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THE POLICY PRACTITIONERS DILEMMA

The national policy and the transnational networks

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The policy practitioners dilemma

The national policy and the transnational networks

by

Alexandra Waluszewski

VINNOVA´s foreword

Ever since VINNOVA initiated the pilot project within the EU project ERA-SME with the consortia type program together with Germany, Austria, Denmark and Belgium (Flanders) Alexandra has been an inspiring support.

And even more in the EU project DEFINE (Designing future methods of supporting innovation through Enterprise-RTO (Research and Technology Organisations) interaction in Europe) which VINNOVA initiated and coordinated. These two projects showed us that we were out too early. It wasn´t that easy and we learned and Alexandra learned, that in addition to the transnational value networking in industry we had to cope with the national cultural differences (rational, no doubts about it, we learned) in the "beureacracies".

And eventually Alexandra has written this report for us in the EU project GLOVAL (GLObal VALue chains as an emerging challenge for national and European RTD policies). And even if we just now have got the EU commission´s decision to enlarge the project group with RTD-bodies from UK, Germany, Finland and Switzerland I am sure that the outstanding result from the project will be this report.

VINNOVA May 2011

Göran Yström
Coordinator for GLOVAL

Preface

This report is a conclusion of experiences of attempts to boost innovation made by two different professions. The first is the policy practitioner, represented by participants in the GLOVAL project, (Global Value Chains as an Emerging Challenge for National and European Research and Technological Development Policies) where representatives of 10 EU member states participated. The second is the researcher, represented by scholars engaged in a wide variety of disciplines; from economic history, history of technology, science and technology studies, economic anthropology, to business studies with empirical based studies of innovation as the common denominator.

My contribution was to utilize these respective professions' experiences; not least the work carried out within my own research field, industrial network research, in the discussion on how support can be created for innovation processes that can lead to economic benefits for the investing communities. The interpretation of these challenges, however, is my own, as is the responsibility for eventual misinterpretations.

The research leading to this report received funding from the European Union's Seventh Framework Program under grant agreement no 234608 GLOVAL and from the Handelsbanken Research Foundation. I would like to thank these financiers and also research colleagues who directly or indirectly contributed to the report. Finally, I would like to thank the participants in the GLOVAL project for important insights into the great challenges of policy in practice.

Uppsala April 2011

Alexandra Waluszewski

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Introduction

> *'Policy is an investment which aims to generate a return for the investing community.'*[1]
>
> *'[…the research and technological development may be done in Germany, product design in the USA and India, sub assembly manufacture in Sweden and Korea, and final assembly in China – and all of that on behalf of a multinational enterprise whose majority of capital is held by Middle Eastern investors.'* [2]

The background of this report is the frustration of some European policy practitioners[3] over the contemporary governmental commission on innovation policy, and the quotations above illustrate the policy practitioners' dilemma: how to reach national effects of policy investments when the business landscape is characterized by transnational business networks?

Per the policy commissioners[4], the policy practitioners' actions were supposed to boost 'research and technological development' (RTD), which would then result in innovation and industrial renewal within the investing nation or region. But when the policy practitioners were working with implementation of this policy they got problems. The companies and the research milieux they faced daily were involved in business networks that definitely did not stop at any national, regional or local community borders.

The best scenario, which was sketched by the governmental commission, was that the policy practitioners' actions in terms of research and technological support would lead to innovation, new or renewed companies, increased investments, employment, tax income and growth. It was essentially taken for granted that these benefits would occur within the borders of the community that made the policy investments.

The worst scenario, which was absent in the governmental commission but present in the policy practitioners' daily work experiences, was that the main costs were divided among actors within the community that made the policy investment, while the main economic benefits were divided among actors outside of these borders.

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[1] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 8.
[2] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6.
[3] Policy practitioners' is in this report the profession that is working with policy implementation.
[4] Policy commissioners' is in this report the governmental bodies that address what policy practitioners are assumed to implement. Behind a policy commissioner in terms of a specific policy agency influence are thus both national and transnational politicians and experts.

In other words, the policy practitioners' dilemma concerned how to act when the governmental commission was to support innovation in order to reach effects *within* national or regional borders, while innovation processes stretched *across* such borders. As one policy practitioner expressed a question to consider:

> *'We are supporting a research and technological development project carried out by a multinational company's R&D unit that, along with its head office, is located within our country. But the main part of the industrial activities is located abroad. Of course we are thinking about where in the world the outcome of the policy supported project will be scaled up and industrialized.'*

Another policy practitioner outlined a related situation:

> *'Can a governmentally financed policy agency give economic support to a research and technological development project assumed to have a substantial renewal effect on one of the larger production units located within the investing nation, when the RTD project is t located abroad, at a multinational company's R&D unit?'*

It was during some EU financed projects related to the 'European Innovation Scoreboard'[5] in the early 2000s that policy practitioners from a number of European countries and regions began discussing this dilemma, which seemed to be absent in the innovation policy commission under which they were working. The general task was about the same – support research and technological development processes that can lead to innovation. Then there were national and regional differences. Some policy practitioners mainly had the task of supporting research and technological development work carried out in cooperation among non-business research and large companies, while others had to focus on small and medium sized sub-suppliers to large companies. However, the discussions among the policy practitioners revealed an urgent need to increase the understanding of what across-company and across-national inter-dependencies meant for policy in practise, regardless of what type of research and technological development areas and industries were prioritized by their respective policy agencies.

With a number of similar 'place-related' dilemmas at hand, and with some policy practitioners at Swedish VINNOVA in the forefront[6], a policy development project abbreviated GLOVAL, 'Global Value Chains as an Emerging Challenge for National and European Research and Technological Development Policies', was formulated. In

[5] The 'European Innovation Scoreboard' was developed on the initiative of the EU commission in the framework of the Lisbon strategy for economic growth and job creation. The main work is analysis and is based on a set of internationally comparable indicators covering the different aspects of innovation performance. (www.ec.europa.eu/enterprises/policies/innovation/

[6] Göran Yström and Bengt Johansson at VINNOVA were two of the initial organizers behind the GLOVAL project.

2008 the GLOVAL project got funding from the European Union's Seventh Framework Program. The funding also included external research on policy investments in a trans-national business landscape and the outcome is presented in this report.

The report proceeds as follows: In chapter 1 the point of departure; the GLOVAL project background is presented, as well as the research aim and the design of this report. In chapter 2 the governmental commission on innovation policy is discussed. In chapter 3 a short empirical illustration and a larger case is presented; the first of an innovation journey that policy practitioners at a national policy organization could not support, and second of an innovation journey that fulfilled the political requirement and that the policy practitioner could support, but where the main economic benefits 'gravitated' beyond national borders. In chapter 4 a closer look is taken at the foundation on which the contemporary governmental policy's great trust on non-business research and market forces rests. In chapter 5 an alternative analytical framework is discussed, based the assumption of a transnational interdependent business landscape. In chapter 6 a matrix is presented, which can be used to outline opportunities for policy practitioners to support renewal processes with the aim to result in a nations sustainable contributions to transnational supplier and user networks. In chapter 7 the conclusion of the report is presented, underlining that if the business landscape is characterised by transnational interdependencies, then there are reasons for policy to intervene.

1 The policy practitioners' dilemma

In the early 2000s policy practitioners involved in projects related to the EU commissions' initiative 'European Innovation Scoreboard' began discussing their frustration with the governmental commission on innovation policy. Not that they objected to the similar general commission they were exposed to: facilitate for research and technological development processes that can lead to innovation. Contrariwise, they shared the basic idea expressed through the governmental commission they were given: that innovation can make new and old companies prosper, invest, employ, and contribute to tax incomes and to a nations' growth. Instead, their main objection concerned how likely it was that the politically sanctioned innovation 'recipe' would result in the expected benefits.

First, the policy practitioners, almost regardless of where in Europe their policy agencies were located, were exposed to a similar political interpretation of where to find the main sources of innovation – in academic and other public research. This meant that support of 'RTD', or 'Research and Technological Development' became a prioritized task for the policy practitioner. Second, they were also exposed to the implicit assumption that such policy actions should result in benefits *within* the borders of the community that made the policy investment.

The policy practitioners meant that they were squeezed between two rather different views of innovations: On one hand, they had to cope with a governmental commission saying that supporting certain kinds of research and technological development processes would lead to innovation, industrial renewal and growth within the policy investing nation. On the other hand, in their practical work they were faced with both research milieux and companies that were embedded into complex patterns of interdependencies to counterparts that very often were located outside the borders of the policy investing nation. The 'place' dimension was certainly considered in the governmental commission, mainly in terms of how policy practitioners' support in terms of 'RTD' could strengthen national non-business knowledge producing milieux – universities and research institutes – and increase their commercial usefulness. However, the governmental commission seemed unconcerned that the industrial effects of national policy investments could 'gravitate' outside the national or regional community borders through connected business relationships. Hence, the policy practitioners meant that they were rather far away from the ideal; that they and their governmental commissioners acted on a relevant, shared understanding of the basic features of innovation in the contemporary business world.

'Out of line with economic reality' – this was how the governmental commission on innovation policy was characterized by the policy practitioners' in the proposal

abbreviated GLOVAL presented to European Union's Seventh Framework Program.[7] The policy practitioners' dilemma; how to create effects of policy investments within certain community borders when companies and organizations are dependent on others' across spatial borders, was sketched as follows:

> *'The impacts of RTD measures are less easily detectable. The gains from RTD executed by or for enterprises are less transparent, more indirect: for example, the benefits of direct (national) public financial RTD support may gravitate to other locations and markets than originally intended or desired.'* [8]

Along with these experiences, the policy practitioners that first joined the GLOVAL project had in common that they represented smaller European regions and nations. This circumstance was expressed as follows in the GLOVAL grant agreement (2008):

> *'It is no accident that smaller countries are participating in GLOVAL. The limited scale and scope of their economies provides a particularly strong incentive for their firms to seek customers abroad, including in Global Value Chains. Moreover, the equally limited scale and scope of their research base frequently encourages their firms to search beyond national borders for specialised research competence which is lacking at home. Smaller countries are therefore particularly affected by Global Value Chains.'* [9]

The GLOVAL proposal was accepted by the European Union's Seventh Framework Program in December 2008 and received funding for three years covering both the policy practitioners' joint development work and external research.[10] Initially representatives from five European policy organizations took part in the project: The Swedish Governmental Agency for Innovation Systems (VINNOVA), Austrian Research Promotion Agency (FFG), Institute for Promotion of Innovation by Science and Technology (IWT) Flandern, The Public Agency for Technology of the Republic of Slovenia, (TIA) and the Scottish Enterprise. During 2010 five new partners joined the project: Ministry of Employment and Economy, Advancis, Finland; Pera, UK; Inno Group, France; Temas, Switzerland and Forschungszentrum Jülich, Germany.

The overall question of the GLOVAL project was formulated as follows:

[7] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6.
[8] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6.
[9] GLOVAL, proposal 234608 Version of 09/Dec/2008, pp 30-31.
[10] GLOVAL, proposal 234608 Version of 09/Dec/2008

'Whether and how research and technological development (RDT) policies can be designed and executed in order to get the best possible (national/regional) results for the (national/regional) money invested'.[11]

1.1 The research aim and the design of the report

The aim of this report, which is the outcome of the external research related to GLOVAL is to outline:

1 The underlying assumptions about innovation that the contemporary governmental commission rests upon, including how the ability to create national benefits in a transnational interdependent business landscape is understood.

2 The underlying assumptions about renewal that an alternative analytical approach rests upon, devoted to the content and function of interdependencies, including how the ability to create national benefits in an across-national business landscape is understood.

3 Opportunities for policy to support renewal of resources, given that the ambition is to make them to a nation's significant, stable contributions to transnational supplier and/or user networks.

The theoretical point of departure, which will more thoroughly discussed in chapter 6, is an analytical tradition that starts out from the assumption of an interdependent business landscape; i.e. where the content and effect of business resources are assumed to be dependent on how they are combined across company and organizational borders. (Håkansson et al, 2009, see also www.impgroup.org)[12] A model was used which allows the investigation of the content and effect of three important 'layers' of a network of connected business relationships; activity links, resource ties and actor bonds. (Håkansson, Johanson, 1992, Håkansson, Snehota, 1995) This model, and an empirical based distinction of three different types of economic logics that characterizes the innovation journey, was used to design a matrix for analysing renewal opportunities; the space dimension included. (Håkansson, Waluszewski, 2007b)

The data used in this report was collected through three types of sources:

a The author of this report took part in GLOVAL workshops and project meetings as a participating researcher in order to get a deeper understanding of the policy practitioners' experiences of the governmental commission they are exposed to,

[11] GLOVAL, proposal 234608 Version of 09/Dec/2008, p.6.

[12] The work of the informal research network the IMP (Industrial Marketing and Purchasing) Group has been one of the main sources of inspiration. The IMP Group is based on a shared interest in the content and effect of interdependencies in the business landscape. The challenge of how to deal with an inter-dependent, interactive business landscape has, over the last decades, triggered a series of research projects where different aspects and effects of interaction and relationships came to the fore. The work of the IMP Group is reported in some dozen books, about 2,000 papers and more than 130 PhD studies. Some of the main sources used in this report are: Ford, ed. 2002; Håkansson & Waluszewski, eds., 2007; Håkansson et al. 2009).

particularly their practical experiences of the ability to link research and technological development support to business development and renewal within the investing communities. [13]

b OECD and EU innovation policy documents, GLOVAL policy agency documents.

c Empirical based research about the content and effect of contemporary science and innovation policy, as well as process oriented research on innovation in a business landscape characterized by interdependencies that stretch across company and organizational borders, across space and time. [14]

[13] The design of the study has benefitted from interaction with colleges in the research project 'Industrial Policy and Business Networks – the Innovation versus the Efficiency Dilemma', financed by Handelsbankens forskningsstiftelser. Here Professor Håkan Håkansson, Norwegian School of Management, BI and Professor Lars-Erik Gadde, Department of Technology Management and Economics, Chalmers, Gothenburg, contributed with research advice. The research project also arranged a workshop where the research problem if this report was discussed with representatives for industrial network research and the GLOVAL project. The final manuscript was also presented at seminar arranged by Uppsala University's Centre for Science and Technology Studies. The final manuscript was also read by Professor Ylva Hasselberg, Uppsala University Centre for Science and Technology Studies and Department of Economic History, who contributed with valuable comments.

[14] The first type of experiences has been gained from the so called S&TS, or Science and Technology Studies, which is a multidisciplinary research field where the focus is on the social relationship of science and technology. Although the STS field today is represented by a rather wide flora of research 'schools', a common denominator is critical perspective on the relation among production, spread and use of knowledge. The second type of experiences has been gained from a specific area in the STS field; so called LTS (Large Technological System) research and from research carried out within the IMP Group. (See e.g. Håkansson, Waluszewski, 2007a)

2 But doesn't the governmental commission rest on a systemic approach?

The first impression of the governmental commission on innovation policy *does however not support the policy practitioners' complaints* about a lack of awareness of the systemic features of the business world. Contrariwise, policy documents presented by OECD[15] and EU[16] that address the issue of policy action; i.e. support to research and technological development to reach innovation, explicitly express an awareness of a 'globally' connected business world. This is mainly expressed through emphasizing the importance of cooperation among different kinds of stakeholders, such as public authorities, users, regulators, industry, consumers and 'poles of excellence' (Lundvall, 2005, Eklund, 2007, Elzinga 2004, Håkansson et al, 2009).

The commission to the policy practitioners is certainly not only influenced by OECD and EU advice but is complemented by national political agendas where a number of different issues are added. However, the practitioners experience that the politically sanctioned tasks given to their respective policy agencies are rather similar, and above all are rather similar to what's stated in OECD and EU policy documents, has also been observed by researchers. (Elzinga, 2004, Eklund, 2007, Elzinga and Jamison, 1995, Lundvall & Borrás, 2005) Under a surface of individual nations' policy agendas there is, argue Elzinga and Jamison (1995), an overall international convergence, where OECD's policy advice has been an important source of inspiration. Or, to use Lundvall & Borrás' (2005, p. 602) wording: 'OECD has 'played a unique role among international organizations in the diffusion of ideas about innovation policy'.

Interestingly enough, the systemic aspects of innovation can be regarded as a common denominator in contemporary OECD and EU policy documents. Organized interaction and network-building among different kinds of 'stakeholders' is appointed a key policy action. As it is expressed in the 2010 OECD innovation policy agenda:

> *'Innovation today encompasses much more than research and development (R&D), although R&D remains vitally important. Innovation rarely occurs in isolation; it is a highly interactive process of collaboration across a growing and diverse network of stakeholders, institutions and users.'* [17]

A similar view is outlined in contemporary EU innovation policy, where the importance of a deeper understanding of the systemic features of innovation is articulated.

[15] See e.g. http://www.oecd.org/department/0,3355,en_2649_34273_1_1_1_1_1,00.html
[16] See e.g. http://ec.europa.eu/enterprise/policies/innovation/future-policy/index_en.htm
[17] http://www.oecd.org/dataoecd/51/28/45326349.pdf, p. 2.

'Initially, a research based linear approach was adopted, although a systematic approach, which includes all the factors involved in innovation, is more appropriate. The systemic model needs to be developed in order to gain an understanding not just of technological innovation, but of other forms of innovation as well. The European Union must therefore deepen its knowledge of this process in order to develop an effective policy.' [18]

But how is it possible that an innovation policy that underlines the systemic aspects of innovation, by policy practitioners is understood as neglecting exactly the same thing? Have the policy practitioners simply not understood the governmental commission? Is their criticism unfair? Let us take a closer look at how the systemic aspect of innovation is expressed.

2.1 The '1990s innovation policy doctrine'

'We are mainly supporting research. We can hardly support renewal processes that are initiated by companies and carried out among companies anymore, even if we can identify significant industrial and economic benefits of such processes for the policy investing community.'

The quotation above is one of the GLOVAL project policy practitioners' complaints concerning what the contemporary innovation policy has meant for policy in practice. The idea that innovation and industrial renewal have a direct and distinct source in research and technological development *outside* business is also one of the cornerstones in what has been labelled the '1990s science and innovation policy doctrine'. (Elzinga, 2004; Elzinga & Jamison, 1995, Eklund, 2007, Högselius, 2010) The '1990s doctrine' does not only launch the idea that university and other research is a critical and most often underutilized source of innovation. Or, as Nowotny, Scott and Gibbons (2001, p. 56) put it '[…'in policy jargon, the socio-economic contribution that science is expected to make has become a dominant theme'. It also stresses that a successful 'marriage' between science and industry spurs innovation and industrial renewal, and that such a marriage can be arranged through policy action. The foundation is the belief that new areas of research, and, more importantly, new areas of commercialization of research, can be created through policy organized interaction among science and industry. (Slaughter & Leslie, 1997, Nowotny, Scott & Gibbons, 2001, Edquist, 2005, Lundvall & Borrás, 2005, Widmalm, 2008, Benner & Sörlin, 2008)

A number of sources of inspiration can be traced to the '1990s science and innovation policy doctrine'. One is changes in the business landscape, where company specialization and outsourcing gave rise to a new and increasing number of *visible*

[18] www.europa.eu/legislation_summaries/research_innovation/research_in_support_of_other_policies/n26021_en.htm

alliances and partnerships across company, organizational and national borders. (Elzinga, 2004, Håkansson et al, 2009)

Then there are some changes which all can be related to 'a more neo-liberal climate' and increased reliance on 'market forces' instead of governmental involvement in technological and industrial development. (Håkansson et al, 2009, Högselius, 2010)

A first is EU legislation based on neo-liberal market theory which does not allow individual member states to 'favour' domestic companies, for example as acting as supporting customers for new technologies. (Högselius, 2010, Edquist, Hommen, Tsipouri, eds, 2000)

A second, related change is the introduction of the so-called 'New Public Management', aimed at transforming the public sector to cost-efficiency. 'New public management' has forced universities and other public research milieux to produce measurable accounts for their financing governments showing that they are 'productive' for society and the economy (Bleiklie, 1998, Olson, Sahlin-Andersson, 2005, Nowotny et al 2005).

Finally, theoretical approaches on innovation and growth, with the common denominator that they are all close to the general market theory, has been an important source of inspiration (Slaughter & Leslie, 1997, Waluszewski, 2004, Håkansson et al, 2009). Even if it goes beyond the scope of this report to make a complete review of these approaches, we will take a short look at the basic assumptions of some that are frequently referred to, as well as how they have been embedded into the governmental commission to policy practitioners.

2.2 Traces from the 'National Innovation System approach'

The contemporary governmental commission of policy practitioners has borrowed ideas concerning how policy actions can be organized to spur innovation, industrial renewal and growth from the 'National Innovation System' approach.[19] This approach, with Freeman (1982), Lundvall (1988, 1992) and Nelson (1993) in the forefront, stresses how a nation can be considered in terms of its 'national innovation system', i.e. all the factors that are behind the development, diffusion and use of innovations (Edquist, 2005). A national innovation system has, as Edquist (2005, p. 182) underlines, 'a function, i.e. it is performing or achieving something'. This main function is 'to pursue innovation processes, i.e. to develop, diffuse and use innovations' (Edquist, 2005, p. 182).

The basic ingredients in a national innovation system are organizations; above all universities, research institutes and R&D units. Their ability to supply society with educated and trained people and, not least, with potential innovations, is regarded as being of great importance for a nations' ability to deliver innovations. The fact that

[19] The 'National Innovation System' approach is also named 'System of Innovation' approach.

regions with high research intensity still can have a relatively low proportion of research intensive innovations, led Perez and Soete (1988) to talk about a 'knowledge paradox' and to stress that an innovation system has to include a functioning transfer system. Some National Innovation System scholars, with Lundvall (1988, 1992) in the forefront, have also stressed the importance of an active user setting, where the new knowledge over time can be transformed and embedded into new commercial solutions. What National Innovation System scholars have drawn attention to is that science and technology based potential innovations are not automatically absorbed by a business setting. They did, in other words, challenge what is often depicted as the 'linear model'. However, a basic assumption is that what is considered as important scientific advances also can contribute to important industrial advances, and, furthermore, that 'complete' innovation journeys' takes place within national borders.[20]

The National Innovation System approach is referred to in many OECD and EU reports. To build and reinforce 'innovation systems' have also become something of a general policy action within the EU as well as within individual nations. The latter has inspired a number of measures, for example, the development of quantitative indicators of national innovation systems and advice on how to build general national innovation systems as well as such for different industrial sectors. The core of the advice concerns how scientific and other new knowledge can actively be taken out of its 'isolated' existence at universities and other public knowledge producing units to contribute to the funding nations' innovation, industrial renewal and growth. Whether the political interpretation of the National Innovation System approach is appropriate has been discussed among scholars behind it. Some National Innovation System scholars stress that the use of the approach has been more in terms of a 'label' of governmental commissions than as an analytical tool. (Edquist, 2005, p. 192) There are also National Innovation System scholars who have questioned the political interpretation that academic research is a key node for commercial exploitation in a national innovation system, or, as Eklund (2007, p. 89) puts it, 'objected to this discursive marriage between innovation and university research.'

2.3 Traces from the 'Triple Helix' approach

Another theoretical approach that has intervened in the contemporary commission of policy practitioners is 'Triple Helix', with the sociologists Etzkowitz and Leyersdorff (2000) in the forefront. Triple Helix is a model of how the state, the academic knowledge producing setting and industry can benefit from an organized interaction among them as groups. In the Triple Helix model the university is at the heart of

[20] The idea is that investment in knowledge production automatically leads to the development of new technology, which in turn will be absorbed by the business world where it will create economic growth. In this sense, the linear model is close to the rationality assumption made in economic theory. (Håkansson & Waluszewski, 2002) The practical consequence of the linear model was that the commercial use of scientific advances was determined ex post the investment in research.

innovation: ‘An entrepreneurial university is the generative principle in the development of a triple helix of university-industry-government’. (Etzkowitz, 2004, p. 69) Along with an ‘entrepreneurial university’ the so-called ‘network drivers’, private business actors who attempt to increase their ‘competitiveness in the market’, are in focus. Through an organized interaction among university-industry-government the ‘network drivers’ act as ‘stage keys’ and create ‘spiral movements’ that ‘lift’ the dynamic to new levels. (Etzkowitz & Leyersdorff, 2000) The authors do not go into exactly how these ‘spiral movements’ work or how the interactions contribute to transforming scientific contributions to innovations. Instead it is based on the supposition that it is possible to create a direct transfer of academic research results to industry through a governmentally organized interaction, where the government engages in creating links among academia and industry.(Etzkowitz & Leyersdorff, 2000, Etzkowitz, 2004)

Perhaps the great promises of the Triple Helix model can explain its rapid entrance into the governmental innovation commission of policy practitioners. What the Triple Helix model explicitly says is that university research is an important but underutilized source of innovation. Furthermore, it also sees an interaction among university and industry as smooth and free from contradictions. What is absent in the Triple Helix model is the conflicting interests and different rationalities among universities, businesses and society. (Håkansson & Waluszewski, eds, 2007a) Instead, the model explains, as Elzinga (2004, p. 286) puts it, ‘innovativeness as a product of coalition building’. Thus, it is taken for granted that all parties – universities, industry and government – will benefit from the organization of network-like structures among them, as well as society as a whole.

2.4 Traces from the ‘Cluster’ approach

A third theoretical school that, along with National Innovation System and Triple Helix, has had an impact on the innovation policy commission of policy practitioners is the so called Cluster approach. (Malmberg, Maskell, 2002) Compared to the Innovation System and Triple Helix scholars, the advocates of Clusters represent a more heterogeneous approach. Here we encounter such different schools as business strategist Michael Porter’s Cluster approach, the research into Industrial Districts and the Inter-Organizational studies of Social Networks (Porter, 1990, Lorenzoni & Baden Fuller 1995, Powell, 1998). In contradiction to the Innovation System and the Triple Helix approaches the Cluster scholars emphasize that a geographically defined innovative business region does not need to be based on direct use of research.[21] The actors who populate the cluster are considered independent and the connections providing the greatest viability for development are not the direct collaborations but the indirect ones characterized by competition or rivalry. Together with the knowledge that ‘spills over’

[21] The most influential definition of a cluster is formulated by Michael Porter: ‘A cluster of independent and informally linked companies and institutions represents a robust organizational form that offers advantages in efficiency, effectiveness and flexibility’ (1998, p. 80).

from indirect connections, both the efficiency and the growth of new solutions are stimulated. Or, to use the wording of Powell et al, (2002), the infrastructure of a cluster 'fosters knowledge transfer and the formation of technology based companies'. What the Cluster approaches have in common is the assumption that it is primarily competition or collaboration within geographically defined networks that foster development. Although the Cluster scholars' original attempt was to analyze the content and function of geographically defined clusters, it has been embedded into the commission of policy practitioners as a tool to possibly build clusters. (Saxenian, 1994, Lorenzoni & Baden-Fuller, 1995, Malmberg & Maskell, 2002)

2.5 Systemic features addressed – but only on an aggregated 'group' level

Whether agreed upon by the researchers behind the National Innovation System, Triple Helix and Cluster approaches or not, these are some of the schools of thought that have been mixed into a blend of a governmental commission to policy practitioners, that stresses the ideas that:

a Research is a direct main source of innovation.
b Through policy orchestration, which can intervene in the direction of research but not in the commercial utilization of knowledge, it is possible to affect both the commercial relevance of research and its exploitation in innovation.
c This orchestration will create national economic benefits.

Besides being very clear about the sources of innovation the governmental commission to policy practitioners is also distinct in terms of *how* the systemic aspects of innovation are considered. First, as discussed above, the most important *source* of potential innovations is seen in non-business knowledge development, mainly in university and institute research, but also in other parts of the public sector. For example, the EU Commission's report[22] on how to implement the Lisbon strategy (with the illustrative name 'More Research and Innovation') explicitly points out policies that direct research to expected commercial exploitation. This means that research and innovation policies have to be united, since together they cover 'the full spectrum of issues affecting the genesis of new knowledge and ideas, their use and commercial exploitation'. (COM 2005, 488, p. 3) The same understanding is expressed in OECD innovation strategy (2010):

> *'Science has always been at the heart of innovation and continues to be an essential ingredient. Science also makes important indirect contributions to*

[22] COM (2005) 488 final. Implementing the Community Lisbon Programme: COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS: *More Research and Innovation - Investing for Growth and Employment: A Common Approach.*

innovation, e.g. by providing impartial scientific advice for policymaking. As most scientific research is carried out by the public sector, a strong and effective public research system is crucial for innovation.'[23]

Second, the most important *means* of embedding new knowledge stemming from research based or other public sources in business and innovations is seen in *transfer*; through adaptations of research due to the anticipated need of industry, and through organized collaborations among research and industry. In EU policy documents knowledge transfer is identified as a key obstacle to overcome between public research organizations, particularly universities, and industry. Thus, another key mission is to adopt guidelines to improve research collaboration and knowledge transfer between universities and other public research organizations and industry (COM 2005, 488, p. 3). In the OECD innovation strategy (2010) the transfer thinking is taken a step further by underlining the need for encouragement of research that adapts to the innovation agenda:

'Barriers and regulations that limit effective interaction among universities, firms and public laboratories should be removed and collaborative arrangements that facilitate the formation of networks should be improved. Ensuring that researchers, public research institutes and higher education institutions have incentives and opportunities to collaborate among themselves and with industry is essential. Criteria for evaluating research performance should be adjusted to reflect the multiple missions of research institutions, including knowledge transfer. Clearly defined expectations and boundaries for collaboration and well-trained technology transfer personnel are essential to achieve this goal.' [24]

Third, in the business world, the processes occurring *within independent but global companies* are treated as most important for reaching innovation. The innovative processes within companies are assumed to, as mentioned above, be supportable by policy measures that facilitate the transfer of knowledge from universities and other public knowledge providers to companies. Companies' 'knowledge absorbing capacity' can mainly be affected through such adaptations as regulation of taxes, labour, etc., and by the supply of capital. Hence, companies are assumed to independently acquire knowledge through external parties and to exchange it in the market:

'Firms source external knowledge through partnerships, alliances and joint ventures with external parties or through the acquisition of knowledge, e.g. through contract R&D and licensing of patents. They also increasingly seek external partners, partly through emerging knowledge markets, to commercialize innovations that are not used internally. The effective management and enforcement of intellectual property (IP) is crucial to these

[23] http://www.oecd.org/dataoecd/51/28/45326349.pdf, p. 16.
[24] http://www.oecd.org/dataoecd/51/28/45326349.pdf, p. 16.

arrangements, not only to identify useful external knowledge, but especially to leverage a firm's intellectual assets to create value.' [25]

Thus, although the governmental commission of policy practitioners stresses the systemic features of innovation, it is mainly made on an abstract 'group level'. The focus is on the possibility to create processes among:

a Non-business knowledge producers as a group.
b Policy/transfer organizations as a group.
c Companies as a group.

However, interdependencies and different rationalities within these groups are simplified away. Furthermore, a closer look at how companies as a group is understood reveals a rather traditional market model inspired view of the processes going on between companies; i.e. companies are assumed to be independent. At the same time companies as a group are regarded as utmost important for the creation of national economic benefits of the policy investments. For example, although companies are assumed to acquire knowledge from external parties they are also assumed to independently decide where to acquire this knowledge, how to use it internally, and if they do not find it useful, how to sell it in the market.

With this abstract view of the systemic features of innovation and the business world, it is easier to understand the complaints from the policy practitioners behind the GLOVAL project. The high level of abstraction and the focus on the systemic aspects between the groups 'science', 'government' and 'industry' works fine as a foundation for a governmental innovation policy commission to policy practitioners: It makes it possible to identify some important 'nodes' in 'science' and 'industry' in *beforehand* , which can be connected to industry through governments' policy commission. However, when broken down to a) national and regional programmes for innovation support and b) evaluation criteria through which policy practitioners can analyze the expected outcome of RTD applications, there is a lack of awareness of and tools to outline how transnational interdependencies intervene in the ability to create national benefits. Or, as expressed by the policy practitioners behind the GLOVAL project:

'The effects of the growth of Global Value Chains over recent years are beginning to pose a new and real challenge for RTD policies in Europe'. [26]

The policy practitioners also stressed that there is no 'accompanying development of global political and governance structures able to compensate or manage' these increasing transnational interdependencies among companies.[27]

[25] http://www.oecd.org/dataoecd/51/28/45326349.pdf, p. 7.
[26] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6
[27] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6

2.6 Others have complained

It is not only policy practitioners who have criticized the '1990s policy doctrine'. Main objections were addressed by empirical oriented researchers in the social sciences and humanities concerned with a) what will happen with company's long term technological and industrial development when they have to engage in direct use of science in order to qualify for policy support, and when individual EU member states abdicates from their role as long-term supporters of technological and industrial development, and b) what will happen with the content and direction of academic and other public research when this is organized in a direction assumed to make it a 'servant of innovation'. Let us start with a short look at the last question.

What happens with academic research planned to deliver innovations?

Already in 1997 Slaughter & Leslie drew attention to what they labelled as 'academic capitalism', a phenomenon emerging in the wake of 'political globalization' and the emergence of transnational and national policies that not only allowed, but also supported, a shift to make academic research more commercially useful. The idea that academic research results, through market-like arrangements, can be more efficiently utilized as solutions of strategic commercial and political interest have a number of negative side effects with the adaptation of academic education and research to narrow, short-term commercial interests as the most severe. (Slaughter & Leslie 1997)

Since then what must be labelled as an intense debate, above all articulated by researchers engaged in the Science and Technology Studies (S & TS) field, has been going on concerning the future of the long-term, faculty driven university research. One common criticism concerned what will happen with the content and direction research which societal and economic effects cannot outline beforehand, when governments increasingly are seeing university and other public research as sources that, through sufficient management, can be utilized as suppliers of potential innovations and as 'growth engines'. (Slaughter & Leslie, 1997, Jasanoff, 2004, Grandin, Widmalm & Wormbs, eds, 2004, Nowotny et al, 2005, Waluszewski 2009, Hasselberg, 2009) This criticism also includes the effects of the growing pressures to make academic research more 'accountable, and to demonstrate more clearly its potential practical usefulness'. (Pavitt 2004, p. 119)

What happens with business renewal when companies are supposed to be able to create innovations from non-business knowledge transfer?

A second main objection concerns the innovation policy commission's great trust in the markets ability to transform non-business research results to innovations which solve both societal and industry problems, when historical evidences underlines that long term interaction among providers and users is pivotal for innovation to occur. Governmental actors have often been involved in the latter role; in terms of purchaser of civil or military technology. Both in the US and in Europe, the emergence of new, specific user-supplier interfaces have benefitted from a heavy state engagement – more or less visible or hidden in the background. (Hughes, 1994, Sörlin, 2004, Trischler & Weinberger,

2005, Malerba, 2002, Håkansson et al, 2009, Lundin, Stenlås, Gribbe eds 2010) As Sörlin and Wormbs, (2010, p. 144) illustrates the role of state engagement in Sweden:

> *'By around 1970 it was already an established fact that Swedish industrial innovation in several areas – railways, hydroelectric power, defence technology, nuclear power, and telecommunications, to mention some of the most important ones – had relied heavily on state technology procurement.'*

Hence, along with an increasing number of governmentally produced documents stressing that academic and other public research is an under-utilized direct source of innovation, researchers representing such disciplines as economic history, history of technology, history of science, sociology, anthropology and business studies, have continued to present studies witnessing about another pattern. (Rosenberg, 1982, 1994, Latour, 1986, Basalla, 1988, Sturgeon, 2000, Grandin, Widmalm & Wormbs, eds, 2004, Nowotny et al, 2005, Håkansson & Waluszewski, 2007, Hoholm, 2009, Ingemansson, 2010)

The common observation in these studies is that utilization of academic research results in business to a large extend is about coping with misfits. Thus, the relationships among academic research results and the commercial utilization of these mainly is a thorny, unpredictable affair which stretches over time and space in ways which makes it hidden for others than those direct involved. And once academic research results are utilized in new commercial solutions; i.e. when they are embedded into large scale production and widespread commercial use, the original academic contributions might be so old, so recombined and utilized in such a different way compared to when they were developed in an academic research setting, that it might not even be possible to distinguish their academic origin. Or, as Basalla (1988, p. 92) underlines: 'second and third hand conceptions of scientific advances can and do serve technology well'. Furthermore, that anything new has proved to be useful or even successful in an academic research setting is no guarantee whatsoever that it should be commercially useful in industry. In the latter setting, the commercial usefulness of something new is determined by what benefits it can create on all the organizational and technological investments already made whether or not it is considered as breakthrough science. (Håkansson & Waluszewski, 2007a) As Ingemansson (2010, p. 173) illustrates the different logics of academia and business: 'scientific and economic significance are not two sides of the same coin – they are not even values within the same currency'. Finally, what's so often forgotten is that the most important utilization of academic research results is the knowledge that is mediated through people, which makes the main contributions from academic research to business 'largely indirect and roundabout' (Pavitt, 2004, p. 120).

As mentioned above, a criticism of the contemporary innovation policy commission was addressed by researchers worried about that insights which some decades ago was common knowledge seems to have faded away; that technological and industrial development occurs in long term interaction among providers and users, and that strong, long-term oriented customers, often in terms of governmental units, have a crucial role

in this process where the heavy costs appears long before economic benefits. (Håkansson et al, 2009, Lundin, Stenlås, Gribbe eds, 2010, Grandin, Widmalm, Wormbs, 2004, eds.) The role of the state and governmental actors has, as Högselius (2010, p. 271) puts it, changed from being a 'competent buyer' to become much more 'indirect, abstract and nebulous' with activities as creating a 'good business climate' in the forefront. A heavy reliance on the market has emerged: 'With the good conditions in place, the free market is then expected to do the rest'…]' (Högselius, 2010, p. 271)

A critical question concerns what commercial interests that can benefit from a policy where governments abdicates from their role as supporting, demanding and co-financing policy actors and/or customers and instead is engaged in steering research directions that beforehand are assumed to be beneficial for both academia and industry. Instead of starting out from provider and user problems and opportunities, the research and technological development agenda is defined from a planning perspective. As Elzinga (2004, p. 293) expresses it; 'policy makers in the public domain try to second guess the needs of commercial users'. This may have unintended side effects not only for the direction and content of university research but also for the commercial providers and users. Thus, a relevant question to ask is what and where societal and commercial interests can benefit when the governmental policy beforehand point out *certain areas* in academic and other public research as potential sources of innovation and obligatory ingredients in policy supported research and technological development? And furthermore, what and where can societal and commercial interests *not* draw from this renewal recipe? The transformation of the business landscape, which interdependencies over the last decades have become increasingly transnational, and consequently, made innovation journeys to spatially dispersed phenomenon, have made these questions even more relevant to ask. As Högselius (2010, p. 271) puts it:

> *'It is a traumatic dilemma for politicians and policymakers that what is good for the Swedish car manufacturer Volvo or the telecommunications equipment producer Ericsson – or, for that matter, for former government agencies such as the State Power Board (today Vattenfall) or the Swedish Telecommunications Administration (today Telia) – is not necessarily good for Sweden.'*

To shed light on these latter questions, which are similar to the complaints made by the GLOVAL policy practitioners, we will take a closer look at how the contemporary commission on innovation policy presents itself in the practical work with 'RTD', research and technological development support, especially concerning the systemic features of the development, supply and use of innovations.

3 Empirical illustrations of the policy practitioners' dilemma

> *'The typical, narrow evaluation logic no longer holds' […] 'the spatial connection between RTD assistance and gross value added output is fundamentally broken.'* [28]

The quotation above is how the policy practitioners behind the GLOVAL proposal express the experience that despite all policy documents that proudly declared a systemic view on innovation, when it came down to the schedule of criteria they had to follow in the evaluation of applications for policy support, the systemic aspects were gone. Instead, the focus was on the estimated short-term effects based on an applying project. As this procedure is sketched in the GLOVAL proposal:

> *'For reasons of efficiency, governments seek to target their assistance at those firms (and/or research organizations) and RTD projects, which provide a reasonable, or the best, promise of return. Thus, typically firms are invited to make proposals that are then evaluated according to a schedule of criteria. These criteria usually include estimates of jobs created/saved, anticipated increments of gross value added, additional exports expected, and so on.'*

The evaluation criteria was focused on, as the policy practitioners characterized them; 'a simple cause-effect model, typically predicted on':

- 'Gross Value Added' due to policy financed 'RTD input'.
- Output occurring 'within a defined geographical space, i.e. the home region or country'
- Output occurring 'in a generally short time-frame, e.g. effects anticipated to occur within three years.' [29]

What did these evaluation criteria mean for the policy practitioners' ability to include the content and effect of interdependencies and transnational business relationships, in the evaluation of RTD support applications? Below we will take a closer look at two different, but still rather typical examples of how the absence of analytical tools which can catch the systemic features of innovation processes, present themselves in practice.

Data concerning the first, shorter empirical illustration were collected through participating observation in the GLOVAL project and through complementary interviews. Data concerning the second, more encompassing empirical illustration were collected

[28] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 8.
[29] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 8.

from a larger study of the emergence of a biotech industry in Uppsala, Sweden (Waluszewski, 2004), a study of the role of venture capital in innovation processes (Waluzewski &Wedin, 2003) and, in particular; from a detailed PhD study of a start-up company aimed at creating an innovation based on a radical scientific breakthrough in the biotech area carried out by Malena Ingemansson (Ingemansson, 2010; Ingemansson & Waluszewski, 2009). These sources were complemented by additional material concerning policy evaluation and decisions, collected from Nutek/VINNOVA (see footnotes).

Despite the fact that the chosen cases concern policy agencies and companies in different parts of Europe, and that the applications for policy support were very different in terms of characteristics of basic technologies, applying companies, focal products/ services, and owner conditions, there are two common denominators: The development processes that the companies are applying support for are:

a To a large extent taking place *outside* the applying company's borders. The applying companies are consequently dependent on processes going on in other companies and organizations, located at both close and distant places.
b The evaluation criteria that the policy practitioners' have to rely on mainly focus on processes going on *inside* the applying company/business unit, while the processes going on outside the company are considered in terms of a general environment or 'market need'.

In the next section we look at the first, short empirical illustration of a development project that did not qualify for policy support.

3.1 A company initiated RTD project that the policy practitioners could not support

The policy practitioners at a policy agency working on a national basis in a smaller European country got an application for RTD support. Behind the application was a production unit with about 600 employees. The production unit, which was a subsidiary of a global, multi-national company, was put under pressure. In order to increase the efficiency, the US based head office decided to move the main part of the production from the European production unit to a low cost country. The activities that should remain in the applying production unit were mainly administrative, which meant that only about 100 of 500 jobs would stay at the applying production unit.

However, despite the head office decision to move production and concentrate on administrative activities, the applying production unit wanted to continue a newly started development project. This was assumed to be of importance for other producing units within the global company. Consequently, the development project was of great importance for the transition of the applying production unit to becoming a knowledge provider within its global mother company, as well as for its role as a knowledge provider in a global producer-user network. Finally, the project was considered to have

positive effects for four external domestic supplying companies, i.e. companies that were located within the same national borders as the applying production unit and the policy agency.

The application from the production unit put the policy practitioners into a tricky situation. They agreed with the estimation made by the applying production unit: No easily measurable benefits of the development project could be accounted *within* the borders of the applying unit. No significant effects in terms of new investments, new production, or increased employment were supposed to occur within the unit. Instead, such effects were supposed to occur among other producing units, within other nations where the multinational owner company operated. But, if the development project succeeded, it would a) make the applying producing unit a supplier of improved technological solutions to a global producer and user networks, and b) strengthen the position of four domestic suppliers in global producer and user networks. Thus, the main benefits would occur *between* the applying company, four domestic suppliers and potential users of the new solution within the global owner company.

However, the policy practitioners had to reject the application despite the fact that the project seemed to be beneficial for at least five domestic business units. The simple reason behind the decision to *not* support the project was that the analytical framework and evaluation criteria only took into account quantifiable effects that occurred *inside* the applying unit. Network effects, i.e. effects that occurred in the interplay between companies, were left outside the evaluation criteria. Sometimes the policy practitioners had dealt with similar situations through interpreting the evaluation criteria 'in a creative way'. However, this time the gap between the evaluation criteria and practice was too big.

Since the policy practitioners had to leave the case here we will also do so. Instead we will turn to the second, more extensive empirical illustration – a development process that policy practitioners working in a Swedish policy agency supported.

3.2 An RTD project that the policy practitioners did support [30]

The policy practitioners responsible for the Biomedicine program at the Swedish policy agency Nutek got an application for support in the late 1990s. [31] The application concerned a co-operation between a newly established start-up company and an academic research unit that had provided the company with its basic technology; a new method for analyzing short DNA strings. The application seemed to be in line with the aim of the policy agency's biomedicine program, which was to strengthen 'the development of networks among biotech science and business', to increase the 'quality in business' and

[30] The main sources of this section are, as mentioned above, Ingemansson, 2010; Ingemansson & Waluszewski, 2009; Waluszewski & Wedin, 2003. Complementary data collected from Nutek/VINNOVA are reported below.
[31] Today the Swedish Agency for Economic and Regional Growth.

to stimulate a more rapid commercial utilization of science based knowledge. The main aim with the program was to 'increase the industry competence within biomedicine', and the support was specially directed to research areas characterized by 'scientific strength' and where corresponding industrial areas had 'great growth potential'.[32]

The project was managed by a company named Pyrosequencing after the name of the method it was about to commercialize, and the application was presented in 1998. The other main participant was the academic research leader behind the invention of the new method, who also represented one of Sweden's most recognized scientific research units within the biotech area; the Department of Biochemistry at the Royal Institute of Technology in Stockholm (KTH).[33] The idea was that the Pyrosequencing company should 'develop and market' a radically new product system and reagents for analyzing short DNA strings based on the new method. In the wake of the HUGO era this was considered a hot topic both for science and business[34]. The applying project group expected user applications both within 'today's research market and tomorrow's diagnostic market'. In the application, the project description was concluded with the following estimation:

> *'It is realistic that already within one or two years after the project is concluded commercial products will be available on the market.'* [35]

The Pyrosequencing method that had been developed by the researchers at KTH represented a radically new way of 'reading' the DNA code. The established electrophoresis based Sanger method, used among others in the HUGO project, could read longer DNA strings but was partly manual, demanded a skilled user, and had low productivity. The Pyrosequencing method was based on a different technology; it was built on a four enzyme system of polymerase and the utilization of Pyrophosphate transformed into a detectible light signal.

While DNA sequencing with the Sanger method took about three days to perform, with the Pyrosequencing method this could be done within a few hours. At the time when Pyrosequencing applied for policy support, the new DNA sequencing method was already acknowledged as a radical breakthrough within science; it had among others been rewarded with an article in *Science*, one of the most prestigious scientific journals.[36] The scientific breakthrough made the Pyrosequencing method a valuable resource in the scientific setting; a substantial number of acknowledged new scientific publications were based on it as well as a number of PhD theses, funding was attracted

[32] Nutek annual report 1998.
[33] Two other small Uppsala based biotech companies had a minor part in the project, Eurona Medical AB and Professional Genetics Laboratory AB.
[34] This was a US governmental project that set out to read the entire human genome. It was instigated in 1990 and considered finished in 2003.
[35] Final version of the Pyrosequencing application, 1998-06-18.
[36] *Science* 17 July 1998, Vol. 281. no. 5375, pp. 363 – 365, 'DNA SEQUENCING: A Sequencing Method Based on Real-Time Pyrophosphate', by Mostafa Ronaghi, Mathias Uhlén and Pål Nyrén.

through it, and the research group was enlarged and strengthened. The commercial challenge was to embed the new method in an automated, accurate and user friendly product system; an instrument and reagents.

Academic research of commercial interest or not?

The Pyrosequencing method attracted commercial interests already during its development. One of the research leaders engaged in the development of the Pyrosequencing method at KTH was also engaged as scientific advisor on the board of one of the world's largest producers of biotech instruments and systems, the Uppsala based company Pharmacia Biotech. A collaboration was initiated among the researchers at KTH and the Exploratory Research Department at Pharmacia Biotech, where the researchers contributed with knowledge about the new enzyme-based DNA sequencing method and the business representatives with knowledge about how the method could be automated, especially how a flow system could be designed. Thus, both parties were interested in forming a joint venture to commercialize the method. However, at about the same time as the research group was about the have their scientific breakthrough published in *Science,* **Pharmacia Biotech decided to withdraw from the joint project. The official explanation was an ongoing merger with** Amersham International, one of the world's largest pharmaceutical companies. However, this was not the only reason for an abandonment of the Pyrosequencing project. There were also some leaders within Pharmacia Biotech who considered the applications of the new sequencing method to be far too specific to ever carry the costs of large scale production, marketing and application development.

The manager of Pharmacia Biotech's Exploratory Research Department and the research leaders at KTH, however, had another interpretation. The rough estimation was that the market for instruments and reagents for DNA analysis reached more than €300 in the mid 1990s, and that a third of this market concerned the reading of short DNA strings. It was also estimated that this market, which was dominated by academic users, should be more 'balanced' already within a decade, in terms of a growing diagnostic market within life science companies and health care organizations. This view was also shared by a Swedish venture capital firm, Health Cap, that specialized in the life science area. In Health Caps' opinion, there had been very little progress within the DNA sequencing area since the 1970s when the Sanger DNA sequencing method was introduced. Combined with the increased interest in DNA sequencing that the HUGO project had created, the venture capitalists' interpretation was that there existed a 'great, potential unmet need' for a more rapid and automated sequencing method. The pyrosequencing method was seen as a unique opportunity to produce and market an instrument that corresponded to that demand. From this vision, the company Pyrosequencing was founded in 1997 with full financial support for the next seven years and with the Pyrosequencing patents as its technological base.

A policy supported innovation journey

The policy practitioners' response to the application for support of the co-operation between the Pyrosequencing company and the researchers at KTH was positive. The application simply fit like hand in glove with the governmental commission behind Nutek's Biomedicine program. In September 1998 a project with the title 'Development and marketing of new DNA sequencing technology with application within science and routine diagnostics' was granted with approximately €200, 000. This was 48% of the total project cost. The rest of the project was financed by the participating companies. The motivation behind the decision, which followed Nutek's traditional evaluation criteria, was following: [37]

- *Relevance*: The project fulfils the general requirements of Nutek's Biomedical program.
- *Environmental aspects:* A faster and simpler DNA sequencing is considered as having a positive environmental effect. The project also provides a more rapid and secure diagnostic opportunity for several severe diseases at a lesser cost than available techniques.
- *Cooperation/Financing:* The project consists of a functioning, integrated project group with participants from industry and academics. The participating researchers at KTH are internationally recognized and the company's work is built on their participation and transfer of knowledge.
- *News value:* Great. The new technology has the possibility of going from research to routine with increased security and capacity in the DNA sequencing area.
- *The quality of the research/project group:* Very high. All members are acknowledged internationally and have shown high competence in earlier development projects. Within a short time (about 2 years) the group succeeded in developing two generations of a functional system.
- *Ability to realize the project.* Good. Experienced senior researchers are tutoring doctoral students participating in the project. The project management is convincing and based on genuine experience.
- *Anchoring:* A personal meeting between representatives from Nutek and Pyrosequencing revealed that the project is accepted and prioritized by all participating members. It is also of great importance for the company's further development.

A successful innovation journey?

In the application to the Swedish policy agency the Pyrosequencing company had made the brave estimation that a product would be launched within one or two years after the project was concluded. This was delivered with a good margin; the policy supported project should be concluded in 2000, but already in 1999 Pyrosequencing could launch the first product system, the so called PSQ96.

[37] Nutek protocol 1998-09-29, nr 1N19-98-03316

In 2000 Pyrosequencing was introduced on the stock market and valued at about €400 million. In terms of the company's own interpretation, it had managed to transform a scientific breakthrough into a successful business venture:

> *'With only 85 million SKr [around €8.5 million] invested in development costs we have transformed an idea into a globally commercial product'* [38]

When Pyrosequencing delivered the final project report to Nutek the same year, the conclusion was that the project had 'reached the goals', that the 'produced results in line with what was expected' and that it had 'strengthened the participating business partners' national and international competitiveness'. The understanding that Pyroseqencing was an innovative, commercial success was also shared by external evaluators. The Royal Swedish Academy of Engineering Sciences (IVA) named Pyrosequencing as the 'start-up company of the year' in 2001, with the following motivation:

> *'Pyrosequencing has developed an exciting business opportunity from a research environment to a stock market introduced company with a focus on innovation'.*

The same year Pyrosequencing was also recognized by Forbe's, which listed it as the 'best newcomer'.

A remarkable technology with lack of users

However, a bit more than a year after Pyrosequencing's successful epithet it became obvious that the expected 'market expansion' was not realized. Instead of selling the estimated several hundred instruments per year, Pyrosequencing managed to 'place out' about 50 per year, and not all instruments were paid for. Second, the main users were not, as expected initially, life science companies with regular and large scale DNA sequencing activities, but academic or non-profit research units with short term, project based DNA sequencing activities. Third, this meant that it was not only the sale of instruments that was dramatically lower than initially calculated but also the frequency of use of the instruments. This caused even greater problems, since the main income was not planned to be based on sales of instruments, but on a continuous purchase of consumables (the reagent kit). Thus, instead of 'black figures' Pyrosequencing had to report a loss of over €30 million per year. And when Pyrosequencing could not live up to the stock exchange's expectations on increased sales and subsequent increased value of the company, the valuation of the company fell. Just 18 months after its stock introduction the estimate had decreased to a tenth of the original valuation.

[38] Pyrosequencing Annual Report 2000, p.3.

Foreign owners and foreign application development

The difficulties creating a 'substantial market' led the venture capital firm Health Cap to merge Pyrosequencing in 2002 with another company in its portfolio. The merger was with another Uppsala based biotech instrument company, Personal Chemistry, which was not yet introduced on the stock market. Shortly after this initial merger an acquisition followed. This time an American company, Biotage LCC, became the owner of the two Uppsala based biotech instrument companies. This also became the new name of the whole company, which mainly was engaged in the production of chromatography equipment.[39] Pyrosequencing was of great importance in this process of mergers and acquisitions. However, this was not due to its technological base, which did not get much attention in the new company constellation.

Instead it was the approximately €10 billion which Pyrosequencing earned in the stock market introduction. All of this was spent on acquisitions; during the first decade of the 2000s more acquisitions followed, all of them exclusively compatible with the Biotage main technological areas, chromatography.[40] Meanwhile, the work with the Pyro-sequencing product system and applications was done with the left hand. Thus, the Pyrosequencing method which had been the sole technology and focus within the Pyrosequencing company, was more or less put on the shelf, to the benefit of the chromatography technologies represented by the new American owner. This made Pyrosequencing a small, un-prioritized product group within the Biotage business constellation and the sales more or less faded away.

However, this did not mean that all of the commercial use of the pyrosequencing technology also faded away. After the merger a start-up company named 454 Sequencing[41] showed an interest in the Pyrosequencing technology. The plan at 454 Sequencing was to put together a 'high throughput sequencing system' with the goal of enabling cheap whole genome sequencing. The idea was to create an automated system for massive DNA sequencing in parallel, thus making whole genome sequencing both faster and less expensive. In this system the pyrosequencing technology was regarded as a valuable component if the read length, along with other features, could be further developed. After a couple of years of development work, the first 454 Sequencing instrument based on the Pyrosequencing technology was sold in 2005. Since 2008 the production, marketing and development of user applications of the 454 Sequencing instrument takes place as a subsidiary within one of the world's leading pharmaceutical and diagnostics companies, the Swiss based multinational Hoffmann-La Roche Ltd.

[39] A technology used for protein purification, i.e. a completely different basic technology compared to the Pyrosequencing method concerning reading of DNA strings.

[40] In late 2008 the division Biosystems was acquired by the German company Qiagen, which is a global provider of sample and assay technologies. One such acquisition was Argonaute which produces consumables for chromatographic equipment.

[41] 454 Sequencing had spun off from American CuraGen, a midsized biopharmaceutical company formed during the beginning of the HUGO-project focusing on identifying disease-causing genes.

To summarize, although several of the actors involved in the development of the Pyrosequencing method in turning it into a commercial product system ascribed it great benefits, and although there were users who shared this view, the invention never became the successful, wide-spread innovation that initially was forecasted. If the innovation journey finally succeeds, i.e. if the commercialization of the Pyrosequencing technology ever takes off and reaches a widespread use is still written in the stars. But if it does, it will not be any Swedish based company that will benefit from 'black figures', as the Swedish policy agency and many other actors had hoped for.

When the main RTD costs appear within national borders and the benefits outside

The Pyrosequencing story obviously had all the ingredients to make it to a project that fulfilled the requirement of an 'RTD' process that qualified for policy support: First, it was based on a radical and visible breakthrough in science, which also was patented and thus easy to deal with as a private property. Second, a Swedish venture capital company specialized in the life science area was prepared to invest in a commercialization of the new DNA sequencing method in terms of the establishment of a start-up company and turning it into a product system. Third, a number of users, mainly in science, showed interest in the new technology even before the first product was launched and, through support from the Swedish policy agency, could be involved in the design of user applications. Furthermore, it was not only those who were directly involved in the commercialization of the Pyrosequencing method that considered it as promising. As mentioned above, in 2001 the Pyrosequencing company was rewarded by the Royal Swedish Academy of Engineering Sciences (IVA) for its innovative science based technology.

One and a half years later it became obvious that providing an innovative technology that corresponded to an 'unmet' need was no guarantee for a successful innovation journey. Users of DNA analysis showed interest in the method and many also tried it, but only a few embedded the instrument in a stable use. This meant that for the venture capital firm the most valuable asset of Pyrosequencing was not its production and marketing of the DNA sequencing instrument, but its introduction on the stock market and the money earned on the *expectations* that within a short time this should become a successful innovation.

It was in order to utilize this asset that the merger and acquisition journey started, making the German company Qiagen the owner of the Pyrosequencing patents and the Swiss company Roche the owner of the company that utilized Pyrosequencing through a licence agreement. Let us summarize this 'RTD' or innovation journey with a consideration of how the main costs and benefits related to the Pyrosequencing innovation journey was divided.

The main research costs were primarily financed by KTH and Swedish research funding. A smaller share of the research collaboration between the inventors at KTH,

Pyrosequencing and two other very small start-up companies, was financed by the Swedish policy agency Nutek.

The cost for the creation of a physical instrument and related application reagents as well as for building a production structure responsible for the supply of the whole product system was financed by the venture capital firm that could benefit from an 'exit' through the introduction of Pyrosequencing on the stock market. Through the series of mergers and acquisitions, the benefits of the licence agreement with 454 Sequencing went to the German company Qiagen. And if the 454 Sequencing licence agreement ever results in a large scale use of the method that it creates 'black figures' for 454 Sequencing, this benefit will go to Roche.

3.3 When costs and benefits are unequally distributed across national borders

> *'Firms' original locations and national partners easily lose importance as the role of global networking partners grows'.*[42]

The experience of the policy practitioners in the GLOVAL project is that distribution of costs and benefits across national borders described in the Pyrosequencing case is far from unique: the journey from investments in research to a commercial product embedded in a producing and using setting typically goes back and forth in a long and winding process, and the main costs and main benefits of the innovation journey do not necessarily appear at the same place.

From a national policy perspective such an innovation pattern is not necessarily a problem. If the long and 'muddling-through' like process, where investments in research respectively embedding of research results in a commercial producing setting are made within the same nation, and if the end-product is met by the emergence of widespread global use, this will certainly be beneficial for the community that made the investment in research and policy support. For example, the commercialization of the Pyrosequencing technology moved back and forth from the academic research unit over to a small start-up to finally end up in an established health care company's production and marketing system. From a policy perspective this should not matter – *as long as this process took place within the same national borders.* From a national policy perspective, the great problem appears when the main investments in research and policy support are made within the borders of one nation, and the main economic benefits appear outside these borders.

It is always easy to see the strength and weaknesses of an innovation journey in retrospect. But could an alternative policy analytical tool, already at an early stage of an innovation journey, provide policy practitioners with additional perspectives on following questions:

[42] GLOVAL, proposal 234608 Version of 09/Dec/2008, p.6.

a What type of commercial producing setting is necessary to take the outcome of a development process to an economically beneficial large scale production?
b What type of commercial using setting is necessary to create a stable, large scale use?
c What consequences do the requirements on the supplier and user setting have for the developing setting?

We will turn to these questions in the last chapters, where an alternative framework and place related questions to ask concerning innovation journeys will be discussed. But first, let us take a closer look at the foundation on which the contemporary governmental policy's great trust on market forces rests; forces that 'with a little help of our friends' will guarantee innovation, business renewal and growth – and at the same time solve societal problems – within the borders of the policy investing nation.

4 The contemporary governmental policy commission – a double disservice?

The policy practitioners' criticism that governmental policy frameworks had only a vague connection to the contemporary, transnationally interdependent business world draws attention to the basic principles that the innovation commission rest upon. What are then the basic principles behind the contemporary governmental innovation policy's great reliance on transfer of knowledge to the 'market'; not only that it will create a supply and use of new potential innovation, but that it also will direct these innovation processes in ways which are beneficial for society? And what view of innovation opportunities and hindrances do these principles assume that policy practitioners will face?

4.1 If the interdependencies had only existed on a group level

If the interdependencies in the business landscape mainly had occurred among the knowledge producing setting and the business setting on a group level, as discussed in chapter two, then the contemporary governmental innovation policy framework should have served policy practitioners very well.

Then a governmental commission, resting on the assumption that the life of the companies that populate the business landscape is close to how this is captured in the market model (see Wilk, 1999 and Marglin 2008 for a discussion) would have been fair. With the assumption that the market tends towards some sort of stability between supply and demand, and that those who populate the market; 'producers, buyers and sellers in firms, households' have perfect knowledge of the resources exchanged, (Wilk 1996:62), the commission to policy practitioners also becomes rather straightforward. If the business landscape is close to the stylized model, then governmental policy commissioners do not have to worry about how to support and organize the development and use of new economic resources among individual companies to stimulate economic growth. As long as the market is vivid and the processes of allocating scarce resources are not disturbed, new resources will automatically be absorbed by the market and create growth and new equilibrium. This view of the business landscape has also drawn support from a 'jungle' myth or metaphor (Polyani, 1944), where the market is understood as being populated by autonomous actors fighting for the survival of the fittest. [43] Thus, the business landscape is assumed to be

[43] In the mid 20th century, Polyanyi (1944) revealed how a myth presented by Joseph Townsend in 1786 had become the dominant metaphor among modern economic thinking. The myth was used to support the idea that the market is populated by autonomous actors fighting for the survival of the fittest. Townsend's legend concerns how the admiral Juan Fernandez let goats loose on an island outside Chile's coast to provide food for future visitors. The goats multiplied rapidly, but the visitors who benefited from them

populated by independent companies and the main relationship among them is antagonistic. If the governmental commission on innovation policy is, whether consciously or not, resting on principles close to the market model, the basic policy commission is clear cut; reduce all hindrances for keeping the *market vivid*. Then the market mechanism will force companies to identify their competitors, analyze their characteristics and behaviour, and in the fight for a 'competitive advantage' in relation to others on the market, absorb new knowledge and technology. (Marglin, 2008; Håkansson et al, 2009)

Furthermore, if the interdependencies in the business landscape had mainly occurred among the knowledge producing setting and the business setting on a group level, then the empirical observation that companies have difficulties commercially to utilize radically new knowledge and technology also could have been dealt with without giving up the basic assumption that the business landscape is close to how it is depicted in the market model. Ideas developed among 'Institutional Economics', which, as a complement to the market model have added the assumption that the market has difficult to absorb certain types of knowledge, could be used as a relevant additional framework. As Wilk (1996:62) explains the Institutional Economics interpretation; 'when information is hard to come by there are many reasons for people to stick together and cooperate, even when they otherwise may do better on their own'.

Again the commission to policy practitioners becomes rather straightforward: organize an interaction between the non-business knowledge production and the market to overcome this obstacle. There are also, as discussed in chapter 2, a number of approaches that provide interpretations of how transfer of 'innovation sticky knowledge' from a non-business setting to a market can be organized. The more the governmental policy can facilitate the transfer of 'innovation sticky knowledge' to companies located within a certain nation or region, the more innovative and competitive this group of companies is assumed to be in relation to other groups of companies located within other regions and nations. Hence, if the systemic features between the non-business knowledge producing setting and the companies that populate the market had mainly occurred on a group level, it would not have been necessary to consider whether the knowledge recognized as being a great advance in a non-business knowledge producing setting could create direct economic benefits if embedded into large scale production and use in a business setting.

Consequently, if the business landscape had been similar to the way it is understood in theoretical sources discussed above, the following requirements on the analytical framework were relevant:

a It must be able to catch general demands on the market.

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were unwanted pirates. The admiral released some greyhounds on the island to kill the goats. In the absence of any social law, a natural law or equilibrium was established through the goats and dogs fighting for survival.

b It must be able to identify sources of radically new science and technology based knowledge within certain regions and/or nations.
c It must be able to suggest how transfer of knowledge can be facilitated from these nodes to companies located within certain regions and/or nations.

4.2 Winners and losers

Whether conscious or not, the above underlying assumptions colour the contemporary governmental commission on innovation policy and lead to, as argued by the policy practitioners behind the GLOVAL project, a very 'narrow investment logic'. The policy practitioners' experience is that they are not allowed to act on effects that cannot be directly estimated, or that are assumed to appear in a long-term perspective. Thus, there seems to be losers in the wake of a contemporary commission on innovation policy. But then who are the winners? Below we will take a closer look at who can benefit and who can lose on the contemporary innovation policy commission.

Positive effects for academic research

The contemporary governmental commission on innovation policy has some positive effects for academic research – at least for some parts of it. In order to be transformed into a commercial resource usable for exchange at, as expressed by OECD[44], 'knowledge market', research results must be able to be 'packaged' and 'productified' in terms of patents, prototypes, etc. A first effect, which can be positive for researchers behind research results that can be 'productified', is that they acquire a shape that makes them visible and able to be sold to investing companies. A related effect, which can be positive both for the researchers behind a research result possible to 'productify' *and* for the academic organizations they belong to, is that such research results are easy to measure. Finally, if researchers are interacting with companies investing in the comercialization of research results, their ability to create research results capable of being packaged and 'productified' will probably increase. In total, this means that the contemporary research and innovation policy creates advantages for particular academic research areas, those in which research results can be packaged and productified and that furthermore can be sold due to expectations that future economic benefits will appear shortly after their development.

Negative effects for academic research

The contemporary governmental commission on innovation policy also has some clear negative effects that will probably affect the main part of academic research. A first negative effect is that research that cannot be packaged, 'productified' and sold to commercial actors due to an expected ability to deliver economic benefits shortly after they were developed will have a lower priority, i.e. research that affects business or other parts of society is difficult to outline in advance. Research that, through learning

[44] OECD 2010

and teaching is embedded into people and whose use is indirect, is hidden, and appears in a different time, at a different place and in a different shape as compared to when it was developed, will not be supported. Thus, research that cannot be adapted to the limiting requirements of a knowledge market cannot expect support from contemporary research and innovation policy. This means that the contemporary governmental commission on innovation policy will negatively affect the variety of research, especially research that does not adapt to short term interests.

Positive effects for business

The contemporary governmental commission on innovation policy has some positive effects for business, at least for some parts of it. As soon as a research result has been 'productified', in terms of a patent, a prototype or a product, companies can invest in it – based on expected future economic benefits. One way for investing companies to economically benefit from research results is to 'bet' on it. For example, venture capitalists and other financiers can 'bet' on which company, commercializing which 'productified' research result, will yield a positive return on investment within a certain amount of time. This type of knowledge market is based on the first investor's speculation in the ability to be bought out by other investors. For example, if the 'productified' knowledge is embedded into a start-up company, an 'exit' can be created through an introduction on the stock-market. Another way for economic actors to 'bet' on economic benefits of research results is through established companies' investments in 'productified' research results, based on the expectation that they will create future benefits in terms of new/renewed products, processes and/or services. Whether it is venture capitalists or R&D organizations of established companies that are buying research results, the common denominator is that they are acting on expectations of future innovations. This means that contemporary research and innovation policy have positive effects for investors and/or established companies with such heavy economic muscles that they can 'bet' on research results' ability to be transformed into innovations.

Negative effects for business

The contemporary governmental commission on innovation policy also has some clearly negative effects for the use of knowledge in business. If, as suggested by policy, the use of knowledge in business increasingly occurs through a knowledge market, the use will also be directed to a limited group of economic actors, those who can 'bet' on or invest in 'productified' research results based on the expectations of future innovations, and return on investments. Furthermore, when larger research fields are adapted to the requirements of research results able to sell on a knowledge market, it is a rather narrow group of economic actors that will influence what types of research results will be available in this market.

Perhaps the most severe negative effect comes from the contemporary governmental commission's limited understanding of the transnational business networks into which any new economic resource has to be adapted and embedded into to become an

innovation. Consequently, companies in need of knowledge development starting out from established supplier and customer settings will not be favoured by the contemporary governmental commission. Thus, companies that do not engage in 'betting', and companies that do not have the economic muscle to invest in 'locked' research results, but that have to start out from investments in place in the supplier and user settings to which they are related, have difficulties finding support from the contemporary innovation policy commission. Companies that want to radicalize their ability to innovate in terms of finding new ways of combining established resources in the supplying and using settings to which they are related are not prioritized – especially if they cannot point to any direct relationship to new research results. This circumstance was clearly demonstrated by the first short empirical illustration in the beginning of this paper. Thus, even if it is hard to imagine a company whose development efforts are not dependent on research of any kind – just try to imagine all research that indirectly is embedded into any company's IT solution and into the people working with it – this type of 'hidden' economic use of research does not matter when applying for policy support. If a company cannot present any direct link to newly developed research results and cannot account for any rapid economic effects within the borders of the applying company in terms of increased investments or employment, contemporary research and innovation policy will be of restricted help.

5 If the policy practitioners are right

But what if the policy practitioners are right; if the contemporary governmental commission on innovation policy is based on a framework that is ‘out of economic reality’? And if empirical based research is right, if the business landscape is rather far away from how it is understood in the prevailing market thinking; the companies populating the business landscape are not solitary entities totally occupied with fighting each other, but each is vital to and dependent on others that it borders and overlaps? Then there certainly is a need for an alternative framework, based on principles which can catch, and not simplify away, the basic features of the business landscape, and contribute to the avoidance of the negative effects sketched above. If the life of one company is dependent on the others and vice versa, i.e. if companies co-evolve in relation to other companies and organizations, over time and over space, then the analytical framework must be able to catch the processes occurring between firms regardless of the time and space over which they stretch.

Thus, a governmental commission on innovation policy that also wants to provide policy practitioners with a framework that can facilitate the understanding of interdependencies among specific companies, and, furthermore, that can facilitate the understanding of both the opportunities and dangers they create, has to fulfil the following requirements:

a It has to start out from the empirical observation that any business solution is interdependent with specific others, on its supplying and using side.
b It has to incorporate the content and effect of multidimensional interdependencies and multidimensional interaction between companies and organizations.
c It has to provide policy practitioners with analytical tools that allow them to catch the interfaces that will be affected by change processes they are trying to support or hinder, including the space dimension.

To develop a complete framework that can live up to the above sketched requirements goes beyond the ambition of this report. However, through building on the work that has been carried out among researchers who, over the last decades have been engaged in these issues, some suggestions for how interdependencies can be analyzed and how place related innovation opportunities can be identified will be discussed. But before we proceed with a discussion of what opportunities for actions, and need for policy intervention, that such analytical framework calls forth, let us take a closer look at how the content and effect of interdependencies in the business landscape have been observed by empirical based researchers.

5.1 That companies are interdependent – what does it mean for innovation?

> *"While many firms have had international operations and trading relationships for decades, and a few for more than a century, international value chains today – which are increasingly of global dimensions, hence global value chains – contain a broad range of activities that are tightly integrated and often managed on a day-to-day basis."*[45]

The policy practitioners' interpretation of an interdependent business landscape is, as the quotation above illustrates, that 'a broad range of activities' are carried out between specific companies, i.e. that these issues are dealt with through business relationships that go beyond regional and national borders. Utilizing interdependency in practise means that a number of activities are undertaken in close interaction with specific counterparts on the supplier and user side, and these interactions and adaptations create imprints on both the human and material resources involved.[46] This is a phenomenon that over the last decades has challenged researchers from a wide variety of disciplines. (Håkansson et al., 1982, Piore & Sabel, 1984, Rosenberg, 1982, 1994, Gudeman, 2001, van de Ven et al., 1999, Ford et al, 2003, Håkansson et al., 2009)

With the interest in interdependencies in the business landscape as a common denominator, both deep empirical investigations of the content and effect of this phenomenon as well as the development of equivalent analytical tools have been carried out, among others by researcher related to the IMP Group. (www.impgroup.org) Put simply, a challenging observation is that companies do not deal with innovation and efficiency issues as assumed in the prevailing market models; playing out suppliers against each other, shifting from one to another to get the best price or shopping around in search of unique, radical potential innovations. Instead, regardless of size, technology, industry or localization, companies seem to create benefit from dealing with efficiency and innovation not by reducing, but by utilizing, their interdependency. Thus, each company's economic benefits appears to depend on how it can be utilized by counterparts on its supplying and using side, including what the company can add to the technological and organizational interdependencies into which these counterparts are already embedded. (Ford et al, 2003, Håkansson et al., 2009)

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[45] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 8

[46] In traditional market thinking the market is assumed to be characterized by independency. This is due to that economic resources exchanged are considered as homogeneous. This means that only necessary information the actors on the market need is the price of the resources. The problem of translating 'knowledge' to a homogeneity assumption has been solved with the assumption that the generation of knowledge is something that takes place *outside the economic world*, to be automatically absorbed by the economic actors when manifested in new economic resources (Wilk, 1996). However, as soon as the development and use of resources is treated as an integral part of the business world, the homogeneity assumption has to be replaced by a heterogeneity assumption; i.e. the value of resources is created in combinations, and is unknowable in advance. The business landscape becomes characterized of interdependencies, which companies through interaction are assumed to try to benefit from. (Penrose, 1959, Ståhl, Waluszewski, 2007)

What does then this interdependent, highly specialized business landscape imply for attempts to create technological and/or organizational change? A short look at a study of a company faced with the necessity to increase both their innovativeness and productivity, presented by Bocconcelli and Håkansson (2008), may serve as an illustration.[47]

When innovativeness and efficiency issues have to be dealt with in relation to others

How can a company facing a crisis increase its innovativeness and productivity – when only 20 percent of the total product costs stems from internal activities – and 80 percent from activities undertaken by suppliers and sub-suppliers? This was the situation that the Italian motorcycle designer and producer Ducati had to cope with when it due to financial problems was more or less forced to make a 'turnaround'.

In Ducati's case, the external suppliers were represented by 380 prioritized, so called 'first tier suppliers', which in turn were utilizing numbers of transnational sub-suppliers. With only a minor part of the activities related to the creation of the Ducati motorcycle internally, it stood definitely clear that any significant 'turnaround' of the company had to be based on interaction with the main external counterparts. But how could these become motivated to work with productivity and innovativeness in ways which was beneficial for Ducati? It stood also clear that the change not only had to be beneficial for Ducati and its users, but also for the main part of its most important suppliers.

The most visible change was undertaken in relation to the users, were the ambition was, as expressed by the management, 'to transform progressively Ducati into an entertainment company offering a complete motor experience'. (Bocconcelli, Håkansson, 2008, p. 28) The attempt was to create a 'Ducati Community' and a 'Ducati lifestyle'. A number of measures were undertaken to reach this. The Ducati stores, which were direct owned by the producer, were totally renewed in relation to the new profile. Ducati's engagement and visibility in racing increased, among others including a return in the GP. The advertising was renewed and intensified. Finally, the assortment of 'bike accessories' was renewed in relation to the 'Ducati lifestyle.

However, this visible change was just the tip of the ice berg. Under this surface Ducati had to reconsider its whole approach the supplier side. On one hand, Ducati had to require that the first tier suppliers increased their engagement in development and efficiency endeavors. On the other hand, Ducati offered opportunities for the prioritized first tier suppliers to take part in co-development of special systems and components, to increasing the volumes sold, and last but not least, to increase their responsibility in relation to a transnational networks of related sub-suppliers. Thus, instead of delivering specific components, the first tier suppliers became engaged in the development of five

[47] A full version of the case is presented in *The IMP Journal*, Vol 2, Issue 2, and can be downloaded at www.impgroup.org

'macro-assembling' groups; all identified in relation what was perceived as valuable for the customer.

The turnaround did not only include an increased utilization of the capabilities of the first tier suppliers and the sub-suppliers, but also a dramatic decrease in the number of suppliers involved in these development and efficiency processes. The number of the first tier suppliers decreased from 380 to 170. (Not all suppliers were prepared to engage in the development issues as suggested by Ducati – and not all suppliers were considered as suiting for this process by Ducati.) The prioritized 170 first tier suppliers became engaged in the design and deliverance of pre-assembled complex systems. Furthermore, they also became fully responsible for the transnational network of sub-supplier beyond them; the technological and functional demands on these included. The increased responsibility of the first tier suppliers meant that nine of these become responsible for 40 percent of the supply costs, and 36 for 80 percent of the supply costs. In total, Ducati's network of related suppliers became responsible for 92 percent of the total production costs. Although Ducati voluntarily had increased its reliance on others, the 'turnaround' was definitely beneficial, leading to both increased innovativeness and productivity.

The Ducati case also has an interesting space dimension. The five most important first tier suppliers, (responsible for wheels, braking system, head engine, basement, cylinders and pistons) were located to the same region as Ducati – something that facilitated the intense interaction that the increasing responsibility of the suppliers meant. Furthermore, 80 percent of the first tier suppliers were located within the national borders. Only 20 percent was located abroad, mainly within EU. However, beyond these first tier suppliers the total degree of utilizing globally delivered components increased. Thus, the national first tier suppliers became something of Ducati's nodes to an increasingly transnational supplier network.

5.2 Voluntarily increased transnational interdependencies

To invest in the utilization of interdependent resources and activities across company and national borders seemed to be a more fruitful way to act compared to try to stay independent and to purchase standard solutions due to price competition – for Ducati as for so many other contemporary companies – almost regardless of what type of business they are engaged in. A business landscape dominated by companies that are relating to others' in a similar way as described in the Ducati seems to provide the interacting parties with possibilities to voluntarily increase – and take economic advantage of – across company interdependencies. However, as we will discuss in the last chapter, such network like characteristics of the business landscape have both light and dark sides – not least in relation to innovation.

Although companies always have been dependent on others; across company, technological and spatial borders, (Gudeman, 2001) this pattern was reinforced during

the last decades. (Piore & Sabel, 1984; Gulati, 1998; van de Ven et al, 1999; Gudeman, 2001, Håkansson et al 2009) As Gudeman, (2001, p. 145) illustrates this development:

> *'In the early part of this (the 20th) century, textile, shoe and other manufacturers had on-site machine shops to produce and maintain their capital equipment: today these workshops are museums, because specialist maintenance workers are hired by contract and brought by helicopter when needed. Accountants, tax advisors, lawyers, public relations experts, long-range planners, management consultants, and financial advisors are hired to complete special tasks, but later they may work for competitors.'*

Already in the late 1980s a Swedish survey of more than one hundred companies showed that on average the top ten suppliers accounted for about two thirds of each company's total purchases. For the sales of each company, the average proportion of the top ten customers amounted to much the same. (Håkansson, 1989) In the wake of the following decades increased specialization and outsourcing, it is not unusual that an end-product consists of parts where around 80-90 % of the total product cost is supplied by other than the company with which the customer is doing business. (Håkansson & Waluszewski, 2008)

One important consequence of a business landscape with the above described characteristics is that no potential innovation; regardless if developed in a business setting or transferred from a knowledge producing setting, ever meet a claimless demand. Any attempt to create change will always have wanted or unwanted side effects for a number of direct and indirect counterparts on the supplier and user side. The effects will be distributed among related companies and their technological and organizational solutions, i.e. among directly and indirectly related interfaces. Thus, these largely indirect effects can both support and kill an innovation journey, depending on what it will add to the others that it affects. This means that effects from public innovation support can 'gravitate' from – but also to – companies and places. Furthermore, it means that potential innovations can be transformed into solutions of quite different characteristics and effects than thought of initially.

Again, if the business landscape had the characteristics sketched in the prevailing market and innovation models, i.e. if it had been characterized by companies that are independent under a group level, this change of characteristics and effects would have been a minor problem. However, if companies as a group, i.e. the business landscape, are characterized by interdependency, as suggested both by policy practitioners and empirical based research, then any attempt to create change will be faced with business networks that influence both the strength and the direction of efficiency and innovation processes (Håkansson et al, 2009).

In the next section we will take a closer look at why and how a business landscape characterized by interdependency affects both the direction and content of any attempt to create change.

5.3 Anything new has to co-exist with 'investments in place'

That neither costs nor benefits of change processes, whether a publicly financed RTD project or an initiative from a company, only will occur in connection with where the change process is an obligatory ingredient in an interdependent business landscape. As underlined above, if companies are interdependent, and are dealing with efficiency and innovation issues in relation to specific other companies and organizations, then all types of investments; in human resources (such as knowledge, organizational experiences, skills and relationships), and in physical resources (such as facilities, equipment, systems), over time will be adapted to and fit with a number of other directly and indirectly related investments across company and spatial borders. Thus, for anything new to be taken into large scale commercial production and use, for example, a new solution developed within science that, through the help of publicly financed research and technological development support shall be transferred to business, this will never be an issue of the quality of the new itself, or of a recognised demand. Instead it will be an issue of what the new can contribute in relation to existing investments; to what costs and what benefits among directly and indirectly affected companies and organizations, on the supplier as well as on the user side. (David, 1985, von Hippel, 1986, 1988, 2007, Håkansson, 1989, van der Veen et al. 1999, Piore & Sabel, 1984, Gudeman, 2001, Håkansson & Waluszewski, 2002, 2007a)

Hence, anyone who wants to introduce something new in an interdependent business landscape has to deal with the fact that the main part of the existing investments, which will have a strong impact on whether the new will ever get the interfaces necessary to be taken into large scale supply and use, are made outside the initiating company/ organization. The process where something new is taken into large scale production and use will furthermore be complicated by the fact that the existing investments are related in intricate patterns that are often not visible until a change attempt occurs. (Utterback & Abernathy, 1975, van de Ven et al 1999, Håkansson, et al., 2009)

The fact that the calculated benefits of something new have to be revised when the new clash with and is affected by an intricate pattern of existing related investments was observed by Utterback and Abernathy (1975, p. 644) decades ago and they warned against having too high of an expectation of what innovation processes can contribute. As long as it is the new in itself that is in focus, the expectation of what new scientific results or new techniques can contribute can be very high, argued Utterback and Abernathy. However, as the new meets all those investments in human and physical resources that are related to each other over time, across companies and spatial borders and with which it has to fit, the expectations in general have to be modified. 'Unfortunately, the pay-off required to justify the cost of change is large while the potential benefits are often marginal'. (Utterback & Abernathy, 1975, p. 644)

Thus, even if a new function from an aggregated perspective can appear as the perfect fit to an 'unmet demand' it will never, when embedded into a new or improved commercial solution, meet an isolated demand in itself. Instead, it will meet a number of

already established interfaces, of which only some are visible in advance, and which, depending on how well the new fits, will have a positive or negative impact on the innovation journey. A challenging complication created by existing investments that are related across companies and places is that the tension between innovation and efficiency is asymmetric. The main costs and main benefits of innovations appear at different times and at different places, i.e. the costs and benefits can be unequally distributed among the involved/affected actors. A related complication is that the path dependency in such a business landscape is 'economically conservative'. Any attempt to create change will directly and indirectly meet a number of existing investments. This meeting with established interfaces creates a pressure, a friction force that directs the development processes to take a route that does not completely direct the innovation journey, but forces it to take advantage of the main investments in place (Håkansson & Waluszewski, 2002).

To summarize the experiences made in empirical based research of innovation in an interdependent business landscape: The life of one company, located in one region, in one nation, is dependent on some specific other companies and organizations, located within *and* outside this region and nation, and vice versa. The circumstance that any border among interdependent companies is 'arbitrarily created' was stressed by Nobel prize recipient Paul Krugman (1991), and was clearly demonstrated by the contemporary economic crisis, where the economic problems of one company in one country has had side effects among related companies at both close and very distant places – something which in turn had side effects for the nations where these occurred.

5.4 There are reasons to intervene

For anyone who wants to create change in the business landscape, whether a company or a policy practitioner working under a governmental commission, the empirical based picture that anything new never will meet a claimless demand, but an intricate pattern of investments in place, might sound both pessimistic and deterministic. However, the empirical based picture also witnesses a business landscape under constant development. This means that established paths can always give rise to new crossroads as long as the new gets embedded into some change processes and gets direct interfaces with at least some existing resources on a supplier and user side. This also implies that the only general means to create change in an interdependent business landscape is interaction. For anyone that wants to support the embedding of something new in a large scale commercial supply and use of anything new it is necessary to get involved with directly or indirectly affected counterparts on the supplying and using sides. (Håkansson & Waluszewski, 2007b)

Hence, if interdependencies among specific companies are a result of interaction over time, it is a reason for anyone that wants to support a certain innovation process to continue to interact, and especially to consider what direct and indirect effects that

interaction gives rise to. This also raises a question similar to what the policy practitioners asked in the GLOVAL proposal:

> *'What opportunities are being missed, if the public RTD and innovation support fail to capture less direct long term outputs and benefits'?* [48]

In the following section we will take a closer look at three different settings of the empirical landscape into which anything new has to be embedded in order to be taken into commercial large scale production and use, and consequently, where both opportunities and drawbacks can occur.

5.5 The different economic logics of development, supply and use

If anything new never meets a claimless demand, but patterns of existing investments related and adapted on a day-to day-basis among specific companies and organizations, across many different types of community borders, then within what types of settings does the new have to get a 'life'?

Based on their different kinds of economic logics, at least three types of related empirical settings can be outlined, where anything new must be embedded into it if it will result in a large and widespread commercial supply and use. This means that there are both opportunities and drawbacks in three different settings that have to be tackled in order for an innovation journey to succeed.

Developing settings characterized by search for new functions

Regardless of the type of *developing setting* within which a new solution emerges, this will create imprints on the new. Earlier investments in human resources, such as knowledge, skills, routines and experiences, and in physical resources, such as equipment, tools, and methods, will create imprints on the new functionality. (Håkansson &Waluszewski, 2007b)

If the developing setting is very close to established supplier and user networks, if it for example consists of companies' R&D units and/or industry related research institutes, the new solution will probably emerge in close relation to human and physical investments made in these settings, as well as in relation to problems and opportunities of the supplier and user networks. If the developing setting has only vague connections to future commercial supplier and user networks, if, for example, it consists of academic research milieux, developing a new solution will carry fewer imprints of earlier investments in supplier and user settings. However, there will always be some kind of influence from business, for example in terms of a company's supply of research equipment and methods. (Håkansson, Waluszewski, 2007b, Galison, 1997)

[48] GLOVALproposal 234608 Version of 09/Dec/2008, p. 6.

When anything new is going to be embedded into commercial supply and use, it is never a solution in itself that creates benefits, but what effects it can create in combination with current human and physical investments. This means that uniqueness from a short term economic perspective most often is a drawback. The more a new solution differs from related investments, the more difficult it is to combine, i.e., the more difficult to find ways to create economic benefits. Even if a new solution can be regarded as an excellent scientific contribution in the academic setting where it was developed, and even if it seems to correspond to a specific demand, there is no guarantee that it will be possible to embed in commercial supplier and user networks where it has to interface with a number of investments (Håkansson, Waluszewski, 2007b, Hoholm 2009, Ingemansson, 2010).

The weak connection between an academic development setting and a future commercial supplier and user setting can be seen a drawback, if the aim of the research is to create solutions that can quickly be commercialized. However, it can also be regarded as something positive that it, from a short term perspective, is a bad fit between a solution developed in an academic research milieu and an established commercial supplier and user network. If the ambition is that the new shall contribute with significant new knowledge and/or to suggestions for how to cope with severe societal problems, related to for example climate, environment and health, it is also likely that such solutions will challenge a number of current investments in commercial supplier and user networks. Thus, from a short term perspective there will always be a bad fit between radically new commercial solutions and existing investments. Consequently, the more the new differs from current investments, but is wanted from a societal perspective, the greater the reasons for policy to intervene.

This implies that the main idea of contemporary innovation policy, to increase the direct utilization of knowledge and technology developed in academic research in business, is to go for the most challenging embedding processes. Academic research has another basic agenda other than business development. The latter has to start out from existing investments, and whether the knowledge is new or established, if it stems from research or practise, of key importance is that it can contribute to new combinations of resources that result in increased efficiency and innovativeness. However, the idea with academic research is to search for new knowledge, regardless of what short term commercial interests this might challenge. In order to be financed, academic knowledge development has to result in research considered as scientific advances. Furthermore, it has to result in a certain amount of scientific advances presented in terms of PhD dissertations, journal articles and other research publications. This in turn means that academic research results must be ‘marked off’ in order to be recognized, in at least some aspects, as radically different compared to the existing scientific knowledge base. (Jasanoff, ed., 2004, Nowotny et al, 2005)

An important question for governmental policy commissioners to consider is how to deal with the fact that academic research results that radically differ from established business investments utilized in commercial supplier and user networks are difficult to

embed in the latter. Shall academic research be adapted in order to fit in with the business landscape's short term interests, to facilitate for a more direct and rapid commercialization? Or shall academic research provide knowledge developed in relation to areas identified as important in order to solve certain technological, organizational, political, societal and/or economic problems – regardless of what existing investments this might challenge? And if, what actors shall take the role of being long term financiers of such innovation processes, which definitely will clash with investments related through transnational business networks, and which main costs and benefits will be distributed over time and space?

That the academic knowledge production has other requirements as compared to business R&D was also an obstacle addressed by the policy practitioners behind the GLOVAL project. One of the participants expressed the dilemma with a governmental commission that more or less forces policy practitioners to involve academic researchers in RTD projects:

> '*University professors and researchers are not interested in or experienced about industrialization, and definitely not about global business networks.'*

The need for benefits in a supplying setting

The difficult step from a potential innovation to a realized innovation, as discussed above, is not only dependent on what benefits the new can contribute in a developing setting, but also in a supplying setting and a using setting, which are characterized by rather different economic logics. Thus, regardless of how great a success something new seems, as in an academic or business developing setting, it is not until it has been embedded into networks responsible for its large scale supply and use that it becomes an innovation. Below we will take a closer look at what challenges the scaling up and embedding of something in a supplier setting implies. (Håkansson, Waluszewski, 2007b)

In a supplier setting, a dominating economic question is how to utilize established facility systems (i.e. investments in place responsible for production, logistics, distribution, marketing, services, etc.) as efficiently as possible. For any new solution to be industrialized, i.e. to be embedded into a number of related companies responsible for all types of human and physical resources necessary for taking it into a regular supply, it has to be beneficial for the main part of these existing investments. Thus, when something new is going to be embedded into a supplying network, it has to be 'locked' in terms of a new product, process and/or service. As discussed above, in the contemporary highly specialized business landscape, the trial-and-error like process of locking a new solution into a product, process and/or service, and embed it into a supplying network, will never be an affair of one single company, but an issue carried out among a number of related companies. Much of the end product will be supplied by others, not just the launching company, and how the end product will be locked will largely be defined by what others can supply, given that the new also has to add to their existing investments. Thus, in order to be industrialized, anything new has to get

interfaces with existing investments related across company and spatial borders. What costs and benefits this can be create will consequently have a great impact on whether a new solution will ever be locked in terms of a commercial product taken up into a large scale supply. (Gadde & Håkansson, 2001, Ford, 2001)

Hence, a critical question for those who struggle with getting a new solution embedded into a network responsible for its large scale production and supply is what adaptations are required by others, and furthermore, how much support for these investments can be mobilized. The more existing investments can be utilized without larger adaptations, the higher the efficiency. Consequently, whether any new product, service or process will ever be embedded into a large scale production is largely determined by whether it will clash with or create new benefits for existing related investments.

An important question for governmental policy commissioners to consider is how to deal with the strong influence that existing investments in established supplier networks have on the innovation process. One important aspect concerns potential innovations considered to be of great importance from a societal perspective, but that, in the short run, cannot build very much on existing investments in established supplier networks. The more difficult it is to build on existing investments, the less likely that the embedding of the new into a network responsible for its large scale supply will succeed. Thus, an innovation journey that can provide solutions regarded as important from, for example, an environmental or a health perspective, but that have great difficulties building on established supplier settings' existing investments, are dependent on the mobilization of very strong financial and technological support in order to be realized. A common denominator among innovation journeys that have succeeded despite that, from a short term perspective, they have challenged existing investments is also that they have emerged over a long period of time, and, through substantial governmental support, often in terms of military investments or other state financed investments. (Freeman, 2002, Malerba, 2005, Lundin, Stenlås, Gribbe, 2010)

Another aspect for governmental policy commissioners to consider concerns the innovation opportunity that established supplier networks, regarded as important from both a societal and economic point of view, provide. By starting out from more mundane local, regional or national nodes in supplier networks, and the need for development and reinforcement that are addressed by companies related to them, potential innovations that can build on and increase the utilization of existing investments made within certain community borders can be identified. (Gadde & Håkansson, 2001, Ford 2001)

A third aspect, which also was addressed by the policy practitioners in the GLOVAL project, concerns what innovation opportunities that supplying and using networks, which mainly are located outside the national borders, can provide. The policy practitioners' experience was that 'it can make a good sense' to support such innovation

journeys, ‘if it is reasonable to expect’ that they will have some positive side effects on indirectly related domestic companies. [49]

The need for benefits in a user setting

A successful embedding in a network of related suppliers is, however, not all that is required to make a potential innovation into a realized innovation. If the new ever will to contribute to ‘black figures’ for those engaged in its supply, (and not end up as a short term ‘bubble’; i.e. a firm investing, employing, purchasing, producing and delivering only as long as it has access to venture capital that can carry its costs) the end product has to be valuable within a commercial *using setting*, i.e. an environment consisting of using companies, organizations and/or consumers. (Håkansson, Waluszewski, 2007b)

In a user setting, a dominating economic question is how to utilize established products and product systems as efficiently as possible. Thus, for anything new to become an innovation it has to, directly or indirectly, be embedded into a commercial product and/or service that has widespread use. This means that the new needs to have to get interfaces to a large number of already existing products and services in a user setting. Hence, existing investments in products and services are crucial for any potential innovation’s ability to succeed. This can explain why the embedding in a user setting is the ‘Achilles heel’ of the innovation journey; only a few of all new products and services survive this process. (Håkansson, Waluszewski, 2007b, Tidd et al, 1997, von Hippel, 2007, van de Ven et al 1999)

This implies that one of the most critical parts of the innovation process is very hard to reach from the supplier side. A number of users must find it economically beneficial to engage in the creation of user applications. This might include an identification of what adaptations of related product systems already in use are necessary in order to embed the new solution, as well as a mobilization of the suppliers and users behind them. Thus, for anything new to gain widespread use, interfaces between the new and a number of existing investments, in a supplier and a user network, have to be created. The more others than those directly related to the use of the new can take advantage of it, the larger the possibility that it will reach widespread use and become an innovation. Thus, regardless of how enthusiastic a few ‘lead users’ are, the value of a new solution will not be determined by them or by how unique the new is, but by how well it fits a larger ‘using system’. The more a potential innovation differs from already established material and immaterial resources in the user setting, the larger the effort required for a successful embedding. Consequently, whether any new product, service or process will ever will reach substantial use is largely determined by whether it will clash with or create new benefits to established material and immaterial investments in the user setting and by how much economic and political support can be mobilized. (Håkansson, Waluszewski, 2007b, Bijker, 1987; Gudeman, 200l, Yates, 2009)

[49] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6.

Hence, a critical question for those who struggle with getting a new solution embedded into a commercial user network is whether the new will be compatible with established products and product systems in use. Are there early users that can be mobilized, who can work out user applications for a larger number of followers? Users from individuals to and user groups, such as NGOs and consumer organizations, and, last but not least, their ability to mobilize support from related suppliers, governments etc., are important for the likeliness that a widespread use of something new will be created.

An important question for governmental policy commissioners to consider is how to deal with the strong influence that user networks have on the innovation process. One aspect concerns potential innovations considered to be of great importance from a societal perspective, but are not yet available for large scale use. Governmental supported user actions have also, over time, proved to be important in embedding potential innovations in large scale supplier and user networks.

Another aspect for governmental policy commissioners to consider concerns the innovation opportunity that established user networks, regarded as important both from a societal and economic point of view, provide. By starting out from local, regional or national nodes in user networks, and opportunities for renewed user applications addressed by them, potential innovations that can build on and increase the utilization of existing investments made within certain community borders can be identified.

The importance of considering the user setting in RTD processes was also stressed in the GLOVAL proposal, where the need for the replacement of a 'simple input-output logic' in favour of a framework that can catch complex supplier-user interactions 'in which the benefits are likely to be dispersed spatially and organizationally'. [50]

The need for rethinking governmental innovation policy

If we accept that the business landscape is characterized by interdependencies, i.e. that it has network-like characteristics which stretches across national borders, and that the outcome of any research and technological development process, in order to contribute to innovation, has to find a 'life' in three related networks that are characterized by different economic logics, the contemporary governmental requirement on direct measureable economic and societal benefits within the borders of the investing community appears limiting. As underlined by the policy practitioners behind the GLOVAL project, if the network characteristics of the business landscape are simplified away, neither innovation hindrances nor opportunities will be taken into consideration. Thus, given that a main characteristic of the business landscape is interdependencies stretching across company and spatial borders, there is a need for rethinking the innovation policy commission. In the next chapter a suggestion for a reformulation is presented.

[50] GLOVAL, proposal 234608 Version of 09/Dec/2008, p. 6.

6 Innovation policy reconsidered

Is the political commission given to the policy practitioners a ‘mission impossible’, given a transnationally interdependent or network-like business landscape? Can policy supported development projects be designed and executed in ways that not only make their costs but also significant societal and economic benefits appear within the investing country? If we take seriously the governmental ambition to reach national economic benefits through innovation policy, as well as the characteristics of an interdependent business landscape, then the agenda for how to reach this needs to be reframed.

Instead of starting out from the assumption that direct transfer of knowledge from non-business to business is a smooth way to boost innovation processes within the borders of the of the nation that made the policy investments, the problems need to be reformulated. If the business landscape is network-like, then it is not neutral, but directs economic processes in a way which favour the main part of existing investments. Thus, if the business landscape has network-like characteristics, the governmental policy cannot rely on that a knowledge transfer to the market will result in the innovations and industrial development needed to solve certain identified economic, societal and environmental problems. Two critical questions are instead how to:

1 Utilize the efficiency and innovativeness of networks forces.
2 Create counter forces against the non-democratic and economically conservative forces of a transnational business networks.

Thus, given that the business landscape is characterized by transnational interdependencies, a relevant starting point for the first question would be to ask:

a How can governmental policy act in order to support the renewal of resources in a way that makes them into the policy investing nations’ contribution to specific transnational innovation forces and transnational supplier and user networks? [51]

Along with this reformulation goes the second question, the requirement on governmental policy commissioners to consider:

b What types of transnational innovation forces, involving what supplier and user networks, that policy investment should be used to relate to – as support or

[51] To what types of global innovation forces and global supplier/producer user networks should policy investments be used to relate national/regional economic resources? Should any opportunity for a nation/region to become an important part of a global supplier/user network be supported? Or should only attempts to become a part of supplier/user networks that are acceptable for environmental, political, democratic reasons be supported? These are important political questions to consider, which, however, goes outside of the aim of this report.

hindrance. Should any opportunity for companies to deliver important contributions to transnational supplier and/or user networks be supported? Or should only projects be supported that are acceptable for environmental, political, and/or democratic reasons. (We will come back to the question of how policy can act in relation to light and dark sides of network forces later on.)

Thus, given a network-like business landscape, a key question for policy actions can be formulated:

What public policy measures are needed to renew resources and make them a nation's significant, stable contributions to transnational supplier and/or user networks?

With such a point of departure, the policy practitioners should be allowed to expand the perspective, from direct effects assumed to be created by a focal company and/or project, to network effects that are likely to occur within and outside the policy investing nation.

First, the policy practitioners would no longer be forced to base their support on the direct measurable outcomes of research and technological development projects. Instead, projects could be supported due to their ability to involve directly and indirectly related companies and organizations within the policy investing nation in the renewal work, and due to the project's ability to make them provide stable contributions to transnational supplier and/or user networks.

Second, the policy practitioner would be allowed to support renewal projects whether or not they included contemporary academic research. The important question would instead concern if a policy supported project, whether starting out from a developing, supplying or using setting, could result in a significant renewal of national resources that over time can result in providing stable contributions to transnational supplier and/or user networks.

Third, academic and other research would be allowed to be used as an indirect source of renewal. The strong focus on direct transfer of solutions from academic and other public research to business could be replaced by a stronger reliance on an indirect use of these sources of knowledge, including learning and teaching.

However, if governmental policy has the ambition to renew and relate resources to transnational supplier and/or user networks, the policy practitioner needs an analytical framework that is based on the assumption of an interdependent business landscape, which allows an analysis of indirect effects, and especially of 'place opportunities'. For smaller nations in particular, a critical question is how to get not only the main cost, but also benefits to appear within their national borders. Given a network-like business landscape, there is a great risk that benefits may 'gravitate' to other locations than intended, i.e. that outcomes of smaller countries' research and technological development investments become ad hoc input to transnational supplier and user networks. Thus, a relevant governmental policy question concerns *how to make the*

outcome of public funding supported projects become a particular place's stable contribution to transnational supplier and/or user networks.

The basic demand on such an analytical framework is that it can provide the policy practitioners with the ability to investigate the direct interfaces, and the main indirect interfaces, on the supplier as well as on the user side, which the project is thought to affect or needs to create. What main developing partners, what main suppliers, and what main users, are thought to be affected by and involved in the project? Where are they located in space? And what transnational networks are they embedded into? In the next section we will discuss how such an analysis can be made and how space related opportunities can be identified.

6.1 Opportunities to renew national developing, supplying and using networks

How can policy practitioners work to support the renewal of national developing, supplying and using networks in a way which make the outcome to important, long-term contributions to transnational supplier and/or user networks? Above it was underlined that in order for anything new or renewed to become an innovation, it has get a 'life' within a developing network, a supplying network and a using network, all of which stretch across technological, organizational, company and spatial borders and across different economic logics.

On one hand this means that the policy practitioners are faced with a huge complexity: For something new to become embedded into transnational supplier and user networks it has to fit with numerous existing technological and organizational solutions, which also are related among companies, organizations and individual users. Furthermore, it has to fit with the different economic logics that characterize the networks where it is developed, supplied, and used.

On the other hand, the same complexity opens up a number of opportunities: There are numerous of attempts to renew existing solutions occurring in developing networks, supplying networks and using networks within and across company and national borders. Thus, there are numerous innovation forces to which the renewal can be related.

Below we will consider, first in a brief overview and second, through focusing on some main dimensions of the business landscape, how policy practitioners can identify such processes.

Opportunities to renew and relate national development settings to transnational developing settings

A first opportunity to create national effects of policy supported RTD projects is to consider how the project will affect not only a focal setting, but also other national developing settings. This means that policy practitioners need to consider if the RTD project will:

a involve only a focal national developing setting,
b involve other national developing settings, and/or,
c involve developing settings in other nations in the renewal work.

Thus, the following key questions can be formulated:

1 *Is the RTD project relating a focal national developing setting to transnational developing settings?* This means that following, related questions have to be considered:
   a Are representatives for transnational developing settings involved?
   b Are the relationships to transnational developing settings varied in terms of type of knowledge development; do they include a mix of representatives for academic research, institute research and business R&D?

2 *Is the RTD project related to other national developing settings, i.e. are the achievements reached in the RTD project open for other national developing settings?* This means that following, related questions have to be considered:

   a Are others than a focal national developing setting directly or indirectly related to the RTD project?
   b Are the relationships to other national developing settings varied in terms of knowledge; do they include a mix of representatives for academic research, institute research and business R&D?
   c Are the relationships to other national developing settings varied in terms of size; do they include a mix of representatives for large, established knowledge developing institutions in academic research, institute research and business R&D, and smaller, specialised units in each of in these settings?

3 *What does a national developing setting contribute to a transnational developing setting?* This means that following, related questions have to be considered:

   a Is the national knowledge development dominated by issues ‘outsourced’ from and directed by a transnational developing setting?
   b Does the national knowledge development represent a specific contribution to the knowledge development in a transnational developing setting?

Opportunities to renew and relate national supplying settings to transnational supplying settings

A second opportunity to create national effects of RTD investments is to systematically search *for how a RTD project can renew and relate national supplier settings to transnational supplier settings.* This means that policy practitioners need to consider if the RTD project will: a) involve only a focal national supplier setting, b) involve other national supplying settings, and/or, c) involve supplying settings in other nations in the renewal work. Thus, the following key questions can be formulated:

1 *Is the RTD project relating a focal national supplying setting to a global supplying setting?* This means that following, related questions have to be considered:

a Are representatives for a national supplier setting, i.e. a setting responsible for scaling up, supplying and producing (parts of) the outcome of the RTD project setting involved?
b Are representatives for national suppliers with established relationships to transnational supplier networks involved, or mainly representatives for start-up firms?

2 *Is the RTD project related to complementary national supplier settings, i.e. are the achievements reached in the RTD project open for complementary national supplier settings?* This means that following, related questions have to be considered:

a Are other complementary national supplier settings involved, directly or indirectly related to the RTD project?
b Are the relationships to complementary national supplier settings varied in terms of knowledge; do they include a mix of representatives for production technologies, supply, logistics, marketing, etc.?
c Are the relationships to complementary national supplier settings varied in terms of size; do they include a mix of representatives for large, established suppliers/producers as well as smaller ones?

3 *Does a national supplying setting contribute to a global supplying/producing setting?* This means that following, related questions has to be considered:

a Is the national supplying setting an important provider of key technological solutions to a transnational supplying setting?
b Is the national supplying setting mainly a sub-supplier to a transnational supplying setting?

Opportunities to renew and relate national using settings to transnational using settings

A third opportunity to create national/regional effects of RTD investments is to systematically search *for how RTD projects can renew and relate a national using setting to a transnational user setting.* This means that policy practitioners need to consider if the RTD project will: a) involve only a focal national user setting, b) involve other national user settings, and/or, c) involve using settings in other nations in the renewal work. Thus, the following key questions can be formulated:

1 *Is the RTD project related to a global user setting?* This means that following, related questions have to be considered:

a Are representatives for transnational business users, governmental users, consumer groups, NGOs, and/or expertise groups involved?
b Are representatives for national users with established relationships to transnational user networks involved?

2 *Is the RTD project related to a national user setting, i.e. are the achievements reached in the RTD project open for national users?* This means that following, related questions have to be considered:

   a Is there an established national user base or is it emerging?
   b Are representatives for national business users, governmental users, consumer groups, NGOs, and expertise groups involved?

3 *Is a national user setting contributing to a global user setting?* This means that following, related questions have to be considered:

   a Are representatives for 'lead-users', i.e. users engaged in 'pushing the limits' for established use, involved?
   b Are national lead-user related to a transnational user setting?

By considering the above questions, an overall picture of the likelihood that a RTD project will renew and relate national developing settings, supplying settings and using settings to transnational innovation forces and supplier and user networks can be outlined. The questions can reflect the balance of an RTD project; will it just include a focal national developing setting or will it bring in others representing large scale supply and use, and finally, will it relate the national renewal work to transnational innovations forces?

This first overall view might also indicate that there is a weak relationship between national renewal processes and transnational supplier and user networks. It might outline that an RTD project is unbalanced, for example that it mainly represents a non-business developing setting, while representatives for settings where the new is thought to be scaled up, supplied and used are absent. Thus, the first overall view might result in a need for policy actions, which in turn raises the need for a more detailed analysis, something that will be discussed in the next section. However, this also requires a short presentation of the utilised framework.

6.2 Analyzing policy opportunities and restrictions

The theoretical framework used in this analysis is, as mentioned in the introduction, based on the IMP or industrial network approach, which emerged in the 1970s as a reaction against a dominating theoretical perspective – the idea that companies and organizations are autonomous and independent. (www.impgroup.org) The triggering reason behind the emergence of an alternative approach was the empirical observation that companies did interact with specific counterparts on then supplier and user side; they adapted and related specific organizational and technological solutions across company borders, with both costs and benefits for the parties involved – and with effects on the structure and processes of the larger business landscape.

Already the first joint IMP project, were more than 1000 European supplier-customer relationships were investigated, witnessed about a business landscape characterized by

companies that systematically were engaged in creating and utilizing interdependencies; for efficiency as well as for innovativeness. This was among others expressed in the significance of relationships among suppliers and customers, which often spans ranges of 20-30 years, with an average of more than a decade. (Håkansson ed 1982, Turnbull and Valla, eds. 1986, Håkansson et al, 2009) Under a pattern of stability; in terms of business relationships connected over time and space, the resources exchanged and activities carried out were constantly developed and adapted in relation to direct and indirect related counterparts. Thus, each company's economic benefits were dependent on how this pattern was worked out. The long term interaction among main counterparts appeared as a way to create a co-evolution among related companies on both the producer and user side. (Håkansson et al, 2009)

Already at an early stage the need for a framework that could catch the content and effect of long term interaction and relationships became obvious. Besides being based on empirical observations, this work was were also inspired by other 'dissident' scholars' struggles which research experiences that strongly contradicted the assumptions of the traditional model world. Some important contributions on how to investigate the content and effects of the interactive features of the business landscape were social exchange theorists, (Homans, 1961, Blau 1968), inter-organisational theory, (Levin & White, 1961, Litwalk & Hylton, 1962, Evan, 1966, Cook-Emerson, 1978, Aldrich & Whetten, 1981) distribution theory, (Mattson, 1969, Stern, 1969, Ford, 1976), transaction cost theory, (Williamsson, 1975, 1979) innovation management, (von Hippel, 1978, 1979) and some critical economists, (Penrose, 1959, Richardson, 1972). Later on important inspiration have been gained from economic history (Rosenberg, 1982, 1984), economic anthropology (Wilk, 1996, Gudeman, 2001) and from researchers related to the so called STS field (Bijker, 1997, Galison, 1997, Hughes, 1983, Latour, 1984, Jasanoff, 2004)

The first analytical tool developed in the IMP setting is the so called Interaction Model (Håkansson ed, 1982) which focuses on the interaction among two parties and their context.[52]

The focus was expanded with the so called ARA model, (Håkansson & Johansson, 1992; Håkansson & Snehota, 1995, Håkansson et al, 2009) which allows the investigation of the content and effect of three important 'layers' of a network of connected business relationships; activity links, resource ties and actors, and will be discussed more in detail below. A related analytical tool that allows a detailed analysis

[52] The interaction model is based on the assumption that interaction leaves traces in several ways – on human as well as physical resources involved. Thus, interaction and business relationships are assumed to have consequences for both costs and benefits – for direct and indirect related parties – and consequently, for the larger business landscape. (Håkansson et al, 2009)

of resource interfaces across company borders and across established business relationships is the so-called 4R model (Håkansson & Waluszewski, 2002). [53]

The analytical tool used in next section is based on the called ARA model (Håkansson & Johansson, 1992; Håkansson & Snehota, 1995, Håkansson et al, 2009), which makes it possible to analyse the content and effects of the three important 'network layers': activity links, resource ties and actor bonds. These can be more or less overlapping – or distant. The basic foundation is the assumption that actor bonds, resource ties and activity links do have consequences that go beyond the specific relationship in which they arise. Thus, the model builds on the assumption that each of these three layers are inter-connected and each affects and is affected by the constellation of resources, pattern of activities and web of actors in the wider network. (Håkansson et al 2009)

Activity links may limit or facilitate resource adaptations over time and space, resource ties may limit or favour the possibility of activity co-ordination over time and space, and actor bonds may open up the possibility of developing activity links and resource ties over time and space. This implies that through the ARA model it is possible to take account of both direct and indirect interdependencies in the business landscape. Furthermore, the ARA-model makes it possible to investigate these different layers separately, or in different combinations. It can for example be utilized in order to investigate if some main resource ties, stretching across certain non-business and/or business organizations and over certain places, also are dealt with through equivalent actor bonds. (Håkansson et al., 2009)

In the discussion of opportunities for policy practitioners to affect the resources ties, activities links and actor bonds, the model is used as following:

- *Innovative forces* are reflected through an analysis of how *resources* are developed and combined within and across companies, within and across national borders.
- *Efficiency forces* are reflected through analysis of how *activities* are performed and linked within and across companies, within and across national borders.
- *Balancing of efficiency and innovation forces* is reflected through analysis of how *actors* are related and how actor bonds are developed within and across companies, within and across national borders.

Thus, following types of processes in the business landscape can be analyzed through the ARA model.

- The investigation of *resource ties* gives an understanding of how resources, physical items such as plants or equipment as well as intangibles such as knowledge, routines

[53] The 4R model is based on four types of resources: Two are mainly technological: a) products and b) facilities or equipment, assumed to be combined with each other into different technological systems. Two types of resources are mainly organizational: c) organizational units that bring together a certain set of physical and human resources for specific tasks, and d) organizational relationships, systematically relating what companies and organizations are doing. It is in the interface between these four types of resources that the economic outcome of resource combinations is assumed to be determined.

and experiences are developed and combined within and across company borders, regardless of where they are located.

- The investigation of *activity links* gives an understanding of how activities such as production, logistics, administration, deliveries, information, are linked within and across company borders, regardless of where they are located.
- The investigation of *actor bonds* gives an understanding of relationships among companies, company units and/or organizations, regardless of where they are located. Bonds that arise between actors, for example between actors representing a customer and a supplier; a multinational's head office and a daughter company located in another nation, a company and governmental organization, a company and a non-governmental organization, may be more or less strong and will influence to varying extents what the individuals involved in a process perceive as possible and feasible directions.

6.3 Opportunities to affect the resources, activities and actors involved in the RTD work

In section 6.1 it was stated that the first overall analysis of an RTD project may outline a number of weaknesses that at the same time can be regarded as a number of opportunities for policy practitioners to act on. In this section we will use the ARA model to discuss three important dimensions of an RTD project, which can all appear as weaknesses or strengths, and that can all be influenced by policy practitioners.

First, there might be a need for a more detailed analysis of the *resources* that are involved in a policy supported project. Here it can be important to outline both what combinations of human and physical resources are already involved in the project, and what could be added. For example, are the resources that are involved in the RTD work representing mainly a non-business developing setting, or are there also other resources, *representing a national supplying respectively using setting* involved in the renewal work? What resources need to be involved, renewed or developed?

Second, there is also a need for a more detailed picture of what *activities* are already involved in the project and what could be added. Are the activities involved in the renewal work representing mainly an academic developing setting, or are other activities, *representing a national supplying and using setting also involved*? What activities need to be involved, renewed or developed?

Finally, there is also a need for a more detailed picture of what *actors* already are, and that can be, involved in the RTD project. Are the actors utilized in the RTD work representing mainly an academic developing setting, or are actors *representing a national supplying and using setting also utilized in the renewal work*? What actors need to be mobilized in the renewal work?

The example above indicates that a deeper analysis of resources, activities and actors; in a developing, supplying and using setting, can outline weaknesses *and* opportunities for policy practitioners to influence the content and direction of an RTD project.

In the next section some complementary questions concerning resources, activities and actors will be presented.

What resources are – and can be – involved in the RTD project?

What resources that are involved in an RTD project will have a great impact on what innovation forces, in what settings, to which the renewal work can relate? *Resources* can be mainly material, as equipment, facilities, materials, etc. Resources can also be mainly immaterial, as knowledge, routines, experiences (for example, experience of interaction with external partners) and relationships. The following overall question can shed light over what resources are already involved in the RTD project as well as what types of resources, representing what settings and what places, are weakly represented:

1 *What material and immaterial resources, representing what types of developing, supplying and using settings, at what places, are involved in the RTD project?* This means that following, related questions have to be considered:

   a What material and immaterial resources, representing what types of *developing settings*, are involved in the project?
   b What material and immaterial resources, representing a *supplying* setting, are involved in the project?
   c What material and immaterial resources representing a *using setting* are involved in the project?
   d What *places* (national/regional respectively global) do these resource combinations represent?
   e What resources in a developing, supplying/producing and using setting need to be involved/renewed/created in the RTD project?

What activities are – and can be – involved in the RTD project?

What activities that are involved in an RTD project will have a great impact on what efficiency forces, in what settings, to which the renewal work can relate. *Activities* can be production of material and immaterial solutions, logistics, administration, etc. The following overall question can shed light on what activities that already are involved in the RTD project as well as what types of activities, representing what settings and what places, are weakly represented:

2 *What activities, representing what types of developing, supplying and using settings, at what places, are involved in the RTD project?* This means that following, related questions have to be considered:

   a What activities representing a *developing setting* are involved in the project?
   b What activities representing a *supplying/producing* setting are involved in the project?
   c What activities representing a *using setting* are involved in the project?
   d What *places* (national/regional respectively global) do they represent?
   e What activities in a developing, supplying/producing and using setting need to be involved/renewed/created in the RTD project?

What actors are – and can be – involved in the RTD project?

What actors that are involved in an RTD project will have a great impact on what mobilizing forces, in what settings, to which the renewal work can relate. *Actors* can be companies, governmental and other organizations, specific groups within companies and organizations, as well as groups of individuals, for example consumer groups, NGOs, and individuals. The following overall question can shed light on what actors are already involved in the RTD project as well as what types of actors, representing what settings and what places, are weakly represented:

3 *What actors, representing what types of developing, supplying and using settings, at what places, are involved in the RTD project?* This means that following, related questions have to be considered:

   a What actors in a *developing setting* are involved in the project?
   b What actors in a *supplying/producing setting* are involved in the project?
   c What actors in a *using setting* are involved in the project?
   d What *places* (national/regional respectively global) do they represent?
   e What actors in a developing, supplying/producing and using setting need to be involved in/created by the RTD project?

By considering the questions above, an understanding of what national resources, activities and actors are involved, need to be involved and need to be created in the RTD projects renewal work can be outlined. Thus, hand in hand with the analysis of strengths and weaknesses of the RTD project, goes the outlining of opportunities for RTD policy practitioners to act. The analysis of renewal opportunities can also be presented as in the following matrix, based on Håkansson, Waluszewski, (2007b)

Figure 1 Nine related but different 'interface logics' that can contribute to 'diagnostics' of forces that shape and direct the outcome of RTD-processes

	Using Setting	Supplying Setting	Developing Setting
Resource combinations *(innovation forces)*	*Renewal opportunities in relation to:* **PRODUCT SYSTEMS**	*Renewal opportunities in relation to:* **FACILITY SYSTEMS**	*Renewal opportunities in relation to:* **IDEA SYSTEMS**
Activity links *(efficiency forces)*	*Renewal opportunities in relation to:* **USER NETWORKS**	*Renewal opportunities in relation to:* **SUPPLYING NETWORKS**	*Renewal opportunities in relation to:* **R&D NETWORKS**
Actor bonds *(mobilizing forces)*	*Renewal opportunities in relation to:* **USER ACTOR BONDS**	*Renewal opportunities in relation to:* **SUPPLIER ACTOR BONDS**	*Renewal opportunities in relation to:* **R&D ACTOR BONDS**

The same data concerning renewal opportunities can also be presented as in the following matrix, which highlights the links among ‘national’ networks; i.e. resources, activities and actors available within the national borders and transnational networks.

Figure 2 Links among ‘national’ and ‘transnational’ networks

	’National’ networks	Links between ’national’ and ’transnational’ networks	’Transnational’ networks
Innovation forces	**Resource combinations**	***National-transnational* Resource combinations**	**Resource combinations**
Efficiency forces	**Activity links**	***National-transnational* Activity link**	**Activity links**
Balancing forces	**Actor bonds**	***National-transnational* Actor bonds**	**Actor bonds**

If a policy practitioner can require that each applicant for policy support provide her with at least a basic awareness about and some information concerning each ‘interface logic’, she has also been provided with an emerging picture of:

a The idea that the RTD applications rest on and how far they have materialized, including at what places that are involved.
b The supplying network that is necessary for a taking the materialized idea to a large scale production and supply, including at what places it is likely that this will appear.
c The user network that is necessary for reaching the using volumes required for ‘black figures’ in the supplying setting, including at what places they are likely to emerge.

Thus, the policy practitioner has been provided with at least an awareness about and a discussion of three related but, in terms of both technological, economic and spatial logic rather different networks, in which anything new has to survive to become a successful innovation.

The final question for the policy practitioner to consider is what RTD processes are going to be supported, and how. Is it the application concerning projects that appear to have a good chance of being embedded in a using, producing and developing network, which to a large extent already exists within certain spatial borders, going to be prioritized? Or is it the application concerning projects that appear to meet severe

difficulties in one, two or all of these settings, but are important for a democratic, environmental or other societal reason and are considered as beneficial, that will be prioritized? And if it is the latter type of processes that is prioritized; where a long-term support is necessary for supplying and using networks to emerge, is the required policy involvement compatible with the contemporary EU legislation?

7 Coping with the light and dark sides of networks

The starting point of this report was the dissatisfaction with the contemporary governmental innovation policy addressed by the policy practitioners behind the GLOVAL project. The policy practitioners' main criticism concerned the governmental commissioners' view of the business landscape, which was regarded as 'increasingly out of line with economic reality'. This in turn raised the question of what 'opportunities are being missed' if public RTD and innovation support disregard the transnational network characteristics of the business landscape and fail to catch 'less direct long term outputs and benefits'.

The main ambition with the GLOVAL project was to provide policy practitioners with alternative tools that could help them to 'adapt their assistance rationales and decision logics' to a business landscape characterized by 'global chains' or 'global networks'. This could appear as a modest attempt. However, firstly the request for a policy framework that can catch the transnational network-like features of the business landscape includes a demand to start out from an approach that is based on the assumption of an interdependent business landscape. Thus, the policy practitioners' criticism is also a questioning of the underlying assumptions of contemporary governmental policy. Secondly, the request for policy actions based on the assumption of a business landscape with transnational network characteristics questions the legislation (or, eventually, the interpretation of the legislation) concerning what processer, at what places, policy practitioners are allowed to act.

The main ambition of this report has been to relate the questions asked by the policy practitioners to a) the contemporary governmental commission on innovation policy and its underlying assumptions; b) empirically based research on innovation in a network-like business landscape; and c), what opportunities for policy actions the latter view calls forth.

The report has shown that while governmental innovation policy commissioners are occupied with creating a system that can facilitate the transfer of knowledge from a non-business setting to a business landscape assumed to have a lot in common with how it is captured in traditional market thinking, the policy practitioners are struggling with a business landscape where interdependencies stretching across companies and nations is the normality. The report also discussed the fact that policy measures that could have been beneficial if the business landscape had the traditional market view's independent characteristics, can be useless, or even be negative for both research and business, given a network-like business landscape. Thus, the main message has been that if the policy practitioners and the empirically based business researchers are right, i.e. if the business landscape is network- like, with interdependencies stretching across national borders,

then there is a need for a governmental innovation policy that takes both the light and dark sides of network forces into consideration. Below we will conclude this report with a discussion of what requirement of governmental innovation policy a network-like business landscape addresses.

A governmental policy that addresses both the light and dark sides of networks

The light sides of networks are that the benefits of innovations are efficiently spread among companies and organizations that directly or indirectly are involved in renewal work. A successful innovation journey, for example a large scale supply and use of an electric car, would not only be beneficial for a particular supplier and user, but for a number of related companies and organizations on the supplier and the user side (von Hippel, 2007, van de Ven et al, 1999, Håkansson et al, 2009).

However, along with the light side also comes the dark side of a network-like business landscape. The dark side has at least three facets that need to be considered by governmental policy commissioners.

A first dark side is that a network-like business landscape influences the direction of the innovation journey in an unequal way. Existing investments, including how they are related, are on one hand powerful in terms of giving the innovation journey a certain direction. However, on the other hand this means that the innovation journey is far from fair or neutral; it is path-dependent in that new cross-roads are influenced by existing material and immaterial investments. Thus, the innovation journey is economically conservative in that it protects the main part of existing investments (David, 1985, Håkansson & Waluszewski, 2002).

A second dark side is that a network-like business landscape not only spreads the benefits of innovations, but also drawbacks in an efficient but unequal way. This aspect is often forgotten, but becomes visible as soon as an end-product faces a crisis of any kind. When, for example, a successful innovation in terms of a new type of loan in the financial setting over time results in a crisis for some large financial actors, the disadvantages are effectively and unequally spread among both directly and indirectly related companies and organizations, across national borders. Thus, a network-like business landscape, where the resources of one company/organization are embedded into other companies/organizations, does not stabilize the effects of different kinds of drawbacks, but rather increases their effect. (Håkansson et al, 2009)

A third dark side is that a network-like business landscape is unequal in terms of who has influence over the innovation journey. Networks are non-transparent. Networks have no intrinsic fairness. Networks do not operate in a common interest and they do not provide the same opportunities to all those related to it, whether they are companies, organizations or individuals. Thus, networks can, as Hasselberg and Peterson (2006:358) underline, ‘exercise an indirect influence over decision making which is

almost invisible'. [54] This implies that a network-like business landscape is unequal in terms of who has influence over the innovation journey and, consequently, over how costs and benefits are shared. (Waluszewski, 2006, Hasselberg & Peterson, 2006)

The final conclusion of this report is straight forward: if the business landscape is network-like, there is certainly a need for governmental policy to intervene. If networks are not neutral, but direct the innovation journey in relation to existing investments, governmental innovation policy cannot rely on creating a transfer of certain kinds of knowledge to 'the market' and trust that this will result in the innovations needed for the identified economic, societal and environmental problems. Governmental innovation policy has to act as a counterforce against the non-transparent, non-democratic and economically conservative forces of a transnational network-like business landscape.

Besides acting as a counterforce against the dark sides of networks, there are also, as suggested in chapter five, a number of network opportunities that governmental innovation policy can help policy practitioners to support and utilize. However, if policy practitioners are going to be able to utilize network opportunities in developing, supplying and using networks, stretching across national borders, their governmental commissioners have to fulfil two main requirements: First, the policy involvement has to have *endurance.* The policy practitioners must be allowed to identify and engage in transnational network processes over time – and not only in a developing setting but also in a supplying and using setting. Second, the policy involvement must be allowed to be *spatially dispersed.* The policy practitioners must be allowed to identify and engage in transnational network processes over space; i.e. over national borders.

Thus, the policy practitioners must be supplied with a governmental commission which allows them to analyse and a) utilize the innovativeness of transnational network forces, and b) to counteract against the economic conservatism of transnational business networks. Both of these two requirements are challenging to a governmental innovation policy commission that is based on an over-developed trust in the ability to reach rapid and direct measurable effects within narrow geographical borders.

[54] Authors' translation

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VINNOVA develops Sweden's innovation capacity
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