Evaluation of the Finnish National Innovation System – Full Report

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Published on 28 October 2009 at 13:00 Finnish local time

Evaluation of the Finnish National Innovation System – Full Report

www.evaluation.fi (Also available: Policy Report)

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Publisher: *Taloustieto Oy*
(on behalf of the *Ministry of Education* and the *Ministry of Employment and the Economy*)

Helsinki University Print, 2009

Cover photo: Kai Kuusisto / Plugi

ISBN 978-951-628-491-3

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This **Full Report** provides further details and elaboration. The **Policy Report** summarizes the key findings of the evaluation. Some of the studies conducted to support the evaluation are also available separately:

- Autio, E. (2009). High-Growth Firms in Finland: Issues and Challenges. *ETLA Discussion Papers*, *1197*.
- Deschryvere, M. (2009). A Comparative Survey of Structural Characteristics of Finnish University Departments. *ETLA Discussion Papers*, *1195*.
- Kotiranta, A., Nikulainen, T., Tahvanainen A-J., Deschryvere, M., & Pajarinen, M. (2009). Evaluating National Innovation Systems – Key Insights from the Finnish INNOEVAL Survey. *ETLA Discussion papers*, *1196*.
- Nikulainen, T., & Tahvanainen, A-J. (2009). Towards Demand Based Innovation Policy? The Introduction of SHOKs as Innovation Policy Instrument. *ETLA Discussion Papers*, *1182*.
- Tahvanainen, A-J. (2009). Finnish University Technology Transfer in a Whirl of Changes – A Brief Summary. *ETLA Discussion Papers*, *1188*.
- Takalo, T. (2009). Rationales and Instruments for Public Innovation Policies. *ETLA Discussion Papers*, *1185*.
- Tanayama, T., & Ylä-Anttila, P. (2009). Tax Incentives as Innovation Policy Tool (in Finnish with an abstract in English). *ETLA Discussion Papers*, *1189*.

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Preface*

In the fall of 2008 the *Ministry of Education* and the *Ministry of Employment and the Economy* commissioned an international evaluation of the Finnish national innovation system. As I was in the final months of my term as an economic advisor at the *Bureau of European Policy Analysis* to JM Barroso, European Commission, and not yet fully returned to my professorship at *Katholieke Universiteit Leuven* (Belgium), the timing was perfect for me to learn about the features of the innovation system that continues to be admired and imitated worldwide.

SHOOTING A MOVING TARGET

The evaluation mission turned out to be challenging not only due to its considerable scope and shortness of time, but also because of the several ongoing transitions in the Finnish system, in part induced by the June 2008 proposal for *Finland's National Innovation Strategy* that served as our starting point; at least four major reforms advanced along with our evaluation and dozens of new policy initiatives have seen the light this year alone. Our solution to this **moving target** problem was to employ heterodox approaches and work (partly) in smaller groups. Despite the evolving nature of the system, as well as the valuable and welcomed diversity in the opinions of the panel, we ended up with a coherent joint view on conclusions that should help in *implementing the Strategy* and in *steering the system* towards a better future.

Our evaluation **task** is outlined in the original contract notice (ref. no. 2327/420/2008), as well as in the evaluation brochure, prepared for the opening press conference on 11 December 2008: The Ministries specifically wanted an *independent outside view* of the system. We were to look into the current and *future challenges* and consider whether or not they are sufficiently acknowledged and addressed. We were to point out needs for institutional and policy *adjustments and reforms,* as well as to draw conclusions on policy *governance and steering*. Given the short time and broad coverage of our task, we were to evaluate the system as a *whole* rather than focus on individual actors, organizations, and instruments. In our evaluation we looked particularly at whether public bodies and policies assist and incentivize both public and private individuals and organizations in generating and utilizing novel ideas.

In collaboration with the two Ministries, the evaluation panel settled on **six main points of view** in the evaluation; the basic choices of the Strategy

* The preface in this **Full Report** is an abbreviated version of the preface in the **Policy Report**.

underlie each point of view. We organized ourselves into six sub-panels, one for each main point of view. Based on the work by the sub-panels, we draw our overall conclusions as the whole panel.

Each sub-panel was led by an international expert working with two Finnish ones: an academic scholar and an innovation researcher representing ETLA. Given the task and the time, each sub-panel had to make hard choices as to its approach and emphasis; all pressing issues could not be addressed. In writing the report we have attempted to produce self-contained chapters, even if this necessarily brings about some repetition.

FINLAND HAS AMPLE UPSIDE POTENTIAL

While not obvious on the surface, a closer look suggests that Finland appears to have certain structural challenges. Reactions to them may have been hampered because, according to many indicators, up until recently Finland was doing well in its traditional strongholds. Now there is both a need and an opportunity to make a clear break with the past.

The ongoing economic and financial crisis started to fully unfold only after we had submitted our evaluation proposal and had laid-out our detailed work plan. Thus, some issues related to the crisis are not integrated into our analysis. In any case, developing a country's innovation system is a medium- and long-term issue. The current crisis may nevertheless be of such a nature that it induces more long-term and even permanent changes in the geography and locus of specialization in innovative activity.

It is quite possible that Finland currently **has** one of the best national innovation systems worldwide. Even that may not be enough in an era, where the global operating environment is rapidly evolving and the whole concept of a **national** innovation system has rightly been questioned. Companies have been the primary object of the innovation policy but, as they become increasingly footloose and geographically dispersed, the focus may have to shift to nurturing and attracting creative individuals.

The survey conducted to support the evaluation suggests that the actors of the Finnish innovation system are optimistic about the ongoing reforms and the future of the system. I personally share this optimism: while some of our proposals are laborious to implement, with some adjustments the good Finnish system could be much better equipped to meet future challenges!

ACKNOWLEDGEMENTS

In the course of the past year or so, the evaluation exercise proved to be both enjoyable and educational. The final outcome can be seen in the **Policy Report,** as well as in this complementing **Full Report**. The former serves as a gentle introduction and summary of our core findings; the latter provides further details and elaboration. I must say that I am personally very happy with the outcome, since in my opinion we managed to meet and even exceed the high expectations (at least my own). Obviously this is first and foremost due to my fellow panelists, impeccably supported by *Etlatieto Oy* (a subsidiary of *ETLA, The Research Institute of the Finnish Economy*) and the research team – thank you very much to all those involved! Over a dozen separate studies were conducted to support our work. Some of these are published separately along with the two main reports.

On behalf of the whole panel, I would like to express our gratitude to the two Ministries, as well as to the Sounding Board overseeing the project, not only for their generous support, but also for vigorously defending the integrity of the panel.

In the course of the exercise we have interviewed and heard over one hundred key actors and experts of the innovation system, the names of which are listed below. Furthermore, around two thousand individuals responded to the survey conducted to support the evaluation. The inputs of these individuals and organizations is highly appreciated – without it, we could not have completed our work.

Brussels, 18 September 2009,

Reinhilde Veugelers

In the course of the evaluation, the panel interviewed and heard over one hundred key actors and experts. The panel would like to thank them all – without their help, it could not have completed its work.

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1. INTRODUCTION

This **Full Report** elaborates on the issues introduced in the **Policy Report**. These two reports complete an international evaluation of the Finnish national innovation system commissioned by the *Ministry of Education* and the *Ministry of the Employment and the Economy*.

The evaluation panel took six main points of view, each of which was studied by a sub-panel led by an international expert accompanied by two Finnish panelists. Besides the short introductory and concluding Sections, this Full Report consists of Chapters contributed by the six sub-panels.

In this Section the June 2008 proposal for Finland's national innovation Strategy and the october 2008 Government's communication to the Parliament are collectively referred to as the Strategy. These documents are the starting point for this evaluation.

Charles **Edquist**, Terttu **Luukkonen**, and Markku **Sotarauta** discuss *broad-based innovation policy* in Chapter 2. They welcome the Strategy's balanced view between the supply and demand sides of innovative activity. They nevertheless note that it remains conceptually fuzzy and urge the government to provide clear contents in order for it not to dissipate. The lack of involvement of the Ministry of Finance and less active involvement of the Prime Minister's Office in coordination of research and innovation policy formulations is seen as a drawback. There are significant overlaps in the services offered by public organizations – an urgent streamlining is called for.

Dan **Breznitz**, Mikko **Ketokivi**, and Petri **Rouvinen** study *demand- and user-driven innovation* in Chapter 3. They too welcome the explicit inclusion of demand-side considerations in innovation policy, even if they otherwise challenge the Strategy's argumentation. They conclude that public promotion of demand- and user-orientation should primarily be indirect. They urge direct public support for private innovative activity to be impartial as to the source, type, and application domain of innovation. To the extent that this has not been the case, they recommend adjusting towards impartiality.

Karl **Aiginger**, Paavo **Okko**, and Pekka **Ylä-Anttila** consider *globalization of business activities* in Chapter 4. Their premise is that innovation and (particularly social aspects of) globalization are closely connected. Particularly smaller countries are increasingly dependent on global knowledge flows challenging national innovation policies. They reveal that the Finnish innovation system is less internationalized than conventionally thought. Furthermore, there are signs that it is falling further behind. Tapping deeper into the global knowledge pool should be one of the main objectives of innovation policy.

Gordon **Murray**, Ari **Hyytinen**, and Markku **Maula** focus on *growth entrepreneurship and finance* in Chapter 5. They state that tax policy should explicitly recognize the incentives needed for talented persons to consider an entrepreneurial career choice as well as for potential High Growth Entrepreneurial Firms (HGEFs) to pursue (international) expansion. They note that the present public support system is in need of a major revision, particularly with respect to its accessibility and relevance for HGEFs. Their proposed outline of (public) actors and their responsibilities should ease the governance and improve the cost effectiveness of the support system.

Gianmarco **Ottaviano**, Aki **Kangasharju**, and Mika **Maliranta** analyze the *geography of innovative activity* in Chapter 6. They note that Finland as a whole would benefit from redesigning its policy combination in order to foster the reallocation of its resources to their most productive uses. In redesigning the policy combination due attention should be paid to the two drivers of aggregate productivity: creative accumulation and creative destruction. Along both dimensions it is important that different policies clean up their acts following a sound division of labour. They conclude that running innovation policy and competition policy with a regional agenda may come at a high cost in terms of foregone growth at both the local and the national level.

Reinhilde **Veugelers**, Otto **Toivanen**, and Tanja **Tanayama** consider *education, research and the economy* in Chapter 7. In their view the most pressing and timely challenge of the Finnish higher education sector is to increase the quality of research, which is best achieved by providing relatively autonomous universities appropriate incentives through funding rules. A detailed proposal for a financing system of Finnish universities is provided. Polytechnics are seen as important actors in the system with their strong regional and applied role. In order to streamline higher education, they recommend a clear division of tasks between universities and polytechnics.

In the concluding section the panel acknowledges that Finland currently has a well-functioning innovation system, which in itself is, however, insufficient to sustain the desired standard of welfare. Due to both internal and external factors, the Finnish innovation system is at a crossroads. While some of the proposals are laborious to implement, in the panel's opinion they are very much needed for Finland to be prepared for the challenges that lie ahead.

2. Broad-Based Innovation Policy

Charles Edquist, Terttu Luukkonen, and Markku Sotarauta*

We welcome the basic ambition of the broad-based innovation policy. It provides a balance between the supply and demand sides of innovative activity, includes non-technical innovations, as well as – besides direct economic impact – emphasizes wider societal considerations.

Conceptually the new broad-based innovation policy is, however, fuzzy, and it is therefore important that the government soon provides clear contents to the concept so as not to let it dissipate.

The Finnish system does not have a strong systems-wide coordination. The lack of involvement of the Ministry of Finance and less active involvement of the Prime Minister's Office in coordinating research and innovation policy formulations is a drawback. There are significant overlaps in the services offered by public organizations. Streamlining is urgently needed.

Broadly speaking the ongoing reforms provide a good basis for pursuance of a broad-based innovation policy. The university reform, offers great opportunities for Finland. We have some concerns as to the university inventions act, but its final impact cannot be conclusively assessed yet.

The SHOK initiative may be helpful in incrementally renewing traditional Finnish industries, but it is unlikely that it would breed new clusters or promote radical/disruptive innovations.

The reform of public research organizations (PROs) seems to be in a permanent gridlock, which is unacceptable and unaffordable. PROs could be a thrust in the Finnish system – an opportunity that is now being wasted.

Sitra is a uniquely Finnish construction and the 'libero' of the system. While its position has at times been challenged, it has served a purpose in the past and in our opinion will continue to do so. The Finnish system is highly consensus-driven and needs more diversity in ideas as well as parties willing to take a more futurist long-term view.

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* Charles Edquist is a professor in innovation studies at Lund University (Sweden) and the director of its Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE). He is co-ordinator and co-editor (Edquist and Hommen, 2008) for the project National Systems of Innovation in a Globalising, Knowledge-based Economy: A Comparative Study of Small Countries in Europe and Asia. Terttu Luukkonen is a head of unit at ETLA. Markku Sotarauta is a professor at the University of Tampere.

2.1. INTRODUCTION

The Broad-Based Innovation Policy Panel has a considerable area to cover and therefore it has inevitably been selective in its choice of topics. We pay special attention to the new innovation policy strategy (Aho et al., 2008, as well as The Government's Communication on Finland's National Innovation Strategy to the Parliament building on it), its role in the Finnish innovation policy, and its goal to advance the so-called broad-based innovation policy. Since this concept is not very clear, the report initially discusses two possible meanings of this concept (the next section).

The report assesses the degree to which recent or ongoing reforms in innovation policy implement the principles of broad-based innovation policy (in two different senses specified below), and which directions policy should take to become more systematically broad-based.

The report and its conclusions are based on extensive background material collected for the whole exercise and on specific data collected for this panel. Furthermore, the panel has carried out jointly with the other panelists and separately in different combinations a large number of interviews or hearings with key policy stakeholders in Finland, and a few in the European Commission (with a total of 50 persons, and with some, several times). The conclusions in each case are solely the responsibility of the panel.

2.2. DIFFERENT MEANINGS OF A BROAD-BASED INNOVATION POLICY

2.2.1. INNOVATION SYSTEMS AND INNOVATION POLICY

The new innovation policy introduces the concept of a *broad-based innovation policy.* The new perspective has already influenced the Finnish innovation scene, for example by creating a buzz in the field. However, its ability to provide more concrete measures to support innovation with strategic direction remains to be seen. At the beginning of 2009, there appeared to be a consensus that Finland needed a broader approach in its innovation policies, but *few, if any, explicitly made clear what this means in practice, and how the policy instruments ought to be reformed to support this new thinking – and which new instruments that have to be developed*. Because of its aim to be broad, the innovation strategy faces a risk of being dissipated in the multi-voice debate, unless it is soon made more concrete.

The concept of *broad-based innovation* policy can be understood in different ways. We will propose two possible specifications of what a broad-based innovation policy can mean. We start with a fairly traditional definition of innovation and innovation policy and, then move on to propose a possible extension for these concepts to embrace the broad-based innovation policy. We will also briefly discuss the concept of innovation system.

According to the traditional view, *innovations are new creations of economic significance* and primarily carried out by firms (but not in isolation). They include product innovations as well as process innovations. *Product innovations* are new – or improved – material goods as well as intangible services; it is a matter of *what* is produced. *Process innovations* are new ways of producing goods and services. They may be technological or organizational; it is a matter of *how* things are produced.[1]

Innovation policy is here seen as a set of actions by public organizations that influence the development and diffusion of innovations (as specified above). In the 1990s it was common to talk about *technology* and *technology policy*. This normally included material goods product innovations and technological process innovations.[2]

Innovation processes occur over time and are influenced by many factors. Because of this complexity, firms almost never innovate in isolation. In the pursuit of innovation they *interact* with other organizations or groups of actors to gain, develop, and exchange various kinds of knowledge, information and other resources. These actors or *organizations* – also called '*players*' – might be other firms (suppliers, customers, competitors) but also universities, research institutes, investment banks, public agencies, and individual customers (Edquist, 1997, pp. 1–2).

The behaviour of firms is also shaped by constraints and/or incentives for innovation, such as laws, regulations, cultural norms, social rules and technical standards. These can be understood as the *rules of the game (institutions)*, influencing the actions of organizations or players (e.g. the firms).

Interactions between various organizations (actors) operating in different institutional contexts are important for processes of innovation. The organizations as well as the contextual factors (e.g. institutions) are all elements of systems for the creation and use of knowledge for economic purposes. Innovations emerge in such *systems of innovations* (Edquist, 1997, pp. 1–2).

The so-called linear approach – which regards innovations as a linear causal chain from basic research to applied research over development work to the final result in the form of new products and processes dominated innovation theory and innovation policy during much of the 20th century. This changed around 1990, when the *systems of innovation approach* was developed. The systems of innovation approach has diffused and enjoyed acceptance to an enormous degree among researchers and – especially – policy-makers – since its conception around 1990.[3]

At a general level, the main or 'overall' *purpose* of systems of innovation is, of course, to pursue innovation processes: that is, to develop and diffuse innovations. In the table in Appendix 2, what we call '*activities*' in systems of innovation are the determinants of the development and diffusion of innovations. In other words, the activities are those factors that influence innovation processes.[4]

Examples of activities include R&D as a means of the development of economically relevant knowledge that can provide a basis for innovations, or the financing of the commercialization of such knowledge, i.e. its transformation into innovations. For a list of the ten most important such activities, please see Appendix 2.[5] The ten key activities listed there are not ranked in order of importance, but the list is structured into four thematic categories:

I The provision of knowledge inputs to the innovation process
II Demand-side activities
III The provision of constituents of the systems of innovation
IV Support services for innovating firms

Each of the ten key activities may be considered to be a partial determinant of the development and diffusion of innovations. The demand-side activities – category II in Appendix 2 – are simply those determinants that influence innovation processes from the demand side, i.e. from the user side (as opposed to the supply side, such as R&D).[6]

The "activities approach", briefly presented above, has been used as a basis for a general definition of a system of innovation. According to this definition a system of innovation includes 'all important economic, social, political, organizational, institutional and other factors that influence the development and diffusion of innovations' (Edquist, 1997, p. 14; Edquist, 2006, p. 183; Edquist, 2009; Edquist & Hommen, 2008, p. 6).

2.2.2. FIRST MEANING OF BROAD-BASED INNOVATION POLICY

The *first* possible meaning of a *broad-based innovation policy* entails the idea that, in addition to technological process innovations and goods product innovations, *organizational process innovations and service product innovations* are included in the concept of innovation. Hence it is a matter of broadening the concept of innovations, i.e. what policy is intended to influence (see definitions in the box in Appendix 1).

The traditional linear view stressed the use of codified scientific knowledge as the basis for a science push/supply driven high-tech policy approach. Broad-based innovation policy stresses the need to use many kinds of knowledge, not only scientific and technological, in innovation processes, and the significance of informal processes of learning and experience-based know-how (Asheim et al., 2007; Jensen et al., 2007). Experience-based knowledge refers to insights and information gained in the course of action and, it often leads to incremental learning and process innovations.

Besides entailing economic significance, this first meaning of a broad-based innovation policy can be extended to encompass wider societal benefits and measures targeted to support service innovation in the public service production[7]. Thus, the notion of innovation is, in this context, not restricted to activities carried out by companies. In this sense, broad-based innovation policies target the public sector organizations and are used as a vehicle to increase the efficient delivery of services and/or to boost public service reforms with innovations. Thus understood, a broad-based innovation policy, in this sense, is aimed at the activities of the public sector itself, and requires a systematic development of incentives for the development and adoption of new innovative products and processes in the public services.

2.2.3. SECOND MEANING OF BROAD-BASED INNOVATION POLICY

Interactive learning among organizations and users and producers in systems of innovation is absolutely crucial for innovations to emerge. Empirical studies have shown that a majority of all innovations are developed as interactive processes between firms and other organizations or actors. The nature of these processes of interactive learning in the systems of innovation approach means that they emphasize feed-back processes. The systems of innovation approach also stresses that innovation processes are influenced from the demand side much more than earlier approaches, including the so-called linear approach.

A *second* possibility to define a *broad-based innovation policy* is to include *all* important factors that influence the development and diffusion of innovations. A hypothetical list of ten such determinants is presented in Appendix 2. For example, demand- and user-driven determinants are included in a "broad-based" innovation policy perspective ('formation of new product markets' and 'articulation of quality requirements emanating from the demand side with regard to new products' are listed in category II in the list of activities). The word "driven" then implies that demand and users influence the development and diffusion of innovations. This aspect of the demand side is emphasized in the new innovation strategy of the Finnish government and is currently in fashion also in other countries. We may point out that, in terms of innovation *processes*, demand and users have always been important determinants of these processes, although to different degrees for different kinds of innovations. However, we also recognize that this has not been translated into explicit innovation *policies* to a large extent earlier (although there are certainly exceptions).

It is to be noted that during the period from 1990 to 2009 the actual *use* of public demand-side innovation policy *instruments* has decreased. This also applies to the specific instrument of Public Procurement for Innovation. In Sweden, for example, public procurement for innovation was used much more from the 1950s to the 1980s than thereafter. A possible interpretation is that the interest in demand side policy instruments at an *analytical* and *policy design* level has increased, but that this has not translated into specific initiatives with regard to the *implementation* of innovation policy. This seems to be changing currently. In May 2009 Tekes launched a new instrument to promote innovative public procurement at the same time as the Ministry of Employment and the Economy outlined its forthcoming demand- and user-driven innovation policies.

We want to stress that a "broad-based innovation policy" should take into account *all* the determinants of the development and diffusion of innovations listed in Appendix 2. In this sense, a "*broad-based*" innovation policy can be said to be the *same as* a "*systemic*" innovation policy – given our specification of the systems of innovation approach in the first part of section 2.2 above. On this basis, the reasons for public policy intervention should be assessed – as discussed in section 2.2.5 below. This implies that demand-side determinants of innovation processes should be emphasized in a "broad-based" innovation policy. However, non-demand related determinants must also be addressed in any innovation policy. Provision of knowledge inputs, provision of constituents for systems of innovation, and provision of support services for innovating firms must also be addressed (see Appendix 2).

If a broad-based innovation policy is understood to include demand orientation, it can entail a wide range of potential policy instruments, both direct and indirect support measures, some of which go beyond conventional innovation policy (see Appendix 3). These measures include, among other things, the improvement of the conditions for the uptake of innovations and measures to spur the diffusion of innovations. The systematic implementation of demand-based innovation policies is a highly demanding task and would require a new "culture" in the governmental administration. Measures such as public procurement for innovation and regulation (standards) have been applied before in many countries including Finland – with varied success. The potential toolbox of a demand-based innovation policy instruments includes further a variety of direct and indirect measures to support private and public demand, such as demand subsidies, tax incentives, awareness building measures, and training and information campaigns (Edler, 2009).

The EU lead market initiative (EC, 2007a, 2007b)[8] toolbox includes a combination of legislation, public procurement for innovation, standardization, labeling, certification and other business and innovations support measures including training and awareness measures. These measures are intended to enable more rapid take-up of innovations and more rapid returns to R&D investments. The gist of the successful development of a lead market is to meet the demand rather than trying to cre ate the market. Thus the policies to promote lead markets are highly challenging, require an ability to respond rapidly to emerging opportunities, and to create general conditions conducive to the emergence of lead markets.

We wish here to refer to the rationale for public involvement, as outlined in section 2.2.5 (the inability or unwillingness of private actors to achieve the objectives formulated and the ability of the public agencies to solve or mitigate the problems). There has not been sufficient discussion of the existence of both requirements for public action in this area. *At the moment, we advocate experimentation with demand-based policy initiatives especially with regard to public sector activities, but also in other areas where they would serve vitally important socio-economic goals.*[9]

Whether and the extent to which actors in the market do not take care of user-producer interaction and identification of user-needs is an open question. Furthermore, tools for user-oriented innovation policies are less well developed and information on the success and challenges met with when applying user driven innovation policy measures is scarcely available.

2.2.4. PANEL'S CONCLUSION

We propose that there are two different possible meanings of broad-based innovation policy.

1. It entails the broadening of the concept of innovation to include product innovations in services and organizational process innovations. Besides economic significance, it relates to wider societal benefits and measures targeted to support service innovation in public service production.
2. It takes *all* determinants of the development and diffusion of innovations into account when designing and implementing innovation policies. This would then include policy instruments operating from the demand side.

Analytically, these different meanings need to be kept separate, since they have different implications for policy analysis and policy formulation. In this report, we will comment on the ongoing reforms in innovation policy and will strive to assess the degree to which they might promote broad-based policies in the two senses above.

2.2.5. THE RATIONALE FOR PUBLIC INTERVENTION

The performance of an innovation system is in a narrow sense the same as the output of the system, i.e. what 'comes out' is – simply – innovations (as specified in the beginning of section 2.2). Innovation policy objectives are formulated in a political process. Normally they are formulated in looser terms than the strict output of innovations – namely, achieving increased economic growth, a better environmental balance or more military strength – objectives which are only partly achieved through innovations, and partly through other means. Hence, most national or regional innovation policies are not based upon the relative performance – in terms of innovation intensities of different categories of innovations – of the country or region in question. A forward-looking innovation policy pays attention to the capabilities of the system to produce innovations also in the future, not just in the past, highlighting the importance of drawing attention to the system components or activities which may hinder the development and diffusion of innovations. It is to be noted that innovations *as such* are not – in the final instance – interesting from a policy point of view. Innovations are interesting because they – *in their turn* – influence *other* things, such as productivity growth, social conditions, competitiveness, sustainable development, military force, health care, etc. Hence, innovations are important for what they can do with regard to other socioeconomic phenomena.

The reasons for public policy intervention in a market economy, i.e. the rationales for public policy intervention, may be specified in terms of two conditions:

1. Private organizations prove to be unwilling (because of high risks or in ability to appropriate the benefits from the innovation) to achieve or unsuccessful in achieving the objectives[10] formulated; thus, a *problem* exists.
2. The state (national, regional, local) and its public agencies have the *ability* to solve or mitigate the problem.

One problem, in our sense – i.e. from a policy point of view – has to do with (a low) performance of the innovation system, caused by deficiencies in the key activities of the innovation system. The explanations of that (low) performance (i.e. identifying the deficiencies) are also crucial for the design of innovation policy. The explanations are a matter of the determinants/activities of the innovation system (outlined in Appendix 2, and partly discussed above). The list of the activities of an innovation system can be used as a checklist in an analysis of the explanations of (a low) performance of the system.

2.2.6. SUMMARY

We have specified two different meanings of a broad-based innovation policy. Each has specific policy implications and will be commented upon later on in this report. We wish to highlight a few salient aspects.

1. The basic concept of innovation refers to *new creations of economic significance*, which are primarily carried out by firms (but not in isolation). One of the meanings of a broad-based innovation policy which we outlined above relates to innovations in public sector services and attention is also paid to wider societal benefits.

2. Innovations can be based on technological (scientific) discoveries, but they can also be derived from experience-based knowledge, and thus be non-technological (e.g., organizational).
3. Rationales for public policy intervention include the fact that a '*problem*' has been identified and public agencies have the '*ability*' to solve or mitigate this problem. If these two conditions are not fulfilled, no policy intervention is called for.
4. It is important to note that a broad-based innovation policy is not the same as economic or enterprise policy. The latter includes the basic institutional framework for private businesses to thrive. Even though this institutional framework is an important part of the innovation system and can hinder or promote innovations, it becomes part of innovation policy only when the institutional framework is specifically harmful or deficient in terms of providing incentives (or obstacles) to innovations (in the meaning above). It can be detrimental for the pursuance of an effective innovation policy if the concept of innovation policy is too wide and covers all potential acts under economic policy. Innovation policy consists of (only) those actions by public organizations that actually influence the development and diffusion of innovations (see Appendix 1).

2.3. THE MANY ROLES AND DIMENSIONS OF THE NEW INNOVATION STRATEGY

2.3.1. FINNISH STEPS TOWARDS A BROAD-BASED INNOVATION POLICY

The Finnish innovation policy community discussed widely the need for a reformulation of Finnish innovation policy in the first decade of 2000. Reforms have been motivated by acknowledgement of the challenges posed by globalization and other changes in the innovation environment[11]. Reports and exchanges at the EU and other international forums have further reinforced the recognition of a need for reforms.

Matti Vanhanen's Second Cabinet adopted the preparation of the new national innovation strategy as part of its political programme. The formulation of the proposal for the new national innovation strategy was carried out by a high-profile steering group chaired by the former Prime Minister of Finland and then President of Sitra[12] Esko Aho. The preparation was co-ordinated by the Ministry of Employment and the Economy. The strategy process included a relatively open and participatory design process with open web-discussions and 11 open workshops with approximately 800 participants in total. In the autumn of 2008 Vanhanen's Cabinet presented a modified version of the proposal to the Parliament of Finland in the form of formal Communication (9 October 2008) and, for the first time in the Finnish history, the Parliament launched a political debate on innovation issues.

The opening words of the proposal reflect both the ambition and concerns which have motivated Finnish innovation policy (Aho et al., 2008, p. 2): "The position of a pioneer requires renewal ... Finland's long-term investments in expertise and technological research & development have produced good results, and its successful science and technology policy has created a basis for many successful industries. This provides a good basis for constructing the future. However, the challenges of growth and competitiveness can no longer be tackled only by means of a sector-based, technology-oriented strategy. Instead, a demand-based innovation policy must be strengthened alongside a supply-based innovation policy."

The main aim of the new strategy proposal is to create a broad-based and multifaceted innovation policy and to strengthen its implementation. According to the proposal, "a broad-based innovation policy facilitates the development and renewal of competence- based competitiveness of industry, economy and the regions. It also advances the utilization of innovation activities in the public sector and society" (Aho et al., 2008). However, the notion of "broad-based innovation policy" is not specified. Neither are the mechanisms of how the results in terms of competiveness and innovation shall be achieved in this new way pointed out.

We welcome the basic ambitions of the broad-based innovation policy. We recognize that the new innovation strategy represents an ambitious, but a fuzzy move towards a new balance between supply and demand-based innovation policies.

It is important that the government soon provides clear contents to the vague concept of a broad-based innovation policy so as not to let it dissipate.

Recent steps taken to clarify the meaning of demand- and user-driven innovation policies, as evidenced by the seminar on demand- and user-orientation in innovation policy by the Ministry of Employment and the Economy on June 10, 2009, are most welcome.

2.3.2. FIVE WAYS TO UNDERSTAND INNOVATION STRATEGY

We understand that the emphasis on demand- and user-orientation in the new proposal for the national innovation strategy does not imply a neglect of basic science and more traditional supply-side measures. The new strategy is complementary by nature and its main task is to pinpoint bottlenecks in the Finnish innovation system which need more attention, and not to provide a comprehensive picture of an entire innovation policy.

It is fairly obvious that the proposal is not a strategic plan to be implemented as such. We assess the five dimensions of "strategy" – in a general sense – as suggested in earlier studies (Sotarauta et al., 2002; Saarivirta and Sotarauta, 2008).

– The strategy as a *plan*, in which a vision, goals and adequate measures are presented in order to channel and direct the use of resources.
– The strategy as a legitimate forum for cooperation.
– The strategy as a way to *raise collective awareness*; to learn common language and new concepts, to create shared lines of action and thought patterns, and a new way of seeing the development and the role of various actors in it.
– The strategy as a *means of communication*, that is, messages from one group of actors to another group.
– The strategy as *a trigger* for new processes

As a strategic plan the new innovation strategy is conceptually fuzzy and, it does not contain a clearly articulated vision, strategy, and adequate measures for the future. The conceptual fuzziness is reflected in a whole variety of interpretations of its meaning and significance. The strategy document and the Communication to the Parliament entails first and foremost a philosophical discussion aiming to raise new issues on the agenda and prompting stakeholders to renew their own activities. It may be admitted that the new strategy has indeed challenged the Finnish innovation policy stakeholders to reflect, not only upon the current bottlenecks, but also upon the need to reorient the current focus. It has also been a message from the core innovation policy community to wider audiences.

The proposal has clearly served as a forum for co-operation and controversy and has triggered a search for new policy measures. It has raised more or less coherent collective discussions at all levels of the innovation system on the need to widen the scope of the current innovation policy. It may be the case that in due time, a more coherent and conceptually robust strategic direction will emerge. Consequently, if the ongoing debates lead to a better-informed and more fine-tuned policy, the new strategy will have served its function as a message and trigger.

2.4. POLICY COORDINATION AND COLLABORATION ACROSS SECTORS AND ORGANIZATIONS

2.4.1. OVERALL POLICY COORDINATION

The pursuance of an effective innovation policy can only succeed if there is a strategic level and organizations which set overall priorities, identify systemic problems (rationales for intervention – see section 2.2.5) and, together with the operational level, identify and design new policies whenever these are called for by the new priorities. The strategic level should also be involved in policy coordination (Teubal et al., 2007). In Finland the Research and Innovation Council (RIC in Figure 2.1)[13], chaired by the Prime Minister, represents this strategic level and is the highest advisory and coordinating body for research and innovation policy. It combines an advisory function and expert members with the highest political-level representation, which gives it more power and influence than more traditional expert bodies outside the government. Thus at the organizational level, Finland has the prerequisites for a well-coordinated innovation policy.

The role of the Research and Innovation Council has been highlighted during the present government since the government programme includes many innovation policy related reforms and initiatives and the Council has an important role in their promotion. The government has expressed its wish to further improve coordination by strengthening the role of its standing economic policy committee in research and innovation policy matters. This initiative, if/when it is put in practice, will involve the Finance Ministry in more active collaboration with the Ministries responsible for research and innovation policy[14]. This would be important because of the strategic position of the Finance Ministry and Minister with regard to the public purse.[15] The closer involvement of this Ministry in research and innovation policies would be important for the creation of a joint understanding of the goals and priorities and for ensuring that important decisions are followed by financial commitments. After the launch of the new broad-based innovation policy, there is an increasing need for the active involvement of all strategically important ministries.

In spite of the fact that the Prime Minister chairs the Research and Innovation Council, the Prime Minister's Office has no active role in innovation policy affairs. For instance, the tasks of the secretariat of the Research and Innovation Council are catered to by the Ministry of Employment and the Economy and the Ministry of Education. In order to provide a more important strategic position for innovation policy, the Prime Minister's Office could adopt some general coordinating roles such as providing the home base for the Advisory Board for Sector Research, as was originally recommended by Neuvo's committee (more of this later on).

At the operational level, the Ministry of Education and the Ministry of Employment and the Economy are the two most important ministries in matters relating to research and innovation activities. The Ministry of Education is responsible for the whole education system including the universities and the Academy of Finland (the Research Councils) is under the Ministry of Education. This ministry has also been given the responsibility for coordinating the public sector research institutes and their reform.

Tekes (The Finnish Funding Agency for Technology and Innovation) is the intermediary organization under the Ministry of Employment and the Economy, and with its budget (552 million EUR in 2009) it has a mission to enhance the development of the Finnish industry and the service sector through technology and innovation. The Ministry of Employment and the Economy (TEM in Figure 2.1) has the largest public sector research institute, the Technical Research Centre of Finland (VTT in Figure 2.1), under its responsibility. After the merger of the former Ministry of Trade and Industry, the Ministry of Employment, and some units of the Ministry of the Interior into the present Ministry of Employment and the Economy as of the beginning of 2008, it has become a 'super' ministry with much improved resources to coordinate innovation policy affairs compared with its predecessor, the Ministry of Trade and Industry.

The powerful position of the Ministry of Employment and the Economy is reflected by the perceptions of the different stakeholders concerning the most important public actors in the innovations system (see Figure 2.1). These views are based on the wide survey launched for this evaluation. According to the respondents, the Ministry of Employment and the Economy, Tekes, and the universities are the most important actors in the Finnish national innovation system. The Ministry of Education, the Academy of Finland, the Ministry of Finance, Finnvera, the Technical Research Centre of Finland, and interestingly, the Research and Innovation Council are only in the next rank.

In policy formulation and implementation the two major research and innovation-related ministries and the major funding agencies, the Academy of Finland and Tekes, engage in cooperation and co-ordinate their activities. There is some competition among them for resources and/or different viewpoints, but from an overall performance point of view it is important that there are stakeholders with different viewpoints challenging each other.

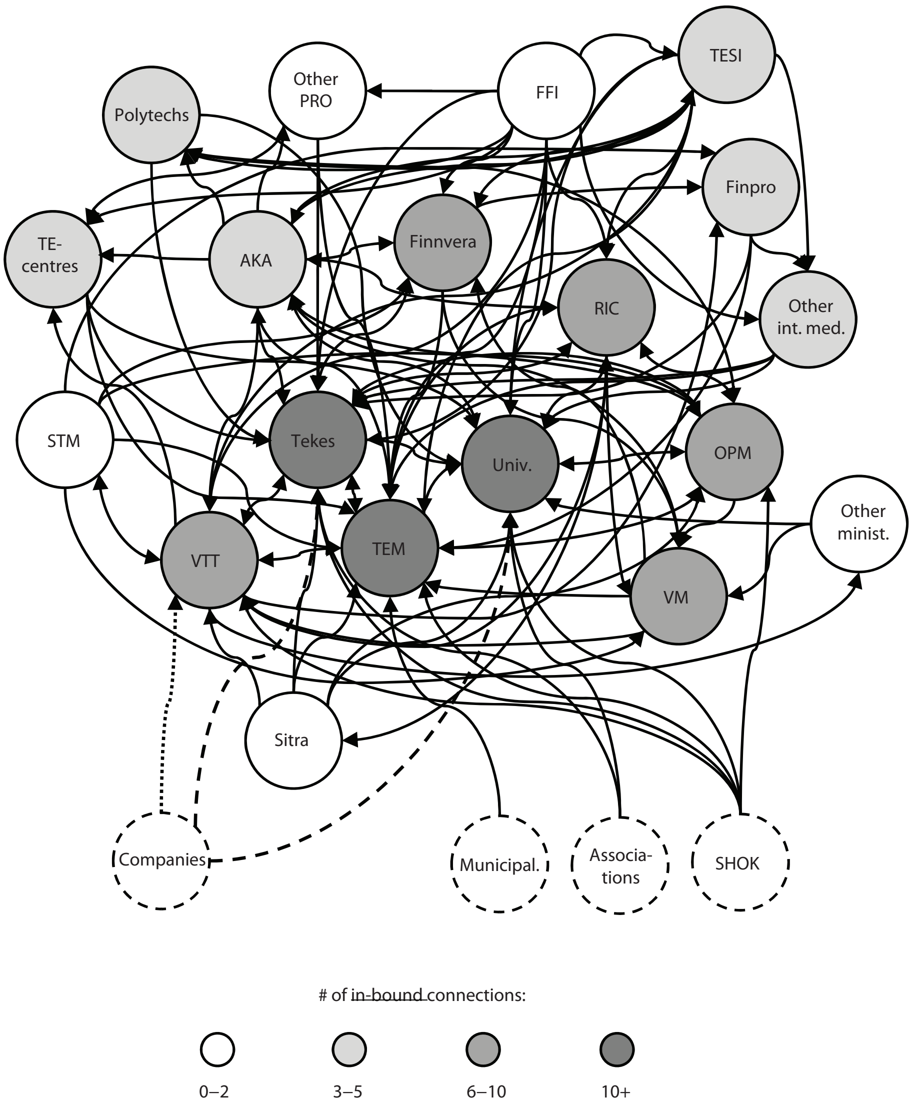
Basic organizational structures for formulating overall strategies and coordinating innovation and related policies are in place.

A major drawback in the workings of the present system is, however, the fact that the Ministry of Finance is less involved in research and innovation policy formulation. A more active role is recommended by the panel.

We refer here also to the report of the subpanel on Growth Entrepreneurship and Finance and its recommendation that the Finance Ministry be more closely involved in the formulation of the initiatives to promote growth entrepreneurship.

We further recommend more active involvement by the Prime Minister's Office in central coordination functions in major reforms, especially concerning public sector research.

Figure 2.1. The importance of the governmental actors in the NIS



Notes: The source is Kotiranta *et al.* (2009). The respondents were requested to indicate the importance of the various governmental actors in the National Innovation System using a scale of 1–4 (the last being very important) and the answers were averaged over the respondents' organizations. A connecting link is established if the relevance is 3.5 or higher. Dotted circle actors have only out-bound links. Long dotted line indicates a threshold of 3.0 (only for companies). Short dotted line indicates a threshold of 3.0 (only for large innovative companies).

2.4.2. THE ROLE OF SITRA

Sitra is an important independent actor in the innovation policy field and able to facilitate strategy processes and commit stakeholders to change. It was created in 1967 in honour of the 50th anniversary of Finnish independence. It was under the supervision of the Bank of Finland until 1991, when it was transformed into an independent public foundation under the auspices of the Finnish Parliament[16].

Sitra has a unique role in the Finnish innovation system. Even though it is a public organization, it is independent of governmental control. It is able to take initiatives and can act as a forerunner for new institutional or organizational innovations, as it did in the realm of funding technological R&D or in the promotion of venture capital. It has also had an important role in training decision-makers, networking them with each other, and committing them to structural change. Sitra is a flexible organization and has resources to take new initiatives quickly.

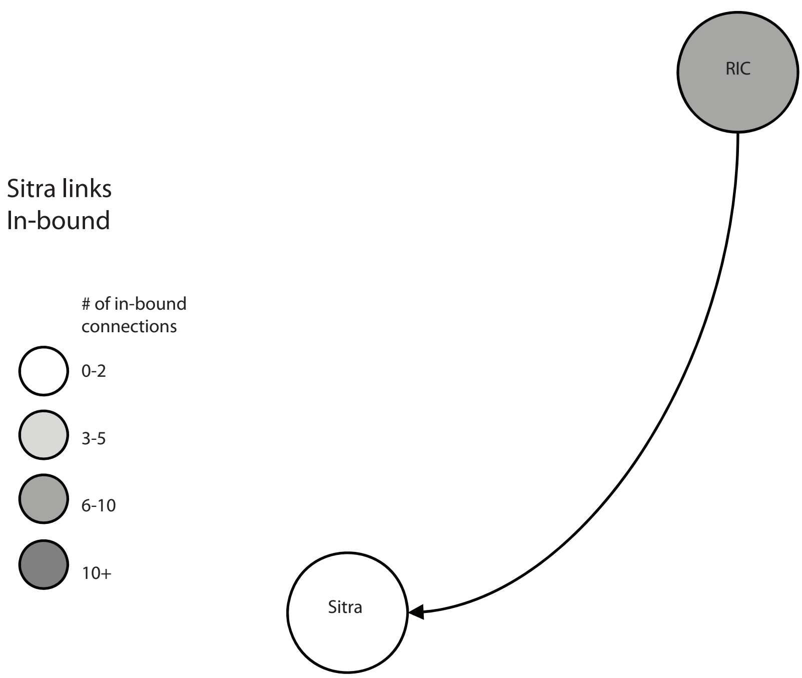
Sitra has twice redefined its major role and strategy. At first, Sitra became the country's foremost public financier of technological research and development. Sitra's activities contributed to the model for operations that Tekes (currently Finnish Funding Agency for Technology and Innovation) overtook after its foundation in 1983. In 1987 Sitra redefined its role for the first time. It focused its operations on business development and venture-capital investments in technology enterprises. Sitra played a role in pioneering venture-capital investment in Finland, and as a syndicate partner with private venture capital investors in the 1990s, it helped to promote venture capital activities in Finland[17]. In the 2000s Sitra again renewed its strategy. Sitra currently concentrates on experimenting with and promoting social innovations in a wide range of applications with the purpose of helping to bring about structural change. It has a number of programmes, each for a fixed period of time[18].

Sitra considers its role as that of a catalyst of processes and a reducer of structural rigidities (institutional or organizational lock-ins) and network failures. An example of Sitra's influence is the fact that many of the central ideas in Finland's new broad-based innovation strategy originated from Sitra's innovation programme in 2004–2006 (Sitra, 2005). It is possible, and perhaps inevitable, that some of its experimentation activities overlap or come into collision with existing organizations and activities. It is also to be expected that some of the programmes and activities fail. In each case, it is important that there is an organization that is committed to policy experimentation and not only to implementation of the officially adopted policies. There are lessons to learn from experimentation.

We do not aim to evaluate the performance of Sitra. Furthermore, we do not wish to take a stance as to what should be the composition of Sitra's portfolio of programmes or the prime focus of its activities. This will be left to its independent strategy processes. The fact that Sitra is generally seen as a non-central actor in the Finnish Innovation System (see Figure 2.2), however, prompts the question of whether its present activities and programmes are ineffective or inadequately communicated. In the past few years, it has managed numerous, short-lived, and diverse programmes, the impacts of which are not transparent.

The above result of the survey is also, to some extent, understandable. The actor in the system that regards Sitra as important (above the threshold of 3.5 in the scale 1–4) is the Research and Innovation Council. It is the major strategy-setting body in the system, and the role of Sitra in the past few years has been one which contributes to strategy and goal setting. It no longer is a grant awarding organization, and its venture capital investments are selective in the areas of its own programmes. This kind of strategic role for Sitra is apparently less visible and/or less effective.

Figure 2.2. Sitra in the eyes of other NIS actors (see also Figure 2.1)



Notes: The source is Kotiranta *et al.* (2009). The respondents were requested to indicate the importance of the various governmental actors in the National Innovation System using a scale of 1–4 (the last being very important) and the answers were averaged over the respondents' organizations. A connecting link is established if the relevance is 3.5 or higher.

We consider that Sitra is an important organization in the Finnish innovation system and has an important role in policy experimentation. It adds diversity to the system, and can help to avoid the risk of too one-sided ideas, policies, and funding opportunities.

2.4.3. EVALUATION PRACTICES

The Finnish innovation system is fairly reflexive: as early as the beginning of the 1980s it started evaluating parts of the system using international panels of peers and publishing the evaluation findings. The practice was started by the Academy of Finland and it spread to other organizations and agencies. The evaluations commissioned by different organizations have largely been based on voluntary decisions by the respective agencies and the perceived benefits of such exercises (such as organizational learning, provision of accountability) have been a major driving force for their diffusion within the research funding and performing organizations. The predecessor of the Research and Innovation Council has paid attention to evaluation and defined principles for evaluation policies, but Finland does not have a law or decree-like binding system for evaluation. In addition to the Academy of Finland, individual organizations, such as Tekes, have adopted a systematic policy to evaluate all the major programmes it finances.

Following the early examples of evaluations at the Academy of Finland, most evaluation findings are made public, and many of them are carried out by international experts, or by an increasing body of evaluation professionals. Publishing findings and commissioning external evaluations are examples of good practices. Published evaluation reports promote transparency and accountability of public support systems. External experts are important in the provision of some degree of objectivity and independence, especially in a small country where “everybody knows everybody”.

The National Audit Office of Finland made an audit report on the R&D evaluation activities in 2008 (Valtiontalouden tarkastusvirasto, 2008). It drew attention to a major drawback in the present evaluation system, i.e., the fact that too often the organization that is the object of evaluation adopts many overlapping roles. It formulates the objective of the evaluation, commissions the evaluation, appoints a steering committee and is the recipient of the evaluation. This is the case with, e.g., the evaluation of Tekes’ programmes. This practice limits the independence and objectivity of the evaluations.

We consider the overlapping roles of the object of evaluation essentially too inward-looking and decreasing the objectivity and independence of evaluation. The evaluation system is rendered healthier if a third party – not the one being evaluated – commissions the evaluation and serves as the customer. This applies, for example, to the evaluations of TEKES' programmes.

We further consider that the Finnish Higher Education Evaluation Council is an example of an organization that could undertake a broader role and become "The Finnish Research, Higher Education and Innovation Evaluation Council" and thus undertake (commission) evaluations of the public sector organizations and their activities.

2.5. RECENT REFORMS IN RESEARCH AND INNOVATION POLICIES IN FINLAND

2.5.1. INTRODUCTION

The basic research and innovation policy structures date back to the 1980s, or earlier. Finland has invested in provision of knowledge inputs to the innovation system (Appendix 2, activity 1) through its long-term strategy to draw attention to training, competence creation, and R&D. The emphasis placed on issues, specific policies, and policy instruments as well as policy rationales have varied according to the demands identified in each time period.

In the past few years, Finland's research and innovation policies have experienced or are currently going through a number of reforms, some of which are far-reaching. The reforms as well as the whole innovation policy strategy were motivated by the acknowledgement of challenges posed by globalization and other changes in the innovation environment. Influential in this respect was the Governmental report on globalization (Valtioneuvoston kanslia, 2004) and it has gained support from the reports and exchanges at the EU or other international fora.

The specific reforms, to be discussed in the following, were initiated before the launching of the new innovation strategy. The notion of a broad-based innovation policy was not specifically taken into account in their formulation and design. It does not, however, necessarily mean that they could not be aligned with the new overall strategy. In the following we will pay attention to this specific question.

At the outset, it may be noted that several reforms concern the provision of knowledge inputs to the innovation process (category I in the list of activities in Appendix 2). These include the new university law, with the proposal being accepted by the government on 19 February 2009 and the law passed by the Parliament in June 2009, the Strategic Centres of Excellence for Science, Technology and Innovation (in Finnish the acronym SHOK), the reform in the sectoral research system, and ongoing reforms in research training and research careers. The reforms other than research training and careers aim to promote the concentration of resources and the creation of critical mass in the chosen areas.

The Centres of Expertise Programme was renewed as of the beginning of 2007 also in order to concentrate resources and competencies to larger entities – competence clusters – and to engage separate regional centres of expertise into closer collaboration. The nature of this programme in terms of the activities of the innovation system or a broad-based policy (Appendix 1) is not clear and will be discussed further in the next section.

Intellectual property law is an important institution in the innovation system and can provide significant incentives for innovation. The recently (2007) changed intellectual property rights law for universities creates a new institutional situation with regard to commercialization of research findings, and we will discuss its implications.

If we apply the criterion of an identified *problem,* we may conclude that recent Finnish innovation policy initiatives have pertained to several different types of components or activities of the system, identified as not performing as well as expected. For example, the universities are considered performing only moderately in international rankings. Furthermore, even though Finland has performed well in the recent past in strong sectors like the ICT and forest products, its competitive position has rapidly deteriorated prior to the recent deep economic crisis. Finland has encountered problems in reaping benefits from its technological inputs in new technology areas and has not succeeded in promoting appropriate circumstances to foster the growth of high-growth start-up firms. The last question is dealt with especially by the panel on Growth Entrepreneurship and Finance. There are thus good grounds for taking new policy initiatives, i.e. "*problems*" exist (condition 1 among the rationales in section 2.2.5). However, it would be advantageous if the problems could be identified in more specific terms, as well as the main explanations for them. Whether the government has the *ability* (condition 2 in section 2.2.5) to design policies which will be effective enough to solve or mitigate the problems is to be seen.

2.5.2. SHOKs

The SHOK programmes are deemed to be a way to strengthen fields of research and technology which are of significance for the promotion of economic growth, renewal, and employment. The SHOK programmes aim at high international standard and globally competitive research, development, and innovation, significant for the business sector and the society. The programme is based on close cooperation between the various parties involved: industry, universities and research institutes as well as public funders of research. The aim is to allocate existing and new R&D resources in a new manner and on a much larger scale than hitherto. The organizational form adopted, that of a non-profit limited company, is expected to commit the owners more firmly to the adopted longer-term research programmes (with 5–10 years' time perspective for applications).

At first, five SHOK areas were chosen by the Science and Technology Policy Council of Finland: forestry, ICT, metal products and mechanical engineering, energy and environment, and health and wellbeing. Further SHOK areas will be chosen by a steering group led by the Ministry of Employment and the Economy and the Ministry of Education. Built environment has been accepted as the sixth SHOK.

Since the SHOKs are a new instrument, they are in the phase of being shaped, and there are still open questions as to the way in which they will operate. A few salient features can, however, be listed as follows:

1. The research programmes of the SHOKs will be chosen and defined by the major industrial owners of the SHOK limited companies, i.e., largely by large companies.
2. The way in which project ideas will be searched can vary, based either on bottom-up and/or top-down procedures depending on the programme. In a similar vein, the selection of project proposals for the SHOK programme varies, but the owners of the SHOK play a major role.
3. The SHOKs will allow for external parties to participate in the programmes, but after the agenda has been formulated.
4. So far the SHOK projects will be funded using existing research funding tools by Tekes and the Academy (or other funding sources).
5. The procedures under which the projects will be evaluated by the funding agencies will by and large be similar to those used by the agencies for their proposal evaluation in general. However, it may be the case that SHOK status will bring with it shorter procedures. This would imply that, to some extent at least, the proposal selection would be outsourced to the SHOKs.

Tekes first estimated that the sums to be allocated to the SHOKs would gradually grow to cover a sizeable part of their total funding, and it expected that the SHOKs would to a large extent replace their own programmes. Tekes later reduced the sums ear-marked to SHOKs to a more realistic level, i.e., to approximately 12–15% of their total funding. Tekes expects to finance its own programmes side by side with SHOKs with somewhat larger sums of money. It means that Tekes will maintain a role in programme activity and will not outsource this activity to the SHOKs as expected in the early stages of preparation. The originally envisaged sums, which would be allocated to the SHOKs (50–100 million EUR annually per SHOK, of which around 60%

would come from public sources) are obviously an overestimation. However, in the beginning of 2009 the parties involved in the SHOKs still maintained the early – as it now seems, unrealistic – expectations concerning the magnitude which the programmes will achieve in a few years time.

The choice of areas for SHOKs is largely based on existing industrial strengths in Finland. The SHOKs may thus be regarded as a tool to enhance and renew the knowledge base and skills in more traditional areas and in incumbent, mainly large firms. As such, they may turn out to be a highly valuable instrument and prompt incumbent firms to pursue longer term research (so-called precompetitive research) to renew their knowledge base and find new products and new application areas. By focusing on the incumbent large firms, they will attempt to remedy the problem that arose in some high tech areas where new start-ups did not find an *industrialist*, a partner with industrial and marketing competencies to bring the innovation into large scale industrial production and distribution Industrialists thus provide vitally important complementary assets needed in the commercialization process. *Therefore, this instrument is geared to promoting very specific assets in the commercialization process* (Luukkonen and Palmberg, 2007). It is not designed to deliver really new and revolutionary knowledge, which might make the existing knowledge base and skills of the large firms redundant. The SHOKs thus have a very specific role and they do not fulfill the need to promote new, revolutionary avenues of search.

The so-called precompetitive nature of the SHOK programmes is enhanced by the Intellectual Property rule of sharing the immaterial rights among the participants (like in the EU Framework Programme projects). At the same time, this rule is <u>not</u> conducive to promoting new start-ups, since in high tech areas, these typically require exclusive intellectual property rights. The scheme thus would not be conducive to promoting 'gazelles', high-growth start-ups to emerge from it.

Hence the SHOKs cannot be expected to be "forward-looking" in the sense of being instrumental in changing the Finnish production structure through the development of new sectors of production (i.e. new sectoral systems of innovation). Neither can they be expected to enhance the creation of new firms in new sectors of production. So far they can even be judged to play a conserving role in the Finnish economy and its presently strong sectors. This can be exemplified by the fact that the forestry SHOK has developed a programme in the field of process innovations, but not (yet) in the field of product innovation. At the same time, new products are much more needed by the Finnish forestry industry than making already well functioning processes even better.

With regard to demand- or user-oriented innovation policy, some of the SHOKs are planning to experiment with demand and customer-based business concepts and can provide one of the means to promote these.

The SHOK initiative is primarily promoting the renewal of existing industries.

The SHOKs will not contribute to the emergence of new industries or new clusters.

We endorse their experimentation with innovation promotion in a demand-based mode.

We endorse this new scheme but consider that it may be important to keep the total allocation of funds to this new instrument limited to a maximum of 12–15% of the total Tekes' funds. It is important to reserve sufficient sums of money for the support of the emergence and development of more radical new technologies in new and emerging sectoral systems of innovation, using instruments such as Tekes technology programmes, and further, through the responsive mode of funding. In particular the development of new products should be emphasized. It is also important to support the development of start-ups in high tech areas more broadly, not just in preselected areas, responding to the needs of existing firms, and spurring their growth.

We recommend that the resources to be devoted to the SHOK initiative be limited to enable the support policies for the development of new product groups in new sectoral systems of innovation.

Given that the SHOKs are expected to promote research, development, and innovation activities which are of high international standard and globally competitive, their research programmes would be more intensively engaged in international collaboration than, for example, Tekes has done with its research programmes.

We recommend that the international dimension be more strongly aligned with the new SHOK programmes and their procedures.

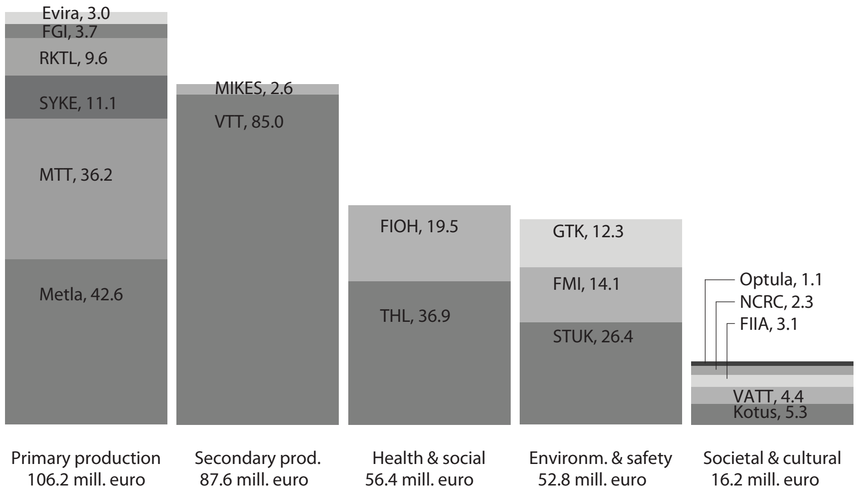
2.5.3. REFORM ATTEMPTS IN SECTORAL RESEARCH

The so-called sectoral research includes research that supports societal policies and services, and is carried out in public research institutes outside the universities, but also at universities and in private organizations, commissioned by the ministries and public agencies to fulfill their information needs. This system has developed gradually and the resources are allocated in a way which does not correspond to the present-day needs; for example, note the large share of funds which still go into agriculture and forestry research (see

Figure 2.3)[19]. Public research institutes have, to some extent, overlapping responsibilities and there are areas not covered by the present system, such as the assessment of the future impacts of policy measures. Furthermore, there is little horizontal cooperation and little capacity or willingness to commission horizontal research tasks by the various ministries. The magnitude of sectoral research is about 10 000 person-years and 500 million EUR per year (including internal and external funding). It is thus a question of substantial resources.

In addition to the above-mentioned more general reasons, the reform of sectoral research – pending a long time – has become even more important from the point of view of a broad-based innovation policy. First, the present system does not seem to be able to address the research-based information needs of the public administration itself both in horizontal, and according to the information obtained through interviews, even in vertical questions. Thus the user-producer interaction in this sector is not satisfactory. Partially this may be a result of lacking resources and competencies in ministries com-

Figure 2.3. Budget funding of public research organizations in 2009, mill. euro



Notes: The source is Statistics Finland. *Evira*: Finnish Food Safety Authority (Elintarviketurvallisuusvirasto); *FGI*: Finnish Geodetic Institute (Geodeettinen laitos); *RKTL*: Finnish Game and Fisheries Research Institute (Riista- ja kalatalouden tutkimuslaitos); *SYKE*: Finnish Environment Institute (Suomen ympäristökeskus); *MTT*: Agrifood Research Finland (Maa- ja elintarviketalouden tutkimuskeskus); *Metla*: Finnish Forest Research Institute (Metsäntutkimuslaitos); *MIKES*: The centre for metrology and accreditation (Mittatekniikan keskus); *VTT*: Technical Research Centre of Finland (Valtion teknillinen tutkimuskeskus); *FIOH*: Finnish Institute of Occupational Health (Työterveyslaitos); *THL*: The National Institute for Health and Welfare (Terveyden ja hyvinvoinnin laitos); *GTK*: Geological Survey of Finland (Geologian tutkimuskeskus); *FMI*: Finnish Meteorological Institute (Ilmatieteen laitos); *STUK*: Radiation and Nuclear Safety Authority Finland (Säteilyturvakeskus); *Optula*: The National Research Institute of Legal Policy (Oikeuspoliittinen tutkimuslaitos); *NCRC*: National Consumer Research Centre (Kuluttajatutkimuskeskus); *FIIA*: Finnish Institute of International Affairs (Ulkopoliittinen instituutti); *VATT*: Government Institute for Economic Research (Valtion taloudellinen tutkimuskeskus); *Kotus*: Research Institute for the Languages of Finland (Kotimaisten kielten tutkimuskeskus). The primary production in the figure includes SYKE, FGI, and EVIRA because they are part of a consortium of research institutes under the Ministry of Agriculture and Forestry.

missioning research tasks and partially a result of inadequate forms of governance. Some of the research that public sector research institutes carry out might be better conducted at universities. The fact that they need research information in order to fulfill their non-research tasks is not sufficient to justify current practices, since they do not need to conduct all the research themselves. We may judge that the administrative procedures and structures in public research institutes lack innovative organizational solutions.

A reform of sectoral research started in April 2005 when the government took the decision to implement structural reforms in the public research system. A committee led by Yrjö Neuvo, appointed in December 2005, in its report a year later suggested a number of fairly radical measures. These included an idea to reorganize sectoral research on the customer-contractor principle and when commissioning projects, to manage them with horizontal coordination across administrative sectors. Competitive bidding was to be the basis for funding decisions. Money for the contractor consortia would mainly come from the basic funding of the current sector research institutes, and to gain back this money, these research institutes would have to compete with other potential providers of research information. These recommendations were not met with enthusiasm by the organizations affected.

Neuvo's committee also made an important recommendation to set up an Advisory Board for Sector Research in the Prime Minister's Office in order to give it a strong coordinating position vis-à-vis the various administrative sectors. This recommendation was not put into practice, and on appointment, the Advisory Council was located in the Ministry of Education, giving it a much weaker position at the outset. Its task was to improve the competencies within ministries to commission sectoral research, and in particular, to strengthen horizontal co-operation across ministries in this matter. It also got a task to promote structural reform in the sector research system.

The board made plans for thematic research programmes spanning across administrative boundaries. These have not, however, led to action, and the Board itself does not have resources to finance this research. It has not been able to suggest allocations of reductions in the numbers of personnel and jobs, as required as part of the overall efficiency programme in public administration. Its efforts to bring about a structural reform in the public research system have not brought about any results (a one-man committee nominated by the Board did not suggest any structural changes but the continuation of current structures and more money for the current institutes). The only changes in this sector recently are two organizational mergers or regrouping of tasks, involving quite large organizations. The Advisory Board was thus given very difficult tasks and no resources or means to implement them, other than voluntary co-operation. It is therefore no wonder that it failed in its task.

One recent development is that there will be a new Act on the Advisory Board with a new composition and reinforced tasks. For example, representation from the different ministries will be lowered from Chief Secretary to lower level civil servants, who will have more expertise in research affairs in their respective administrative sectors. According to the press release by the Ministry of Education of 28 May, 2009, the government has decided that, at first 5 million, and gradually by 2015, 10 million euro, will be earmarked for the new Board to enable the financing of horizontal research programmes or other action to enable a structural reform. Where this money will come from will be decided in the government's budget negotiation. The sums of money are modest in comparison of the total funds spent on sectoral research, but the decision indicates a will to move forward.

According to our understanding, the hoped for reforms in the sectoral research system have largely failed because they affect strong vested interests in ministries and public research organizations. Furthermore, these questions obviously have implications for regional issues – for example, cutting down field stations in the agro-forest sector, though these do not employ large numbers of people – and possibly also for the social sector. These questions touch upon important political interests. Without political will the reforms will not be forthcoming. A structural reform in sectoral research could become a show-case for the new, broad-based innovation strategy. However, unless the government is able to implement the reform, it faces a risk of losing credibility in its commitment to the implementation of the new innovation strategy.

The extent of the reform needed obviously represents too radical a change to be implemented quickly and can realistically be expected to be put in practice only over a longer time period.

We therefore recommend a multi-year reform plan concerning the steps to be taken to implement the reforms. Such a plan could take advantage of retirement of personnel in the reallocation of resources.

We consider that part of the research activities in the public research institutes should be moved to the universities, and that in order to fulfil their public functions and satisfy their information needs in this respect, the sectoral research institutes should outsource some of the studies to universities.

We further recommend the award of significant resources to the renewed. Advisory Board to strengthen its capacity to implement horizontal research programmes to satisfy the information needs. The two major research funding organizations, Tekes and the Academy of Finland, could help and provide lacking research contractor and proposal evaluation skills.

Last, but not the least, in order to facilitate a structural reform, the long-term goal of the sector research reform should be reorganization of the public sector research institutes into a small number of groups according to broad societal questions, and not according to the present administrative sectors.

2.5.4. UNIVERSITIES

The New University Act

The new University Act will be dealt with by the panel on Education, Research and the Economy. This panel wishes to emphasize that the general principles entailed in the legislative proposal are important for the renewal of the Finnish university system. The university reform will create favourable *framework conditions* for the universities to respond to the needs of the society in the provision of excellent scientific research and knowledge, fulfilling the training function, and having societal and economic engagement.

The impacts of the new Act will be affected by the detailed rules and guidelines adopted by the Ministry of Education and the internal changes to be made by the universities. The new Act provides opportunities for positive change, but also a possibility for negative developments. It is up to the stakeholders to seize and shape the opportunities thus opened. Whether the new Act promotes framework conditions which will be favourable for the implementation of the broad-based innovation policy, remains to be seen and will depend on the way in which the stakeholders will mould universities and their interaction with other societal actors.

Removal of the teachers' exemption in IPRs

As of the first of January 2007 the so-called teachers' exemption was removed from the legislation concerning the Intellectual Property Rights of university-based inventions. It means that as a general rule university staff no longer owns the intellectual property of the inventions it has made. The staff owns the rights only in the so-called open research, which means research carried out without external funding. Also this case, the staff has to report the invention to the university within six months.

Patenting is one of the modes of commercializing inventions made at universities and it is an important part in other modes, such as starting-up a new company or collaborating in R&D with an existing company. Patenting rules create a contracting framework for university-industry collaboration[20].

The purpose of the legal reforms in Finland, as elsewhere (Kenney and Patton, 2009), was to promote the utilization of university inventions in an efficient, effective and socially optimal manner. Another motivation may have been a wish to generate income for universities.

The model for the removal of the teachers' exemption was taken from the USA (the so-called Bayh-Dole Act in 1980), though there the legal reforms pertained to giving the universities greater exclusive intellectual property rights for inventions funded with Federal money. This means that the rights were moved "downwards" in the system. In Europe, the changes were by and large about removing the intellectual property rights from the teacher-researcher level to the university level. This means that the rights were moved "upwards". Countries where this happened include Denmark, Norway, and Germany. Since the US Bayh-Dole Act was perceived to be successful, in many countries the model of university ownership of patents has become "the natural method for organizing the interface between university inventions and inventors and the economic realm" (Kenney and Patton, 2009).

In the past few years, questions have been raised on whether the university ownership model is indeed as beneficial as assumed. Overall, however, evidence of the impacts of such legal reforms is not clear and uniform. To some extent this is due to the difficulty of proper measurement and control of the critical factors[21].

In the USA Mowery and Ziedonis (2002) have noted that the most significant change after the Bayh-Dole Act in university patenting has been the rise of biomedical research-related inventive activity, but that the Bayh-Dole Act had little to do with this. The act has attracted new entrants (universities) into patenting, but the patents issued to these universities are less important than the patents issued before and after the legal reform to US universities with longer experience in patenting.

Kenney and Patton (2009) further have drawn attention to the fact that university technology licensing (transfer) offices may pursue their own interests (revenue generation) to the detriment of the university's overall interest, and end up restricting the disclosure of inventions rather than disseminating information. These offices may be badly managed and resourced or simply incompetent. The authors conclude that the technology licensing offices may turn out to be an ineffective and counterproductive solution for the intermediation between the inventors and those who will eventually utilize the inventions.

According to recent research findings in Denmark, where the legislative change took place in 2000, in fields like drug discovery, after the reform, Danish domestic academic inventors have significantly reduced their contributions to patenting (Valentin and Jensen, 2007). There has also been a reduction in collaborative research between universities and industry. One of the conclusions of the study was that the pre-reform convention of allocating IPR to the industrial partner in return for funding and publication rights to the academic partner offers more effective contracting for this type of research (Valentin and Jensen, 2007). Uncertainties and delays caused by negotiations about the ownership rights hamper university-industry collaboration and the utilization of the inventive potential of university scientists. It is to be noted that the above findings relate to one field, but may be indicative of the fact that changes in contractual mechanisms in collaborative research can be counterproductive to the original purpose of the reform.

Disclosure and utilization of university inventions is highly important for a broad-based innovation policy. Effective incentives for disclosure and transfer of knowledge ought to be in place. The above examples illustrate that the institutions (rules) and organizations (players) promoting commercial utilization of university inventions may be ineffective or even counterproductive. It is partially a question of the design of organizations but also of the incentives related to institutions.

We consider that it is too early for a verdict on the impacts of the IPR reform in Finland. Examples from other countries, however, highlight the fact that patent law changes may bring about impacts which are opposite to what was originally sought. Emulating institutional solutions from other countries is always risky and may not work in the new environment. This is also a case where it is not at all clear that the original model (Bayh-Dole) worked and that too hasty conclusions were drawn on the basis of a few exceptional cases which brought high revenues for the universities. It is also evident that in Finland the resources of technology transfer offices are sub-optimal with most of them having just one full-time employee.

Societal and Economic Engagement of Universities

Universities are the primary source of highly educated people and new ideas, the two most valuable assets in the knowledge economy. All over the world, new policies are sought to strengthen the role of universities as core agents of local, regional and national economic development. As Lester (2007) notes, a rising interest in the universities' economic development role has been fuelled by high-profile examples of successful, but fairly atypical cases where the university contribution has been easily identified (Silicon Valley, the Boston area and Cambridge, UK).

The Finnish University Act was last reformed in 2004, when a societal and economic service function of universities, the so-called Third Mission, was added to the law on universities. The purpose in this section is not to evaluate how the Finnish universities have succeeded in fulfilling this obligation, but rather to consider the implications for the broad-based innovation policy on the strengthening of universities' societal and economic engagement. The 2004 Act prompted the universities to adopt a more active role in commercialization. This does not imply that Finnish universities were not active in many technological, societal and economic developments earlier. There is plenty of evidence[22] that Finnish universities have for a long time been an essential part of societal and economic development as a whole in Finland. Certainly, there are significant differences between disciplines, various academic units and universities.

Based on his extensive empirical study on the history of the commercialization of science at the University of Helsinki and Helsinki University of Technology, Kaataja (2009) concludes that teaching, research and commercialization have been carried out in parallel and usually inside the academic world for quite some time. The universities did not for a long time establish extensive technology transfer systems, but relied on individual-level activity and partnerships with various public development agencies and intermediaries. The new law of 2004, as well as the removal of the teachers' exemption in IPR in 2007, have prompted universities to look for new operational models and new ways to engage more systematically in the economy and society as a whole.

Universities are under increasing pressures to create more effective technology transfer mechanisms. The economic significance of the linear technology transfer model, starting from discoveries made in a university and proceeding to disclosure, patenting, licensing of the technology and perhaps to start-up or early stage technology-based enterprises founded by the inventors themselves, is usually exaggerated in the policy spheres. New business formation stemming from university research is only a small fraction of all the new businesses (Lester, 2007). Even in its limited role, technology transfer is an important contribution by the university to economic development.

The possibilities are not limited to patenting and licensing the discoveries made in university laboratories. A systemic perspective on innovation policy also acknowledges the role of universities in attracting new knowledge and resources from outside, adapting knowledge to the local conditions, integrating previously separate areas of technological activity in the region and, unlocking and redirecting knowledge that is already present but is not being put to productive use (see, e.g., Lester and Sotarauta, 2007). University-industry collaboration is a vitally important route for technology transfer, and according to available international statistics, Finland fares quite well in this respect. It should also be noted that most of these university contributions presuppose the presence of industry or other interested and capable organizations, and that in many cases, the indirect support provided by universities for innovation processes is likely to be more important than their direct contributions to problem solving in industry. Indirect support refers to education, training programs, awareness raising conferences and other forms of activity that may shape and direct innovation processes but do not aim to influence them directly.

We adopt a view that in the broad-based innovation policy context, *the societal and economic engagement of universities is related to their primary tasks, i.e. education and research.* Commercialization of university inventions, extension studies for lifelong learning or problem-solving for industry and other partners, to mention a few examples, are not something external to the primary tasks, but stemming from them. Therefore, in the future development of universities within the broad-based perspective, the main question is how education and research could become more systematically integrated in the operation of the society at large. *Technology transfer is an important element in a wide spectrum of ways in which universities are engaged in the economy and innovation activities. Additionally, when assessing the extent of universities' socioeconomic engagement, five different dimensions ought to be taken into consideration. These emanate from the strategic choices made by the universities themselves and include 1) science-based innovation activities, especially technology transfer, 2) engagement in the labour market, i.e. lifelong learning in the working life, 3) engagement in socio-ecological development for sustainability, 4) engagement in the regional development and 5) engagement in wider societal debate (see Ritsilä et al., 2008).*

It is important that the funding principles of universities encourage universities to find their own profile and the ways in which they can contribute to innovation activities in the private and/or public sectors.

2.5.5. REGIONAL INNOVATION INITIATIVES

In Finland, science and technology policy (and especially educational policy) has had a relatively strong regional dimension for decades. Especially from the late 1950s to the 1970s, the university system was explicitly developed to support regional development. And even though Finnish science, technology and innovation policies appear to be of more top-down (dominated by national policies) than bottom-up (being influenced by local developments) by nature, a long-term view reveals their co-evolutionary characteristics.[23] The various localities have been active and invested their own resources in what we nowadays label as local nodes in wider innovation systems; i.e. in infrastructure, local competencies, networks, etc. both directly and indirectly. In spite of all the investments local government and other local and regional development agencies have made in the innovation capacity in their respective regions, the national innovation policy does not fully recognize the role of local and regional development efforts.

Only a few Finnish city-regions have the necessary research base and knowledge producing organizations to support world-leading industries applying a supply-based mode of innovation. Most of the regions lack strong research and innovation environments. However, instead, they have a relatively strong capacity in non-scientific practice-based innovation. During the last decade there has been a growing tension between the promotion of balanced regional development and the promotion of internationally competitive science and innovation activities that would need a concentration of resources and competences in a few locations. The advocates of concentration derive their rationale largely from the supply mode of science and innovation and more narrowly defined innovation systems, and their argumentation focuses on the need to pool scarce resources to develop a few selected city-regions capable of becoming world leading concentrations of science, technology and innovation.

The panel acknowledges that Finland is too small a country to support many truly world-leading science- and technology-based innovation centres. It also maintains that from the point of view of the new – broad-based – innovation policy, Finland should simultaneously promote the development of national spearheads and enhance learning capabilities for continuous renewal in the society as a whole. By doing so, it will attempt to create a fertile soil for unexpected new developments to emerge all over Finland, and not only in a few pre-selected centres.

The broad-based innovation policy provides a good starting point to rethink and to make more explicit the role of localities and regions in the national innovation system. So far, there are only a few examples of how to promote the use of experience-based innovation and to integrate users systematically in the processes of innovation by means of innovation policies. Forum Virium Helsinki[24] is a fine example of an effort to bring together firms, public development agencies and universities, i.e. digital service developers and users to produce many kinds of innovations and to co-ordinate their innovation efforts at the crossroads of common needs and objectives. In Tampere, Demola[25] aims to create an open innovation environment where students represent both users and creators of digital services, products, and social practises. For students, Demola creates unique opportunities to contribute to real-life innovations in collaboration with end-users and globally connected organizations. For companies, Demola creates organized access to young peoples' thinking and behaviour, i.e. to mindsets of users of digital services. "Living Lab[26]" is perhaps the best-known model to promote user-driven and experience based knowledge, methods and tools for the products and services innovations.

While there is an undeniable need to strengthen the strongholds of the Finnish science, technology and innovation, the smaller towns and rural areas could be promoted as experience- and non-science-based innovation arenas. This would require more fine-tuned and more nuanced regional innovation policies to support different needs of the regions, but also a specific science and technology supply-based policy for the spearheads. The Centre of Expertise Programme has already earlier drawn on a broad understanding of the concept of innovation. It has raised, e.g., foodstuffs (South Ostrobothnia), experience economy (tourism in Lapland) and Chamber music (Kuhmo) on the innovation policy agenda. The aim has been to promote innovative activities beyond science and technology supply-based models.

National innovation policy is emphasised in Finland, but the panel considers it important that each region be developed on the basis of its strengths and draw on local initiatives. There is a risk that an overly centralized, coordinated, managed and targeted innovation policy will dampen local and regional initiatives and provide disincentives to them. So far, the Centre of Expertise Programme has been the only national innovation policy tool with an explicit regional focus. Of course, there are several examples how various localities and regions have placed innovation at the core of their own development activities.

The national Centre of Expertise (CoE) Programme was first initiated and launched in 1994 as an objective programme under the terms of the Regional Development Act. It was originally a continuation of many local development efforts. The programme has gradually been expanded during its later programme periods. The second programme period (1999–2006) expanded the range of activities to cover regions which were significantly smaller and less knowledge-intensive than those addressed before. Non-technological fields of expertise, such as the above-mentioned cultural business, chamber music, experience industry, design and new media, were incorporated into the program. The further expansion of the programme to new regions took place in 2003, when the number of centres implementing the CoE programme in 2003–2006 totalled 22, of which 18 were regional centres and four were networked centres with operations in more than one region.

The expansion of the CoE programme diluted the selection criteria that were based on strong research capacity. Smaller regions were given a chance to participate in the Programme. This reflects the nature of the programme in the nexus of regional policy and innovation policy; its selection criteria are based both on innovation and regional development.

While the programme was expected to utilize the best available expertise, it aimed to promote knowledge-based regional development outside the main city-regions, too, where such expertise was less likely to be found. The programme has, nevertheless, highlighted the significance of innovation and the importance of building learning and innovation capacity throughout Finland, and thus has served as an important tool in awareness raising, learning and capacity building for future (Sotarauta et al., 2003).

The third CoE -programme period (2007–2013) introduced a new concept and focus. The notion of 'competence cluster' was adopted as a key concept the objective being to increase regional specialization and to strengthen cooperation between regions. The National Programme involves 13 national Competence Clusters and 21 regional Centres of Expertise. The new programme period is based on the assumption that the national competence clusters enable a more efficient utilization of resources scattered in different regions, and increase the critical mass needed in innovation activity to create CoEs with a stronger international appeal. Moreover, it is argued that the national, cluster-based model will promote the pooling of scattered resources, thus enabling better-integrated networks and diverting attention away from fruitless competition among the regional players for international positions.[27]

While the first two CoE periods clearly represented regional development policies, the third period introduces a closer connection to the national innovation policy. Partly this is due to the fact that national coordination of regional development issues was moved from the Ministry of the Interior to the newly founded Ministry of Employment and the Economy, which is responsible for both regional development and innovation policy.

In spite of the fact that education, science, technology, and innovation have been integral elements in regional development policy for decades, the local and regional innovation policy is a relatively unclear and multifaceted entity in Finland. While the Centre of Expertise Programme is the only formal element of regional innovation policy, there are, nevertheless, countless efforts to support innovation in all regions of Finland. The fuzziness is caused by the fact that:

1. the activities to promote innovation in different parts of the country reflect the situation and the needs of the region, and hence, do not form a common policy all over the country (this is a positive factor),
2. the regional dimension in innovation policy is not explicitly defined and developed as an integral part of the national innovation policy and,
3. the competences and skills required to design and implement effective innovation policies are not yet fully developed across the country.

We stress that the new broad-based innovation policy ought simultaneously

1. to promote the development of spearheads, i.e. world leading concentrations of economic activity,
2. to promote a learning capacity for self-renewal in the society as a whole and thus ensure that there will be a fertile soil for unexpected new developments to emerge also in smaller cities and towns and,
3. to ensure that Finland will not be divided into world leading innovation oases and innovation deserts.

One of our conclusions is the fact that there is a long-standing tradition for integrating innovation into the regional development policy, but not for explicit local and/or regional innovation policy.

In order for regional innovation policy to develop, it needs to be explicitly debated in an open process and accordingly defined. It is furthermore necessary that its role, functions, and adequate tools and resources are determined as integrated parts of the national broad-based innovation policy.

We recommend that:

a) The focus and operational modes of the forthcoming fourth Centre of Expertise Programme should be redirected to support regional learning and innovation capacity in the spirit of experience-based non-scientific[28] innovation instead of supporting research-based competence clusters.

b) The main objective of the thus reformed CoE programme should be to find new ways to enhance non-scientific innovation and learning capacity in businesses relevant for the specific region and local government service providers.

c) Science and technology-oriented activities should be moved from the CoE programme to the SHOKs as far as possible.

If put into practice, the above-mentioned recommendations would create a division of labour between programmes that aim:

1. to renew existing strong sectors of the Finnish economy and boost their innovation activity (SHOKs),
2. to develop innovation awareness and innovation systems explicitly for public service provision and non-science-based clusters (CoE), and
3. to create new possibilities for experimentation and exploration of something totally new and thus to prepare the ground for unexpected innovations to emerge.

Of course, there ought to be coordination among these three spheres of innovation policy.

2.6. INTERNATIONAL DIMENSION OF INNOVATION POLICY

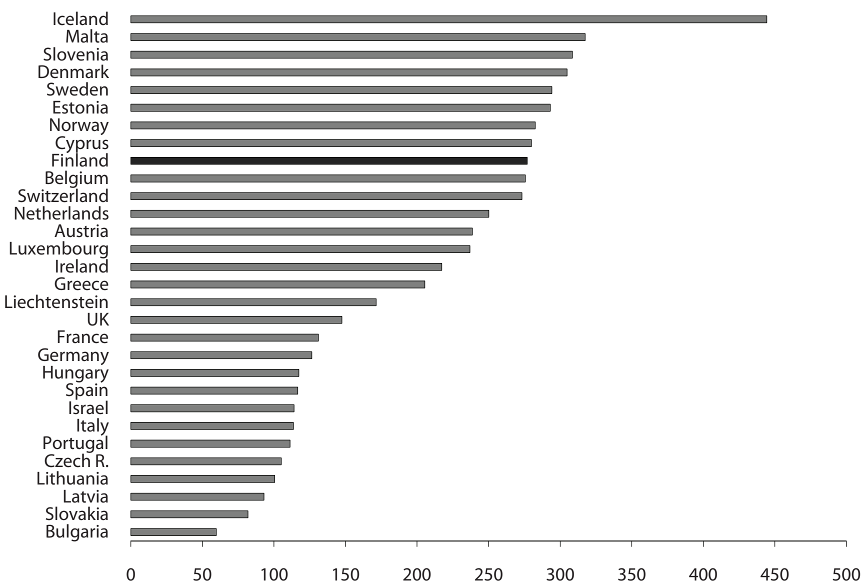
Finnish innovation policy and policy documents[29] emphasise the importance of internationalization and international collaboration in Finland's innovation policy strategy. Internationalisation has indeed been a policy objective for a long time. Still, according to available indicators, such as the share of academic staff from foreign countries, the figures for Finland are among the lowest as compared with many other EU countries.[30] As indicated by the report of the panel on Education, Research, and the Economy, the share of international teacher and researcher visits from and to Finland has slightly decreased in the 2000s, contrary to expectations and policy goals concerning internationalization. The joint programme of the Academy of Finland and Tekes, the FiDiPro Programme (Finland Distinguished Professor Programme) provides one step taken to counteract the above-mentioned trends and to foster internationalization of Finnish academia. The FiDiPro programme enables distinguished researchers, both foreign and expatriates, to work in Finland with the 'best of the best' Finnish academic researchers.

Finnish funding agencies have agreements about research collaboration and exchange with a number of countries outside the European Union. These agreements are made with countries where official contracts are important for achieving joint action such as joint calls. The EU Framework Programmes and other European funding schemes, such as Eureka, COST, ESF etc., however, play a major role in Finland's innovation policy-related international funding schemes. Funding to R&D activities, performed in specified support regions, is also channelled through the so-called EU Structural Programmes.

The EU Framework Programme plays the most important role because of its sheer size, the multitude of research areas and support instruments it covers, and the fact that it provides substantial money for research activities. The Seventh Framework Programme facilitates collaborative research projects as well as networking among the funding agencies, mobility of researchers (Marie Curie) and aims to create a truly European research area where knowledge, researchers, and technology can move freely, and national research activities and policies are coordinated.[31]

Finnish researchers and organizations actively participate in the EU Framework Programmes; both in terms of 'juste retour' (as compared with Finland's share of the EU's R&D budget) and the population size (see Figure 2.4). However, Finland is a highly R&D intensive country and therefore if Finnish participation numbers are related to its R&D expenditures, the Finnish participation numbers in reality are well below the EU average. There is thus room for improvement in this respect (Figure 2.5). Finnish organizations and researchers have not been, when related to the R&D expenditures, much more active in the new integrating and ambitious instruments of the Sixth

Figure 2.4. Total participations in FP6 per million inhabitants (2005)

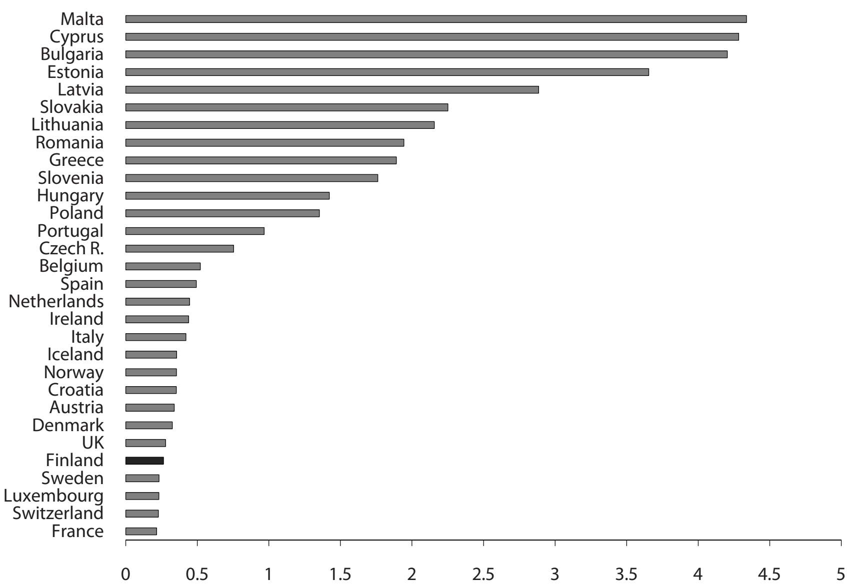


Notes: The source is Tekes/European Commission (EU FP6 2002–2006) and UNFDA. Participation means a participation of one organization in a project. There may be several participating organizations – and thus participations – from one country in a single project.

Framework Programme, ERA-nets, Integrated projects and Networks of Excellence (See Appendix 4, Figures 1–3). ERA-nets and Networks of Excellence represent tools specifically aimed at furthering integration among research performing and funding organizations across the EU member states.

New member states top the list of participations in relation to their R&D expenditures, while high R&D spenders like Sweden and Finland are low on the list. This raises the question of a potential crowding out effect of the national R&D expenditure with regard to the European-level R&D funding. The European Framework Programmes have an advantage over the national level funding programmes – at least for the time being – in that they require European/international collaboration as a prerequisite for funding decisions. European and international collaboration will bring important competence and network building effects as well as competition. Considering that Finnish research environments and researchers are surprisingly and persistently domestically oriented in terms of mobility or the composition of university personnel, more international exchange and mobility would be highly recommended. Empirical research (Kahn and MacGarvie, 2009) further shows that foreign researchers are more productive, bring new ideas and competition. The same applies for domestic researchers abroad after they return.

Figure 2.5. Total participations in FP6 per R&D expenditures (2005)



Notes: The source is Tekes/European Commission (EU FP6 2002–2006) and Eurostat. Participation means a participation of one organization in a project. There may be several participating organizations – and thus participations – from one country in a single project.

The EU is an important arena for international collaboration of Finnish researchers and companies. The EU research policy is a significant forum for pursuing important socio-economic issues which affect the development of European societies. Influencing the EU research policy is a new challenge for Finnish stakeholders and requires new capabilities and modes of action. Influence takes place at several levels and through a multitude of channels, for example, from the special period of a country's Presidency, which offers an unprecedented opportunity to introduce issues to the European research policy agenda, to active membership or special functions in committees and expert groups, to participation in events organized to formulate and assess policies, and to active networking, lobbying, coordinated action, and contacts in between events and special occasions[32]. According to the interviews the panel has conducted, there is room for improvement in Finland in these capabilities.

It has further been brought to the panel's attention that the efficiency programme in the public sector[33] tends to be implemented fairly mechanistically and does not sufficiently take into account the needs of new and demanding tasks related to international collaboration and influencing European research policy arenas. In these kinds of tasks experience and expertise accumulated as well as personal networks play a vitally important role for the successful performance of the tasks. Furthermore, because of the personnel savings, experienced personnel have to divert their time and effort to other areas. An unwisely implemented efficiency programme may turn out to be counterproductive to its original goals.

The government's communication on EU policy in general (Valtioneuvoston kanslia, 2009) pays attention to the fact that influencing EU policies is important both for the development of the Union and, through it, for the development of the Finnish society. The communication acknowledges that exerting influence requires resources. The Prime Minister's Office will launch a project with an aim to assess the practical means to influence EU policy and the resources required by it. We espouse the importance of this matter for innovation policy.

In order for Finnish civil servants to gain competencies and better understand the ways in which the EU arena functions, the Finnish government should actively endorse stays of Finnish civil servants in other organizations abroad as a prerequisite for promotions in tasks needing competencies in international networking.

ERASMUS for civil servants provides new opportunities for building up knowledge and competences concerning the EU policy making and should be taken as part of Finland's internationalization strategy.

2.7. CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

The Broad-Based Innovation Policy Panel has paid special attention to the new innovation policy strategy and in particular to the notion of a broad-based innovation policy, which is one of the central principles in the new strategy. We have noted that the meaning of Broad-Based Innovation Policy is not evident and needs clarification. We specified two meanings of the concept, namely:

1. It entails the broadening of the concept of innovation to include product innovations in services and organizational process innovations. Besides economic significance, it relates to wider societal benefits and measures targeted to support service innovation in public service production.
2. It takes *all* determinants of the development and diffusion of innovations into account when designing and implementing innovation policies. This would then include policy instruments operating from the demand side.

This report addresses the degree to which recent and ongoing reforms in innovation policy implement the principles of broad-based innovation policy, and what is potentially missing in the policy repertoire in terms of a broad-based view.

Many of the ongoing or recent reforms in Finnish research and innovation policy provide a good basis for pursuance of a broad-based innovation policy. This applies, e.g., to the new University Act, which provides favourable framework conditions for the universities to respond to the societal needs, in addition to becoming more competitive in scientific and scholarly capabilities. As pointed out in section 2.4.3, much depends on the way in which the reform is implemented and how well the opportunities are seized. The intention underlying the abolishment of the teachers' exemption in patenting was to promote the utilization of university inventions and to further stimulate their wide dissemination. However, how well the latter reform is achieving its targets, is not yet known.

From the point of view of a broad-based innovation policy, there would be an urgent need for a reform of the sectoral research system as outlined by the Neuvo's committee. The broad-based policy in sectoral research should emphasize, among other things, closer user-producer interaction in the provision of innovations, and utilization of innovations in the production and delivery of public services. Presently, the allocation of the resources in the public sector research follows the needs of earlier decades, i.e. too large a proportion of the support goes to primary production. The system has not been able to change the allocation or to respond to new needs for research. The reform would require new and innovative models of organizing research activities and ensuring that the information needs of the public administration are met with in an effective manner. This includes the fact that not all the research currently pursued in the public research institutes would continue to be carried out in these institutes, but as far as possible, would be outsourced to the universities.

The reform of sectoral research has not, however, been put in practice, probably because of its threat to established interests and because of a lack of resources in terms of power and money. This is an area where the government is called to show its commitment to a broad-based view. The most recent decisions from the spring of 2009 provide a step, though a very modest one, in the right direction.

The SHOK initiative may provide some experimentation ground for user- and demand-oriented programmes, though so far, it is too early to judge whether this will be the case. The basic principle of the SHOKs is fairly traditional and not likely to support the emergence of new clusters, even though as such, the programme concept is an interesting and valuable experiment to provide incentives for large firms to incrementally renew their technological base.

Regional innovation policy is an area which is especially suited for experience-based innovations drawing on a broader notion of innovations. Regional innovation policy would provide a good experimentation ground for pursuing a broad-based innovation policy which takes into account experience-based innovations and local structures and needs arising from them. The development of a regional innovation policy is, however, still in its infancy and would need further clarification of its goals, modes of action, and division of labour with other support schemes (e.g. the SHOKs).

In Appendix 3 we enlist elements of a systematic demand-based innovation policy. The repertoire of policies includes direct and indirect measures for both public and private sectors to improve the conditions for the uptake of innovations and/or to improve the articulation of demand in order to spur innovation and the diffusion of innovations. We welcome the aim of the government to adopt demand-oriented policies and to experiment with new initiatives. This could be especially pertinent to public sector activities, where demand-based innovation policy could have a considerable influence. Furthermore, in vital areas such as energy and the environment, it can exert great influence by setting norms and regulations thus providing powerful incentives for the development of future technologies. These areas are already on the research and innovation agenda, but they need a more focused approach to be really effective. The ICT is another example of an area where public action through, for example, support to diffusion of innovations can greatly benefit the sector and public welfare purposes.

It is to be noted further that a demand-oriented innovation policy is not without risks. In its attempt to hasten the market adoption of new technological solutions, the government may promote technologies which in the end turn out to be losers, and in the worst case, lengthen the dissemination period of a more viable solution. Experimentation and failures are inevitable in the adoption of radical innovations, and only experimentation will show the viability of the different solutions.

We have been cautious in advocating user-oriented innovation policies. We acknowledge that there are functions where the government can play a role (such as promoting more user-oriented innovative services in the public sector and a better identification of user needs in the provision of services through means such as living labs). We also advocate policy experimentation and new initiatives in this vein. However, the overall rationale for active intervention in private innovation activities to promote user orientation would require a clear identification of problems, understanding factors contributing to these problems, and an ability to mitigate the problems. Such arguments with regard to stronger public involvement in user-orientation innovation in general are for the time being still lacking.

Our recommendations related to recent and on-going innovation policy initiatives are summarized in the following:

1. Broad-based innovation policy

We welcome the basic ambitions of the broad-based innovation policy and recognize that the new innovation strategy represents an ambitious, but a fuzzy move towards a new balance between supply and demand-based innovation policies.

We consider important that the government soon provides clear contents to the vague concept of a broad-based innovation policy so as not to let it dissipate.

2. Overall innovation policy coordination

Basic organizational structures for formulating overall strategies and coordinating policies are in place.

A major drawback in the functioning of the present system is, however, the fact that the Ministry of Finance is less involved in research and innovation policy formulation. A more active role for it is recommended by the panel.

We recommend a more active involvement of the Prime Minister's Office in some central coordination functions, especially concerning the public sector research.

2.1. Sitra

Sitra is an important organization in the Finnish innovation system and has an important role in policy experimentation. It adds diversity to the system and can help to avoid the risk of too one-sided ideas, policies, and funding opportunities.

2.2. Evaluation as a policy tool

We consider the overlapping roles of the object of evaluation essentially too inward-looking and decreasing the objectivity and independence of the evaluation. The evaluation system is rendered healthier if a third party – not the one being evaluated – commissions the evaluation and serves as the customer.

The Finnish Higher Education Evaluation Council is an example of an organization that could undertake a broader role and become "The Finnish Research, Higher Education and Innovation Evaluation Council" and thus undertake (commission) evaluations of other public sector organizations and their activities.

3. Recent reforms

3.1. The SHOK initiative

The SHOK initiative is an interesting and worthwhile experiment in promoting the technological renewal of large firms in existing industrially strong areas in Finland.

It is to be remembered, however, that the SHOKs will not contribute to the emergence of new industries or new clusters

Therefore, we recommend that the resources to be devoted to the SHOK initiative be limited to enable support policies for the development of new product groups in new sectoral systems of innovation.

We endorse experimentation with innovation promotion in a demand-based mode in the SHOK programmes.

We further recommend that the international dimension be more strongly aligned with the new SHOK programmes and their procedures.

3.2. Sectoral research reform

With regard to the sectoral research reform, we recommend a multi-year reform plan concerning the steps be taken to implement the reforms. Such a plan could take advantage of retirements of personnel in the reallocation of resources.

Part of the research activities in the public research institutes should be moved to the universities, and in order to fulfil their public functions and satisfy their information needs in this respect, the sectoral research institutes should outsource some of the studies to, e.g., universities.

Significant resources should be awarded to the renewed Advisory Board of Sectoral Research to strengthen its capacity to implement horizontal research programmes to satisfy the information needs. The two major research funding organizations, Tekes and the Academy of Finland, could help and provide lacking research contractor and proposal evaluation skills.

In order to facilitate a structural reform, the long-term goal of the sector research reform should be a reorganization of the public sector research institutes into a small number of groups according to broad societal questions, and not according to the present administrative sectors.

3.3. Removal of the teachers' exemption in IPR

It is too early for a verdict on the impacts of the legal changes concerning the Intellectual Property Rights of university-based inventions in Finland. Examples from other countries, however, highlight the fact that patent law changes may bring about impacts which are opposite to what was originally sought. Emulating institutional solutions from other countries is always risky and may not work in the new environment. This is also a case where it is not at all clear that the original model (Bayh-Dole) worked and that too hasty conclusions were drawn on the basis of a few exceptional cases which brought high revenues for universities. It is also evident that in Finland the resources of technology transfer offices are sub-optimal with most of them having just one full-time employee.

3.4. Societal and economic engagement of the universities

In a broad-based innovation policy context, the societal and economic engagement of universities is related to their primary tasks, i.e. education and research. Technology transfer is an important element in a wide spectrum of ways in which universities are engaged in the economy and innovation activities. Additionally, when assessing the extent of universities' socioeconomic engagement, five different dimensions ought to be taken into consideration. These emanate from the strategic choices made by the universities themselves and include 1) science-based innovation activities, especially technology transfer, 2) engagement in the labour market, i.e. lifelong learning in the working life, 3) engagement in socio-ecological development for sustainability, 4) engagement in the regional development and 5) engagement in wider societal debate.

The universities' funding principles should take into account the fact that different universities and disciplines have distinct roles in societal and economic development.

3.5. Regional innovation policies and the Centre of Expertise Programme

The focus and operational modes of the forthcoming fourth Centre of Expertise (CoE) Programme should be redirected to support regional learning and innovation capacity in the spirit of experience-based non-scientific innovation instead of supporting research-based competence clusters

The main objective of the reformed CoE programme should be to find new ways to enhance non-scientific innovation and learning capacity in businesses relevant for the specific region and local government service providers.

Science and technology-oriented activities should thus be moved from the CoE programme to SHOKs as far as possible.

4. International dimension of the innovation policy

In order for Finnish civil servants to gain competencies and better understand the ways in which the EU arena functions, and thus to better influence EU policies, the Finnish government should actively endorse stays of Finnish civil servants in other organizations abroad as a prerequisite for promotions in tasks needing competencies in international networking.

ERASMUS for civil servants provides new opportunities for building up knowledge and competences concerning the EU policy making and should be taken as part of Finland's internationalization strategy.

Box 2.1. What is required for the further development of a broad-based innovation policy in Finland?

By Charles Edquist and Markku Sotarauta

A "broad-based innovation policy" is not in operation in Finland in a comprehensive and systematic sense. One reason for this is that the meaning of "broad-based innovation policy" has simply not been made clear by policy-makers or in the general discussion. It is hard to implement something which is not specified. However, we have also indicated that some of the policy initiatives recently launched may be in the process of contributing to developing a broad-based innovation policy (see section 2.7).

We could have ended here. However, we feel that we are obliged to say something about how a comprehensive and systematic broad-based innovation policy could be designed and implemented. The purpose here is not to provide the final solution, but to provoke politicians and policy-makers in Finland – and elsewhere – to actually develop and implement "a broad-based innovation policy". Our attempt to do so below will relate back to the (conceptual) beginning of this report. This section will therefore be partly repetitive and of a summarizing nature.

At the very end of section 2.2.6, we stated that innovation policy is (only) those actions by public organizations that actually influence the development and diffusion of innovations. This is also our very definition of innovation policy as we presented it in the beginning of section 2.2 and in Appendix 1. Since there has been some confusion on this issue, we would like to ask the rhetorical question what is innovation policy supposed to influence – if not innovations? This is parallel to the fact that regional policy is intended to influence regions and that growth policy is intended to influence economic growth.

In section 2.2.5 we discussed the rationales for public intervention and specified them in terms of two conditions: that a *problem* must exist and that the state must have the *ability* to solve or mitigate the problem. We then explained that one problem, in our sense, has to do with (a low) performance of the innovation system, caused by deficiencies in the key activities of the innovation system. We further argued that the explanations of that (low) performance (i.e. identifying the deficiencies) are also crucial for the design of innovation policy. These explanations are a matter of the determinants/activities of the innovation system (outlined in Appendix 2 and discussed in section 2.2). The list of the activities of an innovation system can be used as a checklist in an analysis of the explanations of (a low) performance of the system. Another rhetorical question could be asked here: Is it not natural that an innovation policy is influencing innovations by, in its turn, influencing the determinants of innovations, i.e. the activities in innovation systems (as hypothetically listed in Appendix 2)?

One reason for us to feel an obligation to provoke politicians and policy-makers to develop and implement "a broad-based innovation policy" is that the many interviews that we have conducted during this evaluation have indicated that the central policy-makers do not know about the details of the performance of the Finnish national system of innovation, i.e. about the innovation intensities of various categories of innovations (propensities to innovate).[34] No policy-maker presented, during the interviews, any data with regard to innovation intensities for different categories of innovation in the Finnish national system of innovation. It is obvious that there should be a more solid empirical evidence base to underpin policy formulation – and thereby contributing to a better defined policy. Neither did the policy-makers point out any systematic explanations for various intensities (low or high) of different kinds of innovations. They argued only in an ad hoc manner on these issues.[35] This means that they have not been able to identify the strong and weak points respectively in the Finnish innovation system. In addition, the interviews have revealed that there are implicitly a lot of very vague underlying assumptions about problems in the innovation system and their causes.

The various partial policies and initiatives that we have discussed in this panel report were initiated before a "broad-based" innovation policy started to be discussed at any depth in Finland. Therefore these initiatives cannot possibly be a part of an ex ante systematic attempt to develop a broad-based policy. This is all the more the case since, as we have noted, no one has specified what such a broad-based innovation policy could be. This implies that additional policy elements certainly will have to be designed and implemented before a broad-based policy in a systematic sense will be in place. The relevant public policy agencies in Finland have not – as a collective of public organizations – been able to identify the *problems* that should be solved by means of the innovation policy. Neither have they had the *ability* to solve or mitigate those problems. Accordingly, the conditions that constitute the rationales for public policy intervention that we specified in section 2.2.5 have not been fulfilled.

In order to develop such a broad-based innovation policy the following elements are necessary:

1. The *problems* to be solved by means of public innovation policy should be identified through analysis. These problems entail the objectives sought by the innovation policy goals, but that private organizations are unwilling or unable to achieve. (See section 2.2.5.)
2. The main causes of these problems should be identified. (See section 2.2.5 and above in this section.)
3. The state (national, regional, local) and its public agencies should have the *ability* to solve or mitigate the problems. This means that the state must design the various instruments needed. (See section 2.2.5.)

We will discuss these three elements in this final section, each in one sub-section.

However, first we want to make clear that innovations *as such* are not – in the final instance – interesting from a policy and political point of view. Innovations are interesting because they – *in their turn* – influence *other* things, such as productivity growth, social conditions, competitiveness, sustainable development, military force and health care.[36] Hence, innovations are important for what they can do, with regard to other socioeconomic phenomena. *These* are (supposed to be) influenced by innovations and, hence, this is a matter of consequences of innovations. Innovation policy entails *activities* that influence the development and diffusion of innovations (for definitions, see Appendix 1). This means that our notion of innovation policy is very *wide*, although it *is* limited to include only those activities that actually influence the development and diffusion of innovations.[37] These activities are not, in a direct sense, influencing productivity growth, etc. To be short: innovation policy influences innovations and innovations influence – in their turn – a whole lot of other things.

We also want to remind about our discussion in section 2.2 regarding what a "broad-based innovation policy" could mean:

1. It may entail the *broadening* of the *concept* of innovation as such – to include product innovations in services (including service innovation in public service production) and organizational process innovations. This implies that it is important to identify the intensities of different categories of innovations.
2. It may mean taking all determinants of the development and diffusion of innovations into account. (This would include policy instruments operating from the demand side.) This implies that it would be important to know the determinants that influence the development and diffusion of innovations. Innovation policy is a matter of how public actors can influence these determinants.

1. Identification of problems

A *problem* that shall be solved by means of innovation policy can be identified by means of empirical analyses comparing various systems of innovation. In principle, such a policy problem is constituted by a low performance of the innovation system, i.e. low innovation intensity with regard to some category of innovation.

The performance of an innovation system is the same as the output of the system, i.e. what 'comes out' of it. That output is – simply – innovations. To simplify, we are here assuming that the innovation policy objectives are formulated in terms of innovation intensities for certain kinds of innovations. As we know, this is often not the case. Instead, innovation policy objectives are often formulated in much looser terms, e.g. in terms of achieving increased economic growth, a better environmental balance or more military strength – objectives which are only partly achieved through innovations, and partly through other means. Hence, most national or regional innovation policies implemented are *not* based upon the relative performance – in terms of innovation intensities of different categories of innovations – of the country or region in question. However, in order to achieve more precision in innovation policy-making, the objectives should be formulated in terms of intensities of various kinds of innovations. Until then the policy-makers act in the dark – or at least in the mist. Only pure luck can make them successful in achieving their – quite unspecific – objectives. The performance of an innovation system should not be measured in terms of economic growth or military strength.[38]

The innovations in terms of which the objectives should be formulated may be of different kinds or classes. Some examples are

1. The development of innovations ('new to the world') or the diffusion or absorption of innovations (that are 'new to the firm', 'new to the country' or 'new to the region').
2. Radical or incremental innovations
3. Product innovations or process innovations.
4. High-tech products or low-tech products.
5. Innovations related to specific sectors of production (material goods in general, specific goods producing sectors; intangible services in general, specific service producing sectors, etc).
6. Innovations related to different socioeconomic phenomena: economic, social, environmental, military, etc.

The performance of a system of innovation can be measured by means of the propensity to innovate (or innovation intensity). Ideally, propensities should be known for many specific categories of innovations (see just above), which is why the Community Innovation Surveys (in Europe) and similar surveys carried out in non-European countries are so important. They measure (describe) – among other things – the propensity to innovate for specific categories of innovations in various innovation systems (national, sectoral and regional). If we do not know these propensities, we cannot identify problems to be solved by innovation policy. Hence the measurement of propensities to innovate with regard to specific categories of innovations is of utmost importance for policy purposes. It is important to develop the CISs to measure innovations of different kinds in an even more fine-tuned way, for example developing a refined version of the classification above – or other taxonomies.

To be useful for policy purposes, these measurements and descriptions should be comparative between systems. The reason is that it is not possible to say whether innovation intensity is high or low in a certain system if there is no comparison with innovation intensities in other systems. This has to do with the fact that we cannot identify 'optimal' or 'ideal' innovation intensities.

This also means that problems cannot be identified through theoretical analysis alone.[39] The problems cannot be identified through a comparison between an empirically existing system of innovation and an optimal one – since we are unable to specify an optimal system of innovation (just as we are unable to specify optimal innovation intensities). What remains is then to compare existing systems of innovation with each other. Such comparisons can be made between the same systems over time, or between different existing systems.[40] Only in this way can we identify the "policy problems" or "systemic problems". In other words, 'systemic problems' can be identified only by comparing existing innovation systems with each other – over time and space.

The number of studies that are measuring innovation intensities for different categories of innovations in a comparative perspective between innovations systems is surprisingly few. Most of them use CIS data. OECD (2009) is a recent one where Finland is included (as one of 17 countries). There data on the following indicators is presented:

- the percentages of all firms that have introduced a new to the firm product innovation,
- the percentage of all firms having introduced a process innovation,
- the percentage of all firms having introduced either a product or a process innovation,
- the percentage of all firms having introduced a new to the market product innovation,
- the percentages of firms having introduced a marketing innovation, and
- the percentages of all firms having introduced an organizational innovation.

OECD presents data for these categories for all firms, for SME's, for large firms, for manufacturing and for services – all for 2004–2005 (OECD, 2009). Edquist and Zaballa (2009) present data on the same indicators and some additional ones, for a longer time period, (1996–2006), and for a larger number of countries. There it is indicated, for example, that the Finnish national innovation system performed better with regard to product innovations in services than in manufacturing, that Finland's relative position deteriorated with regard to products new to the firm for manufacturing during the early years of the new millennium, and that Finland performed very well with regard to the share of turnover pertaining to products new to the market in manufacturing during the period

1996–2006. As mentioned above, there should be a more solid empirical evidence base to back policy formulation. The content of these references indicate that it is possible to develop such an empirical base. Comparative data that includes Finland does exist. It is rather complicated to develop such an empirical base in detail. But it is very important.

The rationale of innovation policy is to solve or mitigate policy problems. If the system is performing very well, thanks to its spontaneous operation (based on the actions performed by private organizations), then no problem exists and policy intervention is not motivated. Such intervention is only called for when the system is performing badly – in a relative sense. In other words, a 'problem' exists only if the (politically formulated) objectives in terms of innovation intensities are not achieved by private organizations.

2. The analysis of the causes of the problems

An identification of a 'problem' by means of empirical-comparative analysis is not sufficient as a basis for designing innovation policies; it is only a first step. The existence of a problem is only a necessary condition for pursuing an innovation policy. To know *that* there is reason to consider public intervention is not enough. An identification of a problem only indicates *where* and *when* intervention is called for. It says nothing about *how* it should be pursued. In order to be able to design appropriate innovation policy instruments, it is necessary to also know the causes behind the problem identified – at least the most important ones.

A (low) propensity to innovate with regard to a certain category of innovations is actually what should be explained. This is where the determinants of the development and diffusion of innovations systems enter the stage. These determinants are referred to as 'activities' in section 2.2. In Appendix 2 we hypothetically list ten such activities, clustered in four thematic categories:

I Provision of knowledge inputs to the innovation process,

II Demand-side activities,

III Provision of constituents of SIs, and

IV Support services for innovating firms (please see *Appendix 2*).

Each of the ten different activities may be considered to be a partial determinant of the development and diffusion of innovations. The demand-side activities – category II in Appendix 1 – are simply those determinants that influence innovation processes from the demand side, i.e. from the user side (as opposed to the supply side, such as R&D). Hence it is important to point out that we are here not pointing to determinants on the supply side or on the demand side. We point to *all* determinants of the development and the diffusion of innovations, including supply and demand. This means that a broad-based innovation policy is also potentially considering policy instruments with regard to all these determinants of innovation processes. This includes supply-oriented policies and demand-oriented policies, but also policies related to constituents in innovation systems as well as support services. (See Appendix 2.)

The combination of a problem identifying analysis and a causal explanation may be called a 'diagnostic analysis'. Such an analysis may provide a basis for an efficient therapy or treatment – namely, an innovation policy. Without a diagnosis it is impossible to know what prescriptions (instruments) are required. Satisfactory causal explanations in the social sciences are rare phenomena. Therefore, an inability to explain in detail is not a reason to abstain completely from intervention in the process of innovation.[41] Because problems identified may sometimes be very severe – for the economy, for the environment, or for the social conditions – trial-and-error intervention may be necessary. However, it is still necessary to have some clue about the most important causes of a problem.

3. The ability to solve or mitigate the problems

If a policy-maker in the field of innovation has identified the policy problems and their main causes, he knows if and where to intervene and also how. It might still be the case, however, that the policy agencies do not have the *ability* to solve or mitigate the problems. It might, for the time being, be impossible to solve or mitigate the problems identified from the public sphere. This might be because of a lack of policy instruments. This may be a temporary or absolute lack. In the latter case it will be absolutely impossible to solve or mitigate the problem identified. In the former case, the policy organizations have to develop new policy instruments. New organizations (players) or institutions (rules) may have to be created for developing the ability. This includes being prepared to develop instruments that may influence all the determinants of the development and diffusion of a certain category of innovations.

Hence *all potential* determinants of the development and diffusion of innovations should be considered when designing and implementing (broad-based) innovation policies. These determinants or activities in innovation systems were discussed in section 2.2 of this report. Ten activities in innovation systems are listed in Appendix 2, clustered in four groups. Together, these determinants constitute the innovation system. Therefore a "broad-based" innovation policy can be said to the same as a "systemic" innovation policy (see section 2.2.2).

To operate in this "broad" way would certainly include utilizing innovation policy instruments operating from the demand side.[42] However, these constitute only one category of policy instruments that will have to be used in a broad-based innovation policy. Instruments have to be used with regard also to all the other activities in all the four categories. Many of these instruments remain to be designed if the policy agencies shall develop their ability to solve or mitigate the problems identified. This is a very demanding task. It is, however, a possible one.

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APPENDIX 1: DEFINITION OF CONCEPTS RELATED TO INNOVATION

Innovations	New creations of economic significance, primarily carried out by firms (but not in isolation). They include product innovations as well as process innovations.
Product Innovations	New – or improved – material *goods* as well as new intangible *services*; it is a matter of what is produced.
Process Innovations	New ways of producing goods and services. They may be *technological* or *organizational*; it is a matter of how things are produced.
Creation vs. diffusion of innovations	This dichotomy is partly based on a distinction between innovations that are 'new to the market' (brand new, or globally new) and innovations that are 'new to the firm' (being adopted by or diffused to additional firms, countries or regions). In other words, 'new to the firm' innovations is actually (mainly) a measure of the diffusion of innovations.
Systems of innovation (SIs)	Determinants of innovation processes – i.e. all important economic, social, political, organizational, institutional and other factors that influence the development and diffusion of innovations.
Components of SIs	Include both organizations and institutions.
Constituents of SIs	Include both components of SIs and relations among these components.
Main function of SIs	To pursue innovation processes – i.e. to develop and diffuse innovations.
Activities in SIs	Factors that influence the development and diffusion of innovations. The activities in SIs are the same as the determinants of the main function. The same activity (e.g. R&D) can be performed by several categories of organizations (universities, public research organizations, firms). And the same kind of organization (e.g. universities) can perform more than one kind of activity (e.g. research and teaching).
Organizations	Formal structures that are consciously created and have an explicit purpose. They are players or actors.
Institutions	Sets of common habits, norms, routines, established practices, rules or laws that regulate the relations and interactions between individuals, groups and organizations. They are the rules of the game.
Innovation policy	Actions by public organizations that influence the development and diffusion of innovations.

Source: Edquist (2008).

APPENDIX 2: KEY ACTIVITIES IN SYSTEMS OF INNOVATION

I. Provision of knowledge inputs to the innovation process

1. Provision of R&D and, thus, creation of new knowledge, primarily in engineering, medicine and natural sciences.

2. Competence building, e.g. through individual learning (educating and training the labour force for innovation and R&D activities) and organizational learning.

II. Demand-side activities

3. Formation of new product markets.

4. Articulation of quality requirements emanating from the demand side with regard to new products.

III. Provision of constituents of SIs

5. Creating and changing organizations needed for developing new fields of innovation. Examples include enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms; and creating new research organizations, policy agencies, etc.

6. Networking through markets and other mechanisms, including inter-active learning among different organizations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms.

7. Creating and changing institutions – e.g., patent laws, tax laws, environment and safety regulations, R&D investment routines, cultural norms, etc. – that influence innovating organizations and innovation processes by providing incentives for and removing obstacles to innovation.

IV. Support services for innovating firms

8. Incubation activities such as providing access to facilities and administrative support for innovating efforts.

9. Financing of innovation processes and other activities that may facilitate commercialisation of knowledge and its adoption.

10. Provision of consultancy services relevant for innovation processes, e.g., technology transfer, commercial information, and legal advice.

Source: Edquist (2006).

APPENDIX 3: ABOUT DEMAND-BASED INNOVATION POLICY

According to Edler (2009), demand based innovation policy is "*a set of public measures to increase the demand for innovations, to improve the conditions for the uptake of innovations and/or to improve the articulation of demand in order to spur innovations and the diffusion of innovations.*" The following table presents examples of types of action.

Instrument	*Role of State*	*Functioning*
Public demand		
General procurement	Buy and use	State actors consider innovation in general procurement as main criterion (e.g. definition of needs, not products, in tenders).
Strategic procurement (technology-specific)	Buy and use	State actors specifically demand an *already existing* innovation in order to accelerate the market introduction and particularly the diffusion. This can include the targeted co-ordination of different government bodies and moderation with manufacturers.
		State actors stimulate deliberately the *development* and market introduction of innovations by formulating new, demanding needs. This can include the targeted co-ordination of different government bodies and moderation with manufacturers.
Co-operative procurement	Buy / use moderation	State actors are *part of a group of demanders* and organizes the co-ordination of the procurement and the specification of needs. Special form: *catalytic* procurement: the state does not utilise the innovation itself, but organizes only the private procurement.
Direct support for private demand		
Demand subsidies	Co-financing	The purchase of innovative technologies by private or industrial demanders is directly subsidized.
Tax incentives	Co-financing	Amortisation possibilities for certain innovative technologies.
Indirect support for private and public demand: information and enabling (soft steering)		
Awareness building measures	Informing	State actors start information campaigns, advertises new solutions, conducts demonstration projects (or supports them) and tries to create confidence in certain innovations (in the general public, opinion leaders, certain target groups).
Voluntary labels or information campaigns	Supporting Informing	The state supports a co-ordinated private marketing activity which signals performance and safety features.
Training and further education	Enabling	The private consumers or industrial actors are made aware of innovative possibilities and simultaneously placed in a position to use them.
Articulation and foresight	Organizing discourse	Societal groups, potential consumers are given a voice in the market place, signals as to future preferences (and fears) are articulated and signalled to the marketplace (including demand based foresight).

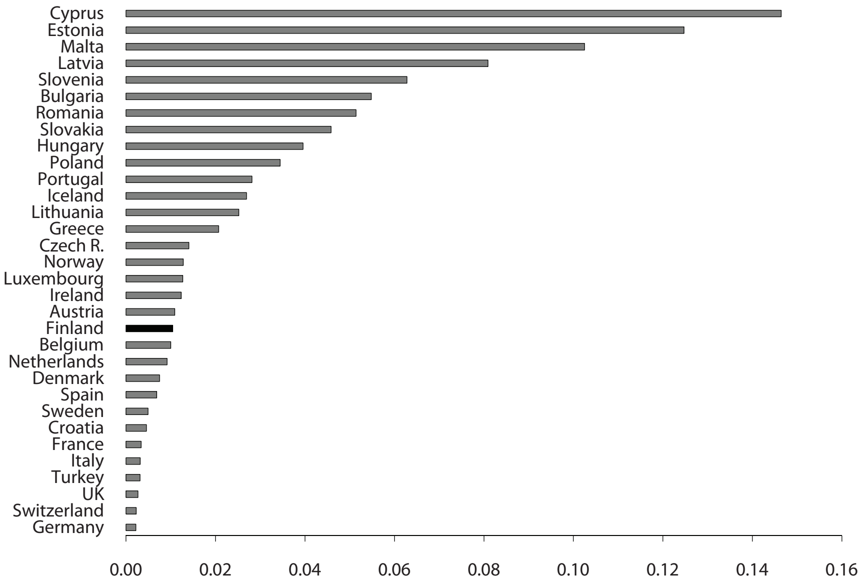
Table continues on the next page.

Instrument	*Role of State*	*Functioning*
Regulation of demand or of the interface demander – producer		
Regulation of product performance and manufacturing	Regulating, controlling ("command and control")	The state sets norms for the production and introduction of innovations (e.g. market approval, recycling requirements). Thus demanders know reliably what certain products perform and how they are manufactured. The norm affects firstly the producer (norm fulfilment), but spreads to the demander by means of the information about norm fulfillment.
Regulation of product information		
Usage norms		The state creates legal security by setting up clear rules on the use of innovations (e.g. electronic signatures).
Support of innovation-friendly private regulation activities	Moderating	The state stimulates self-regulation (norms, standards) of firms and supports or moderates this process and plays a role as catalyst by using standards.
Standards to create a market	Moderating, organizing	State action creates markets for the consequences of the use of technologies (emission trading) or sets market conditions which intensify the demand for innovations.
Systemic Approaches		
Integrated demand measures	Combination of roles	Strategically co-ordinated measures which combine various demand-side instruments.
Integration of demand- and supply-side measures	Combination of roles	Combination of supply-side instruments (R&D programmes) and demand-side impulses for selected technologies or services.

Source: Edler (2009).

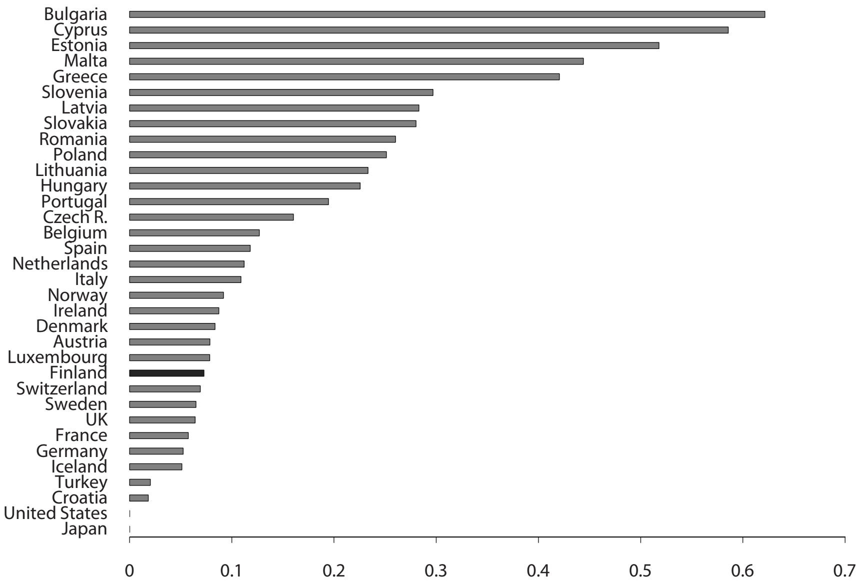
APPENDIX 4: FIGURES ON EUROPEAN COLLABORATION

Appendix Figure 1. Participations in ERA-nets in FP6 as related to gross domestic R&D expenditure (million euro, 2005)



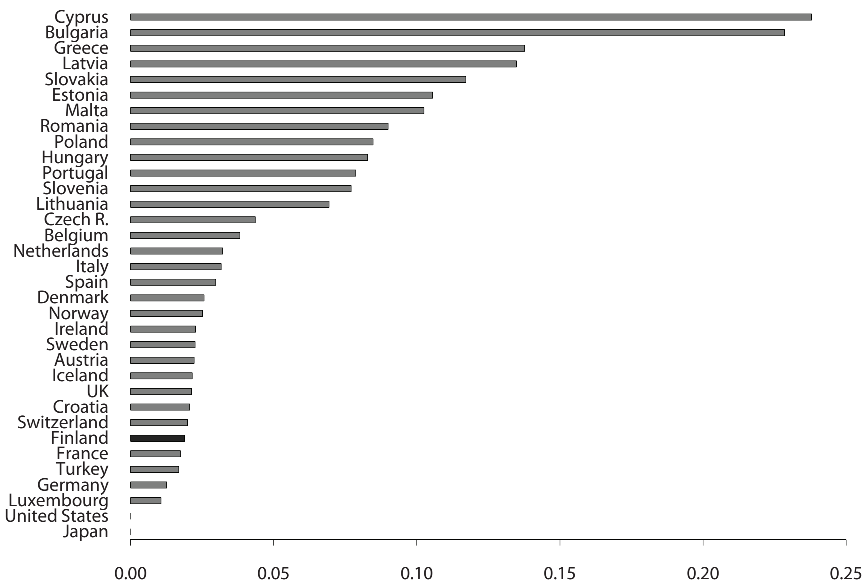
Source: Tekes/European Commission (EU FP6 2002–2006) and Eurostat.

Appendix Figure 2. Participations in Integrated Projects (IP) in FP6 as related to gross domestic R&D expenditure (million euro, 2005)



Source: Tekes/European Commission (EU FP6 2002–2006) and Eurostat.

Appendix Figure 3. Participations in Networks of Excellence (NoE)) in FP6 as related to gross domestic R&D expenditure (million euro, 2005)



Source: Tekes/European Commission (EU FP6 2002–2006) and Eurostat.

ENDNOTES

[1] These, and other concepts, are defined in Appendix 1.

[2] Even earlier, *technologies* were considered to include only or mainly (technological) process innovations.

[3] This is indicated by the fact that "innovation system" had more than 795 000 hits in Google, and that "system of innovation" had more than 540 000 hits by April 2009.

[4] The traditional system of innovation approaches focused strongly upon the *components* within the systems, i.e. organizations and institutions (see, e.g., Lundvall, 1992; Nelson, 1993).

[5] The ten key activities listed in Appendix 2 constitute a hypothetical list of determinants – and the list will be subject to revision when our knowledge about determinants of innovations increases. For the time being, it serves as a reasonable approximation of the determinants of innovation processes.

[6] Users may be firms, public agencies and individual consumers.

[7] This is expressed, for example, in the objective to integrate working life development into innovation policy planning and implementation. In addition, broad-based innovation policy can also be seen to call for innovations carried out by the public sector itself, e.g. in public service production.

[8] See also http://ec.europa.eu/enterprise/leadmarket/leadmarket.htm

[9] The Ministry of Employment and the Economy organized a User-Driven Innovation seminar in Helsinki on 10 June 2009. To see the seminar material, please, consult: www.tem.fi/UDI-seminaari.

[10] Policy objectives are formulated in a political process, normally not – or only to a very limited extent – by analysts.

[11] Influential in this respect was the Governmental report on globalization entitled *Osaava, avautuva ja uudistuva Suomi – Suomi maalimantaloudessa* (Valtioneuvoston kanslian julkaisu 19/2004).

[12] Finnish Innovation Fund, see more about Sitra in Section 2.4.2.

[13] The predecessor of the present *Research and Innovation Council*, the *Science Policy Council* of Finland, was established as early as 1963. It was transformed into *the Science and Technology Policy Council* of Finland in March 1987, and its new name was adopted as of the beginning of 2009.

[14] According to the interviews that the panel has conducted, the Finance Minister and Ministry have been less active in research and innovation policy questions in the Research and Innovation Council and the Ministry has not been represented at any meeting of the Research and Innovation Council or its predecessor.

[15] The Minister of Finance is a member of the RIC but has never attend a council meeting according to the minutes of the council.

[16] According to the Annual report, in 2007 the initial capital of Sitra had the value of 821 million euro, the return on capital was 7.5%, and its funding decisions totaled 42 million euro.

[17] By the early 2000s, Sitra had become a major investor in biotechnology. Since 2004 it has tried to exit from its biotechnology portfolio, though it has met with difficulties in this respect. Its investment strategy at the moment is to invest in firms which are part of its programmes with the purpose to make these programmes more effective.

[18] Examples of Sitra's programmes include health care programme looking for new solutions for health care services, a food and nutrition programme striving to promote healthy nutrition, an energy programme with the objective of improving energy efficiency of the built environment, and a growth programme for the mechanical industry. The concluded programmes include, e.g., an environment programme, Russia programme, India programme, and Innovation programme. Sitra has also been involved in networking in foresight activities; in this latter area, largely overlapping foresight activities taking place simultaneously on the initiative of Tekes and the Academy of Finland.

[19] The GDP share of primary production was only 3% in 2008, though these figures should not be directly compared.

[20] Patents are often considered to be innovation indicators. However they are not, in the proper sense of the word. Patents are rather an indicator of invention. They indicate that something is new, but not necessarily that it is economically useful. (Keep in mind that most patents are never used.)

[21] More researchers have also voiced worries that the increasing trend for patenting in general will be a threat for the advance of science and technology by restricting the commons. See, for example, Kenney and Patton (2009).; Heller and Eisenberg (1998).

[22] See., e.g., Kaataja, 2009; Lester and Sotarauta, 2007; Männistö, 2002; Tervo, 2002.

[23] Co-evolution takes place if two or more actors and/or their environments influence each other's selection, and/or retention processes and, if a series of variations take place at the same time in the respective agents (Sotarauta and Srinivas, 2006; see also, Sotarauta and Kautonen. 2007)

[24] *Forum Virium Helsinki*'s key member companies are Destia, Elisa, Logica, Nokia, TeliaSonera, Tieto, Veikkaus and Finnish Broadcasting Company. Partners include Digita, Itella, SOK, MTV Media and Vaisala. The public sector is represented by the City of Helsinki, SITRA (The Finnish Innovation Fund), TEKES (Finnish Funding Agency for Technology and Innovation) and VTT (Technical Research Centre of Finland). SME partners are Adage, ConnectedDay, Futurice and Idean. FVH's development projects also encompass a large number of high-growth companies based in the Helsinki region. (for more see http://www.forumvirium.fi/en/)

[25] *http://www.demola.fi/* – Demola is a partnership between universities and colleges, companies and other organizations.

[26] http://www.openlivinglabs.eu/

[27] See Centre of Expertise Programme 2007–2013; www.oske.net

[28] Social sciences can be included here.

[29] For example, the latest report issued by the predecessor of the *Research and Innovation Council*, the *Science and Technology Policy Council of Finland*: Linjaus 2008; the strategy of the *Academy of Finland* of October 2006; and the strategy of *Tekes* of 2008.

[30] Source: UNU-MERIT (2009).

[31] http://cordis.europa.eu/era/concept_en.html.

[32] The Government's Communication on the EU policy, highlights ways in which active influence on EU policies can take place (Valtioneuvoston kanslia, 2009).

[33] The efficiency programme during the second cabinet of Matti Vanhanen aims to reduce the work force in the governmental sector by 2011 with 9645 person-years, and additionally, by 2015, with 4800 person-years. http://www.vm.fi/vm/fi/05_hankkeet/02_tuottavuusohjelma/index.jsp.

[34] A list of categories of innovations is presented later in this section.

[35] It should be made clear that innovation policy-makers in other countries have not managed to be more specific and systematic on these issues.

[36] Of course, we need much more knowledge about the specific relations between innovations and these socioeconomic phenomena.

[37] As indicated at the end of section 2.2, we also have a broad understanding of what an innovation system is.

[38] The main reason for this is that it does not make sense to consider the innovation system to be the same as the whole economy or the whole society. It is much more sensible to limit the notion of innovation system to be constituted by innovations of various kinds and the activities that influence their development and diffusion – see section 2.2. This requires, of course, that the innovation output of innovation systems can be measured; it is very difficult to improve what cannot be measured. Much remains to be done with regard to measurement of innovations. Of course, we also need to know the approximate consequences of innovations for economic growth, environmental balance and military strength, since this is what innovation policy-makers want to achieve in the end. However, the consequences of innovations are different from innovations as such or the determinants of innovations – and it is important to distinguish between these three categories. In the literature on innovation systems it is clear that consequences of innovations are normally not included in the definitions of systems of innovation. The consequences of (different kinds of) innovations are, as is generally accepted, extremely important for productivity growth, environmental balance and military strength. However, the study of consequences of innovations is a very complicated issue in itself. Growth is not an output measure of the innovation system, but innovations are very important for economic growth. Hence innovation policy is an important part of growth policy, but they are not the same.

[39] However, we have stressed the importance of taxonomies of innovations. The creation of such taxonomies has a conceptual and theoretical basis or dimension.

[40] It is also possible to compare an existing system with a 'target system'. Such a system can be specified. However, it cannot be argued that it is an optimal one.

[41] Systematic identification of determinants of innovation processes is a surprisingly under-researched area in innovation studies. Partly for this reason, but also because of the very complex nature of innovation processes, as well as the difficulty of developing causal explanations in the social sciences, it is very difficult to arrive at a 'complete' causal explanation of the propensity to innovate in an SI. We might have to accept being able to point out only the main activities behind a low propensity to innovate – and design instruments that can influence these activities.

[42] In vital areas such as energy and the environment, potential demand-based measures include the public procurement of innovation and setting of norms and regulations, thus providing powerful incentives for the development of new innovations, but also streamlining R&D support from the supply side to reinforce the effect.

3. Demand- and User-Driven Innovation

Dan Breznitz, Mikko Ketokivi, and Petri Rouvinen*

There is nothing in the logic of innovation that leads to emphasizing the supply of or the demand for novel ideas. Arguing for either side is misguided. The two sides are complementary. Thus, we welcome the balanced view implied in Finland's new innovation strategy (Aho et al., 2008), although we disagree with some of its policy premises and recommendations. The primary goal of demand- and user-orientated innovation policy is to have (private) input and output markets that celebrate innovation. The tools to achieve this are mostly indirect. Intense competition is the key. Laws, regulations, and standards are important. The role is direct when there is demand (generation) by the public sector (including public procurement) and/or supply by it (public goods and services). As far as direct public support of private innovative activity is concerned, our advice is to be impartial to the source, type, and application domain of innovation. To the extent this is not the case, we recommend adjusting towards impartiality. Demand and user orientation in innovation policy is consistent with promoting market entrants and radical/disruptive innovation.

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3.1. INTRODUCTION

Does Finnish economic policy need stronger emphasis on demand and user aspects of innovation?

Advisors to policy-makers seem to have answered the question in the affirmative. A steering group appointed by the Ministry of Employment and the Economy (MEE) concluded in the June 2008 proposal for *Finland's National Innovation Strategy* (Aho et al., 2008, p. 8) that "Newer innovation policy will emphasize the development of products and services meeting the needs of customers and the strengthening of users' and developers' mutual development work. There is room for improvement in Finland, particularly as concerns the development and introduction of user-oriented service innovations." One of the justifications is the long-standing critique on the Finnish national innovation system as having too strong emphasis on the technical as opposed to commercialization aspects of innovation.[1]

The first problem is encountered at the use of terminology: the concepts of *user-based* and *demand-driven* innovation remain ambiguous. For instance, the Strategy (Aho et al., 2008, p. 15) stated that "The system of research, development and innovation activity expert services and public financing incentives will be updated to meet the needs of a demand- and user-oriented approach. New operating forms and incentives will be created to support broad-based interaction required to provide genuine support for demand- and user-oriented innovation activity."

The policy implications of this statement cannot be understood without answering the following: What exactly are the "needs of a demand- and user-oriented approach"? Why is this important? Is there a problem? What is it? Are firms not paying enough attention to their customers' needs? Is it really about lack of proper incentives? How do we know? Does economic policy have a role in solving the problem? Before these questions can be answered, in turn, key concepts must clearly be defined and our understanding of the current state of demand- and user-oriented innovation re-evaluated.

In this Chapter, we discuss demand and user aspects of innovation and their implications to economic policy. Our emphasis is on evidence-based policy recommendations. The chapter is structured as follows:

1. What are the key concepts and their definitions?
2. What is our current understanding of the topic? What do we know about demand and user orientation based on research?
3. What evidence have we gathered from the Finnish economy in the course of this project?
4. What are the policy implications?

3.2. KEY CONCEPTS RECONSIDERED

Closely re-examining key concepts is necessary, because without explicit definitions, writing understandably about policy is impossible. Our concepts are summarized in Figure 3.1 and elaborated by definitions and examples in the following. We refer back to specific parts of Figure 3.1 as we present the key concepts.

Demand can be defined as a direct purchase of a product or a service, or an ability and willingness to do so.

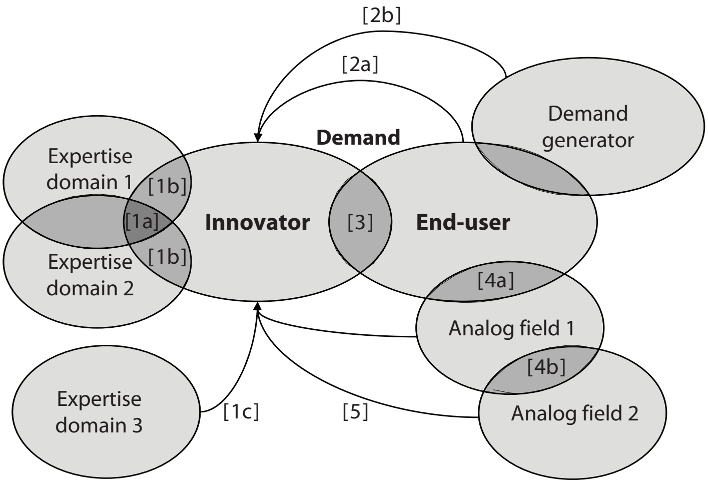
Innovation can be defined at the most general level as ”a new idea, which may be a recombination of old ideas, a scheme that challenges the present order, a formula, or a unique approach which is perceived as new by the individuals involved” (Van de Ven, 1986, p. 591). Innovation can thus mean for example:

1. new products/services (*product innovation*),
2. new ways of producing/offering an established product/service (process innovation, business model innovation, administrative innovation, organizational innovation), or
3. new recombinations of established products/services and ways to produce/offer them (*second-generation innovation*, *business model innovation*).

It is important to distinguish between innovation and **invention**, because unlike inventions ”most innovation projects in most firms do not involve great novelty” (von Hippel, 1990, p. 411). Innovation is a social activity, a process of collectively combining primarily existing ideas, that is, connecting “parallel domains of human expertise” (links [1a], [1b], and [1c] in Figure 3.1) into new goods, services, practices, or ways of thinking. Fundamental inventions are often produced by individual creative minds, and do not have immediate and direct commercial applicability.

Successful innovation is the result of an innovator’s ability to bridge parallel domains which may (region [1a] in Figure 3.1) or may not (region [1b] in Figure 3.1) overlap with one another. The domains may both be, say, within electrical engineering (two overlapping domains), or one can be in electrical engineering and the other, say, in plastic polymer technology (non-overlapping domains), Innovation – bringing ideas to the market – is a multidisciplinary activity often conducted not by specialists but either by generalists or by a diverse team of specialists; expertise that crosses disciplinary boundaries is paramount. Of course, various external domains of expertise can be useful sources of information (link [1c] in Figure 3.1), but innovation tends to be at its most effective when innovators themselves are masters of the parallel domains pertinent to the specific innovation. This is because innovation is not about information gathering or brokering, it is about creation and engineering of new solutions, trial and error, analysis of unexpected and unintended consequences, accidental discovery, re-design and further iteration toward

Figure 3.1. Key concepts and their linkages



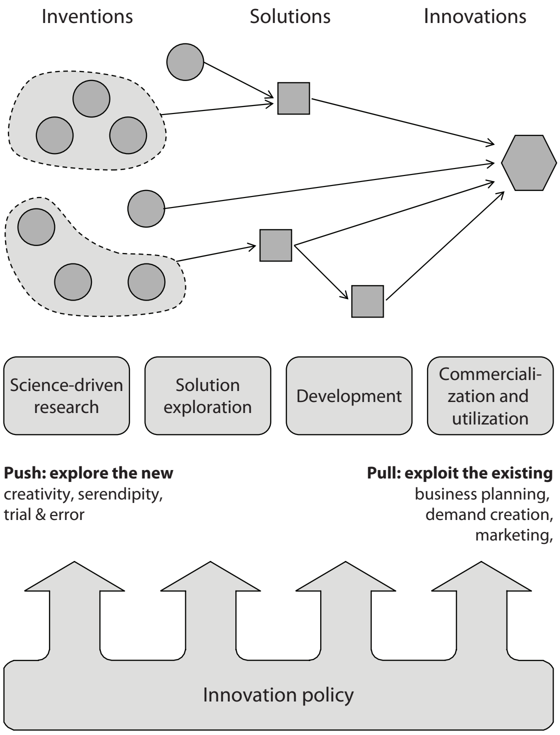
Note: Arrows refer to knowledge flows.

a workable solution either to a well-defined practical or a more general scientific/theoretical problem. These problems cannot effectively be solved by "importing" the expertise of an outside expertise domain. Explicit demonstration of the ability of an innovation to solve practical problems is necessary for commercialization or in the case of non-commercial innovations, adoption by a broader set of users.

Innovations are distinct from invention but have both invention and basic research at their basis (Figure 3.2). In a classic study, Comroe (1977) examined the development of cardiopulmonary medicine and discovered that of the roughly 500 key research results used in the development of the innovation, 41% were outputs of basic research which had been carried out without any relationship whatsoever to cardiopulmonary medicine. Consider similarly various electronic devices such as portable mp3 players. They are all in a fundamental manner based on important inventions and innovations in electronics, many of which were developed without any explicit aim at being used in these devices: microprocessors, digital signal processing, and LCD displays are just three examples of such technologies.

Further distinguishing **solution** from innovation and invention is important. Solution is typically an artifact, technological or otherwise, that solves a specific technological, organizational, or social problem. The focus in developing the solution is, however, squarely on the problem, not on the market potential of the solution. Solving a problem is not the same as innovation, because problem-solving performance criteria may be agnostic, for instance, to cost considerations, and "an excessive or exclusive preoccupation with purely

Figure 3.2. Invention, solution, and innovation



technical measures of performance [=solutions] can be disastrous" (Kline & Rosenberg, 1986). A notorious example of this is the Concorde: a brilliant engineering achievement and yet, a costly commercial failure. The Concorde split the time across the Atlantic Ocean to one half, but at the same time had a fuel cost per passenger of 15 times that of Boeing 747 (Kline & Rosenberg, 1986, p. 277). Many alternative sources of energy have the same problem: they are mostly not commercially viable in the absence of public intervention (e.g., solar energy). Current feasibility problems aside, these alternative energy sources may turn out economically important over time: innovation is not necessarily a process of rapid, radical, and visible progression.

User is an economic actor – an organization (a business), a consumer, or a community (the public sector) – that ultimately consumes or applies the goods or services provided. Most suppliers of both industrial and consumer goods and services do not interact with the end-user, rather, they only respond to the **derived demand** end-users originate. For example, the demand that *Google* faces is for targeted online advertising and yet, *Google's* core service offering to its end-users is Internet searching capability. The concepts of supply and demand are not necessarily connected in a conspicuous manner.

Potential complexity aside, *demand* and *user* are well-established concepts and seldom a source of ambiguity. Problems emerge when these established concepts are used in conjunction with the attributes *-based*, *-driven*, and *-oriented* and in addition, translated into Finnish in an ambiguous manner, such as *"-lähtöinen"* or *"-ohjautuva"*. These attributes are further often used interchangeably, without explicit definitions: user-based, user-oriented, and user-driven are used synonymously. Different attributes do, however, often carry distinct meanings in different contexts.

3.2.1. THE DEMAND (VS. SUPPLY) ASPECT

At the general level, there are two sides to innovation: the demand side and the supply side (Figure 3.1 and Figure 3.2); obviously, both sides must be understood. It is, however, often (mistakenly) suggested that innovation is "conventionally discussed" under the rubric of creative destruction (Schumpeter, 1934) or technology push, that is, with focus on the supply side. The supply side view suggests that innovative activity produces technological or other artifacts, new ways of thinking that the end-users simply cannot even begin to fathom. Many empirical results also support the notion that innovations are not developed for immediate commercial application: "Innovations are not produced because they are useful; they are just produced. If an innovation turns out to enhance life chances, it will be retained and spread through the population with high probability" (Hannan & Freeman, 1984, p. 150). This seriously calls into question the commercial-driven idea of innovation processes.

At the same time, there is an equally established view, supported by empirical evidence, that innovative activity is fundamentally influenced by market conditions, the demand side: "Changes in the composition of demand for goods and services across industries chain back to influence investment patterns, which in turn influence the relative return to inventors working on improvements" (Nelson & Winter, 1977, p. 49; Schmookler, 1966; Tushman & Moore, 1982). One of the classic studies of how innovations develop examined the development of twenty different military weapons systems (Isenson, 1969) and concluded that most of the relevant research and development instrumental to the twenty innovations was highly applied and indeed, had been explicitly funded for the purpose of developing the innovations – hence, almost exclusively demand-driven.

Demand may or may not be generated by the end-user market; in most business-to-business contexts, for instance, the two have less-than-perfect overlap. The demand side involves both direct demand by the end-users (link [2a] in Figure 3.1) as well as their derived demand (link [2b] in Figure 3.1).

Demand-driven innovation embraces the well-established fact that innovative activity is always affected by market conditions, even to the extent that innovation may explicitly be driven by market demand. Demand-driven innovation also suggests that in an important way, innovation markets fail in the sense that underinvestment in innovation is suggested to persist.

However, innovation tracer studies – studies that ”trace” innovation processes from inception to broad adoption by users – such as the afore-mentioned Isenson study and dozens of others have constantly discovered the same empirical regularity: be the context weaponry, agriculture, or medicine, there tends to be a lengthy period between an invention in basic research and its application through commercialization. In this sense, thinking of innovation exclusively as demand-driven misses the point: tracer studies unequivocally demonstrate that ”research is often conducted without a practical application in mind” (Rogers, 2003, p. 163). Thinking of innovation as an explicit commercially driven process is inaccurate and tends to bias focus toward the short-term aspects of innovative activity (Kamien & Schwartz, 1982).

Policy-makers must understand that innovation never happens either by push or by pull, but rather, as a complex reciprocal mechanism involving both technology push and market pull over time. Push and pull are concepts that can be used to describe the basic mechanisms, but focusing either on push or pull provides neither an accurate description of how innovation actually occurs in any real-life situation, nor a defensible basis for economic policy (Jovanovic & Rob, 1987). Some ideas originate on the supply side, others on the demand side, and there is no empirical evidence to suggest that one dominates the other or that one should be preferred over the other (Florida, 1997). Focusing exclusively on either the supply or demand side leads to a seriously limited understanding of innovation processes: ”factors on the cost side as well as on the demand side differ across industries and technologies, and these differences are important in explaining the pattern of innovation that has occurred” (Nelson & Winter, 1977, p. 50). Nelson and Winter further suggested that if there’s been any bias toward push or pull, it has been more toward the pull, the demand side, not the supply side; interestingly, Schumpeter’s (1934) classic work on economic development – often cited as the proponent of the ”technology push” view – strongly echoes this same sentiment. Perhaps we must entertain the hypothesis that the balance has to shift, if anything, more towards the supply side, not demand side. One contemporary author to explicitly point this out is Christensen (1997), whose concept of the ”*innovator’s dilemma*” suggested that many successful companies ”begin their descent into failure by aggressively investing in the products and services that their most profitable customers want” (Christensen, 1997, pp. xxiii–xxiv). ”Listening to one’s customers” sounds appealing, but is not always best long-term strategy; ”the customer knows best” mentality tends to promote incremental innovation. Those who choose not to innovate unless they are certain every effort will be commercially viable will never produce anything except perhaps marginal improvements to existing products and services. Certainty of commercial viability cannot be an evaluation criterion for innovation, and an economic policy that emphasizes commercial viability is necessarily an indirect invitation to avoid risk.

The alleged prevalence of push over pull has its roots likely in discussions not on innovation in general but on innovation policy in particular. Economic policy in Finland has, arguably, concentrated more on the promotion of new technology development, increased R&D spending, and other input-oriented considerations. In this regard, the argument that demand-driven innovation should be given higher consideration merits attention.

An important sub-topic of demand-driven innovation policy is public procurement and more generally, **demand stimulation (or creation)** (Edler, 2007). Through public procurement policy, governments can create markets for innovative products and services. The premier example of this is the US, where focus on anti-terrorism and homeland security has created huge markets for innovative activity, in particular development of military technologies. Public procurement can thus be used as a policy tool to mitigate the risks of innovative activity via the creation of markets.

Public procurement considerations can be linked to various **sectoral policies**, because public procurement can be so significant that economic policy can be used to an extent to steer economic activity in certain directions: ”In Germany, the public purse invested €260 billion in products and services in 2003, more than 12% of GDP. In Europe before the enlargement (EU-15) this share is even higher, at 16%. In certain sectors – construction, public health, energy in public buildings – this public purchasing power constitutes the lion's share of demand.” (Edler, 2007, p. 7). Governments can thus significantly influence the scope of economic activity of a country (or a broader economic region, such as the EU). How extensively they should exercise this power is, however, questionable: Krugman (1996, p. 44) observed that based on empirical evidence, ”governments have a terrible track record at judging which industries are likely to be important”. The idea that governments are like managers of a multi-business conglomerate whose task is to choose the industries in which the country operates are highly problematic: a country is not a company (Krugman, 1996). Innovation researchers such as Eric von Hippel (2005, p. 12) echo the same sentiment: ”Both fairness and social welfare considerations suggest that innovation-related policies should be made neutral with respect to the sources of innovation.”

Public procurement has also been identified as a key policy issue in EU. A recent Communication from the Commission to the European Parliament (EC, 2007, p. 10) discussed the concept of **pre-commercial procurement**: ”This Communication addresses the need for more innovation in the public sector and provides an approach to procure R&D services (pre-commercial procurement)... Pre-commercial procurement differs from and complements other innovation instruments such as grants, tax incentives, access to finance, joint technology initiatives etc. It could shorten time to market and encourage market acceptance of new technologies when seen as part of a coordinated policy framework including standardization, regulation and procurement of other innovative goods and services."

Even those who highlight the role of understanding the demand side call for a balanced treatment of the supply and the demand side: "[A comprehensive policy combines] demand-side and supply-side mechanisms. State actors design a policy for a selected technology, whereby the selection could be assisted by discursive strategic intelligence. The policy ensures not only the necessary factor endowment (R&D promotion), but also creates favorable demand conditions (quantity and quality), ideally aiming for dominant designs to be diffused into international markets." (Edler, 2007, p. 10)

3.2.2. THE USER ASPECT

User-*oriented* and user-*driven* tend to point to user *needs* as the driving force behind innovation. This is wholly consistent with the idea of market pull. Emphasizing user orientation is, however, not at all novel, because discussion quickly converges to the well-established *Schmooklerian* (e.g., 1966) demand pull versus *Schumpeterian* (e.g., 1934) technology push distinction. We have nothing to add to this well-established and unambiguous conceptual distinction.

Turning attention to user-*based* innovation does, however, contain an element of novelty, because the focus shifts from user needs to user *expertise* and more broadly, basis of specialization in the value chain. User needs are obviously still relevant, but the role of users is considerably broadened to cover not just articulation of needs and preferences, but actual engagement of user expertise: users are no longer just targets of market research, sources of articulated needs, and absorbers of the ultimate innovations produced, rather, their expertise becomes instrumental in solutions development (area [3] and link [2a] in Figure 3.1).

User-based innovation places the user in an active role in the innovation process, even to the extent that the entire innovation process may primarily be motivated and driven by the user community, not by any specific product or service supplier interested in a business opportunity. In economics terminology, input and output markets begin to overlap with one another. Many popular early examples of user-based innovation, such as *mountain biking* and *kite-surfing*, are a testament to this. To be sure, kite-surfers invented neither the kite nor the surfboard, but they combined the two in an ingenious manner and developed the requisite *linking technologies*, such as the *kite-surfing harness*.

At a more general level, users are often the source of the first, at least rudimentary solution to a problem; understanding the product life cycle becomes paramount. Consider *Ponsse*, the Finnish designer and manufacturer of timber-harvesting solutions: harvesters, forwarders, cranes and loaders, as well as information systems used in these equipment. Ponsse invests heavily in new product development: a hundred in-house professionals are dedicated to development of new concepts and technologies. At the same time, the original solution, the first Ponsse, was designed and built by the first user, Mr. Einari Vidgrén, for his own personal use.

Consider finally the development of electron microscopy. The first users of the electron microscope – who else? – were the most important actors in its development. If something does not exist, it is the first user who has the incentive to develop it, which in turn may or may not ultimately lead to the creation of a market. Indeed today, there is a well-developed market for electron microscopy and the role of the end-user of the microscope in innovative activity is marginal: the electron microscope is developed, manufactured and marketed by specialized companies in the electron microscopy value chain. A case in point, twenty percent of the employee base of one of the leading developers in electron microscopy, FEI (www.fei.com), are scientists, engineers, technicians and software developers; these professionals, not the users, are the primary experts in development. Particularly telling is the fact that FEI no longer has long-term contracts with its customers; instead, users are free to switch from FEI's products to any alternative product in the market offered by FEI's competitors such as Seiko, Carl Zeiss and Hitachi. This is not to say that innovation is not important (it is paramount: FEI's R&D intensity is 11%) or that customer needs do not change (they change in significant ways), it merely means that the locus of innovation expertise does not reside at the user, but rather, at the company that specializes in electron microscopy. Consequently, instead of trying to develop strong links to the customer, a better strategic option is to seek collaboration – if at all possible – with competitors. One of FEI's recent innovations is "*the scanning transmission electron microscope system platform with unprecedented stability coupled with aberration correction and monochromator technology, enabling sub-angstrom resolution*" (FEI Annual Report, 2007). It is obvious that these innovations extend far beyond the technological expertise of an end-user such as, say, a biologist who uses the electron microscope to study insect anatomy. In mature and stable phases of the product life cycle, different parts of the value chain specialize in very different activities, which leads to economies of specialization.

The **lead-user** is another important concept in user-based innovation. Consider the example of medical imaging described by von Hippel et al. (1999). A team at 3M was developing medical imaging by seeking solutions to one of the contemporary challenges in imaging: detecting very small anomalies, such as early-stage tumors. The team quickly realized that the requisite expertise in medical imaging did not reside within 3M and its experts but indeed, in the users of medical imaging: the best experts were the cutting-edge radiologists who were already addressing the problem in their daily work.

Not surprisingly, the 3M team found that these radiologists had already developed solutions to the problem that were superior to commercially available products. But the research team did not stop there: they asked the radiologists they interviewed to name experts who were even further ahead in *any* important aspect of imaging. Through this ″pyramid approach″ of identifying experts, the 3M team was able to tap the top expertise in medical radiology. What is more, these top experts were then able to identify experts *in other fields* with similar challenges, but fields that were even further ahead in the development of solutions. This led the 3M team to two other ″analog fields″ (term coined by von Hippel, 2005), namely, semiconductor imaging and pattern recognition (regions [4a] and [4b] in Figure 3.1). Lead users in pattern recognition in particular proved a valuable source of insight: ″Specialists in the military had long worked on computerized pattern recognition methods because military reconnaissance experts had a strong need to answer questions such as, 'Is that a rock lying under that tree, or is it the tip of a ballistic missile?' ″ (von Hippel, Thomke, & Sonnack, 1999, p. 49).

The 3M example illustrates the three key features of user-based innovation: (1) users are not merely providing information on user needs (link [2a] in Figure 3.1) but actually engaging in innovative activity (region [3] in Figure 3.1); (2) the ″pyramid approach″ for identifying world-class expertise; (3) identification of ″analog fields of expertise″ and drawing insights from them. Finally, it is important to note that the cutting-edge solutions in pattern recognition did not as such provide solutions to the challenges of medical imaging: the analog fields are not as much a source of technology as they are a source of a more abstract level understanding of the challenge, a way to ″frame the challenge″ in a novel way (link [5] in Figure 3.1). Analog fields are thus a source of ideas, not solutions, therefore, firms specializing in pattern recognition – no matter how cutting edge – cannot simply diversify into the business of medical radiology to leverage their expertise.

The conventional approach to the medical radiology challenge would have been marketing based: the 3M team would have conducted interviews and focus groups with the users, explored their needs and then tried to develop solutions in-house to these needs. To be sure, this approach is much more limited in the insights it can offer, and often tends to lead to incremental as opposed to radical advances. The lead-user approach rigorously seeks to identify existing solutions to challenges instead of defaulting to development of new ones.

Open-source software development (Lakhani & von Hippel, 2003; von Hippel & von Krogh, 2003) and the above-mentioned recreational activities of mountain-biking and kite-surfing (von Hippel, 2005) are other examples of user-based innovation, where users and entire user communities are an important source of innovation, in the early phases of product innovation in particular.

Finally and perhaps somewhat surprisingly, the concept of **needs** requires reassessment. Polanyi (1958) wrote about the concept of *tacit knowledge*, referring to the idea that humans know much more than they can articulate. The idea of tacitness must be extended to examination of economic needs.

Research on Danish assisted-living centers for the elderly aptly illustrates the tacitness of needs (personal communication with Thomas Hammer-Jakobsen, Head of Copenhagen Living Lab, 27 January 2009). In seeking novel ways of managing these centers, researchers found that many of the user needs were *unarticulated*, that is, one could not discover the needs of the residents through an interview. Instead, researchers had to adopt a more *ethnography*- or *anthropology*- based research strategy, where they, instead of interviewing, observed the residents in the daily activities for extensive periods of time. Only from these in-depth first-hand observations, researchers could draw conclusions about user needs, many of which were unarticulated. The requisite information on user needs was, at least initially, simply beyond words (cultural and social conventions) to describe them.

Employing anthropological and ethnographic approaches is not an insignificant anecdote for Denmark. On the contrary, the impact has been so significant that university graduates from anthropology programs enjoy full employment: "*Particularly within the past couple of decades, the private business sector has recognized the usefulness of anthropological perspectives on product and market development and intercultural communication, as well as management and organizational development. In this field, anthropological skills in analyzing complex data and drawing on comparative insights help shed new light on problems and challenges in a changing world, thus contributing to creative and innovative solutions.*" (University of Copenhagen website, http://antropologi.ku.dk).

The idea of unarticulated needs does indeed challenge even the well-established notion of both demand- and user-*oriented* innovation: how does one *orient* oneself toward needs that are unarticulated?

3.2.3. CONCEPTUAL SUMMARY

In summary, an examination of the key concepts leads to a number of important preliminary insights:

1. Demand orientation and user orientation are established concepts, but are both challenged in practice by the presence of unaroused, unarticulated, and unrecognized user needs, which can only be uncovered by extensively observing and interacting with users in real-life situations. Anthropology and ethnography, not business, engineering or marketing disciplines, form the intellectual foundation for contemporary research and application. This has important implications for educational policy.

2. Users may participate in the innovation process not merely as sources of articulated needs (=objects of market research), but indeed as co-creators and co-innovators. This implies a need to reconsider the basis of specialization in the value chain. This shift in the basis of specialization has important implications to property rights and appropriation of societal value.
3. Users may also innovate autonomously, by themselves for themselves, as individuals or as groups, using various advanced information technologies (e.g., the Internet).
4. Public procurement has been identified as a potentially important mechanism for demand creation and stimulation. Creating demand for products and services is, however, more straightforward than creating demand for *innovation* in particular.

In the following sections, we further examine these insights in light of both existing research as well as research conducted as part of this evaluation.

3.3. THE EVIDENTIAL BASIS

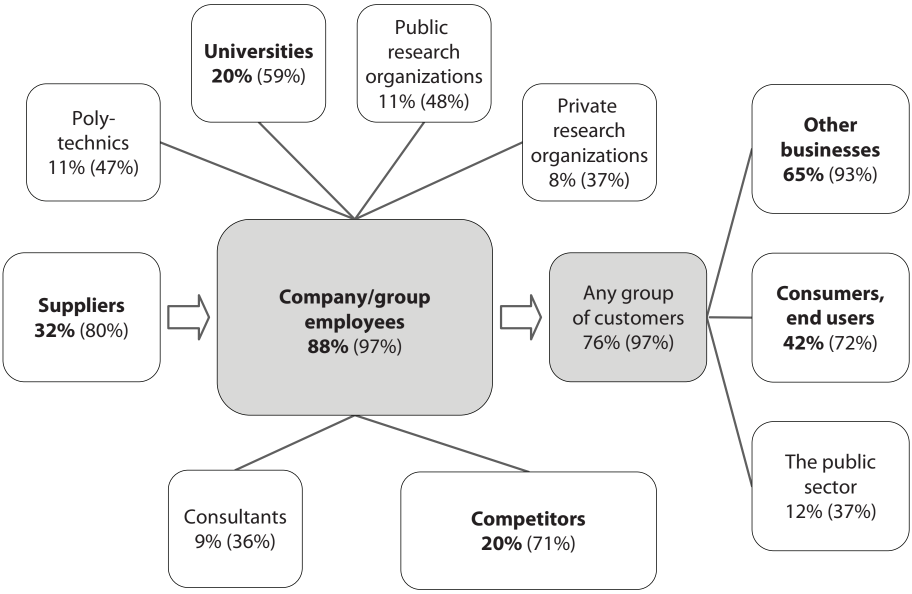
In the preceding section, we laid the conceptual foundation and presented a number of illuminating examples and anecdotes. Policy cannot be based on anecdotal evidence, however. In order to make the inquiry relevant to economic policy, we must examine the broader applicability of the concepts, and potential systematic evidence. To be sure, kite-surfing, mountain biking, and open-source software are interesting and telling examples, but in and of themselves insignificant from the point of view of overall societal welfare. The goal of this section is to examine the broader implications based on an examination of extant research as well as systematic large-sample research conducted in the context of this evaluation.

3.3.1. WHERE DO NEW IDEAS ORIGINATE?

Florida (1997), among others (see also von Hippel, 1988), has examined the sources of new ideas for new product and service development projects. From the point of view of demand- and user-based innovation, the relevant finding is that customers were found to be important or very important sources of new ideas in some 90% of the cases. The only source more important than the customer was, not surprisingly, in-house research staff, which was considered important or very important in practically 100% of the cases (Florida, 1997, p. 96). Other important sources of innovation Florida identified were competitors, joint ventures, and other R&D laboratories.

We replicated parts of the Florida study to identify sources of new ideas and innovations in the Finnish economy (for details of the survey, see Koti-

Figure 3.3. Sources of knowledge in innovative activity



Notes: The percentages refer to the share of firms considering the information source very important (the figure in parenthesis is the corresponding important or very important percentage). Based on the survey conducted to support the evaluation; questions 20 and 21 in the firm survey, i.e., refers to both Finnish and foreign sources. Weighted. See Kotiranta et al. (2009) for details.

ranta Aho et al., 2009). We asked survey respondents to indicate which parts of their organization's value chain and operating environment were important in the innovation process. Figure 3.3 shows a summary of the responses; the percentage in each case is the percentage of respondents who considered the source as a *very important* contributor to the innovation process; in the parenthesis we report the percentage referring to *important* or *very important*. The general findings are very similar to Florida's research results in the US.

From the point of view of user and demand orientation, our results strongly echo the conclusion that customers, consumers and end-users are a common source of input to the innovation process; this research result is well established in earlier research as well (e.g., Knoedler, 1993). Similarly, the "upstream" of the value chain, suppliers, is another important source, as are various lateral or horizontal actors such as other research organizations, universities, and competitors. The Finnish results are very similar to research results obtained in other countries.

3.3.2. USER-BASED INNOVATION

The claim that there is not enough user and demand orientation in the Finnish economy warrants reconsideration in light of empirical evidence. While Figure 3.3 suggests that customers and end-users are indeed important, this finding alone is not enough to draw a conclusion that demand and user-based innovation are prevalent. Figure 3.3 tells us that users are indeed important, but it does not tell us whether users are important in the sense of providing valuable *expertise* to the innovation process. This requires further analysis.

Micro-level innovation studies in countries other than Finland have revealed that not just user-oriented and -driven but indeed user-based innovation has been quite widespread in the industry for decades (de Jong & von Hippel, 2008; Knoedler, 1993; von Hippel, 1976; 1978; 1988; 2005). Any claim that Finland somehow constitutes an exception to this and needs to “catch up with others” must be demonstrated. The challenge that may have misled policy-makers is that conventional research instruments used in statistical analyses – such as the *Community Innovation Survey* – simply do not register user-based innovation (de Jong & von Hippel, 2008, p. 31). This may have led to a common and at the same time, dangerous fallacious conclusion: absence of evidence has been interpreted as evidence of absence.

In one of the few studies that have measured the extent of user-based innovation, de Jong and von Hippel (2008) found that in their sample of 2,416 small- and medium-sized Dutch enterprises, 21% engaged in user innovation by developing or significantly modify existing techniques, equipment, or software. In another survey of technology-based small firms, de Jong and von Hippel documented hundreds of user innovations. They further noted that much more research into user-based innovation is required in order to reveal its real economic significance. Only this can provide the requisite evidential basis for policy: a policy that calls for more of user-based innovation without demonstrating an understanding of the current level of application is misguided and will be deemed irrelevant.

In order to examine the question in the Finnish context, another section in our survey addressed the extent to which user-based innovation was applied. Respondents were asked to answer the following question: “Which of the following characterizes the role of end-users in your innovation process?” [We have re-coded question 22 in the survey so that firms choosing multiple options belong to the highest category they have chosen; weighted, % answering yes]:

1. Users do not have a significant role: 16%.
2. Users are the target of market research and surveys: 22%.
3. Users actively provide us with information on their needs: 37%.
4. Users engage their own expertise in the innovation process: 25%.

It should further be noted that the context of the question is specifically *innovation*, not just any aspect of customer relationship or marketing management. To be sure, also according to this measure some 59% (categories 2 and 3) of Finnish companies engage, in one way or another, user needs input *in their innovation process* (which was specifically the context of the question). Most customer or end-user contacts and feedback have likely very little to do with innovation, instead, they address incremental changes, continuous improvement, and only minor modifications to existing products and services; in an industrial context, for example, these contacts could lead to minor engineering or design changes. It is important not to inflate the concept of innovation; the most efficient way of inflating the concept would be to define all, even minor, changes and modifications to existing ways of thinking as *innovation*.

Category 4 answers can be interpreted as evidence of user-based innovation. We can therefore conclude that **about 1/4 of Finnish companies engage in user-based innovation**. Now, any claim that this percentage is "too low" is certainly dubious. How do we know? What is the basis of comparison? It is roughly of the same magnitude as the corresponding percentage in de Jong and von Hippel's Dutch sample, the only comparison we are able to make based on existing research. Let us, however, examine further the distribution of responses to determine what the explanations and interpretations behind the percentages could be.

The first observation to be made is that the extent of user-based innovation does not seem to correlate with the conventional demographic variables, such as company size or industry. This is confirmed both by a qualitative analysis of the list of companies in each category, as well as more systematic statistical analysis.

Particularly interesting is the 16% of the sample, over 100 companies, in which users have no significant role in the innovation process. Have these companies not discovered the value of user-based innovation? Do they lack the incentives? Or is user-based innovation simply irrelevant for them? We cannot disclose the identities of the individual firms in the category, but a look at the list of companies in this 16% suggests that the likely explanation is that user-based innovation is simply irrelevant. Many companies among the 16% are highly specialized, where the innovation expertise resides fully within the focal organization, not the end-users or even the immediate customers. Companies such as the electron microscope developer FEI would probably be in this category. Similarly on the list are a number of providers of highly specialized professional service providers, where professional expertise is prerequisite to all innovative activity and where the user of the service has no expertise in the development of new service solutions. But of course, there are also service providers, for whom the end-user does indeed have an important role in the innovation process.

3.3.3. USER-BASED INNOVATION AND FIRM PERFORMANCE

Are firms engaging in user-based innovation more profitable than others? In order to examine this, we first took a look at the simple statistical association between the user-based innovation and return on investment (ROI). As expected, there is no association between the role of the user and profitability: the distribution of the well, average, and poorly performing firms is almost identical in all four categories of the user-based innovation variable. The extent to which the end-user participates in the innovation process does not seem to be a performance driver. The proportion of very highly profitable firms in each of the four categories is roughly the same, 25–28%.

Another statistical association examined is the correlation between the role of the end-user and labor productivity (value added per employee). The interesting observation is that a significantly larger percentage of very high relative value-added companies are associated with *less* end-user involvement in the innovation process. The differences between low and high end-user involvement are roughly nine percentage points. This finding can be interpreted as at least indirect manifestation of the locus of expertise argument: whenever value added per employee is high, the probability that the expertise for innovation resides within the organization, not its customers, is higher as well. To be sure, this by no means implies that these firms are not addressing the needs of their customers; it simply means that these companies (and their

Table 3.1. The relationship between firms' user orientation and profitability

			Return on investment				
			Lowest quartile (< 5.1%)	Second quartile (5.1-18.7%)	Third quartile (18.7-38.0%)	Highest quartile (>38.0%)	Total
Role of end user in innovation	No significant role	Count	29	27	30	32	118
		% within Role of end user in innovation	22.3%	24.4%	28.0%	25.3%	100.0%
	Object of market research	Count	84	51	51	70	256
		% within Role of end user in innovation	33.3%	20.2%	19.2%	27.4%	100.0%
	Actively provides information	Count	81	82	80	96	339
		% within Role of end user in innovation	23.5%	24.3%	24.2%	28.1%	100.0%
	Engages development expertise	Count	47	33	45	44	169
		% within Role of end user in innovation	29.1%	19.1%	26.9%	25.0%	100.0%
Total		Count	241	193	206	242	882
		% within Role of end user in innovation	26.6%	23.3%	24.2%	25.9%	100.0%

Source: Kotiranta et al. (2009).

Table 3.2. The relationship between firms' user orientation and labor productivity

			Value added per employee				
			Lowest quartile (< 42.9 k€)	Second quartile (42.9-56.5 k€)	Third quartile (56.5-78.2 k€)	Highest quartile (> 78.2 k€)	Total
Role of end user in innovation	No significant role	Count	25	24	27	39	115
		% within Role of end user in innovation	20.9%	19.2%	24.5%	35.5%	100.0%
	Object of market research	Count	60	63	50	69	242
		% within Role of end user in innovation	26.4%	25.9%	19.4%	28.3%	100.0%
	Actively provides information	Count	73	87	97	75	332
		% within Role of end user in innovation	23.7%	25.6%	27.8%	22.9%	100.0%
	Engages development expertise	Count	36	44	47	38	165
		% within Role of end user in innovation	22.6%	25.9%	26.9%	24.6%	100.0%
Total		Count	194	218	221	221	854
		% within Role of end user in innovation	26.6%	23.3%	24.2%	25.9%	100.0%

Source: Kotiranta et al. (2009).

customers) have recognized that the locus of innovation expertise is located within the supplying firm. This expertise then manifests itself in higher value added per employee.

Obviously, simple statistical associations require further elaboration, but based on Table 3.1 and Table 3.2, we can draw the preliminary conclusion that from the point of view of economic value, user-based innovation may not necessarily constitute an important policy variable. Those who wish to claim otherwise must demonstrate their claim. Our conclusion is that we must seek to understand the contextual determinants and range of applicability of user-based innovation and at the most general level, *understand the locus of innovative expertise, which may be either heavily concentrated or spread throughout the value chain*. Concentration of innovation expertise in the value chain is always a sign of economies of specialization. Dispersion, in turn, means that innovation must be viewed more as a collective effort that involves many different actors. There is no reason why economic policy should favor one over the other and seek to promote, in a manner of speaking, *reallocation of resources in the value chain*: "[re]allocation of intellectual resources would seem to be a simple problem, one that might be easily corrected. The problem is, however, a larger one." (Knoedler, 1993, p. 285). Any conclusions that intellectual resources are somehow incorrectly or inefficiently allocated in existing value chains cannot be assumed, it must be demonstrated.

3.3.4. WHAT CONSTRAINS INNOVATIVE ACTIVITY?

Perhaps the most important role of economic policy is to remove unnecessary constraints and obstacles from innovative activity. While we have little reason to believe that not engaging in demand and user orientation in innovative activity is caused by lack of incentives, economic actors may be constrained in one way or another.

Fragmentation of innovation expertise in economic activity leads to complexities in terms of *intellectual property rights* (IPRs). The problem has been recognized at the more general level as the challenge of joint ownership. Heller (2008) has listed numerous examples of "patent gridlock," a situation in which property rights are so fragmented that economic action and innovation becomes indefinitely suspended. One of Heller's examples is a US drug company that had found a treatment for Alzheimer's disease, but could not bring it to the market, because this would have required the purchase of dozens of patents. Any single patent owner knows that its patent is indispensable and sets the asking price accordingly. The result: "the drug sits on the shelf though it might have saved millions of lives and earned billions of dollars" (Heller, 2008, p. xiv). Innovation is, paradoxically enough, being blocked by property rights. Therefore, in an important way, protection of intellectual property can be downright counter-productive to innovation. This could be one further reason for why firms may seek to avoid dispersion of property rights and consequently, user-based innovation as well.

von Hippel and von Krogh (2003) argued that in the case of open-source software, the patent gridlock and anything resembling it has been avoided. We must, however, understand that open-source software is a unique exception, the insights of which must not be generalized. In how many contexts of economic activity does the claim about open-source software apply: "software users can profit by using open source software or open source software improvements that they develop… there is no commercial market for open source software" (von Hippel & von Krogh, 2003, p. 214).

We must understand that the vast majority of innovative activity still occurs within the conventional, private investment model of innovation and commercial markets: "individuals or organizations will step forward and invest in the development of innovations if and as they expect such action to 'pay' in terms of private rewards" (von Hippel & von Krogh, 2003, p. 213). Any economic policy that does not acknowledge this is going to be irrelevant. It is wholly unreasonable to assume that owners of private IPRs will yield to the benefit of the collective. What would be the incentive for an economic actor to contribute freely to the production of a public good? The idea of private provision of public goods sounds appealing, altruistic, even morally commendable, to be sure, but the propensity and incentive for private providers to engage in such activity must be approached with realistic caution:

"altruism has not played a major role in other industries, so it would have to be explained why individuals in [a specific industry] are more altruistic than others" (Lerner & Tirole, 2002, p. 198). Unfortunately, the media tends to depict, for instance, the open-source software industry as "wanting to help the humankind" (Lerner & Tirole, 2002, p. 198). Such portrayal has, however, little foundation in societal reality.

3.4. IMPLICATIONS TO POLICY

In this final section, we examine the policy implications of the preceding sections. Formulation of policy must start with explicate what kind of a role the state wants to define for itself in national innovation policy. What is the role of the policy maker?

The question is a crucial and a strategic one: different countries have *de facto* defined the role of the state in very different ways. For instance, different national innovation systems vary greatly in their emphasis on sectoral policy. Israel's choices (see Breznitz, 2007), for instance, clearly echo Krugman's and von Hippel's ideas that innovation policy should not target specific sectors of economic life; the task of the policy-maker is not to try to define a *diversification strategy* for the country, primarily because governments have a horrible track record at making the right choices. In stark contrast, the innovation policy of Taiwan focuses strongly on sectoral targeting and state control (ibid).

3.4.1. LOCUS OF INNOVATION EXPERTISE

Policy-makers must understand that the division of tasks and structure of any economic system, be it an entire national economy or the value chain of an individual product or service, fundamentally reflects the basis of specialization and expertise of different actors in the system. This is important to understand in the case of user-based innovation in particular: user-based innovation should be promoted only in situations in which the users have the requisite capabilities, skills, and education to contribute to the innovation. Trying to promote user-based innovation in contexts where this is not the case is a misallocation of resources: if user-based innovation has not been adopted in a given context, there are very likely good reasons for that. Universal promotion of user-based innovation tilts the innovation system into an undemocratic direction, where preference is given to contexts in which the structure of the value chain accommodates user-based innovation. We see no basis for such preferential treatment.

In contexts where user-based innovation is relevant, the central challenge from the point of view of both economic policy and economic activity is creation of mechanisms by which the potentially highly fragmented expertise of the user base is combined. Such mechanisms are under-researched and not well known, but there are examples of various virtual forums, laboratories, user communities, and events, in which users meet and share their expertise. Edquist and Hommen (1999, p. 76) label such forums "development blocks," and identify a policy dimension as well: "*Development block analysis enables policy makers to discern and evaluate transformation problems between user needs and production characteristics occurring in early development of new technologies. Policy may also have to fill such gaps in a way that will both stabilize situations and open up new possibilities for development.*"

Promoting such collaboration requires, however, an intimate knowledge of the economic dynamics of the given context. This understanding could be strengthened by engaging in more in-depth research of user needs, perhaps following the lead of Danish researchers and shifting focus to ethnographic and anthropological research. There is too much emphasis in Finland on the technological aspects of innovation. As Kline and Rosenberg (1986) noted, innovation is not necessarily something that happens in a highly visible, observable, and dramatic manner, it may well be something that evolves slowly over time: "much technological change is of a less visible and even, in many cases, an almost invisible sort" (Kline & Rosenberg, 1986, p. 282). The idea of "market-researching the needs of the context" and consequently "engineering a solution to satisfy these needs" may simply be an unrealistic plan of action or at best, it leads to marginal improvements to highly salient (but perhaps unimportant) technological problems.

3.4.2. FROM USER-BASED INNOVATION TO START-UP OF ENTERPRISES

As the examples in the conceptual discussion demonstrate, entrepreneurial start-ups may originate as user-based innovations. This is where economic policy can serve an important role. User-based innovations are often rudimentary solutions to real-life problems and thus, tend to be problem, not technology, driven. To the extent that the real-life problem to be solved has broader applicability, the user-based innovation may lead to the emergence of a market. Again, we cannot think of a better exemplar of this than *Ponsse*, the Finnish designer and manufacturer of timber-harvesting solutions, an internationally successful enterprise that started as a user-based innovation: "*Before entering the forest machines business, Einari was a forest worker. Displeased with the forest tractors available at the time, he decided to build his own. The resulting innovation was a log forwarder – 'Ponsse' –, which proved to be so durable and efficient that Einari set up a machine shop to manufacture more. Today, the business based on this innovation is an important player in the global forest industry.*" (*www.ponsse.fi*, accessed 25 May 2009, the authors' translation).

User-based innovations are peculiar in the sense that they directly combine technological expertise with the requirements of a practical application, thus effectively linking the demand to the supply side. Because both the needs and the solution are addressed by the innovator-user, the problem with tacit knowledge can partly be avoided: developing a solution does not necessarily require articulation and communication of needs from the demand to the supply side. This advantage could further be used to advantage by an economic policy that facilitates the emergence and development of the start-up, particularly in situations in which the innovation is scalable. In industrial settings where economies of scale are present, such scalability may exist. In many high-intensity professional services, in contrast, such scalability may not be present. Consequently, the growth prospects of specific user-based innovations can be very different from one another. A central task for economic policy would be to find and implement a mechanism that recognizes the scalability potential of a user-based innovation. Determining the scope of applicability and even the scalability of a user-based innovation may be beyond the skills of the innovator. In situations where there is an opportunity but the "natural entrepreneur" is missing, an effective economic policy could help alleviate the problem (Edquist & Hommen, 1999, p. 76).

3.4.3. LOCUS OF EXPERTISE AND INTELLECTUAL PROPERTY

Fragmentation of innovation expertise does present a unique challenge to effective management of intellectual property. Policy-makers must understand that in a somewhat paradoxical way, intellectual property rights are antithetic to innovation, because they place both informational and legal boundaries to the flow and application of knowledge. Yet, it is precisely this flow of information that is at the heart of innovative activity.

3.4.4. DEMAND SIMULATION

Perhaps the most concrete tool for policy is demand creation and stimulation. There is an interesting case in Finland right now with the maritime industry, where the state is trying to boost dramatically declining demand by creating €160 million of demand. The majority of this demand boost package is directed at creating demand for routine services and existing products: maintenance, repair and a number of vessel purchases. There is, however, a provision in the package entitled *innovation support*, which is directed at product and service (e.g., logistics) development.

Public procurement is an established policy tool, but the new challenge is the idea of generating demand for *innovation*. This is a much more complicated policy question, because unlike the case of vessel maintenance and repair, there is no market for innovation as such: how could economic policy create demand in such situations? There are examples of demand-stimulated innovations in military research, but experts have reminded that military innovations tend to be very different from commercial ones (Kline & Rosenberg, 1986, p. 275), hence, any generalization must be made with extreme caution. The problem situations in the case of commercial innovation are likely not nearly as well-defined as they are in the case of military applications.

All policy points must be understood in light of the role that the state defines for itself. This is particularly relevant in the case of demand stimulation: it can be used as both as a sectoral targeting tactic as well as a tactic that remains "democratic" and non-preferential. Both options have their strengths and their weaknesses. The strength of sectoral-targeting-oriented demand stimulation or "niche procurement" is that demand stimulation may indeed have a discernible effect. At the same time, the key policy challenge is: which niches are to be preferred over others? A further problem of the niche strategy is that even with high targeting, it is very unlikely to lead to the emergence of new industries of societal significance. Even small countries such as Finland must promote broad-based innovation policy. Toward this end, remaining impartial in terms of sectoral targeting is a better alternative. While this may not have a significant effect on any single industry or context, it also conveys the message that individual economic actors and innovators cannot expect demand stimulation by the state to provide the requisite market for their products and services.

3.5. DISCUSSION

Based on our analyses, we have no reason to believe that Finland is somehow lagging behind other countries in the application of demand- and user based-innovation, or that there should an explicit bias toward either one of the two in the future. Even though the terms may be novel in policy discourse, both have been widely applied by innovators across the globe for decades.

To be sure, the opportunities of user-based innovation must be understood, but economic policy must not overemphasize their importance. It is further important to note that the applicability of user-based innovation in particular is highly context dependent. In our analysis of the Finnish data, we found solid reasons for both engaging and wholly ignoring user-based innovation. To conclude that appliers are "right" and non-appliers "wrong" would constitute a serious misunderstanding: everything depends on the division of tasks and basis of specialization in the value chain.

The emphasis of innovative activity has always been on the market side; this is in a way embedded in the *very definition* of the concept *innovation*.

This conclusion is further confirmed by numerous studies spanning multiple decades. However, while most innovations are indeed initiated as the result of observing a market need, the interplay between market pull and technology push must be understood: invention, solution, and innovation are all important aspects of the process. Again, to conclude that an economic policy must emphasize pull over push (or vice versa) is misguided. Market pull and technology push are highly complementary parts of innovation. Any call to increase pull and downplay push is an overly simplistic prescription that ignores the complexity of economic action. Innovation is not a process that starts with inventions and then proceeds through solutions to a marketable product or service. As the examples have demonstrated, many inventions are not parts of a specific innovation process, but may instead be developed for an entirely unrelated purpose. Similarly, solutions used in an innovation are not necessarily solutions developed with the particular innovation in mind. Linear and simple innovation models where the entire process follows a well-defined sequence are seriously outdated and cannot provide the basis for effective policy.

There is a positive role for economic policy in the matter, but the task should not be that of planning for the future direction of demand- and user-based innovation. A country is not a company, and the state not its "top management team" in charge of strategic planning; the analogy is dangerously misleading (Krugman, 1996). Instead, the role of policy should be to aid innovators face the uncertainty and risk associated with their endeavors. Particularly crucial are situations in which uncertainty and risk are, say, inhibiting a scalable user-based innovation from leading to the creation a market. The goal of policy should be the development of mechanisms by which these potential and fruitful opportunities are identified. This is an important consideration, because most inventions and solutions do not develop into innovations. Development of such mechanisms must start at looking at innovation from perspectives that are perhaps less familiar to Finnish researchers, innovators and policy-makers than the established methods. The Danish experience and the results of their cutting-edge research are encouraging.

3.6. CONCLUSIONS

The emphasis of Finnish **innovation policy** has been on the **supply** side, that is, on developing new/improved goods and services. This does not mean that the **demand** side has been missing. The demand side has been addressed in **other** policy domains such as anti-trust/competition policy. The broad approach adapted in the new Finnish innovation strategy brings the supply and demand sides under one umbrella. We consider this an important extension.

With the extended scope of innovation policy, however, implementing the policy becomes even more challenging than before.

The fact that the demand side has previously been missing from the Finnish innovation policy has often been interpreted as evidence that demand- and user-orientation is absent in the Finnish **innovation system** at large. To the extent that (existing) private enterprise is considered the core of the system,[2] this is clearly a **misconception** and should be put to rout.

In our understanding **no** profit-seeking inventive/innovative activity exists without *some* demand- and user-orientation. Thus the provider-side issues are then on

– The *extent* of the orientation in *profit-seeking* activity and
– The *presence and extent* of the orientation in *non-profit seeking* activity.

Profit-seeking innovators' user-orientation. The survey conducted to assist our evaluation suggests that even the deepest form of user-orientation is quite *prevalent* among Finnish companies both in absolute terms and in terms of international comparison. Yes, user-orientation is *absent* in many firms, but often *for a good reason*. User-orientation *per se* is not the Holy Grail of innovative activity, and business managers are fully aware of this. The conditions for a worthwhile user-producer interaction are:

– The user must *possess* relevant information.
– The user must be able and willing to *convey* it.
– The information must be (potentially) *new* to the firm.
– Information gathering this way must be *cost-efficient*, i.e., the cost of acquiring it via direct user interaction must be less than via alternative means.
– The information must be (potentially) *useful*, i.e., the (expected) net present value of acting on it – taking into account others' strategic responses – is higher than that of not acting.

It is very likely that **not all** of the above conditions are always simultaneously satisfied, in which case user-orientation is not necessarily applicable in a *private* sense. The policy question then is, does it *still* make sense from the society's point of view?[3] Our conjecture is that the answer is "no". In the above list, the market for information can nevertheless fail on many accounts, in which case the answer would be "yes". Noticing that here an intervention ought to be specific to the actors, context, and setting as well as taking into account practical limitations, it seems likely that the policy-maker would likely fail in trying to steer the market toward user-orientation.[4]

In a roundabout way the promotion of demand- and user-orientation at the provider side translates into promoting radical and disruptive, rather than to incremental and adaptive, innovative activity; the entrants should be favored over incumbents.

Non-profit-seeking innovators' user-orientation. The value the society gets from an innovation may be seen as the sum of utilities it generates to its provider and users.[5] The profit motive brings about a tendency to attend to user needs and thus aligns the interests of the provider and the society (at least in part). With other motives for innovative activity, there is no particular reason why user needs should have any influence, not least because the non-profit-seeking status implies that innovative activity is not fully financed by ultimate beneficiaries.

In Finland non-profit-seeking innovative activity is largely conducted in public research organizations and in the educational sector (or is otherwise publicly financed). As far as demand- and user-orientation is concerned, there is undoubtedly ample opportunity for improvement. Before drawing any conclusions, however, one should note that in this domain there may well be just reasons for not having too much of the orientation. Both public research organizations and the educational sector are discussed in other Chapters. Thus, we do not elaborate the issue further here.

Society and markets embracing innovation. We presented above a number of caveats concerning providers' demand- and user-orientation. As far as the demand side of innovation policy is concerned, they are not the main issue. The main issue relates to **incentives** users (as individuals) and markets (as collections of users and third parties inducing demand) provide. The key question is, how to have markets celebrating innovation in terms of

- **Quality** (demand for and appreciation of novelty),
- **Volume** (good innovations rapidly gain market share and/or expand the market as well as reach a reasonable volume in absolute terms), and
- **Price** (there is high willingness to pay for the most innovative new offerings).

By extension this has also implications to input markets: in order to be able to realize commercial opportunities in the end-market, a successful innovator must be able to attract capital, labor, and other resources at attractive price-quality terms.

It should be obvious that the *new* cannot fully bloom unless some of the *old* withers. Yet the society's, the markets', and often also users' natural and understandable desire for *status quo* is a grossly underestimated issue standing on the way of fully unleashing innovation potential. While the literature also discusses the possibility of excess momentum and bandwagon effects, at least in the Finnish context the focus should be on avoiding excess inertia.

The above argumentation lays down the list of objectives for demand-side innovation policy – as for the actions, we have to ask

- How does the government interact with (end-)markets?
- How does the government interact with users?

By invariably setting basic rules-of-the-game, such as laws and regulations, and at least participating in setting most others, such as standards, the government is in fact indirectly a major force in virtually all markets. Via its extensive public procurement, the government is also directly a customer in many markets. The government's new framework for demand- and user-oriented innovation policy emphasizes these aspects – our thinking is roughly in line with these guidelines. Let us, however, point out a few caveats.[6]

Despite its **great potential**, public procurement, regulation, and standard setting does not have an admirable track record – on balance they have probably demoted rather than promoted innovation. As for regulation and standards, there are no generally applicable rules on good – let alone optimal – timing, setting mechanism, scope, or course of action. In order for public procurement to promote *innovation* in any way, it should include aspects that do not have off-the-shelf solution (anywhere in the world). In the pre-competitive phase this comes with costs (additional use of public funds) and risks (as the innovative step increases, the probability of taking it decreases) that are often not acknowledged. Engagement is costly and risky also on the contractor's behalf, so desirable private outcomes should not be assumed. The post-competitive phase is also tricky when it comes to intellectual property rights and organization of production; if and when using procurement as an innovation policy tool involves extra public costs, they should be considered in the same manner as direct subsidies for innovative activity. Upon using public procurement to promote innovation, one should take care in not to take sides as far as the types of possible solutions or actual providers are concerned – requirements that are sometimes ill-suited to prevailing political realities.

Activities that do not exist. A market may fail to the extent that it simply does not exist or emerge at all, even when there is scope for socially desirable interaction among actors. One of the reasons may be users' inability or unwillingness to communicate their needs or related transaction costs.[7] It may also be the case that a socially desirable market is not privately profitable. The EU lead market initiative is an effort to establish initial or early, and demanding, markets in such contexts. This effort has some potential for markets that are also in the future supported by public intervention, but one has to be skeptical on establishing market this way that would ultimately be privately sustainable.

Users innovating for themselves. Given the topic of our sub-panel and the ongoing public discussion, we have perhaps discussed Internet – and information and communication technologies at large – too little. This is not because we would underestimate its effect. We acknowledge that the Internet

– has greatly expanded and facilitated access to coded information,
– has had a profound effect on virtually every imaginable market empowering both producers and users (often shifting the market balance in favor of the latter),
– has nurtured new markets and reduced the cost of entry in many old ones,
– has enhanced an individual's and an organization's innovative ability, and
– provides an attractive and "democratic" platform for certain types of information.

Yet the use of Internet is mostly **not** about innovative activity. Various forms of online communication and content are **not** innovations. Overwhelming majority of Internet users do **not** engage in what could be defined as innovative activity. Should open-source or other emerging production paradigms ever overtake the prevailing "corporatist" approach, it faces a fundamental problem in both input (How to justly reward contributors?) and output markets (How to charge enough to recoup the costs?). Crowd-sourcing, open innovation, and some other recent buzzwords may well be important issues in organizing innovative activity, but having others provide effort for less than its full value or accessing the existing knowledge pool more extensively are not innovations *per se*.

A few examples notwithstanding, users effortlessly innovating for themselves remains an exception rather than a rule. Yes, a stray programmer striking gold with an iPhone application is certainly possible but these kinds of events are rare indeed. Rareness aside, is the innovation system able to accommodate such activities? Probably not. For instance, the related intellectual property rights present a formidable challenge; in these contexts, IPRs are typically forced upon, undefined, unclear, ill-suited, and/or unenforceable, at least in Finland. From the point of view of direct public support, the innovation system is not well-suited to activities that are not organized around well-defined and scheduled projects or conducted under one legal entity or jurisdiction. As we have not had sufficient time to consider the issue, we are not necessarily calling for any action at this point, although at the least going through some test case with current organizations and instruments would be worthwhile.

What demand- and user-oriented innovation policy is and is not. Demand- and user-orientation in innovation policy does **not** necessarily imply that publicly conducted or supported innovative effort should be "closer to market". At least if this is interpreted as investing in existing strengths, one could actually argue just the opposite.

Demand- and user-orientation in innovation policy does **not** imply that the targets of innovation policy – companies and individuals – should dictate public policy objectives and instruments. Note, however, that demand- and user-orientation in innovation policy is consistent with letting the most micro-level private actors unbiasedly decide on the focus of their own innovative activity. This does not necessarily apply to public or publicly supported actors, as demand- and user-orientation is not built in (see above).

Demand- and user-orientation is **not** about manufacturing vs. services or technical vs. non-technical. If anything, it calls for being impartial and unbiased and uniformly applying the general criteria.

Final remarks. Demand- and user-oriented innovation policy is neither about linking demand and supply nor about producers and users. It is rather about enabling the generation and use of new ideas via well-functioning and elusive input and output markets, especially when the public sector is directly involved as a provider or a customer or otherwise shares a special interest in the emergence and development of the market.

With the Internet and related developments, the possibilities to *organize* innovative activities have expanded enormously. It is, for instance, much easier to involve users as co-creators and co-inventors. In certain domains users have much better opportunities to innovate directly for themselves. Technology might also help one to uncover unarticulated user needs. While engaging, these facts should not be over-emphasized and there growing prevalence does not necessarily call for policy action.

Our best estimate is that firms – given their markets and operating environments (which are among the objects of demand-side innovation policy) – are exactly where they should be in terms of demand- and user-orientation. As for direct support for their innovative activity, our best advice is to be neutral as to the (potential) source and type of innovation. We have no evidence this would currently not be the case, even if some recent remarks suggest otherwise. Should there be any existing biases, in the transition period it might be necessarily to over-emphasize the previously underrepresented aspect(s).

We have expressed our skepticism about *certain aspects* of demand- and user-oriented innovation policies, but this is **not** to say that we would consider them unimportant or would not see scope for policy action in the domain. Furthermore, both internal[8] and external[9] developments call for shifting relative emphasis towards this domain.

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ENDNOTES

1 The previous evaluation of the Finnish innovation support system concluded in that "The use of demand-side innovation policies has been neglected in recent years." (Georghiou, Smith, Toivanen, & Ylä-Anttila, 2003, p.117).

2 A premise we have taken for granted.

3 In part our argumentation rests on the assumption that ignorance and irrationality is not too prevalent and/or it cannot be significantly aided via direct policy action.

4 Public support for living labs, user groups, and cluster interaction may be seen as examples of policy actions related to profit-seeking innovators' user-orientation; in our view these actions are hard to justify on the grounds of *enhancing user-orientation*, even if they may well have other valid motivations.

5 Here we abstract from the important caveats in a small open-economy context as well as from the consideration of both positive and negative externalities to third parties.

6 The latter of the above questions could be restated as follows: How to equip users with the expertise and desire to demand and expect innovative offerings as well as with the ability and willingness to enhance, expand, and develop them? This points to the direction of engaging educational system as well as of discovering one's own "internal entrepreneur" in some capacity.

7 Furthermore, there seems to be a stubborn myth in Finland that users are simply too ignorant to take up all the great inventions that are to be found throughout the country. We are, however, unable to find any evidence of this. The fact that most innovations are never commercialized is not evidence of this, as one of the fundamental functions of the market is to separate good ideas -- that are (privately) financed and become innovations -- from bad ones -- that are let to rest in peace.

8 Finland catching up with the global technology frontier; the increasing role of services.

9 Democratization of coded information and related empowerment of users, global technological trajectories, globalization and the related second unbundling.

4. Globalization and Business – Innovation in a Borderless World Economy

Karl Aiginger, Paavo Okko, and Pekka Ylä-Anttila*

Innovation and globalization are closely connected. Openness and innovation benefit the society both independently and jointly. Today's innovative activity is inherently global. Especially small countries are increasingly dependent on global knowledge flows. This poses a challenge to national innovation policies. Furthermore, traditional innovation policies are not easy to justify in the case of a small open economy. More emphasis should be put on enhancing diffusion of technologies and new knowledge, localizing international knowledge spillovers, as well as on promoting the development of production factors that are less mobile internationally.

The Finnish innovation system has been performing relatively well in international comparison. There are, however, a number of signals of needs for change – these are, in part, due to changes in global drivers of innovation. The system is – as well as the whole Finnish economy – much less international than often thought. This applies especially to the higher education and research. Yet, deeper tapping into the global knowledge pool should be one of the future corner stones of innovation and sustained well-being.

In the global economy Finland is strongly specialized in two industrial sectors: ICT and forest. Both are in turmoil due to shifts in global demand and relocation of production. Our analyses show that there are clear signals of even broader deficits in industrial structure and needs for broad upgrading of quality of exports and production.

Policies – both policy organizations and instruments – to support business sector internationalization needs streamlining. Today, practically all innovation and business support organizations provide internationalization services for firms.

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4.1. INTRODUCTION

Setting the context: Finland in the global economy – One of the Nordics

In an international comparison Finland has been a high performing economy with a quick recovery after the crisis of the early nineties, showing persistently faster than average growth since then. It shares several features of the Nordic or Scandinavian socio-economic model, including the changes and adaptations to make the economies fit for increasing competition in the globalised world. As pointed out by several cross-country comparisons the Nordic economies have succeeded – better than most other countries – in combining economic efficiency and technological dynamism with a fair income distribution and social cohesion.[1]

Finland's *long term economic growth* – over the past 50 years – has clearly exceeded that of the EU-15. The period includes the crisis of the early nineties in which GDP decreased by more than 10%. Growth is definitely higher than the average of the Nordic group since 1990. The resulting position in GDP/capita is above European average.

Unemployment rate is, however, higher than in the Nordic bloc. That applies especially to youth unemployment, which is well above European average. *The employment rate* is marginally higher than in EU-15. Employment rate is, however, lower in Finland for young people as well as for people.

Labour market is less regulated than in EU on average, but the difference is smaller between Finland and continental European countries. Regulation is stricter than, e.g., in Sweden and Denmark, and flexibility since the nineties had not been very pronounced. The share of flexible contracts (part-time plus fix-term contracts) is now much lower than in Sweden and has not increased as much as in other countries. It is now also below EU average and below continental countries (in which labour markets are more regulated). The difference between wages paid by firms and net income of employees (tax wedge) has decreased since its peak in the mid nineties, but is still above EU average and higher than in the continental countries, signalling lower incentives to hire new employees. Career or job related training in firms is very high, as in other Nordic countries.

Finland is a country with a large public sector, and a relatively large number of state-controlled firms. The share of government expenditures in GDP is rather high, so are tax rates. As in other Nordic countries, Finland has a dual tax system in which corporate taxes are kept low as to help firms to stay internationally competitive despite the high overall tax level. The tax system is more redistributive than in continental countries but far less than, e.g. in Sweden. Expenditures on education are high in international comparison, so are expenditures on innovation.

High investment into the future

Finland has so far managed to stay competitive in the globalizing world by going for excellence in education, innovation and by making use of the information technology. Expenditures on research and development increased from 1.2% in the early eighties to about 3.5% in 2008 (second only to Sweden in EU-27). Finland is leading in the quality of the education system as revealed by Pisa ratings, despite the fact that expenditures are not much higher than in EU on average. Finland's expenditures on ICT are high too (6%, EU average 5.6%, Sweden 7.3%). If we take research, education and expenditures in ICT together as an indicator for "investment into the future", we see that this indicator increased from 13.3% (1992) to 15.9% (2006), which is the second highest rate in the EU-27, well above the EU-15. Finland has the highest share of employees with tertiary education. However, people with higher education start late to work (according to OECD the average labour market entry is at the age of 28), there is a gap between finishing secondary education and starting tertiary education. This is obviously a problem since Finland is one of the countries with the most rapidly ageing population.

Summarizing policy priorities and macro performance

Finland is a successful economy as far as growth and other macroeconomic performance indicators are concerned. High growth, above average per capita income, balanced trade and balanced budgets until recently are on the positive side, low employment rate and rather high unemployment rate (specifically for the young people and low employment rate specifically for the elderly) are less favourable stylized facts. Structural change was strong in the nineties, but Finland still has a relatively large low-wage sector and a high share of production in price elastic industries. The manufacturing sector is large and has been growing fast until recent years, the agricultural sector is still rather large (OECD, 2008), and the service sector relatively small.

Finland is part of the Nordic socio-economic model, and enjoys its positive features of a cohesive society, with a high welfare standard. Finland careful upholds incentives and competitiveness by lowering regulation, tax wedge and the tax burden for firms. The labour market is relatively flexible, but not as flexible as in other Nordic countries. There have been signs of mismatch (labour shortage despite of rather high unemployment rate) and of low regional mobility. The share of flexible contracts is quite low. Environment has less priority than in other Nordic countries, if concluded by high CO_2 emissions and energy consumption per capita, and low environmental taxes. High per capita energy consumption is mainly due to industrial structure and is rapidly decreasing as a consequence of industrial transformation. The use of nuclear power instead of alternative energy sources or the strife for excellence in energy efficiency is the answer to the climate problem.

Education and innovation have a very high priority, definitely higher than in other European countries and even within the leading Nordic countries. As far as openness of the economy and society is concerned Finland has a medium position, at best. Furthermore, there are signs for asymmetric openness. Inward investment is lower than outward FDI, migration is low, and number of foreign students and researchers is low.

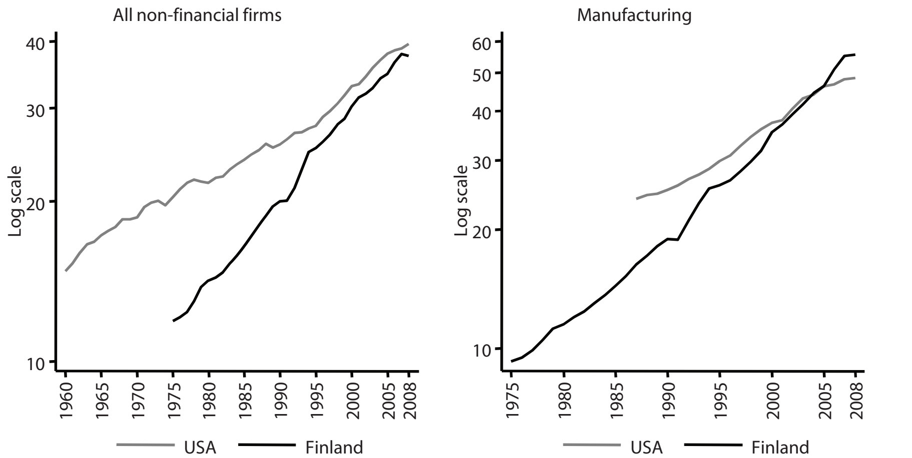
Approaching the global technology and productivity frontier

Since the late 1980s Finland has been moving from an investment-driven catching-up country towards innovation-driven and knowledge-based economy. The transformation relates to the high level of education and increasing technology inputs, but it is as much a consequence of the productivity-enhancing structural change – or creative destruction.[2] Although starting already in the late 1980s, the period since the mid-1990s has been essential in this respect. Resources moved from less productive plants and firms to more productive, and from less productive industries to more productive ones, also entries and exits increased contributing to productivity. There was a radical change in firm and industrial structure. In less than a decade, electronics – notably telecom equipment production – grew by far the largest industrial and exports sector. By the turn of the millennium the country had become the most ICT-specialized country in the world in terms of ICT's share in production and R&D.

As a consequence of the structural transformations over the past two decades the economy today is close to the global productivity and technology frontier (Figure 4.1 and Figure 4.2). As pointed out by modern economic growth literature, being close to the frontier calls for different growth policies from that pursued in the catching-up stage of development.[3] The closer to the world technology frontier, the more economies pursue innovation-based strategy with younger firms, experimentation, and better selection of firms and managers. Investment in fixed capital would be lower, but exploring novel combinations with higher failure rate and subsequent higher exit and entry rates would be more common. That calls for different institutions than in investment-driven stage of development.

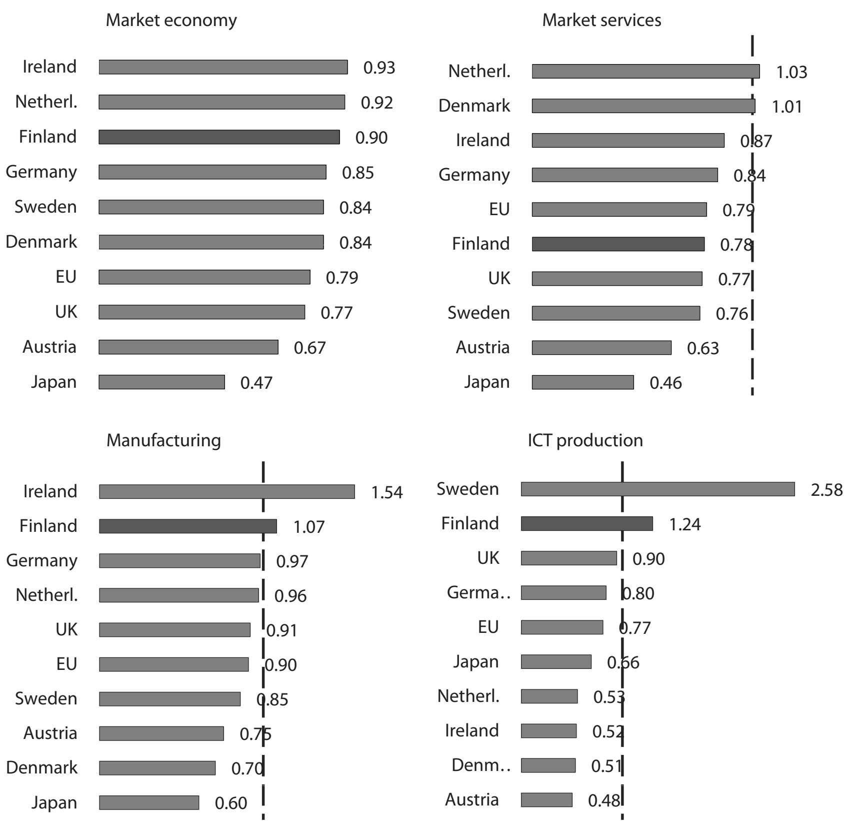
Recent studies using comparable data sets on inputs and output suggest that the country has climbed relatively high in multifactor productivity in almost all sectors. Hence, policies targeted towards specific sectors or firms do not seem justified. Rather, the relevance of institutions and individuals in policy considerations has increased.

Figure 4.1. Labor productivity in Finland and the US, in 2004 Euros



The source is Nevalainen and Maliranta (2009), data from the national accounts, and Bureau of Labor Statistics.

Figure 4.2. Relative levels of multifactor productivity, 2005 (US=1)



Data source: O'Mahony and Timmer (2009, Table 3).

The crucial policy issues now include: Are the current institutions and policies compatible with new stage of development or do they still reflect the catching-up phase? Can the country keep its top position in productivity without major changes in policy instruments? And in particular: What does it take to keep the productivity enhancing structural change as the major source of productivity growth?

There are indications in the recent comparative innovation studies that Finland's innovation performance has been stagnant over the past few years.[4] Although the framework conditions – education and technological infrastructure – are among the best in the world, the innovation performance has deteriorated. The reasons for losing the top position relate to management practices and inability of organizations to make use of individuals' creativity and innovation potential. That signals the need to renew the incentive mechanisms as proposed by the new growth literature referred to above.

4.2. ANALYSIS AND EVALUATION

4.2.1. NATIONAL POLICIES IN A WORLD WITHOUT BORDERS

An essential feature of the globalized world economy is that knowledge flows more and more freely across national borders. Ideas, inventions, technologies and innovations spread within multinational enterprises (MNEs), in global production networks, or embodied in goods and services. World trade has been constantly growing faster than world GDP, foreign direct investment by MNEs more than trade, and the documented surge in non-equity, contract-based value-added networks (or strategic alliances) has even outstripped the FDI growth.[5]

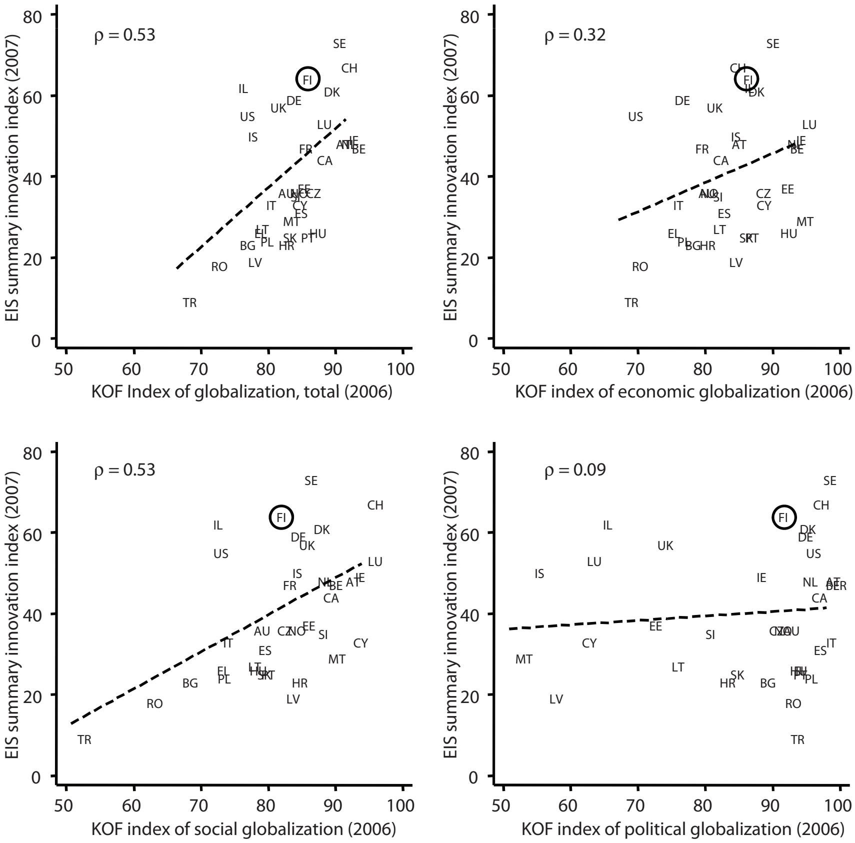
The basic idea of modern production networks is to enhance collaboration and transfer knowledge from one country or location to another to facilitate development of new products and increase the productivity of the whole production system.

How does the idea of national innovation policy fit into this increasingly internationalized world economy? The fact that benefits from new innovations and knowledge generation are by no means confined within the national borders, poses the fundamental policy challenge for a small open, knowledge-based economy. The key policy issue is: Do the standard policy justifications and premises of national policies hold in a globalized world economy? Or should they be changed and reassessed given the more or less free flow of ideas and knowledge?

There is a strong theoretical argument that national innovation policies are not easy to justify in the case of a small open economy while most of the benefits (consumer surplus) from the innovations go outside the national borders.[6] The policy rationales as such hold also in the highly internationalized market[7], but obviously national policies need to be adjusted to take into account the increasingly globalized world economy.

At the general level there seems to be a strong correlation between openness – or degree of globalization – and innovativeness as evidenced by Figure 4.3. Countries that show high level of innovativeness (measured by the European Innovation Scoreboard Index) are those that are also most globalized (measured by KOF Index of globalization[8]). Interestingly, when decomposing the overall globalization index into sub indices, it turns out that

Figure 4.3. Globalization and innovativeness



Data sources: Innovation index: European innovation scoreboard 2007, globalization indexes: Dreher (2006). Country abbreviations: AT = Austria, AU = Australia, BE = Belgium, BG = Bulgaria, CA = Canada, CH = Switzerland, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, EL = Greece, ES = Spain, FI = Finland, FR = France, HR = Croatia, HU = Hungary, IE = Ireland, IL = Israel, IS = Iceland, IT = Italy, LT = Lithuania, LU = Luxembourg, LV = Latvia, MT = Malta, NL = Netherlands, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SI = Slovenia, SK = Slovakia, TR = Turkey, UK = United Kingdom, US = United States.

the highest correlation with innovativeness is that with social globalization. Social globalization measures personal contacts, information flows, and cultural proximity – the density and accessibility of new ideas. One cannot, of course, say anything about the causality, but the strong association between globalization and innovativeness opens some interesting aspects to assess innovation and innovation policies in a borderless world.

The *first* important aspect is that all countries are both senders and receivers of global knowledge spillovers. The amount of the spillovers has been steadily increasing, since knowledge as such has become a more important production factor in all industries and, at the same time, the share of knowledge-intensive industries in most economies has increased. The essential policy issue is: How to tap into the global knowledge pool and spillovers? Finland produces at best less than one per cent of global knowledge (the country's share in global R&D expenditure is about 0.6%). Most – or almost all – of the economically relevant knowledge is generated outside Finnish borders. The recent economic growth literature shows that even in the larger countries the ideas developed elsewhere are of great – and increasing – importance to economic growth.[9] Hence, the crucial issue is, whether the channels and mechanisms to capture global technology and knowledge spillovers are efficient enough.

The *second* aspect relates to the mobility of production factors. Financial and physical capital have become increasingly mobile at the same time when the mobility of human capital has increased less. Technological infrastructures are relatively immobile. Should policies be geared more towards these and less towards mobile and increasingly footloose firms? Are some of the innovation enhancing factors less mobile and more embedded in the economy than others?

A *third* interesting aspect, related to the two above, is that of locational competition and locational advantages. Certain industries and certain kinds of firms tend to locate in relatively well defined regions or hubs. Is there a justification for policy intervention that enhances local clusters, in order to internalize the external economies arising from local knowledge production?

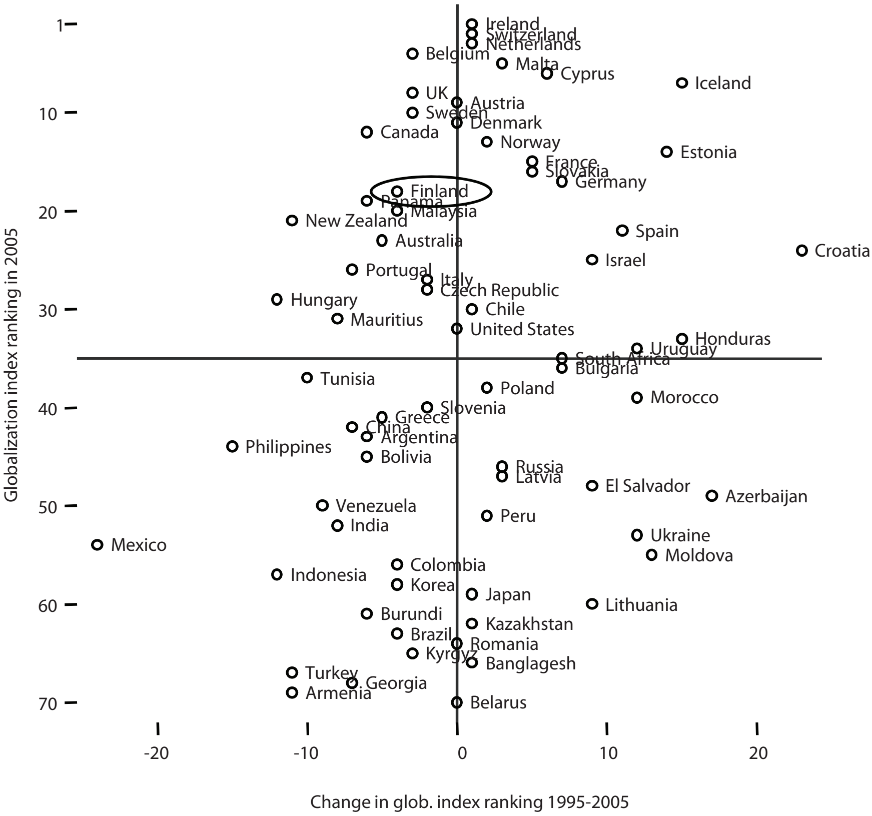
In what follows we will use empirical data to look at to what extent the Finnish innovation system, policies and policy organizations are in line with globalization and growing amount of global knowledge spillovers. In the small open economy the key policy objective inevitably is to enhance diffusion of globally developed technologies and tap into the international knowledge pool.

How globalized the Finnish economy and society are?

There are several ways of measuring globalization and at least half a dozen of indices often used in policy analyses or public debate.[10] According to a new index constructed in Vujakovic (2009) Finland ranks a bit less favorable than in some of the previous studies. The country is number 18 among the 70 countries included in the sample.

The rank is below the rankings of the other Nordic countries. It looks that Finland is highly integrated in the global financial system, but much less globalized as far as social and trade globalization are concerned. The observation fits well with the findings of the modest internationalization level of the research system and low researcher mobility. Furthermore, if anything the globalization of the Finnish economy and society – compared to other countries – has decreased over the past ten years.

Figure 4.4. Globalization of countries and changes in globalization according to a New Globalization Index

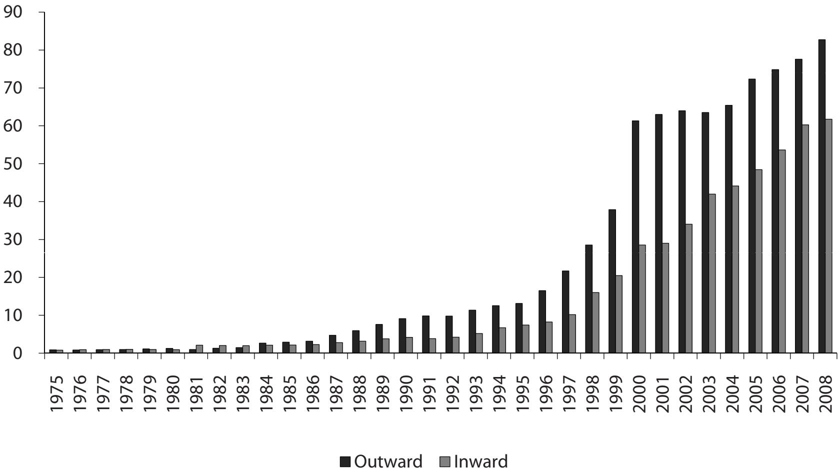


Data source: Vujakovic (2009).

One-sided globalization?

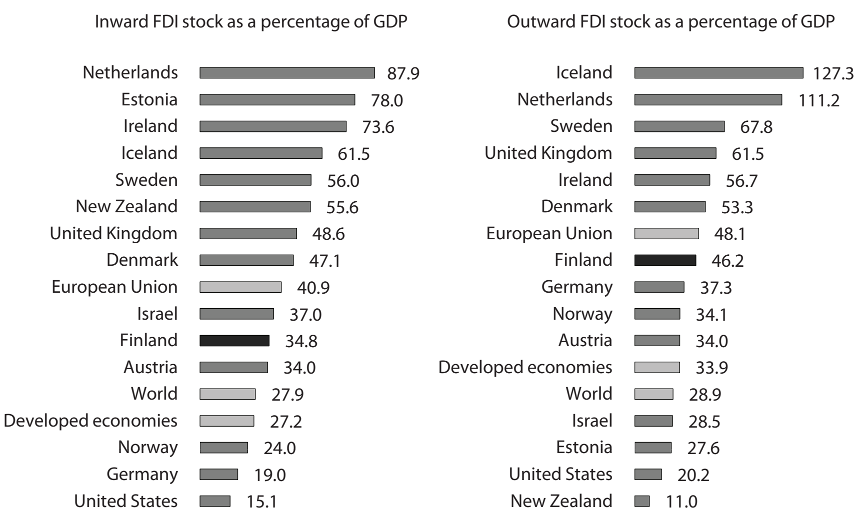
The large Finnish firms today are among the most globalized in the world.[11] Outward foreign direct investment stock has grown more than tenfold since the early 1990s. Although the inward stock has grown even more rapidly, the stock is still some 25% smaller than the outward stock (Figure 4.5). The Finn-

Figure 4.5. Outward and inward FDI stocks in Finland, 1975–2008 (bill. euro at 2007 prices)



Sources: Bank of Finland and ETLA/Maury.

Figure 4.6. Inward and outward foreign direct investment stocks, % of GDP (2007)



Source: UN world investment report 2008.

ish firms have been investing clearly more abroad compared to how much Finland has been able to attract foreign investment.

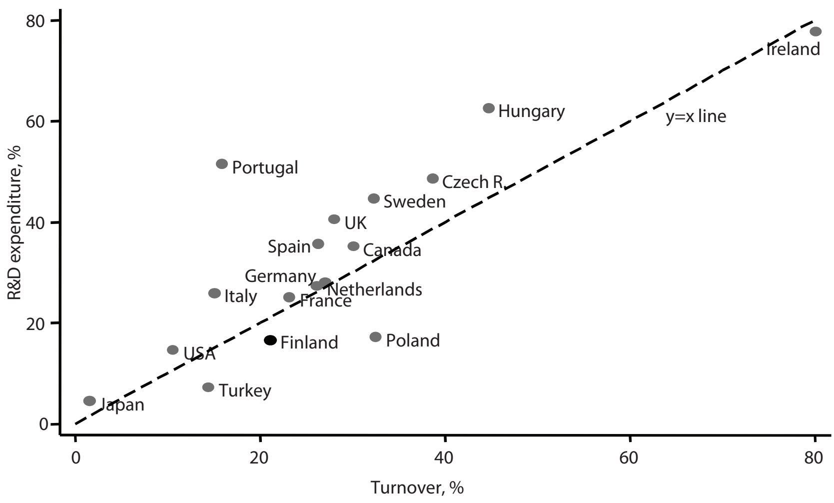
Of course, the excess of outward FDI over the inward is also an indication of the competitiveness of Finnish firms and does not as such tell very much of in- and outflows of knowledge and information. There are probably a lot of knowledge inflows within the Finnish multinationals.

Although the largest Finnish firms are highly internationalized, the business sector as a whole, compared to many other small countries, is not, as evidenced by Figure 4.6.

Another way to investigate the likely effects of globalization of business is to look at the presence and R&D activities of foreign multinationals' subsidiaries in Finland compared to other OECD countries. That is done in Figure 4.7.

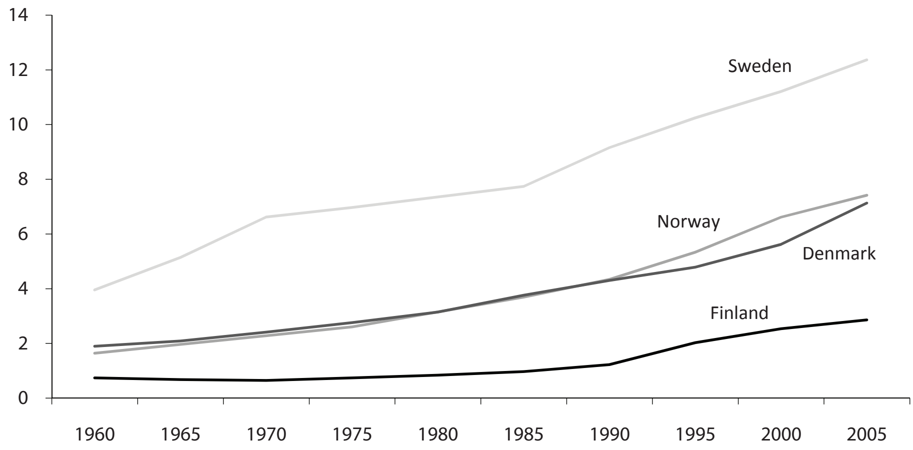
The role of R&D conducted by foreign firms is relatively small in Finland compared to most other European countries. In addition, as data in Figure 4.7 seem to indicate, the R&D intensity of foreign firms in Finland is lower than the average of the sampled countries (foreign affiliates' turnover share is slightly bigger than their share of R&D, i.e. Finland is below the diagonal).

Figure 4.7. Share of R&D and turnover of affiliates under foreign control



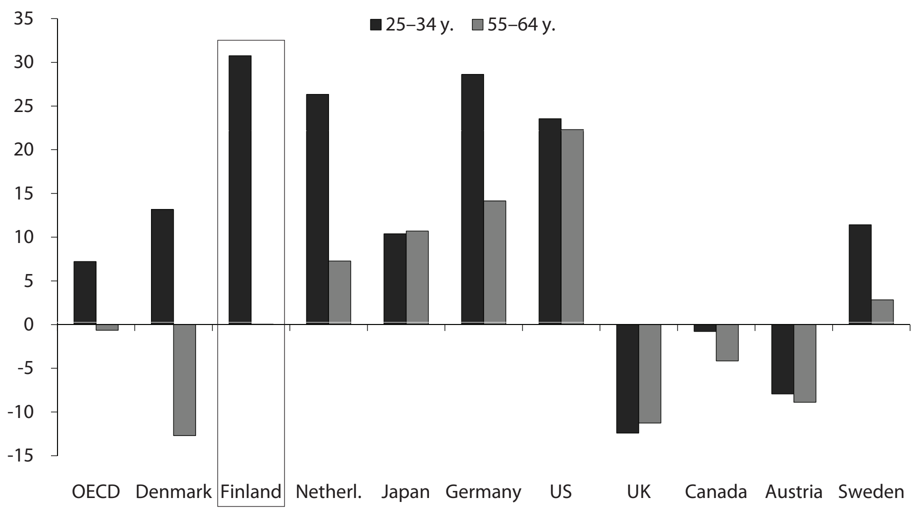
Source: Adapted from OECD Science and Technology Industry Scoreboard 2007, p. 173.

Figure 4.8. Immigrants as a percentage of total population 1960–2005



Source: Adapted from Braunerhjelm et al. (2009, p. 59); data source WDI online 2009.

Figure 4.9. The difference in the share of lower than upper secondary school education between native and immigrants population in two age groups, %



Source: Adapted from Braunerhjelm et al. (2009, p. 168); data source OECD.

A prisoner of its own success?

The Finnish economy is dominated by a few large multinational enterprises (MNEs) many of which have specialized on production where large size, low costs and high capital intensity are defining the competitive edge. This specialisation is suboptimal for a small, high wage country, located at the economic and geographic periphery of Europe where demand is at least quantitatively satisfied and future growth is expected to happen in high quality products and niche-markets respectively. A country like Finland should specialize more in industries, where complex solutions and capabilities to respond to consumers' or investors' demand is defining the competitive edge. Existing firms in developed, high wage countries should specialize in product innovation, adding features and services to the product. The forefront Finnish firms have moved far to this direction, but the SMEs are lagging behind.

As production processes become increasingly geographically fragmented due to globalization, the rapid emergence of global value chains and value-added networks can be observed. Globalization of value chains is motivated by a number of factors, of which enhancing efficiency is the most important. One way of achieving that goal is to source inputs from more efficient producers, either domestically or internationally and either within or beyond the firm's boundaries. This fragmentation of the production process has given rise to considerable restructuring in firms, including the outsourcing and offshoring of certain functions (OECD, 2007).

Within global value chains, MNEs (like Nokia) play a prominent role, as their global reach allows them to co-ordinate production and distribution across many countries and shift activities according to changing demand and cost conditions. Cross-border trade between MNEs and their affiliates, often referred to as intra-firm trade, accounts for a large share of international trade in goods.

The increasing integration of new players (China, India, Russia, etc.) into the global economy challenges existing comparative advantages and the competitiveness of countries, forcing them to search for new activities in which they can excel and confront the competition. The main drive for industrial countries is to move up the value chain and become more specialised in knowledge-intensive, high value-added activities.

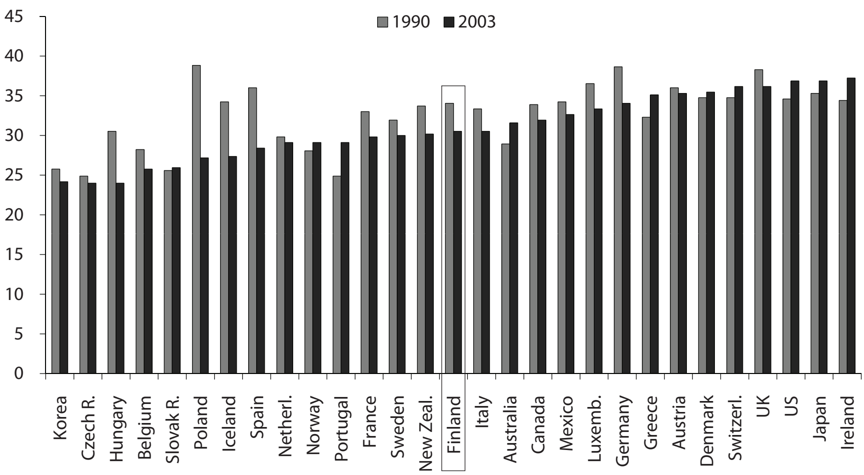
Specialization in more traditional cost-based industries and activities is no longer a viable option for most industrialised countries. The manufacturing sector is most strongly affected and in most OECD countries the process is accompanied by de-industrialisation, driven by rapid changes in productivity in the manufacturing sector and by a shift in demand towards services. Investment in knowledge is crucial for sustained economic growth, job creation and improved living standards. Such investment has increased in all OECD countries in recent years. At the same time, most OECD countries are shifting into higher-technology-intensive manufacturing industries and into knowledge-intensive market services. A considerable number of them still have a strong comparative advantage in medium-low-technology and low-technology industries; this advantage will, however, diminish as developing countries move up the value chain themselves.

A first rough indication of countries' integration into the world economy is derived from the ratio of international trade in goods and services to GDP. Small open economies like Finland are generally more integrated, as they tend to specialise in a limited number of sectors (e.g. telecommunication as well as pulp and paper in Finland) and need to import and export more goods and services to satisfy domestic demand than larger countries. While integration into the world economy in Finnish manufacturing is in line with comparable countries, the trade in services is relatively low.

Empirical evidence of the globalization of value chains materializes in the decline in the production depth in favour of greater uses of intermediary goods as the share of manufacturing value added in gross production decreases. This pattern can also be observed in the Finnish economy where the overall production depth in manufacturing has decreased more than 10 percent since the beginning of the 1990s. The production depth of the Finnish economy is now around 30 percent, i.e. about the OECD average (Figure 4.10).

Compared to other countries the Finnish economy is characterized by relatively small export shares (Figure 4.11) and low intra-industry trade in manufacturing (Figure 4.12) as well as limited – although increasing – offshoring (Figure 4.13) (OECD 2007, Prime Minister's Office 2006).

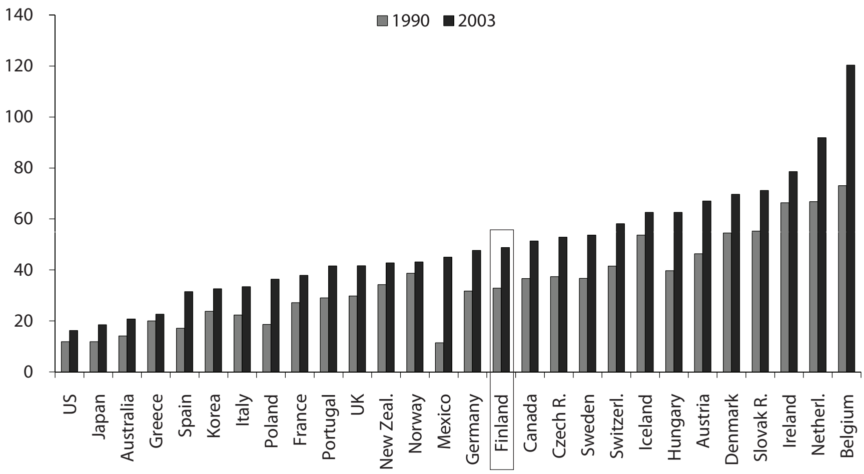
Figure 4.10. Production depth (value added as a percentage of production), 1990 and 2003



Source: Adapted from OECD (2007).

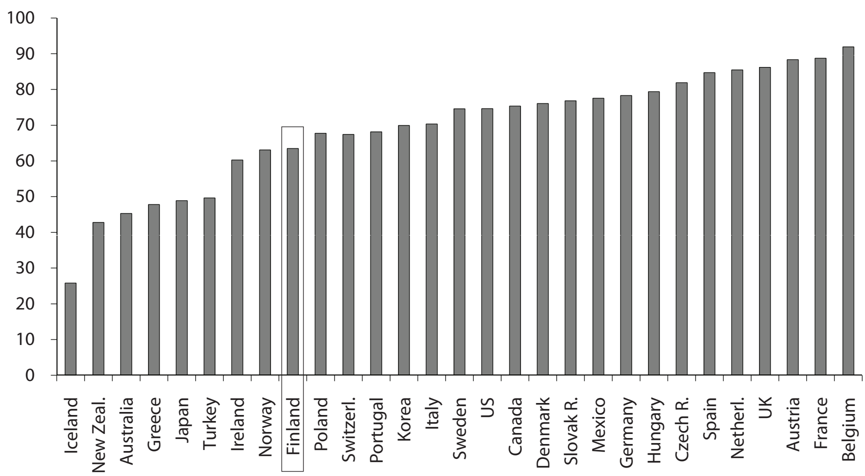
Since mass consumer products generally cannot be produced competitively in small high-wage countries, Nokia has relocated the production of cellular phones almost completely – to a large extent to Asia. Nokia has chosen the way of international in-sourcing, which means that despite production was transferred to another country (off-shoring), it remains within the

Figure 4.11. Share of exports in manufacturing production (%), 1990 and 2003



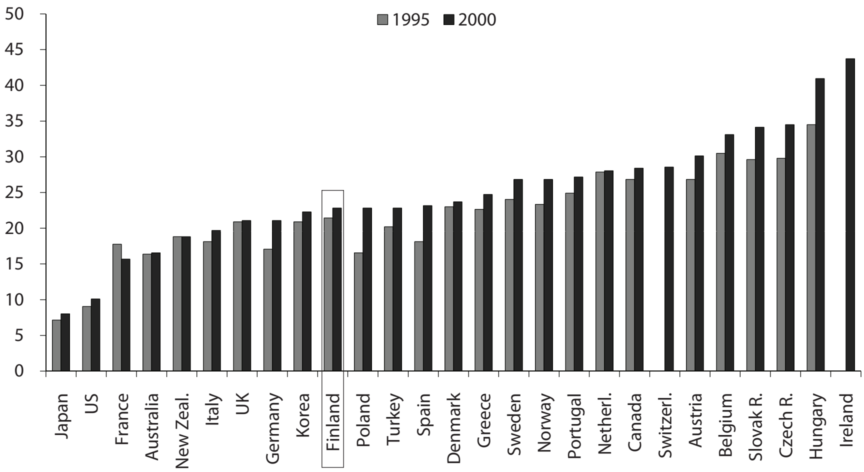
Source: Adapted from OECD (2007).

Figure 4.12. Manufacturing intra-industry trade as a percentage of total manufacturing trade, average 1996–2003



Source: Adapted from OECD (2007).

Figure 4.13. Offshoring/outsourcing abroad, total economy, 1995 and 2000



Notes: Adapted from OECD (2007). Offshoring/outsourcing has been calculated as the share (in %) of imported intermediates in the total of non-energy inputs.

firm done by subsidiaries abroad. Thus the intra-company production depth remains high (contrary to the decreasing production depth in the Finnish economy as a whole; see Figure 4.10), despite extensive relocation of labour intensive production to low wage countries. It is remarkable that also major part of the production of complex high-end products has been moved out. Major part of R&D, headquarter activities, logistics and marketing still locate in Finland.

The bulk of new investment of core industries is thus done abroad which leads to a low investment rate in the Finnish economy as a whole. The investment rate of 20 percent (in 2008) is substantially below the OECD-average and down from more than 30 percent in the late 1980s. The terms of trade have developed weakly and will most probably continue to do so. Finland's industry is specialized in products the real prices of which tend to decrease, e.g. cellular phones and paper. Productivity benefits therefore flow to a significant extent to foreign customers.

The (increasing) quality deficit in Finnish production and exports

Globalization implies that high income countries specialize in goods and services produced with sophisticated inputs (qualified labour, research, knowledge). While this dimension is well known and often investigated, there are other dimensions of structural change across and within industries less explored. High income countries should specialize in industries in which *quality* defines the competitive edge (and retreat from industries where price competition is all important) and they should upgrade production and services in each industry, supplying goods in the highest "quality segment" of each industry.

Neither quality competition as dominating mode is easy to define, nor is quality upgrading within industries easy to define. However, Aiginger (2000 and 1997) developed a set of indicators to monitor the quality position of economies. This method has been widely used for analyzing the catching up of transition countries within and outside Europe (e.g. Sieber, 2009). The supporting study for this evaluation, reported in Appendix 2 of this Chapter, replicates this endeavour for Finnish manufacturing for the period 1985 to 2006.

While Finland is excellent as far as technology input and the education base are concerned, and is a high-income country with a large and dynamic manufacturing sector, there are clear signals for deficits in industrial structure as well as broad upgrading of quality of exports and production.

Most indicators indicate quality upgrading for Finnish manufacturing, but most indicators also show that structure of manufacturing within as well as between industries is less favourable than for European average and most importantly less quality oriented if compared to leading countries. Furthermore, the majority of indicators show that progress made up to 2000 has since levelled off, if not reversed (at least as compared to peer countries).

4.2.2. INNOVATIVE INDIVIDUALS AND COMMUNITIES – HOW INNOVATIONS EMERGE IN A GLOBALIZED WORLD ECONOMY?

The role of national mega clusters in knowledge creation

The "new paradigm globalization" discussed above (new functions and even individual tasks within firms becoming tradable in the world economy) is breaking the national production, manufacturing and technology systems. Specialization is not necessarily taking place by industries or at the firm level but at the level of functions and tasks. That has been leading to loosening of the national and regional cluster structures. What we see increasingly are the regional or local hubs of specialization rather than strong national clusters.

In Finland there have been two globally strong industrial clusters – ICT and forest industry – which both have played an important role in the national innovation system.[12] Finland is the most ICT specialized country in the world – in terms of value added, but especially in terms on R&D. More than half of total R&D expenditure is used in the ICT sector. The forest industry cluster, for its part, has been a unique concentration of competencies in pulp and paper manufacturing, research and education, and also service provision.

The Finnish technical universities still produce a major part of paper technology engineers and industry related research.

The challenge today is that both clusters are losing ground as a consequence of globalization. In both clusters the Finnish located activities are decreasing rapidly. The forest cluster is in deep crisis due to technological advance (ICT based communication is replacing paper) and weakening demand in developed countries. Paper consumption is increasing mainly in emerging economies where the production is being relocated. The making capacity in

Box 4.1. ICT Cluster in Finland

ICT cluster has grown by far the most important industrial concentration in Finland since the mid-1990s. It can be characterized as strong national cluster with several regional hubs in the country. It centers upon telecommunications equipment manufacturing and related service provision. It is not only Nokia and other firms that have been successful in producing competent human resources and world-class R&D to support the cluster's development.[14] Nokia is, however, the dominant and the only really big player of the cluster today. ICT cluster as a whole – both employment and sales – grew very rapidly up until the turn of the millennium. There was a clear turn in the trend in beginning of the 21st century which marked a start of relocation of component manufacturing, and to some extent service production. So far the relocation of R&D has been modest, concentrating mainly on localization and other close-to-market of (product) development. However, relocation of software development has been on increase.[15]

It can be argued that the Finnish ICT cluster has become to a cross-roads.[16] Strong specialization in production and research has beard fruit but might not be the way to go further. The market for ICT equipment and services is maturing and partly changing dramatically towards services. It is very difficult for a small country, and a company originating from a small country, to be both market and technology leader.

Figure 1. ICT Cluster in Finland – Employment, sales, and number of establishments

Data source: Statistics Finland.

Finland has been cut by almost one fifth since 2005, and it is likely to be cut by another fifth over the next ten years.[13] There is a need for a radical change also in the forest sector related R&D. The Finnish located pulp and paper industry has only limited chances to compete with traditional products and current specialization patterns.

ICT cluster is in the different stage of its life cycle – still potentially growing, but main part of ICT manufacturing and some parts of R&D have been moved to cost competitive locations. The size of the Finnish ICT cluster has diminished remarkably (see Box 4.1).

Nokia is the major player not only in the ICT sector research, but in the whole Finnish innovation system. The company's share in total Finnish R&D expenditure is as much as one third and its share in the business sector R&D about a half. Overall the business R&D is very concentrated in Finland: top 10 companies conduct about 60% of all R&D in the enterprise sector.

The significant role of Nokia in the Finnish innovation system is not, of course, any concern as such. On the contrary, there is every reason to make sure that as big part as possible of Nokia's high-end research stays in Finland. It can be concluded from industry and labor market data that Nokia's R&D in Finland has moved towards more strategic and high-skill activities, while the adaptation-to-market, and routine type of development has been growing abroad or been relocated. Hence, there has been a major structural change in Nokia's R&D in Finland.

Rather than Nokia's dominance the concern in Finland is a relatively small number of SMEs engaging in R&D, as indicated by Figure 4.14. Another concern is that currently business sector R&D is heavily concentrated in ICT

Figure 4.14. Nokia in the Finnish business sector R&D in 2006

Notes: Sources are OECD Science, Technology and Industry Outlook 2008, p. 24; the Finnish breakdown by ETLA. * Business enterprise R&D intensity as a percentage of GDP. ** In the order of importance in terms of R&D conducted in Finland: Wärtsilä, ABB, Metso, Ericsson, Orion, Stora Enso, Kemira, TietoEnator and Amer Sports.

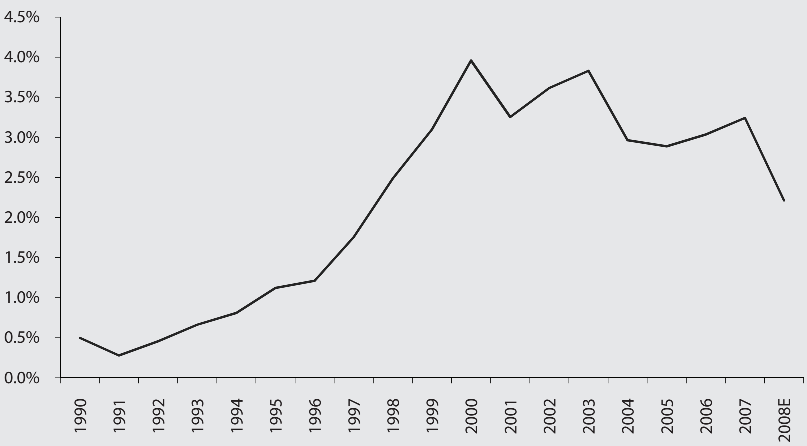
Box 4.2. Nokia in the Finnish Economy

To assess the role of Nokia in the Finnish economy and innovation system, several indicators are used, like share of GDP, employment and R&D expenditure.

In 1995, Nokia's share of the Finnish GDP hardly exceeded 1 percent but five years later in 2000, the share had quadrupled corresponding as much as 4 percent of the GDP (Figure 1). After the turn of the millennium, the share has varied between 2.9 and 3.8 percents. These figures show that in spite of rapid internationalization of Nokia's production and R&D, Finland is still an important location for value creating functions and tasks of the company. An increasing part of Nokia's exports from Finland are various kinds of services – like maintenance, project management, other management and headquarter services etc.

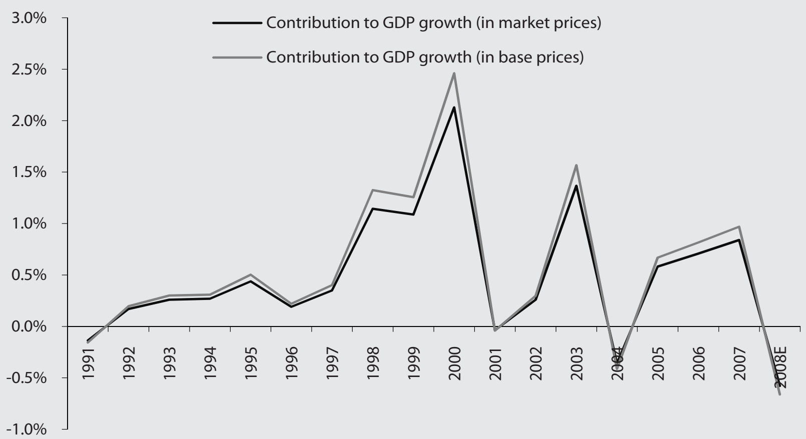
Nokia's contribution to GDP growth further emphasizes its role in the economy. Thanks to the increased value-added, the company has contributed significantly to total GDP growth since the mid 1990s (Figure 2).

*Figure 1. Nokia's share of Finnish GDP, %**



* (Nokia's value added in Finland/GDP)*100, in market prices. Source: Ali-Yrkkö (2009).

Figure 2. Contributions of Nokia and the electronics industry on the Finnish GDP growth, %-points



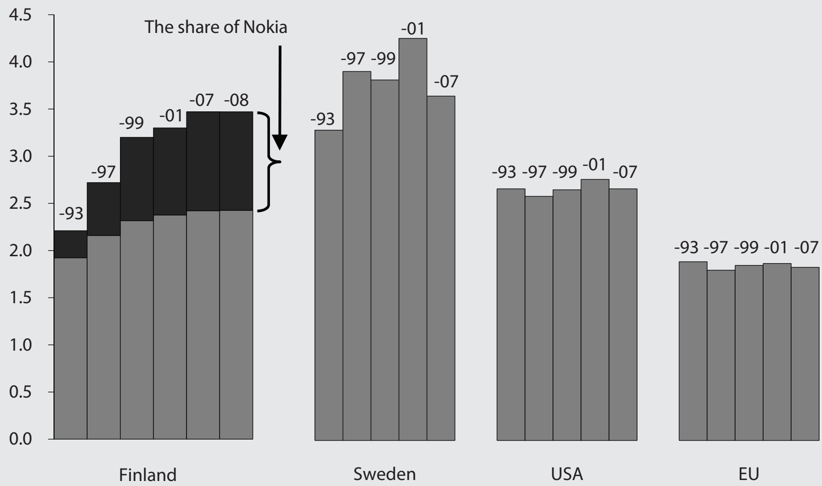
Source: Ali-Yrkkö (2009).

In 2000 Nokia's contribution to GDP growth was close to 2 percentage points, when the total GDP growth was 5 percent. Hence, Nokia was responsible for more than one third of the total GDP growth in that year. Conversely, in 2001 the Finnish GDP growth slowed down to 2.6 percent and Nokia's growth contribution was close to zero. During 2005–2007, Nokia's contribution rose again.

R&D in relation to GDP has grown steadily in Finland over the past few decades. Since the beginning of the 1990s the R&D intensity has exceeded that of the EU average (Figure 3). Figure 3 reveals that Nokia has contributed significantly to the R&D intensity of Finland accounting for one third of the total R&D expenditure (GERD) – without Nokia the R&D share of GDP would be 2.5%, still higher than EU average and approximately at the same level as in the US.

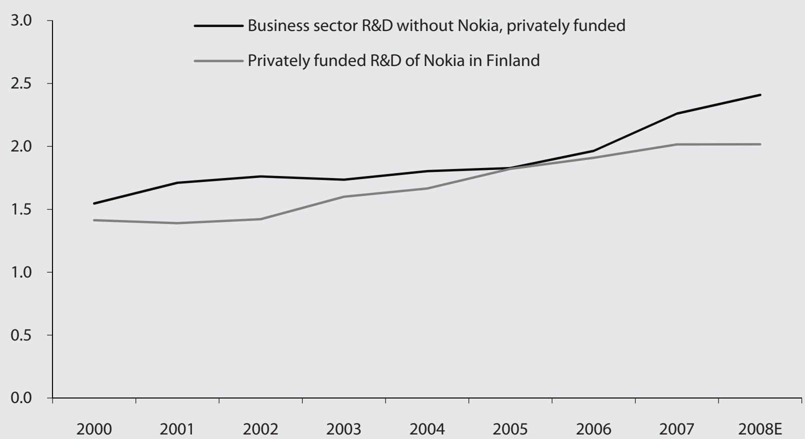
During the last couple of years the growth pattern of the business sector R&D has changed somewhat (Figure 4). Nokia's R&D has grown less than that of the rest of the business sector, reflecting a slight shift away from the Nokia dominance.

Figure 3. R&D expenditure as a percentage of GDP



Source: Ali-Yrkkö (2009).

Figure 4. Privately funded R&D expenditure of Nokia and other companies (in current prices, EUR bill.)



Source: Ali-Yrkkö (2009).

sector. Strong specialization has been one of the strengths of the Finnish economy, but at the same time it poses a risk of missing future growth prospects in domains beyond the current technologies and competences.

Recent data show, however, weak signals of change. The R&D expenditure by non-Nokia sector has been increasing at the same time when Nokia's expenditure, and more notably the R&D working hours, have somewhat declined (see Box 4.2).

Is there a Finnish paradox?

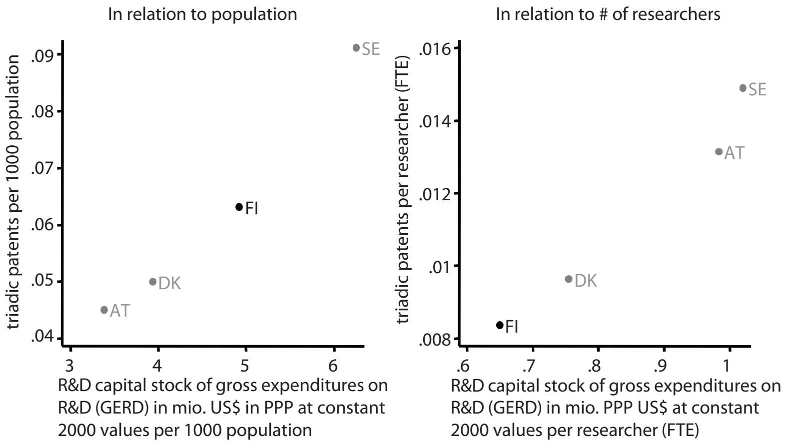
The Finnish education system – especially the basic education – has been ranked very high in international comparisons. The coverage of the basic education system is good and the variation among the schools is low at the same time when educational attainment has come out on top in the OECD studies.[17] There is much less evidence on the quality and efficacy of higher education, but nevertheless the enrollment rates are high – about 50% of each age group take a tertiary degree. Education is the key element of innovation-driven economy and society. Human capital and skilled labor are a necessary complement to technological advances. On the other hand, the demand side is also important: Innovations do not take place or diffuse without demanding and well-educated customers and consumers.

Against this background it is somewhat surprising that according to recent studies Finland is not specializing in education-intensive sectors in production (and trade) as much as some other smaller economies.[18] There is a heavy specialization in high-tech and especially in ICT industries, but less so – compared to other smaller countries – in human capital intensive production. This is probably one of the structural weaknesses of the economy. Finland is probably not making a full use its growth potential based on skills and human capital.

The ongoing university reform is a one way to respond to this challenge. There are obvious shortcomings in the university technology transfer mechanisms, as indicated by recent studies, the transfer mechanisms are still in their infancy.[19] If properly implemented the university reform – giving much more financial and operational autonomy to the universities – is likely to enhance innovation and university-industry collaborative research by providing more incentives for that. It is also important that polytechnics keep and strengthen their original role as institutions having dense connections to work and practice, and close collaboration with local business.

University reform together with recently implemented University Inventions Act is likely to improve innovation management in universities and thus improve individuals' incentives to develop and exploit their inventions commercially. However, it is evident that there is a need to substantially in-

Figure 4.15. The relationship between the R&D capital stock and triadic patents



Source: Aiginger et al. (2009, figure 2.11). Country abbreviations: AT = Austria, DK = Denmark, FI = Finland, SE = Sweden.

crease knowledge in international IPR practices. Much of the research is done within international collaborative networks and most of the potential innovations are aimed for the international markets. IPR issues are clearly underrepresented both in research and university education.

Number of researchers in relation to population in Finland is the highest in the world. That has sometimes been used as a performance indicator of the innovation system. It measures, of course, only innovation input and needs to be related to output indicators. That is done in the figure below using patent data for some other smaller countries. The performance of the Finnish innovation system looks much less flattering than usually thought. The metrics used is, of course, far from complete but indicative.

Introvert universities?

Universities and university researchers play an important role in making use of international knowledge flows and adding to the global knowledge pool. In recent policy discussion a lot of attention has been paid on the low level of internationalization of the Finnish research and university system.[20] From global vantage point universities are competing for the talented researchers, professors and students. Finnish universities, maybe with few exceptions, have not been successful in this competition. The number of foreign professors, researchers, and PhD students is low. One of the key motivations for the ongoing university reform was the fact the Finnish universities have become more introverted rather than opened up to the increasingly internationalizing research and education. Reflecting the concern on this matter, Ministry of Education has prepared an internationalization strategy for the university sector in accordance with the current government program.

The data show that the concern is justified and the strategy was urgently needed and it should be effectively implemented. International researcher mobility has declined from the already low level. For example, the number of Finnish scholars in the US universities has gone down since the mid 1990s by three percent annually while the average for the OECD countries shows an annual growth of more than three percent. At the same time the share of non-national science and technology professionals in Finland (as a share of total S&T employment) has remained among the lowest in the EU (Figure 4.16).

The low level of internationalization is also evident from the international student data. While the number of PhD students (and degrees) in relation to population and relevant age group is high in Finland, the number of foreign PhD students is low in international comparison.

There have been some attempts to meet the challenge, like the so called FiDiPro program (Finland Distinguished Professor Program), funded by Academy of Finland and Tekes. The program aims at attracting foreign top researchers to Finnish universities and research institutes for longer periods. The program has taken a good start but it will, even at best, be only a partial solution to the problem. University steering and funding mechanisms should be designed to include incentives for internationalization of research and education.

4.2.3. DEMAND AND USER ORIENTATION

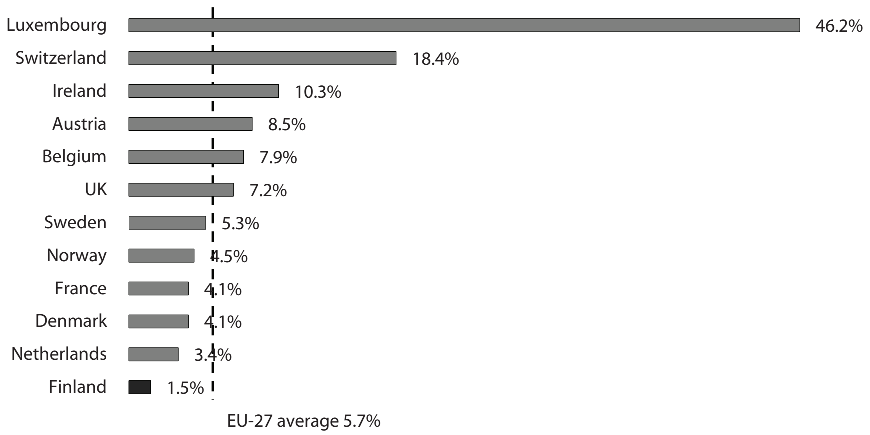
Open innovation model is underutilized?

The idea of open innovation has rapidly gained ground both in firms' innovation strategies and as a guideline for public innovation policies.[21] Obvious reasons for that are the increasingly opening up of the world economy together with technology advances, and the subsequent surge in information and knowledge flows.

The idea of open innovation emphasizes utilizing more external knowledge flows (in- and out-) to complement, and partly replace, internal innovation efforts. That means reorganizing enterprises' innovation activities and, correspondingly need to redesign public policy tools. These should include more instruments to support networks and research collaboration.

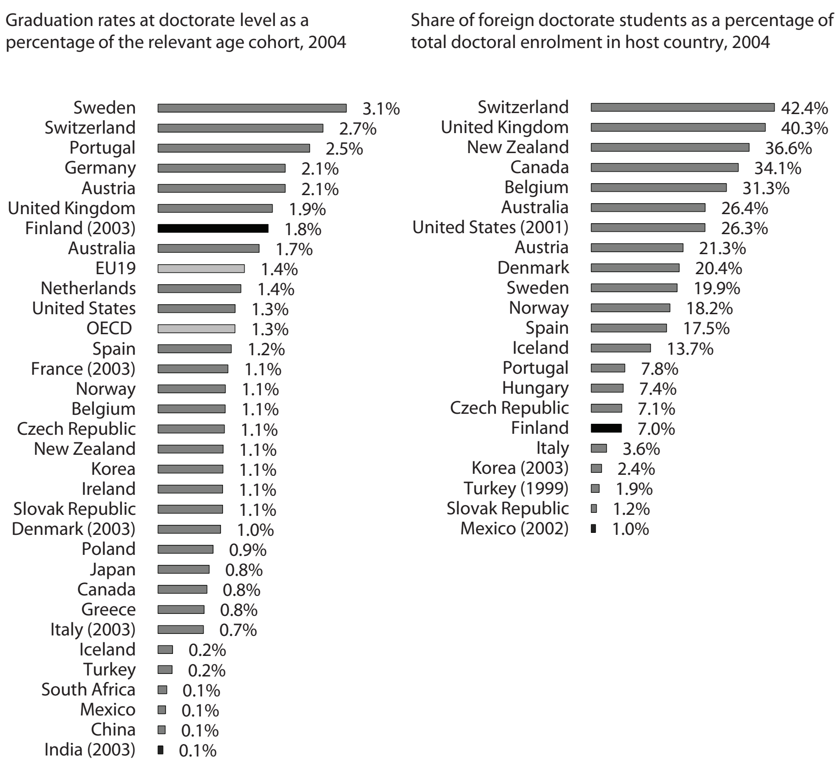
There is quite little empirical data of open innovation practices in Finland, let alone international comparative analysis. However, the low presence of foreign-owned R&D units together with low and decreasing researcher mobility indicates that open innovation advantages are not fully utilized. On the

Figure 4.16. Non-national science and technology professionals in selected countries, % of in total S&T employment



Source: Eurostat, Statistics in Focus 75/2007 (selected countries), p. 2.

Figure 4.17. Graduates at doctorate level in relation to relevant age group and share of foreign doctorate students in selected countries



Source: OECD Science, Technology and Industry Scoreboard 2007.

other hand, there is evidence that the extent of collaboration with other firms and universities is very high among Finnish enterprises compared to other EU countries.[22] The problem – if and when there is one – can be identified to international collaboration and making use of globally available knowledge.

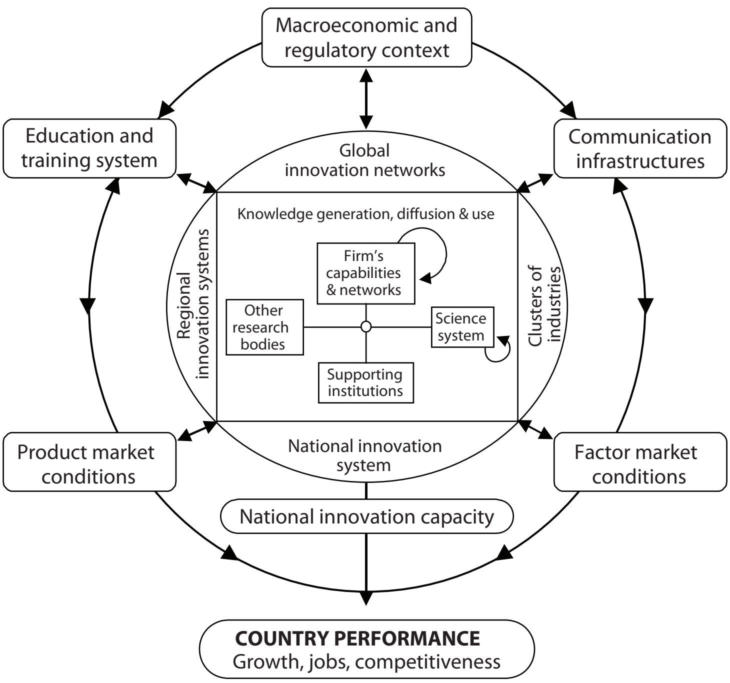
4.2.4. SYSTEMIC APPROACH

In the globalized world economy the interdependencies in knowledge generation, diffusion and adoption are of crucial importance. Production and R&D take place in global systems of value-added networks and strategic alliances. Global sourcing is more extensive in technology-intensive industries than in low-tech sectors.[23]

Hence, globalization adds a special flavor to the request of taking systemic view in innovation policies. There are some signs of increasing systemic thinking among policy organizations within the country.[24] However, the international aspect in innovation needs much more attention.

The Finnish research and science system is an integral part of the EU level research system. The country has so far benefitted from the joint Europe-

Figure 4.18. Systems of Innovation: Global, Regional (European), and National



Source: OECD.

an S&T policies and research programs. There is every reason to contribute to the implementation of a real European Research Area (ERA). From the Finnish perspective among the most crucial elements of ERA would be realizing a single labor market for researchers. Making ERA a reality would enhance collaborative research and specialization across countries – and from the European perspective strengthen European research system in a global world.

4.3. CONCLUSIONS AND POLICY RECOMMENDATIONS

4.3.1. KEY OBSERVATIONS

Global drivers of innovation

Innovation and globalization are closely connected. There is a growing amount of evidence that openness of the economy and society benefits innovation. Innovation today is a global undertaking.

Countries that show high level of innovativeness are those that are also most globalized. Interestingly, when looking at different dimensions of globalization, it turns out that the highest correlation with innovativeness is that with social globalization. Social globalization means personal contacts, information flows, and cultural exchange – the density and accessibility of new ideas. Especially small countries are increasingly dependent on global knowledge flows. This poses a challenge to national innovation policies.

The recent economic growth literature shows that even in the larger countries the ideas developed elsewhere are of great – and increasing – importance for economic growth. Hence, the crucial issue is, whether the channels and mechanisms to capture global technology and knowledge spillovers are efficient enough.

There are new, and potentially huge, global drivers of innovation. These include open innovation, prolific demand for solutions to environmental problems, and rapidly changing geography of innovation towards developing countries. All of these have been recognized, but not yet fully reckoned with in policy making. Especially important is the rising role of large emerging economies (notably China and India) in the global innovation system. They appear already now as significant providers of high-tech products (goods and services) in the world market, and increasingly in the same product groups as Finland. China is already the third largest R&D spender globally, and its R&D investment is increasing faster than in any other country. This provides a huge challenge, but even huger opportunities.

In almost every country the stimulus packages to bridge the global recession include huge public expenditures on energy and environment technologies. This induces new demand and gives an extra boost to innovation in resource- and energy-saving technologies and cross-disciplinary applications.

Finland in the global economy

Finland is a successful economy as far as growth and other macroeconomic performance indicators are concerned. High growth, above average per capita income, balanced trade and balanced budgets until recently are on the positive side, low employment rate and rather high unemployment rate (specifically for the young people and low employment rate specifically for the elderly) are less favourable stylized facts. Structural change was strong in the nineties, but Finland still has a relatively large low-wage sector and a high share of production in price elastic industries. The manufacturing sector is large and has been growing fast until recent years, the agricultural sector is still rather large, and the service sector relatively small.

Education and innovation have a very high priority, definitely higher than in other European countries and even within the leading Nordic countries. As far as openness of the economy and society is concerned Finland has a medium position, at best. Furthermore, there are signs of asymmetric openness. Inward investment is lower than outward FDI, immigration is low, and the number of foreign students and researchers is relatively small.

Since the late 1980s Finland has been moving from an investment-driven catching-up country towards innovation-driven and knowledge-based economy. The transformation relates to the high level of education and increasing technology inputs, but it is as much a consequence of the productivity-enhancing structural change – or creative destruction. Although starting already in the late 1980s, the period since the mid-1990s has been essential in this respect. Resources moved from less productive plants and firms to more productive, and from less productive industries to more productive ones, also entries and exits increased contributing to productivity. There was a radical change in firm and industrial structure. In less than a decade, electronics – notably telecom equipment production – grew by far the largest industrial and exports sector. By the turn of the millennium the country had become the most ICT-specialized country in the world in terms of ICT's share in production and R&D.

As a consequence of the structural transformations over the past two decades the economy today is close to the global productivity and technology frontier. As pointed out by modern economic growth literature, being close to the frontier calls for different growth policies from that pursued in the catching-up stage of development. The closer to the world technology frontier, the more economies pursue innovation-based strategy with younger firms, experimentation, and better selection of firms and managers. Investment in fixed capital would be lower, but exploring novel combinations with higher failure rate and subsequent higher exit and entry rates would be more common. That calls for different institutions than in investment-driven stage of development.

The Finnish innovation system has been performing relatively well in international comparison. There are, however, several signals of needs for change. These are, in part, due to changes in global drivers of innovation. The system is much less international than often thought. This applies especially to the higher education and research. If anything, the internationalization of research and higher education system have, over the past few years, decreased from their already low level. Yet, deeper tapping into the global knowledge pool should be one of the future corner stones of innovation and sustained well-being.

4.3.2. CONCLUSIONS

Industry and firm structure

The most important industrial clusters – ICT and forest industry – are in turmoil due to globalization. Both have benefited and will benefit from global markets but there is an urgent need for renewal. Forest related industries are in crisis which is more profound than any structural transformation before. The renewal of forest industry has to be based on more intense use of multiple technologies, skills, and human capital – and will take at least 10–20 years.

Globalization implies high income countries should specialize in industries in which *quality* defines the competitive edge (and retreat from industries where price competition is all important) and they should upgrade production and services in each industry, supplying products in the highest "quality segment" of each industry.

While Finland is excellent as far as technology input and the education base are concerned, and is a high-income country with a large and dynamic manufacturing sector, there are – according to a special study conducted for this evaluation – clear signals for deficits in industrial structure as well as need for broad upgrading of quality of exports and production. Most indicators indicate quality upgrading for Finnish manufacturing, but most indicators also show that structure of manufacturing within as well as between industries is less favourable than for European average and most importantly less quality oriented if compared to leading countries. Furthermore, the majority of indicators show that progress made up to 2000 has since levelled off, if not reversed (at least as compared to peer countries).

The business R&D is very concentrated in Finland: top ten companies conduct about 60% of all R&D in the enterprise sector. Nokia alone is responsible for nearly half of business R&D. The significant role of Nokia in the Finnish innovation system is not, of course, any concern as such. On the contrary, there is every reason to make sure that as big part as possible of Nokia's high-end research stays in Finland. It can be concluded from industry and labor market data that ICT sector's and Nokia's R&D in Finland has moved towards more strategic and high-skill activities, while the adaptation-to-market, and routine type of development has been growing abroad or been relocated.

Rather than Nokia's dominance the concern in Finland is a relatively small number of SMEs engaging in R&D. Another concern is that currently business sector R&D is heavily concentrated in ICT sector. Strong specialization has been one of the strengths of the Finnish economy, but at the same time it poses a risk of missing future growth prospects in domains beyond the current technologies and competences.

According to recent studies Finland is not specializing in education-intensive sectors in production (and trade) as much as some other smaller economies. There is a heavy specialization in high-tech industries, but less so – compared to other smaller countries – in human capital intensive production. This is probably one of the structural weaknesses of the economy. Finland is probably not making a full use its growth potential based on skills and human capital.

Innovation governance and management

There are obvious shortcomings in university technology and knowledge transfer. The current university management and administration do not provide proper incentives, research organizations tend to be introvert and closed-up to the external world. The ongoing university reform can, if properly implemented, contribute to improving the situation.

Universities are a central – if the most central – part of national innovations systems. Universities and university researchers play an important role in making use of international knowledge flows and adding to the global knowledge pool. From global vantage point universities are competing for the talented researchers, professors and students. Finnish universities, maybe with few exceptions, have not been very successful in this competition.

Open innovation model is not fully utilized in Finland – neither by firms nor by policy makers. Improving the internationalization of the innovation system and, e.g., researcher mobility, is the key to respond to this challenge.

Policies promoting internationalization – everyone's job?

Internationalization of business is, in one form or another, on the agenda of nearly all public enterprise policy agencies. Although, admittedly, internationalization is a cross-cutting issue to be addressed by most of the policy organizations, there is plenty of room for increased coordination and measures to avoid overlaps in the system.

An obvious improvement would be merging of Finpro and Invest in Finland. There is already now a close collaboration between the two, but the

Box 4.3. Finpro – promoting internationalization of Finnish firms

Finpro is a public-private partnership organization which supports Finnish companies in their internationalization activities. The organization was founded in 1919 as the Finnish Export Association, became later known as the Finnish Foreign Trade Association, and was named Finpro in 1999. Finpro has a network of over 50 'Trade Centers' in more than 40 countries. Total staff is about 350, of which 250 abroad. Finpro's budget is about 40 million euro, the government direct funding is close to 60%.

Finpro has been integrating into the innovation system by offering expert services to innovation support organizations and producing market information of various technology fields. Finpro regards its mission to include increasingly a role of an information intermediary, providing information on global megatrends, new business models, and early signals of market opportunities. It offers both free-of-charge and invoiced services. The company clientele is about 4500 Finnish businesses.

Finpro's integration with the innovation support system includes also relying more on funding from public innovation agencies. As much as 30% of Finpro's invoiced revenues come from government organizations. That adds over 10 million euro to the direct government budget funding of 22 million. The biggest single public sector client is Tekes whose share is one third (more than 3 million) of the total. Finpro acts overseas on behalf of Invest in Finland and Finnish Tourist Board, which partly explains the rising share of public organizations in Finpro's funding. Finpro is also an active player in Finnish Innovation Center program (FinNodes).

Finpro's most important (top 5) invoiced clients in 2008 (total invoiced revenues from the clients below was about 10 million euro):

- Tekes
- Finnish Tourist Board (MEK)
- Fintra
- The Federation of Finnish Technology Industries
- Invest in Finland

Our survey reveals that Finpro is serving to a large extent the same target group as other innovation organizations – its clients are more innovative than average and more internationally oriented. They also regard, more frequently than average, the other actors of the innovation system – notably Tekes, VTT and universities – as important for their business.

The role of Finpro in the Finnish innovation system has obviously changed over the past ten years. At the same time promoting internationalization has become ever more important task on the agenda's of other innovation agencies, practically all of them are offering some kind of services related to internationalization activities – often overlapping with each other. Therefore, the evaluation panel welcomes the ongoing project initiated by the Ministry of Employment and the Economy to map the service provision and streamline the system. It would be very important to separately assess the role of Finpro as one of key players of the innovation system and the most important internationalization promoting organization.

merger would most probably enhance the efforts to attract foreign investment and ensure more efficient use of resources. As discussed above, the specific Finnish challenge is the low level of inward foreign direct investment. Globalization is two-way traffic and that should show in how the policy agencies are organized.

The current set-up of the business support system reflects also more generally the traditional industrial society. The support organizations still carry – in spite of major changes in ways of operation – signs of traditional industrial and export-oriented economy. The emphasis is in supporting organizations (firms), exports, and other international business operations, and less in supporting individuals, inward investment, and social dimension of globalization – which, however, looks even more important for innovation than economic and financial integration. In that sense, the current system is not in line with the National Innovation Strategy that stresses the importance of innovative individuals and communities in the borderless world.

4.3.3. POLICY RECOMMENDATIONS

All countries, especially small open economies, are increasingly dependent on global knowledge flows. This poses a challenge to national innovation policies. There is a strong argument that traditional policies – subsidies or other direct policy measures – are not easy to justify in the case of small open economy while most of the benefits (consumer surplus) from nationally generated innovations go outside national borders.

However, at the same time the role of knowledge in creating growth and well-being is proliferating. Investment in knowledge generation is growing faster than ever. Hence, more emphasis should be put on enhancing diffusion of technologies and new knowledge. Global knowledge sourcing has become a key element in today's business and public policies.

Enhancing internationalization throughout the innovation system and especially in research and higher education is extremely important for Finland. Concentrating on human capital, education and other less mobile factors can safeguard the benefits of globalization to the use of domestic welfare even if the business environment is global.

While close to the global productivity and technology frontier, more risk taking in innovation policies is justified. That implies more experimentation and, subsequently, more variation in innovation outcomes, including higher risk of failures, and, as a consequence, willingness and tolerance to accept public policy failures.

Policies to promote internationalization of business should be streamlined and made more effective by merging Finpro and Invest in Finland organizations, and by cutting the overlaps in the activities of other policy organizations.

Measures to encourage private venture capital investments should be implemented. Introducing R&D tax incentives as a new policy tool should be seriously considered as proposed by the governmental working group.

Finally, Finland should assume more active role in EU S&T policies and contribute, e.g., to the emergence of real European Research Area and in particular to formation of single labor market for researchers.

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APPENDIX 1: STATISTICS

Table 4.1. Performance: Short and long run growth of GDP

	Annual growth in %		Unemployment Rate		Employment Rate	
	1960/1990	1990/2008	1990	2008	1990	2008
Scandinavian Model	3.3	2.4	4.6	4.3	70.2	77.0
Denmark	3.0	2.1	7.2	3.1	76.8	78.9
Finland	3.9	2.4	3.2	6.3	74.1	71.8
Netherlands	3.5	2.6	5.8	3.0	65.0	79.2
Sweden	2.9	2.3	1.7	6.0	71.8	74.9
Continental Model	3.6	1.7	7.3	7.2	63.4	68.0
Germany	3.2	1.8	6.1	7.3	69.5	74.3
France	3.9	1.9	8.4	8.0	59.7	62.1
Italy	4.0	1.3	8.9	6.8	57.4	64.4
Belgium	3.4	2.0	6.6	7.1	58.3	63.4
Austria	3.5	2.3	3.1	3.9	69.2	71.9
Anglo-Saxon Model Europe	2.6	2.7	7.3	5.7	70.7	72.1
Irland	4.2	6.0	13.4	6.1	54.6	69.5
United Kingdom	2.5	2.5	6.9	5.7	71.8	72.2
Mediterrean Model	4.6	2.9	10.9	10.1	56.4	66.9
Greece	4.5	3.1	6.4	9.0	59.1	63.4
Portugal	4.8	2.1	4.8	7.7	70.5	72.3
Spain	4.6	3.0	13.0	10.8	53.2	66.6
Anglo-Saxon Model Overseas						
USA	3.5	2.8	5.5	5.7	74.3	72.2
Canada	4.0	2.7	8.1	6.2	71.2	75.6
Australia	3.8	3.5	6.9	4.2	69.2	75.5
New Zealand	2.4	2.9	7.8	3.8	53.7	60.0
EU-15	3.4	2.1	7.9	7.1	64.3	69.1

Source: WIFO calculations according to Eurostat (AMECO). As to sub-aggregates and EU-15 weighted average over countries.

Table 4.2. Indicators on the socio-economic model

	1990	2008
Labour market regulation: all contracts		
Sweden	3.5	2.6 [4]
Finland	2.3	2.1 [4]
EU-15	2.8	2.4 [4]
Public debt as a percentage of GDP		
Sweden	28.2	39.9
Finland	6.3	30.4
EU-15	51.9	61.9
Budget surplus/deficit as a percentage of GDP		
Sweden	-11.2 [2]	2.6
Finland	5.4	5.1
EU-15	-3.9	-1.6
Public expenditure as a percentage of GDP		
Sweden	60.0	53.6
Finland	47.9	47.1
EU-15	48.0	46.6
Tax revenues as a percentage of GDP		
Sweden	65.3	56.2
Finland	53.3	52.3
EU-15	42.4	45.0
R&D as a percentage of GDP		
Sweden	2.98 [1]	3.73 [4]
Finland	2.12 [1]	3.45 [4]
EU-15	1.95 [1]	1.91 [4]
Expenditures for education as a percentage of GDP		
Sweden	7.75 [1]	7.18 [4]
Finland	7.27 [1]	6.42 [4]
EU-15	4.96 [1]	5.21 [4]
ICT expenditures as a percentage of GDP		
Sweden	3.97 [1]	7.25 [4]
Finland	3.94 [1]	6.03 [4]
EU-15	3.60 [1]	5.64 [4]
Exports as a percentage of GDP		
Sweden	29.7	54.4
Finland	22.5	46.1
EU-15	26.0	40.5
Imports as a percentage of GDP		
Sweden	29.1	48.5
Finland	23.9	40.8
EU-15	26.7	39.8
Active FDI (stocks) as a percentage of GDP		
Sweden	25.9 [3]	66.6 [5]
Finland	13.9 [3]	43.2 [5]
EU 25	21.2 [3]	26.0 [5]
Passive FDI (stocks) as a percentage of GDP		
Sweden	12.5 [3]	57.9 [5]
Finland	6.9 [3]	33.5 [5]
EU 25	13.6 [3]	18.9 [5]
CO2 emissions (t per 1000 euro)		
Sweden	0.30	0.16
Finland	0.63	0.41
EU-15	0.61	0.32
Energy consumption (TJ per mill. euro)		
Sweden	6.8	4.4
Finland	10.2	6.7
EU-15	6.5	3.9

Notes: [1]1992; [2]1993; [3]1996; [4]2006; [5]2007.

Table 4.3. Employment rates

	Total		Female		Age 55-64	
	2000	2006	2000	2006	2000	2006
Scandinavian countries	73.6	74.2	69.5	70.7	56.4	63.1
Denmark	76.9	77.4	71.6	73.4	55.7	60.7
Finland	66.5	69.7	64.2	67.3	41.6	54.5
Sweden	75.2	74.2	70.9	70.7	64.9	69.6
Anglo-Saxon countries	71.2	72.0	63.8	65.3	50.2	57.0
Ireland	66.5	70.0	53.9	59.3	45.3	53.1
United Kingdom	71.6	72.2	64.7	65.8	50.7	57.4
Continental countries	67.0	67.8	57.3	61.2	33.9	43.2
Germany	69.9	71.3	58.1	62.2	37.6	48.4
France	61.5	61.5	55.2	58.8	29.9	38.1
Belgium	61.6	62.6	51.5	54.0	26.3	32.0
Netherlands	75.1	76.1	63.5	67.7	38.2	47.7
Austria	69.6	69.9	59.6	63.5	28.8	35.5
Mediterranean countries	59.6	64.6	41.5	49.6	33.0	38.2
Greece	57.3	62.0	41.7	47.4	39.0	42.3
Italy	58.6	63.4	39.6	46.3	27.7	32.5
Portugal	72.7	72.0	60.5	62.0	50.7	50.1
Spain	59.5	65.9	41.3	53.2	37.0	44.1
EU-15	65.8	67.9	54.1	58.7	37.8	45.3
United States	74.5	72.8	67.8	66.1	57.8	61.8

Source: WIFO calculations according to Eurostat (AMECO). As to sub-aggregates and EU-15 weighted average over countries.

APPENDIX 2: THE (INCREASING) QUALITY DEFICIT IN FINNISH PRODUCTION AND EXPORTS

Karl Aiginger

Globalisation implies that high income countries specialize in goods and services produced with sophisticated inputs (qualified labour, research, knowledge). While this dimension is well known and often investigated, there are other dimensions of structural change across and within industries less explored. High income countries should specialize in industries in which quality defines the competitive edge (and retreat from industries where price competition is all important) and they should upgrade production and services in each industry, supplying good in the highest "quality segment" of each industry. Neither quality competition as dominating mode is easy to define, nor is quality upgrading within industries easy to define. However, Aiginger (2000 and 1997) developed a set of 16 indicators to monitor the quality position of economies. This method has since been widely used for analysing the catching up of transition countries within and outside Europe (e.g. Sieber, 2009). Here we replicate this endeavour for 13 indicators for Finnish manufacturing for the period 1985 to 2006, and add findings by Aiginger (2000) for the three indicators, we could not calculate for the longer period.

Position in quality intensive industries (RQE taxonomy)

Finland is slightly less specialized in industries in which quality defines the competitive edge than the European Union (defined as EU 15). The share of High-RQE industries is 35.9% for Finland as compared to 37.8% for EU 15, the gap is nearly ten percentage points relative to Sweden and Germany, three points relative to France. The gap is much larger for exports (35.8% to 46.9%), France and Germany have shares higher than 50% for the group of industries sheltered from low cost countries by quality competition as dominant mode or competition.

Finland has succeeded to increase its share of industries sheltered from price competition between 1985 and 2000 (from 28.9% to 38.9% in 2001), but since 2001 the share of high RQE sectors in value added as well as exports is decreasing again.

The deficit is even more pronounced if we calculate net figures i.e. the share of industries in which price competition is least important minus the share where it is most important. The net RQE is negative for value added as well as export (-2.1% resp. -6.8%). Negative balances of this kind are reported only for Greece, Spain, Ireland and the Netherlands (for value added) and Greece for exports. Again this balance had improved up to 2000 (with some years showing a positive balance), but aggravated since. The main driver of the very disappointing position of Finland has been the persistently high share of price intensive industries. 38% resp. 43% of Finnish value added and exports are placed in industries where price competition is specifically strong, this is the most unfavourable position in all 14 countries compared.

Looking into the industry position (3 -digit industries) shows that as expected the large share of price sensitive industries is driven by the wood and paper industries, but also by the large and increasing difference in the relative shares of the steel industry (larger in Finland). The lower share of quality intensive industries comes from relative low shares of the car industry, pharmaceuticals, medicinal chemicals, botanical products and other chemical products as well as aircraft and spacecraft. The lower share of these industries in value added in Finland, overcompensates the higher share of Finland in ICT industries. The deficits in all the quality dominated industries increased, while the higher shares of ICT in value added decreased since 2000.

Unit values of exports and imports

While RQE analyses the position across industries, the unit value reveals both structural composition as well as quality upgrading within industries. The unit value of Finnish exports is 1,602 €/t. This is 32% below EU average (2,355 €/t), one quarter below the unit value of Swedish exports, half of Germany and Denmark and less than half of Ireland. The export unit value is increasing since 1995, a little more than EU average. However, Finland is the rare exception of a high-income country with an export unit value considerably below European average.

Import unit values are low too, but not that much below EU average. Literature shows, that while high-income countries import goods with intrinsically low unit values (raw material, basic goods), the overall unit value of imports increases with income per head, since high-income countries demand sophisticated inputs (intermediate goods) and engage in intra-industry trade with other rich countries. Relative unit values below 1 indicate that the unit value of imports is higher than that of exports. Finland shared this feature with Greece, Portugal, Sweden and the Netherlands (2006). The relative unit value increased slightly up to 2001, stagnated thereafter.

Shares of sunk cost industries, high skill and knowledge intensity

The share of sunk cost industries (technology driven plus marketing driven) is another indicator for the favourable structural composition of the structure of manufacturing. This share in value added is 36% and 29% in exports; both shares are first increasing and then decreasing.

The share in skill intensive industries is 13.5% for value added and 19.2% for exports; both shares are again considerably lower than that of EU average, Sweden and Germany. Finland is specifically specialized in medium skilled/white collar industries (CT as well as pulp and paper is grouped into this category). The relative best position is reached according to the share of industries using high content of knowledge based service; it is higher for exports as well as value added.

Good performance is seen if we divide industries with high resp. low potential for globalisation, taking a simple openness indicator (exports plus imports/production). The share of this industry group has been traditionally higher for Finland and increased up to 59% in 2001 for value added and to 62% for exports, since that peak it stagnates or is slightly decreasing.

Shares in quality segments for 1998

Additionally we report the finding of Aiginger (2000) for exports according to quality segments within industries. 43% of Finnish exports belong to the highest quality segment (defined for each industry separately by using the spread of EU import data for many countries); while 27.5% belong to the low segment. While this gives a positive net balance, it is much lower than that for Sweden (61% : 12%) and for total EU 55.7% : 15.5%). Finland takes only the 11th position out of 14 countries compared. Finland had also negative position for exports as well as value added in industries with high product differentiation according to Aiginger (2000).

The summary

While Finland is excellent as far as technology input and the education base is concerned, and is a high-income country with a large and dynamic manufacturing sector, there are clear signals for deficits in industrial structure as well as broad upgrading of quality of exports and production.

It is difficult to measure quality and quality has different dimension. However, the set of 16 indictors developed by Aiginger (2000) has become a comprehensive way to evaluate the quality position. Each indicator has its deficiencies and the inclusion of specific industries into one category is often important for the results.

Most indicators indicate quality upgrading for Finnish manufacturing, but most indicators also show that structure of manufacturing across as well as between industries is less favourable than for European average and most importantly less quality oriented if compared to leading countries. And the majority of indicators show that progress made up to 2000 has since levelled off, if not reversed (at least as compared to peer countries).

ENDNOTES

[1] Aiginger (2007), Aiginger and Guger (2006a, b), Aiginger and Leoni (2008), Andersen et al. (2007).

[2] See, e.g., Maliranta (2005).

[3] See, e.g., Acemoglu et el. (2006), Bartelsman and Scarpetta (2004), and Bartelsman (2005).

[4] See Nordic Innovation Monitor 2009. Nordic Minister Council.

[5] See, e.g. Palmberg and Pajarinen (2005a and 2005b).

[6] See Toivanen (2008).

[7] See Takalo (2009).

[8] *www.kof.ethz.ch/globalization*

[9] See Jones (2002) and Hyytinen and Rouvinen (2005).

[10] For review, see Vujakovic (2009).

[11] Pajarinen and Ylä-Anttila (2008).

[12] See Ylä-Anttila and Palmberg (2007).

[13] See Hetemäki and Hänninen (2009).

[14] See Paija (2001) and Hyytinen et al. (2006) for more detailed description of the Finnish ICT cluster.

[15] Ali-Yrkkö (2009).

[16] This argument is discussed by Sabel and Saxenian (2008).

[17] OECD's Program for International Student Assessment (PISA) studies.

[18] See Peneder (2008).

[19] Tahvanainen (2009).

[20] See, e.g. Sitra's Innovation programme Report "Making Finland a leading country in innovation" (2005) (*http://www.sitra.fi/en/Publications/search/publication_search.htm*), and Korkeakoulujen kansainvälistymis-strategia (Internationalization Strategy of Universities). Opetusministeriö (Ministry of Education) 2009. Finnsight 2015. Foresight report by Academy of Finland and Tekes. Helsinki 2006.

[21] See, e.g., de Jong et al. (2008).

[22] CIS – Community innovation survey for several years.

[23] Global Sourcing – Moving Business Functions Abroad. Report by Statistical offices of Denmark, Finland, The Netherlands, Norway and Sweden.

[24] See Georghiou et al. (2003).

5. Growth Entrepreneurship and Finance

Gordon Murray, Ari Hyytinen, and Markku Maula*

Tax policy should explicitly recognize the incentives needed for talented persons to consider an entrepreneurial career choice as well as for potential High Growth Entrepreneurial Firms (HGEFs) to pursue (international) expansion. The planned reform of the Finnish tax system presents a unique opportunity to make the taxation treatment of equity income more favourable to entrepreneurial risk-taking and creation of potential HGEFs.

The Ministry of Employment and the Economy and the Ministry of Finance should publicly assume joint operational responsibility for policies that aim at promoting entrepreneurship and knowledge-based HGEFs.

The present public support system is in need of a major revision. Issues of access and relevance are particularly important for HGEFs. It is believed that both the governance and cost-effectiveness of the support system could be improved by reducing its complexity.

The Finnish innovation system suffers from a mismatch between 1) the growing demand by Finnish HGEFs for global insight, foreign expertise, international networks, and 2) an insufficient supply of inward foreign spillovers due to the scarcity of world class human capital, foreign R&D and cross-border venture capital within Finland's borders. Even if there is no single policy measure that can resolve this issue, it should be urgently recognized and addressed.

The Finnish educational sector has a greater role to play in the creation of HGEFs. The reform of the Finnish university sector and the creation of Aalto University present an important and timely opportunity to create world class infrastructure for entrepreneurial education, training and research accessible to both Finnish and collaborative foreign interests involved in growth oriented and new knowledge based enterprise.

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5.1. INTRODUCTION

High growth entrepreneurial firms (HGEFs) are widely regarded as a key driver of employment, industrial productivity and long-term economic growth in developed economies.[1] We take these positive contributions of HGEFs and the objectives and basic doctrines of the National Innovation Strategy (NIS) largely as given.[2] This chapter therefore focuses specifically on the means available to promote a greater volume and quality of HGEFs in the Finnish economy.[3] We understand that our mandate is i) to provide an analysis and evaluation of how the Finnish economy and innovation system *currently* addresses and accommodates HGEFs, and ii) to identify areas for *future* improvement in those policies seeking to increase the number and contribution of HGEFs to the Finnish economy.

We face five main challenges in addressing this mandate: First, there are many ways to define a HGEF and specifically what is meant by the term 'high growth'. To find a general definition for HGEFs is difficult given the range of metrics applied to growth, (e.g., jobs vs. sales; absolute vs. relative growth); the duration and variability of the growth period; the means and processes by which growth is achieved (e.g., organic growth vs. acquisitions); and the ways in which firms may be classified (e.g., initial firm size, firm age, sector). The OECD (2008b), for example, defines high-growth enterprises as measured by employment (or by turnover) as: '*all enterprises with average annualized growth in employees (or in turnover) greater than 20% a year, over a three-year period, and with ten or more employees at the beginning of the observation period*'. Researchers and policy makers talk about 'new technology-based firms' (NTBFs), 'gazelles', 'young innovative companies' (YICs) and employ a more or less convenient set of definitions (see, e.g., Schneider & Veugelers, 2008).

We cannot easily resolve this problem nor is it prudent from us to adopt a single, possibly arbitrary, operationalization of the term HGEFs. Instead, we take a pragmatic view and define a HGEF to be: an entrepreneurial firm that is relatively small to start with (e.g. has (much) less than 250 employees), is usually young (e.g., is younger than the median[4]) and has, for whatever reason, an expected or a realized growth rate which when computed over a substantial period of time exceeds a non-trivial threshold (e.g. the average three-year growth rate of employment or sales exceeds 20 percent per annum). Thus, HGEFs are generally assumed to be young, relatively small but with the potential for significant growth. They are usually but not exclusively in industries characterized by significant new knowledge and innovation. Where appropriate, we make more precise definitions of HGEFs explicit in the subsequent discussion.

The second challenge that we face when addressing our mandate is that it is very difficult, if not impossible, to systematically identify and recognize HGEFs *before* their growth opportunities start to produce measurable outcomes. In part because we cannot know *ex ante* which companies can and will grow, we are also obliged to discuss in this chapter the overall levels of entrepreneurship and new firm entry in Finland. The logic of this wider purview is that, in order to produce more and better HGEFs, Finland needs first to be able to create more new companies that experiment with novel (e.g., science or new knowledge-based) ideas and thus have high potential value. The economy is then able to provide and focus greater resources and incentives in order to accelerate the growth opportunities for this selected minority of potentially high impact enterprises.[5]

The third challenge that we face is that the creation of new firms including HGEFs in an economy is both a function of the *supply* of innovations and promising new ideas and the *demand* for such opportunities by existing and future entrepreneurs with sufficient skills and experience to exploit them successfully. This creates the well-known 'chicken-and-egg problem' of causality. Namely, will a greater number of good entrepreneurs create better opportunities or do we first need the opportunities in order to encourage more entrepreneurs? In this paper, we avoid making circular inference by taking the supply side (e.g., the scale and quality of private and public sector R&D and innovation activity in Finland that becomes the 'raw materials' to entrepreneurs) as given.[6] Even with this strong assumption, it is very difficult if not impossible to determine how many HGEFs are optimal for Finland. The available evidence does not enable us to determine a number or stock of such firms with any acceptable level of confidence. However, we do address this issue from a more qualitative perspective. The available evidence suggests that European countries, including Finland, are not necessarily laggards in terms of the volume of self-employment or small and medium-sized enterprises (SMEs). However, the Finnish economy is often believed (particularly by Finnish observers) not to compare well to other advanced or rapidly emerging economies in the quality of entrepreneurial activity and the consequent number and potential of HGEFs created. Despite Finland's commitment to innovation and the considerable future public support signalled in the NIS, the number and scale of HGEF activity is seen as disappointing when benchmarked against other highly innovative and competitive countries. We take this shortfall between expectations and perceived reality as one of the starting points for our analysis.

The fourth challenge in addressing our evaluation mandate is that HGEFs are not a single and homogenous entity. Rather, they are a heterogeneous and constantly changing group operating in a diversity of environments for which growth opportunities are consequently often 'lumpy' over time (Autio, 2008). These different milieux mean that several different barriers can exist which may impede both the recognition and pursuit of growth opportunities. For some potential entrepreneurs, the largest constraint may be the limited supply of entrepreneurial finance to support the earliest stages of firm formation and growth (see, e.g., Schneider & Veugelers, 2008; Westhead & Storey, 1997). In many circumstances facing HGEFs, standard collateral-based bank lending is a poor substitute for equity finance (Williams, 1998). For other growth oriented firms, the critical barrier may be their limited access to other specialized factor markets such as skilled employees, specialist managerial talent or internationally focused business services (Bürgel et al., 2004). Thus, in order to complete our mandate, we will also need to discuss the extent to which the Finnish innovation system addresses and accommodates the other, non-financial needs of potential HGEFs.

The fifth and final challenge is arguably the greatest. Namely, to analyze and evaluate a target that is moving in two material ways: First, the present global economic environment, while not a focus of our study, none the less produces huge uncertainties in future global demand and supply which are difficult to ignore. These vagaries are particularly acute for Finland as a strongly export oriented nation. Our specific remit obliges us to look at a range of related issues, including new and emerging technologies, higher education, international labour markets, immigration and the nature of Finnish culture. These are all complex, highly dynamic and inter-related constructs capable of several interpretations and prescriptions. Second, the national innovation system and particularly the public support system are changing very rapidly. There are numerous ongoing and planned policy initiatives that have started to shape the public support system and what it offers to HGEFs.[7] Accordingly, because of the moving nature of our target, it is rather difficult to provide insightful analysis and robust evidence-based conclusions that will necessarily remain fully relevant and feasible within the extended time frame of policy actions.

What our mandate does *not* cover is the consequences of the ongoing financial crisis and economic downturn on HGEFs' behaviour. We do not seek to make any comment or prescription regarding the present and severe problems of a global economic recession. Our analysis addresses policy issues that remain of importance regardless of contemporary difficulties. We do assume, however, that the present crisis does not reduce the long-term capacity of the Finnish financial system to allocate capital efficiently. Further, we also assume that the present recessionary pressures do not lead to a permanent anti-globalization and protectionist movement that significantly reduces long run growth opportunities for international trade.[8]

The remainder of this chapter is organized as follows. In the next section, we develop a framework for our analysis and give a brief account of the economic milieu and policy environment in which the creation of Finnish HGEFs is embedded. The third section describes the two key themes on which our evaluation efforts focus. The first theme describes the incentives and resources that the Finnish system provides *individuals* in order to help them identify and pursue entrepreneurial opportunities. The logic we wish to emphasize in particular is that it is new entry by highly talented and experienced entrepreneurial individuals that is an elemental input to the processes which may eventually result in the creation of HGEFs. The second theme focuses on the incentives and resources that the Finnish public support system provides *existing firms* in order to assist their efforts to identify and pursue exceptional and sustained growth opportunities. The final section of this chapter offers our conclusions and a number of specific policy recommendations resulting from our analysis.

5.2. EVALUATION FRAMEWORK AND ENVIRONMENT

The purpose of this section is to set the framework for our analysis and evaluation. As we see it, the policy framework consists of three major parts: the economic rationales for the public support of HGEFs; the National Innovation Strategy (including the Government's Communication); and the institutional environment and economic milieu in which policies are implemented.

5.2.1. PUBLIC ECONOMICS AND HGEFS

The economic rationales for government policies that target new entrepreneurs and particularly HGEFs are multifaceted. They are often complex and, accordingly, can sometimes be misunderstood (for a review, see Michael & Pearce, 2009). What all these rationales have in common is that they are based on the core idea that market outcomes can be inefficient due to the existence of important market failures of some sort. These market-failure arguments for (and, in some cases, against) government policy intervention include both externalities of entrepreneurial entry, and financial and non-financial barriers to entry (see, e.g., Boadway & Tremblay, 2005; Takalo, 2009).

Externalities of entrepreneurial entry and HGEFs

The *private* value of a new entry to an entrepreneurial agent may differ from its public or *social* value for a number of reasons. First, to the extent that new firms create new products and services or better production processes (i.e., greater productivity) that enhance the welfare of consumers, the private value of a new entry does not reflect its additional social value ('appropriability effect'). Second, new knowledge-based entry creates 'spillover benefits' for future entrants and innovators. These benefits are external to the new entrant because subsequent entrants and innovators can benefit from the accumulation of past experience and knowledge. By learning vicariously from those who have tried to enter a market or innovate earlier (i.e. 'inter-temporal spillovers' and 'learning-from-others' effects), the future and better informed entrants and innovators can more efficiently manage critical costs including R&D and market entry. Third, the location choices of new entrants can lead to powerful agglomeration benefits for other firms. These externalities refer to the creation of industrial clusters (Folta et al., 2006; Kenney & von Burg, 1999; Porter, 1998). They can emerge for example because of network externalities, reduced transportation costs or improvements in labour market matching ("agglomeration externalities").

While the above externalities are by and large arguments *for* policy intervention, certain externalities can speak against such public actions. First, potential entrants do not internalize the destruction of rents or reduction of market share of established firms ('business stealing effect' and 'trade diversion effect'). Second, sometimes potential entrants and innovators have a strong incentive to be the first to enter a market or to make an innovation. There may be a 'first mover advantage' for entrants in many important innovations. If the probability of being first depends on the *relative* level of effort and investment, this may result in an undesirable contest that attracts too much rent seeking entry and investment from the society's perspective.

Non-financial and financial barriers to entry

Entry decisions can be inefficient (even in the absence of externalities) if there are entry barriers. It is somewhat difficult to classify systematically such barriers, not least because the theoretical arguments and empirical evidence on their effects and relative importance on entry in general, and HGEFs in particular, are mixed.[9]

Non-financial entry barriers include regulation, administrative obligations, and taxation, e.g. profit-insensitive taxes and administrative (tax-like) fees. They are commonly more of a burden to new firms than to established ones.[10] However, unfortunately, it is very hard to draw general conclusions of their *quantitative* significance in a given market or at the level of the national innovation systems. Strategic behaviour by incumbents is yet another form of entry barrier. The rival firms may for instance be able to enhance their market power and ability to deter entry by making excessive investments and by building excess capacity. With such capacity, incumbent firms can signal their willingness to compete fiercely if a new entrant enters their market.

Financial entry barriers refer to the imbalance between the demand for (risky) finance by new firms and HGEFs and the local and global supply of such financing. The origins of this imbalance are well-understood (e.g. asymmetric information between investors and entrepreneurs, incentive and other agency problems etc.) and widely studied (see, e.g., Hyytinen & Pajarinen, 2005; Maula et al., 2007). However, determining the existence, magnitude and materiality of such a gap and finding the appropriate form and magnitude of government intervention to address the gap in a given region or at a given point in time are less clear.[11]

5.2.2. THE NATIONAL INNOVATION STRATEGY AND HGEFS

The NIS (and the related Government Communication of 2009) presents four points of departure, or "basic choices" as they are called, for the development and implementation of the national innovation strategy.

National policies in a world without borders

Finland's economic success has long relied on the openness of its economy, i.e. on the extensive and unimpeded trading of high value goods and services with the international community. Building on this doctrine, and subscribing to the belief that a key long term policy goal remains the reduction and removal of barriers between national borders that hamper the flow of goods, services, capital and labour, the Government's Communication on Finland's NIS emphasizes (p.16) that: "Connecting and positioning Finland in the global knowledge and value networks requires ability to participate and influence these networks, international mobility of experts and determined development of the attractiveness of the Finnish innovation environment".

Given the limited size of the domestic market for the commercialization of innovations, the increasing irrelevance of national borders in international markets, and the need to understand customers who select products and services by meritocratic criteria regardless of their provenance, this NIS statement, as we interpret it in the light of our remit, is especially relevant for HGEFs. Entrepreneurs who have the capacity to create and develop internationally-oriented HGEFs with a global reach and impact are a critically important but scarce resource. Earlier analyses of the Finnish public support system suggest that the diverse resources need by HGEFs to grow and ultimately to dominate (or at least influence) global markets are insufficiently developed in Finland (Maula et al., 2007).[12]

Demand and user orientation

Traditionally, industrial or innovation policy has been largely driven by supply-side considerations. To emphasize the need for understanding the diversity and peculiarity of markets and customers on a global basis, the Government's Communication on Finland's NIS concludes (p.17) that: "Innovation steered by demand, paying attention to the needs of customers, consumers and citizens in the operations of public and private sectors alike, requires a market and shared innovation processes between users and developers."

While at the time of writing it is not clear what the content of the policies that aim at enhancing demand and user-driven innovation should or will be[13], we share the view that a deep and often novel understanding of complex and changing customer needs is a necessity for any potential HGEF.[14] For international market leadership, the HGEF will frequently need to redefine fundamentally existing customer relationships as the status quo is challenged. The transaction costs of engaging globally distributed customers in the creation of new and better goods and services can be prohibitively high for internationally-oriented HGEFs, especially if they come from a geographically and culturally isolated economy.[15]

Innovative individuals and communities

New HGEFs cannot be created without the pivotal role of exceptional, entrepreneurial individuals. In the Government's Communication on NIS it is concluded (p.19) that "Individuals and innovative communities play a key role in innovation processes. Innovation capabilities and incentives for individuals and entrepreneurs are critical success factors in the future".

Entrepreneurs are a critical 'catalyst' for change and improvement in competitive and meritocratic markets (Audretsch & Keilbach, 2004). A globally competitive economy has to nurture and encourage entry into entrepreneurial occupations both at the level of individuals and wider communities. New ventures typically start with a big idea and few resources. Should an exceptional growth opportunity emerge, the owner managers of such ventures have to be able very quickly to identify and access the additional resources necessary for rapid growth. As is well-known, it is the heterogeneous economic, social and cultural milieu (i.e., clusters of entrepreneurs, business angels, venture capitalists, experienced managers, flexible labour markets, high quality advisers, competitive exit markets etc.) supporting the entrepreneurial process that has made Silicon Valley a global powerhouse of innovation (Gill et al., 2000; Kenney & von Burg, 1999; Saxenian, 1994; US Senate, 1999). While the technological and entrepreneurial powerhouse of California is not to be easily replicable elsewhere, there is no reason to believe that the basic inputs and infrastructure needed for the creation of innovation-driven and internationally oriented HGEFs will be radically different in Finland.

Systemic approach

Scattered policy measures and piecemeal reforms are invariably ineffective. This is recognized in the Government's Communication on NIS where it concludes (p.20) that: "The exploitation of the results of innovation activities [also] requires broad-based development activities enhancing structural renewal and determined management of change".

In our view, a systemic approach to the creation and growth of HGEFs can be interpreted to mean at least three things. First, the active development of both markets and the ancillary private sector institutions that each supports the identification of and experimentation with novel ideas via new market entry. Second, the design of public policies (taxation, regulation, education etc.) that specifically recognize and promote an entrepreneurial culture including appropriate incentives for informed risk-taking and growth; and the development of a public support system that explicitly recognizes the special needs of HGEFs and their entrepreneurs. And, finally, effective market-focused coordination and collaboration between the private and public sectors that enable the profit seeking vigour of commercial agents to be harnessed via mutually beneficial contracts that also meet public policy objectives.

5.2.3. OVERVIEW OF THE 'ENABLING' ENVIRONMENT

The purpose of this section is to give a brief descriptive overview of the economic, institutional and cultural contexts in which the creation of HGEFs is embedded.

Business demographics: New entry and HGEFs

The volume and quality of entrepreneurship/new entry are elusive concepts that are hard to measure reliably and comprehensively. Entrepreneurial quality *ex ante* is particularly problematic to identify. The following numbers complement the earlier findings (see, e.g., Autio, 2009; Stenholm et al., 2009) and help set the stage for our analysis:

- According to Statistics Finland, the number of new enterprises entering the economy has grown since 2001 and has on average been around 32,000 per year in 2004–2007.[16] Based on a special survey targeted to these enterprise openings, Pajarinen, Rouvinen and Ylä-Anttila (2006) estimate that, in 2005, about 60% of the recorded enterprises are truly new ventures. That is, these ventures are owned and run by an entrepreneur or a team of entrepreneurs that are or about to become active in their business. These firms have not been founded in order to e.g. manage assets passively (e.g. forests etc.). Using this estimate, the volume of relevant new entry has in the recent years been roughly 19,000 new ventures per year.

– Each year, about 0.6–0.7% of the Finnish business sector employees leave their jobs to become entrepreneurs (Hyytinen & Maliranta, 2008).[17] This share has been relatively stable over time with about 7,000–8,500 business sector employees moving into entrepreneurship annually in the recent past. About half (54%) of these transitions come from small firms with less than 9 employees. Transitions from work to entrepreneurship are in Finland about as common as they are in other comparable countries (Stenholm et al., 2009).
– Using comprehensive data from the Business Register of Statistics Finland and Finnish Linked Employer-Employer Data (FLEED) covering the years from 1996 to 2003, Rantala (2006) documents that new Finnish firms are very small on average. The median new firm has only 0.5 employees and the arithmetic mean is 1.2 employees. He also documents that, based on the standard OECD classification, 19.0% of the new firms are in knowledge-intensive business sectors while 2.5% of new firms are in the high-tech/medium high-tech manufacturing industries. Spin-offs from larger firms (as defined in this study) account for less than 1% of new entry.[18]
– In an international comparison (Stenholm et al., 2009), the early stage entrepreneurial activity of Finns was historically quite moderate but seems to have increased lately.[19] In particular, about 5–7% of the adult population has annually been involved in starting up a business (either as a nascent entrepreneur or a new business owner) over the period 2000–2008. This percentage has been increasing slightly during the past few years and in 2008, this share for Finland was 7.3%. The corresponding European and Nordic averages are 6.0% and 7.6%, re-spectively (ibid., p. 27 and 31). Opportunity for 'income increase' is a primary entrepreneurial motive for about 26% of the sampled individuals in Finland (ibid. p. 41). The GEM-data suggest that this share is low in the Nordic context but close to the European average.
– The new global entrepreneurship index (GEINDEX) constructed by Acs and Szerb (2009) measures the quality and quantity of national economies' business formation process. This index ranks Finland the 13th out of the 64 studied countries (Denmark is the 1st and Sweden the 2nd, followed by New Zealand and United States). Based on a Nordic comparison using this index and its components, Autio (2009) argues that "Finland lags behind the trend line and its most comparable peers in terms of the quality of its entrepreneurial activities as well as in terms of the aspirations exhib-

ited by its entrepreneurial ventures." Somewhat surprisingly, he also finds that "in terms of entrepreneurial attitudes, Finns rank well above the international trend line", allowing him to conclude that "[…] the problem seems to be in converting positive attitudes into high-quality action."

– Generally, the Finnish university system has not been a systematic source of internationally-oriented HGEFs. Kankaala, Kutinlahti and Törmälä (2007) report, for example, that between 2000 and 2005, the Finnish universities created on average 3–4 new research-based spin-out firms per year. One should not, however, read too much into this estimate, because it is based on very noisy data and scattered sources (like all the other available indicators of this activity).[20]

Measuring the volume of HGEFs is not as difficult as measuring quality but nevertheless is often controversial.[21] A distribution of Finnish firms' *realized* growth rates shows that, as in most other countries, there is a clear peak (cluster) around zero, i.e. most firms neither grow nor shrink (see, e.g., Rantala 2006, p. 66). This is a robust and common finding, as is the finding that there is also a mass of observations located in the extreme left and right tails of the distribution. This means that some of these 'outlier' firms will shrink and others will grow dramatically. It is this small number of positive outliers with exceptional growth potential that are the focus of much of innovation and enterprise policy.[22]

Some stylized facts about the growth of Finnish small businesses after the national economic crisis of the early 1990s are as follows:

– Based on the Business Register of Statistics Finland and Finnish Linked Employer-Employer Data (FLEED) covering years from 1996 to 2003, Rantala (2006, Table 7) estimates that close to 15 per cent of the surviving new firms grew on average >20% per annum over the seven year period. He also shows that the variance of growth rates across firms is highest during the first years after entry but stabilized at a lower level thereafter.
– It can also be computed from the Business Register of Statistics Finland that the share of SMEs with the average annual growth rate of employment of more than 20% in 2004–7 is 24%.[23,24] Among the SMEs that had over 10 employees at the beginning of the measurement period, the absolute number and relative share of high-growth SMEs (i.e. those SMEs with a three-year average annual growth rate of domestic employment above 20%) are 810 and 6.1% in 2004–2007 and 564 and 4.3% in 2001–2004, respectively.[25]
– Based on the special survey targeted at the recorded enterprise openings, Pajarinen, Rouvinen and Ylä-Anttila (2006) estimate that in 2005 only about 2% of these new entrants *expect* that their employment will grow over 20% per annum over the next three years thereby resulting in a total number of employees of 20 or more. When calculated as an average over 2003–2008, about 9% of the SMEs were reported to be "strongly growth-oriented" in

the bi-annual survey of the Federation of Finnish Enterprises and the Ministry of Employment and the Economy.

- The GEM numbers reported in Stenholm et al. (2009, p. 70) show that between 2002–2008, about 12% of Finnish early stage entrepreneurs have been growth-oriented, i.e. they have expected that their business would grow during the next five years to more than 10 employees, representing at least 50% increase in the number of employees. On average, this share is 16.1% and 16.0% for the Nordic and European countries, respectively. The GEM numbers also show that over the same period, 4% of the established business owners in Finland expect "high growth" (as defined above). On average, this share is 4.0% and 4.6% for the Nordic and European countries, respectively.
- The GEM numbers reported in Stenholm et al. (2009, p. 74–75) also show that when compared to other Nordic or European countries, Finnish early stage entrepreneurs rarely believe that their business is based on the latest technology.
- In OECD (2008b), it is reported that 11.0% of Finnish service companies and 7.0% of Finnish manufacturing companies were high growth enterprises, using a criterion based on the growth of turnover in 2005 (Finland is the 5th out of the 14 included countries).[26] If the growth of employment is used as the criterion, these shares are 3.5% for the service and 1.5% for the manufacturing sectors (Finland is the 13th out of the 17 included countries). Using a stricter definition for the growth of employment (but the same time period),[27] Finland had 0.8% fast growing firms ('gazelles') in the service and 0.4% in the manufacturing sectors (Finland is the 5th out of the 17 included countries). The corresponding shares are 1.8% for the service sectors and 1.0% for the manufacturing sectors, if the turnover criterion is used.

In summary, despite the evidence being a bit mixed, new experimental market entry is a relatively rare event *when compared to Finland's commitment to and investments in higher education, R&D and innovation activity. Importantly, experienced business sector employees appear particularly loath to start new firms.* Entrants are typically small and, conditional on market entry, the expectations and realizations of (international) growth by the great majority of Finnish early stage entrepreneurs are moderate if not negligible. The same applies to those already trading in the market. While we acknowledge that there some signs of increased entrepreneurial activity, HGEFs remain a surprisingly small proportion of both new entrants and the stock of extant companies. Compared to the number and quality of HGEFs created by the US economy and other leading knowledge-driven economies (Audretsch, 2002; Bartelsman et al., 2008), Finnish firms appear invariably 'modest' in their ambitions and achievements.

Public support and provision of risk capital

A number of reports in recent years have discussed the development of the Finnish venture capital market and describe the public support for and provision of risk capital in Finland (see, e.g., Maula & Murray, 2003; Maula et al., 2007, and the references therein).[28] To avoid repetition, we only provide in this chapter a brief and selective account. The key organizations and their existing services for HGEFs are summarized in Table 5.1. As the table shows, there are a large number of public agencies presently involved in the provision of funding and services for entrepreneurs and growth companies. There are also many ongoing and planned developments in the Finnish public service including risk capital provision. These new initiatives are discussed next.

Table 5.1 is by no means comprehensive, as it only lists *some* of the *existing* activities of the public support system that are potentially relevant to HGEFs.[29] We acknowledge that growth entrepreneurship has received increasing policy attention in Finland in recent years via the NIS and several government programs. The recent Government's Communication on Finland's National Innovation Strategy to the Parliament (2009) states that:

> "Business development services and incubators will particularly target those companies which strive to generate rapid growth. The service system for growth companies will be developed as a whole, so that the roles and offerings of public operators form a clear entity.
>
> By means of taxation, experienced capital investors and business experts will be motivated to commit themselves to the development of enterprises aiming at rapid growth and internationalization.
>
> Company taxation and insolvency legislation will be developed so as to encourage small innovative businesses to generate growth and take risks, and to create prospects for serial entrepreneurship.
>
> New forms of operation will be established to encourage international venture capital and expertise to find its way to Finland."

Table 5.1. Selected public organizations providing risk capital and services for HGEFs (Spring 2009)

Finnvera plc ("financing solutions for enterprises") is a specialised financing company, which provides its clients with loans, guarantees, venture capital investments and export credit guarantees. Finnvera has official Export Credit Agency (ECA) status. *www.finnvera.fi/eng*

Funding and reporting	Size and volume	Offerings for HGEFs
Funding from the Ministry of Employment and the Economy (MEE). Supervised by the Corporate Steering Unit of the MEE.	In 2007, funded total 8000 projects (896.9 million euro and 39% share of the total funding of the projects of 2.3 billion). Total 28 000 customers. Funded 3467 starting companies and 1481 growth companies with 10% average 3-year growth expectations (410.6 million).	– **Venture capital fund investments:** Veraventure Ltd makes capital investments in regional funds organised as limited companies. The fund is a subsidiary of Finnvera plc. On the behalf of its parent company, Veraventure Ltd is in charge of managing and developing the investment activities of regional funds. – **Direct seed capital investments:** Seed Fund Vera Ltd, founded in Fall 2005, makes capital investments in innovative enterprises at their early stages. The fund is a subsidiary of Finnvera plc. Veraventure Ltd is responsible for its management and practical activities. The fund makes minority equity investments in the target enterprises. Normally, the fund`s share of ownership in the enterprise is 15–40%. In addition to equity financing, other possible investment instruments are convertible bonds, bonds with equity warrants and capital loans. The maximum investment in an enterprise is 500 000 euro. The initial investment is usually 100 000–250 000. Invested 14.2 million in 59 companies in 2007. – **Loan products** for growth companies.

Finnish Industry Investment Ltd, ("*government-owned capital investor*") is a government-owned investment company, which invests in venture capital funds and directly in growth companies, together with private co-investors. *http://www.teollisuussijoitus.fi/in_english/*

Funding and reporting	Size and volume	Offerings for HGEFs
Funded based on proceeds from privatizations and capitalization by MEE. Supervised by the Corporate Steering Unit of MEE.	The investments amount to over 570 million euro. Staff 22. New investments in 2007 167.6 million of which 144.5 in 13 funds and 23.1 million in six companies. Additionally, Start fund 1Ky invested 12.7 million in 60 companies.	– **Venture capital and private equity fund investments**. Finnish Industry Investment Ltd has made investment commitments to altogether 87 funds: to its subsidiary Start Fund I Ky and to 86 private funds. The total investment capital of these funds amounted to 7.5 billion. The funds are administered by 34 management companies – **Venture capital fund investments** through a fund of funds: Kasvurahastojen Rahasto Ky is a common fund established by government-owned investment company Finnish Industry Investment Ltd and Finnish employment pension companies. Kasvurahastojen Rahasto Ky invests in funds that invest in growth companies. – **Direct venture capital and private equity investments**: Finnish Industry Investment Ltd invests in all sectors with the following model (1) co-invests with private investors (funds, private individuals and pension institutes) nationally and internationally; (2) invests at most one-half of the capital and ownership, and (3) invests especially in projects that would not receive sufficient private capital without Finnish Industry Investment.

Finpro ("*business solutions worldwide*") is an association founded by Finnish companies to help Finnish companies access to high quality, comprehensive internationalization services around the world. *http://www.finpro.fi/en-US/Finpro/default.htm*

Funding and reporting	Size and volume	Offerings for HGEFs
An association partly financed from public funds and partly from client invoicing and membership fees. Supervised by the Innovation Department of MEE.	In 2007, Finpro had 2 024 billable clients, 851 repeat clients, 72 growth companies. Finpro ry employed 322 people in 2006. Finpro has 50 Trade Centers abroad and 8 offices in Finland.	– **Internationalization support** such as consulting work done with the client companies both in Finland and in the Trade Center network, in both of which Finpro has specialist in those industry segments, which are important for Finland. The Trade Centers are staffed both with Finnish and local personnel to ensure the efficiency and expertise in matching Finnish interest with local business society and practices. Finpro partners with other innovation players in Growth Company Service having its offices in the main growth centers in Finland. The consulting services are matched with the life cycle of growth companies – from business concept and market selections to partner search and business concept implementation in the targeted countries. – Active role in **Finnish Innovation Center program (FinNodes)** in collaboration with Tekes and other agencies.

Sitra, the Finnish Innovation Fund ("*in the interest of Finland and the Finns*") is an independent public fund which under the supervision of the Finnish Parliament promotes the welfare of Finnish society. *http://www.sitra.fi/en/*

Funding and reporting	Size and volume	Offerings for HGEFs
Funded from an endowment. Supervised by the Finnish parliament.	Endowment size in the end of 2007 821 million euro. Personnel in the end of 2007 was 100 employees.	– **Direct venture capital investments** in Sitra's programme areas. In the first phase, investments will be mainly made in the Health Care Programme, the Food and Nutrition Programme and the Environmental Programme. The venture-capital investments by these programmes are carried out in co-operation between the investment directors of the programmes and Sitra Ventures. The aim of the market-based investments is to create and develop competitive and profitable businesses. Current portfolio, largely from previous activities, comprises approximately 60 enterprises, with an overall investment of approximately 126 million euro. – **Venture capital fund investments** focused on Sitra's programme areas. Based on prior activities, Sitra has a wide network of international funds with which it co-operates, and has invested in more than 20 VC funds. The funds are concentrated in early-stage technology enterprises in Europe and the USA. Investments in international funds to provide information and knowledge about Finnish opportunities in the world. Through its international contacts Sitra seeks to be able to evaluate development trends in technology and establish business and funding contacts to help Finnish companies to expand to international markets. In addition to the Europe and the USA, a network of contacts has been built up with Northwest Russia, one of the aims of which is to develop new forms of co-operation. Has also invested in 15 Finnish VC funds.

The Foundation for Finnish Inventions ("*from creativity to business*") provides advice, evaluations and funding for the development and exploitation of invention of the inventions of private persons and small enterprises. *http://www.keksintosaatio.fi/*

Funding and reporting	Size and volume	Offerings for HGEFs
Private organization mainly funded through a grant from MEE. Supervised by the Innovation Department of MEE.	Budget 2007 6.6 million euro, of which 2.5 million was grants to inventors. Received 967 applications of which it funded 267.	– **Commercialization services** such as advice, the evaluation of inventions, the related funding for their protection, product development and marketing and the promotion of their commercial exploitation. The Foundation provides unsecured risk funding in the form of grants and support funding. The services are free of charge.

TE Centres (Employment and Economic Development Centres) – "*regional partner for SMEs*") provide their customers with the expertise and regional services of the Ministry of Employment and the Economy, the Ministry of Agriculture and Forestry and the Ministry of the Interior. Customers also have access to the services provided by Tekes, the Finnish Funding Agency for Technology and Innovation *http://www.te-keskus.fi/*

Funding and reporting	Size and volume	Offerings for HGEFs
Funding from MEE. Supervised by the Corporate Steering Unit of MEE.	There are fifteen TE Centres in Finland. The personnel is about 1800.	– **Advice and small grants for startups.** Technology departments (or "innovations and internalisation") activate enterprises (mainly SMEs) to R&D, to promote start ups and growth companies, to promote regional knowledge based competencies and to give services regarding private persons' inventions in a co-operation with the Foundation of Finnish Inventions. "Innovations and internalisation area" of a TE Centre forms also the regional network of Tekes (the regional personnel, about 80 people altogether, belongs both to Tekes and TE Centre organizations). Of the annual more than 2000 R&D-projects of private enterprises and universities funded by Tekes, about 40% analysed by the regional TE Centre's technology advisers, especially focusing to the projects of SMEs. The financing decisions are made by Tekes – only small decisions (under 15 000 euro) targeted at pre-phases of larger projects are made by TE Centre´s technology departments.

Tekes, Finnish Funding Agency for Technology and Innovation ("*technology delivering results*" funds innovative research and development projects in companies, universities and research institutes and seeks to be a gateway to the best technology partners in Finland. *http://www.tekes.fi/eng/*

Funding and reporting	Size and volume	Offerings for HGEFs
Funding from MEE. Supervised by the Innovation Department of MEE.	In 2008, Tekes invested 516 million euro in R&D projects by companies, universities and research institutes. Of this funding, 78 million went to small companies (379 projects) and 75 million to micro companies (543 projects).	– **Direct funding for young innovative enterprises** (NIY) in collaboration with Seed Fund Vera Ltd is a new financing instrument with an objective to increase the number and to accelerate the development of enterprises which are willing to grow fast and to become international. Funding granted in phases with maximum 1million euro per enterprise (in areas eligible for regional aid the maximum is 1.25 million). The support can be in a form of a grant, loan or risk capital up to 75% of the eligible costs. The funding may include a pre-phase for preparing a business plan. The project may include (almost) all the costs which contribute to the achievement of the business goals such as personnel costs, travel costs, materials and equipment, external services. Funding allocated with the help of an external advisory panel consisting of VCs and other experts. – **R&D grants and loans** for growth companies. – **Funding for opportunity evaluation studies** through TULI programme administered by university innovation centres.

In line with these policy goals, several new initiatives have been launched recently in order to develop those public services targeted at growth entrepreneurs and HGEFs. These initiatives include but are not limited to:

- Division for growth ventures: This new unit[30] was established within the Innovation Department of the Ministry of Employment and the Economy at the beginning of 2008. It has been assigned an overall responsibility for structuring, developing and implementing growth business policy as part of the more comprehensive innovation and industrial policy. It should however be emphasized that although this unit has the responsibility for activities related to growth ventures, the actual governance of the various agencies which provide funding and services for HGEFs is still distributed across the different departments of the Ministry (as shown in Table 5.1). This absence of financial resources invariably reduces the authority of this division.
- New role for the Foundation for Finnish Inventions: From the beginning of 2009, the Foundation for Finnish Inventions (FFI) has been given an explicit role in the pre-incubation phase of the commercialization of university inventions. To this end, FFI has been given €3 million additional funding from the Ministry of Employment and the Economy in 2009.
- New fund-of-funds launched by Finnish Industry Investment: Finnish Industry Investment established a €135 million fund-of-funds for VC firms in collaboration with several institutional investors at the end of 2008. The size of the fund-of-funds is EUR 135 million with 40% deriving from public sources and 60% from private sources. The stated aim of this facility is to enable new venture capital funds to be founded without the need to build *de novo* investor syndicates in each case.
- Business accelerators: The Ministry of Employment and the Economy, together with Tekes and Veraventure, is preparing a program of private investor driven business accelerators, i.e., a new type of incubator that focuses on HGEFs with global potential.[31] In April 2009, 43 applications were made by potential accelerator teams in a call opened by Tekes as the coordinator of the program. The aim of the program is to select and establish 3–5 new business accelerators. Tekes and Seed Fund Vera have plans to invest €45 million in this program over the next three years and will direct this funding to the client companies of the accelerators.
- International innovation partnerships: The Ministry of Employment and the Economy is also considering launching new international innovation partnerships. The stated objective of this initiative is to engage several highly regarded, international innovation partners in order to help strengthen the competencies of Finnish universities and research institutions to commercialize their research outputs globally. Again, another stated objective of this initiative is that it will provide additional support for internationalizing growth companies.

- Growth Company Service and EnterpriseFinland: The agencies providing public support to growth entrepreneurs and HGEFs have also recently tried to improve the coordination of their services. Growth Company Service initiative, originally established in 2003, aims to improve collaboration between the involved agencies (Finnvera, Finpro, TE Centres and Tekes). However, its actions have not yet resulted in an integrated service offering. As a part of the broader development program of the EnterpriseFinland service (targeted at various firm segments, including growth companies), there are plans to develop the Growth Company Service into a more customer-oriented and integrated offering.[32] There is also an ongoing plan to increase the effectiveness of public service provision by segmenting systematically the potential and existing customer firms of the public agencies under the supervision of the Ministry of Employment and the Economy.
- Policy initiatives to increase the supply of risk capital: Intentions to remove various regulatory/tax related obstacles for the provision of risk capital have been mentioned in government programs since 2003. Opportunities for cross-border fundraising were improved in 2006, although some acknowledged problems remain. Other on-going policy developments include assessment and removal of the remaining obstacles for cross-border venture capital investments; introduction of tax incentives for business angels; augmentation of the Finnish mutual fund legislation with special clauses for venture capital investing; and an assessment of the opportunities of charitable foundations to invest in venture capital funds.
- Tax initiatives for R&D: In early summer 2009, it was announced that a new scheme for R&D tax credits will be introduced in order to enhance R&D and innovation activity. At the time of this writing, the precise design of the scheme is not known.[33]
- Entrepreneurial culture and education: The Ministry of Employment and the Economy and the Ministry of Education have a number of plans to increase their collaboration and to strengthen areas of joint interest, e.g., university based entrepreneurship and related research and teaching.[34]

This list is not meant to be exhaustive, but it shows that there are numerous ongoing and planned policy initiatives that, if and when implemented fully, will shape in the future how the Finnish innovation system will support the creation of HGEFs.[35] The list also shows how much of a rapidly moving target the Finnish innovation system is from the evaluators' viewpoint. These enhanced objectives also raise additional issues of complexity and communication both for the producers and the consumers of the policy process.

5.3. ANALYSIS AND EVALUATION

Entrepreneurial activity can be defined by three related and inter-dependent activities: the *identification* of new economic opportunities; the *evaluation* of the opportunities so identified; and their subsequent *exploitation* in order to realize additional value from the production of new or improved products and services (Shane & Venkataraman, 2000). In an effective entrepreneurial economy, a high level supply of innovations and new ideas (and thus entrepreneurial opportunities) is roughly in balance with a developed demand for opportunities by (potential) entrepreneurs with sufficient skills and experience to organize the necessary resources to create and grow a new business.[36] This means that there needs to exist contemporaneously the opportunity (unrealized demand), the resources (underused assets of labour and capital) and the capacity (human capital exemplified by entrepreneurial experience and expertise) to generate a steady flow of new entry. The simultaneous absence of supply and demands side resources can result in a 'thin market' for entrepreneurial opportunity (Nightingale et al., 2009).

Taking the supply side largely as given[37], the purpose of this section is to discuss and identify some of the challenges that individuals face in identifying and pursuing entrepreneurial opportunities. We include the challenges present in making entrepreneurship a preferred career choice. We also note the difficulties that incumbent entrepreneurs and existing firms face in identifying and pursuing corporate growth opportunities after entry. Specifically, we focus on four sets of potential hurdles or limitations: entrepreneurial and growth incentives; availability of risk capital; resources for international growth; and the more abstract question of the degree of entrepreneurial culture in Finland.

5.3.1. ENTREPRENEURIAL AND GROWTH INCENTIVES

This section splits the development of an enterprise into entry and growth phases. We adopt this staged viewpoint not because we believe that staging entry and growth is the best way to think about the creation and growth of firms but rather, because thinking in terms of separate 'silos' of entry and growth seems to reflect the current policy approach. This separation is problematic for a number of reasons including the noted fact that it is not possible to determine *ex ante* which small minority of firms in a population of start-ups will subsequently become the future resource-demanding HGEFs.[38] This separation of the sources of early stage growth finance by individual program often increases the administrative burden and transaction costs on the applicant firm (Cowling, 2009; Sharpe et al., 2009)

To start or not to start a (growth-oriented) business?

Why do people – and particularly those with high education and/or business experience – become entrepreneurs in Finland? And from where exactly do new Finnish entrepreneurs come? Does it pay for an experienced manager, a business sector employee with high human and social capital or a skilled researcher to leave his or her job for the uncertainties of an entrepreneurial career? We ask these questions to emphasize that our evaluation mandate is *not* to consider how an ordinary ('randomly chosen') Finnish man or woman can be encouraged to become self-employed. Rather, it is the entrepreneurial attitudes and behaviour of a small cohort of exceptionally talented and experienced individuals that is a critical input to a process that may eventually lead to the creation of a HGEF.

People become entrepreneurs for a range of pecuniary and non-pecuniary reasons. The former refers to expected earnings, dividend income and capital gains, while the latter to a mixture of non-monetary benefits that may be derived from being an entrepreneur. These can include greater autonomy, independence, job satisfaction, more flexible working hours, social status, etc.

There exists a *latent* supply of individuals who are able and prepared to make changes in future career directions. Some of these persons are sufficiently risk-tolerant to consider founding a growth-oriented firm. An even smaller share of such scarce persons has the commitment and social capital to attract and build a competent start-up team around them. They must also have the technical experience and human capital to establish and run a knowledge-based HGEF. If viewed as potential entrepreneurs, these rare individuals may be characterized as:

– forward-looking and likely to make the decision to start (or not to start) a business by explicitly weighting the costs against the expected benefits. They are rational and instrumental in their actions. They do not typically start a business by accident or without deliberation;
– having a high opportunity cost of entering entrepreneurship.[39] They have the ready option to be employed and work in a well-paid job in the private or public sector;[40]
– understanding the risks (to their personal wealth, career, reputation etc.) that they will have to bear and the effort that they will have to commit (i.e., hard work, stress and long working days) in order to create and build such a new firm.

If this profile is accurate, the picture that emerges is that such an individual may be strongly (but not exclusively) motivated by pecuniary rewards. They will be incentivized by the prospect of creating substantial wealth for themselves but will also appreciate the opportunity cost of such actions. Even if the non-pecuniary benefits are significant, a challenge for policy is that it can rarely influence directly the non-pecuniary benefits that entrepreneurship may generate. It is, for example, difficult to imagine how policy could influence the degree of autonomy or job satisfaction that a firm creates for its manager-founder.[41]

As a general rule, an incentive system should reward targeted individuals for making good choices and decisions but it should not provide (overly generous) protection against the consequences of bad choices and decisions. Entrepreneurial incentives, as we understand and use the term, seek to increase the pecuniary rewards to entrepreneurs who have started to build a successful enterprise. These 'upside incentives' consist largely of the share a potential entrepreneur can expect to claim of the added value that he or she creates in the future by starting a business today. The state through its taxation system has the power to determine in significant part the level of financial rewards that the entrepreneur receives (and the state relinquishes) from his or her successful endeavours.

As far as we can determine (and as we argue this issue in greater detail in sub-section 5.4.2 below), the Finnish innovation system, including the relevant aspects of the tax system, provides *no specific or tailored upside incentives* to individuals to encourage them to choose an entrepreneurial career over the (safer and more secure) option of paid employment. Interestingly, the survey conducted by ETLA in connection with this evaluation shows that small and young innovative firms think that reducing company and capital taxation is much more important for them than, for example, the availability of risk capital or guidance and information provided by the public sector (see Appendix, Figure 5.3 and Figure 5.4). A clear majority of these small innovative firms also are more convinced (than larger innovative or other firms) that the emergence of new growth companies could be facilitated by providing them with tax incentives on their future earnings and capital gains (see Appendix, Figure 5.5). The absence of explicit upside economic incentives can be seen as a major weakness of a public innovation system that seeks to increase the number and growth of HGEFs. A less conducive and incentivized environment may, in particular, result in a mismatch between the supply of entrepreneurial opportunities and the demand for them by individuals with high human and social capital.

Entrepreneurial incentives may also be enhanced by decreasing the cost burdens of starting and growing a young enterprise. In particular, further incentives can be designed by reducing the incidence (risk) and costs of failure to individuals. While the costs of failure are important and can be both of a pecuniary (e.g. loss of personal wealth) and non-pecuniary (e.g. stigma of failure) kind, it is unclear to us whether the Finnish system (labour market policies and institutions, bankruptcy procedures etc.) is exceptionally harsh in how it treats failing entrepreneurs.[42] Nor are we convinced that a major redesign of the exit costs of firm failure would have a material effect on the decision of talented and well-educated Finns whether or not to become an entrepreneur. This does not mean, of course, that there may not be scope for improvement at the margin.

To grow or not to grow?

It is unlikely that firm owners that have experienced high growth will subsequently decide unilaterally to deselect themselves from this activity. There may, of course, be some entrepreneurs who elect to go for a quieter life style over time. However, such firms are perhaps less likely to position themselves directly in the way of major growth opportunities. If this surmise is correct, the question is not how we (continue to) incentive owner managers but, rather, how do we ensure that Finnish HGEFs remain in attractive market environments of sufficiently competitiveness and scale that will allow them real opportunities for exceptional growth and economic gain. This redirects the policy focus to questions identifying the nature of the 'enabling environment' for continued and significant growth. Although still important, entrepreneur-level incentives are largely replaced by a concern with the removal of barriers that impede the desired actions of potential HGEFs. Resources specific to HGEFs' changing needs will still need to be put in place. Most particularly, the management of exceptional growth firms requires access to an extremely challenging and demanding set of competencies. Most first time, owner-managers of HGEFs will likely not have sufficient skill sets (at least in a fully developed and tested form), and will necessarily need to have access to human capital and further levels of professional advice consistent with the growth needs of the enterprise. It is in the providing of highly informed and experience-proven human capital across multiple but related areas of corporate need that the deeply integrated professional and social networks of a Silicon Valley or a Greater Boston have proved to be so exceptional at creating a world class competitive advantage (Gill et al., 2000).

This viewpoint emphasizes the importance of well-functioning (factor) market for human capital, be it the labour market for scientists, marketing or export professionals; the market for business services; or the market for experienced board members to oversee the growth process. The questions to ask then become: from where can business talent and experience of the highest level be acquired in Finland? Does it pay an experienced manager or an employee with high human and social capital to leave his or her job in a relatively established firm for a career in a small but high growth entrepreneurial firm? Why would a skilled researcher, enjoying the benefits and security of employment in a large organization elect to join a high-risk HGEF?[43] Similarly, how expensive it is for a HGEF to identify and recruit highly skilled employees (and business partners) consistent with the future needs of the enterprise?

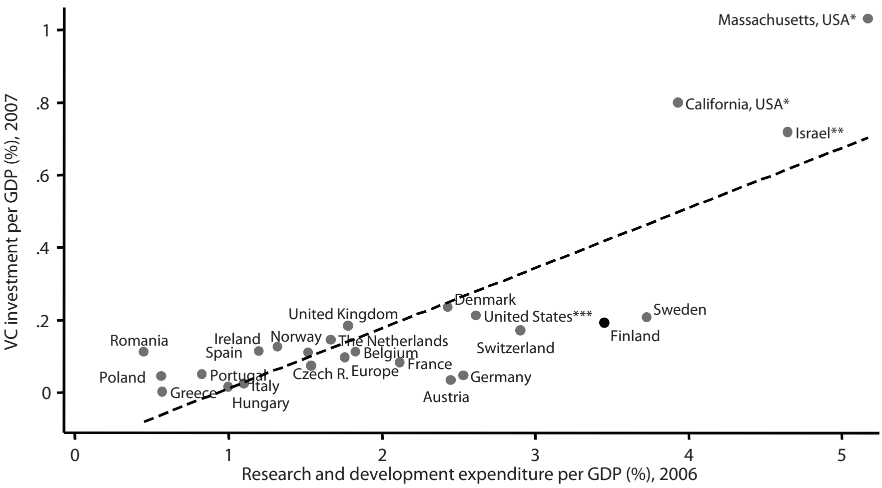
For Finland, the enabling environment must provide sufficient demand and the necessary quantity and quality of factor inputs to ensure that Finnish born companies can exploit material opportunities wherever they occur. This suggests in a globalizing and increasingly borderless world that Finland assumes a role more akin to the headquarters of a multinational corporation. It also suggests that Nokia's metamorphosis from a Finnish to world business is a useful example to consider when national entrepreneurial policies are designed. Over time, any highly successful Finnish HGEF is likely to be markedly less Finnish and increasingly global in its activities, its locations and its priorities.

5.3.2. AVAILABILITY OF CAPITAL AND RESOURCES FOR GROWTH

An important ingredient for the creation of HGEFs is the sufficient availability of risk capital as well as the complementary information and support from active and competent investors and advisors. However, there is ample international evidence (Bank of England, 2001) that the majority of professional equity investors, including both limited and general partners, do not wish to invest at the earliest and most risky stages of a young firm's life-cycle (Avnimelech & Teubal, 2006; Miller & Friesen, 1984). When considering the situation in Finland, it becomes quite obvious that relative to Finland's considerable investments in higher education, R&D and innovative activities, the volume of risk capital targeted to the commercialization of the outputs of R&D appears negligible (although not entirely absent). Figure 5.1 illustrates this mismatch. It shows the relative volume of venture capital (VC) investments in companies in Finland and other countries and regions (VC per GDP) in comparison to R&D expenditure per GDP in the same regions. This comparison shows that, relative to its investments in R&D (exploration), Finland invests disproportionately less in the commercialization of the results of the R&D investments (exploitation).[44] We have already noted that an economy's ability to exploit intellectual property is an issue of fundamental importance (see Bhide 2009 in endnote 2).

However, the relative amount of capital available does not give the full picture of the supply of capital. First, there are only a handful of active *private* venture capital investors which will even consider investing in firms that are in their earliest development stages. A very large share of the early stage venture capital has come from public sources in Finland during the recent years.[45] Second, the funding has been divided in small chunks for a large number of companies with limited opportunities to engage in hands-on value adding roles. From scholarly research it is well known, that a viable VC fund should usually have a minimum size of approximately €50 million[46] (Nightingale et al, 2009) and have partners with serial entrepreneur and venture capital back-

Figure 5.1. National VC investments versus R&D investments: an international comparison



Notes: Sources are EVCA, PEREP Analytics, and OECD (for R&D). * NVCA/PwC MoneyTree and Bureau of Economic Analysis (for R&D). ** IVC Research Center. *** NVCA/PwC MoneyTree. R&D refers to gross domestic expenditure on R&D. VC investment has been defined according to the country of destination approach in 2007 (Italy 2005; California, Massachusetts, Switzerland 2004).

grounds (Zarutskie, 2008). Third, some level of competition between several VC providers is important in order to have a market that is attractive for aspiring entrepreneurs. Fourth, cross-border venture capital and public programs also require competent and internationally experienced, private VCs (Mäkelä & Maula, 2008). Against this background, a perceived problem in the Finnish environment has been the very small number of active VC funds with fund size above €50 million which have been willing to make A-round investments (see e.g. Maula et al., 2007). Limited availability of competitive early stage venture capitalists reduces the attractiveness of the environment for potential growth entrepreneurs. It also can be argued that the allegedly alternative supply of angel finance (Mason & Harrison, 2003) in Finland is rather limited, or at the very least not easily tapped by the large majority of potential entrepreneurs including those with high education and business experience.

The public supply of seed and early-stage funding is not negligible, especially if the recent initiatives are taken into account. As noted, the Finnish government, like several other countries, has assumed a significant role in the provision of early stage equity investments. However, from the perspective of a potential entrepreneur, the public suppliers are scattered around the system. A clear division of labour among public providers is not evident from the users' perspective. There is thus a lack of a systemic approach, a weakness which is recognized by the NIS. Nor are we convinced that the present public providers of pre-seed and seed capital have a strong enough mandate to finance truly experimental business ideas that might be the necessary precursors of HGEFs. Our concern with the Finnish support system as it is presently constituted is that (from e.g. potential users' perspective), there appears to be several partially *overlapping but not integrated* public sources of seed, early stage and growth funding which are provided under numerous headings. However, despite the abundance of public sources and instruments, once the firm needs are greater than the relatively modest sums required to finance A and B rounds, the ability to access Finnish sources of funding quickly increases in difficulty. This is very problematic, because appropriate forms and levels of risk finance are necessary *but not sufficient* for the rapid development of a HGEF. We can see that the relatively small numbers of firms that are able to access multiple rounds of VC finance in the USA are likely to receive considerably larger total sums of money than their European equivalents (Dimov & Murray, 2008). Also critically, the relatively small numbers of North American HGEFs selected by VCs (Shane, 2008) are also in receipt of a formidable array of growth-oriented support resources.

Our main concern with the public support system providing capital to potential HGEFs is that even if the recent (both implemented and planned) developments are taken into account, the system still remains very scattered and fragmented.[47] Because of differences in rules, guidelines, application processes and customer information systems between the support agencies, there is no easy-to-access and integrated service offering that potential HGEFs can easily and quickly access.[48] When viewed collectively, the new initiatives regardless of their intentions do not seem to address this problem nor do they simplify the system. Quite the contrary, they may on occasion *add* new services and dimensions to the current system and thus make it even more complicated to understand and access. As far as we can determine, *no material efforts have been directed to make the innovation and support systems more streamlined, more cost-efficient or more accessible to its HGEF users.* There are plans that may address some of these operational issues but it is very uncertain at the moment how effectively they can be resolved.[49]

It is of interest to observe that the survey conducted by ETLA at the connection of this evaluation shows that all respondent firms (be they small or young, large or old) as well as the involved government agencies give a clearly *lower* grade to the ability of the Finnish innovation system to promote entrepreneurship and the creation of HGEFs than they award the innovation system as a whole (see Appendix, Figure 5.6, Figure 5.7, and Figure 5.8).

5.3.3. INTERNATIONAL GROWTH

For HGEFs, the limits in demand of the Finnish market will be reached quickly. Internationalization is a necessity for continued and significant firm growth. It is frequently the case that first internationalization efforts are made to neighboring countries with similar cultural histories and experience (Bürgel et al., 2004; Johansen & Vahlne, 1977). However, Finland is located a considerable distance from several of the most important international markets for HGEFs. Accordingly, in order to succeed in key markets, HGEFs are obliged to address the issues of both geographic and cultural distance. We know that for technology based firms particularly, internationalization is likely to be a rapid event (Bürgel & Murray, 2000; Rialp et al., 2005). Thus for Finnish firms, these issues are likely to be pressing from very early after market entry.

Ideally, the challenges of global marketplace should be recognized early on and prior to the founding of a new start-up. Since the intellectual assets of a young firm cannot easily be protected from foreign competition, a new enterprise and its investors would benefit from comprehensive market intelligence already being accessible by the opportunity evaluation phase of the proposed business. This ideal outcome is difficult and costly to achieve. At least in some cases, the private value of producing global market information and intelligence falls short of its social value. Thus, the reality is that many companies are started and funded (privately and by government organizations) with noisy estimates of the international demand and the likely degree (and quality) of competition. Internationalizing firms seeking to establish a permanent presence in key overseas markets will also over time have to invest in infrastructures to support customers in several countries. The building of an international sales infrastructure with appropriate distribution channels is a large and risky investment. Without accurate market intelligence, such investments are even more difficult to justify early in a firm's life cycle. Improved access to global market information and networks would reduce the uncertainty of such decision making and could facilitate greater commercial success of the potential Finnish HGEFs.

Global insight, foreign expertise and global networks should be present and accessible in the innovation system at the time the opportunity is recognized. Given the global dimensions of many key markets, the question then becomes who could and should introduce such a foreign (non-Finnish) perspective or provide global reach and information? In short, the generic question is – how can an ambitious, skilled and growth oriented entrepreneur acquire critical market information whenever it is in his/her interests to do so?

From a broader perspective, an obvious problem is that Finland receives negligible spillovers from immigrant human capital and foreign R&D.[50] Finland remains one of the least racially and culturally diverse populations in the developed world. When combined with the distance to key markets, this lack of 'foreign and cultural spillovers' results in a number of challenges:

- First, the management teams of Finnish start-ups are typically culturally homogeneous, which is in stark contrast to the US where most VC backed start-ups include immigrant entrepreneurs or key employees. Managerial labor markets in Finland will similarly reflect this lack of diversity.
- Second, Finnish HGEFs are very dependent on national sources of risk capital. This compares unfavourably to Israel where two thirds of VC funding to start-ups comes from foreign investors. Similarly, three quarters of the nearly £20 billion raised by the large UK venture capital and private equity industry in 2007 came from overseas investors. Finland's ability to secure international support pales in comparison. Yet, Finland is internationally recognized for the quality of its innovation system and the skills and education of its citizens. Finland's loss from such a situation is not just money. As can be witnessed in Israel, international investors can also provide their international experience, contacts and certification to the HGEFs that they finance.
- Third, Finnish companies in general, and HGEFs with their limited resources in particular, have difficulties in getting onto the radar screens of the biggest corporate or public purchasers. Major strategic purchase and acquisition decisions by corporations are commonly made in the international head-quarters of the corporations. They are difficult to access or influence without a direct physical presence and contact with the networks where the decision makers are represented. Without external assistance, young firms find such high level access particularly difficult to achieve in their early years.
- Fourth, only a handful of major R&D centres of global corporations are based in Finland. Such R&D centres are one avenue for Finnish entrepreneurs to enhance their global reach and to gain insight into global customer needs. Inward investments allow Finns to look outwards globally. Conversely, the absence of such international resources forces a more myopic and parochial perspective.
- Fifth, Finland's university and research communities, particularly in the key disciplines of science and technology are largely staffed by Finnish nationals.[51]
- Finally, and similarly to the previous point, the public support system is also overwhelmingly staffed by Finnish nationals most of whom have limited international experience, networks or access.

Our aim is not to argue that there is a lack of public support for the internationalization of innovations and HGEFs or export efforts of Finnish companies. Quite the contrary, nearly *all* public agencies provide some kind of support for such internationalization using one or more policy instruments.[52] Rather, we argue that Finnish internationalization takes place in an environment where much of the information must be derived from secondary sources and where networking opportunities are restricted given the absence on Finnish soil of foreign entrepreneurs, researchers, R&D departments and major foreign-owned businesses. Thus, the challenge for Finland is to attract strong and multifaceted linkages to foreign talent that *by its very presence* would help accelerate and deepen the international understanding and perspective of participants in the Finnish innovation system.

It is unlikely that there is just one barrier stopping a Google or an equivalent world class business setting up a major R&D facility in Finland. Similarly, Finland has to recognize that a large number of developed nations are presently seeking to attract highly educated migrants from Asia and beyond. In such a competitive market for scarce and highly mobile talent, Finland is not likely to fare well in comparison to, e.g., the U.S., Canada, Australia or the U.K. They are all large countries with excellent education and research facilities and, importantly, with established immigrant communities. Finland's efforts to become 'more cosmopolitan by other means' has to be accelerated simply because a small Nordic country with a harsh climate is rarely a first choice of destination for elite and highly mobile communities of knowledge workers. In these circumstances, it is beholden on Finland to explore actively the novel ways by which this problem may be resolved or diminished.

5.3.4. ENTREPRENEURIAL CULTURE

'Culture' is an intangible element within the entrepreneurial infrastructure. Intuitively, a society that visibly celebrates and otherwise endorses entrepreneurial activity would appear to be at a strong advantage in seeking to promote additional entrepreneurial and innovative activity among its citizens. However, the term 'culture' is not easy to define or quantify. Moreover, it is likely to mean different things to different parties be they economists, policy makers, entrepreneurs or the 'man and woman in the street'. None the less, there does appear to be a fairly common and widespread view in Finland that its citizens do not have a particularly entrepreneurial culture. This is especially the case if one compares Finns to a US or Anglo-Saxon benchmark.[53] In Finland, often, the explanation for this situation is made with relatively vague and anecdotal reference to historic circumstances, attitudes etc. Similarly, culture is also often described or assumed to be an unchangeable 'given' or at least very slow to change in a stable society.

Yet, the key question of concern is whether or not Finnish entrepreneurial culture (i.e. popular attitudes to new and growth enterprise and to the desirability of entrepreneurial activity) is an important factor in future economic growth. Further, and critically, can Finnish attitudes be made more accepting of – and ambitious for – greater entrepreneurial activity? Here we make a link between the prevailing culture and values of a society and their tangible translation into multiple areas of commercial activity. The practical manifestation of a supportive entrepreneurial culture will be seen in the 'entrepreneurial orientation' of its citizens and their commercial behaviour.[54] It seems plausible to assume that entrepreneurial culture (at the macro level) and entrepreneurial orientation (at the firm and individual levels) are mutually reinforcing and thereby are likely to contribute positively to the creation of HGEFs.

Evidence to determine the cultural climate faced by (potential) entrepreneurs in Finland is weak. However, there are a number of contemporary indications including a bi-annual survey by the Federation of Finnish Entrepreneurs (FFE). What we can infer from these indicators and see in this FFE survey over time is that entrepreneurial attitudes and experiences appear to be improving in Finland. Further, the attitudes and experience of growth oriented entrepreneurs are no worse (and sometimes more positive) than for all entrepreneurs surveyed. Younger persons in Finland appear to more strongly identify with entrepreneurial values.[55] However, while this positive trend is perhaps encouraging, the fact remains that too little is known of the cultural and 'soft' issues of entrepreneurship than may be able to direct specific policy decisions in a Finnish context. For example, in Finland, are positive attitudes of young persons an indicator of future entrepreneurial activity? A closer tracking of entrepreneurial values within the Finnish culture and their implications for future business activity is a research omission that should be corrected.

While entrepreneurship is taught in a number of Finnish universities, this teaching is not primarily focused on an understanding of, and a preparation in, the creation and cultivation of high growth/high impact and internationally competitive businesses. This latter subject is qualitatively different from small or family business studies. Secondly, our understanding is that students taking these courses are likely to be primarily recruited from business and economics programs. The provision of entrepreneurial training to the Finnish science base – and particularly to high quality undergraduate, masters and doctoral students in the natural sciences – is likely to be much less systematic. The linkages between young scientific researchers and their equivalent business school colleagues through their interaction in university-based entrepreneurship programs is one significant characteristic of the best enterprise training in both the USA and the UK (OECD, 2008a; Roberts & Eesley, 2009). For many countries, and possibly including Finland, this limited scholarly engagement with entrepreneurship education may well have a negative impact on the potential for spin-outs and other commercial outcomes from innovation activity. Indeed, a recent study in the UK based on 25,000 respondents from GEM's year 2005 data (Cowling, 2009) shows that school and particularly university training in entrepreneurship can have a positive effect on business creation.[56]

In short, while an incontrovertible case for cultural change still need to be constructed, there is likely to be a convincing argument for promoting a wider and more popular communication and celebration of entrepreneurial activity in Finland if the goals of the NIS are to be achieved. Such promotion may also make Finland a more attractive destination for high human capital immigrants wishing to work in a strongly meritocratic, entrepreneurial and growth oriented economy and society. The international promotion of this compelling case needs to be more evident in current policy discussions.

5.4. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.4.1. MAIN CONCLUSIONS

The focus of this study has been to address the key question of what policy initiatives can be identified in order to encourage a greater number of successful High Growth Entrepreneurial Firms (HGEFs) being spawned in the Finnish economy. It is often argued that Finland does not produce enough of such firms when compared to competitor countries both in and beyond the Nordic region. Similarly, it has been suggested that Finnish entrepreneurs appear invariably 'modest' in their ambitions. These concerns suggest that Finland has a structural mismatch. Despite being recognised as one of the most innovative countries in the world with an equivalently high level of R&D intensity and business R&D spending (European Innovation Scoreboard 2008, 2009; OECD, 2008c) these inputs do not appear to have resulted in equivalent outputs of a greater *global* supply of world-class, advanced goods and services stemming from Finnish ideas and/or from Finland originated, entrepreneurial firms.

We share the view that there is some level of structural mismatch. The returns to Finnish tax payers' money invested in public R&D and in the public support system should be higher, if measured in terms of the number of world class HGEFs created. While the Finnish innovation system accommodates the needs of small businesses and entrepreneurs relatively well if a European comparison is made, the increased emphasis on growth-oriented, innovative companies in recent policy making (including the NIS) is in our view clearly warranted and the correct strategic choice. Many recent plans and policy initiatives correctly recognize the importance of economic incentives at the level of individuals, and the need for an integrated and holistic public support service for growth companies. Such a public service should facilitate not blunt market signals.

In order to address the structural mismatch in the supply of and demand for entrepreneurial opportunities, policy has to work on several separate levels. This analysis leads us to the creation of four sets of policy recommendations.

5.4.2. POLICY RECOMMENDATIONS

Enhancing incentives for entrepreneurship and risk taking

Observation #1: The innovation system, including the relevant aspects of the tax system, provides little incentive for a highly talented individual to choose a risky entrepreneurial career. In fact, there seem to be few, if any, explicit upside incentives to entrepreneurial entry and risk-taking.

Challenge #1: Individuals with high human and social capital and the ability to create HGEFs have a high opportunity cost of entering entrepreneurship. Policy ought to recognize explicitly the importance of economic incentives at the level of talented and scarce individuals.

As we have argued, in order to create more and better HGEFs, Finland needs a continuing and increased supply of entrepreneurs who are characterized by their ability to accept and manage risk as well as by the high quality of their (international) commercial experience and expertise. It is very likely that these people with high human and social capital will appreciate their market value and will demand substantial pecuniary incentives for their collaboration (for interesting recent U.S. evidence, see Hall and Woodward, 2009). The Finnish innovation system should therefore provide sufficient financial inducements for them to leave their current position (e.g. established private sector careers) when and where appropriate for both the risk and rewards of entrepreneurial ownership.

It is the tax system which determines the distribution of the earnings and value-added generated by a (new) firm between the state and entrepreneur. It is very hard to determine whether or not the current 'dual income tax system', as currently implemented in Finland, hinders or encourages the entry into entrepreneurship of individuals with high quality business experience and good education. The available analyses and the academic literature remain ambivalent on how Finnish dual income taxation treats entrepreneurship and risk-taking; or whether such activities can best be encouraged by providing tax incentives (see for example, Hietala & Kari, 2006; Kanniainen et al., 2007; Sörensen, 2009, and the references used in these studies). However, to the extent that the system is not neutral, there seems to be few, if any, *upside* incentives to entrepreneurial entry and risk-taking.[57] If such incentives are in place, they are likely to be incidental and not systematic.[58] Furthermore, the design of the existing tax system pays, as far as we can determine, limited attention to the incentives required for individuals to be motivated both to build and to exit valuable businesses (perhaps over repeated iterations as serial entrepreneurs). Yet, we have increasing evidence from the academic literature that tax incentives (including capital gains taxes) are extremely important in the investment decision to create and grow a new business (Armour & Cumming, 2006; Da Rin et al., 2006; Keuschnigg & Nielsen, 2004; Poterba, 1989).

Accordingly, we strongly recommend that these incentives are explicitly taken into consideration if and when the tax system is reformed. Given the complexity of the issue[59], it would be inappropriate from us to give detailed prescriptions on how the dual income tax system should be redesigned. Any reform should, however, consider the following issues:

– Although the economic theory of taxation does not give a clear cut prediction on whether risk-taking or (high-growth) entrepreneurship should be given a non-neutral treatment in the taxation, the planned reform of the Finnish tax system presents an important opportunity to challenge positively this principle. It is unlikely that the Nordic dual income tax system and the Finnish tax system in particular could not be made more favorable to individual-level risk-taking and more encouraging of growth-oriented firms.[60] Taxation of equity income could, for example, explicitly recognize the extra-ordinary risks that the entrepreneurial owner-managers of a HGEF have to bear and the positive spillovers to the society at large that such entrepreneurial risk taking potentially generates.[61]
– The role of capital gain taxes as a means to incentivize and reward the recognition and pursuit of growth opportunities should be explored from the perspectives of both entrepreneurial owner-managers and risk capital investors (Armour & Cumming, 2006; Da Rin et al., 2006; Keuschnigg & Nielsen, 2004).
– The decision to establish and grow a HGEF is a discrete and significant choice. An entrepreneurial career is not a trivial or incremental commitment. Thus, entrepreneurs are more likely to be affected by the *average* tax burden and not by the *marginal* rates of taxation (see Devereux & Griffith, 1998; Kanniainen & Panteghini, 2008 and the references in these studies).
– Risky market entry may generate pecuniary returns only after a considerable delay. The tax system ought to explicitly recognize the dynamics of the process that leads to the creation of HGEFs. It is the expected, future after-tax monetary rewards that are likely to influence the incentives of forward-looking individuals with high social and human capital to establish a growth venture today. The tax system should avoid introducing (short run) 'success taxes' that undermine these incentives.

In sum, we think that to the extent possible, the tax system should be viewed as an important element of any policy promoting long-term growth and competitiveness. At the moment, it seems to be an underutilized instrument that can be more effectively used to give individuals appropriate incentives, especially to those who have the mix of human and social capital to become high-growth entrepreneurs.

Our disproportionate emphasis on the incentives of entrepreneurial owner-managers does *not* mean that the recent policy efforts (e.g. tax incentives to business angels and venture capital investors or the tax treatment of certain fund structures to increase the *supply of private risk capital*) should be seen as misguided. Quite the contrary, these initiatives are likely to be complementary to the provision of incentives to entrepreneurs.

The foregoing discussion leads naturally to our next observation about the Finnish innovation system:

Observation #2: The involvement of the Ministry of Finance in the entrepreneurial and innovation policy process has been insufficient, particularly in matters of devising a tax system that unequivocally enhances incentives for entrepreneurship and risk taking.

Challenge #2: In its present form, the Ministry of Employment and the Economy and the Ministry of Finance do not assume joint responsibility for high growth enterprise policy. Forging of a joint responsibility for entrepreneurship between the two ministries has to be a priority.

In common with most public administrations, the Ministry of Finance assumes a major role in monitoring and supervising the financing of expenditure on existing and new policy initiatives. Any suggestions that influence the taxation mechanisms of an economy must ultimately receive the agreement of the exchequer if any action is to be forthcoming. It is our impression that the Ministry of Finance has remained a shadowy but influential presence in the development of the entrepreneurial and innovation policies.[62] We believe strongly that the involvement of the Ministry of Finance in the innovation policy process has to be both more public and more explicit if any future changes are to be effective.[63] Stronger linkages have to be created between the Ministry of Employment and the Economy and the Ministry of Finance in order to exploit their complementary roles in the creation of HGEFs. In particular, the forging of a joint responsibility for entrepreneurship between the ministries should become a priority. In practice, for example, this could mean the establishment of a dedicated unit within the Ministry of Finance that is responsible for the promotion of enterprise and innovation capabilities.[64] Such a unit could take responsibility for the developing of appropriate taxation policy so that the Finnish tax system better supports entrepreneurship, risk taking, the creation of HGEFs and thereby long term productivity and economic growth. It is not for the authors of this report to dictate the nature of such an inter-ministry association. However, it would be expected that *senior* staff secondments from each ministry were represented in their respective entrepreneurship policy units.

Streamlining the public support system

Observation #3: The present public support system is the result of several years of evolving policy actions and also reflects the interests of a variety of public bodies. The system has become excessively complex to both access and administer.

Challenge #3: There is a clear and urgent need for an easy-to-access, streamlined and integrated support service available to Finnish HGEFs.

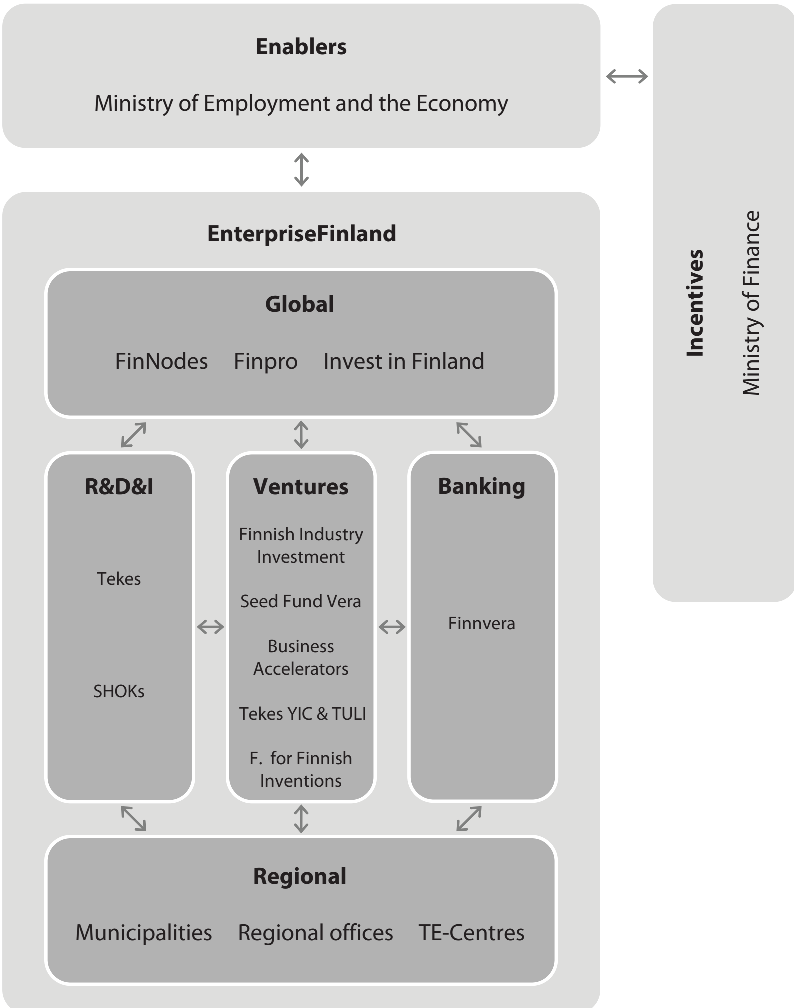
The present Finnish public support infrastructure, which seeks to address growth firms both in their pre-commercial and commercial stages, is the result of a long history of evolving policy actions and practice across a variety of governments *and* ministries. Policy makers necessarily seek to cater for the needs of a wide spectrum of potential users under a range of circumstances. As a result, the enterprise support system has become excessively complex to both access and administer. From the perspective of an outside observer (e.g. a potential entrepreneur), programs often seem to overlap with other programs and on some occasions multiple public agencies appear to work broadly in the same area and/or with the same firms. One costly outcome from this complex system is that high growth entrepreneurs incurring high opportunity costs for their time and effort are not always able to locate and access appropriate sources of support efficiently, quickly and/or at an acceptable cost. While it is hard to quantify how complex the system is, the survey conducted by ETLA at the commencement of this evaluation provides evidence for this view. The survey shows that nearly three-quarters of young and small innovative firms think that the public support system facilitating private business and innovation activities is 'very or quite complex' (see Appendix, Figure 5.9). Our conjecture is that one reason for this finding is that nearly all agencies provide some sort of support to "new ventures" and "growing firms", or provide services with similar titles and headings. As a result, high growth entrepreneurs are not always able to locate and access *appropriate* sources of support efficiently. *Even if the ongoing initiatives and plans are taken into account*, this observation calls for efforts that would make the support system more streamlined, specialized and more cost-efficient and above all, more relevant for Finland's highest potential young firms.

Further, the provision of advice and support does not seem to take into account the *trajectory* of young firms as they grow and evolve over time. Until very recently, Finnish enterprise policies have largely addressed firm formation while providing little support for the critical stage of subsequent, rapid firm development.[65] Our view is that the present structure of advice and support to Finnish entrepreneurs can be further streamlined and integrated in a fashion that can genuinely be described as 'systemic', and thereby better able to meet professionally HGEF users' changing needs over time.[66] The present need by firm clients to devote scarce time and attention in order to understanding the complex support system diverts scarce managerial resources away from a market orientation. This means that both support for entry and (international) growth objectives needs to be integrated if a systemic and coherent enterprise policy regime is to develop and be effective.[67]

While the precise details of streamlining and integration of the system are beyond our remit, we would offer Figure 5.2 as one potential scenario of how the various actions of government in the enterprise support field could possibly be streamlined and more efficiently organized. We would stress that, given that these actions already come under the ambit of the Ministry of Employment and the Economy, much of the restructuring can be carried out within the authority of one existing ministry. We would also like to acknowledge that the proposed integration of the services is to a large degree consistent with some of the recent initiatives (e.g. the EnterpriseFinland initiative and the group strategy of the Ministry) and current proposals that aim to re-organizing similar and related services into common user focused categories. Ideally, some of the governmental and semi-governmental agencies, as well as some of the services of the larger governmental organizations directed at supporting growth entrepreneurship would be organizationally merged and integrated. There also seems to be a clear need to reconsider the internal organization of the responsibilities for entrepreneurship development, growth ventures policy and steering of the related financing and support agencies and institutions within the Ministry of Employment and the Economy.[68] We acknowledge that these may be controversial propositions but, if effectively implemented, such reorganization would ease the governance of the services, lessen the risk of duplication and enhance the cost efficiency of the system.

We would also see the revised structure, an illustration of which is presented in Figure 5.2, being of an order more comprehensible and accessible to high growth entrepreneurs seeking public support or guidance in order to execute ambitious growth strategies. As such, this recommendation is largely in line with the current efforts to develop the present infrastructure, particularly the EnterpriseFinland system and the segmentation of the new and existing customer firms within the support system. However, with regards to these initiatives, no material effort to streamline the system or to make it more cost-efficient has actually been put in place to date. Making the system more accessible to potential (high growth) entrepreneurs is of a first order importance and goes significantly beyond the current plans and efforts. There are some

Figure 5.2. Streamlined public support system?



'simple fixes' to improve collaboration and integration as has been recognized by the new initiatives. However, such easy changes will be quickly exhausted. They will not be sufficient to engender material and long run improvements.

Global linkages locally exploited

Observation #4: Finland remains one of the least racially and culturally diverse populations in the developed world and is located at a considerable geographic and cultural distance from several of the most important markets for HGEFs.

Challenge #4: There is a mismatch between the entrepreneurial demand for global insight, foreign expertise, international networks and the supply of inward foreign "spillovers" from immigrant human capital, foreign R&D and cross-border venture capital. The risk is that opportunities on global markets will not be recognized. When opportunities do arise, the danger is that they will be assessed and (mis)understood from a limited, exclusively Finnish geography and perspective.

We are not the first to stress that the informational barriers and networking challenges that Finnish HGEFs face when trying to access global resources and markets are real and severe. There is clear evidence that companies with internationally networked and experienced managers internationalize more quickly and more extensively to positive economic effect. We do not want to argue that there is a lack of public support for the internationalization or export efforts of Finnish companies. Indeed, nearly *all* public agencies provide some kind of support to such activities. However, there is a lot of room for improvement both in the coordination of these services and in greater understanding from policy makers and public agencies as to why the internationalization of HGEFs deserves special attention from the public support system:

- First, the real challenge to the internationalization of the Finnish HGEFs is the nearly complete absence of foreign talent, international investors, and foreign companies and service providers in the Finnish innovation system. They would, *by their very presence*, reduce the informational barriers and networking challenges of globalizing HGEFs. There is no single policy measure that can resolve this challenge but it should be recognized and given greater priority in the policy discussion.
- Secondly, direct public support for the internationalization of HGEFs should be concentrated on areas where the private value of producing information about global markets or building international networks falls short of its social value. For example, enhancing the visibility and networks of Finnish HGEFs is a means to overcome the local bias of international investors (i.e., the preference of foreign investors to invest in geographically close and familiar companies). The costs of informing foreign investors about the supply of Finnish HGEFs is material but largely fixed (i.e. it is nearly as costly to inform a group of foreign investors about a single

Finnish HGEF as it is to inform them about 30 Finnish HGEFs). This provides an economic justification for publicly supporting such activities.

– Third, the visions of policy makers (including civil servants) or established businesses should not be the exclusive sources of information driving the allocation of public resources that are used to support the international market entry or expansion of Finnish firms. HGEFs entering new markets with novel products and services often represent a direct and disruptive challenge to accepted market views based on historic conditions and practices. There is a need to ensure that future support and funding allocations are primarily influenced by factors that recognize the emerging global market demand.

Building an entrepreneurial culture in Finland

Observation #5: There appear to be a fairly wide-spread self-perception that Finns are not very entrepreneurial.

Challenge #5: An understanding and appreciation of the exceptional skills and determination required to build a growth venture with global market potential is still limited both among the general public and in the innovation and university system. Partly because of this unawareness, risk-tolerant and growth-oriented entrepreneurs appear to be under-valued in Finland. The present reform of the university system and the creation of Aalto University represent a timely opportunity to address this challenge.

Despite Finland scoring high on innovation performance (European Innovation Scoreboard 2008, 2009) and having engineered one of the most remarkable economic turnarounds in recent times (and contemporaneously created one of the most outstanding global businesses in Nokia), its citizens readily downplay their entrepreneurial capabilities. While accepting the caveat that it is neither easy to change attitudes or culture within a stable community nor always clear why government should engage in such activities, there are a number of areas where Finland needs to challenge what arguably are perceived as accepted norms of economic behaviour. Above all, we would argue that the risk taking and pioneering spirit of the entrepreneur needs to be recognized and celebrated for its importance to Finland's economic future. The importance of an entrepreneurial culture should be valued because it is likely to be *complementary* to the tax and other incentives designed to enhance entrepreneurship and to change entrepreneurial risk/reward ratios.[69] While systematic evidence on such complementarities is scant, we think that the support measures are likely to be considerably less powerful if the central message of the key role of the entrepreneur is not widely communicated.

To provide precise recommendations on how an entrepreneurial culture can or should be built in Finland is beyond our remit. We nevertheless see a number of areas where there is room for additional effort:

– First, entrepreneurship appears an 'orphan' in the Finnish policy system. While all questioned ministries and associated organizations allude to its importance, it appears to be on the margins of the direct policy responsibilities of each of the concerned government departments. Consistent with what we have suggested above about the need for *formalized* collaboration between the various ministries and for reorganization of the public support system, this situation needs to change – and publicly be seen to change.
– Second, most policy measures in Finland and elsewhere focus on concrete assistance, and particularly finance, for companies including HGEFs. Little attention has been paid to influencing the attitudes and start-up culture.[70] In addition to improving the conditions for growth entrepreneurship (e.g. by increasing incentives), the cultural issues can be addressed by improving the awareness of entrepreneurial opportunities and better communicating the 'pros and cons' of entrepreneurship as a career choice among the general public. The provision of such information needs to be complemented by comprehensive and research-informed entrepreneurial training.
– Third, the creation of a greater number of better quality HGEFs is directly linked to the entrepreneurial effectiveness of the university system. We agree with the view put forward in OECD (2008a) that a transformation of the activities of higher education institutions is called for if they are to play their full part in stimulating the creation of HGEFs and thereby economic growth in modern knowledge economies. While there is considerable debate as to the introduction of applied subjects such as entrepreneurship into the schools' curricula, there is a greater consensus as to its importance at university level training. In the development of an entrepreneurial culture in Finland, the university sector has a particularly important role given the critical role of new knowledge based enterprises within the innovation system.[71] We would also suggest that the key targets are science (including medicine) and engineering students both at undergraduate and postgraduate levels. We would stress that curricula should be influenced towards teaching entrepreneurship and new ventures development from the predominant perspective of high growth and internationally focused, new knowledge businesses. However, we would also argue strongly that such courses should always be *voluntary*. In order to ascertain the attractiveness of an entrepreneurial career, young men and women need information and (ideally) direct experience of such activities. Entrepreneurship courses can help meet these goals by addressing directly information imperfections and asymmetries. To make rational and considered choices,

scientists need to appreciate what it takes to build a rapid growth venture with global market potential. Accordingly, they also need to have an understanding as to how new knowledge can be transmuted into new products and services regardless of their own academic roles or positions in the innovation value-added chain.

– Fourth, while we believe that students from all disciplines in all universities should have access to entrepreneurial program choices, we are mindful of the scarcity of world class experience in the creation and accelerated growth of new enterprises. If Finland wishes to remain a world class innovative economy, it also needs to have world class infrastructure for entrepreneurial training, education and research. The reform of the university system and, in particular, the formation of Aalto University represents a unique opportunity to create such an infrastructure. This infrastructure could for example take the form of an entrepreneurial centre that is an accessible resource to high potential entrepreneurs and businesses regardless of their location. Such a centre should have complementary remits for academic research, knowledge transfer and practitioner engagement. Critically, it should be global in purview and the centre's employees, students and visitors should strongly reflect its global ambitions in their experience, culture, nationality and diversity. In order to meet such goals, the financing and incentivization of faculty is likely to have to be internationally competitive. Given the centre's ambitions, its governance needs to be a matter of some deliberation. Again, it is inappropriate in this report to design in detail such an infrastructure for international entrepreneurial activity. However, it should be also seen, as with our other recommendations, as creating a very visible, public and powerful signal that Finland is committed to a global entrepreneurial mindset across the range of its innovation activities.

5.4.3. CONCLUDING THOUGHTS

In conclusion, we believe that the Finnish innovation system could *significantly* increase the effectiveness of the support offered to its high growth entrepreneurial firms. We have summarized the results of our analyses and discussions into a number of specific recommendations (see above). However, we would wish to conclude with two observations which are related to the nature of policy actions: namely, complexity and political intent.

First, new programs and policy initiatives are simple to introduce but can all too easily make the existing support system increasingly complex. In many respects, it is far easier to create new programs than to retire existing but no longer relevant activities. The result of this phenomenon is that there is a constant buildup of policy measures, systems, channels and programs in any modern government. In Finland at the present time, there are too few efforts to streamline the existing support system available to young firms. Making the system more cost efficient and more accessible to potential (high growth) entrepreneurs is of a first order of importance.

Second, it remains to be seen whether or not there is enough political will to make the promotion of growth entrepreneurs and HGEFs a primary goal of the relevant ministries and the various agencies under their command. In practice, most countries have a large number of programs for start-ups and small businesses. Such programs are seldom of real relevance and help to exceptional HGEFs. All too often growth firms remain on the sidelines in policy discussions and actions. Their needs are quite different from the very large number of 'rank and file' small businesses. Finnish growth entrepreneurs and HGEFs require incentive and support systems that are complementary, effective and easy to understand and access. In the absence of such 'catalytic' resources, access to world class technological and scientific expertise will remain a *necessary but not sufficient* condition of Finland's future economic success.

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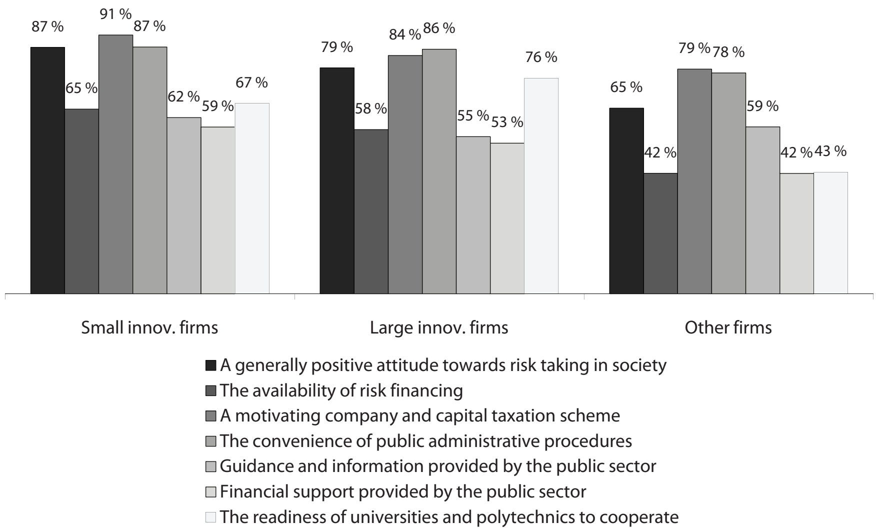
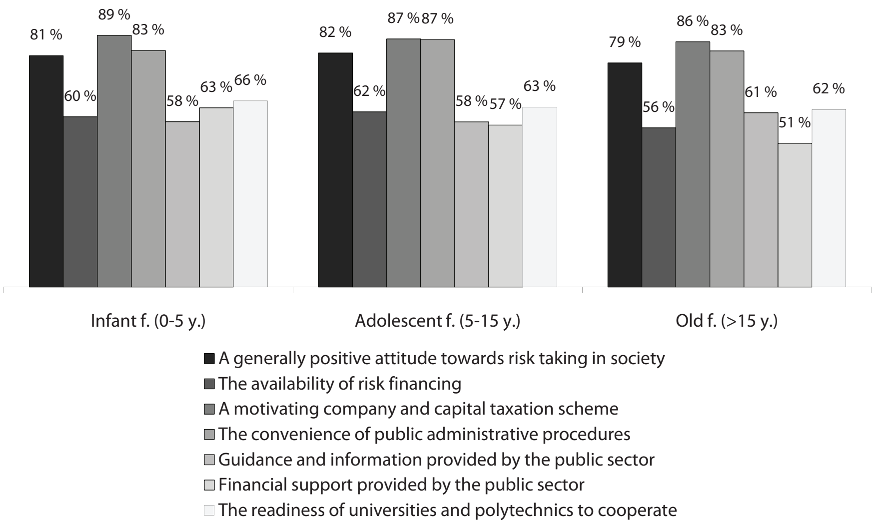
APPENDIX: SURVEY RESULTS

Figure 5.3. How important are the following aspects from the perspective of your business?



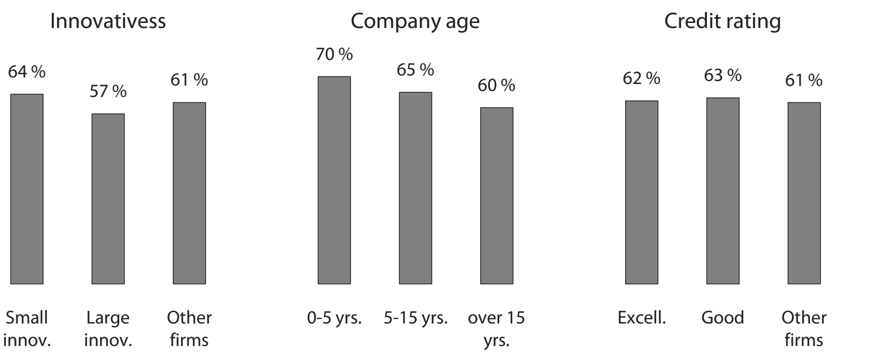
Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts the share of firms answering to the question very important or quite important. Small innovative firm: Less than 50 employees and has done innovative activity during the past 3 years; Large innovative firm: At least 50 employees and has done innovative activity during the past 3 years.

Figure 5.4. How important are the following aspects from the perspective of your business?



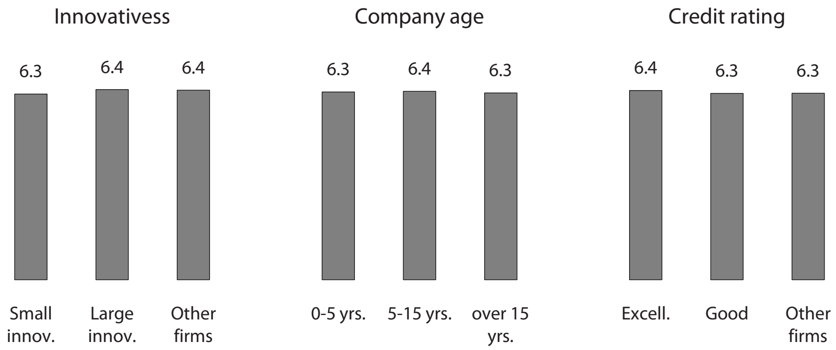
Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts the share of firms answering to the question very important or quite important.

Figure 5.5. The emergence of new growth companies could be facilitated by providing them with tax incentives regarding their future earnings and profit sharing. How efficient are such tax incentives in increasing the number of growth companies?



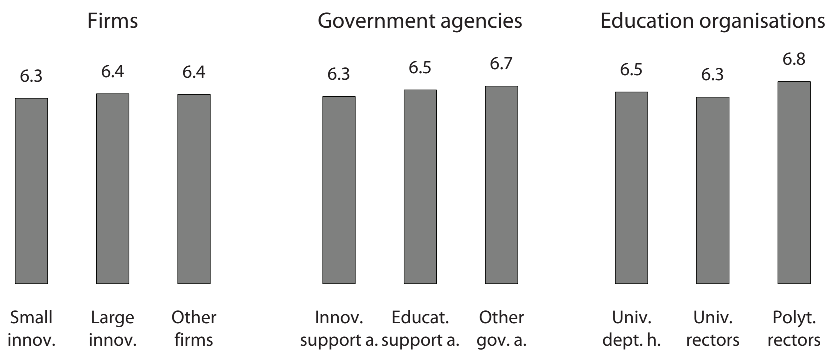
Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts the share of firms answering to the question very or quite efficient.

Figure 5.6. One of the objectives of the NIS is to promote growth entrepreneurship and create rapidly growing companies. How would you grade the system in this respect?



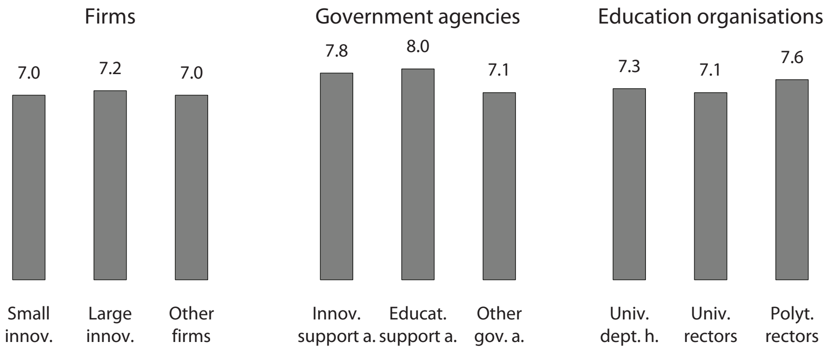
Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts means to the question (scale 4–10).

Figure 5.7. One of the objectives of the NIS is to promote growth entrepreneurship and create rapidly growing companies. How would you grade the system in this respect?



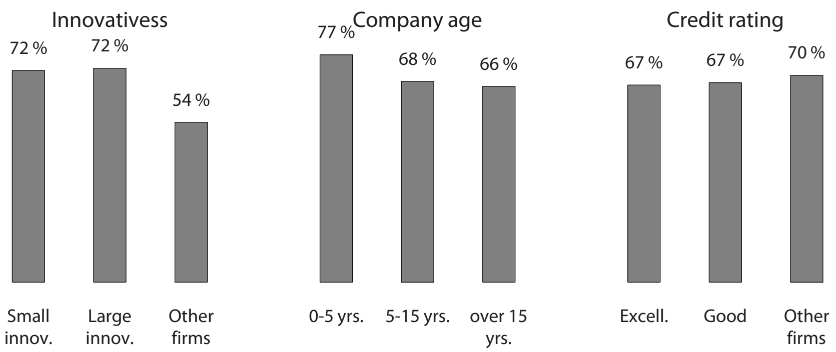
Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts means to the question (scale 4–10). Innovation support agencies: TEM, Tekes; Education support agencies: OPM, Akatemia. Univ. dept. h. = University department heads, Univ. rectors = University rectors, Polyt. rectors = Polytechnic institutes rectors.

Figure 5.8. How would you grade the Finnish National innovation system (NIS) at the moment?



Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts means to the question (scale 4–10). Innovation support agencies: TEM, Tekes; Education support agencies: OPM, Akatemia. Univ. dept. h. = University department heads, Univ. rectors = University rectors, Polyt. rectors = Polytechnic institutes rectors.

Figure 5.9. One of the most central functions of the system is to facilitate PRIVATE business and innovation activities. Against this backdrop, how would you characterize the innovation system as a whole?



Notes: The data source is a survey conducted by ETLA to support the evaluation. The figure depicts the share of firms answering the system is very or quite complicated.

ENDNOTES

1 For a recent survey of how rapidly growing firms contribute to job creation, see Henrekson and Johansson (2009). The contribution of *new* firms to productivity growth has not yet been conclusively established (nb. it can even be negative, see e.g., Shane, 2009), but *surviving* HGEFs have a positive effect on productivity growth.

2 Many recent studies and accounts that examine the linkages between innovation and economic growth put increased emphasis on the commercialization of new technologies and innovations *instead* of inventions. Bhide (2009) concludes, for example, that "*[i]t doesn't matter where scientific discoveries and breakthrough technologies originate – for national prosperity, the important thing is who commercializes them.*"

3 By the NIS, we refer both to the Finland's National Innovation Strategy 2008 and to the Government's Communication on Finland's National Innovation Strategy to the Parliament.

4 A number of studies of rapid internationalisation by 'young' NTBFs use a ten year definition (e.g. Bürgel et al., 2004; Storey & Tether, 1998).

5 As briefly summarized in e.g. Hyytinen and Maliranta (2008), a growing economics literature emphasizes the process of "creative destruction" and market experimentation of new ideas as a source of long-term economic growth (see, e.g., Foster et al., 2001; Klette & Kortum, 2004). Such experimentation calls for a sufficient supply of high-quality entrepreneurs and makes selection of talented employees into entrepreneurship instrumental for long-term growth. If anywhere, this holds in economies close to the global technology frontier, such as the Nordic countries (see e.g. Acemoglu et al., 2006; Audretsch & Sanders, 2007). Empirical evidence suggests that companies with high potential value are more likely to come from the science base in developed economies (Autio, 2008).

6 It is difficult to obtain reliable and objective measures of the scale and quality of private and public sector R&D and innovation activity and thus the availability and quality of knowledge and innovation based entrepreneurial opportunities. The European Innovation Scoreboard 2008, published early 2009, suggests that Finland's innovation performance is good, especially if benchmarked against the other EU countries.

7 The majority of the analyses reported here were conducted in February 2009 (with some of the conclusions and recommendations published at *www.evaluation.fi* in March 2009). During the Spring 2009, several new plans and policy instruments have been launched by the Ministry of Employment and the Economy and its various agencies and committees. For example, the monitoring group of growth entrepreneurship published a report in June 2009 which discusses many of the challenges related to growth entrepreneurship in the Finnish innovation system.

8 In the short-term, the on-going economic crisis may affect the creation of HGEFs for a number of reasons including but not limited to reduced supply of (risk) capital and weakened export demand. To focus on structural issues, we try to look beyond the macroeconomic cycle. Of course, if the crisis deepens and becomes a long-lasting global depression, it is likely also to have some significant adverse effects on the long-term creation of HGEFs.

9 For an example of this perversity, Cassiman and Ueda (2002) show that a decrease in the cost of starting up can actually reduce the rate of market entry.

10 'Red tape' or administrative burdens can generate major compliance costs particularly on small businesses. Several governments have set up initiatives to control the growth of these costs. See for example: http://ec.europa.eu/enterprise/admin-burdens-reduction/home_en.htm

11 There are two things that are worth emphasizing: First, imperfections in the market for early stage and small business finance do not automatically mean that there is too little entry. Asymmetric information in the market for early stage finance can, for example, result in excessive entry and over-investment due to the cross-subsidization of bad projects by good projects (see, e.g., de Meza, 2002; and, for further references, Takalo, 2009). Second, the precise reason for the imperfections in the market for small business finance is often not known (see, e.g. Hyytinen & Väänänen, 2006). This is unfortunate, because it often determines whether or not the imperfection can be understood and addressed effectively.

12 As we will discuss in greater detail below, the future creation of successful HGEFs which are based on Finnish experience and intellectual assets will likely require the leveraging of substantial resources from foreign partners and early stage investors to ensure their full commercial impact. The additional resources to create globally competitive enterprises are not restricted to finance. Such a change will also require a profound reorganization of the means by which Finnish businesses envisage and engage in international participation.

13 See also the analysis of Breznitz, Ketokivi and Rouvinen in this report.

14 A similar concern as to the limited focus on demand-side entrepreneurship policies has been expressed by the UK government's Department of Business Innovation and Skills (Toschi & Murray, 2009).

15 This remoteness can exacerbate the difficulties that Finnish HGEFs face in the understanding of actual and potential customer groups.

16 The numbers on enterprise openings come from Statistics Finland's Business Register and are based on those firms that are "liable to pay value-added tax or act as employers". They do not cover foundations, housing companies, voluntary associations, public authorities and religious communities, or enterprises of the Finnish municipalities. Of the officially recorded enterprise openings, 33% were limited liability firms in 2004–2007.

17 Hyytinen and Maliranta estimate this rate of transition based on a representative sample of business sector employees that covers years from 1997 to 2001 and consists of 409,277 individuals. This resulted in a total of about 1.4 million person-year observations.

18 Rantala's definition for a spinoff is that it is a firm with 2 or more workers, such that more than 60% of them are coming from other than the parent firm and that the group of people moving from the parent firm to the new firm does not account for more than 10% of the parent firm's work force.

19 The precise definition of this activity is given in Stenholm et al. (2009, p. 25): "*Early stage entrepreneurial activity (TEA) refers to nascent entrepreneurs and new business owners. Nascent entrepreneurs are defined as individuals aged between 18 and 64 who have taken concrete steps towards establishing a new business during the past 12 months. New business owners are adult individuals who are owner-managers of a firm, which has been paying salaries (either to owners or to employees) over 3 months but less than 42 months*".

20 Nor should one infer from this number how intense university-industry collaboration is overall. At least some indicators suggest that the Finnish business sector, especially established firms, collaborate actively with the university system.

21 It is important to emphasize that we are *not* particularly interested in the prevalence of small businesses or in the overall participation rate of population in self-employment or entrepreneurial activity, as measured for example by the number of SMEs or the ratio of established business owners to the adult population.

22 Fast growth firms are said to share a set of common characteristics that appear to transcend nationality and sector (Autio, 2008): They are rare, ubiquitous across geography and sector and innovative in products and/or processes. Fast growth is lumpy and volatile. Conversely, we do not know when exceptional growth will start, for how long it will occur and when it will decline again. The US seems to create more HGEFs than Europe and that surviving US firms tend to grow more rapidly than their European equivalents.

23 Calculated as a percentage of all SMEs with a non-negative growth rate of employment.

24 These SMEs account for 62% of the gross job creation of all SMEs with a non-negative growth rate of employment. These numbers are similar for years 2001–2004 and change only a little if one focuses only on the SMEs that have 10 or more employees at the beginning of the measurement period.

25 See also Deschryvere (2008) and the recent report "Kasvun mekanismit" (Kovalainen & Heinonen, 2009).

26 The precise definition is as follows: "*enterprises with average annualised growth in employees (or in turnover) greater than 20% a year, over a three-year period, and with ten or more employees at the beginning of the observation period*" (OECD, 2008b).

27 OECD (2008b) defines 'gazelle enterprises' as "*a subset of high-growth enterprises; they are the high-growth enterprises born five years or less before the end of the three-year observation period. In other words, measured in terms of employment (or of turnover) gazelles are enterprises which have been employers for a period of up to five years, with average annualised growth in employees (or in turnover) greater than 20% a year over a three-year period and with ten or more employees at the beginning of the observation period*."

28 Detailed descriptions of the individual public sector organizations and services provided can be found from a shared web portal of the organizations *EnterpriseFinland*., see *www.enterprisefinland.fi*.

29 Our table excludes for example the SME foundation.

30 http://www.tem.fi/?l=en&s=2383

31 See http://www.vigo.fi/

32 Työ- ja elinkeinoministeriö (2008).

33 See, e.g., the mimeo of The Ministry of Employment and the Economy (2009) released in early June. Tanayama and Ylä-Anttila (2009) provide a review of the literature on subsidies to business sector R&D and gives some recommendations on the desirable properties of such a subsidy scheme.

34 For some recent analyses and initiatives by the Ministry of Education (2009b, 2009a) (Yrittäjyyskasvatuksen suuntaviivat Opetusministeriön julkaisuja 2009:7 and Korkeakoulupohjaisen yrittäjyyden edistäminen Opetusministeriön työryhmämuistioita ja selvityksiä 2009:10).

35 We emphasize that besides those that we have listed, a number of other ongoing developments also have an effect on how the Finnish innovation system supports the creation of HGEFs. For example, the technology transfer framework of the higher education system is (and has been) subject to many simultaneous changes: They include but are not limited to: the ongoing reform of the Universities Act, the foundation of the so-called Strategic Centres for Science, Technology and Innovation (known as "SHOKs") that aim at enhancing cooperation between the academia and the business sector and the recent enactment of the new University Inventions Act (in early January 2007). See Tahvanainen (2009) for a brief review of these developments.

[36] Audretsch and Keilbach (2004) usefully see the entrepreneur as an economic 'catalyst' transmutating input resources to novel products and services.

[37] Here we mean that our analysis will be focused on the uptake and exploitation rather than the generation of new opportunities. It should not be taken to mean that Finland should not continue to strive to improve its innovative output.

[38] As Storey (1998) has noted in his study of the top decile of the fastest growing firms in the UK, factors that can discriminate for the most exceptionally successful companies may also similarly signal potentially failing companies. For example, a personal commitment to exceptional growth goals may be acceptable 'strategic stretch' for a high quality entrepreneur or conversely the irrational and ill founded hubris of a poorly trained and self deceiving business owner.

[39] Cassar (2006) investigates how the opportunity costs of entrepreneurs are related to the growth-orientation of their new firms.

[40] The more secure the rewards from remaining an employee, the greater the incentives necessary to change the people's perceptions of self-interest.

[41] However, efforts by the state to increase the status with which entrepreneurs are held in a society may indirectly influence such psychic benefits as public esteem and self regard. In the UK, entrepreneurs are increasingly becoming 'celebrities' and, as such, exemplars for many persons.

[42] Systematic evidence on this aspect of the Finnish innovation system is quite scant. The Ministry of Employment and the Economy has commissioned a study examining this issue (forthcoming later in 2009).

[43] Acemoglu and Shimer (2000) provide an economic analysis of this question, considering in particular the role of unemployment insurance.

[44] Figure 5.1 can be cr iticized, because Nokia accounts for a large share of the Finnish R&D expenditures. However, Nokia's R&D should also be seen as a source of new business ideas, like any R&D that is being done in Finland. Although the relative importance of Nokia and its R&D activities as a source of growth ventures is hard to determine, anecdotal pieces of evidence suggest that many of the most growth oriented ventures in Finland are related to the Nokia cluster and have founders or business angel investors that have either worked in Nokia or that have close connections to Nokia. It is also important to note that in Figure 5.1, the relative position of Finland is qualitatively similar when using scientific output (scientific publications per capita) as a measure of innovation intensity instead of the R&D expenditure.

[45] The increased role of public finance in early stage VC funds is a pattern replicated in several countries including the UK and the USA.

[46] In 1996, Murray and Marriott (1998) calculated via a cash flow model using UK and US data that the minimum viable size of an independent VC fund in 1996 was around €21 million. In 2009, updated estimates for Nightingale et al, 2009 indicated a minimum viable early stage VC fund size in the UK of circa £50 million.

[47] We acknowledge that collaboration between the various agencies of the Finnish innovation system responsible for supporting HGEFs has increased recently. The rotation of personnel between the agencies is a good example of this.

[48] It should be stressed that it has taken weeks if not months for us to determine and understand the various ways in which the Finnish innovation system supports potential HGEFs. Time is a scarce managerial resource and the owner-managers of HGEFs cannot spend a lot of time to learning what the public system can offer to them. Time-consuming public support services are therefore likely to be an ineffective means to support HGEFs.

[49] See e.g. the report by the Ministry of Employment and the Economy on the renewal of the Enterprise-Finland system (Työ- ja elinkeinoministeriö, 2008).

[50] See also the views put forward by Aiginger, Okko and Ylä-Anttila in Chapter "Globalization and business – Innovation in a borderless world economy" of this report.

[51] See also the analysis by Veugelers, Tanayama and Toivanen in Chapter "Education, research, and the economy" of this report.

[52] These instruments are heterogeneous and include various sources of funding, support services, programs and networks that are either directly aimed at supporting internationalization or that use internationalization as an allocation criterion. See mimeo titled "TEM-konsernin kansainvälistysmistoiminnan kehittäminen" (produced by Gaia Consulting Ltd) for an overview of the public activities that either directly or indirectly support the internationalization of Finnish innovations and firms.

[53] We also fully recognise that this benchmark will increasingly be the entrepreneurial spirit of an Asian or other non European community in a globalising world.

[54] Entrepreneurial orientation refers to a firm's strategic orientation and its pro-active mode of addressing business opportunity. See Rausch et al. (2009) for a review of entrepreneurial orientation and other factors influencing small business growth.

[55] An encouraging contemporary piece of anecdotal information supporting the more accepting attitudes of young people is the Aalto Entrepreneurship Society, a student initiative, that has already over 1000 members despite Aalto University not yet formally being incorporated.

[56] Some academic scientists may even be hostile to the introduction of entrepreneurship studies into student curricula. These subjects are seen as 'commercial', a term that is frequently used pejoratively.

[57] We emphasise that these conclusions are based on indirect evaluation and assessment. They are not the result of any complete or conclusive quantitative analysis of the extent to which the Finnish tax system encourages or discourages, say, a seasoned private sector manager or an expert with international work experience to establish a firm and to become an entrepreneur. Nor have we found any comparative analyses of how well or badly the Finnish dual income tax system addresses this challenge, for example relative to the tax systems of the other countries that are R&D intensive.

[58] How the planned R&D tax credit supports the creation of HGEFs cannot easily be inferred from the mimeo that The Ministry of Employment and the Economy released in June 2009 (The Ministry of Employment and the Economy, 2009). As we understand the planned new scheme, it provides firms with an incentive to use R&D *inputs*, but significantly it does not reward them for producing commercially successful innovations.

[59] See, for example, Kanniainen (2007) and the numerous analyzes and mimeos that the working group on the reform of the Finnish tax system has produced and commissioned. They are available from *http://www.vm.fi/vm/fi/05_hankkeet/012_veroryhma/06_esitysaineisto/index.jsp*. We acknowledge, in particular, that there are a number of desirable features that a tax system should ideally have and that guide the overall design of the system.

[60] See e.g., Henrekson & Sanandaji (2008) and Keuschnigg & Dietz (2007) and the mimeos produced and commissioned by the working group on the reform of Finnish tax system. Kari and Kröger (2009) provide a number of additional references. See also Crawford and Freeman (2008) who have explored the need to reform small business taxation in the U.K.

[61] General principles, like the "normal return to investment" in some tax models, do not seem allow for the additional expected return that entrepreneurial risk-taking demands. We acknowledge that this is a complex issue, but argue that paying attention to the (risk-taking) incentives of the (potential) owner-managers of HGEFs is very important.

[62] The Minister of Finance is the permanent member of the Research and Innovation Council. Interestingly, the minutes of the meetings of the Council reveal that, in the past, the Minister of Finance has rarely participated in the formulation of the innovation policy. This is despite the Council being the premier forum for such policy-making.

[63] The need for the greater involvement of the Ministry of Finance in the design of growth-enhancing policies has already been recognized. The remit and associated work of the working group on the reform of the Finnish tax system is a concrete example of this change. Another example of the Ministry's efforts to meet this need is evidenced by the report on HGEFs that it published recently (Rainio, 2009). This report, however, pays only limited attention to the importance of tax system in creating entrepreneurial incentives. We also acknowledge that the Ministry of Finance has been involved in the design of innovation and entrepreneurship policy at many formal and informal levels. However, the point we want to emphasise is that taxation has not in the past been seen as a concrete means to enhance the effectiveness of the Finnish innovation system and the sustaining of longer-term economic growth. The recent plans to introduce a new scheme for R&D tax credits can also be interpreted as a step towards the greater involvement of the Ministry of Finance.

[64] The UK's HM Treasury has a Business and Enterprise Unit as well as a Growth and Enterprise Tax team involved in tracking and responding to entrepreneurship and small business policy developments in other ministries including the Department of Business, Innovation and Skills.

[65] In his recent assessment of the Finnish high growth entrepreneurship, Autio (2009) concludes that "*high-growth entrepreneurship merits specific attention in a national innovation strategy because of the direct economic potential associated with the phenomenon*".

[66] The authors of this analysis recognise that calls to streamline and segment the present public support systems may generate significant opposition as present organizational objectives and responsibilities are challenged.

[67] The creation of HGEFs calls for a range of integrated resources and incentives to be quickly made available in order to promote, accelerate and sustain exceptional firm growth. This support should not exclusively be addressed to start up and early stage firms. It needs to be recognised that accelerated firm growth can occur at different times in a firm's life cycle (Ács, Parsons, & Tracy 2008).

[68] The distribution of responsibilities for the policies relevant to enhancing the creation of growth ventures and the control of resources available to support the policies should be evaluated critically and reconsidered. At the moment, the responsibilities seem to be somewhat scattered around the Ministry. For example, the Group responsible for Entrepreneurship Development and Enterprise Support is a part of Employment and Entrepreneurship Department of the Ministry, the Group responsible for Growth Ventures is

a part of the Innovation Department, whereas a number of agencies and institutions providing support to new entrepreneurs and growth ventures are steered by the Ministry's Corporate Steering Unit.

[69] Entrepreneurial culture and tax incentives are complementary, if the effect of the former magnifies the desired effect of the latter.

[70] See e.g. Autio et al. (2007) for a review and categorization of entrepreneurship policy measures.

[71] Besides their role in enhancing entrepreneurial culture, Finnish universities have a number of other roles to play in the creation of HGEFs. One of them is technology transfer. The available evidence indicates that the university system has not been a systematic source of science- or knowledge-based HGEFs. One of the questions on which policy-makers have to take a stance is whether universities are given an incentive to maximize their revenue (e.g. licensing or IPR income) from university innovations and spin-offs or whether they are rewarded for creating potential HGEFs.

6. Local Innovative Activity and Regional Productivity: Implications for the Finnish National Innovation Policy

Gianmarco I.P. Ottaviano, Aki Kangasharju, and Mika Maliranta*

Finland as a whole would benefit from redesigning its policy combination in order to foster the reallocation of its resources to their most productive uses.

In redesigning the policy combination due attention should be paid to creative accumulation and creative destruction. It is important that different policies clean up their acts following a sound division of labour.

Innovation policy should celebrate firms that endeavour to move the current technology frontier forward no matter where they are actually located, even when they happen to locate in 'advantaged' regions. Innovation policy should also foster the diffusion of knowledge by helping inefficient firms adopt more efficient production methods.

Product and labour market policies should be used to grease the wheels of creative destruction. In particular, competition policy should be used to promote the entry of new innovative players. It should also stimulate the reallocation of market shares from less to more efficient competitors.

Regional imbalances should not be of any concern for innovation related policies, no matter whether promoting knowledge diffusion contributes to regional convergence or peddling creative destruction increases regional disparities. Any regional agenda may lead to slower productivity growth and cumulative losses in value added.

Social equity should be targeted through traditional redistributive tools by targeting 'disadvantaged individuals' rather than 'disadvantaged regions'.

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6.1. INTRODUCTION

This chapter investigates the regional dimension of the Finnish national innovation system. The investigation is organized in three parts.

Section 6.2 identifies the aspects of the national innovation system that have regional relevance. It argues that, while the innovation policy of Finland is inherently national, there is nonetheless an important regional dimension. To some extent, such a regional dimension materializes because regional policy largely shares the same tool box with national innovation policy. As a result, innovation policy and regional policy have created a complicated system in which both target similar objectives though with somewhat different emphasis. Both focus on innovation, competitiveness and renewal. Officially, innovation policy does just that without any other agenda. However, large part of regional policy shares the same objectives and tools, using these to allow 'disadvantaged' regions to catch up with the rest of country.[1] Due to these similarities and overlaps, in practice it is very difficult to distinguish between innovation policy conducted across regions and regional policy focused on innovativeness and renewal per se.

This combination ends up supporting 'disadvantaged' regions disproportionately. In particular, while regional policy does so by definition, to some extent the same bias towards 'disadvantaged' regions can also be found in innovation policy. This does not necessarily imply a conflict between policy objectives as long as such bias succeeds both in fostering innovation nationwide and in decreasing regional disparities. It becomes, instead, problematic whenever the support to 'disadvantaged' regions hampers innovation and growth at the national level. In this case the risk is that firms in 'disadvantaged' regions become dependent on public support, being tied to those regions only thanks to such support. As a result, the biased combination of regional and innovation policies might have an impact similar to the lack of competition, giving rise to sclerosis at the firm level and paralysis of firms' own innovation incentives and, thus, hampering healthy restructuring. In other words, the opportunity cost of maintaining the regional bias of regional and innovation policies has to be evaluated taking into account not only the direct costs of the programs involved but also the costs arising from lower productivity and slower renewal at the national level.

Potential conflict of interest between innovation and regional objectives deserves due attention, since government uses substantial amounts of public funding to both purposes. The budget for 2009 shows that TEM will be using 512 million euro for regional development (including national and EU funding) and 736 million for the innovation policy. These are not the only resources for innovation and regional policies. Some evaluations calculate, for example, that all national funds allocated to regions by some regional characteristics total up to 5 billion euro annually (ALKU, 2008). Of course, not all of these resources are used directly to improve the competitiveness or the renewal of regions. They are all, nonetheless, used to 'develop' regions in one way or another. Moreover, total public support to private R&D is 1.9 billion euro in 2009. Again, not all of this money goes directly to the innovative activity of private firms, but it all supports that activity either directly or indirectly.

As a preliminary step towards evaluating regional effects of public support motivated by innovation and regional goals, Section 6.3 provides a map of competitiveness across Finnish regions. The underlying idea is that, for nations as well as regions, the best measure of competitiveness is productivity and the contribution of innovation policy to productivity growth is ultimately the best measure of its success. In particular, since firms' capabilities and incentives are the key drivers of regional productivity, a promising strategy to analyze the working of the national innovation system at the regional level is to look at the evolution of firm-level productivity across Finnish regions. This is possible for Finland thanks to the exceptional richness of its firm-level databases.[2]

There are two main findings in Section 6.3. First, productivity is lower in 'disadvantaged' than 'advantaged' regions and the gap has been growing in recent years.[3] This divergence is mostly due to the fact that more productive firms are able to achieve larger employment shares in 'advantaged' than 'disadvantaged' regions. Second, in all regions new firms have a lower labour productivity than incumbents but especially in Services the productivity gap is smaller in 'advantaged' than 'disadvantaged' regions. The productivity gap is particularly high in the most 'disadvantaged' region (i.e. Object 1 region of the EU). Accordingly, Finland has experienced a growing divergence in regional competitiveness and the main reason seems to be the relatively lower efficiency of new firms and the relatively smaller size of efficient firms in 'disadvantage' than 'advantaged' regions. In other words, the source of regional divergence seems to be a misallocation of resources in 'disadvantaged' regions between efficient and inefficient firms both in terms of incumbents and in terms of entrants.

Against this background, Section 6.4 checks whether the way national innovation policy is conducted across Finnish regions plays a role. In so doing, it focuses on two types of public support. One is clear innovation support provided to firms (in terms of direct subsidies, loans and guarantees) by the Finnish Funding Agency for Technology and Innovation (Tekes). The second one includes both modern support for renewal and the more traditional support of regional policy, provided by the former ministry of trade and industry (currently ministry of employment and economy), EU structural funds or Finnvera[4]. The main findings of this section are rather intriguing, even though they have to be handled with some care due to limited data availability. First, public support to innovation has a negative impact on industry productivity in 'disadvantaged' regions and a positive impact in 'advantaged' regions.

Second, this happens because in 'advantaged' regions innovation support fosters the reallocation of employment towards *more* efficient firms whereas in 'disadvantaged' regions it fosters the reallocation of employment towards *less* efficient firms. Accordingly, the (unspoken) regional bias in national innovation policy seems to contribute to the misallocation of resources that drives the recent divergence in competitiveness between Finnish regions.

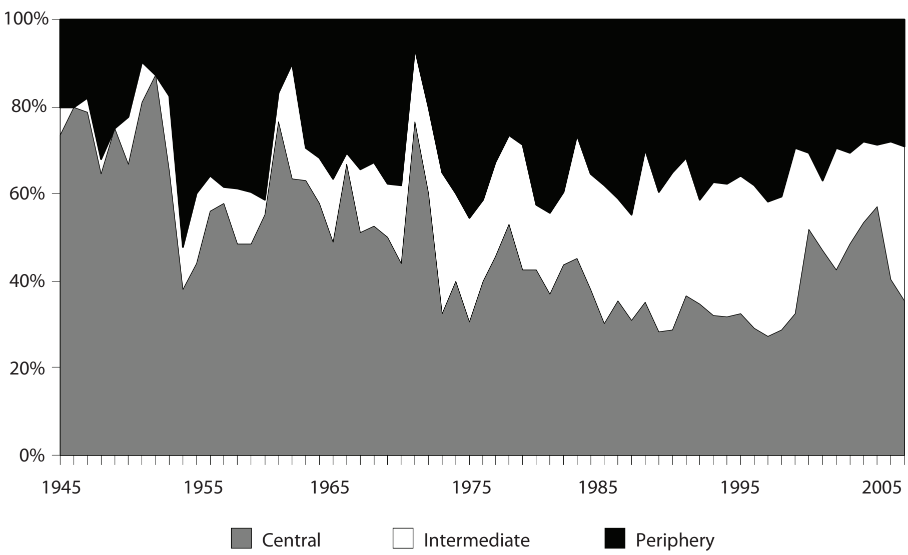
The policy implications of these findings are discussed in Section 6.5, which concludes the paper.

6.2. THE REGIONAL DIMENSION OF NATIONAL INNOVATION POLICY

Innovative activity is highly concentrated regionally. The Helsinki sub-region, accounting for one third of the Finnish gross domestic product and one fourth of the population, conducts 40% of R&D investments in Finland.[5] The six largest sub-regions (out of a total of 77 sub-regions) account for 83% of the all R&D investments in 2007. R&D activity has become even more concentrated over time. In 1995 the six largest sub-regions accounted for 77% of the total R&D.

R&D activity is an input in the innovation process. Regional concentration also shows up in the innovation outputs, actual innovations (see e.g.

Figure 6.1. Geographical distribution of innovations in Finland in 1945-2005



Source: VTT Sfinno database of significant Finnish innovations (Hyvönen & Saarinen, 2009).

Valovirta et al., 2009). As shown in Figure 6.1 for example, product innovations have been made increasingly more in centres than periphery (see e.g. Valovirta et al., 2009).

These features raise a question as to whether this regional pattern is economically and politically acceptable. Should innovation policy ignore regional pattern and consider it only as a natural outcome in a globalised world, or should it take the regional dimension into account and aim at reducing regional variations? Currently, the innovation policy of Finland is inherently national. This section argues that, although it is not easily admitted, there is nevertheless an important regional dimension, to some extent linked to regional policy.

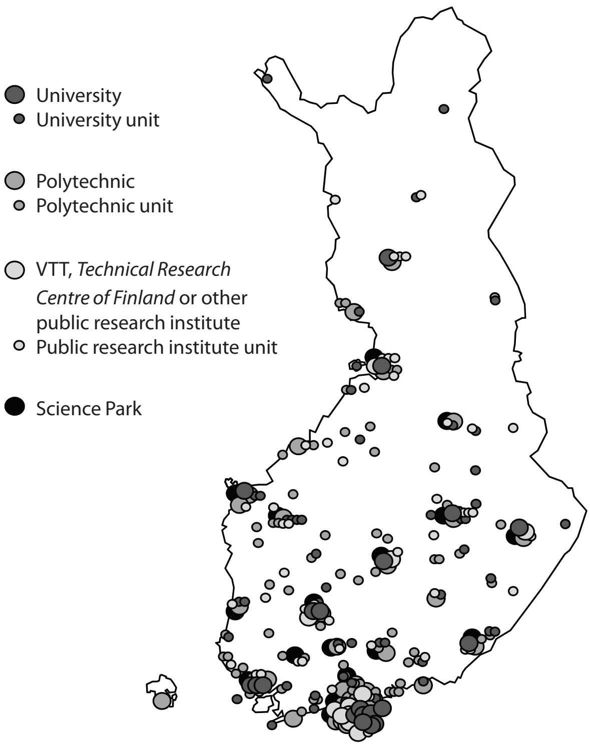
6.2.1. IS THERE ANY 'REGIONAL' INNOVATION POLICY?

According to the responsible ministry (the ministry of employment and economy, TEM), there is basically only one rationale behind 'regional' innovation policy. It aims at seeking innovative potential in all regions by reducing the information gap of the local actors. The information gap varies far more by the size than the location of firms. Therefore, the main target group consists of the small and medium sized enterprises (SMEs) all over Finland. Besides information, the SMEs often lack ambition. Hence, another aim of the policy is to motivate small and medium sized firms everywhere in Finland. The role of the national innovation policy is seen as important also in coordinating local and regional actions and educating local actors in the development work (Viljamaa et al., 2009).

Building networks between firms, local governments, private developers, regional councils, polytechnics and universities is a crucial expedient for achieving these objectives. Accordingly, regional innovation policy develops capacities and favourable environments for innovations all over Finland. A signal of this policy is the strong presence of public ventures in peripheral regions (Figure 6.2). Section 6.2.3 below describes further how regional network building is an integral part of national innovation policy instruments, particularly in the Centres of Expertise, CoE, programme.

Together with building capacities for innovation all over Finland, the public sector provides more direct support to innovative firms in terms of subsidies, loans and guarantees. Although the official statements and the EU competition legislation argue that building favourable business environments is preferred to direct business subsidies, direct aid is nevertheless sizable. The Firm Support panel, compiled by Statistics Finland together with the ministries involved, shows that in 2006 the Finnish government delivered 490 million Euros of public support in a form that allows individual recipient firms to be identified.[6] Table 6.1 shows the sources and support amounts per person in the recipient firms. It appears that support from Tekes was the highest, 152 euro per employee, and that from MTI (KTM) was the second highest, 125 euro per employee.

Figure 6.2. Geographical distribution of public R&D units



Source: Tekes.

Table 6.1. Business support in terms of direct subsidies, loans and guarantees

	TEKES	MTI	Agriculture	Labour
2001	121.9	88.7	9.2	n/a
2002	117.3	97.6	9.3	n/a
2003	118.8	86.1	13.4	32.1
2004	130.2	98.1	16.5	38.2
2005	136.4	109.8	15	37.5
2006	152.6	125.6	4.8	44.2

Source: The Structural Business Statistics data and the Firm Support panel. MTI = Ministry of Trade and Industry.

The official national innovation policy does not recognize regionally differentiated criteria. To investigate this we focus on the business sector and compare the productivity levels across groups of regions classified according to the eligibility to Structural Funds 2000–2006. This classification gives the four groups of regions shown in Figure 6.3, namely:

- Objective 0 regions (white)
- Objective 1 regions (black)
- Objective 2 regions (dark grey)
- Phasing-out regions (grey)

Figure 6.3. Structural funds coverage 2002–2006

Notes: Objective 0 regions (white), Objective 1 regions (black), Objective 2 regions (dark grey), Phasing-out regions (grey).

It appears that firms in the Southern Finland (regions 0) receive more Tekes funding per employee than firms elsewhere in Finland (Table 6.2). For example the Tekes support in the region 0 was 180 euro per employee, whereas it was 109 Euros for the firms in the Eastern and Northern Finland (regions 1). These aggregate flows are mainly accounted for by differences in industrial structure. We do not find economically or statistically significant differences in the support intensity between those two regions when industrial structure is taken into account by means of an OLS regression model.

Table 6.2. Business support by source in 2006, euro per employee

Objective region	TEKES	MTI	Agriculture	Labour
0	178.7	38.5	1	31.1
1	108.9	532.4	35.8	95.6
2	87.9	221.1	1.5	64.4
4	93	147.9	1.4	48.7

Notes: Basically all business sector industries are covered from "Mining and quarrying" (Nace 10) to "Sports activities and amusement and recreation activities" (Nace 93) excluding Financial and insurance activities (Nace 64–66) according to the standard industrial classification (Nace Rev. 2). MTI = Ministry of Trade and Industry.

A different picture emerges when we look at the probability of receiving any support from Tekes. Firms in regions 1 receive support more often than firms in regions 0 even after controlling for industrial structure (with 32 industry dummies) and firm size (with log of the number of employees). A similar finding is obtained by Einiö (2009). This result is consistent with the view that there seems to be a regional bias among the smallest firms.

The regional bias towards 'disadvantaged' regions is more pronounced in terms of support from other sources, which we call 'non-innovation' support. Firms in Northern and Eastern Finland (Region 1) receive much more non-innovation support than firms located elsewhere in Finland. For example, MTI support in regions 1 was 530 euro per employee in 2006, whereas it was 109 Euros in regions 0. A simple regression of total non-innovation support (calculated by summing up all funding sources different from Tekes) per employee in the four regional groups shows that, after controlling for industrial structure, firms in regions 1 obtain 412 Euros more than firms in regions 0.[7]

Table 6.3 shows that the regional bias in MTI support is accounted for by investment subsidies. In particular, firms in regions 1 obtained 444 euro per employee investment subsidies in 2006.

Table 6.3. MTI support by type in 2006, euro per employee

Objective region	Energy	Investment	Internationalization	Production environment	Other
0	3.8	22.1	6.1	1.4	5
1	6.8	444	15.4	4.6	61.6
2	10.8	175.2	8.9	6.2	19.8
4	15.5	111.9	3	0.8	16.6

A part of the projects supported by investment subsidies may include R&D investments, making it eventually difficult to distinguish between innovation and non-innovation support. However, though it is very difficult to draw a clear line between innovation and non-innovation support, our statistical analysis shows that, net of Tekes, public funding shows a clear propensity to favour 'disadvantaged' regions. This clearly indicates the presence of regional policy objectives behind these non-innovation tools.

The regional bias in non-innovation support towards 'disadvantaged' regions seems to indicate that there is a parallel agenda in innovation policy. This is linked to traditional regional intervention aimed at fostering regional convergence and a balanced regional economic structure by delivering support to firms in 'disadvantaged' regions more easily than to those in 'advantaged' regions.

More generally, on the one hand, part of traditional regional policy shares the aims of 'pure' national innovation policy. On the other hand, official innovation policy emphasises the broadness of the concept of "innovation", which essentially refers to all kinds of productivity growth (due to process, product or organisational innovations) in all kinds of firms (efficient and inefficient firms). As a result, the borderline between "innovation" and "non-innovation" policies is blurred on both sides, potentially confusing the spheres of responsibilities in the conduct of policy intervention.

Actually, it is unofficially admitted by high ranked civil servants that there are double standards favouring 'disadvantaged' regions. The overall results from the survey questionnaire conducted as part of the present evaluation process are in line with these views. In particular, a clear majority of the respondents answered 'yes' to the following survey question: "Would you say the NIS promotes also the agendas of regional policy"?

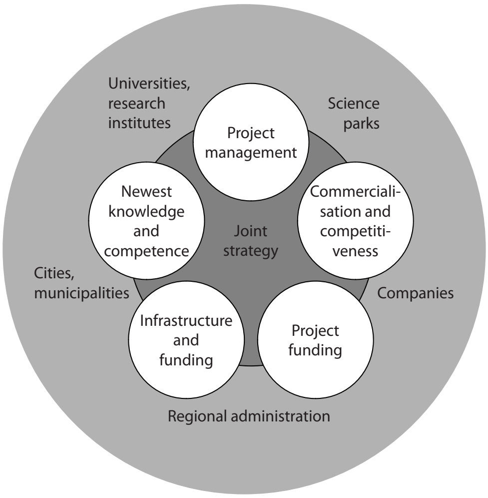
6.2.2. PREPARING AND CONDUCTING REGIONAL (INNOVATION) POLICY

The responsibility for regional development rests with the State, municipalities and Regional Councils acting as regional development authorities. However, there are many players involved as detailed in Figure 6.4.

The State and the ELYs

The common targets of regional development in Finland are based on the Regional Development Act and the "Government decision on national regional development targets". The decision directs and coordinates regional strategic programmes, the regional development targets, and the use of policy tools in different administrative sectors. In their activities, State authorities take ac-

Figure 6.4. Partners at the regional level



Source: Tekes/TEM.

count of the national regional development targets, promote the implementation of these targets and evaluate the impact of their measures on regional development.

TEM is the responsible ministry preparing and conducting the innovation policy as well as its regional dimension. The state conducts the regional policy mainly in ELYs (Centre for business and industry, transport and the environment), former TE-centres. ELYs serve the entire economy. They provide expertise and regional services of the Ministry of Employment and the Economy, the Ministry of Agriculture and Forestry and the Ministry of the Interior. In ELYs, customers also have access to the services provided by Tekes. A total of 15 ELYs' services are designed for:

– companies' product development, technology, internationalisation, business management development and financing;
– entrepreneurs starting their business, company establishment counselling and other, closely related activities;
– employment promotion, adult education and employment services, as well as the management of employment office activities;
– specialisation of farms, rural industries and fishery and the enhancement of their operating conditions, as well as the supervision of farm subsidies.

Regional councils

Finland is divided into 19 regions, plus the autonomous province of Åland. Finland's Regional Councils are statutory joint municipal authorities operating according to the principles of local self-government.

Regional councils are legally responsible for the planning and development of their respective areas. As regional development authorities, they are charged with responsibility for the Regional Plan, the regional programme and drafting the regional land use plan. These are formulated in cooperation with representatives of state and municipal administration, the business sphere and other specialists. The Regional Plan sets guidelines for regional development over the long term (20–30 years). The drafting of plan involves the participation of state and local government officials, the business sector, establishments providing education and training, a variety of organisations and individual citizens. All other development plans and programmes affecting the region are based on this document. For example, the 3–5-year regional programmes reconcile and direct, in accordance with guidelines laid down in the regional plan, the development programmes and resources of the European Union, state and regions.

The councils operate as regional development and regional planning authorities and are thus the units in charge of regional planning and looking after regional interests. On the basis of municipal democracy, they articulate common regional needs and work to promote the material and cultural well-being of their regions. They have also other tasks besides their statutory responsibilities. The delegates on the decision-making bodies of the councils are influential political appointees of the member municipalities. They represent the political will of the inhabitants of the region according to the results of local elections. In their work the emphasis is on both long-term planning and rapid reaction on current affairs. In addition, the councils implement and coordinate a number of various national and EU projects. Planning for a region covers a strategic regional plan, a regional plan and a regional development programme as well as its implementation plan. A strategic regional plan is the fundamental document when developing a region.

Municipalities

Municipalities have their own (tax based) resources to promote innovation and other business activities. They also utilise the national and EU funds in development projects. Large cities have considerable resources to promote business development. The role of municipalities in the regional innovation policy is further discussed in Chapter "Broad based innovation policy" of this report.

Local developers

Public and private developers are mainly science parks and technology centres providing networks and premises. Technology centres, for example, provide three types of support: incubation, development programmes, and premises. Measured by the number of corporate customers, Technopolis is one of the Europe's largest technology centre operators. Technopolis works to discover new companies and helps them grow and succeed. It combines modern premises with business and development services into one package to provide the optimal environment for high tech companies.

6.2.3. INSTRUMENTS OF THE REGIONAL (INNOVATION) POLICY

The regional innovation policy is mainly implemented through the Centre of Expertise Programme (CoE). The policy for 'large urban regions' helps to deepen and strengthen the division of labour and specialisation between urban regions in terms of national innovation policy. The Regional Centre Programme (RCP) also aims at improving the innovativeness and knowledge base of regions in accordance with the national targets.

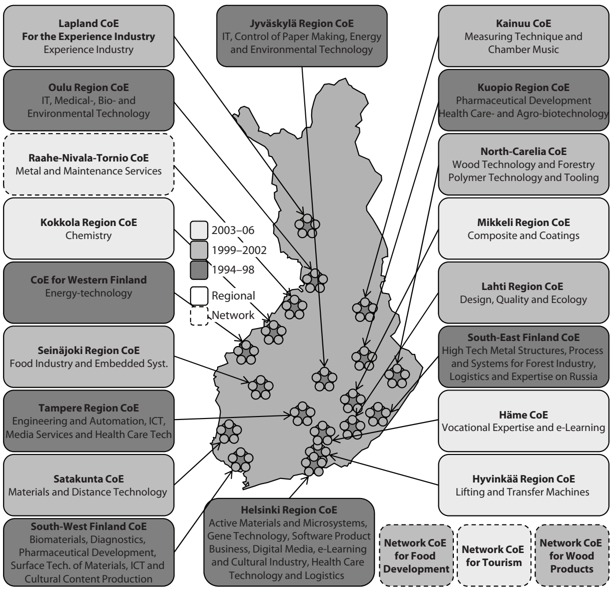
Centre of Expertise Programme (CoE)

The Centre of Expertise Programme plays an important role in the national growth strategy based on information and expertise. The programme is designed to pool local, regional, and national resources to the exploitation of top-level expertise. The programme supports regional strengths and specialisation and furthers cooperation between the centres of expertise. The programme was first launched in 1994. Since then the number of centres has evolved as shown in Figure 6.5.

The centres, which were appointed by the Government for a term running from 2007 until the end of 2013, implement the programme at the local level. Moreover, 13 national Competence Clusters which will be implemented by 21 Centres of Expertise have been nominated to the Centre of Expertise Programme for the years 2007–2013. The competence clusters and Centres of Expertise represent top expertise in their respective fields (Figure 6.6).

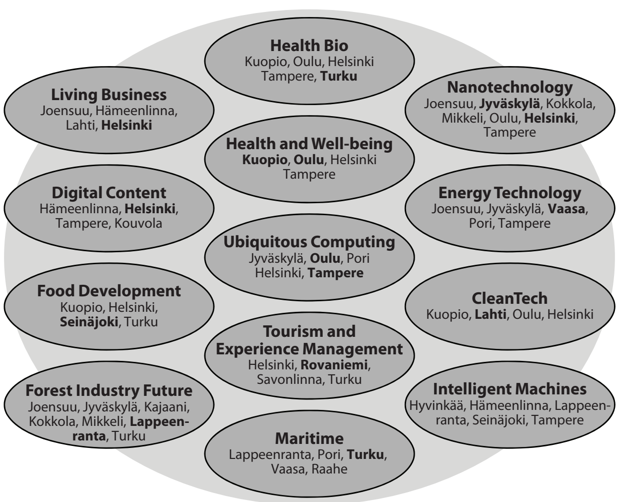
The centres of expertise launch cooperation projects between the research sector, educational institutions, and businesses and industry. These projects boost the productivity of companies, strengthen and improve regional expertise, create new businesses and promote the creation of new innovation environments. The number of enterprises participating in the programme has increased every year. Over 5 000 enterprises has participated, most of them being small enterprises with under 10 employees. The objective is that 6 000 companies before the year 2010 and 8 000 before 2013 participate in the implementation of the programme.

Figure 6.5. Centres of expertise



Source: TEM.

Figure 6.6. Competence clusters



Source: TEM.

The Centre of Expertise Programme channels regional and national resources in order to make the best use of excellence. It supports regional strengths and specialisation as well as partnerships between Centres of Expertise. The Programme focuses on business development and the capitalisation of selected fields of global excellence. During the 2007–2010 programme period, basic funding for the Centre of Expertise Programme will be channelled in particular towards developing global excellence in a few strong fields, thus giving more weight to large urban regions as actors implementing both regional and national innovation policy.

Large urban regions

As major generators of innovation, knowledge and skills, large urban regions greatly influence the overall success, welfare and economy of the country. Large urban regions compete on the world market by attracting businesses to Finland. Urban regions have the best opportunities to attract capital, businesses and skilled labour. For the regions to succeed amongst this global competition, their special role should be taken into account in regional development measures. Supporting the globally competitive skills base is one of the most important objectives of urban policy. For the development of innovation strategies and the productivity of urban regions, the key factors include training, research, the application of research results, the development of businesses, transport and infrastructure, and securing the availability of skilled labour. The main objective of the urban development policy is to promote vitality, well-being and cooperation and to strengthen the productivity of urban regions, which are diverse both in terms of their special characteristics and size. The development tools for urban policy are provided by the Regional Centre Programme, while implementation of the policy mix for large urban regions will be based on the Regional Centre and the Centre for Expertise Programmes.

Besides urban policy Government is reinforcing the development of the largest urban areas by metropolitan policy. The metropolitan policy will focus on the following issues:

- strengthening the global productivity of the largest urban regions;
- strengthening the cohesion of social structures;
- preventing social and regional divisions.

Regional Centre Programme (RCP)

The aim of the Regional Centre Programme is the development of a network of regional centres covering every region/province, based on the particular strengths, expertise and specialisation of urban regions of various sizes. Regional development based on a network of regional centres aims at promoting a more balanced regional structure and enhanced international competitiveness. In the future, the resources of national regional policy are meant to be expressly directed to regional centres, and to the enhancement of their network.

The Regional Centre Programme is implemented on 35 regions. It was launched in March 2001. The second programme period continues from 2007 until the end of 2009. RCP shows that Finland is still inclined into balanced regional development. Whereas CoE focuses on the top expertise in a few clusters and cities, the RCP aims at spreading economic growth into the middle sized cities.

Cohesion and Productivity Programme (CoCo)

The new Cohesion and Productivity Programme will unite several national programmes and traditional regional development programmes. RCP, the policies for large urban regions, the rural programme, and the island development programme will be united into a CoCo programme during 2009–2013. Interestingly, even the policy packages including traditional tools are named according to competitiveness and productivity.

Structural Funds

EU structural funds have a connection to the Finnish regional innovation policy, as the EU-programmes also aim at improving the productivity of regions. Figure 6.3 above shows the classification of Finnish regions into four groups on the basis of eligibility of Structural Funds 2000–2006. Structural funds provide additional funding for the national innovation policy. For example, ERDF funds can substitute for Tekes funding in 'disadvantaged' regions. The EU programmes are a good example how the objectives of renewal and regional cohesion are aimed jointly. For example the Regional Competitiveness and Employment objective focus on research, innovation, accessibility, the creation of jobs, and investment in human capital.

To summarize, although it is not easily admitted, there seems to be a regional bias in innovation policy favouring 'disadvantaged' regions. This bias looks complementary to more traditional tools of regional intervention such as the EU structural funds.

Regional objectives may be pursued in different ways. One way is to combine EU structural funding with the national policy tools. For example, Tekes funding is amended by ERDF in disadvantaged "Objective" regions.

ERDF is a major regional development fund in the EU. Clients (firms or research institutes) apply for funding from Tekes, where the civil servants evaluate whether the project can be funded from the national or EU funds. The advantages of the ERDF funds include a higher subsidy rate, which is 50% (that of Tekes funds is 25%). The disadvantages of the ERDF funds include higher bureaucracy relative to the national Tekes funding. These differences in the funding sources may lead to a systematic sorting of firms with different innovative capabilities, which in turn may show up in differences in productivity.

Another source of regional bias is the direct measures of some authorities to help innovation in 'disadvantaged' regions. For example, Finnvera has an interest rate subsidy for firms operating in those regions.

6.3. REGIONAL DIFFERENCES IN COMPETITIVENESS AND THEIR SOURCES

For nations as well as regions, the best measure of competitiveness is productivity and the contribution of innovation policy to productivity growth is ultimately the best measure of its success. Almost by definition, productivity grows when a firm puts to use ideas that are not previously employed in the firm and does it in a commercially profitable manner. Thus, a comparison of productivity patterns across Finnish regions is a useful approach to evaluate the impact of the regional dimension of the Finnish innovation system. In particular, since firms' capabilities and incentives are the key drivers of regional productivity, a promising strategy to identify potential problems in the innovation system is to look at the evolution of firm-level productivity. This is possible thanks to the exceptional richness of Finnish micro-level databases (see endnote 1). The analysis below is related to two recent studies on regional productivity in Finland. Kotilainen (2009) investigates regional vitality and competitive advantage, and Huovari and Lehto (2009) scrutinize determinants of regional productivity in Finland.

Data come from the firm-level Structural Business Statistics data (SBS data) that basically cover all firms in the Finnish business sector excluding some industries, for example Finance and Insurance. We have excluded firms that employ "less than one person" (in terms of average number of employees per year). Furthermore, we have dropped outlier observations, such as firms that have negative value added.

We measure the competitiveness of a region in terms of the average labour productivity (value added per person) of its firms. Specifically, we start with computing labour productivity for each firm in each industry in each region. Then, we calculate the labour productivity of an industry in a region as the sum of its firms' labour productivities weighted by their shares of regional employment. Finally, we evaluate the productivity of a region as the sum of its industries' labour productivities weighted by their shares of national employment. By using national rather than regional weights in this last calculation, we net out the differences in regional productivities that may arise from different sectoral composition.

Since the productivity of an industry is given by the average of its firms' productivities weighted by their employment shares, it may differ across regions because its firms' productivities differ or because the employment shares of firms at the various levels of productivity differ. The second source of variation matters as long as a firm's productivity and its employment share are linked. Indeed, one can come up with several reasons why they should be linked even though it is not a priori obvious whether higher productivity comes with larger employment share or not. For example, one could argue that large firms can exploit economies of scale in production. Someone else could stress, instead, the fact that large firms may suffer from inertia in reacting to market conditions.

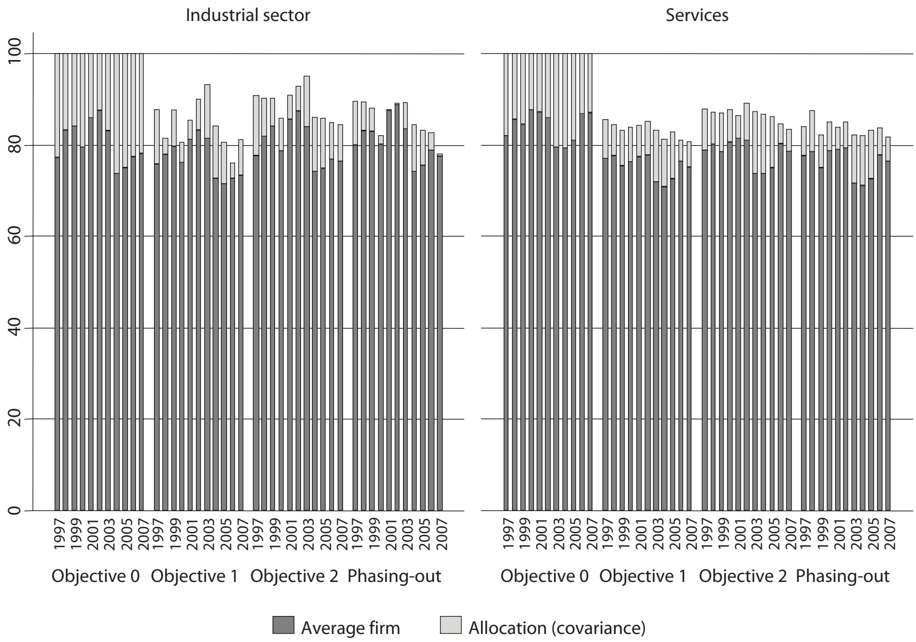
6.3.1. LABOUR PRODUCTIVITY AND THE MICRO-LEVEL ALLOCATION OF EMPLOYMENT

The two sources of variation in industry productivity across regions can be disentangled by decomposing industry productivity in two components: 'productivity per firm' measuring the simple (i.e. unweighted) average productivity; 'allocation' measuring the relationship of firms' employment shares with their productivities.[8] This second component is positive when larger employment share is associated with higher productivity. It is negative when larger employment share is associated with lower productivity. It is zero when employment share and productivity are unrelated. Concretely, the allocation component is calculated as the difference between weighted average productivity (i.e. industry productivity) and unweighted average productivity (i.e. productivity per firm).[9]

For the analysis, the industries are classified into two sectors; Industrial sector (Nace 10–43) and Services (Nace 45–92). The results of the productivity decomposition by sector, region and year are shown in Figure 6.7. For each year the productivities of the different groups of regions are normalised so that the productivity of Objective 0 regions equals 100.

Five interesting results emerge. First, the allocation component is always positive, thus revealing that more productive firms have larger employment shares. This holds true for the both sectors considered here. Second, productivity is 10–20 percent lower in 'disadvantaged' regions (Objective 1, 2 and phasing-out) than in 'advantaged' regions (Objective 0). Third, most of the productivity gap between 'advantaged' and 'disadvantaged' regions

Figure 6.7. Decomposition of productivity levels across Finnish regions



Notes: Business sector, Object 0 region = 100. Decomposition has been made separately for each of the 18 industrial sectors and 11 services industries. The industry-level results are aggregated to the sector level by using the national industry shares. Labour productivity is measured by value added per person. Observations from 1997–2007. Data source: Firm-level structural statistics database of Statistics Finland.

can be attributed to the positive allocation component. Fourth, the productivity gap between 'advantaged' and 'disadvantaged' regions shows a widening tendency. Fifth, the main driver of diverging productivity between 'advantaged' and 'disadvantaged' regions is the allocation component that increases more in the former than in the latter regions.

We can summarize these findings as:

Fact 1. Productivity is lower in 'disadvantaged' than 'advantaged' regions and the gap has been growing in recent years. This divergence is mostly due to the fact that more productive firms are able to achieve larger employment shares in 'advantaged' than 'disadvantaged' regions.

All in all, the results point to the importance of the micro-level allocation as one key factor in explaining the productivity performance of regions and its changes over time.[10]

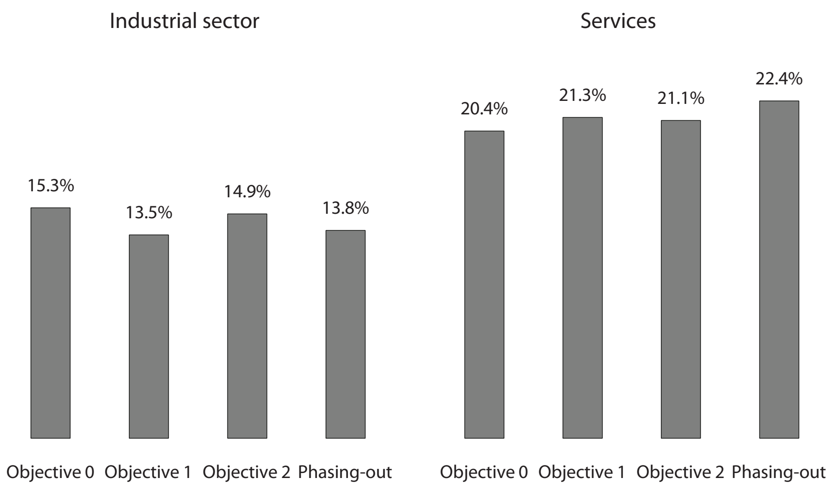
6.3.2. THE ROLE OF NEW FIRMS

Productivity per firm and allocation may change because of changes in the productivities of incumbents as well as in their market shares. They may also change because of the entry of new firms. This entry process may follow different patterns in different groups of regions. For example, one may argue that regional policy encourages high productivity firms to make an entry in 'advantaged' regions while low productivity firms self-select into 'disadvantaged' regions (e.g. Baldwin & Okubo, 2006).

To examine the role of new entrants, we classify firms in two groups: those who did not exist three years earlier (the 'entrants') and those who already existed (the 'incumbents'). We then extend the previous decomposition by distinguishing the contribution of entrants to industry productivity. The entry component is positive (negative) when the weighted average productivity of the new firms is higher (lower) than the weighted average productivity of the incumbents. The magnitude of the effect depends on the market share of entrants. Additional details can be found in Appendix.

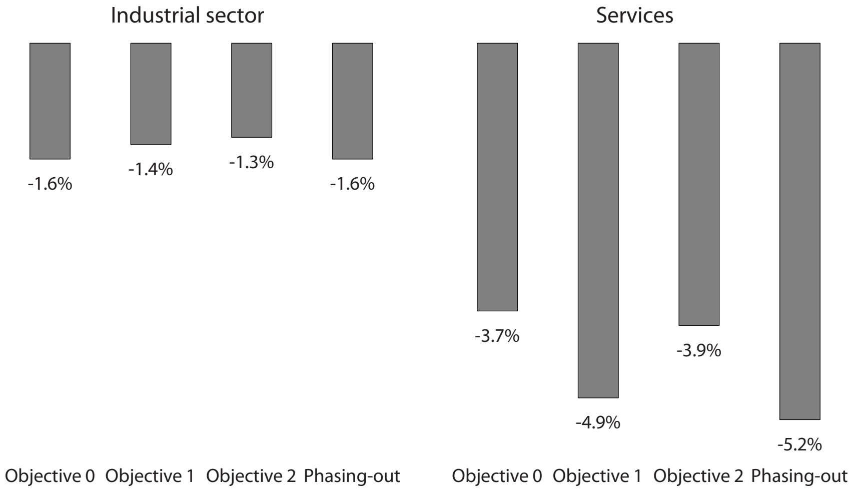
Figure 6.8 shows that the industry employment shares of entrants are between 13.5 and 22.4 percent varying by sector and region. The employment shares of entrants are larger in 'advantaged' than 'disadvantaged' regions in the Industrial sector but in Services the situation is the opposite. Additional

Figure 6.8. Market shares of entrants



Notes: The bars depict employment shares of new firms; averages of years from 1997 to 2007. Entrants are those that were not found in the market three years earlier (some of them may have existed ealier so that they have made a re-entry). Computation has been made separately for each of the 18 industrial sectors and 11 services industries. The industry-level results are aggregated to the sector level by using the national industry shares. Data source: Firm-level structural statistics database of Statistics Finland.

Figure 6.9. The contribution of the entrants to industry productivity



Notes: The bars depict the entry component; averages of years from 1997 to 2007. Computation has been made separately for each of the 18 industrial sectors and 11 services industries. The industry-level results are aggregated to the sector level by using the national industry shares. Data source: Firm-level structural statistics database of Statistics Finland.

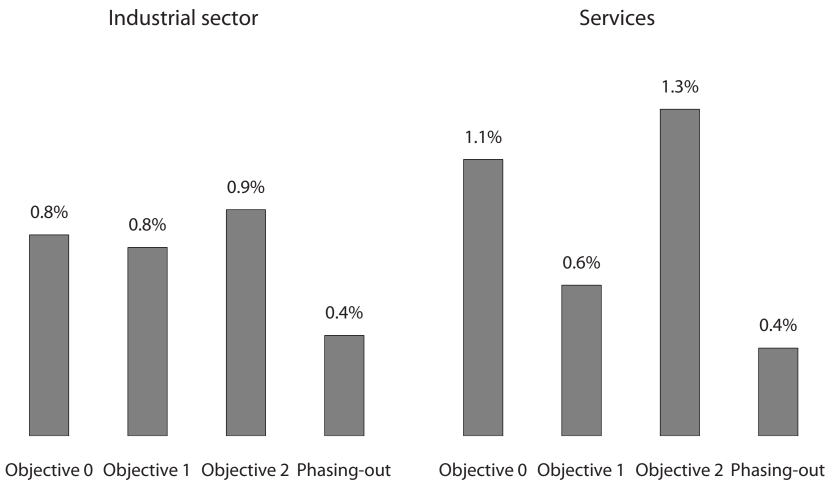
information on the role of entrants can be found in Figure 6.9, which shows the contribution of entrants to industry productivity.

Two key features emerge. On the one hand, entrants have a negative effect on industry productivity in all regions and in both sectors, but in Services in particular. This means that industry productivity would be higher if new firms had not entered. So, at least the direct short-term effect of the entrants is negative, which is explained by the fact that they include a large number of small firms with rather low productivity levels.[11] On the other hand, the effect of entrants of productivity is particularly negative in Services of Objective 1 and Phasing-out regions. This is mainly due to the fact that the productivity gap of the entrants with respect to the incumbents is larger than elsewhere. The average productivity gaps between entrants and incumbents for Services in Objective 1 and Phasing-out regions are 22.5 and 22.6 percent respectively. The corresponding number for Objective 0 region is 18.1 percent.[12] Hence, we have:

Fact 2. In all regions new firms are less productive than incumbents but the productivity gap is particularly large in Services of Objective 1 and Phasing-out region.

To get a more detailed picture on the role of the new firms, the contribution of entrants can be broken down in two parts that mirror the decomposition in the previous section: ‘productivity per firm’ and ‘allocation’. The

Figure 6.10. The allocation effect of the new firms



Notes: The bars depict the impact on allocation component; averages of years from 1997 to 2007. Computation has been made separately for each of the 18 industrial sectors and 11 services industries. The industry-level results are aggregated to the sector level by using the national industry shares. Data source: Firm-level structural statistics database of Statistics Finland.

latter is positive when the relationship between market share and the productivity level is stronger among entrants than among incumbents. Figure 6.10 shows that this is the case in both sectors and in all regions. The component is relatively small in Phasing-out regions in both sectors and in Objective 1 region in Services.

To summarize, Finland has experienced a growing divergence in the competitiveness of its regions. The main reason seems to be relatively smaller size of efficient firms in 'disadvantage' than 'advantaged' regions. In addition, the relatively lower efficiency of entrants seems to be another problem in Services of the most 'disadvantaged' region. Accordingly, the source of regional divergence seems to be a misallocation of resources in 'disadvantaged' regions between efficient and inefficient firms both in terms of incumbents and in terms of entrants.

6.4. REGIONAL DIFFERENCES IN THE EFFECTS OF INNOVATION SUPPORT

Having provided a description of the regional variation of industry productivity, we now turn to the effects of innovation policy on regional competitiveness. In so doing, we focus on support provided by the Finnish Funding

Agency for Technology and Innovation (Tekes). We use the Firm Support panel for the years 2001–2006 that is constructed by linking several administrative sources of the departments of government (see Pajarinen et al., 2009). The data are maintained by the Research Laboratory of Statistics Finland, which provides researchers an access to these data in its premises. By linking the Firm Support panel data to the Structural Business Statistics data, we have been able to construct a balanced panel data set covering the years 2001–2007 (that include information on public support for years 2001–2006).

In our analysis we include all firms (employing on average at least one person per year) in the Finnish Business sector that have existed in all years from 2001 to 2007 and have obtained neither innovation support from the Tekes nor 'non-innovation' support from the former the Ministry of Industry and Trade (now part of the Ministry of Employment and the Economy) nor from Finnvera in years from 2001 to 2002. These restrictions leave us with a data set that has 52 829 firms per year (7 x 52 829 = 369 803 observations in the panel). Recall that, given our discussion in Section 6.2, the distinction between 'innovation' and 'non-innovation' support is someway blurred. Non-innovation support is often given to projects that aim at renewing firms' operations in some way or another. Hence, when "innovation" is understood in its wide sense, it is difficult to judge whether an investment project leads to renewal that can be labelled as "innovation" or it is something else.

The firms in our data set are classified into three types: those that received no public support in years 2003–2004 (50 705 firms in each year); those that received non-innovation but not innovation support in years 2003–2004 (1 874 firms in each year); those that received innovation support in years 2003–2004 (250 firms in each year).

Because the main group of our interest, i.e. firms that received innovation support, is quite small (only 250 firms per year), we have to make two changes with respect to the analysis in the previous section. Firstly, here computations are performed not at industry level but at the level of the total business sector. This is not, however, as bad as it may sound since we are interested in the *changes* in the same group of firms over time (i.e. differences between periods 2001–2002, 2003–2004 and 2005–2007). Secondly, we combine Objective 1, Objective 2 and phasing-out regions in a single category of 'disadvantaged' regions. As we discussed in the previous section, these regions are reasonably similar to each other when it comes to relative productivity levels, their changes over time as well as the sources of these changes.

We are now ready to make a series of comparisons that reveal the impact of innovation and non-innovation support on firm productivity. Unveiling this impact means tackling a difficult counterfactual question: what would have happened to supported firms if they had not been supported? This implies identifying a benchmark against which to evaluate the actual behaviour of supported firms. The simplest approach, and the one adopted in this chapter, is to compare the behaviour of supported firms with that of non-supported firms. We call the former firms the 'treated group' and the latter the 'control group'. The reason for these labels is that, as in a medical experiment, the firms in the treated group have received 'medication' (in our case, support) while those in the control group have not received it, or in medical terms have been given a 'placebo'. In our case, firms are monitored from 2001 to 2007 with 'treatment period' 2003–2004.

Of course, in order to identify the impact of public support, the firms in the two groups should differ only in terms of that specific treatment. Hence, before inferring anything about the effects of the support, one has to net out any relevant difference not directly attributable to it. For example, if all supported firms belonged to 'disadvantaged' regions and all non-supported firms belonged to 'advantaged' regions, it would be extremely hard to separate the impact of public support from the effect of belonging to a 'disadvantaged' region. In such a scenario the location of firms would act as a 'confounding factor' that might lead us to attribute to the treatment some effects that are not in fact attributable to it.

The fact that there are supported firms in 'advantaged' regions and non-supported firms in 'disadvantaged' regions allows us to disentangle the impact of public support by comparing the behaviour of six types of firms:

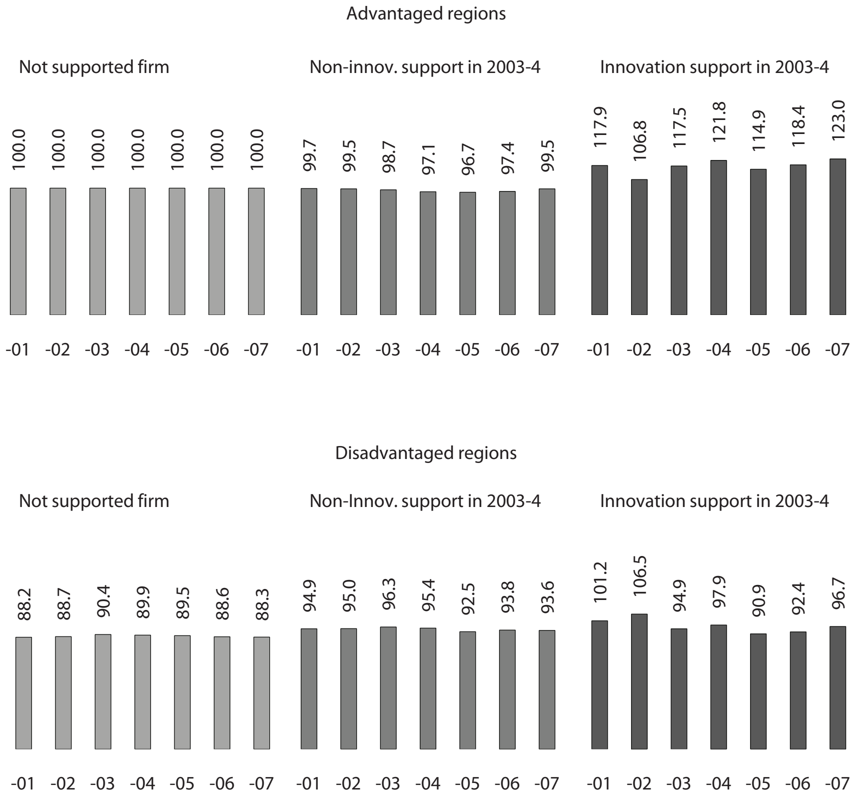
A. firms receiving innovation support in 'disadvantaged' regions;
B. firms receiving non-innovation support in 'disadvantaged' regions;
C. firms receiving no support in 'disadvantaged' regions;
D. firms receiving innovation support in 'advantaged' regions;
E. firms receiving non-innovation support in 'advantaged' regions;
F. firms receiving no support in 'advantaged' regions.

Several bilateral comparisons potentially yield interesting implications. Comparisons between types of firms within the same group of regions can be used to unveil the impact of the 'treatment' due to public support. For instance, A vs. C (B vs. C) conveys information about the impact of innovation (non-innovation) support to firms controlling for the specificities of 'disadvantaged' regions; A vs. B conveys information about the differential impacts of innovation and non-innovation support to firms controlling for the specificities of 'disadvantaged' regions. Analogous information is revealed by similar comparisons in the case of 'advantaged' regions. Comparisons between groups of regions within the same type of firms (A vs. D and B vs. E) can be used to unveil the differential impact of the 'treatment' between 'disadvantaged' and 'advantaged' regions.

The aggregate productivity levels of the six types of firms in the two groups of regions are shown in Figure 6.11. Remember that firms are monitored from 2001 to 2007 with 'treatment period' 2003–2004.

Figure 6.11 highlights several interesting features of the data. First, comparing the productivity of 'not supported' *firms* in 'advantaged' and 'dis-

Figure 6.11. The effect of public innovation support on regional aggregate productivity



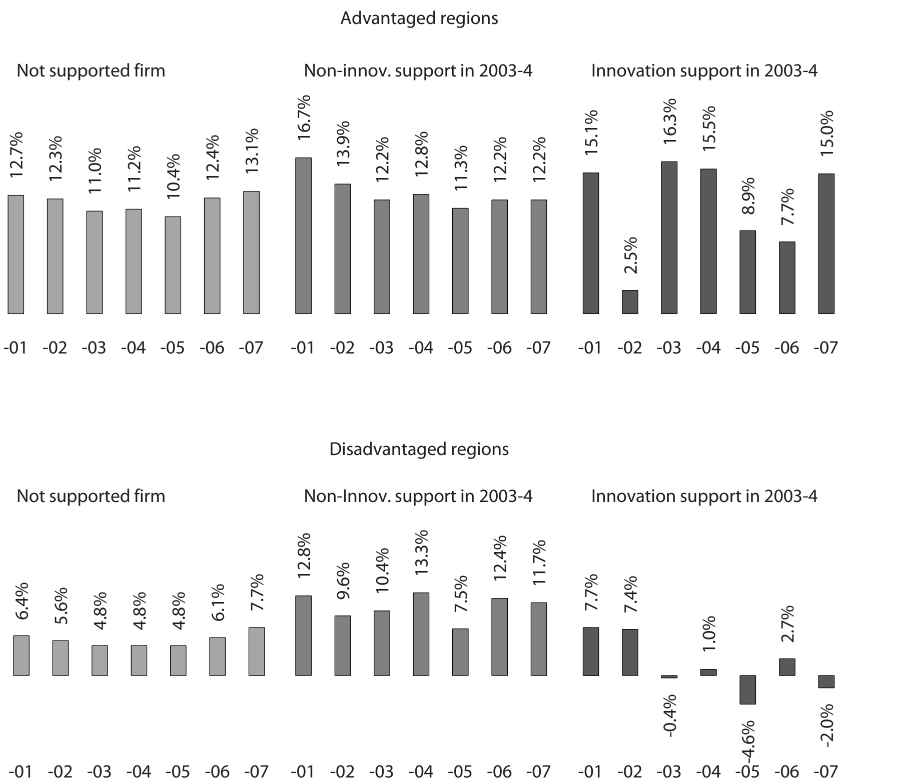
advantaged' regions shows a persistent productivity gap in favour of the former every year. This gap is sizeable lying above 10 percent.[13] Second, innovation-supported *firms* have higher productivity than the not-supported already before receiving support within both regions. The same finding applies to the non-innovation-supported in 'disadvantaged' regions, whereas in 'advantaged' regions there is virtually no difference between supported and not-supported firms before support (the average of the productivity index in 2001 and 2002 is only 0.4 per cent lower among non-innovation-supported firms relative to not supported ones). Third, in both types of regions *non-innovation support* has no visible effect on productivity during 'treatment'. For example, in supported regions the productivity index of firms receiving non-innovation support is 95.9 (the average of the index in 2003 and 2004), whereas it is 95.0 before support (average in 2001 and 2002). Thus, the change is actually slightly negative: -0.9 per cent. In the non-supported group the change is -1.7 per cent. After the support period, the negative effect continues to increase in 'disadvantaged' regions, whereas the effect slightly bounces back in 'advantaged' regions. Fourth, *innovation support* has a positive effect on productivity in 'advantaged' regions both during and after treatment. It has, instead, a negative impact in 'disadvantaged' regions during 'treatment', and the decline continues in the following years. We highlight this key finding as:

> Fact 3. Relative aggregate productivity has fallen in 'disadvantaged' regions during and after public innovation support. Differently, in 'advantaged' regions it has risen.

This fact is compatible with the use of innovation support to pursue non-innovation purposes in 'disadvantaged' regions. To dig deeper into this crucial issue we go back to the decomposition of productivity introduced in the previous section. In particular, we check whether the negative impact of innovation support in 'disadvantaged' regions is due to the evolution of productivity per firm or to the allocation of employment across firms. We find that the driving force is indeed allocation.

Figure 6.12 shows that, before the 'treatment' through innovation support, there is not clear difference in the allocation of employment shares in favour of more productive firms between 'disadvantaged' and 'advantaged'

Figure 6.12. Effect of public innovation support to allocation by region



regions. This can be seen by comparing the two right-hand-side diagrams in the upper and lower panels of the figure, in which in 2001–2002 the average allocation component is rather similar in 'disadvantaged' and 'advantaged' regions (though somewhat unstable over time in the latter). More importantly, after treatment a different pattern emerges with the allocation component falling to even negative values in 'disadvantaged' regions while this downward tendency cannot be found in 'advantaged' regions. In other words, we have:

Fact 4. In 'disadvantaged' regions innovation support is associated with the reallocation of employment towards *less* productive firms. This does not happen in 'advantaged' regions.

Figure 6.12 also shows that these patterns are not observed in the case of non-innovation support (see the central diagrams). Hence, the negative impact of non-innovation support on average productivity in 'disadvantaged' regions is mainly driven by a fall in productivity per firm rather than by the reallocation of markets shares.

A word of caution is much needed here. The group of firms receiving innovation support in 'disadvantaged' regions consists of only 72 firms. This implies that one should be careful not to draw too strong conclusions. Nevertheless, our findings illustrates a potentially important mechanism through which innovation policy, and industrial policy more generally, might have a negative impact on the competitiveness of a region (see e.g. Criscuolo et al., 2007).

To summarize, according to the evidence based on the limited data available, the (unspoken) regional bias in national innovation policy seems to contribute to the misallocation of resources driving the recent divergence in regional competitiveness.[14]

6.5. CONCLUDING REMARKS AND POLICY IMPLICATIONS

This chapter has investigated the regional dimension of the Finnish national innovation system. We have started by arguing that, while innovation policy is inherently national, the regional dimension is nonetheless rather important. Innovation policy and regional policy have created a complicated system across regions in which both target similar objectives though with somewhat different emphases. Due to large similarities and overlaps, in practice it is very difficult to distinguish between innovation policy conducted across regions and regional policy focused on innovativeness and renewal per se. This chapter has taken into account both dimensions. Although complex, this combination is not necessarily a problem, since it is not important under which heading a policy measure is conducted. What is important, however, is a sound functionality of the whole public system aiming at the renewal of the whole economy and its regions.

Public intervention on innovative activity across regions (including both the regional dimension of innovation policy and the innovation dimension of regional policy) consists of two parts. Indirect public support aims at creating fertile regional environments for the efficient creation and diffusion of knowledge among all stakeholders. In this respect, building strong regional networks has been an integral part of the Finnish national innovation policy instruments, especially in the Centres of Expertise programme. More direct public support supports renewal through the investment and R&D activities of recipient firms. Our analysis has specifically checked whether this more direct support (through grants, loans and guarantees) plays a role in driving regional performance. Nonetheless, we have also taken into account the impact of indirect support.

Our analytical approach has focused on the statistically measurable final outcomes of innovation. The basic idea is that successful innovation should be ultimately captured by firms' ability to create value to customers as determined by their willingness to pay for products and services. This ability materializes in value added per worker ('labour productivity'), whose changes are driven by firms' efficacy in introducing new successful products and services or in supplying already existing products and services at lower costs. The more productive firms are in a certain region, the higher its competitiveness in terms of value creation.

Our analysis has shown that Finland is experiencing a growing divergence in the competitiveness of its regions. The main reason seems to be the relatively smaller size of efficient firms in 'disadvantage' than 'advantaged' regions. The relatively lower efficiency of new firms seems to be an additional problem for Services. This suggests that a potentially important source of regional divergence is to be found in the misallocation of resources in 'disadvantaged' regions between efficient and inefficient firms both in terms of incumbents and in terms of entrants. This hampers productivity growth through the reallocation of resources to their most efficient uses.

The implication is that the complex system of innovation-related policies has been rather unsuccessful in compressing the differences in competitiveness among Finnish regions. Moreover, our results indicate that some policy actions, 'innovation' or 'non-innovation' ones, may have even promoted regional divergence. Though we have focused on direct support, widening regional divergence also implies that the performance of indirect support has been disappointing in dealing with regional disparities.

These negative outcomes have two alternative interpretations. On the one hand, one could say that direct and indirect public support has not been effective *enough* to invert more general tendencies due to the rising of a knowledge-based economy in a globalised world economy. The drivers of these tendencies include various agglomeration benefits accruing from increasing returns to scale and spillover effects. On the other hand, our analysis of the effect of direct support could be read as evidence suggesting that policy actions have not been effective *at all* and have possibly been even detrimental. By distorting competition, innovation policy and regional policy actions may have disturbed industry dynamics and restructuring in 'disadvantaged regions'. Indeed, our strongest piece of evidence is the negative allocation of resources both during and after two years since innovation support in disadvantaged regions.

This allows us to point out an important distinction between measuring the success of public R&D support in terms of private R&D investments (and outputs) and measuring it in terms of value added from the provision of goods and services. For example, a recent study finds that public R&D support encourages firms' own R&D spending in the Finnish Objective 1 regions (Einiö, 2009). This suggests that the innovation system functions well in promoting an intermediate product (i.e. private R&D), which is not incompatible with our findings that would then suggest that policy actions should be further improved in terms of promoting the ultimate outcome (i.e. productivity).

Our statistical approach has both pros and cons. The effectiveness of innovation policies is usually analysed by case studies. In this respect, our approach has the advantage of allowing us to distil the essence of a very large set of case studies. In doing so, it highlights the limits of current regional innovation policy, which are important to acknowledge no matter which of the two above interpretations is closer to the truth. The general tendencies we uncover undoubtedly conceal some great regional success stories, typically achieved by strict specialisation in certain core fields. We do not deny these cases, but focus on the overall picture instead.

An important objection to our findings could be that, although ineffective, the amount of public funds involved in the specific policies we target is negligible. However, it is worthwhile pointing out that the sheer amount of money involved is not a complete measure of 'wasted resources'. The main negative effect of those policies is the loss in terms of foregone productivity that cumulates through time so that even small yearly losses of productivity growth may build up in large output losses as time passes by.

To some extent, our findings have nonetheless to be handled with care due to the following reasons. First, our analysis on direct policy effects only contains incumbent firms that continue operating all the years between 2001–2007. Thus, the role of firms' birth and death is ignored. Second, we only look at the first four years after the firms start receiving support. While all supported firms receive support for at least two years, only some of them stop being supported in the subsequent years. This is a confounding factor in assessing the impact of our targeted two-year support. However, given that we find negative support effects even during the support period, such a confounding factor should not bias our results too much. Third, we have not been able to identify whether our negative results come from inefficient support or adverse selection in the pool of supported firms. Specifically, adverse selection could be relevant if, within regions and industries, public agencies had chosen to support firms that would have performed worse than non-supported ones even without public support. Finally, the data analysed only acknowledge support when recipient firms can be identified. Therefore our analysis does not capture the possible benefits arising from forms of indirect support such as those aimed at building networks and improving the business environment. A detailed investigation of these benefits would, however, require data on firms and other actors participating in such indirect programmes that are currently not available to us.

Conditional on these caveats, our analysis yields a number of policy recommendations. First of all, Finland as a whole would benefit from redesigning its policy combination in order to foster the reallocation of its resources to their most productive uses. Pursuing this national strategy may lead to the reallocation of resources away from 'disadvantaged' regions to already 'advantaged' ones. However, the ensuing pattern of regional divergence would not necessarily mean rising inequality among people as economically challenged citizens could be helped through direct income support irrespective of the place where they live.

Second, in redesigning the policy combination due attention should be paid to the two drivers of aggregate productivity: 'creative accumulation' and 'creative destruction'. While the former leads to productivity growth within firms, the latter generates productivity growth at the industry level when more efficient firms grow at the expense of less efficient competitors, moving workers and other resources from less to more productive uses.

Along both dimensions it is important that different policies clean up their acts. In particular:

– Innovation policy should celebrate firms that endeavour to move the current technology frontier forward no matter where they are actually located, in particular even when they happen to be concentrated in 'advantaged' regions. For example, the new SHOK-programme has picked up some core fields in the Finnish economy where new breakthroughs and inventions are sought through public and private involvement.
– Innovation policy should also foster the diffusion of knowledge and the adoption of innovation across firms and regions by helping inefficient firms adopt more efficient production methods to catch up with the technological frontier.
– Product and labour market policies should be used to grease the wheels of creative destruction. In particular, competition policy should be used to give stronger incentives for 'creative accumulation' as well as 'creative de-

struction' by promoting the entry of new innovative players. It should also stimulate the reallocation of market shares from less to more efficient competitors. In this respect workers' mobility should be fostered too.

- Regional imbalances should not be of any concern for innovation related policies, no matter whether promoting knowledge diffusion contributes to regional convergence or peddling creative destruction increases regional disparities. The reason is that any regional agenda may lead to slower productivity growth and cumulative losses in value added.
- Social equity should be targeted through traditional redistributive tools by targeting 'disadvantaged individuals' rather than 'disadvantaged regions'. For example, the **grands-in-aid** system helps municipalities provide citizens with welfare services all over the country. National redistribution policies, in turn, provide direct welfare benefits to people in need. Unemployment insurance could be strengthened to better isolate workers from the churning naturally associated with creative destruction.

To summarize, public intervention should follow a sound division of work. Running innovation policy and competition policy with a regional agenda may come at a high cost in terms of foregone growth both at the local and at the national level.

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APPENDIX: EXTENDING THE STATIC OLLEY-PAKES DECOMPOSITION TO ACCOUNT FOR ENTRANTS

The industry productivity index can be defined as follows:

$$\Phi_1 = \sum_{i \in \Omega_1} s_{i1} \varphi_{i1} \tag{1}$$

where s_{i1} and φ_{i1} are the share of firm i in an industry in period 1 and its productivity index defined as:

$$s_{i1} = \frac{L_{i1}}{\sum_{i \in \Omega_1} L_{i1}} \tag{2}$$

$$\varphi_{i1} = \frac{Y_{i1}}{L_{i1}} \tag{3}$$

with L_{i1} and Y_{i1} denoting labor input and output, respectively.

Inserting (2) and (3) into equation (1) gives the form

$$\Phi_1 = \sum_{i \in \Omega_1} \frac{L_{i1}}{\sum_{i \in \Omega_1} L_{i1}} \frac{Y_{i1}}{L_{i1}} = \frac{\sum_{i \in \Omega_1} Y}{\sum_{i \in \Omega_1} L} \tag{4}$$

which is the standard aggregate (or industry) labor productivity index that can be obtained from industry-level data such as the EU-KLEMS database. From the standpoint of making micro-level decompositions of productivity it is useful to see that the standard aggregate labor productivity level is a labor input weighted arithmetic average of the firm productivity indices (3) (see e.g. Van Biesebroeck, 2003).

Alternatively, firm productivity can be measured in terms of log-units as:

$$\tilde{\varphi}_{i1} = \ln \frac{Y_{i1}}{L_{i1}} \tag{5}$$

In this case we obtain a measure of industry productivity that is also measured on the log-scale

$$\tilde{\Phi}_1 = \sum_{i \in \Omega_1} \frac{L_{i1}}{\sum_{i \in \Omega_1} L_{i1}} \tilde{\varphi}_{i1} \tag{6}$$

It should be noted that $\exp\left(\tilde{\Phi}_1\right)$ is a weighted geometric average of firms' productivity indices defined in (3).

The firms of in period *1* can be classified into two groups: "incumbents", which appeared also in the previous period *0*; and "entrants", which did not exist in period 0. The former group is denoted by Ω_M and the latter by Ω_N. The industry productivity index can then be expressed as

$$\tilde{\Phi}_1 = \sum_{i \in \Omega_M} s_{i1}\tilde{\varphi}_{i1} + \sum_{j \in \Omega_N} s_{j1}\tilde{\varphi}_{j1} \tag{7}$$

where $\sum_{i \in \Omega_M} s_{i1} + \sum_{j \in \Omega_N} s_{j1} = 1$ by definition

Aggregate industry productivity index can then be written

$$\begin{aligned} \tilde{\Phi}_1 &= \left(1 - S_1^{entrant}\right)\tilde{\Phi}_1^{incumbent} + S_1^{entrant}\tilde{\Phi}_1^{entrant} \\ &= \tilde{\Phi}_1^{incumbent} + S_1^{entrant}\left(\tilde{\Phi}_1^{entrant} - \tilde{\Phi}_1^{incumbent}\right) \end{aligned} \tag{8}$$

where $S_1^{entrant} = \sum_{j \in \Omega_N} s_{j1} = 1 - \sum_{j \in \Omega_M} s_{i1}$

is the employment share of the entrants (see Maliranta, 1997; Vainiomäki, 1999; Diewert & Fox, 2009).

The second component in the second row of (8) indicates the contribution of the new firms to the current industry productivity, i.e. how much lower or higher the industry productivity level would be without the entrants. The component is positive when the aggregate productivity of the new firms ($\tilde{\Phi}_1^{entrant}$) is higher than that of the incumbent firms ($\tilde{\Phi}_1^{incumbent}$). The magnitude of the effect is dependent on the share of the new firms in period 1 ($S_1^{entrant}$) and the difference in the productivity level between the incumbents and the entrants.

The industry productivity index can be decomposed into two components by using the static Olley-Pakes decomposition (Olley & Pakes, 1996):

$$\begin{aligned} \Phi_1 &= \bar{\tilde{\varphi}}_1 + \sum_{i \in \Omega_1}\left(s_{i1} - \bar{s}_1\right)\left(\tilde{\varphi}_{i1} - \bar{\tilde{\varphi}}_1\right) \\ &= \bar{\tilde{\varphi}}_1 + \operatorname{cov}\left(s_{i1}, \tilde{\varphi}_{i1}\right) \end{aligned} \tag{9}$$

Obviously a similar decomposition can be made for the incumbents

$$\tilde{\Phi}_1^{incumbent} = \bar{\tilde{\varphi}}_1^{incumbent} + \operatorname{cov}_1^{incumbent}\left(s, \tilde{\varphi}\right) \tag{10}$$

and for the entrants

$$\tilde{\Phi}_1^{entrant} = \bar{\tilde{\varphi}}_1^{entrant} + \operatorname{cov}_1^{entrant}\left(s, \tilde{\varphi}\right) \tag{11}$$

By inserting (10) and (11) into (8) we obtain (see Melitz & Polanec, 2009)

$$\tilde{\Phi}_1 = \bar{\tilde{\varphi}}_1^{incumbent} + \mathrm{cov}_1^{incumbent}\left(s,\tilde{\varphi}\right) + S_1^{entrant}\left(\tilde{\Phi}_1^{entrant} - \tilde{\Phi}_1^{incumbent}\right) \quad (12)$$

and further

$$\tilde{\Phi}_1 = \bar{\tilde{\varphi}}_1^{incumbent} + \mathrm{cov}_1^{incumbent}\left(s,\tilde{\varphi}\right) +$$
$$S_1^{entrant}\left(\bar{\tilde{\varphi}}_1^{entrant} - \bar{\tilde{\varphi}}_1^{incumbent}\right) + S_1^{entrant}\left(\mathrm{cov}_1^{entrant}\left(s,\tilde{\varphi}\right) - \mathrm{cov}_1^{incumbent}\left(s,\tilde{\varphi}\right)\right) \quad (13)$$

The industry productivity level consists of three (equation (12)) or four components (equation (13)). In the latter both the incumbents and the entrants have two sub-components; an average and a covariance component. The covariance component of the incumbents is the difference between the weighted (i.e. aggregate productivity level) and the unweighted average of the incumbents (see (10)). It is positive when there is a positive relationship between the productivity level and the employment share among the incumbents. Accordingly, entrants can contribute to the industry productivity level through two channels; through the unweighted average component and the covariance component. The former is positive when the unweighted average productivity of the new firms is higher than that of the incumbents. The covariance (or allocation) component of the entrants is positive when the covariance between the size and the productivity level is larger among the entrants than among the incumbents.

ENDNOTES

1 Regional policy is actually a combination of modern and more traditional tools. Modern tools are more like extensions to national policies, such as innovation and industrial policy that try to diffuse economic growth and development all over the country, by helping the deployment of economic resources outside the largest cities. Traditional tools, on the other hand, operate more directly in the periphery in terms of rural and island policies.

2 The empirical analysis of this evaluation is based on two databases. The first is the Structural Business Statistics data (SBS data) that basically cover all firms in the Finnish business sector industries excluding Financial and insurance activities. It is constructed by linking several surveys and data obtained from the Tax Administration's registers. For a more detailed description, see *http://tilastokeskus.fi/meta/til/syr_en.html*. The second data source is Firm Support panel that is compiled by Statistics Finland together with the ministries involved (see Pajarinen et al., 2009). For access to these (and other micro-level) data, please contact the Research Laboratory of the Business Structures Unit, Statistics Finland, FIN-00022 (see http://tilastokeskus.fi/tup/yritysaineistot/esittely_en.html).

3 In this analysis the region of a firm is the one that has the highest employment share of the four regions examined. The four regions are shown in Figure 6.3.

4 Finnvera is a state-owned financing company which provides its clients with loans, guarantees, venture capital investments, and export credit guarantees. Promoting regional development is one of Finnvera's goals. The Annual Review 2008 describes the mission as follows: "*By supplementing the financial market and by providing financing, Finnvera promotes the business of SMEs, the exports and internationalisation of enterprises, and the realisation of the State's regional policy goals.*"

5 These figures are from Regional Accounts and R&D-statistics compiled by Statistics Finland.

6 More specifically, data are constructed by linking the Structural Business Statistics and the Firm Support data maintained in Statistics Finland.

7 From a statistical point of view, the difference is highly significant as the standard error is only 8 Euros (thus, the t-value is about 49).

8 See Appendix and Melitz and Polanec (2009) for technical details.

9 In our computations a firm's productivity is measured in the natural logarithm units. For the presentation of the results, however, we have taken anti-logs of the components which implies that comparisons are made by using geometric averages (see more details in Appendix).

10 Böckerman and Maliranta (2007) examine the regional differences of micro-level dynamics in twelve manufacturing industries. Although their study focuses on the manufacturing sector only and uses a different dynamic decomposition, the results are largely consistent with ours. Their results indicate that the mid-80s was the turning point in the regional productivity development. Productivity-enhancing restructuring became an increasingly important source of industry productivity growth in the Southern Finland but less so in the other parts of Finland, especially in the Eastern Finland.

11 Maliranta (2003) shows that an important part of the productivity-enhancing restructuring within manufacturing industries in Finland can be attributed to the relative young plants (to those less than 13 years old).

12 These numbers are not reported in the figures but are directly linked to those portrayed in Figure 6.8 and Figure 6.9 as shown in equation (8) in the Appendix.

13 It should be noted that the differences in the industry structures are not controlled for here so that the results are not strictly comparable. However, when comparing differences over time within one category (A-F) the effect of industrial structures is cancelled out. Furthermore, this comparison concerns only firms active during the whole period from 2001 to 2007.

14 This recent pattern of divergence has been highlighted in Section 6.3.

7. Education, Research, and the Economy

Reinhilde Veugelers, Tanja Tanayama, and Otto Toivanen*

The objectives in reforming the Finnish education and (public) research sectors are as follows:

- *Increasing the quality of research.*
- *Streamlining the sectors to reduce fragmentation and overlapping activities.*
- *Increasing internationalization.*
- *Tackling the problem of late graduation.*
- *Enhancing efficient knowledge dissemination from the sectors to the rest of society.*

The most pressing and timely challenge is to increase the quality of research in Finland, which is best achieved by providing autonomous universities incentives through funding rules emphasizing it (see our separate proposal for details).

To streamline the higher education sector we recommend a clear division of tasks between universities and polytechnics. In addition the role and tasks of public research organizations (PROs) should be critically re-assessed.

To reduce the problem of late graduation, our main policy recommendation is to make a clear distinction between bachelor's and master's programs and ensure that it is easier for students to change fields and establishments when exiting the bachelor's and entering the master's programs. To further enhance industry – science links we stress the need to avoid top-down policy making in selecting areas for academic research. In addition, technology transfer offices should have an adequate scale, expertise and resources to truly be efficient.

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7.1. INTRODUCTION

In the knowledge-driven global economy, the ability to generate and exploit knowledge is an increasingly crucial factor determining economic success and wellbeing. Universities are among the key actors in constructing a knowledge-based society. Through their teaching, they disseminate knowledge and improve the stock of human capital; through the research they perform, universities extend the horizons of knowledge; and by their other activities, they transfer knowledge to the rest of society, work with established industry and create the seeds that lead to new companies.

As Europe has approached the world technology possibility frontier and is leaving the era of catching up to the US behind, innovation and highly-educated people are becoming crucial drivers of its growth potential. This development has put new demands and pressures upon universities. More and more emphasis is put on ensuring that the capabilities of universities contribute to countries' economic and social objectives.

European universities are however not able to match these expectations and achieve their full potential. European universities are hampered by a combination of excessive public control, and bad governance coupled with insufficient funding opportunities. In addition, the Higher Education and Research Area in the European Union is still too fragmented. As a result, compared with their counterparts in the US, Australia and perhaps soon also China, European universities are behind or falling behind in the increased international competition for talented academics and students, and miss out on fast-changing research agendas, innovative opportunities and teaching curricula.

Modernization of Europe's universities, involving their interlinked roles of education, research and innovation, has therefore rightly been acknowledged as a core condition for the success of a move towards an increasingly global and knowledge-based economy. Various policy communications have identified the main items for change, at the level of the EU and also in many European countries[1]. University reforms are taking place in several European countries.

Finland takes part in this European level development. Several reforms reshaping the higher education system and research base have been or are about to be introduced. This chapter evaluates the role of research and education within the Finnish innovation system. Starting from the Finnish preferences and strategic policy choices this chapter presents our analysis of the current Finnish higher education and public research structure and its performance, internationally benchmarked. This allows identifying the main challenges that the Finnish university sector is facing, which should be addressed pivotally in the Finnish reform agenda. Reviewing analysis and international practices of university reforms, the chapter closes with policy recommendations and suggestions for improvements.

Our analysis will focus mainly on the university sector. Like in many OECD countries, universities are central players for the Finnish innovation system, with their unique blending of basic research, higher education and dissemination of scientific knowledge. All of these activities will be reflected in our analyses. Although the focus is on universities, the role of other higher education and research institutions relative to universities is also discussed.

Based on our evaluation we argue that for the Finnish innovation system to generate world-class innovation activity in the future, prompt and determined action should be taken to increase the quality of university research, to streamline the higher education system to cope with both regional and global needs and to increase internationalization of the university sector. We also highlight developments needed to enhance the functioning of university education. In addition, we believe that there is still scope for enhancing efficient knowledge dissemination from universities to the rest of society.

The chapter is organized as follows. Section 7.2 starts with a brief discussion of the Finnish strategic innovation policy choices, setting the contours in which Finnish universities are operating and to which they are and should be increasingly contributing to. In the next two sections (7.3 and 7.4) we look at the current performance of the Finnish universities and compare their funding, governance and performance internationally. Section 7.5 discusses how in light of best practices and theoretical considerations a reform agenda should look like. In section 7.6 we develop our proposals as to how Finland should address the challenges identified in sections 7.3 and 7.4. The concluding section summarizes our main policy recommendations.

7.2. FINNISH STRATEGIC INNOVATION POLICY CHOICES

The Government's Communication on Finland's National Innovation Strategy to the Parliament (NIS) sets as goal to be *pioneering in innovation activity* in selected sectors of innovation. We take this goal as a starting point. Our objective is to evaluate the developments needed in education and research to reshape the Finnish innovation system to better match with this goal.

NIS presents four strategic choices that are deemed especially important for the future of the Finnish innovation system. Those are: "innovation activity in a world without frontiers", "demand and user orientation", "innovative individuals and communities" and "systemic approach". Our evaluation task was to assess the Finnish higher education and public research sector through these four strategic choices. Starting from these premises we have framed our evaluation to cover the quality of Finnish university research and education, industry science links (ISLs), internationalization of the university sector and the structure of the Finnish higher education and public research sector.

In relation to "innovation activity in a world without frontiers" NIS stresses the need to participate and influence international networks. According to NIS the success of enterprises and regions depends on their ability to position themselves in global networks. Positioning requires active participation of Finnish experts that can provide added value to partners based on their state-of-the-art competences. For universities this means that they are expected to provide the society with knowledge and competence that meets and even creates the international standards. This challenge in itself requires mobility and extensive participation of academics in international networks since achieving and bypassing international standards is hardly possible without international engagement. The internationalization of Finnish universities will be evaluated extensively in the next sections.

The emphasis of NIS on "innovative individuals and communities" highlights the key role of individuals and innovative communities in innovation processes. As NIS states, innovativeness is based on the skills and creativity of individuals. This stresses the importance of a high-quality base of competences. Although Finland is known for its overall good quality competence-base we strongly believe it is critical for the future success of the Finnish innovation system to further strengthen it. In this respect the quality of Finnish university research and education in forming innovative individuals are crucial, laying the seeds for innovative communities. The research and education activities of Finnish universities are the core focus of the analysis in this chapter.

It is a widely held view that Finland has been better at creating innovations than getting the commercial benefit from them. Related is the perception of supply-side or technology-push oriented policies. As such, "demand and user orientation" is surely something that needs to be stressed. Applied to research and education, this does not necessarily require universities to be engaged in pure applied research or innovations themselves. Universities have a comparative advantage in, and are valued for, their basic research that is driven by a quest for fundamental knowledge that may also be user-inspired (Pasteur's Quadrant), but not in pure applied research that is only user driven. Universities should focus on high quality, internationally excellent, long term basic research that is not necessarily solely conducted with any practical end in mind. Bearing in mind their specialized capabilities and institutional constraints, the question is how universities can optimally contribute to the formation of an organizational ecology that generates sustained demand and user driven innovation?

Our approach is that for university research, the "demand and user orientation" should rather mean more efficient and rapid exploitation of the generated knowledge, better connecting universities with firms' innovative activities, through stronger networking arrangements, collaborative funding of research programs and the like, fully respecting the division of labor between academia and commerce. This is different from a perspective that seeks to bring universities more fully into the market as a producer of pure applied research and/or a supplier of innovation services. The challenges related to industry-science links (ISLs) are discussed in the next sections.[2]

The "systemic approach" within NIS primarily relates to the conduct of innovation policy that should entail broad-based and close cooperation across different political sectors. In addition, the systemic approach can be understood as calling for coordinated structures that efficiently pull together resources. The fragmentation in the Finnish higher education and public research sector will be examined in detail.

7.3. CHARACTERIZING THE FINNISH HIGHER EDUCATION AND PUBLIC RESEARCH SYSTEM

This section first describes, who are the major actors in the Finnish higher education and public research system. It then describes two important dimensions that condition the performance of these actors, namely their funding and their governance. On both dimensions, Finland is internationally benchmarked.

7.3.1. THE ACTORS: UNIVERSITIES, POLYTECHNICS AND PROS

For tertiary education, Finland has a dual model consisting of two parallel sectors: universities and polytechnics. Currently there are 20 universities and 26 polytechnics. The 20 universities are based in 11 cities and towns providing degree education in over 20 different localities with bachelors, masters, licentiate and doctorate studies. Polytechnics in turn provide degree education with bachelors studies in over 80 different localities all over the country. As part of the ongoing restructuring of the Finnish higher education sector the number of universities is planned to decline to 15 by 2020 and the number of polytechnics to 18.

According to the University Act (1997) universities have four main tasks: to promote free research, to promote scientific and artistic education, to provide higher education based on research and to educate students to serve their country and humanity. The so-called third task, the obligation to serve the surrounding society, was added to the legislation in 2004. Polytechnics are professionally oriented higher education institutions (HEIs). According to the Polytechnics Act (2003), polytechnics provide professional education, support professional development, conduct applied R&D which supports regional development and offer adult education. The main aim of the polytechnic degree programs is to provide professional competence.

For public research, a third group of public institutions needs to be considered, consisting of public research organizations (PROs). Currently there are 19 PROs under eight ministries. These PROs have been established on a sectoral basis and besides research they have other sector and organization specific functions defined by law to serve sectoral needs of their "owning" Ministry (Hyytinen et al., 2009). However, the nature and the extent of these other duties differ considerably across PROs. According to Rantanen (2008) research covers some 30–40 percent of the volume of activities in large and medium-sized PROs. Expert and other service tasks serving directly the relevant administrative sector cover another 30–40 percent. Education, information and other tasks cover the rest. Also some of the research conducted at PROs serves directly the duties defined in law.[3]

The survey conducted by Etlatieto to support the evaluation investigated the general perceptions about universities, polytechnics and PROs in

Table 7.1. Percentage of actors considering the institution serving well the specified task

	Universities	Polytechnics	PRO's
International top class research			
Smaller innovative firms	90 %	4 %	25 %
Larger innovative firms	91 %	3 %	25 %
Other firms	84 %	6 %	26 %
All Firms	89 %	4 %	25 %
All Actors	93 %	3 %	34 %
Research for the national needs			
Smaller innovative firms	56 %	34 %	51 %
Larger innovative firms	65 %	32 %	52 %
Other firms	60 %	34 %	43 %
All Firms	59 %	34 %	49 %
All Actors	68 %	36 %	64 %
Supply of experts for international business activities			
Smaller innovative firms	82 %	26 %	14 %
Larger innovative firms	85 %	29 %	17 %
Other firms	83 %	27 %	11 %
All Firms	83 %	27 %	14 %
All Actors	86 %	27 %	15 %
Supply of experts for local business activities			
Smaller innovative firms	39 %	82 %	13 %
Larger innovative firms	46 %	86 %	13 %
Other firms	35 %	78 %	12 %
All Firms	39 %	82 %	13 %
All Actors	50 %	86 %	16 %

Source: Kotiranta et al. (2009).

Finland. Table 7.1 shows the opinions of firms and other actors about how well these different institutions are perceived to serve their different tasks. Universities are rated very favourable in terms of "international top class research" and "supply of experts for international business activities". On these tasks, they are also clearly seen as the main supplier, with polytechnics and PROs not being rated favourably on these tasks. The main and specific task of polytechnics is clearly seen to be the "supply of experts for local business activities". This suggests a clear division of tasks between universities and polytechnics, as perceived by firms and other actors. PROs in turn do not seem to stand out in any dimension, always dominated by universities. They have their highest score on "research for the national needs", but universities are rated more favourable also in this dimension.

7.3.2. FUNDING

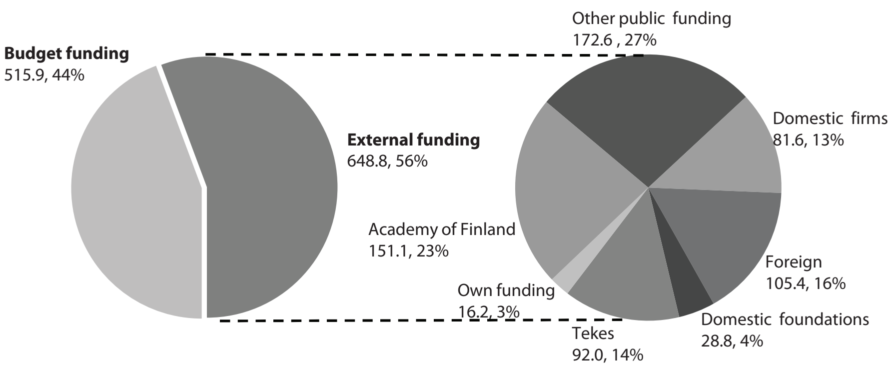
(i) Finnish funding actors

Both universities and polytechnics are mainly financed by public funding. However, the model of administration differs between universities and polytechnics. Universities are maintained by the state while polytechnics are run by municipalities, joint municipal bodies or foundations.

For polytechnics, the state's share of base funding is 57 percent while municipalities fund the rest (43 percent). The base funding is based on a school specific unit price per student that takes into account discipline specific differences in the cost of education.

For universities, base funding covered 44% of the total university funding in 2007. However, Figure 7.1 reveals that 64% of the external funding came

Figure 7.1. Sources of university funding in 2007, € million



Source: Statistics Finland.

also from public sources. This means that actually 80% of university funding comes from public sources in one way or another. The Academy of Finland and the Finnish Funding Agency for Technology and Innovation (TEKES) are the main domestic agencies allocating public competitive research funding. The Academy of Finland is the prime funding agency for basic research in Finland[4]. It is operating under the Ministry of Education. Tekes in turn funds innovative research and development projects in companies, universities and research institutes and operates under the Ministry of Employment and the Economy[5]. Academy of Finland and Tekes funding to universities, together accounting for 37% of external funding or 21% of total university funding, can be classified as being allocated through competitive bidding.

The main funding for PROs comes from three different sources: the state budget, Ministries and external domestic and foreign competitive funding. Depending on the organization, the share of external funding varies from 3 to 70% of the total financing. The trend in external funding has been increasing and in 2008 accounted for some 45 percent of the total financing of PROs (Rantanen, 2008).

Table 7.2 below shows the distribution of government R&D funding across the various public funding organizations.

Table 7.2. Government budget appropriations or outlays for R&D in 2008

	R&D funding, € mill.	Share of R&D funding, %
Universities	452.2	25.2
University central hospitals	48.7	2.7
Academy of Finland	296.5	16.5
TEKES - Finnish Funding Agency for Technology and Innovation	526.3	29.3
Government Research Institutes	281.6	15.7
Other R&D funding	192.6	10.7

Source: Statistics Finland.

(ii) Comparing Finland's HEI & PRO funding internationally

Funding for education

Panel A in Table 7.3 indicates that investment in higher education as a percentage of GDP in Finland is among the highest in EU countries. Finland invests 1.7% of GDP in tertiary education. Panel B in Table 7.3 shows that 1% of GDP goes to educational core services, the rest going to Research (cf infra). Figures for OECD countries on average are 1.05% (OECD, 2008a). Spending on instruction is thus at the OECD average.

The US stands out as being the country spending the most on educational core services as highlighted by Panel B in Table 7.3 (2.26% of GDP). Expenditure on instruction per student in the US is almost three times higher than the EU19 average. Panel A in Table 7.3 reveals that this is due to high private spending generated by tuition fees. In Finland private funding for tertiary education is not important, while public spending (as % of GDP) is the highest among OECD countries, including the US.

Table 7.3. Funding for education

Panel A. Spending on tertiary education as percentage of GDP, 2005.

	US	Japan	EU19	Finland	Denmark	Sweden	UK	Germany	France
Total	2.9	1.4	1.3	1.7	1.7	1.6	1.3	1.1	1.3
Public	1.0	0.5	1.1	1.7	1.6	1.5	0.9	0.9	1.1
Private	1.9	0.9	0.2	0.1	0.1	0.2	0.4	0.2	0.2

Panel B. Expenditure on instruction and R&D in higher education institutions.

Educational Core Services as % of GDP

US	EU19	Finland	Denmark*	Sweden	UK	Germany	France
2.26		1.07	1.35	0.85	0.78	0.63	0.86

Educational Core Services per Student, relative to EU19 average

US	EU19	Finland	Denmark*	Sweden	UK	Germany	France
2.78	$6 707	1.13	1.64	1.23	0.98	1.07	1.05

Source: OECD (2008a). Data are for 2005, unless * (=2004).

Funding for research

Table 7.4 shows the high expenditures on R&D by the Higher Education sector in Finland, as per cent of GDP. This is substantially higher than the US and the EU27 average (but lower than Denmark and Sweden). But relative to the private sector, this is lower than in other EU countries. The share of R&D done by HEI and financed by industry is above EU average and even higher than in the US.

Table 7.4. Spending on research in higher education

	US	Japan*	EU27*	Finland	Denmark	Sweden	UK*	Germany	France
Expenditures on R&D by Higher Education Sector, as % of GDP									
	0.36	0.43	0.39	0.65	0.70	0.77	0.46	0.40	0.41
Total Expenditures on R&D as % of GDP									
	2.68	3.39	1.77	3.47	2.54	3.63	1.78	2.53	2.08
Share of total R&D performed by Higher Education Sector									
	13.3	12.7	22.3	18.7	27.5	21.1	26.1	16.3	19.2

Higher Education Sector R&D financed by industry									
US	Japan*	EU27*	Finland	Denmark*	Sweden*	UK*	Germany*	France*
5.7	2.9	6.6	7.0	2.5	5.1	4.8	14.2	1.7

Source: OECD (2008b). Data are for 2007 unless * (=2006).

7.3.3. UNIVERSITY GOVERNANCE

University governance systems can be characterized along two important dimensions: (i) *autonomy* and (ii) *accountability*. *Autonomy* captures the extent to which institutions are free to manage their resources and to shape their activities. *Accountable* systems provide incentives by allocating resources on a performance basis and by evaluating outcomes. OECD has developed a series of indicators based on surveys of its member countries measuring autonomy (financial autonomy, staff policy autonomy with respect to hiring/firing and wages, student selection and course content) and accountability (evaluation mechanisms and funding rules) (Martins et al. 2007). A summary of these indicators are presented in Table 7.5 below.

Table 7.5. Governance characteristics of universities in OECD countries

	US	Japan	UK	Sweden	Denmark	Finland	Germany	France	Spain	Italy
A. Autonomy										
Selection of students	7.8	6.6	6.7	8.9	7	7.1	2.8	2.8	10	3.7
Budget flexibility	8.5	8.2	6.8	6.2	6.2	7.7	7.2	6.8	7.9	7
Staff Policy flexibility	10	10	10	10	10	7.5	7.5	1.8	4.9	7.9
Hiring/Firing	10	10	10	10	10	10	10	0.9	3.8	10
Wage/non-wage conditions	10	10	10	10	10	5	5	2.7	5.9	5.7
Course content	10	10	10	5.5	10	10	5.5	10	10	5.5
B. Accountability										
Evaluation mechanisms	6.6	6.2	7.7	6.5	4.6	4	6.9	5.6	6.5	6.8
Funding Rules	3.6	3.9	5.5	4.6	5.3	6.2	5.2	6.6	4.8	5.9

Source: Martins et al. (2007).

Box 7.1. Financing modes of higher education in the EU

Block grants are common, with serious autonomy on how to spend grants. In several countries a significant amount of public funding is associated with a performance contract. Nevertheless, whether or not the qualitative objectives included in these contracts are met, has still little influence on the amount of funding allocated in the following contract, for the moment. Almost all European countries use standardized funding formulas for the allocation of public funds. The use of performance indicators is becoming increasingly common. Most of the time, this includes the number of students enrolled at an institution and research activities. However, in most countries, only a small proportion of funds are allocated on performance indicators. The UK (England) is indisputably one of the countries where the amount of funding allocated to institutions depends most on their performance in terms of students' results and the quality of research.

Public funds for research are allocated via various mechanisms. All countries have at least part of these funds allocated on a competitive basis for specific research projects and programs, next to basic research grants. The calculation of these basic grants varies markedly across countries.

The vast majority of European countries have implemented incentives to support higher education institutions in their search for private funding and in developing partnerships with the private sectors, with tax allowances for donors the most common.

Source: On the basis of OECD (2008).

The US has the highest scores on all dimensions of autonomy. In Europe, Finland scores high on autonomy, with the exception of wage/non-wage conditions. On accountability, Finland scores good on financial accountability, but has the poorest scores of all countries considered on evaluations.

7.4. PERFORMANCE OF FINNISH HEIS AND PROS INTERNATIONALLY BENCHMARKED

Performance is evaluated on three dimensions: higher education (7.4.1), research (7.4.2), and industry science links (7.4.3). An evaluation of the international scope in each of these dimensions is singled out in section 7.4.4. A concluding section summarizes the main findings (7.4.5).

7.4.1. EDUCATION PERFORMANCE

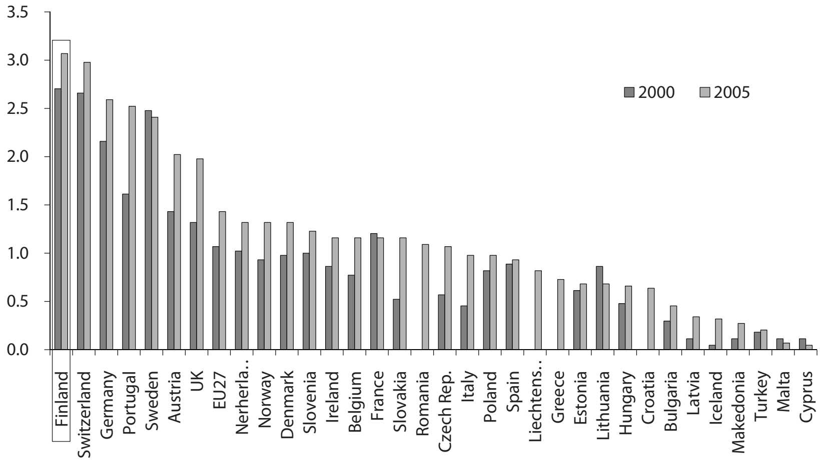
The Finnish higher education sector ranks high in many aspects of educational performance in international comparisons. As Table 7.6 shows, over one third of the population aged 25–64 has a tertiary qualification. The figure is among the highest in EU and only slightly below the level in the US. 76% of young adults are estimated to enter tertiary education in Finland during their lifetime, among the highest figures in OECD countries. In addition the

Table 7.6. Higher education attainment rates (% of population aged 25–64 with completed tertiary education in 2006)

US	Japan	EU19	Finland	Denmark	Sweden	UK	Germany	France
39	40	24	35	35	31	30	24	26

Source: OECD (2008a).

Figure 7.2. Doctoral graduates per 1000 population aged 25–34, in 2000 and 2005



The source is DG Research, data from Eurostat. For Italy and Switzerland the last observation year is 2004.

estimated share of higher education students who complete a higher education degree was 72% in 2005, slightly higher than the OECD average of 69%. Also on doctoral graduates (relative to the population), Finland scores highest among EU countries (Figure 7.2).

The above standard education statistics provide a relatively flattering image of the Finnish higher education system. Finns participate actively in higher education and also complete a higher education degree at a fairly high rate.

Yet, one downside of the Finnish university system is persistently showing up in the statistics: the late entry of highly educated people to the workforce. Compared to other countries, Finnish students enter university later and study longer than their counterparts in other countries. OECD has also recently stressed this problem (OECD, 2008c).

The average age of new university students is 21.6. The median age of university graduates is 28, among the highest in OECD countries, while the average graduation time at the universities was 6 years in 2006. The aging of the Finnish population puts increasing pressure on the phenomenon of late entry to the workforce. In order to cope with ageing, the employment rate of the work-age population should increase. An important channel to enhance this is to improve the inefficiencies caused by late entry and long study times.

The main reason for late graduation is the delayed transition to higher education after the matriculation examinations. Among the 19-year-olds, only 20% are studying in a higher education institution in Finland, compared to almost 50% in the US, Canada and Belgium (OECD, 2008a). Among the 20-year-old the corresponding figure is about one-third. The delayed entry is due to the unique Finnish university admissions system. First, the study places are centrally allocated according to estimated labor market needs. The Ministry of Education uses these estimates when agreeing on university specific targets with the universities and based on the targets, universities decide the student intake in each field. Second, the admission system is highly decentralized. Admission is based on matriculation examination results and entrance examinations that differ in many cases from one university to another.

Due to the mismatch of educational preferences of secondary school leavers and the available places in higher education, a huge pool of potential applicants has accumulated. The annual number of applicants is three times the size of the matriculated cohort (OPM, 2005). In 2008 only 35% of those participating in entrance examinations gained entry to universities while the rest is waiting for the next year's application round[6]. The entrance examination is often challenging and in fields in high-demand students spend months to prepare for the examination. Admission to universities takes on average 2–3 years (OPM, 2005). In 2008 the share of new university students who matriculated the same year was 29%[7].

In addition to the late entry to universities also study times are relatively long in Finland. In 2004 expected years in tertiary education were 4.2 in Finland compared to the OECD average of 2.4 (OECD, 2006). Part of the difference is explained by the fact that the majority of Finnish students study for the Master's degree. There are however other issues as well. One is the common habit of Finnish students to work while studying. In 2004 the share of part-time students was 43% while the OECD average was 20% (OECD, 2006). Actually, when looking at the expected years in tertiary education only for full-time students the figure for Finland is 2.6 compared to the OECD average of 1.9 – i.e., the difference is considerably smaller (OECD, 2006).

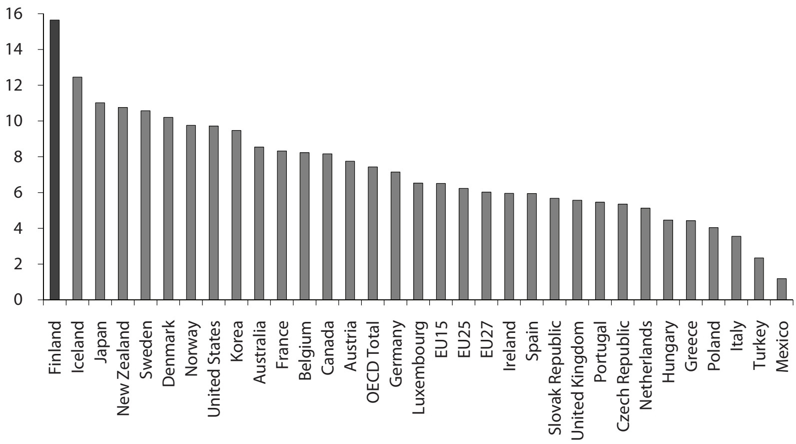
One striking feature of the Finnish university sector is that the units providing education are very small compared to international counterparts. During the evaluation Etlatieto conducted a small benchmarking survey to compare the size of university departments (1) between departments from selected countries, (2) between national departments with a different ranking and (3) between different fields. Box 7.2 reports the main findings.

7.4.2. RESEARCH PERFORMANCE

Number of researchers

The supply of researchers is at a high level in Finland. Finland has the highest share of researchers in employment among all OECD countries considered, as Figure 7.3 reveals.

Figure 7.3. Researchers (full time equivalent) per 1000 total employment in 2007



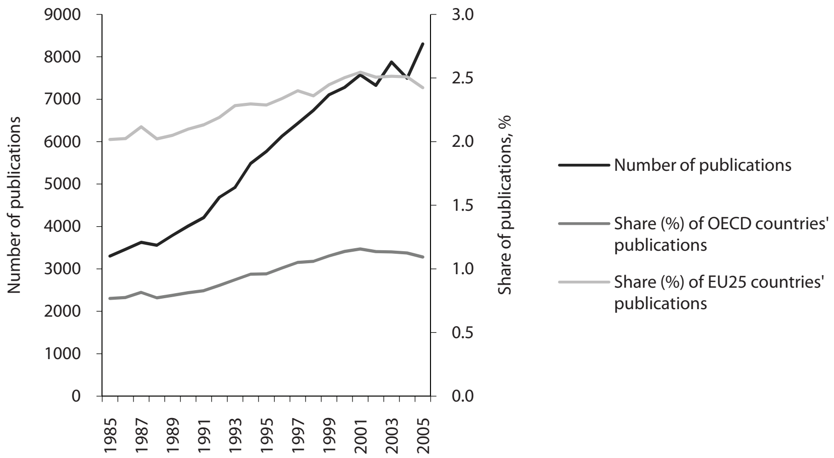
Source: OECD (2009).

Publication output

As Figure 7.4 shows, publication activity measured by the number of publications has increased considerably over the past 20 years in Finland. But, the trend is very similar to the average development in EU and OECD, leaving Finland's share in total EU and OECD publications more or less stable. All this implies that the increase in the Finnish publication activity is part of a more general development of increasing publication output.

When concentrating on the EU-27, and taking into account the more recent period 1995–2005 Finland not only has a low share in total EU publications, but it also has a modest increase in publications, contrary to most other EU countries (see Table 7.7).When expressing the number of publications relative to population, as a size correction, Finland ranks fourth among OECD countries in 2005. However, Table 7.8 reveals that when measuring the number of publications per researcher, a more relevant size measure, Finland is well below OECD and EU average. Also when relating scientific output (as measured by publications) to the public expenditures on R&D, we see from

Figure 7.4. Number of Finnish publications and share of EU25 and OECD publications in 1985–2005



Source: Lehvo and Nuutinen (2006), data source Thompson Scientific.

Table 7.7. ISI publication output

	Share in EU-27			Change		Avg. annual
	1995	2000	2005	95—00	00—05	growth (95—05)
Portugal	0.5%	1.2%	1.2%	12.8%	8.7%	10.8%
Greece	1.1%	1.8%	1.8%	7.4%	7.3%	7.3%
Spain	5.8%	6.6%	7.8%	5.4%	4.3%	4.8%
Czech	1.0%	1.3%	1.3%	4.8%	4.9%	4.8%
Poland	2.3%	2.9%	2.9%	3.8%	4.3%	4.1%
Hungary	0.9%	1.1%	1.1%	5.8%	2.1%	3.9%
Italy	9.1%	9.6%	10.5%	3.6%	2.8%	3.2%
Austria	1.7%	1.9%	1.9%	1.4%	2.9%	2.9%
Belgium	2.6%	2.9%	2.9%	2.1%	3.5%	2.8%
Finland	2.1%	2.0%	2.0%	-0.1%	1.7%	1.7%
Germany	19.2%	19.5%	18.8%	2.9%	0.3%	1.6%
Denmark	2.2%	2.1%	2.1%	0.6%	1.5%	1.5%
Netherlands	6.2%	5.9%	5.9%	0.4%	2.4%	1.4%
Sweden	4.7%	4.3%	4.3%	1.2%	0.3%	0.8%
France	14.7%	12.9%	12.9%	1.7%	-0.7%	0.5%
UK	23.2%	19.4%	19.4%	1.2%	-1.1%	0.0%
EU27	100.0%	100.0%	100.0%	2.6%	1.1%	1.8%

Notes: Authors calculations on the basis of NSF, S&E indicators. Countries ranked according to contribution to overall EU growth (share*growth); only countries with at least 1% in EU-27 2005 share are reported.

Table 7.8. EU performance on scientific publications

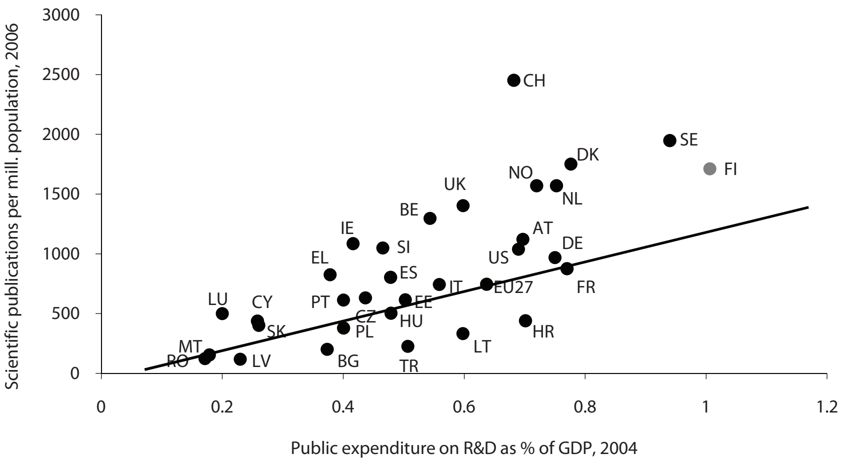
S&E Publications per researcher relative to OECD average (1=OECD=0.164) 2003

US	Japan	EU25	Finland	Denmark	Sweden	UK	Germany	France
0.96	0.54	1.17	0.77	1.23	1.30	1.86	1.01	1.01

Source: OECD, STI 2007.

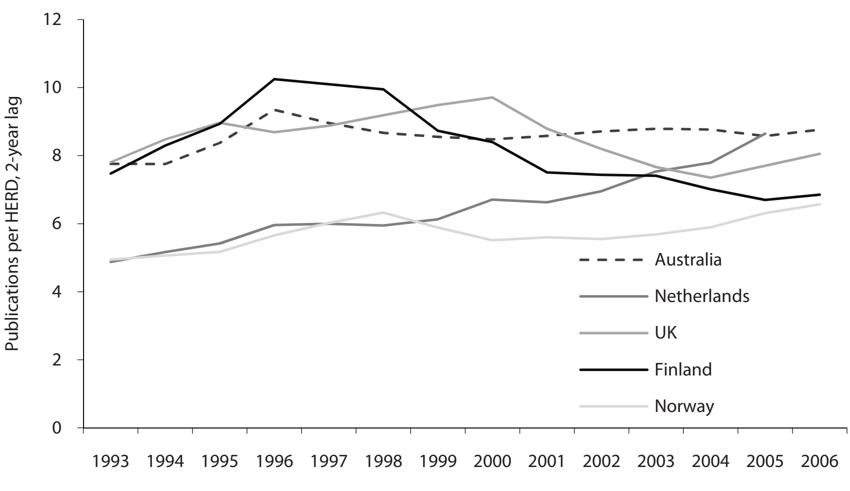
Figure 7.5 that although Finland scores high on both dimensions, it scores below most countries in terms of the ratio between the two, reflecting lower efficiency of public R&D, compared to other countries. Moreover, Figure 7.6 reveals that the efficiency of higher education sector R&D in terms of publications has declined considerably since 1996.

Figure 7.5. Scientific publications in relation to public expenditure on R&D



Notes: The source is DG Research, data from Thomson Scientific/CWTS, Leiden University, Eurostat, and OECD. In order to take into account the gap between R&D input and scientific output, a two year lag between public expenditure on R&D and scientific publication has been applied. For EU27 the scientific publications full counting method was used at a country level. At the aggregate level, double counting was avoided. Population was measured as a 2006 average; for the US as a mid-year estimate.

Figure 7.6. Relative change from 1991 to 2006 in publications per higher education sector R&D expenditure (million constant US dollars 2000 prices and PPPs)



Source: Auranen et al. (2008).

Box 7.2. Looking into universities: what are the structural characteristics of the departments of Finnish and foreign universities?

During the first half of 2009 Etlatieto Oy surveyed Finnish university departments from seven fields (mathematics, physics, chemistry, computer science, electrical engineering, psychology and history). Questions about structural features were sent to both Finnish and foreign departments (US, UK and Scandinavia). The unique survey aimed at finding out the differences (1) between departments from selected countries, (2) between national departments with a different ranking and (3) between different fields.

Finnish university departments are definitely small

A first finding underlines that the average size of Finnish university departments is smaller than the size of the foreign university departments. This size difference applies both to the number of staff and to the number of students. The discrepancy is pronounced in the case of the US but holds also compared to other countries. Figure 1 illustrates the differences in department sizes by plotting the average number of junior and senior professors versus the number of Ph.D. level researchers on outside funding. Figure 2 shows those differences in department size by plotting the average number of new undergraduate and graduate students.

The best departments tend to be bigger

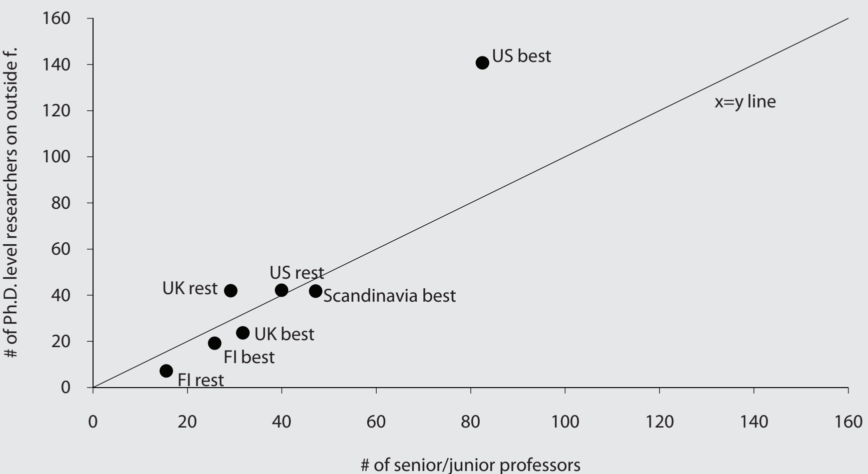
A second finding reveals that the best departments in a certain country tend to be bigger than the rest, although the relationship between size and ranking seems not to be linear.

Returning to figure 1 shows that the average number of professors of the best departments is larger than that of the other departments. Indeed, an additional t-test revealed that the best departments in the US and the UK have a significantly higher number of junior/tenured-track professors than the other US/UK departments.

It is also interesting to note that in our sample (according to the number of staff) the best Scandinavian departments are remarkably bigger than the European departments and the rest of the US departments.

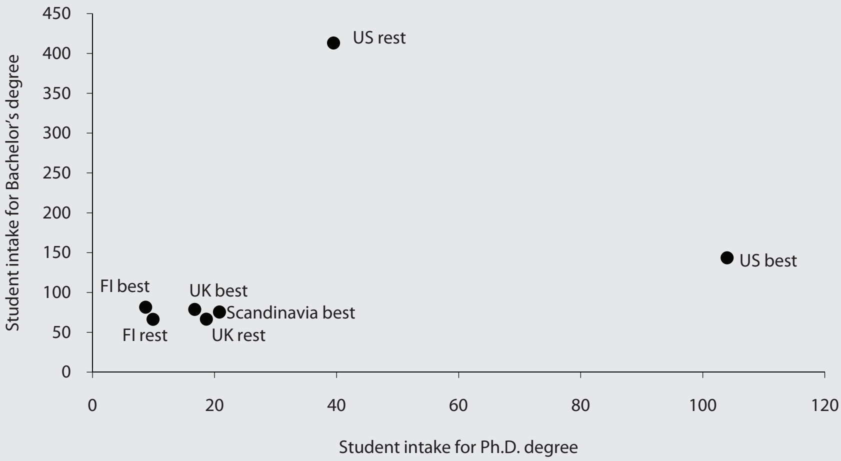
At first sight this pattern also holds for the number of students. But here results seem to depend on which category of students is considered (undergraduates or graduates). In addition there seems to be a discrepancy between the US and Europe (see figure 2).

Figure 1. Average size of research personnel in different university departments: # of professors vs. # of Ph.D. level researchers on outside funding in 2008



Source: Deschryvere (2009).

Figure 2. Average number of new undergraduate and graduate students in different university departments in 2008

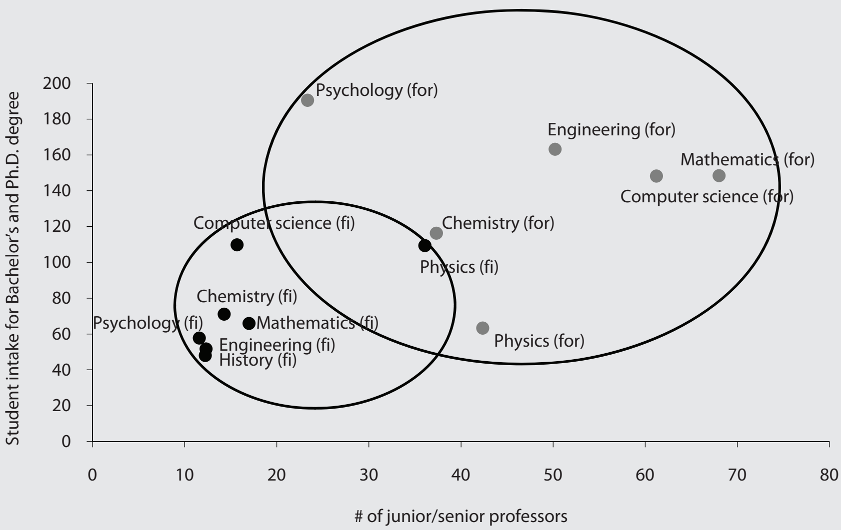


Source: Deschryvere (2009).

Departments of different fields are allowed to have different sizes

A final result reveals that Finnish university departments are small, irrespective of the department field. Figure 3 plots department fields along two size dimensions (number of staff and students) and discloses two findings: Firstly, the variation in department size between different fields seems to be smaller in Finland than abroad, and secondly, only in the case of Computer Science and Physics Finland seems to approach the size (number of students) of the foreign departments in our sample.

Figure 3. Comparing the size of university departments by field: Finland (fi) versus the rest (for)



Source: Deschryvere (2009).

Note: For a full description of the university departments' survey results see: Deschryvere, M. (2009).

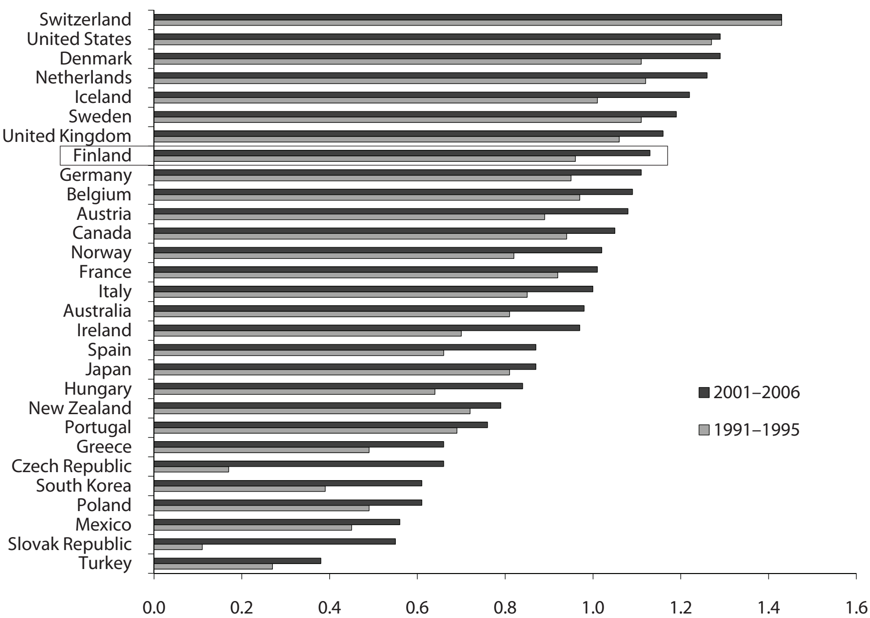
Research quality

Achieving world-class basic research is about quality. A commonly used indicator for assessing research quality is citations to publications. Figure 7.7 shows the performance in terms of relative citation impacts. Finland ranks eighth among OECD countries. A more detailed look by major field of science reveals that the rank of Finland is among the top 10 only in two fields: Medical sciences (6th) and agriculture (1st) (Lehvo and Nuutinen, 2006).

CWTS-Leiden produces a ranking of research universities in Europe on the basis of citations received per publications (corrected for field specific patterns). The following table reports all Finnish universities in this Top 250. The top 2 universities in the ranking are Oxford and Cambridge. The first Finnish university in the ranking, University of Helsinki, enters at 20th position. (Technical University of Denmark holds the 5th place).

Although the quality indicator is not size sensitive, the table suggests that size and specialization matter for quality. The best performing university in terms of quality, University of Helsinki, is also the biggest in Finland. The second highest ranked Finnish University, University of Kuopio, is one of the most specialized Finnish universities. This seems to suggest that a critical mass, either through mere size or specialization, is needed to reach internationally

Figure 7.7. OECD countries' relative citation impacts in 1991–1995 and 2001–2006



Notes: The source is Lehvo and Nuutinen (2006), data source Thompson Scientific. Relative Citation Impact measures the number of citations per publication of a country relative to the OECD average.

Table 7.9. Place and score of Finnish universities in Leiden Top 250 Ranking

Rank	Name	Share in publications*	Quality of publications**
20	University of Helsinki	45.80 %	1.41
44	University of Kuopio	11.30 %	1.27
88	University of Tampere	9.20 %	1.16
111	Helsinki University of Technology	12.30 %	1.12
136	University of Oulu	13.70 %	1.06
167	University of Jyvaskyla	7.70 %	0.99

Notes: The source is Leiden CWTS, 2009. * Total is all Finnish universities in Top 250. Table columns therefore add up to 100. ** Quality of Publications is measured as CPP/FCSm: Citations Per Publications, relative to the field-based World Average.

compatible quality levels. As documented in Box 7.2 the Finnish research performing units are generally very small in international comparison.

Although the Shanghai ranking of universities is heavily criticized, it is nevertheless influential and is therefore interesting to examine in some more detail. Shanghai ranks universities on a set of indicators, measuring their research performance. These indicators include beyond quantity also a number of indicators which are closer related to quality: (i) the number of alumni winning Nobel Prizes; (ii) the number of university faculty winning Nobel Prizes; (iii) the number of articles published in Nature & Science; (iv) the number of articles published in ISI WoS journals; (v) the number of highly cited researchers; (vi) size of universities.

Table 7.10. Aggregate Shanghai Rankings

	TOP50	TOP200	TOP500
Switzerland	97	228	230
Sweden	7	179	217
Denmark	0	114	161
UK	72	98	124
Norway	0	91	107
US	100	100	100
Finland	0	75	81
EU15	13	41	67
Germany	0	37	67
EU25	10	32	54
France	3	29	45

Notes: The source is Brueghel PB 2007/04, Why Reform Europe's universities. The best university in the Top-50 is given a score of 50, the next best university is given 49, and so on. For each country (or region), the sum of Top-50 Shanghai rankings that belong to this country is summed, and divided by the country's population. Finally, all the country scores are divided by the US score, as benchmark. This gives the Country Performance Index for the Top 50 universities. The same logic applies, respectively, to the Top-200 and TOP-500. Selected countries are ranked according to their score on TOP-500.

Brueghel researchers (Aghion et al., 2007) have aggregated these Shanghai rankings per country, and corrected for the size factor. The US completely dominates all European countries in the Top-50. Only the UK and Switzerland rival the US on a per capita basis. The analysis suggests that what Europe lacks most is top-class universities. Like many other EU countries, Finland has no university in the Top 50. But once we move to Top-200 and Top-500 universities, some European countries outperform the US on a per-capita basis. This holds most notably for Sweden and Denmark. Finland however continues to score in the medium tier below these countries and the US, but nevertheless outperforms the EU-15 average.

And finally, when looking at the recently awarded ERC Advanced Grants (2008), based on a highly competitive, excellence driven selection procedure, Finland obtained less than 4% of the available funding. When looking at successful proposals expressed per 1000 researchers, Finland scores 10th after countries like Switzerland, Israel, Netherlands, UK and Sweden, but is also behind countries like Hungary.

7.4.3. DISSEMINATION OF KNOWLEDGE/INDUSTRY SCIENCE LINKS

Assessing Finnish universities on how well they are doing with respect to industry science links, particularly in comparison with other benchmark in the EU and the US, is challenging. No good internationally comparable data exist yet on university R&D contracting, licensing and spin-offs. Only recently, a number of surveys have been conducted across EU countries to assess universities' performance on various Industry Science Links, but these surveys are for the moment still with limited participants and therefore cannot be considered as representative across countries[8].

We will present some industry-science link indicators that allow Finland to be benchmarked internationally. A first indicator is *co-publications between industry and universities*. Although this indicator only covers a limited scope of industry-science links, it has the advantage it can be internationally compared. It is also an indicator that is being introduced in the latest edition of the EU's Enterprise Innovation Scoreboard (2009).

Overall Finland scores above EU average (83 co-publications pmi compared to 31 for the EU average), but lower than Sweden (116) and Denmark (109). In the CWTS-Leiden list of universities worldwide which are active in co-publications with industry (UIC-Rank), 80% are from the US or Japan (the University of Tokyo and Harvard in first and second place). The table below gives the scoring of Finnish universities in this ranking of UIC active universities in the EU. The first Finnish university in the European UIC-Rank is Helsinki University of Technology, in 6th place.[9]

Table 7.11. UIC-ranking of Finnish universities

UIC-Rank	Name	Share of UI co-publications in total publications
6	Helsinki University of Technology	6.10 %
55	University of Turku	3.90 %
70	University of Helsinki	3.60 %

Source: Leiden CWTS, 2009.

Eurostat's Community Innovation Survey provides EU-wide comparable information on firms using various mechanisms to link to HEIs and PROs. R&D Cooperative agreements between HEIs and firms are intensely being used by Finnish innovative firms: about one out of three Finnish innovative firms cooperates with HEIs, a rate which is much higher than in other countries. This higher intensity holds across all size classes. The differential effect is even more important for SMEs.

Despite the high incidence of cooperation between universities and firms in Finland, Universities are not quoted as important sources of innovation by Finnish firms, on average. But this is a general pattern in many countries, reflecting the lack of a science link for the average innovating firm. Only for a minority of firms in science-based technologies, university links matter. With its 4.9%, Finland scores higher than other countries.

Table 7.12. The share of innovative firms cooperating with HEIs, by firm size

	TOTAL	10–49	50–249	>250
Finland	33.2	24.5	42.1	69.4
Sweden	17.4	14.1	18.8	48.7
Belgium	13.2	10.3	15.8	37.5
Germany	8.5	5.8	9.3	25.2
France	10.1	7.6	10.9	25.8
UK	10.0	8.8	11.2	20.3

Source: CIS-IV, Eurostat.

Table 7.13. Importance of universities as sources of innovation / information

% firms quoting universities and other HEIs as important sources of innovation (2004)				
Finland	Belgium	France	Germany	Netherlands
0.049	0.038	0.023	0.034	0.026

Source: CIS-IV, Eurostat.

Table 7.14. Perceptions of industry leaders about higher education

	Higher education and training	Tertiary Enrolment	Availability of scientists and engineers	Brain Drain	Quality of the educational system	Quality of scientific research institutions	University-industry research collaboration
Finland	1.07	1.14	1.07	0.85	1.24	0.90	0.95
Denmark	1.05	0.98	0.96	0.80	1.16	0.89	0.91
France	0.95	0.70	1.02	0.66	1.00	0.86	0.67
Germany	0.91	0.58	0.89	0.75	0.98	0.92	0.93
Sweden	1.03	0.97	1.02	0.80	1.06	0.90	0.97
UK	0.93	0.74	0.87	0.75	0.92	0.90	0.88
EU15	0.93	0.82	0.92	0.73	0.97	0.82	0.79

Notes: On the basis of WEF, GCI 2008; Tertiary enrolment is on the basis of hard data; Score relative to the US (=1).

A final set of internationally comparable information on Industry Science Links is provided by WEF-GCI. On the basis of surveys, the opinion of industry leaders is polled on a number of factors related to how they perceive higher education in their country. Although this information is more subjective, it nevertheless reflects the opinion of key "users" of the output of HEIs & PROs. Overall Finland is scoring very high on a composite factor "Higher education and Training". Together with Denmark and Sweden, it scores even better than the US. On availability of human capital and quality of the educational system, Finnish industry leaders rank their country very favorably. Although the problem to keep talented people at home is smaller in Finland than in other EU countries, it is nevertheless more so than in the US. Also the quality of its scientific research institutions and the scope for university-industry research collaboration is rated very favorable in Finland, above the EU-15 average, close to but below the US.

7.4.4. INTERNATIONALIZATION OF THE UNIVERSITY SECTOR

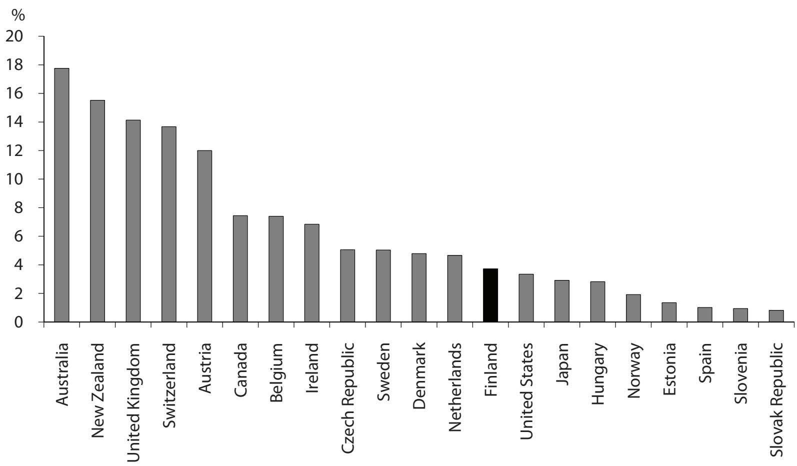
As highlighted by numerous policy communications and reports, one of the main weaknesses of the Finnish university sector is its low internationalization.[10] This applies to various dimensions, ranging from the composition of the personnel and student body, over mobility of Finnish academics to participation in international networks.

International students consist of 3.7% of all tertiary enrolments compared to the OECD and EU-19 averages of 6.9% and 5.7% respectively. Figure 7.8 reveals that this is among the lowest figures in OECD countries. In advanced research programs the corresponding figure is somewhat higher, 7.4%, but still well below the OECD average of 15.9%.

Moreover Figure 7.9 and Figure 7.10 show no major improvements in internationalization in the more recent periods. If anything, the trend in international teacher and student visits as well as in student exchange from Finland is on the decline.

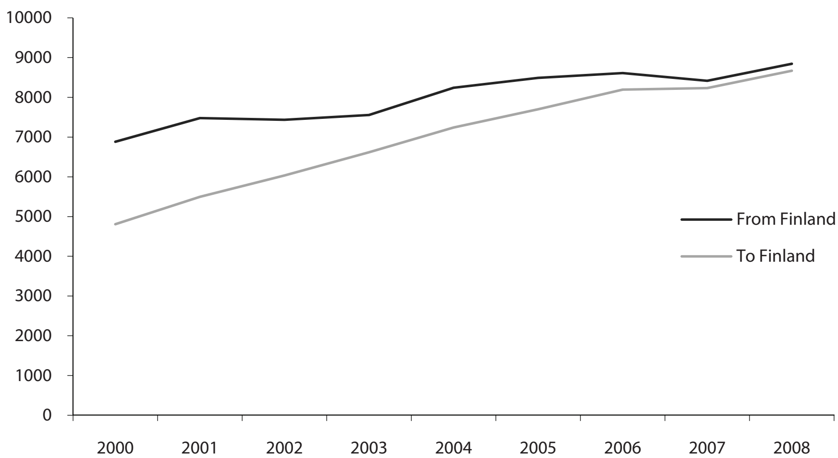
With less internationally mobile researchers, Finnish universities are also not scoring high on engagement in international collaborations. We use two indicators in Table 7.15 to measure this: international co-publications and participation in EU collaborative research projects.

Figure 7.8. Percentage of international students in tertiary enrolments



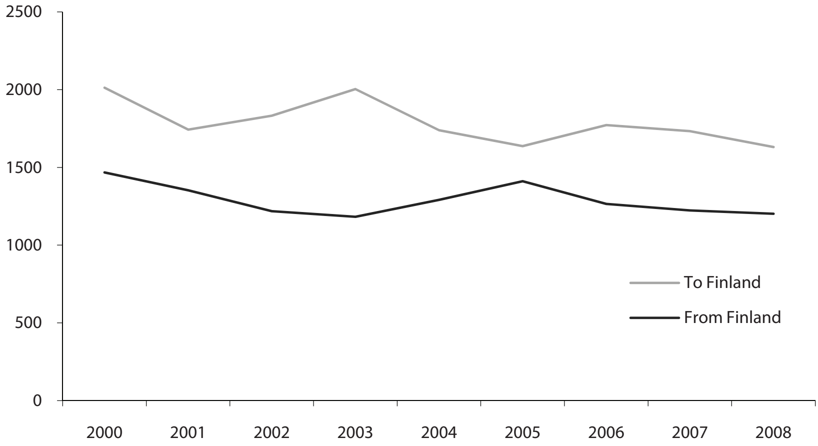
Source: OECD (2008a).

Figure 7.9. Exchange students in Finnish higher education in 2000–2008



Source: CIMO.

Figure 7.10. International teacher and researcher visits in 2000–2007



Source: KOTA database.

With respect to international co-publications, Finland scores lower than other comparable countries like Denmark, Sweden, Switzerland, and Norway in terms of share of international co-publications in total publications (Column 1).

Table 7.15. International co-publications and participation in EU collaborative research projects

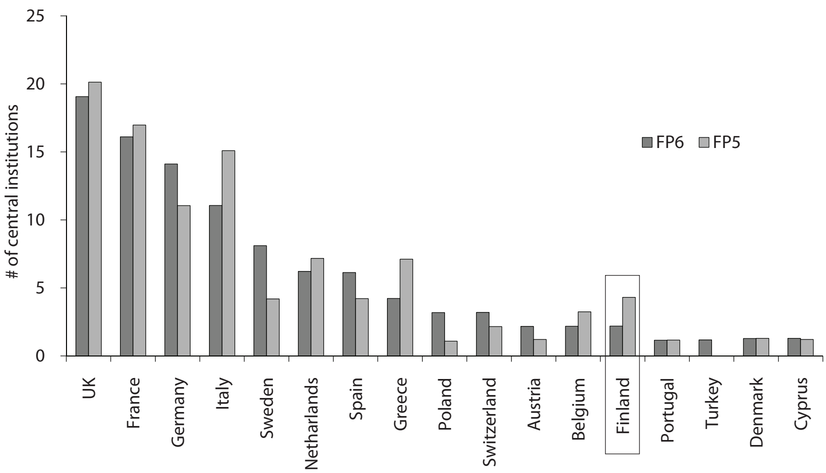
	ICP/P	sICPworld	sICPFin	RICPFin
US	0.32	0.44	0.27	0.61
UK	0.62	0.19	0.2	1.08
Germany	0.67	0.2	0.19	0.97
Sweden	0.75	0.05	0.19	3.84
France	0.72	0.14	0.1	0.71
Spain	0.57	0.07	0.1	1.41
Netherlands	0.72	0.07	0.09	1.45
Italy	0.59	0.09	0.09	0.94
Russia	0.59	0.06	0.08	1.49
Norway	0.78	0.02	0.07	3.78
Switzerland	0.99	0.06	0.07	1.22
Denmark	0.84	0.03	0.06	2.31
China	0.3	0.08	0.03	0.31
India	0.27	0.03	0.01	0.36
Finland	0.71	0.02		

Notes: Authors calculations on the basis of NSF, S&E indicators. The year is 2005. ICP: International Co-Publications, P: total Publications; sICPworld: share of the country in total world International Co-Publications; sICPFin: share of the country in total Finnish International Co-Publications; RICPFin: share of the country in total Finnish International Co-Publications relative to the country's share in total world International Co-Publications. Only countries with >250 co-publications with Finland are represented; Countries are ordered in descending order of total number of co-publications.

The partners for Finnish international co-publications (Column 3 in Table 7.15) are first and foremost the US, followed by UK, Germany and Sweden. If corrected for the size of these partners (Column 4), it is interesting to note the Scandinavian and Russian preference. But the low relative score for the US (the frontier country in most fields) is distressing. Also with the new emerging countries, particularly China, Finland is very poorly connected through co-publications.

Finnish institutions are also not playing a major nodal role in EU funded international collaborative projects. The number of Finnish central institutions in EU funded networks has even decreased from FP5 to FP6 (Figure 7.11).

Figure 7.11. The countries with the most central participants in FP5 and FP6



Notes: The source is DG Research, data from EUPRO (Austrian Research Centres).

7.4.5. MAIN FINDINGS

The evidence presented points towards several observations regarding the Finnish higher education and public research sector.

- The Finnish higher education and public research sector is highly fragmented in three dimensions: First, the resources are scattered into three types of institutions with partly overlapping duties – universities, polytechnics and public research organizations (PROs); second, these institutions are scattered around the country; and third, universities are internally fragmented with too small research and teaching units.
- In terms of higher education, Finland ranks high in many respects, but one persistent problem is that Finnish students enter university later and study longer that their counterparts in other countries.

– Investments in higher education R&D are at a relatively high level and Finland produces a lot of researchers;
– Research output, measured by publications and expressed relative to inputs is low in Finland. Also the quality of the research output, as measured by citations received is below part. World-class excellence in research is rare in Finland.
– Internationalization of the Finnish university sector is low.
– Available statistics indicate that Finnish innovative firms cooperate actively with higher education institutions.

In section 7.6 we return to these observations and based on them develop our proposals to improve the functioning of the Finnish higher education and public research sector.

7.5. REFORMING THE HIGHER EDUCATION SECTOR: HOW SHOULD THE REFORM AGENDA LOOK LIKE?

Section 7.6 will detail our proposal for reforms. In this section, we provide some insights from economic analysis (section 7.5.1) as well as best or common practices of university reforms abroad (section 7.5.2). It allows identifying crucial reform dimensions. We will particularly focus on the importance of having properly designed incentive systems in place (section 7.5.3). Universities are facing increasing pressure to efficiently transfer knowledge to the rest of society and improving industry science links (ISLs) is high on the policy agenda in many countries including Finland. In the last subsection (section 7.5.4) we focus on good practices related to ISLs and which policy interventions are most effective to stimulate ISLs, fully taking into account the comparative strength of all parties.

7.5.1. WHAT CAN WE LEARN FROM ECONOMIC ANALYSIS OF UNIVERSITY REFORMS?

Hampered by the lack of good data, embarrassingly few economic studies assess which factors can explain good performance of universities. A Bruegel study (Aghion, et al., 2007) reports some first findings on the drivers for research performance of European universities, where research performance is measured by the Shanghai Ranking. Their findings suggest that size and age of universities affect positively research performance. This suggests the advantage of scale and experience/reputation. In addition, they find a positive effect from funding (budget per student). The governance indicator that turns out to be significant is budget autonomy. But perhaps most interestingly, they find that larger budgets per student are more effective if institutes enjoy more budget autonomy. The latter effect suggests that policy should tackle simultaneously funding and governance.

At this stage, with the caveat of having limited analysis and evidence available, a few policy implications for the reform agenda can be put forward.

Boosting investment in higher education

Beyond the need for sufficiently large public investment in universities, there is also the issue of *how* to allocate public money to universities. Governments should strike the right balance between core, competitive and outcome-based funding (underpinned by robust quality assurance). Beyond the case for public spending, the empirical evidence suggests that private returns to higher education are substantial, also in Europe. This suggests more scope for private funding of higher education and in particular for asking students to pay higher tuition fees.

Improving governance

Policy makers should be careful not to impose a standardized, micro-managed governance model on their universities. Society through its government could enforce a number of objectives on universities (e.g., with respect to selection of students or curriculum design) in return for public funding, but beyond this universities should be given sufficient degree of freedom to develop their own strategies. In return for being freed from over-regulation and micro-management, universities should accept full institutional accountability to society at large for their results. In many countries this would mean a new approach to policy making with less ex ante checks and greater ex post accountability of universities for quality, efficiency and the achievement of agreed objectives. For universities, this requires new internal governance systems based on strategic priorities and professional management of human resources, investment and administrative procedures.

A European integrated Higher Education and Research Area

Competition for students and faculty is an international game. Barriers within Europe are slowly removing and a larger, integrated market for higher education and research is being established. In a more integrated EU Higher Education and Research Area, European universities can develop their comparative advantages and become stronger players on the world scene. Countries opening up their Higher Education and Research, by fostering international mobility, cooperation and competition, will therefore be able to build a stronger performing system.

7.5.2. WHAT CAN WE LEARN FROM BEST PRACTICES INTERNATIONALLY?

The majority of countries in the EU are implementing or are in the process of introducing reforms of higher education. There is no predominant model for higher education governance reforms in Europe: diversity remains the hallmark of European higher education reforms, reflecting inter alia a diversity in preferences and priorities. But although concrete policy actions vary from country to country, there are some common themes: increasing public funding for higher education, granting autonomy to institutions in the management of financial resources, promoting the direct link between results and the amount of public funding allocated, and encouraging the diversification of funding sources and the creation of partnership with business.

Changing funding models and the use of performance agreements

Most European countries have a dual funding model: On one hand, the so-called block grant aiming at teaching and research based on fixed budgets, and, on the other hand, competitive funding exclusively aiming at research that allocates a budget to winners of programmes or projects in competition. The trend is an increase of competitive funding.

Promoting excellence

European countries have become more attentive to excellence and international recognition in awarding funding. A clear illustration is the German "Excellenz initiative" selecting outstanding universities, clusters of scientific disciplines and doctoral schools in competitions.

Increasing institutional autonomy and accountability

Most European Member States have implemented national legislation changes aiming at providing universities with more institutional autonomy in terms of the margin of manoeuvre of higher education institutions to allocate resources, identify research priorities and define and implement strategic plans. The trend to allocate higher autonomy to universities requires more accountability of the institutions at the same time.

Fostering university collaboration with business

Efforts to foster collaboration of universities with business encompass funding joint university/business research projects, creation and funding of joint research laboratories and units, promoting the knowledge transfer and the commercialisation of research results, legislative and financial support for spin-offs, and the support for mobility of human resources between both sectors.

A common neglect in the reform process, are the policies concerning academic staff. Only very few countries are working on reforms to provide institutions with more room to manoeuvre in terms of staff. In most countries at least parts of the process are regulated or supervised. Also, in terms of salaries, regulation and supervision remain common.

7.5.3. AUTONOMY COMBINED WITH THE RIGHT INCENTIVES

An important unifying theme underlying the insights from economic analysis and best practices is the importance of incentives. Providing the right incentives is vital to change institutional behavior. This puts special emphasis on the governance and steering system of universities. In order to get the benefits of autonomy it has to be combined with an appropriate steering system that provides the right incentives for universities to strive for the stated goals. The funding mechanism constitutes one of the main components of the steering system.

The standard way of providing incentives is to reward good output, and to ensure through competition that resources are not wasted. Often, competition generated by the market place is the best way of providing the right incentives. For universities, that is nowhere the case in practice, and even less so in those countries such as Finland where the university system is almost entirely state-funded. For many reasons related to the specific features of knowledge production, unfettered competition may not yield the socially optimal outcome.

Key requirements of any incentive system for universities are:

- **transparency**: Universities need to understand what they are rewarded for. Otherwise they cannot plan how to act in order to improve their funding.

- **stability**: Universities need to be able to rely on the system not being changed too often, as otherwise, the incentive effects are lost (and, potentially, universities switch their effort to lobbying for changes rather than investing in producing output)
- **competition**: Given that most of the university funding comes from the public sector, universities will be competing to get a "larger slice of the cake". The system needs to ensure that universities cannot collude.
- **funding based on output measures**: It is important to base funding on dimensions that universities can affect – meaning output. Only if output is very uncertain or hard for universities to control for, one may revert to using input measures.
- **avoidance of micro-management**: The idea is to give the universities the autonomy to make their own decisions and the freedom to implement their strategies as they see fit. The tool to make sure that societal objectives are met is funding.

In our view, the best way of promoting objectives that are not tied to output is to award fixed funding. That way, one does not distort the performance of individual universities while at the same time being able to achieve the ancillary goals, like diversity. One cannot stress too much the detrimental effects of trying to bring goals that are not tied to performance into the incentive system – the result will be incentives that channel efforts and resources in the wrong direction. Therefore, disconnecting the funding which seeks to e.g. maintain the diversity of the university system from the funding that is allocated according to academic performance is a crucial component of a good funding system for universities.

The challenge facing any university system where most of the resources come from the state budget is to find a way to bring the right incentives to bear. Arguably, the systems that have performed best are those that have been able to introduce competition between universities. Aghion et al. (2009) show that university autonomy combined with competition is positively correlated with university output, both among European universities and among U.S. public universities.

Competition in research has happened primarily through two channels: First, by funding universities with a diverse ownership structure through competitive funding – e.g. the National Science Foundation in the US. Second, by funding state-owned universities through a system where allocation decision have been delegated to academic peer review (the UK system with funding being split between quantity based measures and research quality, measured by academics through the Research Assessment Exercise, and quality being given a high weight).

Competition in education is best realized by informing the students and future students about differences in quality between institutions and programs, and rewarding institutions for success. Because teaching quality is hard to measure, one should consider ways of allowing students to "bring the money" with them.

7.5.4. GOOD PRACTICES AT UNIVERSITIES FOR ESTABLISHING INDUSTRY SCIENCE LINKS (ISL)

Improving ISLs is high on the policy agenda in many countries including Finland. Universities are facing increasing economic pressure on academic research. They are demanded to participate actively in turning scientific developments into useful innovations. This however does not imply necessarily that universities should shift more towards producing pure applied research and/or supply innovations to the market. It rather calls for wider and deeper "interactions" between the universities and other private actors, fully respecting the division of labour between academia and commerce.

Which institutional setting and policy environment is most conducive to the right type of "industry-science" interactions? A match of knowledge *supply* and *demand* provides a first necessary condition for having ISLs. High ISLs require an innovation orientation at the industry side and a performing science base, with specialization in science-based technologies. But even if there is supply and demand for knowledge dissemination, effective industry-science interactions may not materialize. The empirical evidence suggests that the contributions of science to innovation and the relations between research institutions and enterprises are not as straightforward, reflecting market failures in the scientific knowledge market.

A factor which receives quite some attention as conditioning feature for smooth industry science links is a clear *intellectual property rights* regime (Link, et al., 2003). Another major issue is whether researchers have sufficient *incentives* to disclose their inventions and to induce researchers' cooperation in further development. Then there is the *asymmetric information* between industry and science on the value of the innovations. Firms can typically not assess the quality of the invention ex ante while researchers may find it difficult to assess the commercial profitability of their inventions (see Macho-Stadler, et al., 2004). A partners' lack of understanding of the other partner's culture and *conflicting objectives* among partners may further impede good industry science relations, notably the conflict of interest between the dissemination of new research findings versus the commercial appropriation of new knowledge (Siegel, et al., 2003).

The following practices at universities have been identified in various exercises as facilitating a high level of Industry Science interaction (Polt, 2001; OECD, 2000; Debackere & Veugelers, 2005).

- Reaching scientific excellence in research is a necessary condition for ISL. Attractiveness for industrial partners demands competence at universities both in short-term and long-term oriented basic research.
- Universities that are successfully engaged in ISLs do not solely rely on contract research with industry. They rather show a balanced financing consisting of a mix of basic financing by the government for long-term oriented, strategic research, industry financing in the course of contract research and collaborative R&D projects, and a competition-based public financing, including funds for joint research with others.
- In the mix of ISL mechanisms, contacts and networking are key, underscoring the importance of personnel mobility between industry and science.
- Exercises to improve ISL at universities are especially successful when they implement ISLs as a central part of the institutions' mission, and consider ISL activities in researchers evaluations, providing both individual and organizational incentives.
- Many countries established *specialized technology transfer offices* either at universities or within public research laboratories as an instrument to improve ISLs. Technology transfer offices at universities operate next to other intermediaries such as technology and innovation consultants for SMEs, technology and science parks, incubators, information provision systems and contact platforms. Nevertheless, there is no clear evidence on the effectiveness of these intermediaries and their role in ISLs (Polt, 2001). While there is no doubt that comprehensive intermediary structures foster ISLs to some extent, a clear good practice model is missing. As most of the critical success factors for ISLs (such as appropriate incentive schemes and institutional settings, the level and orientation of R&D activities of both industry and science, legislation) can not be shaped by intermediaries themselves, they often fail to foster ISLs given the existing barriers to interaction. In the EU, most organizations are rather small and are therefore often below the necessary critical mass to stimulate ISLs effectively. Evidence from the US in terms of good practices for technology transfer units (Siegel, et al., 1999), identifies as critical organizational factors for university technology transfer offices, adequate faculty tenure and promotion policies and royalty and equity distribution systems, as well as staffing practices within transfer offices, requiring a mix of scientists, lawyers and managers. Best US practices furthermore indicate as an important skill required for technology officers, to have a "boundary spanning" role, serving as a bridge between the firms and scientists.

When looking at policy instruments for stimulating ISLs, common practices in the EU include public initiatives (i.e. often funding) to foster ISL at a sufficiently large scale. Also legislation should not constitute a major barrier for interactions (most notably IPR rights). But perhaps most importantly, ISL policies need to be embedded in a *coherent policy* strategy designed to improve

Box 7.3. Some best practices from LERU

A survey of 12 European Universities, all members of the League of European Research intensive Universities (LERU) (which includes the University of Helsinki), shows high levels of similarity in the approach adopted towards managing ISLs as well as the incentives provided at the respective institutions. It is obvious that the level of maturity with TTO structures and ISLs can differ amongst the institutions surveyed. However, the basic approaches and tenets are quite similar. More specifically:

– The universities surveyed consider the exploitation of research activities as an explicit mission of their institution.
– All universities surveyed recognize the need to support a mix of ISL activities ISLs, IP manage ment and spin-off creation generate important spillovers amongst them. Every university surveyed combines the three activities in its TTO structure.
– Each university also recognizes the need to decentralize its TTO structure, with a lot of frequent interactions with the research groups and with large levels of delegated decision power towards the TTO as it comes to decision-making with the research groups on what to exploit under what conditions using which mechanisms.
– Each university has a well-established incentive policy towards its researchers. The incentives, financial and administrative, occur both at the level of the individual researchers involved in exploitation of research as well as at the level of the research groups involved.

Source: Debackere & Veugelers (2005).

all elements of the national innovation system. Effective public support for ISLs needs a long-term approach as it attempts to change structural features of innovation systems and traditional attitudes and behaviour of actors.

7.6. THE REFORM AGENDA IN FINLAND

Like the majority of European countries Finland is also currently reforming its higher education and public research sector to better fit the needs of knowledge-driven global economy. A key component of the Finnish reform agenda is the new Universities Act, which will be enacted in autumn 2009. Universities will have to comply with it starting January 1st, 2010 (see Appendix 2). In addition to the new university legislation there are two resent reforms in Finland that aim at improving ISLs: the foundation of the so-called Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) and the enactment of the new University Inventions Act in early January 2007 (see Appendix 2).

In this final section we will provide our suggestions for improvements. To this end, we will confront the Finnish higher education and public research system with the characteristics derived in the previous section on how an optimal reform agenda should look like, while taking into account the specific challenges the Finnish Higher Education and Public Research sector needs to deal with.

Based on the observations derived in sections 7.3 and 7.4 and the interviews conducted during the evaluation, the following key challenges have been identified, which the Finnish higher education and public research sector reform needs to tackle.

- Increasing the quality of university research
- Streamlining the higher education sector to reduce fragmentation and overlapping activities
- Increasing internationalization of the university sector
- Tackling the problem of late graduation

Related to ISLs the limited available statistics do not clearly indicate major weaknesses in the Finnish system. Based on interviews and existing literature on ISLs we nevertheless want to stress some important issues that we consider especially important to improve in these ISLs the exploitation of the relative strengths of academia and industry.

In this section we present our proposals as to how Finland should address these challenges by an appropriate reform agenda. Following many other European countries a central part of the new Finnish university legislation is the goal of giving universities more independence. Finnish universities will have an independent legal status with full financial responsibility. As the discussion in section 7.5 made clear, this is indeed an important and essential component of the university reform agenda. However, in order to get the benefits of autonomy, it has to be combined with an appropriate steering system that provides the right incentives for universities to strive for the stated objectives. On this dimension, the new Finnish university legislation is insufficient and needs to be developed further.

7.6.1. IMPROVING THE QUALITY OF UNIVERSITY RESEARCH

We argue that the most critical challenge to achieve pioneering in innovation is the quality of research in Finland. Pioneering in innovation activity requires world-class research and this cannot be achieved without world-class basic research at the universities.

The evidence suggests that although the Finnish research fares relatively well in international comparisons there is still room for improvement to increase the efficiency of research expenditures and to improve on the quality of research performance to achieve top-class status. Several avenues can be suggested to raise the quality of basic research further and to keep it at a high level.

First of all, universities should be adequately rewarded for high quality research. We strongly argue that research and the quality of research should receive considerably higher weight in the funding system of universities than is the current practice. Our proposal for the new financing system of universities in the appendix explains in detail how this should be done. Here we only emphasize the main issues:

– We propose a split of funding between education, research, and strategic objectives that give a high weight to research (35%). This would ensure both that the universities have strong incentives to improve research quality while still making sure that they place a large enough weight to their important task of providing education (55%).
– Few and clear measures of quality and quantity of research should be included in the funding mechanism. All of the research indicators included should take discipline-specific practices into account. We suggest the following two-part way of measuring the quality and quantity of research: First, a discipline – specific quality-weighted count of publications. Second, a "light" peer-review to complement the necessarily crude quantity – based measure.
– The Academy of Finland has a long tradition in allocating competitive research funding in Finland. Its expertise in assessing the quality of research could be exploited to implement the new financing system. One example could be to allocate the research-based funding through the Academy of Finland using the proposed quality measurement guidelines. This would only require a separation of the research-based funding from the base funding of universities, and an according increase in the amount of competitive research funding. The main difference to the current Academy of Finland funding practices would be that this type of funding is allocated to universities and units within them, not individual researchers or projects, and the funding is allocated according to observed research quality instead of project plans.
– One of the key features of a good incentive system emphasized in section 7.6.4 is transparency. Given that our financing proposal differs considerably from the current system a move to the new system should be announced 2–4 years before the actual implementation. Universities need to be given the information on funding rules well in advance, allowing them the necessary time to start acting in a way that takes the funding rules into account.

Second, it seems that resources for high quality long term basic research are too low. Achieving the international level in research requires systematic and long term development of potential research units. In Finland the Academy of Finland and Tekes are the main instruments for allocating competitive research funding. Although both may serve their purposes well, neither is suitable for building a long term high quality research agenda for potential research units. Both institutions focus on allocating project-based funding. Given that resources are limited, project-specific funding does not provide an adequate basis for long term development of research units. Moreover, Tekes-funding is to a great extent too short term oriented and applied in nature for the purposes of long-term basic research.

Third, the university sector is far too fragmented. Not only are there many universities, but also the fields covered by each university are overlapping to a great extent. There are too many micro units doing the same thing. It is widely acknowledged that achieving a high level in research requires some sort of critical mass. Our small benchmarking exercise also supports this argument (see Box 7.2).

In order to build critical mass into the Finnish system, universities should specialize in their strengths. The best way to achieve this is to provide incentives for specialization but leave it up to universities to decide where to specialize. As Aghion et al. (2009) emphasize, the production function in higher education is hard to observe for outsiders, not to mention understanding it. Moreover, the contributions of academic research to innovation and economic performance are likely to materialize with long lags and in unpredictable forms (Mowery and Sampat, 2005). Hence, it is unlikely that centralized government control could be more effective in directing efforts than autonomous universities competing with one another. For sure it is the universities themselves who best know their strengths. We argue that strong incentives for high quality research would encourage specialization in universities.

Specialization would necessarily mean closing down some activities. These are difficult decisions to implement in practice. However, in this respect the Finnish university sector is facing a unique opportunity in the next years. According to statistics over 40 percent of professors will retire during the next 5–10 years (KOTA database). In terms of specialization this is an opportunity that should not be wasted.

The fragmentation of public research is wider than the fragmentation of the university system: the public research organizations are operating in a way that is overlapping with university research. This dimension of fragmentation should also be addressed and is discussed in section 7.6.2.

Fourth, specialization and excellence must be allowed for and supported also in practice. The ideological atmosphere and political tradition in Finland strongly emphasize equality between regions and universities. Individuals in each region should have equal access to higher education of equal quality. This approach has surely been beneficial in the past and likely accounts for the high educational level in Finland. However, the world is changing and also the international position of Finland is now different. Instead of catching-up the question is now how to move ahead. This is widely acknowledged also among the Finnish policy makers and excellence in key fields is regarded crucial. Unfortunately, in practice the strive for equal access and equal quality seem to bypass the goal of excellence. We want to emphasize that specialization and excellence must be allowed. Instead of dictating which fields to cover and to what extent, universities should be given equal opportunities to specialize and excel. The strive for equal access to higher education continues to be important, but maybe the mechanisms to achieve this should be changed. We will discuss the balancing between regional and global needs in more detail in section 7.6.2.

Fifth, increasing the attractiveness of research careers is important. The 4-stage research career promoted by the Ministry of Education is a good start. One needs to enable freshly minted Ph.D.s to obtain a job where they can prove themselves while at the same time ensuring competition for these places, and the ability of departments and institutions to follow their chosen strategies. After the post-doc phase (which may be funded by a variety of means), there has to be the possibility of an established and reasonably secure position as a senior researcher. Again, one needs to ensure competition and the ability of institutions to follow their strategies. A tenure track – type system would provide the needed features. A tenure track system however builds upon two fundamental principles: First, there is a small probability of getting tenure at the institution who hires a researcher after she/he has completed his or her Ph.D. Second, there is a small probability of the researcher not getting tenure at some institution. Tenure track, through these two fundamental principles, provides young researchers strong incentives to perform while at the same time providing them "insurance" against failure. A corollary of the above two principles is that there has to be a "market" both for young and for senior researchers, with a sufficient number of open positions every year. It is highly unlikely that the Finnish university system alone could guarantee that. Therefore, one would have to develop the tenure track system in tandem with similar developments internationally. It is important to note that this would necessitate a change in the hiring culture of Finnish universities: They should much more aggressively seek international placements for their (Ph.D.) graduates, and similarly seek to recruit senior researchers internationally.

7.6.2. STREAM-LINING THE HIGHER EDUCATION AND PUBLIC RESEARCH SYSTEM

The wide regional coverage of the Finnish higher education institutions dates back to 1950s. The demand for highly trained labor increased due to the structural change of the economy, which raised issues of equal access to higher education across the country. As a result, the Finnish higher education system grew to the present regionally comprehensive network during the 1960s and 1970s. Both universities and polytechnics have a wide regional coverage and strong regional missions. They are regarded as the drivers of regional innovation systems and competitiveness of local businesses.

It is true that universities can contribute significantly to the regional economic dynamism as many studies argue. However, increasing globalization puts small open economies under pressure to find a proper balance between regional and global needs. We argue that the current balance should be altered to better match with the goal of global excellence. Although universities may still have important regional impacts they should primarily be regarded as global, not regional institutions, a perspective apparently shared with a large majority of private and public actors in Finland (see Table 7.1). Finland is a small sparsely populated country and it is not realistic to assume that all the regions offer sufficiently challenging basis for the operations and long-term development of a world-class university.

While achieving excellence in a global world is not possible without world-class universities, it is important to enhance at the same time the vitality of Finnish regions. How then to balance between the increasingly global and persistent regional needs? Here the duality of the Finnish higher education system could provide a solution. Polytechnics should be given the incentives to specialize for local needs for which they, given their ownership structure, are better suited than universities, while universities should be encouraged to strive for excellence to meet the global needs the society as a whole is facing (see Table 7.1, confirming this).

From a systemic point of view, reconciliation of global and regional needs relates to a more general need in the Finnish higher education and public research sector to stream line the tasks of different institutions. The current fragmented and overlapping structure does not provide a sustainable basis for tackling future challenges. In general there should be a clear division of tasks between universities, polytechnics and public research organizations combined with well functioning collaboration among the complementing institutions.

Universities should be given strong incentives to excel in research as discussed in more detail in section 7.6.1. Polytechnics in turn should be given incentives to maintain the more applied and regionally oriented nature of their curriculum. Pressures to yield polytechnics similar duties as to universities should be resisted. Equal access to higher education could be sustained by moving towards a system where the study right is first granted up to a bachelor's degree only, while at the same time allowing students with a bachelor's degree from a polytechnic to apply for master's programs at universities (see section 7.6.4). This type of a system would also likely lead to more mobility nationally after the BA, as well as to more mobility between disciplines after the BA thus enabling students to acquire multidisciplinary skills more easily. At the same time, it would allow institutions to specialize in BA/masters education.

As the results in Table 7.1 already suggested, also the role of public research organizations (PROs) should be re-assessed. Maintaining a large network of public research organizations fragments the Finnish research base even further. Therefore, it should be carefully analyzed, which (administrative) tasks now performed by PROs are such that they necessitate the maintenance of in-house research capability. As PROs by nature lack the integration of teaching with research, one should strive to integrate as much as possible of the research functions within PROs into universities. Although this may sound rather radical, it is not a new idea. In Denmark the majority of public research institutes were merged with universities in the beginning of 2007[11].

To the extent that the PROs have research infrastructures that are a necessary requirement for high quality research (such as data bases), these should be made available to all, with access granted potentially through competition. In addition, it should be studied to what extent the research and evaluation duties now performed by the PROs could be outsourced. Such a new way of organizing research would allow the government more degrees of freedom in allocating its short term, policy-oriented, research from one field to another. Given the unique feature of universities – their ability to bring together education and research – one should explore ways of returning basic research resources from public research organizations to universities.

7.6.3. INTERNATIONALIZING FINNISH HEIS

The strategy for internationalization of the current government shows that this important weakness is well diagnosed. The strategy introduces 33 different steps in order to improve the situation. Assessing these steps in detail is not possible within the scope of this evaluation. Instead we approach the issue of internationalization by asking what kind of incentives would increase the internationalization of the Finnish university sector.

First and foremost we strongly argue that the best way to increase the participation of Finnish academics in the international community and to attract foreign experts to Finland is to reward universities for the quality of research. Within the global economy it is unlikely that excellence in research can be reached without international engagement. Therefore strong incentives for high quality research would likely increase internationalization. Another benefit would be that the promoted internationalization would be truly "organic". This is something that is needed in order to achieve excellence. Research excellence is also essential in order to attract foreign talent to Finland.

Second, to attract foreign students universities should be able to experiment with different programs and be rewarded for providing programs to foreigners (tuition fees).

Third, to attract foreign experts there has to be attractive posts with adequate compensation.

7.6.4. UNIVERSITY EDUCATION

Besides building a knowledge base through research, the primary task of universities is the formation of human capital through teaching. A well performing innovation system needs an adequate pool of people with appropriate education, skills and training. Education is one of the most important tasks of the higher education sector within the innovation system and university education is a crucial component of higher education. We argue that prerequisites for a well functioning and high quality university education are an adequate unit size and high quality research. An adequate unit size is required to cover the whole curriculum of a high quality program. High quality research is reflected in university education through complementarity of research and education activities, a fortiori at the Master level (Becker, 1975 and 1979, Mowery and Rosenberg, 1989).

In addition, to guarantee the quality of university education the teaching staff should have appropriate incentives. The main difficulty in providing incentives for high quality education is the unobservability of the quality of education. Observable measures, such as the number of students earning some specific amount of study points, are dangerous – this particular measure would give universities an incentive to lower standards at least at the end of the academic year, and at least for those students just below the threshold. The best way to provide these incentives would be to let students "vote with their feet". In practice this means that well informed students should, in one way or another, bring the money with them (publicly or privately funded).

Within the scope of this evaluation it is not possible to extensively assess the education activities of the Finnish university sector. The statistics in section 7.4 showed that on quantitative terms the Finnish university sector has in general fared well in education.

In order to reduce the problem of late entry it would be important to move towards a system where study right is first granted to BAs only. This makes it less risky to choose "quickly" the first study place and program or enter other than the first-choice fields. This necessitates that the master's programs are ready to admit students with diverse backgrounds and thus requires that universities rethink the qualifications they require for admission. Similarly, universities should think through what additional studies they require master's students to absolve in order to obtain the degree. Students at polytechnics should acquire the necessary qualifications to apply for master's programs at universities.

In addition it would be important to rethink the university admission system. Granting study rights first to BAs would already help in solving the current "queuing" problem. Furthermore, possibilities to stream line the application process by relying more on the matriculation examination should be assessed.

In order to reduce average study times we suggest a re-evaluation of the strong stance on "free" education. Vouchers and other schemes should be studied without political preconditions. Fees or vouchers would give strong incentives to study faster. Note that fees or vouchers could be implemented so that the education continues to be free as long as students graduate within certain time-limits. In addition, universities (degree programs) should be allowed to experiment with maximum study times and minimum yearly study requirements (example: UK). The current law proposal makes it too easy for students to extend their study rights. Experimentation here may be important as effects in Finland are unknown.

7.6.5. IMPROVING ISLS AT HEIS

The discussion in section 7.5.3 highlights that reaching scientific excellence in research is a necessary condition for ISLs. As such our emphasis on increasing the quality of academic research in Finland also contributes to further enhancing ISLs. In addition, we point out some issues related to ISLs that we deem especially relevant for the Finnish innovation system. Since it is hard to find good data on the various ISL our view on the current status of ISLs in Finland is based on the interviews conducted during the evaluation. As such we provide food for thought for policy making rather than precise recommendations.

A first issue worth discussing is a match of *supply* and *demand* for Industry Science Links. Statistics in section 7.4.3 show that Finnish firms rate their interactions with HEIs positively. This would indicate that knowledge supply by HEIs meets demand from firms. However, section 7.4.2 revealed that Finnish universities are lagging behind in terms of research quantity and especially quality. Combining these two observations suggests that maybe the innovation paths of Finnish firms in general are lagging world class. There is a match of knowledge supply and demand but at a quality level that is falling behind the frontier. If this is the case, the quality of demand needs to be raised simultaneously with the quality of supply in order to generate ISLs geared towards world class excellence.

A related issue is the impression of relatively strong top-down orientation in policy making related to ISLs in Finland with emphasis on the needs of established firms and traditional sectors. An example of this is the Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) (see Appendix 2). If established players in the traditional sectors have difficulties in seeing the relevance of basic research, have very short term research agendas and lack real aspiration or vision for renewal, this approach may jeopardize the development of the competence bases at both sides of the ISL interaction. A more natural habit for ISL interactions are newly created or recreated firms in new science-based markets, a habit that risks being underrepresented in top-down SHOK-like programs.

In general, we strongly argue that the best way to guarantee a high relevance of research for society is to motivate universities to strive for world-class research and avoid top-down policy making in setting the research agendas and ISL priorities. Knowledge dissemination is not a separate third activity of universities. It is something that happens in close cooperation with education and research. Demand from industry for ISLs at universities is driven by quality of academic research and teaching. ISLs should materialize because universities have something that firms want. World-class research and excellently trained students are the best way to attract the firms that truly operate at the world technology frontier.

Many countries have established specialized technology transfer offices (TTOs) either at universities or within public research laboratories as an instrument to improve ISLs. This institutionalization of ISLs in the form of TTOs within universities is a relatively new phenomenon in Finland and the organizational structure is still in development. Therefore, we focus on issues that should be considered in developing the structure of TTOs further.

Based on interviews conducted by Tahvanainen (2009) it seems that much of the discussion on TTOs in Finland centers on licensing and spin-offs. However, these money making activities are in general a marginal activity of TTOs. The role of a well functioning TTO is rather a facilitator between university and industry that screens the research activities of the university and has the relevant contacts.

In addition, it seems that the TTOs in Finland do not in general have the adequate scale, resources and expertise to stimulate ISLs effectively. Given the fragmentation of the Finnish university sector, finding an organizational structure for TTOs that allows for critical mass is challenging. Achieving critical mass is likely to require some pooling of resources across TTOs. At the same time it is essential to have on-site presence at the university for better links with science. Moreover, on-site presence would make it easier to link the activities of the TTO to the strategy of university. One solution to combine critical mass and proximity, might be to pool resources related to contacts to industry and technicalities like legal affairs while having on-site presence at the university to get an understanding of the competencies of the university and link the activities of the TTO to the strategy of the university.

7.7. CONCLUSIONS

As Europe has approached the world technology possibility frontier and is leaving the era of catching up to the US behind, innovation and highly-educated people are becoming crucial drivers of its growth potential. This development has put new demands and pressures upon universities. More and more emphasis is put on ensuring that the capabilities of universities contribute to countries' economic and social objectives, and reforms are taking place to ensure that universities will be in a position to achieve their full potential. Finland takes closely part in this European level development and several reforms reshaping the higher education system and research base have been or are about to be introduced.

Our task was to evaluate the role of research and education within the Finnish innovation system. Given that universities, with their unique blend of basic research, higher education and diffusion of scientific knowledge, are central to the innovation systems of frontier countries like Finland, we have focused mainly on the university sector. The Government's Communication on Finland's National Innovation Strategy to the Parliament (NIS) sets the goal of *pioneering in innovation activity* in selected sectors of innovation. We took this goal as a starting point. NIS presents four strategic choices that are deemed especially important for the future of the Finnish innovation system. Those are: innovation activity in a world without frontiers, demand and user orientation, innovative individuals and communities and systemic approach. Our objective was to evaluate the reforms needed in education and research in order to reshape the Finnish innovation system to better match these choices.

Starting from these premises we have framed our evaluation to cover the quality of Finnish university research and education, industry science links (ISLs), internationalization of the university sector and the structure of the Finnish higher education and public research sector.

The evidence presented in the chapter points towards several observations regarding the Finnish higher education and public research sector.

- The Finnish higher education and public research sector is highly fragmented in three dimensions: First, the resources are scattered into three types of institutions with partly overlapping duties – universities, polytechnics and public research organizations (PROs); second, these institutions are scattered around the country; and third, universities are internally fragmented with too small research and teaching units.
- In terms of higher education, Finland ranks high in many respect, but one persistent problem is that Finnish students enter university later and study longer that their counterparts in other countries.
- Investments in higher education R&D are at a relatively high level and Finland produces a lot of researchers.

- Research output, measured by publications and expressed relative to inputs is low in Finland. Also the quality of the research output, as measured by citations received is below part. World-class excellence in research is rare in Finland.
- Internationalization of the Finnish university sector is low.
- Available statistics indicate that Finnish innovative firms cooperate actively with higher education institutions.

These observations clearly imply the following main challenges to be addressed by policy:

- Increasing the quality of university research
- Streamlining the higher education sector to reduce fragmentation and overlapping activities
- Increasing internationalization of the university sector
- Tackling the problem of late graduation

Despite the positive evidence on ISLs in Finland, we nevertheless raise a few issues that we deem especially important in enhancing ISLs further. These are based on the interviews conducted during the evaluation and our perceptions and therefore should be considered more as food for thought for policy making rather than precise policy recommendations.

To address the identified challenges we argue that the *most critical challenge is to increase the quality of research in Finland*. Excellence in research is vital to world class innovation activity and it is also a precondition for internationalization of the university sector, industry science links and relevance of research for innovation. The best way to increase the quality of academic research is to provide autonomous universities incentives through funding rules emphasizing quality. We strongly argue that research and the quality of research should receive considerably higher weight in the funding system of universities than is the current practice.

In a separate proposal for the new financing system of Finnish universities we show in detail how the funding rules should look like. A key feature of our proposal is to give a large weight for quality weighted research output, evaluated on a discipline basis, in allocating base funding to universities. We suggest a two-part way of measuring the quality and quantity of research: a discipline – specific quality-weighted count of publications and a "light" peer-review to complement the necessarily crude quantity–based measure. The expertise of the Academy of Finland could be used in implementing the quality assessment. In addition, it is important to announce the future funding principles sufficiently many (at least 2–4) years earlier to allow universities to react to the funding principles. The general funding rules should be stable over an even longer time to allow universities both to plan ahead, and to execute their plans.

Second, *it is necessary to stream-line the higher education and research structure*. Division of tasks between institutions is needed in order to reduce the fragmentation of the research environment. Universities should be given strong incentives to excel in academic research while polytechnics should maintain the more applied and regionally oriented nature of their curriculum. Within universities the specialization should happen through universities reacting to incentives rather than by the Ministry of Education dictating structural changes. Also the role and tasks of PROs should be critically assessed and the basic research activities of PROs should be shifted to universities. Equal access to education can be sustained by easy access to (university) master's programs with BA from polytechnics.

Third, we strongly argue that the best way *to increase the participation of Finnish academics in the international community and to attract foreign experts to Finland* is to reward universities for the quality of research. Within the global economy it is unlikely that excellence in research can be reached without international engagement. In addition, there should be career opportunities for foreign experts and attractive programs for foreign students in place.

Fourth, in order *to reduce the age of graduation* we suggest limiting the study rights that are initially granted to the BA only. This would decrease the risk of "choosing the wrong field/educational establishment. To truly be helpful, measures must be taken that make it easier for students to change fields and establishments when exiting the BA and entering the master's programs. This would also enhance the division of tasks between polytechnics and universities and allow both to specialize in the education that they offer. In addition, vouchers and other schemes should be studied without political preconditions as they provide strong incentives to study faster.

To further enhance ISLs we stress the importance of world-class academic research. The aim of pioneering in innovation activity calls for excellence. ISLs materialize because universities have something that firms want. For firms operating at the technology frontier this means world-class research and students. The limited evidence available suggests that maybe neither academic research nor the innovation paths of average Finnish firms are world-class. To change this, the quality of demand needs to be raised simultaneously with the rise in quality of supply.

Linked to the above, we argue that the best way to achieve relevance of academic research is "bottom up", where funding is based on strictly academic criteria. This will allow the build-up of areas of strength in research. Applied funding will then be allocated to those areas that have the promise of yielding commercial innovations. A top-down approach in selecting areas for academic research would be counterproductive.

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APPENDIX 1: A PROPOSAL FOR THE NEW FINANCING SYSTEM OF FINNISH UNIVERSITIES

SUMMARY

Finland has good reasons to be proud of its educational system. The current university reform is one of the most comprehensive, and holds the potential to become an example of how to redesign a system that faces very different tasks and challenges compared to those it faced in the world into which it was born. An excellent feature of the reform is the independence it grants universities in decision-making. Despite its importance, this however is a necessary, not a sufficient condition to achieve the objectives set for the reform. The courage that Finnish developers of the university system have shown gives us confidence that they are capable of amending the central, yet undeveloped part, of the new university system – the financing of universities.

The way universities are financed is arguably the most important way to provide them incentives to perform. Therefore, the success of the proposed law depends crucially on how Finnish universities are going to be funded. Despite its huge importance, there has been little discussion of the financing system. In this proposal we discuss the key features of a well functioning financing system and provide explicit proposals as to how to design such a system in Finland.

Key features of our proposed system are:

- 55/35/10 split of funding between education, research, and strategic objectives. The strategic financing component contains a fixed funding component geared towards maintaining the diversity of the system.
- Measures of education should be based on quantity, as quality is hard to observe. Measures can and probably should be discipline-specific.
- Two-level criterion for research: First, a *discipline specific*, *quality-weighted* count of research output. Quality weights should be established using international (non-Finnish) experts, discipline by discipline, and international benchmarking to e.g. the UK RAE exercise. We propose the use of impact factor weighted publications and citations. Second, a "light" discipline specific international peer review to complement the quantitative measures.
- Advance allocation of funding by the Ministry between disciplines. Consideration should be given to the amount of resources needed to have one/two/X institutions of high international standard.

While we emphasize strong incentives for academic excellence our proposal also allows for funding aimed at maintaining the diversity of the university system. We however stress that it is important to separate the in-

centive–based funding from the funding aimed at maintaining diversity. The best way to achieve these two goals is to devise good and strong incentives for academic excellence, and to give the diversity–based funding in a lump sum fashion.

PROPOSED FINANCING SYSTEM

We argue that one of the most critical challenges the Finnish innovation system is facing is the quality of research in Finland. For the financing system to provide strong incentives for excelling in research, the weight on the quality of research should be high enough to affect institutional behavior. If the State wishes to steer activities towards excellence it must set the incentives accordingly. One may attain to achieve these objectives while striving to maintain diversity in the Finnish university system.

We propose the following key features, and elaborate on them below:

1. High weight to research and to quality – lacking existing research on what the best weight would be, we suggest a 55/35/10 split between education, research and strategic objectives. This would ensure both that the universities place sufficient weight to their important task of providing education, while making sure that they have strong incentives to improve research quality. At the same time, there would be room for strategic decisions.
2. Few and clear measures of quality and quantity of research, but these geared to take discipline-specific practices into account. We suggest the following two-part way of measuring the quality and quantity of research: First, a discipline – specific quality-weighted count of publications. Second, a "light" peer-review to complement the necessarily crude quantity – based measure.
3. Carefully specifying explicit strategic measures. We propose to divide these into permanent and temporary components. Temporary components can be used to signal and underline the importance of specific objectives, e.g. internationalization by giving an additional initial push, or measures (such as number of spin-offs, number of patents) for dissemination of knowledge to the society. Permanent components should consist of fixed financing not tied to any measures. The purpose of the last component is to provide a tool to strive for maintenance of diversity in the university system.

55% WEIGHT ON EDUCATION

The primary task of the universities is to educate highly skilled individuals. Teaching, despite technological advance, is still a very labor-intensive and therefore expensive process. Furthermore, quality of education is hard to observe. Given the importance of this task, the universities need to be compensated for excelling in it. Another layer of difficulty is added by the long "production process" of universities – the average time to graduation is around 7 years.

In light of these features, we propose the following measures to be used:

1. The number of bachelor, master's and Ph.D. degrees obtained, each with their own weight. If one wants to create incentives for universities to specialize in master's and Ph.D. degrees, then these can be given higher weights.
2. The number of bachelor and master's students (again, different weights can be applied to students at different levels). We also propose that one should not reward universities for students that are registered beyond the planned study times. One could for example lower the reward of 4th year bachelor students to 75% of that of 1st – 3rd year students, of 5th year students to 50%, and of 6th year students to 0. One should not reward the universities for the number of Ph.D. students as that would create incentives to allow as many as possible to enroll whether or not they have an intention to complete the degree.

The main difficulty in providing incentives for high quality education is the unobservability of the quality of education. Observable measures, such as the number of students earning some specific amount of study points, are dangerous – this particular measure would give universities an incentive to lower standards at least at the end of the academic year, and at least for those students just below the threshold.

Such behavior is surely not in anybody's interest. Quality assurance needs to be a mechanism that truly enhances quality, rather than one that simply forces compliance with bureaucratic requirements.

A more promising way to assess the quality of education is to base the assessment at least partly on students' and/or graduates' view. One example is the National Student Survey conducted in the United Kingdom[12]. At the same time, this sort of survey could generate valuable information for prospective students to make choices about what and where to study. However, to provide reliable information cost-effectively this approach should be carefully designed and would require thorough scrutiny before implementation.

Finally, it is important to note that one can well introduce discipline – specific weights into this system, as has been the case in Finland to date.

35% WEIGHT ON RESEARCH

We view as the most important incentive mechanism the explicit and high rewards for research excellence. Given the stated objectives it is of central importance and moreover research quality trickles down to the quality of education. While quality of education is very hard to measure, quality of research can be measured with reasonable accuracy.

There are a number of issues one has to take into account in devising such measures.

1. The key is to weigh research output by quality. In most fields of scientific inquiry, readily available information exists – at different levels of detail and sophistication – on journal quality. Not taking quality into account would be a serious mistake. One should carefully consider before taking any no–peer-reviewed publication outlets into account.
2. Publication practices vary over disciplines. To take two examples, in medical research, the norm is to have 5 or more authors for an article, to publish short articles (where priority is set according to publication date), and lots of them. In economics, the norm is currently to have 2 authors per article, to publish long articles, and few of them. In some disciplines, books are still an important form of publication of research, in others that is not the case. It is therefore important to design the measures by field.
3. Degree of internationalization of disciplines varies. While we do think that in most cases, one should simply look for the publication practices of world class departments in a given field, we do also think that for some (few) disciplines the claim that research is more national than international is legitimate. We do underline the importance of striving for international standards wherever possible. That a field has a tradition e.g. of publishing solely or mainly in Finnish is not a good reason to eschew international measurement. It is therefore of first rate importance to measure quality discipline by discipline.
4. As research is produced in departments / academic disciplines, these are the units that should be rewarded. This way rewards would flow to a good department in an otherwise mediocre university. This is important, as it would create an incentive for universities to think carefully which fields they want to "invest" in. The stated objective of achieving excellence calls for specialization. Choices must be made and the strategic decisions are best left to those who know best what they are good at – i.e. the universities. Funding by fields would further support universities in making these decisions.

The UK Research Assessment Exercise has until now (including the last, 2008 round) relied on peer review instead of "mechanical" citation – based (or something similar) weights of publications. Even in the UK, the move is towards more mechanical measures, apparently for reasons of cost and speed.

We would think that a combination of quantitative quality measures such as citation weights in combination with peer review that is allowed to override the mechanical weights, would be a practical solution. Given the small size of the Finnish academic sector, the cost of such a "light" peer review (and the time it would take) should not be too high.

How then to construct quality weights? This is a practical design issue where little prior knowledge exists. Our proposed solution is to use impact weighted publication counts and citations. Variation by discipline in these measures is not only unavoidable but desirable, given the heterogeneity of publishing practices in across different scientific disciplines. One should also closely follow how the UK plans to proceed in this respect. Notice also that one can within this system take into account cost differences between disciplines. It is important to note that for this type of an exercise to work, the Ministry would have to decide:

1. How much funding to allocate to a given field. (The UK RAE uses 61 fields in the 2008 exercise)
2. How to reward quality. Here, the UK has at least until now adopted a rather steep reward mechanism, i.e., funding has increased more than proportionally when the grade of a given department has increased. We think this is advisable, as just as quality is unevenly distributed, so are the efforts to produce high quality research more than proportional to the improvement in quality.
3. How often to evaluate quality. This is an exercise that should not be carried out too often as the production time of academic research is long, and the costs of evaluation high, even making relatively heavy use of quantitative measures instead of direct peer review. A cycle of at least 4 years would seem to be sensible.

10% WEIGHT ON STRATEGIC OBJECTIVES

It seems clear that there is a need for some flexibility on the part of the Ministry allocating budget funding. How large the room for flexibility, and what the rules that govern its use should be are unclear. It is our view that the room should not be large, but rather, should be small. The reason for this is that any room for flexibility creates an incentive for universities to lobby for the strategically allocated funding whereas it would be in the interest of the society that they concentrate on gaining resources through the academic incentives. Therefore, whatever the room, the Ministry should strive to come up with ways of allocating strategic funding on a competitive basis. Finally, there is also the danger that the Ministry uses the leeway provided by the strategic funding to counterbalance the effects coming from the incentive-based funding. One should not underestimate this problem as the Finnish university system is unaccustomed to unequal outcomes, and these are the unavoidable, indeed the hoped-for, result of an incentive-based reward system.

Having said that it seems clear to us that the Ministry needs some room for funding new initiatives such as emerging (potentially multidisciplinary) scientific fields. Our proposed 10% is admittedly ad hoc, but for the above mentioned reasons think that this is an upper bound. Moreover, the proposed allocation of funding by fields further reduces the need for separate weight on strategic objectives.

We strongly emphasize that these strategic objectives and the related measures should be explicitly specified and we propose to divide these into permanent and temporary components. Temporary components can be used to signal and underline the importance of specific objectives, e.g. internationalization by giving an additional initial push. Permanent components should consist of fixed university-specific financing not tied to any measures. These permanent components allow the Ministry to achieve other objectives such as maintaining the diversity of the university system and to not adversely affect the incentives of universities.

A word of caution relating to the fixed funding component. It is our understanding that the current system of negotiations between the Ministry and the universities has opened the door for university lobbying. This is harmful as it rewards universities for investments in lobbying skills instead of rewarding them for academic excellence. The Ministry should seek to allocate the fixed funding in a as transparent and ruled-bound way as possible.

IMPLEMENTATION ISSUES

Regarding implementation, there are of course many issues to be considered. Let us comment on two that we see as critical: transfer from the old to the new system, and allocation of resources between subjects.

Transfer to the new system

We want to stress that there is no need to immediately jump to the proposed system in the sense of allocating e.g. 2010 funding based on it. For the system to perform, universities need to be given the funding rules, and time to start acting in a way that takes the funding rules into account. Thus, we could imagine that a transition period of 2–4 years would be needed during which funding is more or less based on the old system.

Allocation over disciplines

An important feature of any system, the one we propose included, is that decisions of allocation over disciplines are necessary. Our system differs from the current one in that these are more explicit.

Regarding this, let us draw attention to another feature of the Finnish university system that seems to be unappreciated. While there are reasons to doubt that there are benefits to scale at the university level, there seem to be undoubted benefits to scale at the level of individual disciplines. In order to achieve the critical mass Finland, as a small country, can only host a limited number of research and teaching units (be they departments or something else) in any given academic discipline. In order to balance the benevolent aspects of competition, which requires several units, with the important need to have units of at least minimum international scale, which would call for fewer units, is an important and problematic design problem that the Finnish university system faces. We propose that in this regard two things are done: First, an evaluation of the resources needed to achieve a high international standard in different fields, and an evaluation of how many units of such size it is possible to accommodate in Finland. Instead of engineering the "right" number of units, one should allow the academic incentives provided by the above proposed system to have their effect.

Allocation mechanism of research-based funding

In practice, the research-based funding could also be allocated through the Academy of Finland using the quality measurement guidelines proposed above. This would only require a separation of the research-based funding from the base funding of universities, and an according increase in the amount of competitive research funding. The main difference to the general current Academy of Finland funding practices would be that the funding is allocated to units, not individual researchers or projects, and the funding is allocated according to observed research quality instead of project plans. It would also be important to separate this unit-based competitive research funding from research programs with fixed amounts allocated to specific fields.

APPENDIX 2: MAIN ONGOING AND RECENT REFORMS[13]

There are three main ongoing or recent reforms that change the operating environment of universities: the renewal of the Universities Act, the foundation of the so-called Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) and the enactment of the new University Inventions Act in early January 2007. We will refer to these changes in section 7.5.

The reformed Universities Act is planned to be enacted September 1st, 2009, and universities will be obligated to comply with it starting January 1st, 2010. The reformed Act will replace the current Universities Act enacted in 1997, and extends the financial autonomy of universities by converting their current status as governmental accounting offices into juristic persons of public law that are independent of governmental control. For universities it is the most significant change since universities were nationalized in the 1970s.

Also the administration of universities will be reformed. The election of university board members will still be handled internally but the share of external members will increase to at least 50 percent including the chairman. The task of external board members is to set down strategic university policies, to allocate resources, and to develop universities as organizations. Internal decision making power of the university community will be increased in issues of education and research. The power to appoint a rector is delegated to the universities' boards. Another major reform will be the conversion of the university employees' status from that of a civil servant to that of a contract based employee. The degrees granted by universities and the educational responsibilities related to them will still be governed by decree of the Council of State. In parallel, the allocation of educational responsibilities among different universities will be governed by decree of the Ministry of Education.

The second change is the foundation of the so-called Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) that aim at establishing and re-enforcing long-term research cooperation between the academia and the Industry. Six SHOKs in six strategic sectors of the Finnish industry bring together companies, universities and research institutes that represent excellence in their particular fields. The participants of each SHOK jointly design a long-term (5–10 years) strategic research agenda based on the visions of future technological needs of the Finnish industry. The agenda is then implemented in SHOK-programs. SHOKs are financed by Tekes and the Academy of Finland.

The final change is the enactment of the new University Inventions Act in early January 2007. The Act provided universities with the rights of ownership to inventions made in sponsored research that, according to the principle of the professor's privilege, were considered property of the respective academic inventors prior to the change. The aim of the act was to update the incumbent legislation to better match the modern networked nature of academic research and it's financing. In particular, the allocation of IPRs between diverse parties involved in different types of research, a task that was rather cumbersome under the incumbent legislative regime, was at the center of renewal and streamlining efforts.

ENDNOTES

1 E.g. 'Mobilising the Brainpower of Europe: Enabling Universities to Make their Full Contribution to the Lisbon Strategy', COM(2005) 152 of 20 April 2005 and Council Resolution of 15 November 2005.

2 Industry-science links refer to the different types of interactions between the industry and the science sector that are aimed at the exchange of knowledge and technology (start-ups, collaborative research, contract research, consulting by science, development of IPRs by science and other formal and informal co-operation).

3 More information on PROs can be found at the web site of the Advisory board for Sectoral Research (*http://www.minedu.fi/OPM/Tiede/setu/?lang=en*).

4 For consulting the homepage of the Academy of Finland go to (http://www.aka.fi).

5 For consulting the homepage of Tekes go to (http://www.tekes.fi/).

6 See (www.koulutusnetti.fi).

7 See (www.koulutusnetti.fi).

8 Proton and ASTP, two associations of Technology Transfer Offices (TTOs) in Europe, are currently carrying out surveys among their members. ASTP surveys are comparable to the American AUTM-surveys.

9 To compare: Technical University Denmark (7.4%), Chalmers (7.2%) and Karolinska (5.4%).

10 Strategy for Internationalisation, thematic OECD review, "Osaava, avautuva ja uudistuva Suomi", Suomi maailmantaloudessa -selvityksen loppuraportti, 2004, "Suomen vastaus globalisaation haasteeseen" – Talousneuvoston sihteeristön globalisaatioselvitys, 2006, Suomen Akatemian kansainvälisen toiminnan strategia 2007–2015.

11 See (http://cordis.europa.eu/erawatch/).

12 See (*www.hefce.ac.uk/learning/nss*).

13 This section borrows heavily from Tahvanainen (2009).

8. Conclusion

As discussed in the preceding Chapters, the evaluation panel mostly welcomes the ambitions and premises of the June 2008 proposal for Finland's National Innovation Strategy and the October 2008 Government's Communication to the Parliament. On many accounts the panel nevertheless challenges some of the argumentation and proposed measures. Overall the panel finds these documents vague, leaving room for misinterpretation. Furthermore, the panel calls for caution on several accounts: Broad-based innovation policy can indeed be too broad (see Chapter 2 in this Full Report). Demand and user orientation should be interpreted as impartiality as to the source, type, and application domain of innovation, not as a shift to the other extreme from the current technology and supply-side emphasis (Chapter 3).

Analysis reveals that the Finnish system is less international than conventionally thought and that there are signs that it is falling further behind (Chapter 4; see also Chapter 5); current ways of addressing the issue are clearly not working. Tapping deeper into the global knowledge pool should become one of the main objectives of innovation policy.

Current (public) aspects of the system are an outcome of an evolution of several decades. The system has grown complex to both access and administer. Thus, the evaluation calls for a reform of the current education, research, and innovation system, including its rationales and goals as well as its organizations and instruments. The outline in Figure 8.1 should not be taken as a blueprint or an organization chart but rather as a guiding principle. It is nevertheless the case that the desired outcome cannot be reached without adjusting existing organizational boundaries.

Several sub-panels touch upon the issue of introducing tax incentives to the Finnish system as well as more generally the role of the Ministry of Finance, which in innovation policy has been tolerating but remote. The panel urges for consideration of all possible innovation policy tools.

The panel takes a strong stance for the university reform and encourages it to go further than what is currently being suggested (see particularly Chapters 2 and 7). The panel calls for a continuation of the higher education reform: Polytechnics are important actors in the system with their strong regional and applied role. There should, however, be a clear division of labor between universities and polytechnics.

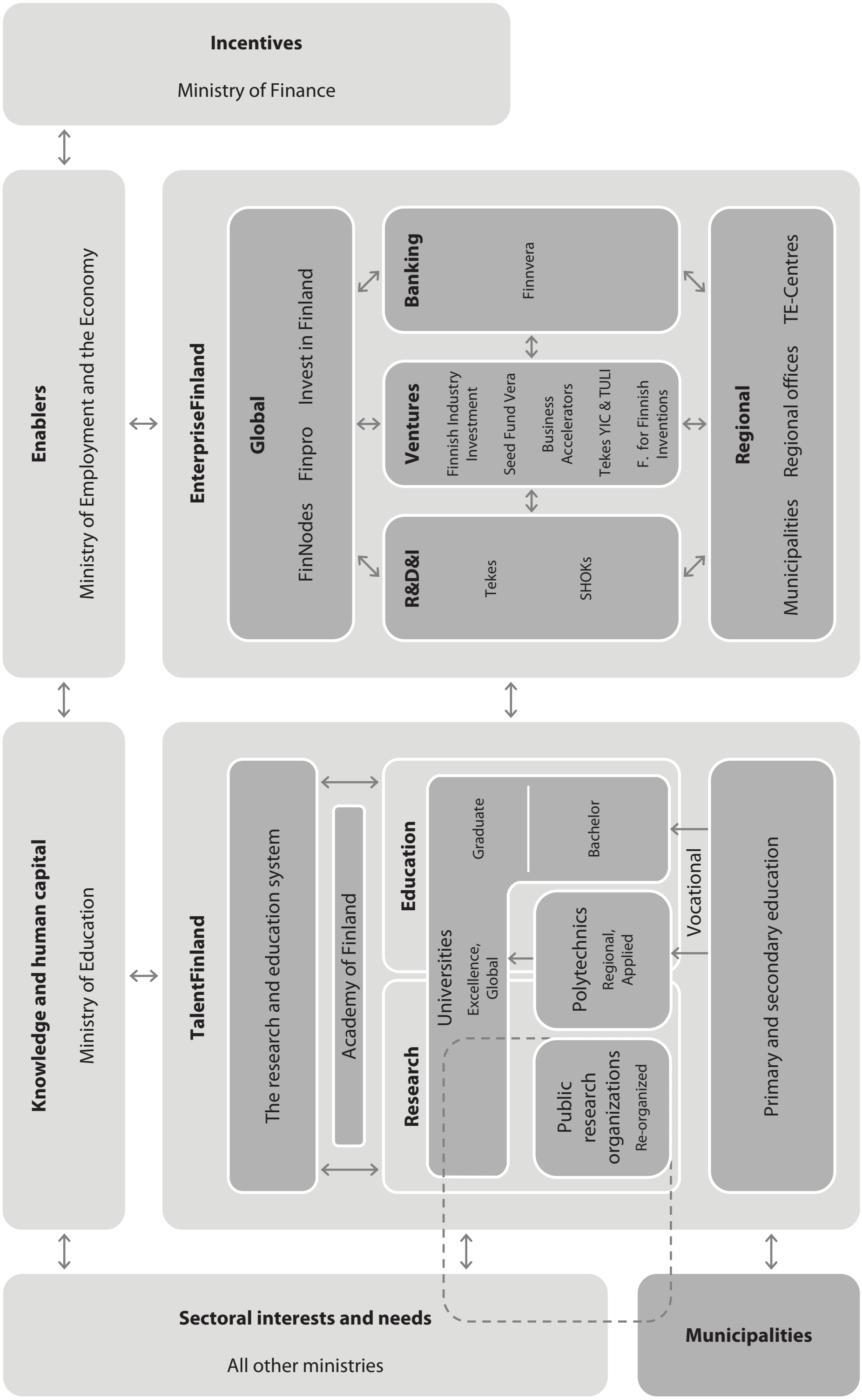
The panel is cautiously optimistic about the national Strategic Centres for Science, Technology and Innovations (SHOKs) but suggests limiting public resources devoted to them. In the panel's view SHOKs are mostly about incrementally renewing larger incumbent companies in traditional industries.

The true reform of sectoral research (public research organizations, PROs) remains in gridlock. Even if the PROs make a worthy societal contribution as well as provide high quality research and services, the panel believes that they have considerable upside potential that could be unleashed. The panel recommends moving their academically-orientated research to universities and organizing the remaining tasks into 4–5 units in accordance with larger societal needs (as opposed to the ministries' administrative boundaries). A long-term binding action plan is needed to implement the reform.

The panel calls for a clarification and coordination of the roles and interrelations of international, national, regional, and local innovation and non-innovation policies. Local and regional actors have grown important also in innovation policy matters. They have, e.g., assumed similar tasks as TE-Centres. Currently national innovation support has an 'unspoken' regional bias, which may have a negative overall impact in the relatively disadvantaged regions. Although the direct cost is not very large, the total cost becomes considerable in terms of hampered regional development and foregone growth.

The Finnish system is at a crossroads due to both internal and external factors. Innovation (policy) is in turmoil worldwide. While Finland is quite well-positioned to meet future challenges, there is a unique opportunity for further reforms. Furthermore, both structural challenges and the financial crisis bring about a sense of urgency that should not be wasted. Indeed, key actors of the system expect, and even demand, change and fundamental shake-ups. The current state of the Finnish innovation system is good but it does not suffice. Major adjustments are needed in order for Finland to meet its future challenges.

Figure 8.1. An outline of actors and responsibilities in the Finnish national innovation system



The Ministry of Education and the Ministry of Employment and the Economy commissioned an international evaluation of the Finnish national innovation system. An independent panel conducted the work with the support of Etlatieto Oy (a subsidiary of ETLA, The Research Institute of the Finnish Economy). This Full Report elaborates on the issues introduced in the Policy Report; together they summarize the findings and recommendations of the evaluation.

The panel welcomes the two new elements of Finnish innovation policy – the broad-based approach and demand and user orientation – but points out risks in their adoption. The former should not lead to considering even minor changes as innovations or to labeling all enterprise policies as innovation policy. The latter should be interpreted as impartiality to the source, type, and application domain of innovation.

The two main challenges – relatively weak internationalization and somewhat lacking growth entrepreneurship – remain orphans in the Finnish system. They are both side issues for a number of public organizations and not particularly forcefully advanced by any. The panel puts forth an outline of (public) actors and their responsibilities in the system, which particularly implies changes in these two domains.

The panel calls for a clarification and coordination of the roles and interrelations of international, national, regional, and local innovation and non-innovation policies. In recent years local and regional public actors have grown important also in innovation policy, even if they are largely ignored at the national level. The current national innovation support has an ‘unspoken’ regional bias, which may not benefit regional development and may come at the cost of foregone growth.

The panel takes a strong stance for the ongoing university reform. With relatively autonomous universities incentivized through appropriate funding rules, it has real potential to address the most pressing and timely challenge in Finnish higher education – the increase of research quality. Polytechnics are important actors in the Finnish system with their strong regional and applied role. To streamline the higher education sector, the panel recommends a clear division of labor between universities and polytechnics.

The Finnish system is at a crossroads due to both internal and external factors. Innovation (policy) is in turmoil worldwide. The current state of the Finnish innovation system is good but it does not suffice. There is both a unique opportunity and a sense of urgency in implementing reforms. Major adjustments are needed in order for Finland to meet its future challenges.