed towards this), to define and select fields of excellence (for developing sustainable Competence Centers, Centers of Excellence), and

to provide appropriate support to develop human capital (through financing PhDs, repatriation, mobility schemes, etc.). Currently, one of the main criticisms on Estonian science policies is that they usually involve project-based implementation schemes. Financing is provided through target financing, base financing, national R&D programs, R&D grants, and grants for infrastructural expenses. This induces fragmented research activities, increases administrative burdens for academic community, and also reduces the emphasis put on the diffusion of scientific results (Masso & Ukrainski, 2008, Huisman et al., 2007).

It is expected that better policy coordination can be achieved with the National Technology Programs (that are coordinated by the agency under the MER) and more coordinated and targeted measures in the competence of the MER (as the 2004-2006 policy period was based largely on open application principles and not on explicitly developed policy measures as planned for the period 2007-2013).

XIV. Balanced incentives
One of the ideas of Open Innovation is to stress the importance of valorization of science. In Estonia, the government policy-making capacities in this field are limited because the Estonian university sector is rather autonomous and the internal governance is largely in the hands of the institutions themselves (Huisman et al., 2007). In this context, the government is so far unable to introduce wide-scale policy measures to restructure the incentive system of academia that is primarily focused on scientific excellence at this time. Instead, the government has better opportunities to balance the incentives through wider policy measures and programs that could, as a subsidiary goal, provide more balance between scientific excellence and application (e.g., Spinno Programs, Centers of Excellence Programs). Yet, in this context the incentive question is only a part of a larger set of policy goals and whether these programs have wider effect on achieving more balanced actions by individual scientists depends on their interplay with general funding and other policy measures and how the autonomous institutions implement them.

XV. Focus on excellence
The main policy measures for achieving excellence in science are (a) Competence Centers Programs, (b) Centers of Excellence Programs, (c) general research funding schemes (projects are selected through project-based competition approaches based on pre-set standards and criteria), and (d) the support (in the form of consultations) provided by the Archimedes Foundation in triggering international cooperation (e.g. participation in the EU Framework Programs). The former two measures are rather specific as the topics and funding is provided to the areas representing potential for university-industry collaboration and valorization. The latter two mechanisms are rather general and offer basic support for further investments towards achieving excellence.

XVI. Organizing diffusion
The most explicit programs to organize diffusion are Competence Centers Programs and the Spinno Program. Both are designed to enhance better diffusion of scientific results. Yet, these programs and the experience with them have so far been extremely short and they represent only a prelude of many steps the Estonian science policies need to go through before one of the main challenges of the Estonian science structure - overly academic focus - can be resolved and the real potential for collaboration and valorization can be realized (for an assessment of the Spinno Program, see SQW (2007); the mid-term evaluation of the Competence Centers Program is still in progress).

In sum, it seems that science policies, and also linked educational policies, are developed in a fundamentally different context compared to the Open Innovation paradigm and understanding. Assessing these policy areas without due attention to the contextual differences may obscure the understanding of the context in which Estonian policy-makers and enterprises operate and how they could bring about a change towards the contemporary understanding of innovation. Thus, it can be said that even if the 2004-2006 policy measures and more explicitly developed 2007-2013 policies (with very explicit internationalization, interdisciplinary, and diffusion-related goals) seem to be somehow in line with our framework's guidelines, the argumentation behind the need for these policies stems from a rather different line of reasoning.

Education policies

The Open Innovation concept assumes some significant in-house absorptive capacity to enable external technology and knowledge purchase strategies. Yet, this automatically creates several conditions that have to be satisfied before this strategy becomes successful and sustainable. The framework explicitly brings out two areas of importance: enhancing educational capacities at all levels, and teaching entrepreneurship.

XVII. General stimulation

The Open Innovation paradigm implies that there have to be strong and relevant R&D capacities available in society so that enterprises have people capable of operating in this environment. This requires a good level of education (higher education, including business skills, engineering capacities, language skills, management skills) that is in turn dependent on competitive and high-quality science. Socially and economically compatible and state-of-the-art science is dependent on interactions, networking with industry through suitable mixes of basic and applied research (e.g. mix of public grants and private contracts for scientific research).

Most of the evaluations analyzing Estonian educational policies in the context of innovation bring out one or all of the above-mentioned aspects as challenges to Estonia as a transition state, which need to be overcome before policy learning and introduction of cutting edge policy measures can happen (Huisman et al., 2007; Kattel & Kalvet, 2006). In general, the interplay of these issues and policy areas creates a suitable and internationally competitive human capital and the best of this pool of human capital has the capacity for international networking, collaboration and thus creating skills for reading/understanding markets and technologies. Thus, the human capital necessary for Open Innovation has to be consciously developed through education and innovation policy measures before viable Open Innovation thinking can emerge and be of relevance. Looking at the current Estonian policy measures, most of the educational policy measures seem to be too generic in nature to be explicitly related to this policy guideline. As such only the government agencies – Archimedes Foundation and Foundation INNOVE – may present some capacities to place explicit emphasis on the challenges through their everyday activities. These government agencies have some capacities (grants, scholarships, participation in international networks and trans-European programs, initiating domestic programs for developing awareness, skills and competencies relevant for innovation, etc.) for fostering both domestic and international educational cooperation and development. But, as has been noted above, the administrative capacity of these agencies is too limited for this kind of policy-making and leadership and these organizations are mostly concentrating its resources and capacities on managing finances from the EU's Structural Funds.

XVIII. Entrepreneurship education
Most of the interviewees emphasized that one of the key challenges that influences Estonian economic environment and innovation policy capacities is severe lack of qualified human capital (both within the public and educational sectors and in the enterprises). That would enable more successful operations in the international environment. It is not a matter that can be fully solved by lifelong learning and training schemes (for a critique of the current capacities of the Estonian lifelong learning system, see to Huisman et al., 2007). Experts rather view it as a challenge for general education (e.g. there is a need to have entrepreneurship as an integral value of the educational system, and it is currently perceived insufficient). The interaction between industry and education (e.g. internships, joint curriculum development) is perceived to be more developed at the vocational level and in non-academic higher education institutions when compared to universities (Huisman et al., 2007; Leetmaa, 2006). Yet, the former institutions are less valued and are perceived to provide lower quality education compared to universities, both by society and enterprises. This has created an over-sized university sector with not enough students in the fields of natural and technical science, and severely under-sized vocational education supplies (Huisman et al., 2007). Thus, there seems to be a contradiction or lack of suitable policy instruments for developing entrepreneurship through education.

This may also be one of the reasons why our analysis has indicated that one of the basic necessities in relation to entrepreneurship policies is the advancement of very basic entrepreneurship capacities themselves, before more sophisticated aspects can be fully tackled. In addition, it was brought out that there should be more emphasis on entrepreneurship education in the higher education system; and that the current low quality business and management courses/programs, low level of language skills, international marketing knowledge, etc. are the core problems of the educational system that decrease the innovation capacities of Estonia. The provisional 2007-2013 programs seem to tackle these major challenges, e.g. it involves internationalization aspects and increased mobility of studies. Yet, in their context and content they seem to be policy measures that our policy assessment framework presumes to be existent for investing into 'next generation' measures based on different arguments.

Labor market policies
We have identified two policy guidelines that are especially relevant for the Open Innovation paradigm: aim for flexibility (XIX) and enable knowledge migration (XX). In the context of Estonian policy-making, the issues of labor contracts and the pros and cons of international migration of workers are in general important policy issues that are publicly discussed. Thus, the topics or guidelines on labor market policies are relevant and under constant review.

XIX. Aim for flexibility
As emphasized in the theoretical framework, one of the main ingredients of the Open Innovation paradigm is the high level of education and mobility of the labor force that induces knowledge spillovers and increases the absorptive capacity of organizations. Yet, labor market issues are traditionally regarded more as an issue of social policy than a purely economic one. This requires a parallel concentration of both social policy concerns (social security of employees) and economic policy (competitiveness of the labor force).

In the European context, the concept of 'flexicurity' has potential to offer a suitable framework for the institutional conditions needed to increase flexible interaction, networking and collaboration in the innovation context. Yet, the concept of flexicurity requires complementary emphasis on both the flexibility of the labor market (e.g. flexible labor contracts) and providing necessary security and support mechanisms (e.g. sufficient unemployment benefits). In addition, the concept also requires coordinated and complementary training and educational policies (mainly lifelong learning and skills training). Thus, complementary attention needs to be paid to (a) legal aspects of labor law, (b) active labor market policies, (c) reliable lifelong learning systems, and (d) modern and sustainable social security systems (Leetmaa, 2006).

There are two contradictory aspects of current labor market policies in Estonia. On the one hand, the formalistic labor market regulations (mainly labor contracts) seem to be rather strict in comparison to the ideas of the flexicurity approach. On the other hand, the 'de facto' mobility of employees among the highest in Europe, implying that current legal mechanisms are not implemented according to their original intent. Thus, it seems that there is more flexibility than can be presumed based on the formalistic, legalistic system. Yet, in current discussions concerning new labor contracts that would make its flexibility even more advanced, there is not much emphasis put on the social security side. The process is hampered by relatively weak social partners (especially unions) with narrow interests that create obstacles for wide scale social dialogues on the desirability and feasibility of the comprehensive flexicurity approach. Thus, the current labor policies have been developed in a rather etaist manner with more emphasis on economic interests rather than social concerns. Without complementary policies this could have detrimental results on labor market conditions. In addition, there is also a need to pay more attention to the active labor market policies and measures (Leetmaa, 2006; 2007).

XX. Enable knowledge migration

On the issue of specific policy measures to stimulate labor mobility (national), the most comprehensive scheme, according to the interviewed experts, seems to be the information mediation provided by labor market agencies in case of wide scale layoffs to better match the new unemployed with enterprises seeking for qualified staff. In other cases, most of the active labor market measures are rather person-based with less attention paid to increase the inclusion and cooperation between the government, employers, and employee (Leetmaa, 2007). There are no explicit links to the innovation policy context.

According to the study on the mobility of academics in Estonia, the main factor that supports the mobility of foreign academics to Estonia is the potential for fast career paths in the Estonian academic sector (Archimedes, 2007b). Yet, the smallness of Estonia sets quantitative limits on the sustainability of this potential. International inward mobility of academics and top researchers could be further motivated by providing opportunities of complementary careers both in academia and industries. This would also be in line with general policies that foster networking and collaboration between different organizations and institutions. The 2007-2013 measures seem to be the first preliminary steps towards the implementation of such policies.

In the context of general international migration, Estonia has just recently (in 2008) introduced policy changes through amendments to the Foreigners Law (concerning immigration from the third countries). It sets strict limits on the number of immigrant employees that can enter the country every year (0.1% of the population) and requires

monthly salaries of at least 1.24 times the average Estonian pay. As this requirement applies to both long-term and temporary employees it may have negative consequences, i.e. it limits the possibilities of practicing rather flexible labor management in fields where market conditions are unpredictable, and also in the emerging fields of economic activities that are characterized by high risk, unpredictability, but potentially high profits and growth. On the positive side however, the changes have reduced the red-tape of the application procedures for the immigrant employees. Gabrielsson et al. (2007) have also suggested introduction of more pro-active schemes which are currently being developed.

In terms of policy-making capacities, it is evident that the division of labor between different public institutions has separated two relevant labor market policy issues: the task of prevention (under the authority of the MER and the MEAC) and the task of solving the problems that have already arisen (under the authority of the Ministry of Social Affairs). Yet, the issue of coordination capacity between the authorities of the two tasks has not been thoroughly dealt with, at least not in the context relevant for innovation. In addition, there is a clear lack of impact and outcome assessments of the labor market policy mechanism (Leetmaa, 2007). Thus, there are no empirical grounds for making thorough conclusions on the effectiveness of these measures.

Most of the direct labor market mechanisms are currently, at least partly, financed by the EU's Structural Funds. Reliance on EU funding may raise questions over future sustainability of these measures. The 2004-2006 funding period lacked priority setting by the central government and most funding was distributed drawing on open applications. There were also no limits to the labor market issues that needed to be addressed. The 2007-2013 funding period seems to have a clearer model/system to approach labor market challenges (through central programs managed by governmental implementing/funding agencies), yet the new schemes seem to complement existing structures and programs, not providing any fundamental shifts.

Competition policies

Estonia is rather known for its transparent and universal economic policies. There is a conscious attempt not to complicate the tax system and government intervention policies through tax exemptions and special regulations. Rather, the guiding principle is to provide equal opportunities to all enterprises for independently succeeding on the market and also equally benefiting from government interventions. This also means that there is a tendency towards rather general government subsidies and programs that the majority of enterprises can apply for (e.g. so far, there has been rather weak priority setting in terms of economic sectors that should receive special attention and support, including state intervention).

XXI. Stimulate competition

With the opening of the EU's Structural Funds, the role of the government the financier of some of the innovation policy measures has been put even more at arm's length. Some of the interviewees emphasized that Estonia seems to have adopted a rather unique policy of supporting innovation policy measures dominantly through EU funding. If this is the case, this means that the rules and priorities are not developed solely based on local needs, but by taking into account the general EU Structural Funds' financing schemes and priorities interpreted, if not prescribed, by the EU. This puts competition policies in a different light as the dependence of possible policy initiatives on the EU funding and financing rules limits the possible pool of policy measures that can be

employed. Yet, there is a lack of comprehensive research that analyses the impact of the EU on the funding and development of innovation policies in the new member states.

To our understanding, there are relatively minor problems concerning monopolies, cartels and other issues of competition distortion in Estonia that our policy assessment framework advocates to be removed and that the Estonian Competition Board is not addressing. We do remark however that there is still perceived lack of sufficient competition in several sectors due to their small sizes.

7.3 Conclusions

Estonian innovation policies need to be clearly analyzed against the backdrop of EU structural funding, as this provides a context and time frame that is most influential in Estonia's current policy-making (a feature that is shared with other CEE countries). The 2007-2013 policy period has a potential to offer a more systemized and comprehensive approach to innovation policy in Estonia. Its realization, however, is largely dependent on a few key policy measures - mainly, National Technology Programs and the Cluster Program. These policies require much more advanced policy-making and coordination capacities than the current innovation system may offer. Thus, this clearly raises issues of governance of innovation policies and general policy coordination as the fundamental aspects of more systemized and comprehensive innovation policy paradigms that cross the borders of traditional policy measures under the competence of single ministries.

Based on the analysis, it can be concluded that Estonian innovation policy measures have been developed in a way that comparatively puts more emphasis on the implementation of the following Open Innovation policy guidelines:

a) The provision of financial incentives (in grants/subsidy form) is a main RTD policy aspect. Over the years both the qualitative and quantitative content of these measures has increased.
b) In interaction-based policies, most emphasis has been on building basic interaction skills. Within the 2007-2013 policy framework, there seems to be a move towards widening these measures to also include cluster development.
c) Entrepreneurship policies are mainly developed with the intent of providing financial incentives. As these incentives are often linked to SMEs and start-ups, they also offer opportunities to back up challengers.

Science policies present a unique case because they are developed in a fundamentally different context compared to what open innovation presumes. Thus, it is rather challenging, from the Open Innovation point of view, to distinguish between the most developed and less developed policies implemented. It can be said that the focus on excellence and appropriate funding schemes seem to be the most tackled challenges in making policy measures since the problems in these areas are also linked to challenges in other policy fields.

The Open Innovation approach stresses the importance of networking, collaboration and interaction between innovation actors, and achievement of this is considered crucial for Estonia as well. As can be seen from the Estonian policy measures presented here, facilitation of interaction is central in many policies. In reality however the policy mix is rather chaotic and does not entail truly cooperative efforts. Such cooperation arrangements should be on a more systematic basis and should be given a more

influential role in setting corresponding policies (e.g. joint curricula development by private companies and education institutions).

In addition, it is possible to highlight several Open Innovation policy guidelines that are not as consciously developed in the current policy mix:

a) As for RTD policies, the policy guidelines of standard-setting and user innovation are not present.
b) In the area of interaction policies, the same applies for policies to enhance technology markets.
c) In the field of science policy, the institutional autonomy of academic institutions seems to limit public policy capacities to create incentives for scientists and to stimulate valorization of knowledge.
d) The policy areas of education and labor markets seem to represent areas that are not well developed in the sense of providing customized support for innovation policies, e.g. current policy instruments are more generic and tackle socio-economic challenges in a more universal manner, and therefore, it is rather challenging to explicitly link any of the existing measures to specific Open Innovation guidelines and assess whether there is sufficient, or lack, of support from public policies.

We do remark however that in the Estonian context, not all Open Innovation policy guidelines can be considered equally important. For standard-setting, user innovation and enhancing technology markets, one may argue that these guidelines are still incompatible with the current economic structure of Estonia. Considering that the open paradigm originated in developed countries and is illustrated mainly with case studies of high-technology knowledge-based enterprises, it raises a legitimate question regarding the impact of full application of Open Innovation policy guidelines to less developed or developing countries. In the Estonian context, and probably also in other transition states, it makes sense to emphasize relatively simple, 'basic' policy guidelines such as developing basic innovation and interaction skills of enterprises, initiate go-betweens, direct stimulation of interaction between innovation actors, and broad support for entrepreneurship. This would enable the Estonian innovation system to catch up. A fundamental problem of Estonian policies has so far been a strong desire to imitate the policy mixes of advanced industrial economies. As a consequence, the bulk of local industry which does not qualify as high-tech or R&D-intensive enterprises tends to be overlooked (see Radoševic & Reid, 2006). In this context, several interviewees for the Estonian case study argued that Open Innovation approaches (and especially lessons for company management) are fully applicable to only a limited number of companies in Estonia. These companies are already making heavy use of external knowledge and have entered into global knowledge production and dissemination networks. Should policies be aligned based on Open Innovation only, this would enable to achieve better results for these and other successful companies, but as a consequence, many other enterprises would not be helped. As many of the interviewees argued, the main focus of innovation policy should be on building absorptive capacities of existing enterprises.

Open Innovation can be considered an answer to the criticism of the closed innovation model. Yet, while the open model redesigns some aspects of the closed innovation model and add new elements, some parts of the old model are maintained as foundations of innovation (e.g. R&D behavior, science and valorization). Especially in the case of transition states, this means that there needs to be a thorough analysis whether the basic foundations of the old model are present and whether these are mature

enough to be reformed in line with Open Innovation thinking. Intellectual property rights may be an example of a policy area where there needs to be much more basic or fundamental capacity building before Open Innovation thinking can be fully adopted. Thus, it may be concluded that in their present form, the theoretical guidelines are more applicable, or at least easier to implement, in industrialized countries with well-developed innovation systems.

Nevertheless, Open Innovation theory may provide a basis for developing more suitable policy tools also for less innovative, low-tech enterprises. The challenges of networking and collaboration and the context of the support environment are main innovation policy challenges that are defined by most recent evaluations of Estonian innovation policy (see, for example, Masso & Ukrainski, 2008; Polt et al., 2007; Technopolis, 2006). Therefore, the Estonian innovation system context calls for the attention both on helping the most successful to succeed even better, and on helping lagging and/or less-developed enterprises and sectors to catch up. There is a pressing need to help the next generation of innovative companies to grow-up and to create sustainable economic environments. The need for this dual approach is also reflected in the *Estonian Research and Development and Innovation Strategy 2007-2013 'Knowledge-based Estonia'* and may be interpreted – based on the analysis of the *Operational Plans* for the implementation of the Structural Funds and based on the interviews with national experts – as one of the main goals of the innovation policy measures of the current Structural Funds implementation period.

Another issue is that the proposed Open Innovation guidelines do not fully reflect some of the highly relevant subjects in current policy discussions in Estonia, including globalization and sector-specific policy interventions. As for globalization, considering the high significance of multi-national corporations in many developing and less developed countries, it remains a challenge to achieve a situation where Open Innovation policies implemented in one country will have economic impact in the same country. In today's global world it might be the case that the best ideas, people and technologies are picked up by large multinational enterprises while economic benefits will be realized abroad, leaving the host country as 'brain drainer' (for a case study, see Kattel & Anton, 2004). Another problem characteristic of many developing and less developed countries is that their economic structure could be oriented towards low value-adding subcontracting activities, where the intensity of skills is rather limited, like in Estonia. As economic activities are qualitatively different this has historically resulted in different development paths (see Reinert, 2007). The challenge for policymakers has always been on how to change the whole set-up of the current industrial structure, including the prioritization of the development of some economic sectors that are 'paradigm carriers' (see Perez, 2002). The national innovation systems approach has been criticized based on this line of argumentation and such criticism can also be extended to the Open Innovation guidelines. Prioritization or preferential policies in favor of specific sectors is not generally recommended (maybe with the exception of backing up clusters), but it seems to be very much needed in countries where economic restructuring is needed. Open Innovation may thus inspire valuable new policy elements, but policy makers may also have good reasons to refrain from following all guidelines and rather choose alternative pathways.

A final important element is related to governance – the administrative/managerial challenges of planning and implementing suitable Open Innovation policy measures. Again, developed and developing countries are profoundly different. According to the

interviewed experts, the newness of the Open Innovation framework could come from systemized integration of policy areas such as education, labor market and competition into the innovation policy framework. This could also mean that there is some need for public policies to link these areas with enterprises' strategies and activities related to networking and collaboration to realize more embedded interaction and common thinking between policymakers and entrepreneurs. Thus, there is a need for better integration and coordination between framework policies and behavior-related aspects of innovation (for, among others, better comprehension of the usefulness of workers mobility). Yet, the current context of Estonian policy-making has lacked the tradition of close inter-ministerial coordination and cooperation in policy-making. The new approach would require better coordination between different ministries and other governmental organizations (e.g., between the Ministries of Economic Affairs and Communications, Education and Research, and Social Affairs). The fact that most Estonian innovation policy measures are financed from the EU's Structural Funds has increased the number of institutions with direct influence on developing these policy measures and also implementing the programs. For example, the State Chancellery of Estonia has introduced programs to increase the strategic management capacities of public sector partners that are also relevant for building the general environment or framework for innovation policy development.

Also, as the Structural Funds are implemented by agencies operating at arm's length from the central government (e.g. the main agencies are Enterprise Estonia, Innove, Archimedes, Estonian Labor Market Board), the challenges of communication, control and coordination are further increased. Most of the experts from the relevant ministries and agencies confirmed the problem that in many cases there are coordination problems between ministries and their subordinate agencies and more commonly there is a lack of coordination and communication between different agencies. This is an extremely important challenge as this situation creates threats of duplication of different initiatives and lack of complementarities between different programs implemented at certain points in time. Further, the 2007-2013 financing period differs from the previous 2004-2006 period as there are plans to introduce more horizontal programs in the key areas identified by the *Estonian Research and Development and Innovation Strategy 2007-2013*. These programs are intended to coordinate different programs and projects to have a more complementary system of policy measures. Yet, it seems that there has been more coordination and cooperation during the development of general guidelines for the use of the Structural Funds and the development of specific policy measures has been done in a more closed system.

In sum, the preceding analysis is valuable because it provides some new insights, although context-specificity is important. The awareness-raising argument of Open Innovation may be considered highly positive. While innovation policies seem to stem from the national innovation systems approach that puts 'functioning of the system' in the locus of analysis (and, sometimes, at the expense of forgetting the role of companies), Open Innovation correctly emphasizes that economic benefits largely follow from the enterprise sector.

8. DISCUSSION

Open Innovation enables knowledge and ideas to find greater use, in a wider variety of business models and network configurations, than was previously possible. Overall, this can be a source for further value creation in society. In the current project we developed a framework to identify and assess guidelines for policies to support Open Innovation. We applied the framework to three Era-Net countries, i.e. The Netherlands, Flanders (Belgium) and Estonia, to assess which guidelines are reflected in current policy mixes, and to identify which ones are lacking and may be further developed. This chapter starts with a comparison of the three cases (section 8.1). Next, we discuss our main conclusions and elaborate on the implications for policy makers (section 8.2). We end the chapter with a discussion of limitations and suggestions for future research (section 8.3).

8.1 Benchmark

In table 8 we again presented the results of the case studies. From that, in the right-hand column we inferred an overall conclusion on the presence of policies for Open Innovation. We stress that the table reflects the incidence of policies for each of the Open Innovation guidelines, but does not evaluate their effectiveness. Rather, table 8 suggests which policy guidelines are currently present, and which ones are missing.

As the analysis only covers three countries strong inferences are obviously impossible, but nevertheless some interesting results are found. The findings in table 8 confirm our presupposition that current policy mixes already reflect many of the guidelines that can be derived from Open Innovation theory (at least, as far the three countries are concerned). This applies most to policies offering financial incentives for private R&D, to stimulate interaction between actors in the innovation system, to better secure innovating enterprises' access to finance, and to generally stimulate competition and the functioning of markets (guidelines I, VI, XI and XXI). Financial incentives to stimulate private enterprises' R&D are offered in each of the studied countries and in multiple forms. Policies aiming for more interaction and collaboration among innovation actors are also quite popular and seen in many varieties. This strength is probably a consequence of policy makers' increased attention for network failures as a rationale for policymaking. Moreover, policy makers in the three countries seem well aware that challenging enterprises, especially high-tech SMEs, should be supported in order to bring disruption and to increase knowledge spillovers. Next, we also found multiple measures to secure enterprises' access to finance in all three countries. Finally, competition is a topic that seems to be prioritized everywhere, given the presence of rather strong competition authorities and support measures in all three cases. The Netherlands and Flanders (Belgium) have become much more active in this field ever since the European unification in 1992. For Estonia, after its independence it has fully embraced the market mechanism by developing generic institutions enabling level playing fields for all enterprises in order to obtain a competitive business environment.

table 8 Presence of Open Innovation policies in three countries*

Policy areas/ guidelines		*The Netherlands*	*Flanders (Belgium)*	*Estonia*	*Overall Conclusion*
RTD policy					
I	Financial incentives	++	++	+/++	++
II	High-quality IP systems	+	o	o	o
III	Support standards	o	-	-	-
IV	User innovation	-	-	-	-
Interaction policy					
V	Develop skills	o	+	o	o
VI	Stimulate interaction	++	++	+/++	++
VII	Enhance technology markets	-	o	-	-
VIII	Use go-betweens	+	+	o	+
IX	Back up clusters	++	++	o/+	+/++
Entrepreneurship policy					
X	Support corporate entrepreneurship	-	-	o	-
XI	Access to finance	++	++	+	++
XII	Back up challengers	++	+	+	+
Science policy					
XIII	Appropriate funding	+	+	o	+
XIV	Balanced incentives	-	o/-	o	o/-
XV	Focus on excellence	+	+	o	+
XVI	Organized diffusion	++	++	o/+	+/++
Education policy					
XVII	General stimulation	+	+	+	+
XVIII	Entrepreneurship education	+	o	o	o
Labor market policy					
XIX	Aim for flexibility	+	o	+	+
XX	Enable knowledge migration	+	-	o/+	o
Competition policy					
XXI	Stimulate competition	++	+	++	++

* -: not/barely present, o: slightly present, +: reasonably present, ++: well present.

Other guidelines which are frequently encountered in the current policy mixes of the three countries include backing up clusters and supporting the diffusion of scientific/fundamental knowledge (IX and XVI). Here, both the Netherlands and Flanders offer very substantial policies to private enterprises. In Estonia, policy attention has so far been limited, but in the forthcoming 2007-2013 policy period the efforts in these areas seem to be seriously increased.

Another finding is that the current policy mixes seem somewhat unbalanced if Open Innovation would be regarded as a standard. From table 8 it becomes evident that some of the guidelines are not or only barely present in the reviewed countries:

- Support for user innovation (IV) is an aspect of RTD policies that is missing. In all three countries no policies are found that aim to stimulate, support or facilitate users to develop their own innovations to better satisfy their process needs.
- Policies to enhance technology markets (VII) are scant. As for the three cases, only Flanders seemed to be somewhat inclined to offer policies in this area. Here we found some tax benefits and subsidies to stimulate the acquisition of external patents.

- Attention for corporate entrepreneurship (X) is limited as well. The Estonian case provides relatively many examples of policy measures supporting enterprises to develop their innovation strategies, but policies which directly aim to support and assist in spin-off creation, intrapreneurship or venturing activities are not found.
- Efforts to create and introduce balanced incentives (XIV) for scientific researchers, i.e. incentives that also reflect the importance of valorization, are missing. We found that all countries are quite active in creating new institutions and grant schemes to organize valorization, but career incentives to directly influence researchers' behavior are left untouched.
- Support for standard setting processes (III) also seems an opportunity for additional policymaking. We must however stress that support for standards primarily needs to be dealt with on an international level, so it may be obvious that within the reviewed countries only few policies measures are found.

In the next section we sum up our main conclusions and elaborate on the implications for policy makers. An important remark in advance is that a lack of policies at such does not justify new efforts. This is further discussed in the limitations section (8.3).

8.2 Conclusions and implications

The study proposed a framework of 21 guidelines for policymaking in a world of Open Innovation. These guidelines are derived from theoretical and empirical work and anticipated to support the key characteristics on Open Innovation, including enterprise behaviors, i.e. what do enterprises do when they practice Open Innovation (i.e. networking, collaboration, corporate entrepreneurship, proactive IP management, and R&D) and main external conditions facilitating the new paradigm (i.e. availability of basic knowledge, a highly educated and mobile labor force, and good access to finance). The policy guidelines can be classified in seven policy areas, including RTD, interaction-oriented, entrepreneurship, science, education, labor market and competition policies. In sum, the framework provides a theory-driven inventory of what policy aspects help enterprises to practice Open Innovation and/or stimulate the most facilitative external conditions. The framework is anticipated to help policy makers to identify relevant and missing aspects in their current policy mixes.

Main findings

From our theoretical and empirical efforts, the following overall conclusions can be drawn. Firstly, we conclude that current innovation policy mixes already contain many good elements (at least, in the three reviewed countries). Open Innovation thinking will not completely upset traditional policies, i.e. the common rationales to legitimize policy interventions, including spillovers, system failures and market failures, are still applicable. As for spillovers, Open Innovation dictates that organizations make better use of their knowledge. In the closed paradigm, knowledge could easily remain 'on the shelf' and wait endlessly for internal development. When organizations open up their innovation processes, more knowledge spillovers can be anticipated. Open Innovation regards spillovers not as just a threat, but the mere existence of spillovers rather provide opportunities to proactively benefit from internal knowledge. As for system failures, we conclude that the Open Innovation model is closely related to the systems of innovation literature, a literature that is increasingly used to justify policy interventions. Although Open Innovation and system literatures have been developed by different disciplines (managerial versus economic), their similarities are striking. A main

distinction is that Open Innovation has so far been studied mostly at the organizational level, while innovation systems research aims for the levels of nations, industries or regions. Both literatures are complementary rather than competitive. For market failures, we admit that some hampering factors will diminish in a world of Open Innovation. This applies most to failures like indivisibility and uncertainty. The open model for instance stresses external collaboration, implying a diminished burden on individual innovating enterprises, and offering better opportunities to spread risks. On the other hand, market failures such as lack of appropriation and asymmetric information will probably become more severe. Due to labor mobility, enterprises face problems with keeping their knowledge behind doors. This forces them to increasingly rely on intellectual property rights. Besides, the open model is characterized by multiple sources of information and increased vertical specialization. It is unlikely that information asymmetries will diminish in such a context. As policy makers increasingly use the innovation systems literature to guide new policy initiatives, it was anticipated that current innovation policies of EU countries already reflect many aspects of Open Innovation. Evidence from the three country cases confirms this presupposition. In all, Open Innovation does not upset traditional policies, but rather it offers some new guidelines, i.e. opportunities to bring more balance and to further develop current policy mixes.

A second overall conclusion is that Open Innovation inevitably broadens the scope of innovation policymaking. The proposed framework prescribes that Open Innovation is influenced by a rather broad set of policy areas, and some of them are clearly outside the traditional domains of RTD and interaction-oriented policies. The open model stresses a need to also develop more remote policy areas such as labor markets and education. Even when traditional RTD and interaction-oriented policies would be well organized, the policy mix would still be suboptimal if the more remote ones remain inadequately covered. Therefore, policy makers should explore how to integrate various policy areas in a coherent manner. Our policy guidelines should not be considered in isolation, but their strength rather stems from alignment and integration into a coherent and comprehensive set of policies. We remark that especially labor markets, science and education policies tend to be influenced by other considerations than innovation and welfare of the business population. A major challenge would be to stimulate the awareness of policy makers in these areas, including their attitude towards innovation. The Dutch case for example revealed that integration between science and innovation policies is suboptimal (Boekholt, 2007). Foreign experts noted a 'lack of coordination between (…) the policy system dealing with industrial R&D and the part of the system dealing with academic and other scientific research' (p. 7). In Flanders and Estonia, similar problems were identified. To support Open Innovation, comprehensive and coherent policies are required, i.e. objectives and instruments in different policy areas should be compatible. It would involve not just coordination of simultaneous policy actions, but also an evaluation of their possible interaction with policies pursuing other primary objectives.

A third conclusion is that Open Innovation stresses that policymaking should be much broader than offering financial support. In general, policy interventions may be designed as financial instruments (e.g. subsidies, loans, guarantees), information services (advice, matchmaking services, etc.) or legislation (rules and guidelines, laws, etc.). We have the impression that policy makers generally seem to prefer direct support measures such as subsidies, because these are more visible and do not hurt special interest groups. In the Dutch, Flemish and Estonian cases we indeed found numerous examples of financial instruments. We stress that policy makers need to be cautious as the establishment of

financial measures may weaken the incentives for regulatory reform (e.g. of the educational system). Given the nature of the policy guidelines which are not or barely present, and how they may be designed (see hereafter), information services and legislation issues probably deserve more attention from policy makers.

Specific guidelines

The Open Innovation paradigm raises some new policy issues that were less salient so far. As identified in table 8, the case studies in the Netherlands, Flanders and Estonia showed that a number of policy guidelines are not or only slightly developed. While acknowledging that the case studies only covers three countries and are limited in scope, the following guidelines probably can be improved in most countries.

The proposed framework uncovers user innovation as an emerging area for new policies (guideline IV). Results in the three countries are fairly consistent, as no policy measures were found at all. Here it becomes evident that Open Innovation requires more than financial instruments. Most users innovate to satisfy their process needs, i.e. they modify or develop techniques, equipment or software to make these applications better suitable for their own needs, and because of a lack of market supply. Most users share their innovations with other users (but also with suppliers) without charge, i.e. user innovation induces significant knowledge spillovers. Support measures for user innovation would primarily focus on external conditions. Governments might for example support technology platforms, user communities and repositories for intellectual commons. To our knowledge, so far only few attempts have been done to develop policies for user innovation. Policy makers may be able to learn from experiences in Denmark and the United Kingdom, where recent, experimental interventions were initiated focusing on innovating users.

Our results also suggest that there are opportunities to enhance technology markets (VII). One of the key enterprise behaviors in Open Innovation is proactive IP management, and this is possible only when markets for technology are to some extent developed. However, very few policies are present in the three countries. Only Flanders offers some financial incentives to acquire patents and to stimulate technology trade. As technology markets are still in their nascent phase, there is a need to develop policies to support and facilitate this process. A first necessary ingredient would be that IPR systems must be well developed, or private enterprises would not be willing to reveal their knowledge to potential buyers. The establishment of an integrated European Patent and enforcement system would be helpful in this respect. The Aho report (European Commission, 2006c) argues that 'European intellectual property systems provide a high level of protection but suffer from drawbacks such as national discrepancies and high costs, which hamper both developers and users of technology, especially when considering cross-border collaborations and transactions. A balanced set of improvements is called for, including the Community patent system for obtaining and enforcing patents on an EU-wide basis'. Admittedly, there is also a dark side to strong patents as they may be equivalent to creating monopolies with associated welfare losses (Hölzl, 2007). To solve this potential problem, patent maintenance fees may be used as incentives to discourage patents that would remain on the shelf (cf. Encaoua et al., 2006). Another possible intervention would relate to the provision of market information by developing information standards for IP licensing and associated trade, by making the supply and demand for technologies more visible, and by developing know-how to value IP once they are located. Such data could for example be supported with a specific buy-out mechanism for patents (Encaoua et al., 2006). This idea implies that patent

holders determine fixed buy-out prices that anyone interested can pay to license their patents, and corresponding maintenance fees which will increase with this buy-out price. This system would give public authorities and potential buyers information on the value of the patent (in the eyes of the patent holder). Finally and probably most important, we stress that technology markets will be international markets, so policy efforts must be done at an international (European) level rather than within countries. National policy makers should urge and equip their EU representatives to prioritize the issue of technology markets.

Another opportunity relates to policies to support corporate entrepreneurship (X). Our case studies have demonstrated that such policies are scarce. This is important to develop, as corporate entrepreneurial activities are a main feature of Open Innovation. Just as with IP management, such activities help enterprises to organize purposive outflows to better benefit from their knowledge. Policies could be developed to inform and support private enterprises' to develop new innovation strategies, i.e. by means of spin-offs, participations, venturing or intrapreneurship programs. This could be done by raising incumbent enterprises' awareness, by offering models and best practices, and by means of specific support packages including consultancy services to support the development of entrepreneurial strategies. In this context, policy makers could learn from the Norwegian experience. This country offers support programs for incumbent enterprises' venturing activities.

In the context of science policies, incentives of publicly funded researchers can probably be improved (XIV). In all three countries, we found that researchers' career and work incentive mechanisms mainly depend on scientific achievement and, to a lesser extent, performance in education. Valorization behavior barely counts. We encountered many financial and institutional arrangements to organize valorization processes, implying that valorization is stimulated from the outside. Yet, the lack of balanced incentives for individual researchers may be considered a hampering factor in the diffusion of scientific knowledge, i.e. valorization is at most marginally stimulated from the inside of public research organizations. Science policies should ensure more balanced incentives so that researchers get better motivated to spend time on valorization. This problem has both an institutional dimension (performance and reward criteria) and a cultural one (scientific cultures tend not to appreciate valorization behavior). By modifying the institutional framework in which universities operate, but also by intervening in their organizational processes, valorization can probably be triggered more effectively. In this context, one can doubt if it is sufficient to award scientific researchers with part of the revenues from their IP. This option also has a dark side. It may slow down and diminish valorization, and make researchers being more secretive in sharing their knowledge to protect its proprietary value (cf. Fabrizio, 2006).

Support for standard setting processes (III) also provides options for additional policy efforts. Although standard settings organizations are found in all countries, and they tend to be partly supported with public money, there are only few and incidental attempts to involve 'weak parties' such as SMEs. We must however stress that, just as with technology markets, support for standard setting processes primarily needs to be dealt with on an international level. Again, national policy makers should stress the importance of the issue in their communications with representatives of the EU and other international bodies.

Finally, the case studies also revealed strengths and weaknesses which were fairly unique for specific countries. Dutch policies for example pay much attention to the migration of knowledge, while in Flanders this topic is only modestly covered. Likewise, the Estonian case shows that relatively many Open Innovation guidelines are not or slightly reflected in the current policy mix (see chapter 7), but as a consequence of the still emerging status of its innovation system and specific features of local industries (i.e. many enterprises operating on low value-added basis), the priority of Open Innovation guidelines needs to be regarded as diverse. For a detailed discussion of the peculiarities of the three countries, we refer to the concluding sections in chapters 5-7.

8.3 Limitations and suggestions

Our theoretical and empirical work presented here inevitably contained limitations. As we will discussed hereafter, some of them directly create future research opportunities.

In chapter 1 we explained that our main objective was to charter policies which are most relevant in a world of Open Innovation, or to express it more simply, to identify the consequences of Open Innovation for policymaking. The proposed framework does not capture all of today's popular topics in innovation policy. Examples of influential current policy topics which are not included are creative industries, social challenges, characteristics of demanding customers, environmental/ecological issues, and more. The proposed framework is anticipated to be a source of inspiration and reflection, rather than a blueprint for policymaking. It is up to policy makers to judge how Open Innovation relates to other criteria to determine the content and priority of new policies. These criteria would also include mere political considerations.

A related dilemma is how important Open Innovation actually is to guide policymaking. Especially in developing countries there may be other priorities for policymaking due to the low absorptive capacity of incumbent enterprises and under-developed innovation institutions. The Estonian case (chapter 7) for example concluded that high priority should be given to relatively simple policy measures related to the development of basic innovation and interaction skills, go-betweens, direct stimulation of interaction between innovating actors, and broad support for entrepreneurship (corresponding with the guidelines V, VI, VIII and XII of the proposed framework). We remind that a majority of the Estonian business population includes enterprises with relatively low value-added levels. It would probably be less useful to start with relatively sophisticated policy measures to enhance technology markets and corporate entrepreneurship as long as basic infrastructural elements, including basic innovation skills, have not been thoroughly developed. Relatively few advanced innovative enterprises would benefit from such policy interventions. As for the Netherlands and Flanders, we remind that also in these developed countries large shares of the business population must be classified as low-tech, non-innovative enterprises. In sum, the proposed framework for policy assessment is broad and offers many guidelines, but especially in case of transition states our guidelines probably need to be picked up in particular sequences. How this can be done most effectively is an area for future research. Such research would also clarify if the proposed framework needs to be refined in order to be most useful in the context of developing countries.

As for the case studies, we remark that these could have been even more detailed. We obviously had to confine ourselves as there were limitations to the number of policy

documents, notes and reports that we were able to study. Especially the Dutch and Flanders innovation governance systems have many actors and may contain more relevant policy measures. Although we expect that these cases now capture the most important elements, and more importantly, that adding more details would not compromise our findings, we still need to remark that there is opportunities for more extended analyses. First and foremost, we feel that the case studies should be expanded to include more countries. This would enable stronger conclusions on the incidence of Open Innovation policies, and to identify in what areas additional efforts are most needed. Another recommendation is that we assessed the presence of Open Innovation policies by counting relevant policy measures and (rather implicit) judgments of their scope. We recommend that future cases are developed in a more quantitative fashion. If one would be able to objectively quantify the scope of current policy mixes (as far as they relate to financial instruments and information services), for example by retrieving their budgets, the benchmark exercise could induce interesting new insights (at first sight, when compared to the size of its business populations, we have the impression that Flemish policies are more generously financed than Dutch ones). Finally, enumerating lists of policy measures does not give us any idea about their effectiveness. In chapter 3 of this report we have provided several arguments why policies for Open Innovation are legitimate, but these arguments do not say anything about the quality of current policy measures that are taken by national or regional policy makers in Europe. Again, future work should deal with this issue.

Another limitation is that the case studies focused on national policy issues. One should however realize that some policy guidelines require international approaches. As innovation policies at the national and international (European) level are interconnected, a purely national view on the link between policymaking and enterprises' performance in Open Innovation is admittedly incomplete. We identified a number of guidelines that should primarily be picked up at the international level (e.g. high-quality IP, support for standards and enhancing technology markets), but did not systematically analyze if and when the national level is optimal for Open Innovation policies. One important related question that still remains is how to cope with increased globalization, an issue that is obviously influential in how enterprises can benefit from purposive inflows and outflows of knowledge (also see OECD, 2008). Considering the increased transfer of knowledge across borders, a key question is how governments should deal with situations when Open Innovation policies implemented in one country will have their impact in other countries. Due to increased globalization, it may be expected that policies should be increasingly offered at the international level. Future work should shed a light on the issue of globalization and optimal levels of policymaking, i.e. which policies can be best offered at national or international levels, or combinations of the two.

In the previous section, we concluded that comprehensive and coherent policies are desirable, implying that there is a need for lateral policymaking. A sheer multitude of current policy measures may give the impression of balanced policies which are well aligned with the principles of Open Innovation, but in fact, this does not imply that there is coherence. It is recommended that policy makers adopt integrated approaches to innovation in every detail of policymaking, including remote areas such as labor market legislation, competition and education policies. It is however not clear how policy makers and external stakeholders in these areas can be influenced to better account for Open Innovation. A related finding that was shared by all three countries is that the governance structures of innovation policymaking can probably be improved. Local Ministries of Economic Affairs, Employment and Social Affairs may for example not align

their efforts and offer contradictory policy interventions. For future work, it is very essential to identify effective governance structures to be influential in remote areas and to effectively align and integrate policies for Open Innovation.

Finally, due to the massive literature and plethora of policy documents, we had to confine our framework to the most important issues. We end this section by briefly discussing two emerging topics. These should be further investigated and possibly integrated in future versions of our framework. First, there is growing evidence that governments may themselves act as open innovators. Governments are in several cases the constituents of important research projects, for example in defense and space inventions. Due to such projects, they may own quite substantial IP that has huge economic potential when key insights would be applied in other industries. Qinetiq is for example one of the biggest government induced experiments in Open Innovation. Before 2001, the Defense Evaluation and Research Agency (DERA), part of the British Ministry of Defense, was the largest science and technology organization in the United Kingdom. In July 2001 DERA was split into two organizations: the Defense Science and Technology Laboratory which assumed responsibility for the most sensitive technologies (nuclear, chemical, and biological research), and QinetiQ, a commercial spin-off. QinetiQ is nowadays a private company and listed on the London Stock Exchange. In 2003, it entered a public-private partnership with the Ministry of Defense to commercialize its untapped resources, including around 5 000 unused patents, in the private sector. It specializes in defense technology, but also operates as an engineering contractor, licensor and service-provider in industries as diverse as healthcare and energy. Vice versa, governments may also benefit from purposive inflows of knowledge. Milcom Technologies for example is a US seed-stage venture fund that conceives, creates and launches technology companies in partnership with defense contractors, federal laboratories and other leading-edge research and development sources. In nine years, it launched 14 companies, which in turn have attracted over $ 600 million in venture capital. In 2003, Milcom Technologies was selected by the United States Army to manage OnPoint Technologies, a not-for-profit strategic private equity organization with a mission to discover, fund and support companies and programs developing innovative mobile power and energy technologies for the benefit of the U.S. Army and Department of Defense.

A second potential new element in Open Innovation policymaking relates to the growing importance of large, online knowledge repositories. Due to the worldwide growing importance of the internet, there is a rapid increase in the global distribution of useful knowledge, which enables enterprises to look externally for useful ideas or to find alternative pathways to benefit from their internal knowledge. Repositories of knowledge, and processes to search those repositories, may be considered critical to Open Innovation. Given the growing importance of a limited numbers of suppliers in these processes (e.g. Google, Yahoo), this raises questions of 'net neutrality' and necessity of close government monitoring. If and when knowledge repositories choose to limit access to their information, this could dampen the flow of information and with it, Open Innovation. This would imply a new dimension for competition/antitrust policies in that it is not concentration in single industries that is the concern, but rather the effects of extremely concentrated information sources at limited internet locations.

ANNEXES

Annex I: References

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Annex II: Interview partners

Interviews were done to develop the framework and guidelines for Open Innovation policymaking, and to comment initial versions. Our interview partners included:

- mr. J. Balodis	Latvian Technological Centre	Latvia
- ms. B. van den Bergh	Advisory Council on S&T Policy	Netherlands
- mr. K. van den Berghe	European Commission	Belgium
- mr. A. Brandsma	Institute for Prospective Technological Studies	Spain
- ms. T. Danilov	Ministry of Economic Affairs and Communications	Estonia
- mr. W. Hölzl	WIFO Austrian Institute for Economic Research	Austria
- mr. L. Klomp	Ministry of Economic Affairs	Netherlands
- mr. A. Kolk	Enterprise Estonia	Estonia
- ms. K. Kubo	Estonian Development Fund	Estonia
- mr. A. Reid	Technopolis Group	Belgium
- mr. L. Tammiste	Ministry of Economic Affairs and Communications	Estonia
- mr. H. Toivanen	Project manager National Innovation Strategy	Finland
- ms. N. van der Wenden	Ministry of Economic Affairs	Netherlands

To develop the country case studies, more detailed interviews were done with local experts to add to the inventory of policy measures and to collect more specific information. Our interview partners are listed hereafter.

Netherlands:

- ms. B. van den Bergh	Advisory Council on S&T Policy	Netherlands
- mr. P. van Beukering	Ministry of Economic Affairs	Netherlands
- mr. J. Dexel	Ministry of Economic Affairs	Netherlands
- mr. J.W. van Elk	EIM Business and Policy Research	Netherlands
- mr. J. de Jonge	EIM Business and Policy Research	Netherlands
- mr. R. Kemp	NMa Competition Authority	Netherlands
- mr. L. Klomp	Ministry of Economic Affairs	Netherlands
- mr. J. Meijaard	EIM Business and Policy Research	Netherlands
- mr. S. Ruiter	Ministry of Economic Affairs	Netherlands
- mr. R. van Tilburg	Advisory Council on S&T Policy	Netherlands
- ms. N. van der Wenden	Ministry of Economic Affairs	Netherlands

Flanders (Belgium):

- mr. K. van den Berghe	European Commission	Belgium
- mr. J. van Helleputte	IMEC	Belgium
- mr. M. Hinoul	University of Leuven	Belgium
- mr. J. Sijnave	Bekaert	Belgium
- mr. P. Spyns	Department EWI	Belgium

Estonia:

- ms. T. Danilov	Ministry of Economic Affairs and Communications	Estonia
- ms. K. Kiisler	Archimedes Foundation	Estonia
- ms. M. Kompus v.d. Hoeven	Estonian Chamber of Commerce and Industry	Estonia
- ms. R. Leetmaa	PRAXIS Centre for Policy Studies	Estonia
- mr. S. Raie	Estonian Chamber of Commerce and Industry	Estonia
- mr. L. Tammiste	Ministry of Economic Affairs and Communications	Estonia
- ms. K. Targama	Foundation INNOVE	Estonia
- mr. M. Võõras	Foundation Enterprise Estonia	Estonia

Annex III: Policy measures in the Netherlands

#1. WBSO – R&D promotion act

Objective: Stimulate private enterprises' R&D expenditures

Description: The WBSO stimulates private enterprises' R&D by alleviating the wage burden of R&D workers through tax reduction. It provides a fiscal facility for enterprises and self-employed persons who perform R&D work. A contribution is paid towards the wage costs of employees who are directly involved in R&D. The contribution is in the form of a reduction of payroll tax and social security contributions, or an increase in the tax deductions available to self-employed persons. The tax reduction is provided in such a way that SMEs and start-ups are given a (temporarily) higher benefit, the WBSO is more generous to start-ups and (potentially) challenging enterprises.

Scope: All enterprises and self-employed persons doing R&D are eligible. R&D activities have to be organized by applicants themselves and carried out within their own organization, carried out as part of projects or programs, and carried out in the EU. WBSO must be applied for in advance. In the past, the scope of the WBSO has been broadened multiple times. Extensions include the broadening of the R&D definition, raising the magnitude of the tax credit, and creating opportunities for funding R&D projects in other (EU) countries. Overall budget € 425 million in 2007.

#2. SBIR – Innovation procurement

Objective: The Small Business Innovation Research Program (SBIR) aims to stimulate start-ups, young fast growing enterprises, and SMEs to perform innovative research and develop new products and services.

Description: SBIR is an innovation program for SMEs. It is a procurement scheme granting SMEs to develop innovations that contribute to solving societal challenges. At the same time, these SMEs get the opportunity to develop new and innovative products, processes and services. The program is inspired by the American SBIR scheme. In the USA, governments spend a fixed percentage of their R&D budgets to innovative SMEs.

Scope: Only starters, young fast-growing enterprises and innovative SMEs can submit proposals. The annual budget is contingent on the number of procurement procedures initiated by the government.

#3. Innovation Performance Contracts

Objective: The core of this scheme is an agreement (contract) between SMEs and a coordinating body that acts for the group about an extra effort in innovation. The Ministry of Economic Affairs provides grants to initiate and execute the contracts.

Description: The scheme targets SMEs that are somehow related (in a value chain, region, theme or industry). The SMEs run their own innovation plans. They also collaborate with each other, but this is not obligatory. The scheme has two phases. In the first phase the coordinating body (usually an industry association) assesses the possibilities to prepare a contract and develops it. In the second phase participants execute their innovation plans using external knowledge and collaboration.

Scope: Each phase is applied for separately. The first phase covers 50% of the costs made by the coordinating body with a maximum of € 175 000. In the second phase 15 to 35 SMEs should be involved. The grant amounts to no more than € 50 000 per SME for a period of 3 years to cover the cost of individual and collective projects. The second phase subsidy is no more than 50%. Eligible costs include labor costs and other project related costs. The overall annual budget of the scheme is € 17 million.

#4. Innovation Programs

Objective: By means of grants, innovation programs stimulate public-private interaction, enhance research excellence in a limited number of key areas, back up clusters of enterprises, and provide direct financial incentives for private R&D.

Description: Innovation programs target so-called key areas, i.e. fields that are believed to exert a powerful influence on the Dutch economy. Within these areas, enterprises and publicly funded research institutions (including universities) can initiate their own innovation programs. Proposals are submitted to the Ministry of Economic Affairs for financial support. Each program is unique and tailored to the needs of a specific sector (e.g. high-tech systems, water, food and flowers) and usually also to a particular region. The participants themselves determine the most suitable form of organization and what action is needed to reach their innovation objectives. Recently, the IOP-TTI modules (see hereafter #5) have been integrated in the innovation programs. Another recent trend is that the Dutch government has initiated so-called 'social innovation programs'. These innovation programs are very similar to the innovation programs described above, and are focused on research and innovative solutions for social problems (such as health, safety and environment).

Scope: All actors in the national innovation system can be involved, including enterprises, universities, other publicly funded research organizations, intermediaries and industry associations. The total budget is substantial, i.e. annual grants for individual programs now range from € 5 million up till € 80 million.

#5. IOP-LTI – Public private partnering

Objective: Subsidies for collaborative innovation programs involving multiple applicants, to stimulate interaction and the diffusion of scientific knowledge, give a financial incentive to their R&D-efforts, and to create focus and mass in fundamental research in selected key areas.

Description: IOP-LTI aims for long-term strategic R&D collaboration between private enterprises and publicly funded research organizations in areas which are believed to be of strategic importance to the Dutch economy. This policy intervention integrates two formerly separated modules. The Innovation-oriented research programs module (IOP) primarily focuses at strengthening fundamental research at Dutch universities and other research institutes in the direction of strategic needs for research of the Dutch business sector. The leading technological institutes module (LTI) wants to create knowledge in a specific themes (with international significance) that answers fundamental-strategic questions of the Dutch business sector. The common goals of both modules are to create excellence ('focus and mass') in a limited number of technological areas, to improve the interaction between private enterprises and publicly funded research organizations, and to improve valorization of scientific knowledge.

Scope: Aims for private enterprises and publicly funded research organizations. In 2007, the IOP module was budgeted for € 19 million. The LTI module used to have an annual budget of € 29 million. Both modules have very recently been integrated with the innovation programs scheme (#4).

#6. OCNL – Netherlands Patent Office

Objective: OCNL grants patents in the Netherlands and disseminates knowledge derived from the patent literature.

Description: OCNL is the main patent body in the Netherlands. It is the national counterpart of the European patent organization (EOB) and the world patent organization (WIPO). The target audience consists of small-, medium- and large enterprises, self-employed, inventors, technology institutes, scientists, teachers and students. It is an agency of the Ministry of Economic Affairs. Its services include granting applicants with patent rights, providing public information, informing applicants and disseminating patent information by means of training courses, brochures, information, presentations and workshops. One important objective is to inform

participants on how information embedded in the patent database may be used.

Scope: The Ministry of Economic Affairs makes an annual contribution to OCNL, WIPO (international patent office) and EOB (European patent office) of € 20 million. From patent application and maintenance fees, the Dutch government receives € 27 million on annual basis.

#7. Patent information project

Objective: Stimulates patent awareness and promotes the use of patents as a source of information for innovation.

Description: The Patent information project ('Innovatie door Octrooi-informatie') consisted of information services for SMEs, as well as training programs and consultancy services to develop their skills to use patent information. The project was implemented by the Netherlands patent organization (OCNL) and Syntens, a publicly funded innovation intermediary for SMEs.

Scope: The focus was on SMEs only. The average annual budget was € 1.5 million.

#8. NEN – Standard Setting Organization

Objective: Organizes, supports and contributes to the development of standards, and organizes knowledge transfer.

Description: NEN is the main organization in the Netherlands for the development of and knowledge transfer on standards. Its services include support for the development of national standards, actively contributing to international standards, promoting the application of standards, and serving as a knowledge centre for standards. The NEN organizes standard settings processes by actively involving industry and public organizations. It cooperates with European (CEN, CENELEC, ETSI) and world standard settings organizations (ISO, IEC, ITU). It publishes and distributes standards documents, and organizes training courses and events to support knowledge transfer.

Scope: The Ministry of Economic Affairs gives an annual grant to the NEN of € 1.4 million. NEN receives most of its revenues from membership fees and publishing and selling standards.

#9. Standards Awareness Project

Objective: Increase the knowledge of SMEs of standardization and the number of SMEs involved in standard setting processes.

Description: This project entailed a broad range of activities to better inform and involve SMEs in standard setting processes, e.g. a portal to make information better available, special information campaigns, subsidies to compensate wage costs for involving enterprises in standard setting parties, strengthening the consultancy function of NEN (special consultancy projects for SMEs), and involving industrial associations in standard setting processes.

Scope: The project was funded by the Ministry of Economic Affairs, the national standards body (NEN) and some other organizations. The project has recently been finished. The annual budget was € 1.5 million.

#10. OASE – Open Source Software

Objective: The Open Access Software Expertise (OASE) project aimed to support the application of open source software by SMEs.

Description: The project subsidized ten pilot projects to develop and diffuse open source software. It was implemented by Syntens, the Dutch intermediary organization supporting innovation in small businesses. In cooperation with ten industrial associations, pilot projects were financed to investigate and develop open source software projects, and to develop the results to SMEs.

Scope: The project had an annual budget of € 0.7 million. It has recently been terminated.

#11. Syntens – Intermediary organization

Objective: Syntens is an intermediary organization that aims to increase the innovative ability of small- and medium-sized enterprises, and that connects various actors in the innovation system.

Description: Syntens is a publicly funded organization that provides four types of services: information, consultancy, helpdesk and matchmaking services. It employs 230 consultants and labels itself as an innovation network for entrepreneurs. Its services cover three themes: technological innovation, ICT development and adoption, and organizational innovation. The core of its services however is to inform and coach entrepreneurs to develop and implement innovation strategies. In doing so, Syntens helps SMEs to develop their interaction and innovation skills. It also frequently provides matchmaking services, i.e. enlist universities, vocational training institutes, or other commercial enterprises to support their customers' innovation processes. Thus, Syntens is a major go-between in the Netherlands that helps to connect actors in the innovation system.

Scope: Syntens has local offices in all provinces/regions of the Netherlands. Only SMEs (businesses up to 250 employees) are eligible. The annual budget is € 40 million, i.e. € 32 million base funding and € 8 million project-based funding.

#12. ROMs – Regional development Agencies

Objective: Regional Development Agencies (ROMs) stimulate tentative innovation projects by providing seed capital, by participations, and by matchmaking activities. This is all done to enhance regional economic development.

Description: In the Netherlands ROMs operate in various lagging regions (i.e. the North, East and very South of the country). They perform activities related to regional economic development, including investment promotion, innovation and participation. Their main activities include stimulating innovative investments by providing seed capital, and matchmaking activities between various enterprises and other actors in the innovation system. The ROMs also have an explicit role in the development of business parks, as the shortage thereof is identified as a bottleneck for attracting and expanding business activities.

Scope: All enterprises are eligible as long as they operate in one of the focal regions. The annual budget from the national government is about € 8 million. The ROMs also have a seed capital fund (approximately € 260 million in total). Not all development agencies are funded by the national government, i.e. there are examples of local development agencies financed by (collaborations of) municipalities. One example is NV REDE in the southeast part of the country.

#13. Innovation vouchers

Objective: Stimulate knowledge transfer to SMEs, improve interaction between SMEs and public research organizations (universities, publicly funded technological institutes)

Description: The main objective of the Innovation vouchers scheme is to enable SMEs to buy knowledge from knowledge institutes. For this purpose they are granted with an innovation voucher, i.e. a small grant that can be spend at any publicly funded research organization (PRO). Besides, innovation vouchers can be spend to large enterprises with R&D expenditures that exceed € 60 million per annum, and to foreign public knowledge institutes within the EU. The knowledge supplier can hand in the voucher at the Dutch government and receive payment. As the grant is only a few thousands of euros, and in most cases must be co-financed with own means, innovation vouchers are meant only to stimulate SMEs to make the first step towards public research organizations.

Scope: Although there are exceptions, in general all SMEs (industrial, agro, services, health care, etc.) are eligible. Additional requirements include that enterprises did not receive too much finance from other innovation subsidies. The budget is 2007 was € 37.8 million.

#14. RAAK – Public private partnering

Objective: Stimulates knowledge transfer from higher vocational education and polytechnics to SMEs (i.e. valorization), and stimulates public-private interaction.

Description: The RAAK (Regional Attention and Action for Knowledge innovation) scheme strengthens the connection between vocational educational institutes (polytechnics) and SMEs. The scheme offers financial support for collaboration projects in the areas of knowledge creation and valorization between these education institutes and SMEs. Subsidies can be awarded to innovation projects and programs that aim to exchange knowledge, and which are executed by a consortium of one or more education institutes and one or more SMEs. In doing so, valorization becomes better organized and public-private partnerships are stimulated.

Scope: Eligible for funding are non-profit consortia which aim to stimulate knowledge circulation with a region, and which are open for both private and public actors. These consortia should (as a minimum requirement) include representatives of the SMEs and education institutes in the region. Grants are given for labor costs and external expertise (consultants, feasibility studies, etc). In 2007, € 8.5 million was available.

#15. Peaks in the Delta

Objective: This program supports regional clusters by means of grants. It fosters interaction between innovation actors and stimulates public-private partnerships.

Description: Peaks in the Delta is the flag-bearer of the Dutch regional economic policy. It supports innovative regions with the capacity to develop into internationally competitive innovation 'hot spots'. This is a major shift in the Dutch regional policy making; rather than supporting laggard regions, the focus is now on capitalizing on existing strengths. The program entails a combination of customized regional measures and more general national incentives. More specifically, regional innovation programs are developed for identified regions. Within each region, a limited number of key areas have been identified. The aim is to boost specific aspects of innovation processes in these areas by means of professional training, technology transfer, encouraging start-ups and knowledge networks. This is put into practice by stimulating the development of local and regional innovation networks involving enterprises, the knowledge infrastructure and public authorities.

Scope: For the period 2007-2010, the Ministry of Economic Affairs has made available € 297 million. This contribution is complemented by regional public and private funding. Thus, eventually Peaks in the Delta involves a much larger sum of money.

#16. Innovation credit

Objective: Stimulate private enterprises' R&D expenditures

Description: The Innovation Credit supports the development of new products, processes or services. The project should have a high-risk profile with substantial technical problems that need to be solved. It is a subsidized loan, without interest for SMEs. The innovation credit is a relatively new financial measure to support innovation projects that are outside the scope of the key areas and innovation programs. With the introduction of the Innovation Credit the Ministry of Economic Affairs aims for challenging SMEs who do not manage to apply for bigger policy instruments such as innovation programs.

Scope: All SMEs are eligible. The credit can amount to 35% of the development cost, with a maximum of € 5 million (ceiling will be determined in 2008). The minimal project size is € 300,000 (estimated development costs). The project may run for a maximum of three years. The credit should be repaid in max. 6 years after successful completion of the development project. The overall budget in 2008 is € 25 million.

#17. TechnoPartner

Objective: Realize more and better technology-based start-ups, through the creation of a

better climate inside and outside publicly funded research organizations (universities and other institutes).

Description: The TechnoPartner program offers partial grants and guarantees related to various action lines. First, it contains the so-called Knowledge Exploitation Subsidy Arrangement (SKE) aimed to stimulate publicly funded research organizations to generate more technology-based start-ups. It offers a pre-seed facility for potential start-ups in order to explore entrepreneurial opportunities and to promote valorization. Second, TechnoPartner offers a patent facility in which technology-based start-ups can license-in patents to developed new products. This facility helps enterprises to acquire external IP rights and helps to create technology markets. Third, a seed facility promotes and mobilizes the Dutch venture capital market to invest in technology-based start-ups. Via small business investment companies, investment funds are created. TechnoPartner also offers a guarantee label, which enables applicants to obtain bank credits more easily.

Scope: The program is open for scientists, researchers, public research organizations and venture capital funds. The program has a budget of € 37 million (in 2008).

#18. BBMKB – SMEs credit guarantee

Objective: Ensure innovating SMEs' access to finance

Description: This scheme stimulates the provision of credit by private financial institutions. It ensures that they are compensated for a part (but not all) of their credit in case the SME fails to succeed. For financial institutes guarantees are important to compensate a shortage of other securities, a situation that is often seen in innovating SMEs. For start-ups and self-employed, the scheme offers some extra advantages (so the scheme is relatively friendly to challengers).

Scope: Each year, circa 3 000 SMEs are supported. They obtain a maximum credit guarantee of € 1 million. The credit guarantee has a typical duration of 6 years (or 12 years in case of real estate). In 2008, the Dutch government will have guaranteed about € 730 million of bank loans. In practice, most credits are paid back. Real expenditure on the scheme was (in 2006) € 16.5 million.

#19. Venture capital scheme

Objective: Improve that start-ups have better access to finance

Description: It is a fiscal facility for business angels and informal investors to invest in new businesses (up to eight years old). In the direct variant of the scheme, taxpayers can loan money to starting entrepreneurs, and in the indirect variant, they can invest money in an officially recognized VC fund, which, in turn, finances starting entrepreneurs. The scheme consists of exemptions for the capital yield taxes, and tax deductions for any (direct) investments or losses on such investments.

Scope: All private persons who wish to invest in new enterprises are welcome. Single applicants may use the scheme for up to five years. The budget in 2007 was € 23 million.

#20. New Entrepreneurship Action Plan

Objective: Improve the quantity and quality of start-ups in the Netherlands

Description: The action plan aims for more and better entrepreneurs. The plan consists of a range of activities, such as information services, loan guarantees, reduction of administrative burdens for starting entrepreneurs, etc. Concrete activities include promoting entrepreneurship through the use of role models, sponsoring prizes and awards, sponsoring tailor-made television programs, providing micro-loans, and promoting competence development of relevant intermediary organizations (e.g. the Dutch Chambers of Commerce).

Scope: The action plan is funded with an annual budget of 3 million euros

#21. Lump-sum research funding

Objective: Lump-sum funding of universities and other public research organizations to ensure that a stock of basic knowledge is maintained and further improved.

Description: In the world of Dutch science, all activities are funded from three sources. The first source a lump-sum directly financed by the Ministry of Education, Science and Culture. Part of this money is financed by the Ministry of Agriculture, the responsible ministry for the agricultural Wageningen University and Research Centre (the agricultural sector traditionally has its own budget cycle and institutions).

Scope: Lump-sum funding is given to all (15) Dutch universities, and to eight academic medical centers. Besides, a number of technological institutes still have part of their budgets financed as a lump-sum (see hereafter).

#22. NWO funding

Objective: Distribution of grants for basic, fundamental research on the basis of scientific quality.

Description: The second source of funding is distributed by NWO, the Dutch scientific research council. It is an independent administrative body that acts as a funding agency for the Ministry of Education, Culture and Science. Its mission is to promote and raise the quality of fundamental research at Dutch universities and research institutes. NWO provides grants for excellent research and for research equipment. Besides, it administers various research institutes in the fields of physics, mathematics and computer science, astronomy and space research, marine research and history, and also the technology foundation STW which funds scientific research projects with an eye for valorization (see hereafter). Finally, NWO organizes the so-called Renewal Impulse, a grant scheme for young researchers to initiate and implement their own research in order to stimulate excellence.

Scope: The distinctive feature of the second source of funding is that it is based on competition; applications are awarded drawing on peer reviews of scientific quality. By increasing the second stream central government is able to influence competition and quality aspects of research, and thus to create focus and mass in scientific research. NWO has an annual budget of € 450 million for basic research funding (of which € 80 million is forwarded to the above-mentioned research institutes).

#23. Incidental research funding

Objective: Distribution of grants for basic, fundamental research, also to create focus and mass in fundamental research and to stimulate diffusion of fundamental knowledge.

Description: In the past years, there are many examples of incidental grants, i.e. the central government and/or Ministries of Economic Affairs and Education have repeatedly dedicated extra funds to scientific research (usually financed from the Dutch natural gas reserves and other incidental benefits). Examples include the so-called BSIK and FES grants (to stimulate high-quality public-private networks within the Dutch knowledge infrastructure that can address long-term knowledge demands) and Smart Mix (grants for consortia of knowledge producers and users to create focus and mass and to enhance valorization; the Smart Mix was taken from universities' lump-sum funding and abolished after one year).

Scope: For BSIK the budget was about € 200 million in 2003-2006. For FES the budget was € 500 million in 2005 and € 300 million in 2006. The Smart Mix had an annual budget of € 100 million.

#24. Technological institutes

Objective: Technological institutes are financed to stimulate the application of fundamental knowledge by performing applied research. They are increasingly organized to work on specific themes which are relevant to society.

Description: In the Netherlands there are a number of large technological institutes geared to the application of knowledge. In order to do this, they also conduct research of a relatively fundamental nature. The largest institute is TNO, the Netherlands Organization for Applied Research. TNO is an umbrella organization with several

research centers in five key areas which are believed to be most relevant to society (i.e. to create focus and mass in research): quality of life; defense, security and safety; science and industry; built environment and geosciences; and information and communication technology. Besides, there are other technological institutes, conducting applied research and related activities, such as advising industry and government in specific fields. These institutes are active in aerospace, water management, hydraulic engineering, maritime research and energy research. Finally, there is DLO which is part of the Wageningen University and Research Centre, and responsible for applied research in agriculture.

Scope: In 2005, TNO had a total revenue of € 501 million. From these revenues, € 266 million was obtained from public sources (€ 195 million as a lump-sum and € 71 million of contract assignments for Dutch governments). The other technological institutes had a total revenue of € 259 million. Here € 108 million was financed by public authorities (€ 66 million as a lump-sum and € 42 million of contract assignments.

#25. STW – Technology foundation

Objective: Support and finance scientific technological research projects, and promote valorization of the research output by third parties.

Description: The technology foundation STW is part of NWO (see above). It serves as an alternative funding agency for university research. Tenured university staff can apply for a research grant, provided that their proposal includes valorization, i.e. the embedding of the results in society. STW actively supports valorization by involving private enterprises in users' committees of research projects.

Scope: The Technology Foundation supports research that meets two criteria: it must have high scientific quality and at the same time it must be directed towards practical application. In 2005, STW had a budget of € 50 million. Of this money 40% is provided by the Ministry of Economic Affairs (and the rest comes from the NWO).

#26. Leading social institutes

Objective: Organize diffusion of scientific knowledge for a limited number of themes with high relevance for society.

Description: This initiative is funded by the Ministry of Education, Culture and Science. It grants networks of public research organizations and private enterprises to better attune scientific research to social needs. The leading social institutes are virtual organizations, and meant to create knowledge in specific, publicly needed research themes. The grants are eligible to private enterprises and public research organizations (including universities) that are willing and capable to participate in strategic research programs. These parties initiate a virtual collaborative research network which implements the pre-defined social research program.

Scope: Aims for private enterprises, higher education institutions and other public and non-profit research organizations.

#27. Opportunity zones

Objective: Back-up challengers, i.e. spin-off entrepreneurs, and stimulate the diffusion of scientific knowledge to the broader society.

Description: In 2005, a new initiative was launched to create so-called 'opportunity zones' for start-ups and fast-growing enterprises. The zones were created around the three technical universities in the Netherlands (Delft, Eindhoven and Twente). In addition, a zone of opportunity is created at the business park Avantis in the province of Limburg. In these zones, experiments will be made to improve services for starting and fast-growing enterprises. Within zones of opportunity enterprises are supported by being given work/office space, coaching and assistance in the application of subsidies, licenses and permits.

Scope: A total budget of € 1.2 million for five years is allocated to the three zones of opportunity around the three universities. Avantis – the fourth pilot – is a transnational business park.

#28. Valorization grant

Objective: Valorization of scientific knowledge

Description: The valorization grant enables researchers at universities to apply for a grant to create a spin-off from a public knowledge institute. The grant can be used for product-market analysis, for development of a prototype, for development of personal skills, for protection of intellectual property, etc. The grant consists of a feasibility study phase, and a valorization phase. The final phase has to be funded by private investors.

Scope: Aims for individual researchers of (semi-)public research institutes. The budget for the scheme is approximately € 1.3 million per year.

#29. Technological Sciences Platform

Objective: Promote education in science and technology to enlarge the number of graduates in these fields.

Description: The technological sciences platform ('platform betatechniek') focuses primarily on how to educate more young people in science and technology. It develops activities in primary, secondary and tertiary education, and it conducts a number of projects in the field of tertiary education and innovation; both in promoting the image of technology and stimulating regional action plans.
Activities include improving scientific education, improving the attractiveness of careers involving scientific and engineering know-how, and making science and engineering more attractive to children and youngsters (for instance through science centers). The platform is a joint effort of the Ministries of Economic Affairs, Social Welfare and Employment, and Education, Culture and Science.

Scope: The platform has a budget of (in 2007) € 61 million.

#30. Lectureships

Objective: Strengthen education and applied research at higher vocational education institutes by creating networks with regional businesses.

Description: The Ministry of Education, Culture and Science has financed over 200 lecturers at the Dutch higher vocational education institutes. A 'lecturer' is the counterpart of a full professor in universities. There are appointed to create knowledge networks with regional businesses, with a special focus on SMEs. They also stimulate applied research activities to foster the diffusion of knowledge to SMEs, and to boost the quality of vocational education by means of (research) apprenticeships.

Scope: In the agreements between lectors and their knowledge networks a budget is included of € 38.4 million in 2006, further extended to almost €50 million in 2007.

#31. Project Learning and Work

Objective: Stimulate lifelong learning activities by employers and their organizations, trade unions, governments and citizens.

Description: To stimulate lifelong learning, the ministries of Education, Culture and Science, and Social Affairs have initiated the Project Learning and Work. This project aims to trigger stakeholders (employers and their organizations, trade unions, governments, citizens) to initiate and implement lifelong learning activities, via information, consultation and subsidies.

Scope: In 2006, the project had a budget of € 24 million.

#32. Entrepreneurship and Education Action Program

Objective: Stimulate entrepreneurial attitude of the youth (students, pupils) and develop their entrepreneurial competences.

Description: Today's education in the Netherlands is regarded to pay too little attention to entrepreneurship. This action program aims for more attention for entrepreneurial competences in the curricula of schools and universities, to promote entrepreneurship among teachers, and to create enterprising educational institutes.

This is done by information and promotional activities by means of road shows (entrepreneurs in classrooms), apprenticeships for teachers in business, developing and implementing performance criteria to assess the entrepreneurial content of current curricula, and stimulating education institutes' incubation services. Grants are also provided for these activities.

Scope: One of the main activities is to initiate and fund centers of entrepreneurship, to be organized by various universities in the Netherlands. These centers will serve as hotspots of expertise in their regions. In the period 2008-2011, the centers have an average annual budget of € 7.5 million.

#33. Casimir – Mobility scheme

Objective: Increase mobility of scientists and researchers, and valorization of fundamental knowledge.

Description: The Casimir scheme – named after a former head of the R&D department of the Dutch high-tech multinational Philips – subsidizes the mobility of researchers to enhance knowledge flows between publicly funded research organizations and private enterprises. Such mobility of researchers helps to reduce the gap between knowledge production and application. Mobility is also perceived as a means to improve the attractiveness of researchers' jobs.

Scope: The scheme aims for scientists and researchers. The overall budget was € 2.8 million in 2007.

#34. Knowledge Migration Desk

Objective: Offer a 'one-stop shop' service to employers and education institutes to simplify the temporary immigration of knowledge workers from abroad.

Description: Due to serious complaints from employers organizations, multinational enterprises and education institutes, the Dutch government has decided to seriously simplify the procedures for temporary immigration of knowledge workers. Rather than having multiple government bodies being responsible for the immigration procedure, a one-stop shop concept is offered by the Dutch Immigration and Naturalization Service (IND). The Knowledge Migration Desk ('snelloket kennis- en arbeidsmigratie') first asks employers to register themselves and to accept specific responsibilities for their foreign knowledge workers. Next, any application for knowledge workers is processed in two weeks. The desk also offers an online residence map to potential applications in order to improve the transparency of the Dutch procedures.

Scope: Eligible for all private enterprises and educational institutes. There are specific requirements for knowledge workers, such as a minimum pay (one needs to earn at least € 48,000, or € 34,000 when one is under 30 years of age, but for scientific work at educational institutes this requirement does not apply) and the exclusion of specific professions (e.g. religious predecessors, football players, prostitutes, etc).

#35. NMa - Netherlands Competition Authority

Objective: Supervise and ensure competition in all Dutch industries; prevent that entrepreneurial opportunities and choice options for consumers are curtailed.

Description: The Netherlands Competition Authority (NMa) enforces fair competition in all sectors of the Dutch economy, It is an autonomous administrative agency financed by the Ministry of Economic Affairs. Its main enforcement powers are laid down in the Competition Act. Moreover, the NMa applies articles 81 and 82 from the EC Treaty in the Netherlands. The NMa deals with the search for and fight against illegal cartel activities. Besides, it imposes sanctions for infringements of the competition law such as abusing a dominant market position (e.g. private enterprises imposing unfair conditions on buyers or excluding competitors) and it assesses merger proposals to avoid the emergence of concentrations obstructing the proper functioning of markets. Finally, the NMa has certain sector-specific duties and powers, namely in relation to the energy and transport sectors. These

industrial duties are carried out by two chambers of the NMa: the Office of Energy Regulation (DTe) and the Office of Transport Regulation.

Scope: The NMa operates with an annual budget of (in 2008) € 44 million.

Annex IV: Policy measures in Flanders

An overview op policy measures which are relevant in Flanders is presented hereafter. The overview contains measures offered by the Federal government of Belgium, and by Flemish community government (also including Flemish regional policies).

#1. Tax exemption for researchers employed by enterprises

Objective: Since 2003 Belgium has set up an attractive tax exemption scheme for employers who employ researchers. The law provides that employers are exempted from paying the Belgian treasury part of the advance payment they deduct each month from the remuneration paid to the researchers they employ.
This exemption gives the institutions employing researchers more financial resources which they can immediately use to boost their efforts in terms of employing researchers, launching new research programs or investing in new R&D material.

Description: Offered by the Federal government of Belgium. Initially the partial tax exemption was only available to public or academic research institutions. In 2005 and 2006, the partial tax exemption was extended to companies in two specific cases (a third variant aimed at Young Innovative Companies became effective as of 1 July 2006, see below):
- Exemption for co-operation with research institutions (Belgian or European Economic Area (EEA)) in research projects
- Exemption for employees with specific scientific profiles (PhD's and civil engineers).

Provided they are not already concerned by one of the other measure application cases, the advance payment partial exemption has been extended as of 1 January 2007.

Scope: The overall budget is not known. Nevertheless, L'Echo (18/05/2007) reports an annual cost of the researchers' income tax deduction (65%) of € 50 million for the whole country. The memorandum of the Federal Scientific Advisory Council issued in June 2007 states that the estimated annual costs of the extension of the measure to Master's degrees is € 31 million.

#2. SME Program ('KMO-Programma')

Objective: The SME program aims to stimulate and enhance through financial support the innovation activities in Flemish SMEs. Innovation is defined as 'the realization of a new product, process or service for which a technological solution is required', where the latter should be understood as innovative to the company with a clear impact on the market. This innovation can require the development of own technology or the creative application of existing technology. Also non technological activities required for the innovation can be subsidised. A second aspect concerns knowledge acquisition: through the innovation, the knowledge of the SME should increase. The overall goal is to accumulate via the study the required knowledge in order to make it possible to define better and in a more focused way the required activities for the realization of this innovation. A follow-up project can typically be an SME-Innovation project, but also European projects.

Description: Offered by the Flemish government. Provided in the form of grants. The program was developed for the following activities:
- technological advice provided by a knowledge centre accredited by the IWT
- study executed with own input of the applying SME
- study with own input of the applying SME and required input of a third party
- study executed by the applying SME to prepare the European project proposal, a Eureka-proposal or a technology transfer project

- study undertaken by a engaged staff member with technical higher education
- support for studies related to starting an innovation related new business
- projects aimed at the concrete realization of an innovation.

Scope: The applicant must be an SME (eventually leader of a consortium) having its seat in Flanders and fulfilling the following conditions: having a legal personality, counting no more than 250 employees, have less than € 40 million turnover or less than € 27 million balance total and be controlled for less than 25% directly or indirectly by non-SMEs. A larger participation of banks or investment companies is nevertheless allowed.
Overall budget is € 62.3 million. From the start of the program in 2001 to December 2004 an amount of financial support of € 48.6 million was approved (including a limited amount of EFRO support). In 2005 € 13.7 million support was approved, in 2006 € 16.2 million and in 2007 € 18.0 million.

#3. Knowledge transfer in strategic areas

Objective: This program is designed to support and strengthen Belgium's scientific capability in high technology areas that are more than ever vital in effectively meeting the major societal challenges. The resources mobilized for these purposes are evenly balanced between fundamental research, research to support policymaking, and applied research in a variety of sectors. The program stimulates the creation and development of innovation poles, networks and incubators bringing together universities, research institutions and enterprises, including at regional and local level, helping to bridge the technology gap between regions.

Description: Offered by the Federal government of Belgium, in the form of grants. The Program aims to:

- consolidate scientific and technical potential in areas of strategic importance;
- stimulate the transfer of knowledge and research results to all socio-economic and environmental sectors, enabling them to make the most of available opportunities according to their constraints and specific needs, and thereby bring about the benefits of innovation;
- promote and support Belgian involvement in all international - and especially European - activities in these areas to ensure that Belgium plays an active role in ongoing developments, notably in the establishment of European or international codes and standards.

Scope: Each project is undertaken by an interdisciplinary network composed of 3 to 4 funded teams belonging to at least two separate Belgian scientific institutions. Each network includes at least one university institution, a collective research centre, one Dutch-speaking partner and one French-speaking partner, so that the issues can be addressed at national scale.
The contribution of the different network partners may differ according to the content. The call for proposals is open to Belgian university institutions, scientific institutes, non-profit research centers and specialized consulting offices (limited to a maximum of 25% of the total budget). If it brings added value to the project and to the development of Belgian expertise, applicants may propose cooperation with non-Belgian universities or research centers. Non-Belgian partners may be funded by PPS Science Policy up to a maximum of 20% of the total budget requested by the network. The non-Belgian partner is responsible for the co-funding from other sources, to a value at least equivalent to that sought from PPS Science Policy.
Overall budget € 14 439 000. Budget 2002-2005: € 8 939 000. Budget 2006-: € 5 500 000.

#4. Research mandates ('Onderzoeksmandaten')

Objective: Research mandates aim to assist researchers to contribute to the commercialization of scientific results in industry. The measure is in line with the general policy to increase the economic activity as a result of research at a university or research institute. The government tries to target knowledge transfer from the university to companies (contract research, licenses, research and IPR issues in

public/academic/non-profit institutes).

Description: Offered by the Flemish government, in the form of grants. Economic commercialization in Flanders is an essential dimension of the innovation policy. Three types of mandates exist (of which the first two are directly relevant with respect to innovation as they are focusing on the economic valorization of the research results and not only on deepening basic research):

- Type 1 mandates support researchers from a Flemish university or research institute who aim at validating their research results through the creation of a spin-off;
- Type 2 mandates aim at the transfer of basic research from a research institute to an existing enterprise (including spin-offs), with a view to the later effective valorization/implementation by the company. Research takes place essentially within the enterprise of the industrial promotor;
- Type 3 mandates target exclusively researchers that conduct research to deepen their research results and prepare the implementation of these results.

Scope: Candidates must satisfy certain conditions regarding their education (PhD in certain well specified disciplines such as Sciences, Applied Sciences etc., or engineer with experience, or honors), and be of the nationality of one of the Member States. The scientific promotor (who provides advice on the scientific aspects) must be part of the academic staff of a Flemish HEI (including universities) or research centre; the industrial promotor (who provides advice on the valorization) should be part of the general or scientific management of a Flemish company (for type 1 risk capital funds and consultancy companies can also function as industrial promotor).
Overall budget € 1.794 million for 2003 and which evolved to € 3.021 million for 2008.

#5. Poles of Excellence/Centers of Excellence

Objective: Collective/cooperative research activities have a strategic importance for the Flemish economy in order to create/maintain a sound knowledge base for innovation. The government cannot adequately support innovation by individual R&D projects of companies, it is rather complemented by collective centers of excellence. These competence poles must provide the innovation potential for specific sectors and must build on already present competences in Flanders.

Description: Offered by the Flemish government, in the form of grants for basic and/or collective research. The Flemish Government has in the past founded large (strategic) research centers, e.g. IMEC, VITO, VIB and more recently IBBT, and somewhat smaller initiatives including for example VIL (Flemish Logistics Institute), Flanders' Drive (Centre for the Automotive Industry) and Flamac (Flanders Material Centre).

Scope: There is an individual Government decision on every new centre. The overall budget is not defined. However on the four large research institutes (IMEC, VITO, VIB and IBBT), an amount of approximately € 100 million is spent every year. In 2008, € 146 million has been budgeted. The smaller poles of excellence have been granted some € 75 million in the period 2006-2007. In 2008, € 44 million was budgeted for these poles of excellence.

#6. Strategic Basic Research - SBO

Objective: Strategic basic research has to be situated between the fundamental knowledge increasing research at the universities on one hand and applied research on the other hand. The purpose is to develop knowledge of strategic importance with broad economic or social applications in Flanders. Hence, it is intended to increase the valorization orientation of university research.

Description: Offered in the form of grants, i.e. financing of cooperative pre-competitive research. Applies to the Flanders and Brussels region. Also eligible in case of collaboration with foreign partners. The SBO program is the continuation of the former GBOU program. This support channel focuses on the development of strategic research investments based on two essential aspects: the strategic and

generic nature of the research , and the extent of the (economic or social) valorization potential in Flanders.

Scope: This instrument is open to all the parties involved (universities, institutes of higher education, research institutes, businesses, etc.) in Flanders. An SBO project should be submitted by at least one Flemish R&D actor. The primary target group are the academic research groups and technological institutes. Enterprises and other centers can also participate and may receive funding.
The overall budget for 2003 was € 35 million. In 2004 the budget was € 37.5 million (€ 25 million for projects with economic relevance, € 12.5 million for projects with societal relevance). In 2005 and 2006 the budget already rose to € 37.5 million euros (2/3 economic; 1/3 societal); For 2007 and 2008 the total budget was fixed at a level of € 38.6 million.

#7. Action Plan for Science Information & Innovation

Objective: The Flemish government wants to popularize science, technology and technological innovation through a yearly action plan. With this program the government intends to get support for science and technology from the general public to stimulate the influx of young, talented people in the science and innovation system.

Description: Offered by the Flemish government, in the form of grants. The Flemish Action Plan for Science Information and Innovation forms the basis for the science communication policy in Flanders. It is drafted yearly, and has come in the third phase. After periods of sowing (1995-1999) and growing (2000-2004), the period 2005-2010 will be a period of consolidation and validation of activities and expertise and some reorientation on activities. Important aspects are structural embedding of science and innovation in the education at schools, cooperation with experienced partners, structural involvement of universities and polytechnics in science popularization (as a change from the present ad hoc involvement), extensive networking to improve mutual learning and a media strategy.

Scope: Most important interventions in the action plan are programs to support science popularization in schools, the financing of continuous activities (like the science centre Technopolis), financing of media activities, networking activities and the 'Flanders Technology Day'. Furthermore there are calls for proposals. Each initiative that can contribute to enhance scientific and/or technological interest of a specific target group can apply for financial support.
The total budget for the action plan 2003 was € 9 million of which € 744 000 are reserved for the call for proposals for science popularization. In 2005 the budget was € 7.6 million and in 2006 about € 9 million was invested.

#8. Growth subsidy

Objective: This subsidy on investments tries to stimulate enterprise development and investment in Flanders. The innovative nature of the project is an additional criterion in selecting projects to receive support but is not predominant. The measure focuses on the commercialization of innovation (including IPR) and the diffusion of technologies in enterprises.

Description: Was offered by the Flemish government in the period 2003-2005, in the form of grants. It provides financial support to enterprises that invest in Flanders (both existing SMEs, large companies and inward investors). Eligible investments include, among others, the purchase, at market conditions, of patents, exploitation licenses or licenses with respect to patented technical know-how.

Scope: Only proposals from individual organizations are accepted. Overall budget € 108 million (2003-2005) € 30 million in 2003; € 30 million in 2004 (both in one call) and € 48 million in 2005 (4 calls).

#9. TETRA Fund

Objective: The TETRA Fund ('TEchnology TRAnsfer') provides support for research and knowledge diffusion for a group of interested parties, composed of one or more applicants (higher education institutes, including universities) and a group of users

(companies and other organizations). The overall objective is to promote technology transfer between HEIs and (less technological, in some cases also high-tech) SMEs.

Description: Offered by the Flemish government, in the form of grants for pre-competitive research, applied industrial research, development/prototype creation and diffusion of technologies in enterprises. Projects should concern an innovative concept that can lead to results that can be used by enterprises (among others).

Scope: TETRA Fund projects can only be submitted by a Flemish HEI (polytechnic or university) as main applicant. Other actors can be involved in the consortium but 2/3 of the budget should be allocated to the HEI.
Overall budget from € 6 to 7.4 million per annum, i.e. € 6 million per annum in 2004-2005, € 7.0 million in 2006, € 7.4 million in 2007 and € 8.9 million in 2008.

#10. Financial support for industrial estates and science parcs

Objective: Enterprises need a good infrastructure. Within the Action plan 'ondernemen' (venturing) there is a specific action line called 'Space for Venturing' aiming at providing a modern and sustainable infrastructure by means of providing financial support for industrial estates and enterprise centers. Special attention is paid to science parks at universities in order to support university related businesses (including spin-offs).

Description: Offered by the Flemish government in the period 2003-2007, in the form of grants. It is relevant for innovation as it includes subsidies for science parks and for incubators/ innovation centers. Science parks: Every Flemish university is assigned an area to develop as science park in order to stimulate the establishment of research intensive companies with links to the university. The program supports the (re)development of such a park. Incubators and innovation centers are specialized types of enterprise centers, located at the science parks, where activities, related to research and development, are carried out with an explicit incubator role.

Scope: Targets higher education institutions and research units/centers. Regional development corporations and consortia of local communities are also eligible. Overall budget is unknown, but the maximum grant per incubator is € 500 000.

#11. VINNOF

Objective: The Flemish Innovation Fund (VINNOF) aims to provide financial means to young, innovative companies to transform their ideas or technologies into a business plan and find financing for the start-up.

Description: Offered by the Flemish government, in the form of subsidized loans (including interest allowances) and venture capital (including subordinated loans). This type of pre-seed and seed financing is meant to bridge the gap towards private early stage financing. By co-financing of, among others, IPR, feasibility studies, market orientation studies, prototype development, initial marketing, etc. VINNOF must guide start-ups to private capital. The management of VINNOF is done by the Flemish Holding Company (PMV). The fund is open for participation with private capital or public capital from other sources.

Scope: Only start-ups providing an innovative product or service are eligible. Overall budget is € 75 million per annum. The Flemish government has announced a financing of € 75 million in 2005. In 2006, again € 75 million was invested. In 2007 it was decided not to grant the VINNOF another additional amount. It covers up to 50% of eligible costs with the maximum rate of reimbursement set at around € 12 500.

#12. Industrial Research Fund - IOF

Objective: As research at universities is not enough application oriented, IOF is an initiative to redirect them towards more industrial relevance.

Description: Offered by the Flemish government, in the form of grants for pre-competitive research. The fund is divided over the Flemish universities every year, based on an

output related, distribution formula with several criteria (number of personnel, number PhD-theses, publication output, number of patents, participation of university in IWT projects and FP projects, number of spin-offs). Every university then has a intra-university competition to award IOF-funding to projects. IOF has been based on ad-hoc regulation in 2004 en 2005 but has changed in a formal program in 2006. In this formal program the criteria which determine the distribution of IOF funds over the universities will be gradually changed and in the end (2010) for 70% be based on the track record of the universities.

Scope: Overall budget is € 34.3 million. In 2004 € 2 million was available, in 2005 € 10 million, in 2006 € 11.3 million, € 11.5 million in 2007 and there is a planned budget of € 16.7 million for 2008.

#13. Enterpreneurship Action Plan

Objective: General support for entrepreneurship.

Description: Offered by the Flemish government. This plan consists of the following:

- Dna-vouchers ('dare after taking advice'). A support measure subsidizing professional advice in developing a business plan and carrying out a feasibility study for persons that want to start a company
- Free start-up ('Gratis Opstart'). A subsidy for starters whereby the Flemish government is financing a number of administrative start up costs for new enterprises
- Advice vouchers. Subsidizes the costs for attracting external know-how for SMEs
- Life-long learning vouchers. Subsidizes education for employees and entrepreneurs
- Growth premium. Supported investments in existing enterprises in the Flemish region (also see #8)
- Investment support for strategic projects and ecological investments
- 'Peterschapsprojecten' or mentorship projects. Subsidy for programs that promote the exchange of experience between entrepreneurs (also see #28)
- Subsidies for industrial estates and buildings: A special part of this subsidy is aiming at science parks and incubators and is described separately
- Subsidies for sustainable investments.

The VLAO (Flemish Agency for Entrepreneurs) was set up to implement the Entrepreneurship Action Plan and to give advice to entrepreneurs. These four first-mentioned vouchers have recently been integrated in a new support mechanism of the Flemish Government, called BEA (Budget for Economic Advice).

Scope: Depends on the specific measure. In general the support programs target SMEs and have low administrative barriers (internet application, simple procedures).

#14. NRC Fund

Objective: The NRC Fund is supposed to supply high-tech companies with loans (under market conditions) to finance non-recurring costs of investments in product development.

Description: Offered by the Flemish government, in the form of subsidized loans (including interest allowances). The loans must be paid back depending on the income that applicants get from the production based on the investment supported.

Scope: Criteria for eligibility and overall budget not yet known.

#15. ARKimedes

Objective: The Flemish government provides fiscal incentives to mobilize private capital of individuals. This capital is then used to match private venture capital. In this way the available VC is doubled with limited costs for the government.

Description: Offered by the Flemish government, in the form of venture capital (including subordinated loans) and tax incentives (including reduction of social charges). The ARKimedes Fund is a public initiative, managed by the Flemish Holding Company. The ARKimedes fund is, with fiscal incentives, attracting investments (shares or bonds) from private persons in Flanders. These investments are put into a fund that

invests in private Venture Capital Funds with a professional management and successful track record. The ARKimedes investment in a fund is 50%. These funds (the so-called ARKIVs) invest in start up and expansion of SMEs in Flanders. The investment of an ARKIV is always smaller than 1 million euros, and is not influenced by the ARKimedes fund. The ARKimedes fund does not interfere with the decision process of the ARKIV to invest in a company.

Scope: Investments can be made in start-ups and SMEs that are seeking for expansion and must lead to creation of jobs or added value in Flanders.
Overall the ARKimedes-Fund budget is € 106.4 million. If this budget is invested in 2005-2010, € 218 million will be invested in SMEs. Early 2008, the ARKIVs invested already in 59 portfolio enterprises in Flanders for a total amount of € 42 million.

#16. Win-win loan

Objective: Start-up companies normally need only limited amounts of money that are too small for VC providers and too risky for normal banks, because these start ups have no track record. Financing is in general provided by friends, family and other fools. By giving these private capital providers a fiscal incentive and a limited guarantee the Flemish Government tries to increase the availability of capital for start ups.

Description: Offered by the Flemish government, in the form of venture capital (including subordinated loans) and tax incentives (including reduction of social charges). In order to increase the availability of private capital for start-up enterprises the Flemish Government intends to provide fiscal incentives for business angels who want to invest in start ups. The investors get a tax reduction of 2.5 % of the win-win loan. The win-win loan is a subordinated loan of maximum € 50 000, running for 8 years. The loan must be repaid in one installment. If the loan is not repaid the investor receives an additional fiscal reduction of 30% of the loan.

Scope: Only start-ups (SMEs) can apply. The creditor must be a natural person, not employed by the start-up company and not the spouse of the entrepreneur. Overall budget in 2008 is 2 milllion euros.

#17. Young Innovative Companies

Objective: Financial aid for innovation and financing newly created, innovative SMEs for which the risk of failure to access other modes of financing are more difficult.

Description: Offered by the Federal government of Belgium, in the form of tax exemptions on labor costs (including overheads). The measure provides a partial exemption of tax deducted at source on wages of personnel involved in R&D for small businesses qualifying as 'Young Innovative Company'. This exemption gives the institutions employing researchers more financial resources which they can immediately use in whatever way they deem most economically appropriate to boost their efforts in terms of employing researchers, launching new research programs or investing in new R&D material.

Scope: Young Innovation companies are defined based on the following criteria
- involved in research to the extent that 15% of the company's expenses are R&D expenses
- small companies only (no more than 50 employees and € 6.25 million turnover VAT excluded)
- in existence for less than ten years and only 'truly' new companies qualify, excluding those generated from concentration, restructuring or extensions of activities.

#18.One-off Innovation Premium

Objective: The measure is part of the Federal Government's effort to promote and stimulate investments in innovation and a more creative economy. The measure is essentially an award or bonus that employers can grant to innovative or creative employees who have helped to develop specific technological or non-technological

innovations which create additional value and are implemented or at least developed to their prototype phase.

Description: Offered by the Federal government of Belgium, in the form of tax incentives (including reduction of social charges). The bonus rewarding an innovation attributed by employers to employees is excluded from the income base which serves as reference for the calculation of social contribution, personal income tax or non-resident tax.

Scope: Eligible to all companies. From the point of view of social security, the innovation premiums are not considered as being remuneration and are therefore exempt from social security contributions under a number of conditions.

#19. Applied Biomedical Research with a Primarily Societal Finality

Objective: This program aims to support development of research on new therapies and diagnosis methods, which are not so interesting for industry but do have a large societal importance. The measure supports the development of diagnosis and treatment methods that will not be developed by industry, or any other party because the number of patients is too small for economic viability.

Description: Offered by the Flemish government, in the form of grants. The program focuses on biomedical research with a clinical application in therapies or diagnosis, and applied research to translate scientific findings into clinical applications.

Scope: A project must be submitted by a consortium of Flemish non-profit research organizations, including at least one Flemish hospital. Non-Flemish partners may participate up to 20% of budget. Minimum project size is € 250 000, maximum € 750 000, duration of the project is 2-3 years. Industrial interest for the result of the project is not allowed.
Overall budget € 10 million. € 5 million is available for the years 2006 and 2007. In 2008, € 6 million was budgeted.

#20. Flemish Cooperative Innovation Networks - VIS

Objective: This measure focuses on the optimization of the exchange of knowledge between knowledge centers and companies, in particular SMEs. Targeted actors are intermediary organizations active in the area of supporting technological innovation in companies.

Description: Offered by the Flemish government, in the form of grants for collective research, technological services (provide technological support by answering questions, but also through a more pro-active approach, to companies that are conducting innovative activities), sub-regional innovation stimulation (activities of innovation stimulation targeted at companies in certain areas), thematic innovation stimulation, feasibility studies to prepare collective innovation initiatives like foresight such as road mapping, and cooperation projects to develop tools to increase the performance of the Flemish Innovation network.

Scope: Projects should be submitted by a collective center recognized by the VIS Decree, a consortium of mainly Flemish companies or an organization that represents a group of companies, such as a professional federation, or a combination of the three previous possibilities. Applications are examined per project type. Overall budget 2001-2003 was € 61 million. In 2001 € 12.5 million; in 2002 € 34.8 million and in 2003 € 13.5 million. The budget in 2005 was € 17.0 million and in 2008 € 26.6 million.

#21. University interface services

Objective: The main goal of this measure is to encourage universities to strengthen their role in economic innovation in Flanders through the valorization of their scientific and technological knowledge. This measure will be broadened so that other institutes of higher education and research institutes will be included.

Description: Offered by the Flemish government, in the form of grants. The services should be organized as an easily accessible window or 'business counter' for every company that wishes to approach the university. The Flemish government supports the

interface activities of universities in the following fields: stimulation of co-operation between university and industry, promotion of the creation of spin-off companies, valorization of research results in industry, support for IPR in universities.

Scope: All interface services are eligible. Overall budget was over € 10 million in the past six years. For the years 2002, 2003, 2004 and 2005, the budgets were of respectively € 1.307, 1.326, 1.345 and 1.365 million. The budget for 2006 was € 2.084 million and rose to € 2.762 million in 2008.

#22.Tax deduction for R&D investments and patents acquisition

Objective: Aims to strengthen the financing of private R&D activities and to promote investments in R&D.

Description: Offered by the Federal government of Belgium, in the form of tax incentives (including reduction of social charges). The investment allowance permits the deduction, from the tax base, of quota related to the amount of R&D investments made in the course of the tax period. R&D investments also include the acquisition of patents.

Scope: The investment allowance applies to investments in tangible or intangible fixed assets newly acquired or created during the tax period and which are assigned in Belgium for the exercise of a professional activity. The rates vary according to criteria relative to the number of employees, size of the investments, and more.

#23. OPRI-DIE - Office for Intellectual Property

Objective: OPRI-DIE is part of the Federal Ministry of Economic Affairs. This office provides various services concerning information on patents, trademarks and models. In the context of innovation support, and beyond the traditional role of administering IPR, important roles of this service are, first, to increase access to the sources of technical and strategic information contained in patents; and second, to conduct awareness-raising activities in the field of IPR.

Description: Service to clients of the office OPRI-DIE, financed by the Federal government. Promote patents, trademarks and models in view of the low and decreasing number of EPO patent and high-tech patent applications. It is a also regulatory obligation for every Member State in the EU.

Scope: Accessible to all enterprises located in Belgium. Services are also open to (and effectively used by) organizations in charge of delivering services to enterprises.

#24. R&D projects of companies

Objective: The measure targets (large or small) enterprises with activities in Flanders that wish to realize an innovation through an R&D project and that need to acquire scientific-technological knowledge for this purpose. Companies may collaborate with other companies and/or universities or research institutes. Results should be valorized in Flanders.

Description: Offered by the Flemish government, in the form of grants. The R & D projects must pursue an economically relevant innovation, for the realization of which a technical-scientific problem needs to be solved. Three types of activities can be supported: industrial basic research, prototype or development activities and mixed research (R&D activities with aspects of industrial basic research as well as development).

Scope: The measure applies to any company, SME or multinational, located in the Flemish region. Applicants and partners may also be of foreign origin. Overall budget approximately € 420 million (2001-2006). The support was approximately € 70 million per year in the period 2001-2005. In 2006 about € 83 million was invested, while the budget for 2007 was € 107 million.

#25. Tax deduction for increase in R&D personnel

Objective: The measure is a long standing tax incentive aimed to support Belgian enterprises which are carrying out scientific research or technological development and thereby

boost the research and innovation intensity of the economy. The deduction is not automatic and requires the deliverance by the Federal Science Policy Office of a certificate attesting to the qualifications of the personnel for which the deduction is claimed and the nature of their activities.

Description: Offered by the Federal government, in the form of tax incentives (including reduction of social charges). All Belgian enterprises have the possibility to obtain a tax deduction (exemption) for hiring, and thereafter maintaining on an annual basis, for additional members of personnel assigned to scientific research, the development of the company's technological potential, or to the management of the total quality department. The tax deduction amounts to an exemption on paying taxes on the profits of the company. The deduction is doubled if the person hired is a highly qualified researcher.
This measure will be discontinued as of 2008 tax exercise, being slowly replaced by the partial exemption for advance tax payment for researchers hired by enterprises, which is a simpler tax credit scheme.

Scope: The overall budget annually amounts to about € 15 million and depends on the level of recruitment (maintenance) of personnel fulfilling the criteria on an annual basis.

#26. Tax deduction for patent income

Objective: The main purpose of this new Belgian incentive is to increase technical innovation in Belgium by stimulating the patenting of innovations, and licensing of patents.

Description: Offered by the Federal government, in the form of tax incentives (including reduction of social charges). Belgium has introduced a special tax deduction of 80% on the tax base for patent income in a new programming law in April 2007. As a result of this deduction, patent income would be subject to an effective Belgian tax rate of 6.8% (i.e. one-fifth of the Belgian statutory tax rate). The regime applies not only to self-developed patents but also to certain patents acquired and licensed from third parties. There is no cap on the amount of deduction that can be claimed. It can be combined with other important features of Belgian domestic tax law.

Scope: This regime only applies to patents and additional protective certificates, but other intellectual property rights such as copy rights and trademarks do not qualify for the tax deduction.

#27. R&D Tax Credit

Objective: This measure aims to improve presentation in accounting terms of the cost price of R&D so that by transforming it into a tax credit, which can be reimbursed over time, the fiscal advantage currently linked with the deduction for investment (#22) can be directly used to reduce operational R&D costs. This should facilitate and clarify international comparisons of the cost of R&D within international groups, and thereby enable a better evaluation of the advantages linked with basing R&D activities in Belgium.

Description: Offered by the Federal government, in the form of tax credits for R&D related expenditure including patents. A tax credit for research and development in favor of companies has been introduced in December 2005. This tax credit came into force from 2007 tax year onward. This tax credit applies only to patents and assets tending to promote the research and development of new products and advanced technologies which have no effects on the environment or aim to reduce negative environmental effects. This measure aims in practice at offering companies the possibility of choosing irrevocably, as from a fixed tax period, for a new tax credit for R&D, instead of the current deduction for investment (#22), which offers the same tax saving as the tax credit for R&D. Like the deduction for investment, this tax credit may be applied in one go or spread. A taxpayer having irrevocably chosen for the tax credit can no longer benefit from the deduction for investment for the investments concerned.

Scope: This tax credit applies only to patents and assets tending to promote the research and development of new products and advanced technologies which have no

effects on the environment or aim at reducing the negative effects on the environment. All companies are eligible. The tax credit for R&D applies only as of the 2007 tax year. To date no data are collected on the financial impact of the measure.

#28. Mentorship Programs ('Peterschapsprojecten')

Objective: Transfer of knowledge and experience between entrepreneurs and experienced corporate level staff in order to professionalize management skills.

Description: Offered by the Flemish government. The mentorship programs are also classified as part of the entrepreneurship action plan (#13). Each entrepreneur or company comes at a point where new decisions have to be made. Mentorship programs aim to support these crucial moments by sharing experiences with executives from large companies or with senior entrepreneurs (free of charge). Activities include group discussions, networking events and individual coaching.
Mentorship programs are project based. Its calls for proposals are open to any public or private entity that is planning to organize a mentorship program for at least 60 companies based in Flanders. Examples of such programs are VOKA's PLATO project and UNIZO's OVO project.

Scope: The Mentorship Program budget varies from one year to another. It is very important that subsidized projects are targeted at decision makers with a clear and unmistakable impact and influence on strategic decisions within their company. The Flemish government reserved € 3 million for 2008.

#29. Hercules Foundation

Objective: The Hercules Foundation is a government agency, created to finance the purchase and exploitation of research infrastructure for strategic basic research in all scientific disciplines.

Description: Offered by the Flemish government, in the form of grants. The Hercules Foundation finances medium to heavy research infrastructure investments by Flemish universities or other higher education institutes. It must however always consider and promote the possibility of sharing expensive research infrastructure among multiple public knowledge institutions or between public and third party research institutes. For that reason, subsidized percentages will be higher if requests are made by a consortium.

Scope: For medium research infrastructure investments, initiatives are divided into two categories: Hercules 1 initiatives can range from € 150 000 to € 600 000 and if accepted they get 100% subsidy for all relevant costs. Hercules 2 initiatives range from € 600 000 to € 1.5 million and get a 70% subsidy. This percentage can be raised in case of collaboration. Heavy research infrastructure investments are above the € 1.5 million mark. The Flemish government reserved € 15 million for 2008.

#30. Special Research Funds ('Bijzonder Onderzoeksfonds')

Objective: Because of special research funds, each university has the means to finance basic research.

Description: Offered by the Flemish government, in the form of grants. Each university may follow its own policy, whereby both projects and mandates can be financed. The exact distribution of the funds is calculated based on four parameters: the number of second cycle degrees, the number of doctoral degrees, the number of citations and publications and finally also the share in the total amount of the operational payments. The mechanism was recently revised. The most important changes were the newly created Methusalem financing tool (#32) and a modified distribution calculation to attract more foreign and female researchers.

Scope: In 2006, approximately € 100 million was distributed over all universities.

#31. Flemish Young Enterprises - VLAJO

Objective: Introducing and inviting children and adolescents to entrepreneurship.

Description: Offered by the Flemish government. VLAJO contains several initiatives inviting

children starting at age 5 to 'dream, do, dare and persist'. This initiative is in line with Flemish Minister of Education Frank Vandenbroucke's concept and policy of a competence agenda. The most popular activities, mostly in close harmony with the children's schools are 'The Dream Factory', Kid@Bizz, Jieha!, Mini-enterprises and Small Business Projects.

Scope: ---

#32. Methusalem

Objective: Structural financing mechanism for top researchers.

Description: Offered by the Flemish government, in the form of grants. The program is designed to provide top researchers at Flemish universities with longer term and structural financing, instead of the standard procedure of project based financing of research work. The potential instability of both the team and the project's financial window has more than once terminated promising research projects before their final stages. To overcome these issues, universities can hand in an application dossier containing a seven year research plan. An international panel of experts then examines the candidates' status of international excellence.

Scope: In 2006, the Flemish Government reserved € 3 million, to be distributed to all participating universities through the same algorithm as the one used for the Special Research Funds (#30). The budget increased to € 10 million in 2007 and € 15.2 million in 2008.

#33. Odysseus

Objective: Giving top researchers who built their career abroad the chance to come to Flanders to continue their work here in the best possible circumstances (academic staff, research infrastructure, etc).

Description: Offered by the Flemish government, in the form of grants. Flemish universities select potential candidates after a call from Flanders' FWO, while they introduce scientists worldwide to Odysseus. The candidacies then go to FWO, the Flanders Research Foundation, which will appoint an international, multi-disciplinary jury to evaluate whether a scientist can be allowed to the program.

Scope: As from 2006, an (indexed) amount of € 12 million was reserved for Odysseus. The Flemish government budgeted € 12.1 million in 2007 and € 12.3 million in 2008.

#34. Economy – Education Bridging Projects

Objective: Support collaborative projects between educational organizations and companies in order to stimulate entrepreneurship for children and adolescents. The focus is on 'the entrepreneurial attitude or mindset'.

Description: Offered by the Flemish government, in the form of competition-based grants. Applications have to be submitted with an official form following an official and competition based call.

Scope: Selected projects receive 50% support, the other 50% has to be financed by the private partner(s). The maximum support is € 250 000 and for both calls (in 2003 and 2006) so far € 2.5 million was set aside.

Annex V: Policy measures in Estonia

This annex first presents the inventory of Estonian policies for 2004-2006, then proceeds with the 2007-2013 period. For the latter period the presented information has been gathered from official legislative acts concerning specific programs and also from the Operational Plans to guide the implementation of EU Structural Funds. In case no official data are available, information has been obtained from other public sources and presented in *italics*.

Policy inventory 2004-2006

#1. R&D Financing Program

Objective: Scheme foresees the financing of the enterprises R&D projects with grants and loans and R&D institutions with grants. The main objective is to increase the competitiveness of enterprises through developing new or improved products, services, technologies or processes.

Description: The scheme consists of 3 parts: a) financing of enterprises' applied research and product development projects; b) financing of R&D institutions' applied research projects; c) financing the feasibility studies of applied research and product development projects. The program was designed to support the planning and initiation phases of applies research and product development (e.g. planning processes and technology strategies, market and competition assessments, patent surveys, preparation of international applied research projects or product development, technology feasibility studies etc.). The program has clear links to technology development e.g. it does not support basic research, developing business model without development of related technology etc.

Scope: Program applicant can be: a) Estonian enterprises, b) R&D institutions.
The grants provided are at least around € 6000 and the grants cover from 50 to 75% of the overall cost of enterprise applied research projects, from 25 to 50% of the overall costs of enterprise product development projects. The R&D institutions applied research projects are supported in general in the amount of 50 to 75% of the overall costs. In case of wider socially relevant and accessible impact of the R&D institution's applied research the grant can cover 100% of the cost of the project. The system prescribed also grants for pilot studies relevant for applied research or technology development projects (up to around € 12 500).
The average annual budget for the program was around € 4.8 million. The activities under the funded projects were designed to be finished by October 2008, the latest.

#2. Competence Centers Program

Objective: Co-financing (through grants) the technology competence centers, which are founded and leaded together by (at least) 3 enterprises and 1 research centre. The general objective is to increase the competitiveness of enterprises through strengthening the strategic and long-term collaboration between enterprises and R&D institutions.

Description: The 4 main aims are as follows:

a) gathering together the critical amount of competencies in specific or at least complementary fields;
b) increasing the long-term R&D planning and management capacities in both enterprise and academic sectors;
c) increasing the number of R&D workers fulfilling the needs and expectations of enterprises and increasing the mobility between academics and enterprise sectors;
d) supporting the internationalization of R&D activities.

The purpose of the centre is to implement the research activity important to the founders. The main focus is on applied research indicated in the project plan of respective competence centre, but the centre could put into practice product development projects and basic research if the founders perceive it necessary (and produces supplementary funding). The program does not support projects related merely to infrastructure investments, developing new business models or design options, conducting only basic research, concentrating upon defending intellectual (including industrial) rights.

Scope: Applicants can be recognized existing technology competence centers (whether business or non-profit entities) that are created by at least one R&D institutions and 3 enterprises.
The budget of the program was around € 19.2 million for the 2004-2006 period. The activities under the funded projects were designed to be finished by June 2008, the latest.

#3. Estonian Patent Office

Objective: The Estonian Patent Office (hereafter: Office) is a government agency which operates within the area of government of the Ministry of Economic Affairs and Communications and has a directing function on the bases and to the extent prescribed by law. In fulfilling its tasks, the Office represents the state.

Description: The area of activity of the Office is to implement the directing function in the field of the legal protection of industrial property within the extent of tasks prescribed by law.
The objective of the operation of the Office is to implement national economic policy in the field of legal protection of industrial property.

Scope: The main functions of the Office are:
a) to provide legal protection to the objects of industrial property in the name of the state, and to inform the public about the providing of legal protection and about its validity;
b) to participate in the development and implementation of legislation within its area of activity, and to submit proposals for the amendment and supplementation of such legislation;
c) to participate in the development of policies, strategies and development plans within its area of activity; to prepare and implement projects connected with its area of activity, including participation in the preparation and implementation of international projects.

#4. Enterprise Incubation Program

Objective: Main goal of the Enterprise Incubation Program is to support (through grants) the emergence and sustainable development of innovative companies with high growth potential. This is to be achieved through incubation services development and provision in Estonian enterprise incubators.

Description: The financing is provided for feasibility study of founding the incubator (up to 6,400 euros and maximum 80% of eligible costs), development activities (e.g. exchange of experiences and best practices both internationally and locally), and providing of incubation services (e.g. consultations, counseling, information mediation etc.) (up to 192,000 euros and maximum 75% of eligible costs).

Scope: Applicants may be:
a) registered private organizations offering incubation services
b) vocational and higher education institutions in case the applications centers on the pilot study on the feasibility of initiating incubator service

The activities under the funded projects were designed to be finished by June 2008, the latest.

#5. Estonian Centre for Standardization

Objective: Estonian Centre for Standardization (EVS) is a non-profit association recognized by the Government of Estonia as the national standards body. It started its operations

as provided by the Technical Regulations and Standards Act on April 1, 2000.

Description: According to the Statute, the main responsibilities of EVS are as follows:
1) participation in the work of international and European standards organizations;
2) compiling the Estonian standards program;
3) notification of foreign states' and international standards organizations about the draft and adopted European standards and of the standards program;
4) elaboration of the proceeding requirements for drafting Estonian standards;
5) adoption, amendment, declaring void, publication information of and publishing of Estonian standards, dissemination of information on standardization;
6) maintenance and making available to the public of Estonian standards, standards of other states, international and European standards, and publications on standardization;
7) providing information, training and certification services;
8) establishment of standardization infrastructure and supporting its activities;
9) sales and dissemination of Estonian standards.

Scope: EVS is funded from the state budget, international co-operation projects and income obtained through providing services related to standardization. The state budget finances the membership fees of international organizations, elaboration of national standards based on a specified plan and development of technical infrastructure (library, notification, official publication), elaboration of standards program and procedural rules for adopting a national standard. International projects provide finances mainly for the development of standardization and strengthening EVS.

#6. Spinno Program

Objective: The emphasis of the SPINNO program is on having a comprehensive approach, including all phases of commercializing an innovative idea e.g. also increasing the cooperation between enterprise and R&D sectors. The emphasis is placed on building up and strengthening capacity at universities for supporting entrepreneurship and ability to manage spin-off processes. The support is provided through grants.

Description: The program supports activities, which contribute to the increase of entrepreneurship in universities and the development of a systemic higher education environment, which should promote entrepreneurial activities. The activities include the development of a regulative framework, patent and license policy, promotion of the emergence of spin-off enterprises and their growth, including the creation of access to capital markets and co-operation networks with enterprises. Three main goals are:
1. Raising the amount of research results of Estonian universities and research institutions that have found implementation in real business (including managerial and administrative support services and counseling)
2. Development of the entrepreneurship friendly environment in Estonian universities and research institutions (through creating substantive and administrative framework conditions, increasing the awareness about the issues of commercialization (through information dissemination and training activities, creating networks etc.)
3. Development of the interuniversity partnership in supporting the knowledge intensive entrepreneurship (including exchange of knowledge and experiences, participating in different networks etc.)

Scope: Applicants may be:
a) R&D institutions owned by the government or acting as a legal person in public law;
b) public higher education institutions.
Maximum grant was designed to reach about € 955 000 (amounting up to 65% of eligible costs), the total budget for the 2001-2006 period was around € 4.1 million. The activities under the funded projects were designed to be finished by February 2008, the latest.

#7. InnoAwareness

Objective: InnoAwareness program (grant scheme) foresees a broad improvement of innovation awareness via various publications, seminars, and training programs, innovation prize and also aims at involving the media. The main goal is to raise the awareness of innovation subject and its role in competitiveness of enterprises, and as a warrantee of economic growth and social welfare increase among different actors of innovation system and wider public.

Description: The Innovation Awareness Program aims to increase the awareness of innovation as an important factor of economical growth and to reinforce knowledge and know-how on innovation methods and tools. Enhanced innovation awareness is instrumental for Estonian businesses in increasing their productivity, the results of which would widen their opportunities in expanding markets, strengthen products and services as well as leading to successful company management.

The program covers the following activities: development of knowledge and information about the societal impact of innovation among policy makers; development of public interest (including media, opinion leaders) and positive attitude towards innovation and development of general knowledge about how to disseminate information on innovation; development of skills and knowledge about the centrality of innovation for competitiveness among entrepreneurs, managers and investors; development of creativity and innovation management skills among specialist and engineers; development of skills and knowledge about innovation and entrepreneurship among scientist, university students and teachers, among regular students and teachers, and among general public. This may be achieved through research, surveys, seminars, exhibitions, training schemes, publications and its' dissemination, competitions etc.

Scope: Applicants may be:
a) legal person in public law
b) government organization
c) private organization

The budget for the program was around € 1.5 million for the 2002-2006 period. The grants were intended to cover up to 100% of eligible costs and the amount was set between € 6 400 and around € 95 000. The activities under the funded projects were designed to be finished by June 2008, the latest.

#8. Innovation Audit Program

Objective: Innovation Audit Program (pilot program in 2005) is targeted to small and medium-sized enterprises and the impact of the program is gained through raised innovation awareness in these companies. The nature of the program is that trained consultant carries out an innovation audit (IA) in the company. Auditor's work in the company is rewarded directly from Enterprise Estonia.

Description: After that IA reports are compiled and the bottlenecks and opportunities are discussed with the company. Based on the IA results, the consultant in collaboration with the audited company puts together action plan, which brings out both short and longer term activities. Taking into account the results alternatives are proposed to the company on how to implement the above-mentioned activities, including e.g. the opportunities of financing those activities via EU programs. Consultant carries out an innovation audit (IA) in the company. After that IA reports are compiled and the bottlenecks and opportunities are discussed with the company. Based on the IA results, the consultant in collaboration with the audited company puts together action plan, which brings out both short and longer term activities.

Scope: Directed towards: SMEs and other companies. The budget for the 2005 pilot project was approximately € 163 000 and the project carried out audits in around 60 companies.

#9. Enterprise Estonia – support organization for enterprises

Objective: Enterprise Estonia, a government agency, is one of the largest institutions within the national support system for entrepreneurship in Estonia, providing financing products, advice, partnership opportunities and training for entrepreneurs, research and development institutions and the public and third sectors. Enterprise Estonia was founded in 2000 by the Ministry of Economic Affairs with the aim of promoting the competitiveness of the Estonian entrepreneurial environment and Estonian businesses, thereby increasing prosperity.

Description: Enterprise Estonia actively operates in the following areas: the enhancement of the competitiveness of Estonian enterprises in foreign markets, the inclusion of foreign direct investments, inbound and domestic tourism, the elaboration of technological and innovative products and services, the development of Estonian enterprises and the entrepreneurial environment and the enhancement of general entrepreneurial awareness. The activities are carried out by the central agencies and its regional centers.

Scope: Enterprise Estonia is one of the institutions responsible for the implementation of EU structural funds in Estonia, as well as being the primary provider of support and development programs targeted towards entrepreneurs. Thus, it's budget and scope of activities is mainly dictated by the Structural Funds policies.

#10. Training Scheme

Objective: The program was developed to support (through grants) retraining and continuing training activities in enterprises to maintain and increase the competitiveness of employees on the labor market, to develop entrepreneurship, create conditions for the emergence of new jobs, and to increase the capabilities of employees in the fields of R&D and technology development.

Description: The eligible activities were intended to include:
a) general work and management related continuing training;
b) specific work-related continuing training.
This training was intended to be carried out in customized training schemes (e.g. not general education, conferences, training offered for unemployed, general and not work-related language courses, etc.)

Scope: Applicants may include:
a) self-employed entrepreneur and Estonian enterprises (with less than 25% of public sector ownership);
b) registered employers associations;
c) registered occupational associations.
The activities under the funded projects were designed to be finished by July 2008, the latest.

#11. Mentoring/Counseling Program

Objective: The objective of the measure was set to support (through grants) the growth of enterprises and the creation of new jobs by providing necessary knowledge and skills for entrepreneurship and helping entrepreneurs in finding new markets.

Description: The initial activities supported included counseling on the following topics: development of business-, financial, marketing- and strategic development plan; managerial consultations; personnel development; work related security and health; quality and environment management; feasibility and patenting studies; production and technology related counseling; activity analysis; etc.

Scope: Applicant may be self-employed entrepreneur or an SME registered in Estonia with less than 25% share held by the state or local government unit.
The grant covers up to 50% of eligible costs with the maximum rate of reimbursement set at around € 12 500.
The activities under the funded projects were designed to be finished by August 2008, the latest.

#12. KredEx – credit and guarantee organization

Objective: The Credit and Export Guarantee Fund KredEx was founded in 2001 by the Ministry

of Economic Affairs and Communications with the aim to improve the financing of small enterprises in Estonia, decrease export-related credit risks, enable people to build or renovate their homes and promote energy efficiency in Estonia.
The mission of KredEx is to help raise the competitiveness of Estonian enterprises and the improvement of living conditions. The vision of KredEx is to offer financial solutions based on the best practices from the world.

Description: The agency is active in 3 areas of activity:
a) business – providing start-up loans, equity loans, business loan guarantee, guarantee for bank guarantee, leasing guarantee;
b) export – short-term credit risk guarantee, long-term credit risk guarantee, pre-shipment guarantee, investment guarantee;
c) housing – different loan guarantees and grants.

Scope: ---

#13. Export Plan Program

Objective: The objective of the measure was set to support the growth of enterprises and the creation of new jobs by providing necessary knowledge and skills for entrepreneurship and helping entrepreneurs in finding new markets. The measure provides support for developing and/or implementing an export plan. The support is provided through grants schemes.

Description: The program covers the consultation costs of developing an export plan. For implementing the export plan, the program offers support for acquiring consultation, participation in foreign fares, conduction foreign market research, visiting foreign markets, carrying out activities directed towards target markets, preparing advertisement materials for the foreign target market. Each applicant can apply for one grant per product, service or market.

Scope: Applicant may be a business entity registered in Estonia with less than 25% share held by the state or local government entities. The grant covers up to 50% of eligible costs and the maximum of the grant for developing an export plan is around 4800 € and for implementing an export plan around € 64 000.
The activities under the funded projects were designed to be finished by August 2008, the latest.

 # 14. Start-up Program for Enterprises

Objective: The objective of the program was set to increase the chances of emergence, survival and development of SMEs through increasing the access (through grants) to finance.

Description: The program was developed for the following activities:

a) support for the acquisition of necessary basic assets needed for the implementation of specific project;
b) renovation of production or service facilities required for the implementation of a specific project

Scope: Applicant may be an enterprise that is being founded or that has not been registered for more than 12 months and where other private legal entity or legal entity under public law does not have a share. The grant cover up to 75% of eligible costs and the limit was set to around € 3 200 and € 10 200 depending on the average planned sales profit of the company during the first three years. The activities under the funded projects were designed to be finished by July 2008, the latest.

#15. Centers of Excellence Development

Objective: The objective of the program is to enhance the R&D&I related capacities in Estonia, to increase the competitiveness of Estonia in the ERA, and to create and maintain leading competencies of R&D. This is seen to be achieved through supporting (through grants) a limited number of centers of excellence in the fields relevant for the economic growth of Estonia thereby developing RD infrastructure to correspond to the needs of the contemporary RD activities, providing help for repatriating

Estonian scientist and bringing foreign scientists to Estonia.

Description: The centers of excellence could apply for support for their infrastructure development (including labor costs of people involved in the project and general costs of infrastructure development). The eligible grants deal with the following challenges:
a) creating conditions for the emergence and transfer of the socially relevant knowledge;
b) bringing together top level scientific potential to competitive entities and thus supporting the realization of larger strategic research projects and interdisciplinarity of research;
c) providing the necessary pool of top scientist for increasing the capacities in the fields of entrepreneurship and R&D that are viewed important from the point of economic and social development;
d) creating better potential for the participation of Estonian scientist and entrepreneurs in international collaboration.

Scope: Applicants may be R&D institutions owned by the government or acting as a legal person in public law that manage the centers of excellence. The maximum grant for one centre is € 1.92 million, co-financing is not obligatory (if only the project's whole costs are not higher).
The budget of the program was around € 6.4 million. The activities under the funded projects were designed to be finished by June 2007, the latest.

#16. Research Funding Schemes

Objective: General public funding of research in Estonia through different financing schemes.

Description: The central government funding is allocated through:
a) Targeted financing: this is provided through the budget of the Ministry of Education and Research; the annual amount of targeted financing of research topics is approved by the Minister of Education and Research on the proposal of the Scientific Competence Council;
b) Research grants: funds are allocates through the budget of the Ministry of Education and Research to the Estonian Science Foundation;
c) National research and development programs: funds for the implementation of national R&D programs are allocated to the ministry responsible for the implementation of a particular program;
d) Infrastructure expenses: additional funds for current expenditure (electricity, heating etc.) currently linked with the allocation of targeted financing.

Scope: R&D activities in Estonia are financed mostly through the central government budget and these schemes cover the vast majority of public research funding in Estonia.

 # 17. Archimedes Foundation

Objective: Archimedes Foundation is an independent body, a government agency, established by the Estonian government in 1997 with the objective to coordinate and implement different EU programs and projects in the field of training, education, research, technological development and innovation.

Description: The main objectives of the Archimedes Foundation are to manage and use the appropriations allocated to the Foundation to:
a) promote and modernize Estonian education and science systems and reinforce co-operation with other spheres of society;
b) prepare Estonian education, science systems and youth organizations for joining the European Union structures;
c) prepare Estonian education and science systems and youth institutions for participating in and implementing various programs of both the European Union and other programs.

Scope: ---

 # 18. Development Programs Vocational and higher education and R&D institutions infrastructure

Objective: The objectives of the measure where set to create material conditions for developing vocational and higher education that are internationally competitive and fulfils the needs of the labor market.
The general objective of the program is to increase the capability of research and development activities and innovation in Estonia through developing an internationally competitive RD infrastructure system providing comprehensive support to higher education, RD activities and innovation in strong and strategically important areas of RD.
The support is provided through grants.

Description: More specifically the measure was intended to create up-to date learning and research environment in educational facilities including the necessary technical base, and development of infrastructure (counseling and information mediation etc.) intended to provide for the smooth transition of the youth to the labor market. The sub-objectives of the program are: 1) to stimulate the strategic planning of RD activities, incl. establishing priorities and making financially sustainable investment decisions in RD institutions; 2) to increase the efficiency of the RD system as a whole through improved inter-relatedness between higher education, RD and innovation, through concentration of resources and enhancing cooperation within and between RD institutions, between different disciplines, between RD institutions and enterprises and at an international level; 3) to increase the human resources used in RD activities and to ensure the sustainable development thereof by increasing the number and quality of the scientists and engineers involved. The supported activities include the purchase and upgrading of infrastructure (labs and their equipment), libraries and databases, and planning and management of the listed activities.

Scope: Applicants may include:

a) state or local government owned vocational educational schools;
b) privately owned, but with share of state or local government ownership, vocational educational schools;
c) public higher education institution;
d) local and country governments;
e) counseling and information centers and open youth centers
f) educational NGO's and foundations

The grant covers up to 100% of eligible costs with the minimum set grant of about € 32 000. (the maximum size of the grant is set by the specific programs for the implementation of the measure). Applicants can be R&D institutions owned by the government or acting as a legal person in public law**.** Institutes and other sub-units can apply for the program through the R&D institution as such.
The grant was designed to cover up to 100% of the eligible costs with pilot applications having the maximum size of around € 95 500 and full applications falling between around € 1 915 000 to € 6 389 000.
The activities under the funded projects were designed to be finished by December 2008, the latest.

 # 19. INNOVE - Lifelong Learning

Objective: Foundation Innove, a government agency, has been established to promote initiatives and activities of lifelong learning through Estonian and EU programs in the area of human resources development. The mission of Foundation for Lifelong Learning Development Innove is to offer experience, advice and support to the organizations promoting vocational education and training, and life-long learning, and to the learning members of society.

Description: The Agency is mainly involved with management of the Structural Funds finances in the fields of vocational education and training, and life-long learning. Thus The Foundation's mission is to develop the human resource not only in the Estonian vocational education system, but more broadly – in the context of lifelong learning.

Scope: ---

#20. Program for educational system providing labor market flexibility, lifelong learning, access

Objective: The goal of the measure is to develop the human resources and its' competitiveness on the labor market through the development of education and training systems and creating a suitable environment for life-long learning and training opportunities.

Description: The specific goals of the measure are:
a) providing for the quality of education and training;
b) creating equal opportunities for acquiring education;
c) creating conditions and providing opportunities for life-long learning.
Some of the activities applicable for grants were set as follows: developing and application of the system for training of the pedagogical staff of both vocational and higher education institutions (including internationalization); curriculum development; development of counseling system; introduction of flexible learning opportunities (internship at the enterprises, e-learning etc.); development of mechanisms of life-long learning and prevention of the dropping out form general education systems; development of quality assurance systems; training and bringing in from abroad top specialists in the key areas of Estonian economy; widening the use of ICT applications in education; etc.

Scope: Applicants may be:
a) governmental organizations and their subordinate agencies;
b) local government entities and their subordinate agencies;
c) Estonian private legal bodies.
The budget of the program was approximately € 53 million. The grant covers up to 75% of eligible costs with the minimum grants size set around € 14 300. Specific activities eligible for grants were set by annual action plans.

 # 21. Program for equal labor market opportunities

Objective: The main objective was set to be to increase the efficiency of prevention and provide rehabilitation for unemployment and social displacement, thereby increasing social inclusion.

Description: The primary goals were set to increase the speed and scope of the integration to the labor market of the unemployed and employees who have received a notice of lay-off.
The projects were devised to include either activities of the Labor Market Agencies or activities organized by other actors, but were mainly related to continuing training and retraining, general active labor market measures, language training, counseling and guidance for starting enterprises etc.

Scope: The applicants may include:
a) Estonian Labor Market Board and employment agencies
b) Other governmental and private organizations and local government units
The grants were set to cover up to 80% of eligible costs with the rest being finance from public sector expenditure. The budget for the program was planned to be approximately € 33 million.

 # 22. Estonian Competition Authority

Objective: Since January 1st, 2008, the previous Estonian Competition Board, Estonian Communications Board and the Energy Market Inspectorate have been merged into the new Estonian Competition Authority, dealing with supervisory activities in the areas of competition supervision, fuel and energy, electronic and postal communications.

Description: As a government agency it fulfills the supervisory functions in the following areas.
a) general supervision of fair competition;
b) fuel and energy;
c) electronic communication and postal services;
d) rail transport and infrastructure management.

Scope: ---

Policy inventory 2007–2013

##1. National Technology Programs

Objective: *The aim of the programs is to bring together the demand (private and public sector organizations) and supply (internationally recognized and competitive researchers) for certain technologies and their development to increase cooperation and initiate projects and programs of national and economic significance.*

Description: *Programs are financed by the MEAC and MER and other relevant ministries and the EU e.g. these are government programs with ear-market grants from other programs.*
The supported measures include (provisionally) targeted support (linked with to the 4 defined technologies with special fiscal allocations from other programs) for technology specific innovation projects, competence centers, adoption of new technologies, support for HR development, innovation awareness projects, intellectual property and technology transfer activities.

Scope:
a) *ICT (2008)*
b) *Biotechnology (2009)*
c) *Energy technologies (2009)*
d) *Material technologies (2010)*

Currently being designed.

##2. Cluster Program

Objective: *Programs aimed at less technology intensive sectors (compared to technologies covered under the technology programs) to initiate clusters and strategic cooperation between enterprises and aligning other enterprise support measures with cluster specific needs.*

Description: *The main aim is to increase cooperation between less technology intensive (traditional) and technology intensive enterprises. The clusters are identified and developed in a bottom-up manner (as opposed to technology programs) and will be supported based on their potential for sustainability and relevance to the economy in total. In principle these are programs with ear-market grants from other programs*

Scope: *The measure supported will include cooperation between enterprises in training, product development, export marketing and the sub-activities under them.*
Currently being designed.

##.3 R&D Financing Program

Objective: *Follow-up program. The program will continue to support projects aimed at development of products, services and technologies.*

Description: *The program will support both technological development (applied research and product development) by enterprises and applied research by R&D institutions aimed at creating economic added-value.*
Currently being designed.

Scope: *Planned budget approximately € 141 600 000.*

##4. Investments in New Technology

Objective: *The aim is to support (through grants) adoption of new technologies that will increase the efficiency of operating procedures and will increase the added-value of products.*

Description: *The program will be linked to the counseling, training, and mobility programs. Currently being designed.*

Scope: *Planned budget approximately € 45 000 000.*

##5. Competence Centers Program

Objective: *Follow-up program e.g. see policy measure #2 of the 2004-2006 period.*
Description: *Mid-term evaluation of the 2004-2006 period in progress and the current program is being designed.*
Scope: *Planned budget approximately € 86 500 000.*

##6. Estonian Patent Office
Objective: The Estonian Patent Office (hereinafter: Office) is a government agency which operates within the area of government of the Ministry of Economic Affairs and Communications and has a directing function on the bases and to the extent prescribed by law. In fulfilling its tasks, the Office represents the state.
Description: The area of activity of the Office is to implement the directing function in the field of the legal protection of industrial property within the extent of tasks prescribed by law.
The objective of the operation of the Office is to implement national economic policy in the field of legal protection of industrial property.
Scope: The main functions of the Office are:
a) to provide legal protection to the objects of industrial property in the name of the state, and to inform the public about the providing of legal protection and about its validity;
b) to participate in the development and implementation of legislation within its area of activity, and to submit proposals for the amendment and supplementation of such legislation;
c) to participate in the development of policies, strategies and development plans within its area of activity; to prepare and implement projects connected with its area of activity, including participation in the preparation and implementation of international projects.

##7. Enterprise Incubation Program
Objective: *Follow-up program e.g. see policy measure #4 of the 2004-2006 period.*
Description: *Currently being designed.*
Scope: *Planned budget approximately € 6 600 000.*

##8. Estonian Centre for Standardization
Objective: Estonian Centre for Standardization (EVS) is a non-profit association recognized by the Government of Estonia as the national standards body. It started its operations as provided by the Technical Regulations and Standards Act on April 1, 2000.
Description: According to the Statute, the main responsibilities of EVS are as follows:
1) participation in the work of international and European standards organizations;
2) compiling the Estonian standards program;
3) notification of foreign states' and international standards organizations about the draft and adopted European standards and of the standards program;
4) elaboration of the proceeding requirements for drafting Estonian standards;
5) adoption, amendment, declaring void, publication information of and publishing of Estonian standards, dissemination of information on standardization;
6) maintenance and making available to the public of Estonian standards, standards of other states, international and European standards, and publications on standardization;
7) providing information, training and certification services;
8) establishment of standardization infrastructure and supporting its activities;
9) sales and dissemination of Estonian standards.
Scope: EVS is funded from the state budget, international co-operation projects and income obtained through providing services related to standardization. The state budget finances the membership fees of international organizations, elaboration of national standards based on a specified plan and development of technical infrastructure (library, notification, official publication), elaboration of standards program and procedural rules for adopting a national standard.

International projects provide finances mainly for the development of standardization and strengthening EVS.

##9. Spinno+ Program
Objective: *Follow-up program e.g. see policy measure #6 of the 2004-2006 period.*
Description: *Currently being designed.*
Scope: ---

##10. Science and Technology Parks
Objective: *Further development of science and technology parks and their services.*
Description: *Currently being designed.*
Scope: *Planned budget approximately € 26 000 000.*

##11. Cooperation with Universities
Objective: *Development of technology transfer units (including awareness and skill rising of academic personnel concerning commercialization of intellectual property) and initiating long-term cooperation.*
Description: *Currently being designed.*
Scope: *Planned budget approximately € 13 500 000.*

##12. Innovation and Entrepreneurship Awareness Program
Objective: Partly a follow-up program e.g. see policy measure #7 of the 2004-2006 period. The aim of the program is to develop entrepreneurship and innovativeness and management skills of Estonian entrepreneurs through influencing general values in the society.
Description: The aims will be achieved through general awareness raising and information dissemination and through increasing the explicit managerial and entrepreneurial skills and capacities among Estonian entrepreneurs. The program is directed towards wide range of audience – from policy-makers and public opinion leaders and media to entrepreneurs, general public and students. The supported activities range from conducting surveys to media projects to publications, training sessions etc.
Currently being further designed.
Scope: *Budget approximately € 7 950 000.*

##13. Enterprise Estonia - support organization for enterprises
Objective: Enterprise Estonia, a government agency, is one of the largest institutions within the national support system for entrepreneurship in Estonia, providing financing products, advice, partnership opportunities and training for entrepreneurs, research and development institutions and the public and third sectors. Enterprise Estonia was founded in 2000 by the Ministry of Economic Affairs with the aim of promoting the competitiveness of the Estonian entrepreneurial environment and Estonian businesses, thereby increasing prosperity.
Description: Enterprise Estonia actively operates in the following areas: the enhancement of the competitiveness of Estonian enterprises in foreign markets, the inclusion of foreign direct investments, inbound and domestic tourism, the elaboration of technological and innovative products and services, the development of Estonian enterprises and the entrepreneurial environment and the enhancement of general entrepreneurial awareness.
Enterprise Estonia is one of the institutions responsible for the implementation of EU structural funds in Estonia, as well as being the primary provider of support and development programs targeted towards entrepreneurs.
Scope: ---

##14. Innovation Vouchers
Objective: *Aimed at increasing the demand by enterprises for innovation-support measures*

e.g. providing vouchers for companies with lack of experience in R&D for approaching R&D institutes and accessing sources of technology.
Description: *Currently being designed.*
Scope: *Planned budget approximately € 1 000 000.*

##15. Training Program (incl. training services)
Objective: *Follow-up programs – providing training services and training program e.g. see policy measure # 10 of the 2004-2006 period.*
Description: *Currently being designed.*
Scope: *Indicative budget approximately € 21 000 000.*

##16. Information Gateway for Entrepreneurs
Objective: *Providing information services for entrepreneurs.*
Description: *Currently being designed.*
Scope: *Planned budget approximately € 1 000 000.*

##17. Mentoring/ Counseling Program
Objective: *Follow-up program e.g. see policy measure #11 of the 2004-2006 period.*
Description: *Currently being designed.*
Scope: *Planned budget approximately € 2 650 000.*

##18. Estonian Development Fund
Objective: Estonian Development Fund is a public law entity founded by the Estonian Parliament on the basis of an Act of 2006 the objective of which is to initiate and support changes in the Estonian economy and society to help updating the economic structure, ensuring the export growth, and creating new jobs requiring a high qualification.
Description: The Development Fund performs risk capital investments into the starting and growth-oriented technology companies together with the private sector and carries out socio-economic and technology foresight. Within the framework of foresight, technology and field-specific development trends in the world are analyzed; in their light, long-term developments of the state of Estonia are forecasted, and the decision-makers (incl. entrepreneurs, politicians, and officials) are helped in making relevant management-related decisions. The ambition of the Development Fund is, on one hand, to develop Estonia into a regional centre of investment banking and, on the other hand, as an organization to be the centre of discussion handling the development of the Estonian economy.
Scope: ---

##19. KredEx – credit and guarantee organization
Objective: The Credit and Export Guarantee Fund KredEx was founded as a government agency in 2001 by the Ministry of Economic Affairs and Communications with the aim to improve the financing of small enterprises in Estonia, decrease export-related credit risks, enable people to build or renovate their homes and promote energy efficiency in Estonia.
The mission of KredEx is to help raise the competitiveness of Estonian enterprises and the improvement of living conditions. The vision of KredEx is to offer financial solutions based on the best practices from the world.
Description: The agency is active in 3 areas of activity:
a) business – providing start-up loans, equity loans, business loan guarantee, guarantee for bank guarantee, leasing guarantee;
b) export – short-term credit risk guarantee, long-term credit risk guarantee, pre-shipment guarantee, investment guarantee;
c) housing – different loan guarantees and grants.

Scope: ---

##20. Export Support Schemes

Objective: *Partly a follow-up program e.g. see policy measure #13 of the 2004-2006 period. Schemes foresee support for marketing, joint marketing, international trade fairs; export mentoring, export awareness, export information and databases. The support is provided through various policy measures, grants, subsidies.*

Description: Export marketing support sub-program – the goal of the program is to increase the competitiveness of Estonian enterprises through supporting planned, goal-oriented and comprehensive marketing (projects with duration from 1 to 2 years). Support will be provided (50% of the project cost, from € 10 000 to 100 000 per project) for product development to increase its compatibility with export markets, for activities related to entering chosen export markets, for development of brands and registering of trademarks in foreign markets (as indicated in the export plan) etc.
Currently being further designed.

Scope: *Total indicative budget approximately € 40 635 000, including* export marketing budget of approximately € 26 835 000.

##21. Services for Foreign Investors

Objective: *Services directed towards foreign investors to increase the incentives for their activities in Estonia.*

Description: *Currently being designed.*

Scope: *Planned budget approximately € 2 650 000.*

##22. Foreign Representative Offices

Objective: *Official representations of Estonia in foreign economic centers to foster links and communication between different regions, companies and Estonia.*

Description: *Currently being designed.*

Scope: *Planned budget approximately € 4 475 000.*

##23. Mobility Program

Objective: *Increasing the mobility of workers potentially beneficial and necessary for the innovative activities of enterprises e.g. providing support for increasing the mobility of highly skilled specialist and R&D workers.*

Description: *Currently being designed.*

Scope: *Planned budget approximately € 20 000 000.*

##24. International Cooperation Networks

Objective: *Increasing the cooperation and networking capacities on the international level.*

Description: *Currently being designed.*

Scope: *Planned budget approximately € 4 000 000.*

##25. Start-up Programs and Loan Guarantees

Objective: a) Start-up program
b) Start-up loan guarantee
c) Program for state guarantees on entrepreneurship loans and capital loans

Description: a) The objective of the program is to increase the chances of emergence, survival and development of SMEs through increasing the access to finance. This will be achieved through providing access to finance for the emerging promising small enterprises (75% of the project cost, up to 3200 €) and providing additional financing to already existing or emerging small enterprises with high export, growth and development potential (50% of the project cost, up to 12 800 €). Funding will be appropriated for activities related to organizational, product and process development (ICT applications, trademarks, design solutions, obtaining patents, licenses etc.)
b) The goal of the program is to increase potential financing opportunities of

emerging or infant SMEs with high export and growth potential for financing and investing in to their long-term development. The program will provide guarantees for up to 75% of the loan of SMEs that are too young and lack sufficient own capacities for independent loan servicing.
c) The goal of the program is to increase the innovative and growth capacities of enterprises through better access to capital loans and financing and investments of SMEs. The two activities include: a) financing capital loans; b) financing (up to 75% of the total cost) guarantees for loans and lease-purchasing

Scope: *a) Budget approximately € 7 500 000€*
b) Budget approximately € 6 000 000
c) Budget approximately € 18 725 000

##26. Centers of Excellence Development

Objective: The goal of the program is to support the Estonian R&D institutions in developing high-quality and internationally competitive R&D activities.

Description: The goal will be achieved through supporting (through grants) research groups that develop internationally competitive research environment, research topics, collaborations (both between researchers and with industry, and internationally) and sustainable research activities. The support will be provided (95% of the project, up to 7 665 000 € per project) for both research activities (from fundamental to applied to development) and management of the centers.

Scope: *Budget approximately € 37 635 000.*

##27. Research Funding Schemes

Objective: General public funding of research in Estonia through different financing schemes.

Description: The central government funding is allocated through:
a) Targeted financing: this is provided through the budget of the Ministry of Education and Research; the annual amount of targeted financing of research topics is approved by the Minister of Education and Research on the proposal of the Scientific Competence Council;
b) Research grants: funds are allocates through the budget of the Ministry of Education and Research to the Estonian Science Foundation;
c) National research and development programs: funds for the implementation of national R&D programs are allocated to the ministry responsible for the implementation of a particular program;
d) Infrastructure expenses: additional funds for current expenditure (electricity, heating etc.) currently linked with the allocation of targeted financing.

Scope: R&D activities in Estonia are financed mostly through the central government budget and these schemes cover the vast majority of public research funding in Estonia.

##28. Archimedes Foundation

Objective: Archimedes Foundation, a government agency, is an independent body established by the Estonian government in 1997 with the objective to coordinate and implement different EU programs and projects in the field of training, education, research, technological development and innovation.

Description: The main objectives of the Archimedes Foundation are to manage and use the appropriations allocated to the Foundation to:
a) promote and modernize Estonian education and science systems and reinforce co-operation with other spheres of society;
b) prepare Estonian education, science systems and youth organizations for joining the European Union structures;
c) prepare Estonian education and science systems and youth institutions for participating in and implementing various programs of both the European Union and other programs.

Scope: ---

##29. Infrastructure development program for R&D and higher education institutes

Objective: a) Infrastructure development program for R&D and higher education institutions;
b) *Program for developing research equipment*

Description: a) The goal of the project is to increase (public) investments into infrastructure development of R&D and HE institutions to increase the capacity of the education system to be internationally competitive and fulfill its strategic objectives. The main aims are to increase the capacities in the strategic fields, provide better working conditions and opportunities for pursuing excellence and partnership with other stakeholders (international partners, industry). The supported activities are set by the general investment plan.
Currently being further designed.

Scope: *a) Budget approximately € 128 700 000.*

##30. INNOVE - Lifelong Learning

Objective: Foundation Innove has been established as a government agency to promote initiatives and activities of lifelong learning through Estonian and EU programs in the area of human resources development.
The mission of Foundation for Lifelong Learning Development Innove is to offer experience, advice and support to the organizations promoting vocational education and training, and life-long learning, and to the learning members of society.

Description: The Agency is mainly involved with management of the Structural Funds finances in the fields of vocational education and training, and life-long learning. Thus The Foundation's mission is to develop the human resource not only in the Estonian vocational education system, but more broadly – in the context of lifelong learning.

Scope: ---

##31. Programs to develop R&D human resources

Objective: *The programs will complement the national technology programs with specific focus on the needs (related to human resource problems) in these areas.*

Description: *The supported measures will be aimed at:*

a) developing the key technology areas and educational science - supporting international temporary inward mobility of researchers and the mobility of Estonian researchers, collaborative project between enterprises and educational sector (reducing drop-out, developing teaching methods);
b) developing PhD studies – increasing the amount of positions, increasing financial security, flexibility, introducing Industrial doctorate schemes, enhancing the quality of PhD schools (consolidating the schools, enhancing cooperation with entrepreneurship sector and increasing the innovativeness and technology intensiveness of the outcomes, promoting internationalization), internationalization of PhD studies, introduction of internal PhD quality assessment system, counseling system;
c) developing internationalization and cooperation – increasing the mobility of researchers and PhD students between academic and enterprise sectors, targeted support for international studies, developing the recruitments capacities of R&D institutions;
d) increasing the conformity with KBE – programs for popularization of science, especially exact and natural sciences;
e) developing quality of higher education and science policy – carrying through an analysis of Estonian research policy, introducing monitoring mechanisms for the implementation of R&D&I Strategy, intensifying curricula development (introducing results-based approach) and introduction of monitoring and prognosis system (including personnel training);
f) developing E-learning.

Scope: *Currently being further designed.*

32. Life-long Learning Programs

Objective: *There are two main aims for the programs:*

a) increasing the participation in LLL based on needs and capacities - the supported programs will be aimed at increasing the amount of flexible and contemporary learning possibilities and support measures including general regulations, integration measures, competence based qualifications system, awareness measures for the youth, training for the implementers of different projects, development of integrated counseling system, initiating career and counseling services at vocational institutions etc.

b) achieving societally compatible and high quality basic and vocational education – the main support activities will be concentrating upon developing quality assurance measures (initiating suitable measures); developing professional skills of teachers (development plans, training schemes and models); curricula development (with emphasis on developing social skills and entrepreneurship); increasing the ratio of student in the areas of natural and exact sciences and technologies; developing counseling services for students; increasing the flexible educational measures for non-standard target groups (e-applications, work-based studies); enhancing the effectiveness of internships of vocational students (through introducing internship contracts, training and motivating entrepreneurs etc.); increasing the awareness and information of vocational education.

Description: *All the measures will be implemented mainly through centrally developed programs.*

Scope: *Currently being further designed.*

##33. Estonian Competition Authority

Objective: Since January 1st, 2008, the previous Estonian Competition Board, Estonian Communications Board and the Energy Market Inspectorate have been merged into the new Estonian Competition Authority, dealing with supervisory activities in the areas of competition supervision, fuel and energy, electronic and postal communications.

Description: As a government agency it fulfills the supervisory functions in the following areas.

a) general supervision of fair competition;
b) fuel and energy;
c) electronic communication and postal services;
d) rail transport and infrastructure management.

Scope: ---