

*Knowledge for Growth – Industrial Research & Innovation (IRI)*

# Internationalization of Research and Innovation – new policy developments

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**CORPORATE R&D: AN ENGINE FOR GROWTH,  
A CHALLENGE FOR EUROPEAN POLICY**

**Globalising Economies &  
Internationalization of Corporate R&D**

## Abstract

The forces of globalization and the enabling characteristics of internet communication have impacted the nature of research and innovation. Knowledge and innovation processes are both more dispersed and more openly accessible. In addition, we witness a shift in the global knowledge and innovation geography with both being increasingly generated and developed in regions outside Europe, North America and Japan. Countries, which in some respects are still regarded as being in the early stages of economic development, are increasingly driving global knowledge and innovation development.

To access and make use of globally-dispersed knowledge and connect with important innovation hubs in new markets, both public and private sector research activities are internationalising. Universities and other research institutions act to attract and retain the best talent in order to secure stable research financing. Companies act to find the most suitable innovation environments in which to locate to secure skilled personnel and supportive business conditions, as well as access to strategic customers and markets. And different levels of government act to simultaneously build strong, stable hubs that drive economic growth and ensure agile, entrepreneurial global networks that catalyze continuous renewal.

Policymakers, at regional, national and supranational level, are responding in different ways to the changing knowledge and innovation geography. From the perspective of innovation policy, the challenge is to enable domestic actors to connect to world-leading knowledge and innovation hubs in ways that benefit and strengthen regional and national innovation systems. Policymakers are often expected to encourage internationalization that allows firms and researchers to access world-class knowledge and strategic markets while at the same time ensuring that value creation resulting from international science and technology cooperation accrues to the domestic constituency.

This paper examines how countries respond to the above-defined challenges by designing strategies and policies aimed at enabling national innovation systems to benefit from the changing global knowledge and innovation geography. By analyzing two surveys and a number of national

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innovation and internationalization strategies, we are able to identify a number of new trends in policy strategies and types of instruments used to achieve objectives. The comparative analysis highlights an evolving and broadening scope for innovation policy, an increased need for strategic prioritisation of research and innovation investments and collaboration partner targets, and an increased demand for more complex internationalization support services necessitating a deeper engagement of public sector intermediaries. The analysis also highlights a number of policy challenges related to the internationalization of innovation.

**Key words:** innovation policy, internationalization, policy instruments

**JEL classification:** O38

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# 1 - Introduction

## *1.1 Innovation systems, economic growth and the role of policy*

According to innovation system theory, innovation and technology development are results of a complex set of relationships among actors in a system, which includes enterprises, universities and research institutes (Freeman, 1988, 1995; Lundvall, 1985, 1988). National innovation systems, broadly defined, are “the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge...and are either located within or rooted inside the borders of a nation state (Lundvall, 1992).”

Innovation and economic growth theories are linked by the common factor of knowledge and human capital. Knowledge is viewed as a key resource driving growth and differs from other factors of growth in that it does not have diminishing returns. Instead, exchanges of knowledge (or learning) have positive spillover effects (Marshall, 1890) and contribute to the evolutionary advancement of the economy (Schumpeter, 1934; Nelson and Winter, 1984). National innovation policies promote the transformation of knowledge into products and services.

Traditionally, policy instruments have focused on affecting innovation actors and processes within national borders. However, a number of factors are increasingly propelling policymakers to include international linkages in their policy focus. In the following section, we identify these factors.

## *1.2 The transformation of knowledge, production and innovation*

### **1.2.1 Changing knowledge transfer and innovation processes**

The methods of knowledge transfer and innovation are continuously changing. As generally known, there are two types of knowledge: codified (i.e. information that can be easily transferred) and tacit (i.e. skills or experiences that can generally be transferred only via people-to-people interaction). The increased proliferation of information and communication technologies (ICT) has increased the flow of codified knowledge, while increased mobility and international networking activities have increased the exchange of tacit knowledge. Both of these changes have had an impact on innovation processes. According to Archibugi and Iammarino (2002), technological change and globalization are mutually reinforcing phenomena, with technological change acting as a “lubricant” for globalization, and globalization, in turn (by “facilitating the circulation of people, goods, capital and, above all, ideas and knowledge”) accelerating the rate of technological change (p.100).

The low cost and global proliferation of ICT has enabled not only a broader spread of knowledge, but also more open and distributed innovation processes (including open source software, mass customization toolkits, co-creation platforms, etc.). The ‘democratization’ of knowledge enabled by the internet has made consumers more aware of ‘what’s out there’ and, more importantly, given them the means to communicate their demands and actually take part in development processes. These more sophisticated and demanding consumers – with masses of information and the ability to buy from companies all over the globe – no longer consider the price/quality trade-off as the sole driver of choice. Instead, consumers increasingly consider how a company and its products match their own personal values, behaviours and needs. This has catalyzed companies to include users in the innovation process – gaining insight on what to produce, and developing new innovations together with users. This pattern of involving users – and society more broadly – in innovation processes has been described by several business management authors (Chesbrough 2003, 2006; Prahalad 2004, 2008; and von Hippel 2005, among others).

In addition to the dramatic changes driven by ICT, increased international mobility and networking activities have also impacted the way companies innovate. AnnaLee Saxenian (2006) discusses how skilled “technology entrepreneurs” lever their experience and relationships to operate in several countries simultaneously – identifying market opportunities, locating partners and managing cross-border business. This type of international interaction – based on leveraging and promoting specific regional advantages – reduces the importance of national borders and instead increases the significance of “region-states” in the globally-interlinked economy Ohmae (1991, 1995, 2005). Audretsch (2003) and Scott and Storper (2003) argue that globalization, rather than reducing, actually further reinforces the importance of regional agglomeration tendencies for economic development. Increasingly, innovation processes are embedded in distinct local/regional environments, linked internationally. These local hubs are challenged to define their competitive niche and position on the global playing field, to attract and retain talent, to interact with relevant stakeholders locally and internationally to access new (tacit) knowledge, and become integrated in global innovation networks.

Today, we are witnessing the increasing internationalization of science, technology and innovation, manifested by rapidly growing numbers of international co-publications, cross-border co-patenting activities, mobility of human resources for science and technology, and off-shoring of corporate R&D activities (see, for example, OECD 2008 and Edler and Boekholt 2001). The latter refers to a

growing trend whereby firms are establishing R&D centers outside their home countries (see, for example, Karlsson, ed., 2006). Linked to this is the fact that internationalization of innovation means that the value chain is broken up and that research, innovation, production and value creation no longer necessarily occur in the same geographic location.

In their analysis, Archibugi and Iammarino (1999 and 2002, based on Archibugi and Michie 1995) provide a very useful taxonomy of the globalization of innovation (see Table 1) in which they identify three main categories as well as actors and respective forms of globalization of innovation. In addition to the actors identified in Table 1 (below) – firms, individuals, universities and public research centers – governments also promote or hamper globalization of innovation through various policies, initiatives and instruments, which is a point we will return to later.

**Table 1: Taxonomy of the globalization of innovation**

<b>Categories</b>	<b>Actors</b>	<b>Forms</b>
International exploitation of nationally-produced innovations	Profit-seeking firms and individuals	Exports of innovative goods Cession of licenses and patents Foreign production of innovative goods internally designed and developed
Global generation of innovations	Multinational firms	R&D and innovative activities both in the home and host countries Acquisitions of existing R&D laboratories and Greenfield R&D investments in home countries
Global techno-scientific collaborations	Universities and public research centers	Joint scientific projects Scientific projects, sabbatical years International flows of students
	National and multinational firms	Joint ventures for specific innovative projects Productive agreements with exchange of technical information and/or equipment

### **1.2.2 Changing knowledge and innovation geography**

As products and services are produced for global markets, it follows logically that the knowledge used to conceive, develop and produce these innovations is also sourced globally. Industrialized countries (North America, Europe and Japan) have for a long time dominated the global R&D landscape, accounting for the majority of global knowledge resources both in terms of R&D investments and human resources for science and technology.

This dominance is increasingly being challenged as growth and transition economies increase both their supply and demand for knowledge and innovation. China, Brazil and India are perhaps the most prominent examples of countries where domestic investments in R&D and the number of students, engineers and researchers are growing dramatically at the same time as large domestic markets are attracting R&D investments of foreign companies. In the most striking example, China's share of global R&D expenditure (in purchasing power parity terms) is projected to increase from 9.5% in 2007 to 12.5% in 2009, at the same time as the shares of the US, Japan and Europe are all projected to decrease (Battelle 2009). As a result, we are witnessing a shift in the center of gravity when it comes to knowledge and innovation resources, with transition and developing countries, such as China and India, rapidly increasing their knowledge resources (see, for example, OECD 2008 and Battelle 2009) and their importance as innovation drivers, both because of their growing technology strength and their large and growing markets. In particular, we see a growing number of European, Japanese and US companies setting up R&D activities in China and India (see, for example, Schwaag Serger 2009). China's rapidly increasing scientific might is reflected in the rising number of Chinese academic publications. Thus, Glaenzel *et al.* (2008) show China and other "emerging scientific nations" rapidly increasing their scientific production and thus "challenging the leading sciento-economic powers" (p.71).

### 1.2.3 Global challenges

Currently, the world is facing a number of global challenges, such as climate change, pollution and natural resource depletion, and potential pandemics. The term 'global' refers to the fact, firstly, that their reach is not limited to a single country or region and, secondly, that their solution requires countries and regions working together to address the problem. Globalization itself, defined as "increasing cross-border flows of information, knowledge, commodities and capital" (Archibugie *et al.* 1999), but also of people, reinforces the 'global' nature and reach of the challenges. As we will see later, several countries and regions are identifying the tackling of global challenges as an important driver of international science, technology and innovation cooperation.<sup>1</sup>

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<sup>1</sup> See also: The Lund Declaration and The Lund Declaration Addendum at [http://www.se2009.eu/en/meetings\\_news/2009/7/7/new\\_worlds\\_new\\_solutions\\_research\\_and\\_innovation\\_as\\_a\\_basis\\_for\\_developing\\_europe\\_in\\_a\\_global\\_context](http://www.se2009.eu/en/meetings_news/2009/7/7/new_worlds_new_solutions_research_and_innovation_as_a_basis_for_developing_europe_in_a_global_context)



All of the above changes – changing knowledge transfer and innovation processes, changing innovation geography, and global challenges – put new requirements on international cooperation in science, technology and innovation.

### ***1.3 Policy's role in the 'new knowledge and innovation geography'***

Overall, the reference to a 'new knowledge and innovation geography' can be defined as referring to four distinct aspects. Firstly, innovation processes are changing, with communications technologies, among other things, driving a more open and user-driven approach to innovation. Secondly, increased international mobility and networking activities have supported an increase in the internationalization of science, technology and innovation, leading to a more common practice of linking local innovation hubs within global knowledge networks. The third defining characteristic refers to the geographic shift in the center of gravity of knowledge and innovation resources, with transition and developing economies accounting for a rapidly growing share of both R&D investments and human resources for science and technology. Finally, growing internationalization combined with the global nature of some of the current challenges (such as climate change, environmental degradation, epidemics, etc.) require countries and regions to cooperate in science, technology and innovation in order to find solutions to global threats.

In this new global knowledge and innovation geography, the competitiveness and prosperity of countries and regions are increasingly dependent on their ability to harness the forces of globalization, science, technology and innovation to generate economic and social value. Countries and regions seek to optimize the use of global knowledge and innovation resources for their own benefit. According to Auerswald and Branscomb (2008), the challenge of globalization is that "...unless an economy enjoys success at every stage of the process – from invention, through innovation and economic disruption, to growth – it may lead the world in research but the final economic returns will flow to others" (p.339).

As companies increasingly set up research facilities outside their home countries (see, for example, Karlsson ed. 2006), and as a growing pool of highly skilled human capital ends up working in other countries than the ones they were educated in, it becomes increasingly difficult for national governments to ensure that returns on research and education investments will accrue at home. More specifically, scientific research may increasingly be conducted in (and financed by) one country but yield economic or commercial benefits in another country.

The break-up of the value chain and subsequent internationalization of innovation places new demands on policymaking. Governments (on regional, national and supranational levels) are challenged to design policies or enable conditions which ensure that their constituencies are attractive to knowledge and innovation resources – both firms and human capital – and that they secure a significant part of the value creation stemming from research and innovation.

Archibugi *et al.* (1999) emphasize the importance of countries' strengthening their technological competencies and absorptive capacities in order to be able to benefit from, rather than be negatively affected by, globalization. Edquist (2008) argues that:

*Globalization is not decreasing the need for innovation policy; on the contrary, it may be strengthening it. Firms are encountering rapidly changing and highly uncertain market and institutional conditions in the international context on top of the technological uncertainties associated with inventive and innovative activities. For that reason, public action needs to focus on the adaptability of the innovation system with the overall objective to generate a national or regional framework that is conducive to firms' adaptability and efficient exploitation of the opportunities offered by globalization... [P]ublic action shall focus on the different elements in the systems and their real bottlenecks vis-à-vis globalizing dynamics, and in particular, the deficient and/or missing aspects in the national institutional set-up that enhances the firms' capabilities to operate in this globalized context.*

One of the key contentions of this paper is that while it is relatively straightforward for governments to promote the internationalization of research and international research cooperation, particularly when it is based on academic excellence, it is far more difficult to identify instruments for promoting the internationalization of innovation, particularly if such activities are expected or required to improve competitiveness and lead to value creation at home or for the home constituency.

So far, the bulk of academic literature and policy discourse has focused on the internationalization of research – often neglecting to address innovation. A few articles examine the role and instruments of governments in promoting internationalization of innovation. Archibugi and Iammarino (1999) list a number of possible targets and policy instruments at the disposal of policymakers seeking to promote the globalization of innovation. Edler and Boekholt (2001) similarly examine the role of policy by comparing government policies or initiatives of a number of

selected countries. They identify three overall categories of policy instruments, namely instruments to increase attractiveness, to absorb knowledge created abroad, and to “open doors both ways”. They conclude that “despite the wealth of analyses of the rising importance of internationalization of science and research, governments have been slow to react. ...[O]nly a minority of countries has given internationalization in public science and industrial research policy priority, supported by the political will to invest money beyond short-term considerations of reciprocity” (p.320).

In a more recent paper, Boekholt *et al.* (2009) identify and analyze drivers of science, technology and innovation cooperation. They identify six principal drivers: improving national competitiveness, strengthening/expanding human resource base, achieving research excellence, creating good and stable diplomatic relationships (and indirectly ensuring international security), supporting less developed countries by developing STI capabilities, and tackling global societal challenges. It is interesting to note that the drivers and categories of policy instruments to support international STI cooperation described by Boekholt *et al.* have evolved over time – demonstrating a broadening scope for innovation policy (a point we discuss later).

A number of recent studies, national strategies, and ongoing activities (on national and European levels) show that internationalization of science, technology and innovation is receiving more attention from policymakers (see for example CREST 2008, TAFTIE 2010 and Boekholt and Edler 2009). Yet, as this paper will conclude, innovation policy actors are still struggling to define their role.

#### ***1.4 Objectives and structure of the paper***

Innovation policy has traditionally been coupled to the concept of national innovation systems; therefore, policy instruments have focused on impacting actors and processes within national borders. As innovation processes become more globally interdependent, innovation policy is gradually responding by introducing new instruments aimed at harnessing the forces of globalization to the benefit of national innovation systems and prosperity.

On a national level, bilateral research cooperation seems to be a relatively widespread policy response. Yet few countries have developed internationalization components to their national innovation strategies, and even fewer have implemented programs to act on their internationalization strategies (Edler and Boekholt 2001). On a European level, the Commission has

undertaken a number of new initiatives to strengthen and globally broaden the European Research Area. Yet, these initiatives tend to be strongly focused on research cooperation rather than innovation, and it is still unclear as to what the appropriate policy response at EU level should be.

This prompts a number of questions. How do the trends related to the ‘globalization of knowledge’ affect innovation strategies? What are the concrete drivers and alternative strategies? What are some of the policy responses and concrete instruments that are used in different contexts?

The objective of this paper is to provide some responses to these questions and address the gap in current research – which has given much focus to the internationalization of research, but less focus to the implications on innovation processes and policy. Building on the work by Archibugie and Iammarino (1999 and 2002) and Edler and Boekholt (2001), in this paper we examine recent policy developments regarding strategies and instruments for promoting the internationalization science, technology and innovation in a number of countries.

We use three data sources for our analysis. Firstly, we analyze the results of a survey carried out by the Swedish Governmental Agency for Innovation Systems (VINNOVA) in which Swedish research environments and clusters were asked about their internationalization activities and the potential need for government support in promoting internationalization. Secondly, we assess the results of a survey among member agencies carried out by the Association of European Innovation Agencies (TAFTIE) on internationalization efforts and strategies in the field of STI in their countries and agencies. Finally, we look more in depth at four selected countries, Canada, Sweden, China and Germany. By analysing empirical evidence from these national and multinational institutions, we are able to identify a number of new trends in policy strategies and types of instruments used to achieve objectives.

The paper is structured as follows. The next section examines recent trends in internationalization activities at cluster and innovation agency level. This section is based on two data sources: a survey carried out by the Swedish Governmental Agency for Innovation Systems (VINNOVA) which assessed the demands for policy initiatives with regard to the internationalization of innovation, and the findings from the TAFTIE survey carried out in the spring of 2009. Following this, four country case studies (Canada, China, Germany and Sweden) will be presented in section three. Section four will discuss and analyze the various policy strategies and instruments used, highlighting new trends

in innovation policy. The concluding section will present a number of challenges related to the internationalization of innovation policy, and propose future research areas.

## **2 - Internationalization of innovation: innovation agencies' responses**

### *2.1 The Swedish internationalization survey*

In 2008, the Swedish Governmental Agency for Innovation Systems (VINNOVA) asked Swedish research and innovation environments – defined as research groups, centers or clusters which combine academic with industrial and public sector actors – to respond to a survey about their internationalization activities and challenges. The survey was initiated in response to the growing importance of international linkages for firms' competitiveness and innovative capacity.

Furthermore, the initiative was driven by the realization that clusters or research and innovation environments can play a significant role, firstly, in attracting human capital and research investments to Sweden, and, secondly, in facilitating the internationalization efforts of innovative small and medium-sized enterprises (SMEs), which often lack the resources to engage in such activities on their own. Finally, while VINNOVA already has several programs which encourage international cooperation, these initiatives tend to focus on research cooperation and on promoting cooperation within Europe (particularly through the EU Framework Program for Research and Development). The aim of the survey was to identify potential needs, opportunities and geographic focus for policy action to support the internationalization efforts of research and innovation environments.<sup>2</sup>

More than 90 research and innovation environments completed the survey.<sup>3</sup> The respondents can be said to be a representative sample of the total population of research and innovation environments in Sweden, in terms of thematic orientation and location. The survey found that nearly all Swedish research and innovation environments have extensive international contacts and cooperation, particularly within Europe and with North America. However, a clear majority of respondents declared a strong ambition and need both to increase internationalization efforts and to adopt a more

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<sup>2</sup> More specifically, research and innovation environments were in this context defined as a consortium of actors (universities, institutes, companies, public sector organizations, etc.) which have a cooperation, structured interaction or common regarding research and innovation within a defined area.

<sup>3</sup> The results of the survey are summarized in VINNOVA (2008).

strategic approach to international cooperation and linkages. A large number of respondents indicated that while linkages and cooperation within Europe and with North America were relatively well developed, they had a strong interest in increasing their linkages with regions outside Europe and North America, and particularly with Asia.

Research and innovation environments listed three primary drivers of internationalization efforts: The first driver is to source knowledge and gain access to complementary technologies, data and equipment. The second driver is to establish education cooperation, in particular ‘joint degrees’ between education institutions. The third driver is to get information about and link up with growth markets. A final observation is that internationalization efforts are often viewed and treated as an ‘add-on’ activity, rather than being an integral part of research and innovation environments vision and action plans. As a result, research and innovation environments often list lack of resources, both in terms of money and time, as an obstacle to strengthening their internationalization activities.

A number of environments or centers that responded to the survey receive research and other funding from VINNOVA. Two evaluations of VINNOVA’s cluster programs found that they should have a stronger focus on promoting international linkages and international benchmarking (VINNOVA 2007a and 2007b). The survey results show that research and innovation environments frequently still view internationalization as an ‘extracurricular’ activity, and the above evaluations raise the question of whether national cluster programs carry a risk of strengthening regional networks at the expense of international linkages and orientation.

Based on the survey, VINNOVA identified the following areas where research and innovation environments expressed a need for improvement and possible support actions in their internationalization efforts:

- Developing tools for systematic international benchmarking of Swedish research and innovation environments’ attractiveness and competitiveness.
- Developing strategies and action plans for global positioning, ‘branding’ and the establishment of international linkages with actors with complementary competencies.
- Strengthening the ability of Swedish actors (research funding bodies, research performers, companies, clusters, regions, etc.) to develop strategic alliances.
- Strengthening linkages with actors and regions outside Europe and North America.

- Designing specific policies or activities for promoting internationalization in terms of financing, skills development, intellectual property management and strategies, export and investment promotion, etc.
- ‘Branding’ and promoting Swedish universities and institutes as research performers in the global market.
- Designing activities for promoting the export and international linkages of new, knowledge-intensive firms.
- Strengthening and further integrating the international perspective in the design of national R&D programs.

Overall, the picture that emerges from the VINNOVA survey is that of, on the one hand, a strong perceived need identified by research and innovation environments to strengthen international linkages, particularly with countries outside Europe and North America, and, on the other hand, a lack of clear strategies or goals for internationalization activities. Furthermore, internationalization activities appear to be viewed as activities which, rather than being an integral component of research and innovation environments’ visions and action plans, are viewed as ‘add-on activities’ which require additional efforts and resources. Finally, the survey raises the question whether national cluster policies or programs run the risk of strengthening regional cooperation and linkages at the expense of international linkages and orientation.

## ***2.2 The TAFTIE survey***

In 2009, TAFTIE created a Task Force on Internationalization. In this context, a survey was conducted on the internationalization activities and strategies of the TAFTIE member countries and agencies. Eleven innovation agencies from different European countries participated in the survey.<sup>4</sup>

At the national level, only two of the countries surveyed, Finland and Ireland, had an overall international science, technology and/or innovation strategy. Germany which also has such a strategy did not participate in the survey. This finding is confirmed by Boekholt *et al.* 2009 who showed that a comprehensive government-wide strategy for international STI collaboration is an exception.

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<sup>4</sup> The survey results are summarized in TAFTIE (2010), *Internationalization of National Innovation Agencies*.

At the agency level, about half of the agencies surveyed already had or were in the process of establishing a strategy for international cooperation, although the focus is sometimes broader than international cooperation. Some agencies considered the international dimension to be strategically integrated in their overall activities. Few of the agencies had a dedicated budget for international activities outside Europe. About half of the agencies had a presence through offices abroad.

The main drivers for international activities outside Europe were access to world-class research and innovation environments, a government mandate and bilateral agreements, as well as market access and commercialisation. Attracting inward investment was an important driver for four of the respondents. Development aid seems not to be a driver in itself, but is considered of interest in the context of the overall strategies. For some agencies, international activities as a whole were mainly linked to existing programs. Several agencies had strong focus on promoting the internationalization of technology-intensive firms in their activities outside Europe.

The above-mentioned drivers correspond fairly closely to those listed in a survey carried out among EU Member States and Associated Countries in 2007 on the policy objectives for promoting the internationalization of R&D (CREST 2008). In that survey, countries listed access to knowledge and new markets as important objectives for internationalization of R&D. In addition, however, countries listed the desire to jointly solve global challenges as an important third objective of internationalization of R&D. In the TAFTIE survey, cooperation on tackling global challenges was not identified as a prominent driver of internationalization activities. This difference in drivers could maybe be explained by the fact that in the CREST survey, the respondents were primarily Ministries of Education, whereas in the TAFTIE survey the respondents were innovation agencies, the latter of which have a primary mandate to strengthen competitiveness of the national innovation system.

The bulk of international cooperation occurred within Europe. Few agencies appear to have bilateral programs with countries outside Europe. Again, this is confirmed by Boekholt *et al.* 2009 who find that countries within the EU are still very much focused on ‘mainstream’ EU collaboration, such as the EU Framework program, multilateral research infrastructures such as e.g. CERN, EMBL<sup>5</sup>, and various bilateral agreements within the European Union. At the same time, many agencies expressed the ambition to scale up bilateral cooperation with countries outside Europe.

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<sup>5</sup> The European Organization for Nuclear Research (CERN) and The European Molecular Biology Laboratory (EMBL)



Among the existing programs for cooperation with countries or regions outside Europe, agencies worked both with jointly-funded and unilaterally-funded initiatives and programs. The following models emerged as the ones that seem most widely-practiced today:

1. Bilateral research programs with joint calls for proposals and joint or unilateral funding in selected thematic areas (examples include VINNOVA's ICT program with the Chinese Ministry of Science and Technology or its 'Multidisciplinary Bio' Program with Japan's Science and Technology Agency)
2. Funding companies' research projects with partners outside Europe (In this case, funding is not coordinated between countries as in the above model; rather, countries decide unilaterally to fund companies' or researchers' cooperation with partners from other countries)
3. Funding networking activities (seminars, trade fairs, matchmaking events, etc.)
4. Funding different types of centers (e.g. research centers, innovation centers or business centers, with uni- or bilateral location and activities)

In terms of focus of the internationalization activities of responding agencies outside Europe, there is large diversity in agencies' activities. Most agencies are involved in several types of activities, the most common of them being research and/or innovation cooperation, the promotion of internationalization of SMEs, and commercialisation activities. Some are involved in promoting foreign direct investment and human capital mobility.

The survey responses revealed similarities in the geographical interest for international cooperation among European innovation agencies. The countries most frequently mentioned concerning current cooperation or interests in future cooperation were China, India, Japan, Brazil, North America, Russia and South Africa. In a survey carried out among EU Member States in 2007, China was most frequently mentioned prioritized country for science and technology cooperation (CREST 2007).

The current internationalization activities of innovation agencies include both so-called 'top-down' and 'bottom-up' initiatives. Top-down initiatives are, for example, bilateral research programs in which two countries agree upon a thematic area for cooperation and then issue a joint call. These initiatives often originate in bilateral agreements between two countries for economic, scientific or political cooperation. Bottom-up initiatives generally have some form of 'open calls' where firms, universities and institutes or clusters can apply for funding or other support for internationalization

activities. The UK's Technology Strategy Board, the Netherlands SenterNovem<sup>6</sup> or Finland's TEKES are examples of agencies that apply this principle. The UK Technology Strategy Board recently established an 'International Fund' which allows UK clusters to apply for financial support for a range of international activities. In general, the latter approach can be described as a principle whereby the agency 'follows its customer' i.e. firms, clusters or other actors decide on the type of activity, the sectoral or industrial orientation and/or the geographic focus of the internationalization activity for which they seek financial support. The combination of 'top-down' and 'bottom-up' approaches can partially be explained by differences in the countries with which cooperation or linkages are sought. In many Asian countries, official bilateral agreements and programs are the main channel for cooperation.

As innovations are increasingly both generated and exploited globally and as the new users and producers of innovation are increasingly found outside the traditional research and innovation powerhouses of Europe, North America and Japan, European innovation agencies are challenged, firstly, to integrate the international perspective into their, often very nationally-oriented, programs, and, secondly, to identify their role in the new global innovation landscape. Their mandate (to strengthen innovation), their status (as government agencies), and their competencies (an in-depth knowledge of national and regional innovation and commercialization processes and actors) provide them with an important platform for promoting internationalization for the purpose of strengthening national innovation systems and competitiveness. At the same time, agencies are still searching for effective ways to support internationalization in ways that benefit national competitiveness.

The results of both the VINNOVA and the TAFTIE surveys show that there are considerable differences in the drivers and focus of activities and strategies for internationalization. In the case of the innovation agencies, this is in part a reflection of the diversity of missions of the different member agencies of TAFTIE. Partly, however, this is also a reflection of the challenge for innovation agencies to find ways to add value to the already ongoing internationalization processes and activities.

Overall, internationalization efforts are growing, and there seems to be some similarity in terms of the geographic orientation and interest for international cooperation outside Europe. The latter raises the question of possible coordination or cooperation among European innovation agencies in

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<sup>6</sup> now called NL Agency

activities towards, for example, China, which many agencies identified as a prioritized country for future initiatives. The TAFTIE report explores possibilities for such joint activities (TAFTIE 2010).

## 3 - Presentation of Country Cases

### 3.1 Introduction to Country Cases

As explained in the previous section, different drivers have led to the increasing internationalization of innovation policies. This is a relatively new phenomenon – evidenced by the low number of countries who have developed specific internationalization strategies. As such, there are few publications that provide insights on the type of policy instruments that are used in this context. To address this gap, this paper presents case examples from four countries who are working with various policy instruments to internationalise their innovation processes. The countries were chosen based on two factors:

1. level of openness and international orientation relative to the two largest economies of the world (the U.S. and Japan); and
2. the different national contexts driving their internationalization activities

#### 3.1.1 Openness and international orientation

A number of measures can be used to indicate levels of openness and internationalization. Niosi and Bellon (1994) use a range of indicators to illustrate the “systemic openness and the globalization of science and technology”: R&D by multinational firms, international technical alliances, international technology transfer, international trade, international flows of S&T personnel, and joint international science projects. This article uses primary data on co-publications and secondary data on corporate R&D and co-patenting. Comparative statistics on trade and FDI (in Annex I) supports the analysis. The four case countries chosen exhibited “internationalization levels” that were either higher than the U.S and Japan, or growing at a faster rate.<sup>7</sup>

**International co-publication** data provides an indication of international research cooperation, which is a logical precursor to international commercial cooperation. In addition, it has been shown

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<sup>7</sup> However, this does not imply that the four countries chosen have higher internationalization levels than any other country in the world.

that articles which have been internationally co-authored have higher citation rates<sup>8</sup> – which are generally viewed as a measure of an article’s importance and impact.<sup>9</sup> Table 2 below shows that Canada, Germany and Sweden have around double the rate of international co-publications (in percentage terms) compared to Japan and the USA in both 2000 and 2007. China also has a higher rate of international co-publications compared to Japan and the USA in 2000, but not in 2007. This measurement provides an indication of the high level of openness and international knowledge production that exists in the four case countries.

**Table 2: International Co-Publications**

<i>Country</i>	<i>Year of Publication</i>	<i>%</i>	<i>Top 5 partners (by order of # co-published articles)</i>
Japan	2000	18.7	USA, Germany, China, England, France
U.S.	2000	18.7	Germany, Canada, England, Japan, France
Canada	2000	37.4	USA, England, France, Germany, Japan
China	2000	24.8	USA, Japan, Germany, England, Taiwan
Germany	2000	38.0	USA, England, France, Switzerland, Russia
Sweden	2000	45.3	USA, Germany, England, France, Finland
Japan	2007	24.5	USA, China, Germany, England, S. Korea
U.S.	2007	30.1	Canada, England, Germany, China, France
Canada	2007	45.3	USA, England, Germany, France, China
China	2007	24.3	USA, Japan, England, Germany, Canada
Germany	2007	50.6	USA, England, France, Switzerland, Italy
Sweden	2007	53.4	USA, Germany, England, Denmark, France

*Source:* ISI Web of Knowledge, author’s calculations, OECD 2009 (for 2007 only)

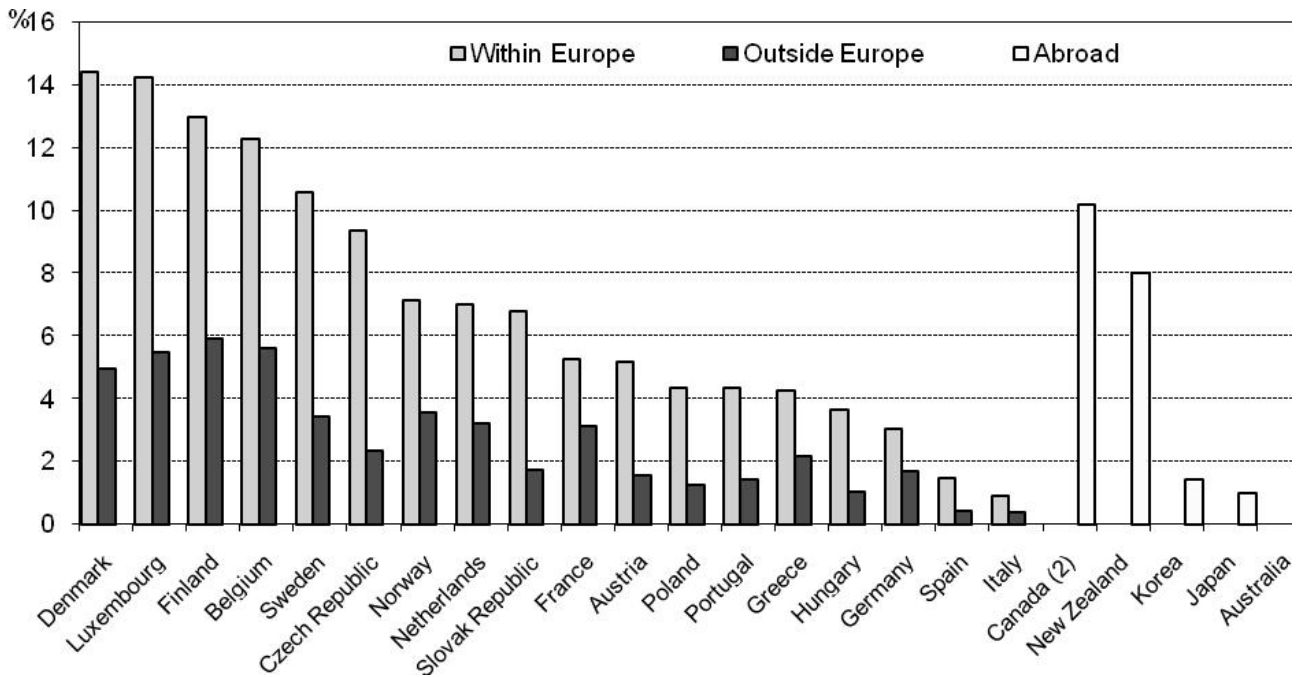
**Rates of corporate R&D funding abroad also provide an indication of international research cooperation within the commercial sector.**

Figure 1 below illustrates the high rate of corporate R&D funding from abroad in the four case countries, relative to Japan (U.S. not included). Sweden and Canada are characterized by relatively high rates of enterprise R&D funding coming from abroad. According to an OECD report, foreign firms’ R&D investments in China accounted for around 25-30% of total business R&D in China in 2007 (OECD 2007.) Germany has a relatively low share of R&D from abroad (see Figure 1).

<sup>8</sup> In presentation made by Prof. Dr. Frieder Meyer-Krahmer on November 5<sup>th</sup>, 2009 at 5<sup>th</sup> annual forum of Pôles de Compétitivité in Sophia Antipolis, France

<sup>9</sup> See also Inzelt, A., Schubert, A., and Schubert, M., 2009. “Incremental citation impact due to international co-authorship in Hungarian higher education institutions” in *Scientometrics*, Vol.78, No.1, pp.37-43.

**Figure 1: Funds for R&D from abroad**  
(as a percentage of business enterprise R&D, 2005)



Source: OECD 2008b

The internationalization of corporate R&D has displayed an increasing trend for quite some time. A report by Booz Allen Hamilton and INSEAD (2006) highlights that “the rate of R&D internationalization has increased, and looks set to continue to grow significantly”. One illustration of this is the growing share of foreign R&D sites – from 45 percent to 66 percent of all R&D sites – over the last three decades. From a national policy perspective, this may seem like a frightening trend, indicating the loss of jobs, intellectual property, and global positioning. However, studies have shown that innovation spending appears to flow in both directions simultaneously.

“Companies that invest wisely in a multinational innovation footprint are gaining better returns on their R&D investments than companies that keep their laboratories exclusively at home” (Battelle 2009).

A further indication of the increase of internationalization of innovation is rates of **international co-patenting**. The average share of patent applications filed under the Patent Cooperation Treaty (PCT) that involved co-invention increased from 6.6% in 1996-98 to 7.3% in 2004-6. (It should be noted, however, that different inventors may be employees of one MNE with affiliates in different countries.) On average, small and less developed economies engage more actively in international cooperation. Figure 2 below indicates that the four case countries have higher rates of international co-patenting than the U.S. and Japan. Again, Canada stands out, with co-patenting rates around

## Internationalization of Research and Innovation – new policy developments

30%. Whereas Canada, Sweden and Germany have all increased their levels of international co-patenting over the last eight years, China has experienced a contraction (of approximately 30%) in international co-invention.

**Figure 2: PCT patent applications with co-inventors located abroad (2004-06)**



Source: OECD 2009

In general, all three indicators highlight the high level of openness and international orientation of the four case countries relative to Japan and the U.S.

### 3.1.2 Different national contexts

In addition to selecting countries with a high degree of openness and international orientation, it was important to choose countries from different areas of the world, with different types and sizes of economies – which in turn have an impact on the key drivers of internationalization (see Table 3 below).

**Table 3: National context and drivers of internationalization of innovation**

<i>Country</i>	<i>Type/Location of Economy</i>	<i>Size of Economy (IMF world rank '08)</i>	<i>Key Drivers of Internationalization<sup>10</sup></i>
<b>Canada</b>	Developed/N. America	Medium (11)	<ul style="list-style-type: none"> <li>• Improving competitiveness of industries/firms</li> <li>• Competition for scarce human resources</li> <li>• Achieving global research excellence</li> </ul>
<b>China</b>	Transition/Asia	Large (3)	<ul style="list-style-type: none"> <li>• S&amp;T capacity building</li> <li>• Improving competitiveness of industries/firms</li> </ul>
<b>Germany</b>	Developed/Europe	Large (4)	<ul style="list-style-type: none"> <li>• Achieving global research excellence</li> <li>• Improving competitiveness of industries/firms</li> <li>• Tackling societal issues (including support to developing countries)</li> </ul>
<b>Sweden</b>	Developed/Europe	Small (22)	<ul style="list-style-type: none"> <li>• Improving competitiveness of industries/firms</li> <li>• Competition for scarce human resources</li> <li>• Achieving global research excellence</li> </ul>

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*Source:* Size and world rank of national economies measured by GDP in 2008, according to International Monetary Fund (IMF) and authors' calculations (where large: >5% of world economy; medium: 1-4.9% of world economy; and small: <1% of world economy).

Different national contexts have an effect on the strategies and choices of policy instruments to support internationalization. The various national strategies are presented and discussed in the next sections of this article.

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<sup>10</sup> Driver categories are based on Boekholt *et al.* 2009.

## 3.2 National Cases

### 3.2.1 Canada

The federal government's 2006 economic plan, *Advantage Canada*, highlighted the need to leverage existing strengths and do more to turn ideas into innovations that provided solutions to environmental, health and other social challenges, and improve economic competitiveness. The 2007 science and technology (S&T) strategy *Mobilizing Science and Technology to Canada's Advantage* outlined the agenda to achieve those broad goals. The strategy highlighted the need for a new approach to S&T management – ensuring that Canada is connected to the global supply of ideas, talent, and technologies. In June 2008, the global commerce strategy *Seizing Global Advantage* followed up on the Government's plans to boost Canadian access to and engagement in global markets, investment, and innovation networks. The global commerce strategy allocated \$50 million (Canadian) a year towards three over-arching policy objectives:

- Expanding Canadian access to global markets and networks
- Boosting Canada's share of global investment and innovation
- Strengthening Canada's international commercial network

The strategy highlighted 13 priority markets around the world where Canadian opportunities and interests have the greatest potential for growth, as well as four priority areas for enhanced investment and activity.<sup>11</sup> Specific actions and instruments were proposed to address the three policy objectives.

To expand access to global markets and networks, the government stressed its continued work with multilateral trade agreements (e.g. WTO and NAFTA), as well as bilateral innovation and S&T cooperation arrangements. To boost Canada's share of global investment and innovation, the government is to promote Canada's strengths as a partner and destination, and build the Canada "brand" in key markets and priority sectors. Specific initiatives include:

- *The Investment Champions Program* – where Canadian business leaders are recruited to reach out to prospective investors internationally
- *Investor Aftercare Services* – introduced to help foreign investors in Canada connect to suppliers, professionals, labour, knowledge and innovation networks they need

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<sup>11</sup> The four priority areas are: environmental science and technologies; natural resources and energy; health and related life sciences and technologies; and information and communications technologies.



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- A number of new *Global Value Chain Initiatives* – helping Canadian companies identify, explore and tap into global value chain opportunities, particularly those driven by U.S.-based multinationals or overseas-based multinationals with operations in the U.S.
- *Going Global Innovation* – the innovation component of the Global Commerce Support Program which is designed to promote and enhance Canada’s international innovation efforts by supporting Canadian companies and/or researchers in pursuing international R&D collaborative opportunities through the development of partnerships with key players in other countries/economies
- *Vanier Scholarships and Global Excellence Chairs* – to attract foreign students to Canadian post-secondary institutions

To strengthen Canada’s international commercial network, the federal government is expanding the network of Trade Commissioners worldwide (opening offices in new markets), and increasing the skills and level of support offered by trade commissioners. Support services are offered to Canadian companies to help with: accessing global value chain opportunities, establishing operations abroad, connecting with global innovation networks, finding potential joint venture partners, licensing technologies, and attracting talent and capital.

The activities of the global commerce strategy are just one part of the broader Canadian S&T strategy. The S&T strategy has encompassed other investments and activities aimed at fostering Canadian competitiveness including: improving investment incentives and the business environment, branding Canadian universities as world-class research and training grounds, and creating a more competitive immigration system.

### 3.2.2 China

China's economy during the past 30 years has changed from a centrally planned system that was largely closed to international trade, to a more market-oriented economy that has a rapidly growing private sector and is a major player in the global economy. China has achieved rapid growth in GDP, R&D expenditures and highly-skilled human resources. It is also frequently ranked as one of the most attractive locations for foreign corporate R&D activities due to a combination of market size, proximity to production and availability of attractive human capital. Yet China faces a number of challenges to its economic transformation. These include a perceived over-dependence on foreign technology and a lack of a critical mass of internationally competitive knowledge-intensive

firms, in addition to pressing environmental problems and a daunting demographic situation. This makes the goal of developing stronger domestic STI capabilities all the more urgent.

In February 2006, the Chinese State Council presented its 15-year, or long-term, Science and Technology Plan, which highlighted the importance that China places on the role of STI in its future economic growth (Schwaag Serger and Breidne 2007). One of the overall goals of the long-term plan is to make China a world innovation country. Some specific goals are set in the plan, namely, to increase R&D expenditure of GDP to 2.5% by 2020. Other goals include: strengthening China's domestic innovative capacity (and reducing its dependence on foreign technology), and strengthening incentives for companies to innovate.

International cooperation in science and technology is viewed as one of the most important tools for acquiring know-how and technology and thus for China to boost the country's S&T capabilities in leapfrog fashion by capitalizing on technology developed elsewhere. This is accomplished by implementing different types of instruments in three main policy areas:

- Attracting foreign direct investment and particularly knowledge-intensive investments
  - o Incentives to induce foreign companies to locate R&D activities in China (tax rebates and other financial incentives)
  - o Incentives to foreign technology-intensive activities (exemption from custom duties, etc.)
- Attracting human capital
  - o Encouraging students to study abroad
  - o Attracting overseas Chinese to return and highly-skilled foreign talent to immigrate (e.g. scholarships or grants for overseas Chinese, low-interest loans and high salaries, etc.)
  - o Establishing overseas high-tech parks (in Singapore, Maryland, USA, Cambridge and Manchester, UK and Moscow, Russia) to make most of overseas talent
- Encouraging domestic firms to seek knowledge abroad
  - o Grant foreign exchange and financing support for businesses to establish R&D institutes in foreign countries
  - o Provide firms with foreign investment facilities and top-notch service

### 3.2.3 Germany

The federal government's first overarching national innovation strategy – the *High Tech Strategy* (launched in August 2006) – outlined three central objectives: set new priorities and create lead markets; build bridges between industry and science; and improve the framework for innovation in industry. To achieve these objectives, actions in five cross-cutting fields were undertaken:

- pooling the resources of industry and research
- improving conditions for high-tech start-ups and innovative SMEs
- supporting the rapid dissemination of new technologies
- strengthening Germany's international position
- investing in talent

Activities to strengthen Germany's international position were driven by the desire to make use of the international division of labour (positioning German areas of strength, and drawing on the strengths of others to foster innovative advances in high-tech fields) and the ambition of taking on a leading role in solving grand challenges. The High Tech Strategy highlighted number of overarching objectives and priority areas for enhanced international cooperation: laser and optical technologies, nanotechnology/new materials, IT and biotechnology.

In February 2008, the *Strategy for the Internationalization of Science and Research* was launched. This strategy elaborated on the High Tech Strategy's cross-cutting theme of internationalization, and presented four main goals:

1. strengthening research cooperation with global leaders – helping German researchers to develop closer cooperation with internationally leading research groups, and to become the first choice for the best students and researchers from all over the world
2. exploiting international innovation potentials – helping German companies to secure a good place in the world's leading and newly emerging high-tech markets and win the world's most creative R&D centers as partners, which in turn increases Germany's attractiveness as an environment for innovation
3. intensifying cooperation with developing countries in education, research and development on a long-term basis – constituting an important contribution towards the economic, social and cultural development of countries and forming part of international efforts to reduce poverty and solve other global problems

4. assuming international responsibility and mastering global challenges – using Germany’s research and innovation potential to contribute to the solution of global challenges in the areas of climate, resources, health, security and migration, which addresses science policy, foreign policy and development objectives at the same time.

In the recent “Results and Outlook” report on the High-Tech Strategy, several specific actions and instruments used to address internationalization objectives were highlighted. To strengthen research cooperation with global leaders, research endowments are used to attract top-class scientists to Germany, and funding is provided to encourage the mobility of German scientists abroad. In addition, international advertising campaigns help to promote Germany as a location for studies, science and innovation.

The establishment of German Houses of Science and Innovation (in Russia, India, Japan and Brazil) is helping companies enter new markets and establish new partnerships, strengthening Germany’s presence abroad. International cooperation is also supported through new approaches in the federal government’s funding programs. Support is also provided for the worldwide networking of innovative companies.

Germany is active in multilateral settings to set up international research agendas (covering e.g. climate change, securing energy supplies, and fighting poverty and infectious diseases). Germany also plays a leading role in European research policy – taking part in Knowledge and Innovation Communities (KICs) within the European Institute of Innovation and Technology, receiving a high share of European research funding (in the framework programs), and participating in joint technology initiatives, Eurostars and other European-level research and innovation programs.

The Initiative for Foreign Science Policy (through the Federal Foreign Office) provides additional support for a number of research and innovation-related activities with other countries, including: the establishment of centers of excellence abroad, joint research and teaching, and the expansion of the network of science representatives at German embassies. This is motivated by the view that international science and research ties support the achievement of foreign policy aims.

### **3.2.4 Sweden**

Sweden is often listed among the top of the list of most competitive and innovative countries in the world (see World Economic Foundation’s Global Competitiveness Report, OECD STI Scoreboard

and European Innovation Scoreboard). Given its size, Sweden has always been dependent on the global market, and is therefore very open to and engaged in international research and commercial cooperation (see section 3.1). Sweden has established a “global brand” for innovation, based on its highly-skilled human capital, investments in R&D, and research outputs (e.g. publications and patents). At the same time, Sweden struggles with reaping economic and employment creation benefits of education and research investments.

In 2008, the Swedish government published a paper on “Main features of an international strategy on Swedish research policy” (Kirsebom, 2008). This paper also incorporated part of innovation policy related to research. The paper stressed that international cooperation is necessary to ensure and raise the quality of research, and that Sweden must have access to knowledge taking place globally. It was proposed that the Government should develop an international strategy, which would stimulate and facilitate the participation of Swedish academic and industrial research in international cooperation, through three pillars: eliminating legal and administrative barriers; rewarding successful participation and adjusting financial resources to support the development of the international dimension of Swedish research; and investing in improvements to Sweden’s access to global knowledge production. The paper also stressed that a prioritisation of knowledge areas, and of targeted cooperation countries, should be made.

Soon after, VINNOVA (the Swedish agency for innovation systems) published its international strategy. VINNOVA saw an opportunity for leveraging its knowledge base and both attracting and linking up with top innovation environments globally in order to strengthen its international competitiveness. The strategy highlighted certain countries that were of priority interest, and outlined four overall objectives and instruments for achieving stronger international research and innovation cooperation. These are presented below:

- Strengthen Swedish research and innovation capacity through international cooperation
  - o Strengthen Swedish participation in EU’s programs for research and innovation
  - o Increase and broaden support for bilateral cooperation with countries that have strong research within areas of strategic importance for Sweden
- Promote Swedish actors’ competitive position through international linkages and presence in international markets
  - o Increase the analysis of and presence in countries outside of Europe in order to increase knowledge and build contacts with organisations and agencies

- Formulate specific initiatives to promote the capacity and opportunities for SMEs to participate in international cooperation
- Influence the international research agenda
  - Actively participate in formulation of EU research and innovation programs
  - Ensure visibility and active engagement in international benchmarking activities and policy learning fora
- Promote Sweden as one of the world’s leading knowledge and innovation environments
  - Promote Sweden’s strategic participation in European and other international research and innovation programs
  - Speed up the internationalization of the Swedish innovation system through increased investments in bilateral cooperation and exchanges
  - Increase awareness about Sweden as an attractive knowledge and innovation environment

### ***3.3 Internationalization of science, technology and innovation at EU level – recent initiatives***

Within the European Union, international collaboration in research and innovation involving countries outside the European Union is gaining increasing prominence. International cooperation with “third countries” appears on the European agenda for achieving policy goals in a number of areas, such as competitiveness, cohesion and sustainability. Catalyzed by the 2007 Green Paper “European Research Area: New Perspectives” which outlined six targeted features of the ERA, the European Commission has been promoting international collaboration with third countries.

In 2008, the Commission published ‘A Strategic European Framework for International Science and Technology Cooperation’. The Communication presents a strategic European framework for international cooperation in science and technology. It also covers the specific aspects of international cooperation that relate to information and communication technologies (ICT). It outlines a number of actions under the framework that are aimed at raising the S&T profile of Europe worldwide, and putting the European Research Area (ERA) on the global map. Recommended actions include: integrating Europe’s neighbours and other strategic “third country” partners into the ERA, tackling scientific challenges through global research infrastructures, strengthening mobility of researchers and global networking, and increased efforts at opening national research programs to third countries.

The Council Conclusions from December 2008 called for a European partnership for international S&T cooperation. Thus, a ‘Strategic Forum for International S&T Cooperation’ (SFIC) was created as a dedicated configuration of CREST<sup>12</sup> – with the aim of facilitating the further development, facilitation and monitoring of the international dimension of the ERA. This forum is chaired by a Member State (the first chairman was from Germany). Furthermore, the Commission also set up a European Business and Technology Center in New Delhi and an EU SME Center in Beijing.

Conclusions from the recent ERA conference “Working together to strengthen research in Europe” highlight that S&T policies and strategies at national and European level are entering a new phase where international cooperation will play a key role. To improve the efficiency and generate a higher impact for European research, there is a need to improve the engagement of S&T stakeholders, and act in a coordinated manner. It was recommended that national policymakers and funding agencies take the international dimension into account in their programs, and allocate resources for international S&T cooperation.<sup>13</sup>

In addition, within DG Enterprise and Industry, there are focused efforts to strengthen innovation networks between clusters and other innovation environments through, for example, INNO Nets and Cluster Innovation Platforms. Other DGs and European institutions host comparable initiatives to link innovation environments internationally (e.g. Regions of Knowledge initiative within DG Research, InterReg initiatives of DG Regio, and the Knowledge and Innovation Communities within the European Institute of Innovation and Technology). It should be noted, however, that these initiatives are – to date – primarily focused on transnational collaboration within Europe.

Summing up, efforts at EU level to promote internationalization of science, technology and innovation – that is, efforts at promoting linkages with countries outside the European Union – are still dominated by initiatives aimed at promoting research cooperation (e.g. increasing international S&T agreements, researcher mobility and joint research infrastructures). The single most important instrument, in terms of funding and visibility is clearly the European Framework Program for Research and Technological Development. Although there are efforts to strengthen collaboration between both research and innovation stakeholders on the European level, internationalization

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<sup>12</sup> European Union Scientific and Technical Research Committee

<sup>13</sup> see [http://ec.europa.eu/research/conferences/2009/era2009/documentation/conclusions/1\\_7\\_international\\_cooperation.pdf](http://ec.europa.eu/research/conferences/2009/era2009/documentation/conclusions/1_7_international_cooperation.pdf)

strategies and activities are still mainly targeted on research. However, there appears to be increasing attention on the internationalization of innovation as well.

## 4 - Analysis of Strategies and Policy Instruments

An overview of the four case countries' strategic objectives, key policy drivers and instruments for internationalization of innovation (see Annex II) highlights a number of distinct characteristics for each country. Combined with summary results from VINNOVA's and TAFTIE surveys (presented in Section 2), the overview also highlights a number of new policy developments.

### 4.1 Comparative Analysis of Country Cases

Canada's efforts focus on being an *attractive international business partner*. One of Canada's main challenges is leveraging its national strengths to broaden its international sphere of activity and strengthen its share of global investment and innovation. Strategic objectives are focused on building stronger international networks and better access to international markets. Policy instruments are used to build brand awareness, attract people and capital to Canada, and provide support to Canadian companies to network and develop commercial relations abroad. This portfolio of activities may not be much of a surprise given that the strategic objectives and instruments are part of Canada's global commerce strategy. One should be reminded, however, that this strategy was prompted by the science and technology strategy – which highlighted the need to ensure that Canada was connected to the global supply of ideas, talent and technologies.

China distinguishes itself as a *knowledge sourcer*. One of China's main challenges is strengthening its innovation capacity while continuing to maintain steady economic growth rates. Strategic objectives are focused on attracting (tacit) knowledge to China, and on facilitating Chinese firms to gather knowledge and experience internationally. Policy instruments are used to provide incentives to investment, attract foreign skilled workers, facilitate mobility (of students and researchers), and provide support services needed by businesses wishing to establish R&D facilities overseas. This portfolio of activities illustrates the many methods used to be a “sponge of global knowledge”. The overall goals and approach are anchored at high levels of government and are being pursued in a strategic manner.

Germany can be characterised as a *responsible research and innovation leader*. Whereas Germany has a large economy, strong competitive position and innovation performance, future growth



depends on its ability to position itself within new and dynamic markets and research environments. Germany's strategic objectives are focused on strengthening research cooperation with global leaders, intensifying cooperation with developing countries and taking on an active role in solving global challenges. Policy instruments are used to fund mobility of German scientists and attract top scientists from abroad, support international networking of innovative companies, establish a strong presence in new markets, promote Germany as an attractive location for innovation, and actively participate in the design of international research agendas. This portfolio illustrates an ambition to become a research leader (particularly in Europe), and take on high levels of responsibility in addressing societal issues.

Sweden positions itself as a *strong science collaborator*. Like Germany, Sweden also has a strong competitive position and innovation performance, but in contrast to Germany, Sweden has a much smaller economy. Sweden's main system bottlenecks are continually strengthening their competitive position and reaping the rewards of their research investments. Sweden's strategic objectives are focused on strengthening research and innovation capacity through international collaboration, promoting Swedish actors' competitive position through international linkages and presence in international markets, and promotion of Sweden as an attractive knowledge and innovation environment. Policy instruments are used to support actors' (particularly SMEs) engagement and presence in international cooperation, increase and broaden bilateral cooperation and exchanges with countries that have strategic importance for Sweden, and ensure active engagement in international fora. The portfolio of activities illustrates an ambition to maintain its position as a leading research nation, and make additional investments to link its commercial actors into global value chains.

It should be noted that all four case countries have expressed a number of sectors/research areas, and countries/regions of the world where international collaboration has strategic importance.

The types of instruments (or policy actions) for internationalization of innovation are quite similar across the four countries, and can be grouped into several categories:

- Knowledge development (including analysis of new markets and participation in international benchmarking)
- Attraction (including campaigns to build awareness and promote national strengths, and incentives to attract human and financial resources)
- Networking (including bi- and multilateral S&T agreements and mobility schemes)

- Innovation collaboration support (including scouting and matchmaking between innovation networks, and broadening of innovation funding programs)

Over a decade ago, Archibugi and Iammarino (1999) described similar policy instruments for the global generation of innovations and global techno-scientific collaborations. Some interesting distinctions since then include: the increase in government-firm activities, the expansion of instruments to support global techno-scientific (or innovation) collaborations, and the broadened scope of innovation policy (inter-linking with foreign affairs and development – as well as research – policy goals).

#### ***4.2 New Policy Developments***

The empirical evidence from the VINNOVA and TAFTIE surveys, and from the four case countries, illustrates some interesting new developments in innovation policy.

Firstly, it appears that ***the challenges that innovation policy are expected to address are evolving and broadening – creating a greater need for coordination between a number of policy areas.***

Following the Lisbon Summit in 2000, innovation policy was focused on issues related to the development and commercialisation of knowledge. Innovation strategies and instruments typically addressed issues such as: research and knowledge production, ICT infrastructure, venture capital, and regulatory issues (e.g. IPR and standards). Later, innovation strategies started addressing issues such as knowledge sharing within and between innovation environments (primarily in a national context). This has continued to evolve into quite robust activities in the realm of cluster policy in most countries.

Most recent national innovation strategies (and innovation policy communications from the European Commission and OECD) are increasingly focused on issues related to global access of knowledge, integration into and positioning within global value chains, promotion of open (and inclusive) innovation processes, and (joint) development of solutions to global challenges.

The increasing international nature of innovation activities prompts the need to consider the wider context and impact of research and innovation. Research and innovation strategies should be

coordinated with other policy realms, as collaboration activities can be levered to fulfil a range of policy goals (within, for example: competition policy, foreign policy, development policy, etc.).<sup>14</sup>

Although national contexts drive different internationalization strategies and activities, we see a convergence of goals between national and European levels (particularly in the area of “grand challenges”), indicating an opportunity for the EU-level to complement (rather than overlap) national-level efforts in facilitating platforms for cooperation – along thematic lines.

Secondly, we see *an increase in strategic planning for international innovation activities*. Even though based on a small set of case examples, there is evidence that different internationalization strategies are pursued by each country – driven by their specific national contexts and key drivers. This implies a challenge to undertaking joint action on a European level (mentioned above).

In addition, there is a clear trend for establishing a short-list of priority research areas/sectors, as well as priority countries or markets that are targets for international cooperation. This can be a challenge for countries to implement for a number of reasons:

1. Picking a short list means excluding others (research areas/sectors or countries), which creates a ‘picking the winner’ scenario.
2. Identifying relevant partners for collaboration (and initiating contact) in other countries is a time consuming task which requires special competencies and resources
3. Without data/information to guide decisions and indicators to measure progress at regular checkpoints, it is difficult to know when priorities should change.

Thirdly, an increase in international activities in both research and commercial spheres has led to *increased demand for a broader range of support services and a more engaged role of innovation agencies*. There is a need not only for information and financial support (e.g. for networking and mobility), but also for neutral agents to identify relevant actors in foreign markets and facilitate initial stages of cooperation. This may imply new roles for policy. In particular, there seems to be a need for an increased role of the public sector as an intermediary – taking on the role as change agent and facilitator of international collaboration.

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<sup>14</sup> For a more detailed discussion on innovation policy governance, see Lundvall and Borrás, 1997 and Borrás 2003.

The 2006 Booz Allen Hamilton and INSEAD study pointed out that “whilst many companies are building more international R&D networks, few have really begun to build the internal capabilities to run these networks effectively and efficiently.” Complex governance of international activities requires certain capabilities which national institutions may be best suited to take on. This view is supported by Carlsson (2006), who states that there is a continued importance of national institutions’ support to innovative activity, even though that activity is becoming increasingly internationalized.

As pointed out by the TAFTIE task force (forthcoming), innovation actors (universities, research institutes and companies, both large and small) may have difficulty obtaining and maintaining networks, contacts, advice and information themselves. Innovation agencies can provide substantial value in terms of legitimacy and weight in international fora, acting as a “door opener”, and facilitating access to governmental funding (through international co-funding of activities), among other things.

## **5 - Conclusions**

The internationalization of science, technology and innovation has increased rapidly in recent decades. A clear pattern seems to be emerging as to why governments should promote or enable internationalization, namely to promote competitiveness, to strengthen research and innovation capacity, to solve global challenges, and to strengthen political cooperation.

While the promotion of research cooperation is relatively easy to implement, finding optimal instruments and approaches for strengthening innovation cooperation seems less straightforward. Innovation policy actors are still trying to define their role, as well as the extent to which policy actions should support the internationalization of innovation processes.

Our analysis has highlighted several new policy developments. Firstly, the role of innovation policy is evolving and broadening, leading to an increased need for coordination across a range of policy areas. Secondly, the broadened scope of innovation policy prompts an increased need for strategic planning and prioritisation (particularly related to policies to support internationalization of innovation activities). Thirdly, there is an increased demand for more complex internationalization support services and deeper engagement of public sector intermediaries.

These new policy developments present a number of challenges, including the need for identifying suitable modes of governance in internationalization efforts (what should be done at regional, national and EU level). Furthermore, the changing nature of innovation is creating the need for new or different skill sets to deliver a broadened “service offering” as innovation agencies become “agents of innovation”.

At a more fundamental level, innovation agencies face a challenge in clarifying their role in enabling the internationalization of innovation. In general, the mandate of innovation agencies is to optimise the environment for innovation and strengthen the linkages between different innovation actors within the national system. Given their mandate, innovation agencies need to show that their efforts not only strengthen international linkages *per se*, but also that they lead to value creation and prosperity in their respective countries. Overall, innovation agencies are still searching for their niche in the landscape of activities that range from academic research and education cooperation to export and inward investment promotion. Several agencies are experimenting with new instruments such as the establishment of business innovation centers in emerging markets (as in the case of the Finnish Innovation Center ‘Finchi’ established by Tekes in Shanghai in 2005), and new approaches to bilateral technology cooperation (as in the case of the ‘2+2’ initiative of the German government, where cooperation is based on joint projects involving the participation of industry and academia from both countries). A more in-depth examination of these rapidly developing policy instruments is an area for future research.

Accessing and attracting global knowledge and innovation resources, as well as the ability to manage the broadening spectrum of science and technology activities and alliances are becoming increasingly important determinants of competitiveness – both at firm and national level. At the same time, companies (particularly SMEs) face significant challenges in establishing successful international linkages. The challenges relate to finding suitable partners, financing international activities, protecting their intellectual property, and accessing new users and growth markets.

The above-mentioned factors indicate a potential role for national policy responses and particularly for innovation agencies which combine technological and industrial expertise with commercialization competencies. Identifying good practices for internationalization activities, acquiring suitable skill sets as well as developing indicators for monitoring success will be some of the major tasks for innovation agencies in the globalizing innovation landscape.

## References

- Archibugi, D. and Michie, J., 1995. “The globalization of technology: a new taxonomy” in *Cambridge Journal of Economics*, Vol. 19, pp. 121-140.
- Archibugi, D., Howells, J. and Michie, J., 1999. “Innovation systems in a global economy” in *Technology Analysis and Strategic Management*, Vol.11, Nr.4, pp.527-539.
- Archibugi, D. and Iammarino, S., 1999. “The policy implications of the globalization of innovation” in *Research Policy*, Vol. 28, pp. 317-336.
- Archibugi, D. and Iammarino, S., 2002. “The globalization of technological innovation: definition and evidence” in *Review of International Political Economy*, Vol.9, Nr.1, March, pp. 98-122.
- Audretsch, D., 2003. “Innovation and Spatial Externalities” in *International Regional Science Review*, Vol.26, Nr. 2, pp. 167-174.
- Auerswald, P. and Branscomb, L., 2008. ”Research and innovation in a networked world” in *Technology in Society*, Vol. 30, pp. 339-347.
- Battelle, 2009. *2009 Global R&D Funding Forecast*, [www.battelle.org](http://www.battelle.org).
- BMBF, 2006. *The High-Tech Strategy for Germany*.
- BMBF, 2008. *Strengthening Germany’s role in the global knowledge society – Strategy of the Federal Government for the Internationalization of Science and Research*.
- BMBF, 2009. *Research and Innovation for Germany – results and outlook*.
- Boekholt, P., Edler, J., Cunningham, P. and Flanagan, K., 2009. *Drivers of International collaboration in research*. Final Report of the DG Research Task Force.
- Booz Allen Hamilton and INSEAD, 2006. *Innovation: Is Global the Way Forward?*
- Borrás, S., 2003. *The Innovation Policy of the European Union*. Edward Elgar, Cheltenham, UK and Northampton, Massachusetts.
- Carlsson, B., 2006. “Internationalization of innovation systems: A survey of the literature” in *Research Policy*, Vol. 35, pp. 56-67.
- Chesbrough, H., 2003. *Open Innovation*. Harvard Business School Press, Boston.
- Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds.), 2006. *Open Innovation – Researching a New Paradigm*. Oxford University Press, Oxford.
- CREST, 2007. *Analytical Report: Policy Approaches towards S&T Cooperation with Third Countries*, written by CREST Working Group on Internationalization of R&D – Facing the Challenge of Globalization.

- CREST, 2008. *Internationalization of R&D – Facing the Challenge of Globalization: Approaches to a Proactive International Policy in S&T*, Brussels.
- Edler, J. and Boekholt, P., 2001. “Internationalization of S&T - Benchmarking national public policies to exploit international science and industrial research: a synopsis of current developments” in *Science and Public Policy*, Vol. 28, Nr. 4, August, pp. 313-321.
- Edler, J. and Meyer-Krahmer, F., 2005. “How International are National (and European) Science and Technology Policies?” in Llerena, P. and Matt, M. (Eds.). *Innovation Policy in a Knowledge-Based Economy*. Springer, Berlin, Heidelberg, pp. 319-337.
- Edquist, C., 2008. ”Identification of policy problems in systems of innovation through diagnostic analysis”. Paper presented at PRIME Conference, Mexico City, Sep.24-26, 2008.
- Freeman, C., 1988. ”Japan: a new national system of innovation” in: Dosi, G. (Ed.). *Technical Change and Economy Theory*. Pinter Publishers, London, pp. 330-348.
- Freeman, C., 1995. “The national system of innovation in historical perspective” in: *Cambridge Journal of Economics*, 19(1), pp.5-24.
- Glänzel, W., Debackere, K., and Meyer, M., 2007. “‘Triad’ or ‘Tetrad’? On global changes in a dynamic world” in *Scientometrics*, 74 (1), pp. 71-88.
- Karlsson, M., ed., 2006. *The Internationalization of Corporate R&D. Leveraging the changing geography of innovation*. Institute for Growth Policy Studies, A2006:007, Östersund.
- Kirsebom, B., 2008. *Main features of an international strategy on Swedish research policy*. Ministry of Education and Research, Stockholm.
- Lundvall, B.Å., 1985. *Product Innovation and User-Producer Interaction*. Aalborg University Press, Aalborg.
- Lundvall, B.Å., 1988. “Innovation as an interactive process: from user-producer interaction to the national system of innovation” in: Dosi, G. (Ed.). *Technical Change and Economy Theory*. Pinter Publishers, London, New York, pp.349-369.
- Lundvall, B.Å., 1992. “Introduction” in: Lundvall, B.Å. (Ed.). *National Systems of Innovation – Towards a Theory of Innovation and Interactive Learning*. Pinter Publishers, London, pp. 1-19.
- Lundvall, B.Å. and Borrás, S., 1997. *The globalising learning economy: Implications for innovation policy*. Report based on contributions from seven projects under the TSER program, DG XII, Commission of the European Union.
- Lundvall, B.Å., 2001. “Innovation Policy in the Globalizing Learning Economy” in: Archibugi, D. and Lundvall, B.Å. (Eds.). *The Globalizing Learning Economy*. Oxford University Press, Oxford, pp. 273-291.
- Marshall, A., 1890. *Principles of Economics*. Macmillan and Co., Ltd., London.

- Minister of Public Works and Government Services Canada, 2008. *Seizing Global Advantage – A Global Commerce Strategy for Securing Canada’s Growth & Prosperity*.
- Minister of Public Works and Government Services Canada, 2009. *Mobilizing Science and Technology to Canada’s Advantage – Progress Report 2009*.
- Nelson, R. and Winter, S., 1984. *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge.
- Niosi, J. and Bellon, B., 1994. “The Global Interdependence of National Innovation Systems: Evidence, Limits and Implications” in *Technology in Society*, Vol. 16, No. 2, pp. 173-197.
- OECD 2007. *OECD Reviews of Innovation Policy: China. Synthesis Report*. OECD, Paris.
- OECD, 2008. *Science, Technology and Industry Outlook 2008*. OECD, Paris.
- OECD, 2008b. “Open Innovation in a Global Perspective – What to existing data tell us?”. STI Working Paper 2008/4. OECD, Paris.
- OECD, 2009. *Science, Technology and Industry Scoreboard 2009*. OECD, Paris.
- Ohmae, K., 1991. *The Borderless World*. HarperCollins Publishers, New York.
- Ohmae, K., 1995. *The End of the Nation State*. Free Press Paperbacks.
- Ohmae, K., 2005. *The Next Global Stage*. Wharton School Publishing.
- Prahalad, C.K. and Ramaswamy, V., 2004. *The Future of Competition: Co-creating Unique Value with Customers*. Harvard Business Press, Boston.
- Prahalad, C.K. and Krishnan, M.S., 2008. *The New Age of Innovation*. McGraw-Hill.
- Saxenian, A., 2006. *The New Argonauts – Regional Advantage in a Global Economy*. Harvard University Press, Cambridge.
- Schumpeter, J., 1934. *The Theory of Economic Development*. Harvard University Press, Cambridge.
- Schwaag Serger S., and Breidne M., 2007. “China’s 15-year plan for scientific and technological development – a critical assessment”, research note, in *Asia Policy*, Nr.4, July 2007.
- Schwaag Serger, S., 2009. “Foreign Corporate R&D in China: Trends and Policy Issues”, chapter 3 in *The New Asian Innovation Dynamics: China and India in Perspective*. Palgrave Macmillan, Basingstoke, pp.50-78.
- Scott, A. J. and Storper M., 2003. “Regions, Globalization, Development”, in *Regional Studies*, Vol.37, No.6&7, pp.579-593.
- TAFTIE, 2010. *Internationalization of National Innovation Agencies – seizing global opportunities*. Final report of the TAFTIE Task Force on Internationalization.
- VINNOVA 2007a. *Evaluation Report by the VINNVÄXT International Review Team*. VR 2007:11.



VINNOVA 2007b. *First Evaluation of the VINNOVA VINN Excellence Centers NGIL, HELIX, SAMOT and ECO2 together with the STEM Competence Center CICERO*, VR 2007:14.

VINNOVA, 2008. *Starka forsknings- och innovationsmiljöers globala länkar – preliminär analys/sammanställning*.

VINNOVA, 2009. *VINNOVA's internationella strategi*.

Von Hippel, E., 2005. *Democratizing Innovation*. MIT Press, Cambridge, Massachusetts.

## 6 - Annex I: Comparative Export and FDI Statistics

World **export** market shares are an important indicator of the ability of companies located in a specific country to compete on world markets. They are also an indication of exposure to global competition, which can enable learning and be an important driver of increased efficiency and productivity. Table 4 below shows that the four case countries have high trade to GDP ratios relative to Japan and the United States. This highlights the higher exposure (and learning potential) of these four countries to global competition. Table 4 also illustrates that China, Germany and Sweden have experienced high growth in exports over the last eight years. This highlights the strengthening ability of these countries to compete on the global market.

**Table 4: Global Trade Statistics**

<i>Country</i>	<i>Trade to GDP ratio (2006-2008)</i>	<i>Share in world total exports (% in 2008)</i>		<i>Annual percentage change in exports (2000-2008)</i>	
		Merchandise	Services	Merchandise	Services
Japan	34.3	4.87	3.88	6	10
U.S.	28.7	8.01	13.80	6	8
Canada	70.9	2.84	1.72	6	6
China	73.4	8.89	3.88	24	22
Germany	87.4	9.10	6.39	13	15
Sweden	96.5	1.14	1.90	10	17

*Source:* World Trade Organization country profiles

Inward **foreign direct investment (FDI)** is an indication of a location's attractiveness for foreign companies. Outward FDI is an indicator of the ability of local companies to transfer their competitive advantages to foreign locations. In many cases, outward FDI is a substitute for exports that provides companies with control of a larger part of the value chain. Both inward and outward FDI provides companies with access to knowledge and better linkages to foreign locations. Table 5 below provides some interesting insights. Firstly, it is notable that Canada, Germany and (particularly) Sweden have quite high levels of outward FDI and growth in outward FDI (as a percentage of gross fixed capital formation) compared to Japan and the U.S. This provides an indication of these countries' strong orientation toward global access of knowledge and international linkages. Canada and Sweden also have high levels of inward FDI (as a percentage of gross fixed capital formation) relative to Japan and the U.S., indicating that they are attractive locations for foreign companies. Although China's absolute levels of inward FDI have increased

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substantially between 2000 and 2008, this measure has decreased by half as a percentage of gross fixed capital formation – indicating high levels of total domestic investment.

**Table 5: Foreign Direct Investment (FDI)**

<i>Country</i>	<i>FDI flows</i>	<i>FDI, selected years (millions of dollars)</i>		<i>as a percentage of gross fixed capital formation</i>	
		<b>1990-2000 (annual average)</b>	<b>2008</b>	<b>1990-2000 (annual average)</b>	<b>2008</b>
Japan	Inward	3.149	24.426	0.3	2.2
	Outward	25.409	128.020	2.1	11.3
U.S.	Inward	109.513	316.112	8.0	12.5
	Outward	92.010	311.796	6.8	12.3
Canada	Inward	15.716	44.712	13.4	13.2
	Outward	15.778	77.667	13.4	22.9
China	Inward	30.104	108.312	11.9	6.0
	Outward	2.195	52.150	0.9	2.9
Germany	Inward	29.354	24.939	6.3	3.6
	Outward	44.323	145.457	9.6	22.3
Sweden	Inward	13.958	32.655	32.5	46.7
	Outward	13.307	37.351	31.0	40.0

*Source: UNCTAD, World Investment Report 2009, Country fact sheets*

## 7 - Annex II: Overview of Objectives, Drivers and Instruments for the Internationalization of Innovation

<i>Case Country</i>	<i>Strategic Objectives (national policy documents)</i>	<i>Policy Drivers (Boekholt et.al. framework)</i>	<i>Instruments</i>
Canada	<ul style="list-style-type: none"> <li>• Expand Canadian access to global markets and networks</li> <li>• Boost Canada’s share of global investment and innovation</li> <li>• Strengthen Canada’s international commercial network</li> </ul>	<ul style="list-style-type: none"> <li>○ Improving competitiveness of industries/firms</li> <li>○ Competition for scarce human resources</li> <li>○ Achieving global research excellence</li> </ul>	<ul style="list-style-type: none"> <li>- Continue work with multilateral trade agreements and bilateral S&amp;T cooperation agreements</li> <li>- Build awareness of the Canada “brand” in key markets and priority sectors</li> <li>- Reach out to potential investors internationally</li> <li>- Support researchers and companies to identify, explore and tap into international collaborative opportunities</li> <li>- Provide financial incentives to attract foreign students</li> <li>- Expand network of trade commissioners (increasing level of support and opening offices in new markets)</li> <li>- Create a competitive immigration system</li> </ul>
China	<ul style="list-style-type: none"> <li>• Attract (knowledge-intensive) foreign direct investment</li> <li>• Attract human capital</li> <li>• Encourage domestic firms to seek knowledge abroad</li> </ul>	<ul style="list-style-type: none"> <li>○ S&amp;T capacity building</li> <li>○ Improving competitiveness of industries/firms</li> </ul>	<ul style="list-style-type: none"> <li>- Provide incentives to induce foreign companies to locate R&amp;D activities in China</li> <li>- Provide incentives to foreign technology-intensive activities</li> <li>- Encourage students to study abroad</li> <li>- Offer scholarships/grants and other incentives to attract overseas Chinese to return and highly-skilled foreign workers to immigrate</li> <li>- Establish overseas high-tech parks (and establish links with overseas talent)</li> <li>- Grant foreign exchange and financing support for businesses to establish R&amp;D institutes abroad</li> <li>- Provide Chinese firms with foreign investment facilities and other services</li> </ul>
Germany	<ul style="list-style-type: none"> <li>• Strengthen research cooperation</li> </ul>	<ul style="list-style-type: none"> <li>○ Achieving global research excellence</li> </ul>	<ul style="list-style-type: none"> <li>- Provide research endowments to attract top scientists to Germany</li> </ul>

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- with global leaders
- Exploit international innovation potentials
- Intensify cooperation with developing countries in education, research and development on a long-term basis
- Assume international responsibility and master global challenges
- Improving competitiveness of industries/firms
- Tackling societal issues (including support to developing countries)
- Provide funding to encourage mobility of German scientists abroad
- Implement international advertising campaigns to help promote Germany as a location for studies, science and innovation
- Establish German Houses of Science and Innovation in overseas locations of strategic interest to help companies enter new markets and establish new partnerships
- Support international networking of innovative companies
- Implement new approaches in federal funding programs to encourage international collaboration
- Actively participate in design of international research agendas (particularly in Europe)
- Coordinate international activities with other policy realms (e.g. foreign office) to pursue joint objectives

Sweden

- Strengthen Swedish research and innovation capacity through international cooperation
- Promote Swedish actors' competitive position through international linkages and presence in international markets
- Influence the international research agenda
- Promote Sweden as one of the world's leading knowledge and innovation environments
- Increase awareness about Sweden as an attractive knowledge and innovation environment
- Improving competitiveness of industries/firms
- Competition for scarce human resources
- Achieving global research excellence
- Formulate specific initiatives to promote the capacity and opportunities for SMEs to participate in international cooperation
- Increase the analysis of and presence in countries outside of Europe in order to increase knowledge and build contacts with organisations and agencies
- Increase and broaden support for bilateral cooperation and exchanges with countries that have strong research within areas of strategic importance for Sweden
- Actively participate in formulation of EU research and innovation programs
- Promote Sweden's strategic participation in European and other international research and innovation programs
- Ensure visibility and active engagement in international benchmarking activities and policy learning fora