A Climate for Knowledge: How Governments can Enable Innovation

Herman Vantrappen, Nils Bohlin, and Gert Bijnens

Governments all over the world have recognised that the future of any country's economy depends on the ability to turn it into a knowledge-economy. Especially in Europe there is a rising concern that the old continent could fall behind. Remains the question: What can European governments do in order to correct this situation? In a series of studies, Arthur D. Little asked European business leaders what they think the priorities are. Vantrappen, Bohlin and Bijnens present a summary of the results and present their ideas what policy-makers can do.

If you hear a government leader give a speech about globalisation, there is a fair chance you will also hear the terms "innovation" and "knowledge economy". Leaders across the world share the view that the comparative advantage - and therefore the wealth and prosperity - of their region, nation or supranational community must be based on its capability to create and exploit knowledge. Their economy will be a knowledge economy or else, as the following quotes testify:

- "We recognise that higher education is the economic engine of the knowledge-based economy we are seeking to build in the new Arizona. [To develop the knowledge-based economy, we] recently released a blueprint for developing Arizona's tech industries, so that we can become pace-setters in an increasingly competitive arena." (Janet Napolitano, Governor of Arizona, January 2004)

- "If we look back on the history of Asia, we are reminded that it was Asians who came up with such inventions as paper, the art of printing and the digit zero. In the knowledge-based economy of the future, their high level of education and outstanding creativity will be the greatest assets of the peoples of Asia as they strive to achieve successful development." (Lee Han-dong, former Prime Minister of South Korea, April 2002)

- "The [European] Union's key priorities must be knowledge and innovation. Investment in education, lifelong learning and research are not abstract problems; they are an objective that must be pursued now because our international competitors are overtaking us or have already done so. We must step up our efforts to become a knowledge economy." (Romano Prodi, former President of the European Commission, January 2004)

While this concern - which sometimes turns into real angst - is global, nowhere is it more manifest than in Europe. The phenomenon of offshoring admittedly cre-

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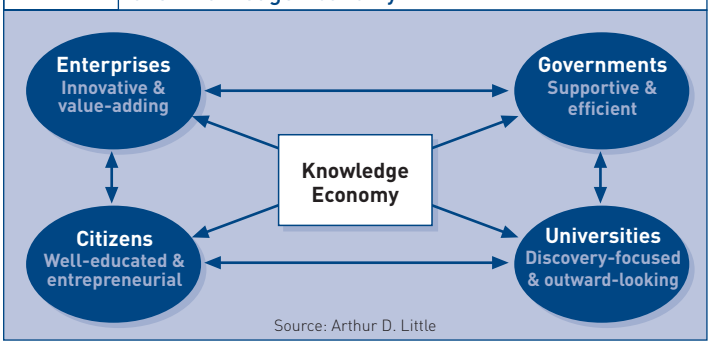
ates much debate in the US, but offshoring is a natural expression of structural renewal that ultimately should benefit all the economies involved. Europe, however, suffers from structural rigidities that prevent its economies adapting rapidly enough to the forces of globalisation and staying competitive. As a consequence, enterprises are moving not only manufacturing but also R&D activities out of Europe. This phenomenon fundamentally undermines the coveted creation of a knowledge economy. When R&D and therefore innovation activities disappear, the virtuous interplay between enterprises, governments, citizens and universities is broken (see Exhibit 1).

Exhibit 1 **Interplay Required for the Creation of a Knowledge Economy**



Source: Arthur D. Little

Many recent studies demonstrate that it is indeed a challenge for Europe to remain a good place to innovate and, as a consequence, secure its economic prosperity. Without being exhaustive, we can point to studies from the European Commission ("More Research for Europe", September 2002), the European Round Table of Industrialists ("The European Challenge", March 2003), Unice ("Lisbon Strategy, Status 2004") and the European Business Summit ("Research and Innovation: A European Strategy for More Growth and Jobs", March 2004). Likewise, figures about Europe's position abound in publications such as the World Competitiveness Yearbook by IMD, the Global Competitiveness Report by the World Economic Forum, the Science & Technology Indicators from the European Commission's Directorate General for Research, the Global Entrepreneurship Monitor and reports from the World Bank.

In other words, the factual diagnosis and quantitative evi-

dence of the risk of Europe lagging further behind the US and Asia are there for all to see. The question now is: what policies should European governments adopt to improve the framework conditions for innovation by enterprises? In a series of country studies, Arthur D. Little set out to gauge the sentiment of European business leaders about the priorities for policy changes. In this article, we will present a summary of the results of the studies and, more importantly, a framework for policy-making.

Need for Improvement

In the course of 2003 we finalised surveys in four European countries - Germany, Austria, Switzerland and Belgium - involving a total of some 700 business leaders. The surveys focused on the following topics:

- The relative attractiveness of the country as a place for innovation activities;
- The satisfaction with the framework conditions having an impact on innovation;
- The importance of these framework conditions relative to other factors that have an impact on a company's innovation strategy;
- The measures companies plan to take in order to increase their competitiveness in innovation;
- The specific framework conditions where the need for improvement is greatest.

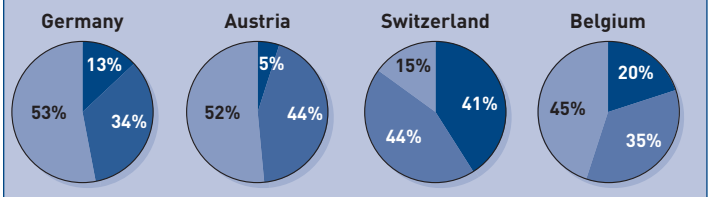
The full study report can be consulted on our corporate website. Here we will focus on a number of salient findings.

The first finding is that fewer than one in five managers in Germany, Austria and Belgium think that their country is ahead of other leading industrialised countries in terms of innovation location (see Exhibit 2).

Nine out of 10 managers in these three countries see a

Exhibit 2 **Attractiveness as a Location for Innovation Activities**

... compared to other leading industrialised countries



Percentage of respondents who consider their country to be ...

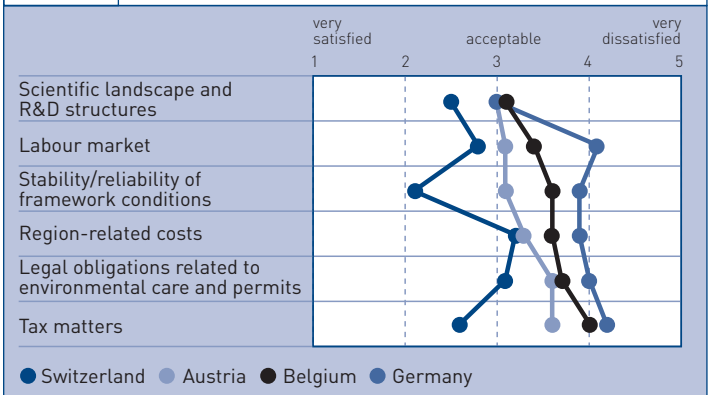
ahead equal lagging

Source: Arthur D. Little

The results from Germany, Austria and Belgium are pretty similar: dissatisfaction is highest with taxes, permits and region-specific costs.

great need to take measures to improve the overall set of political, administrative and legal framework conditions for innovation. Of all the factors that constrain or support the innovation strategy and capacity of companies, managers find that unfavourable framework conditions are the most constraining. While the relative importance of specific conditions can vary between countries, the results from Germany, Austria and Belgium are pretty similar: dissatisfaction is highest with taxes, permits and region-specific costs (see Exhibit 2). It is also clear why managers in Switzerland are less pessimistic about the attractiveness of their country as a location for innovation than their neighbours: the tax regime is much more favourable and the framework conditions are much more stable. One recent example concerns Google's decision to set up its first European R&D centre in Zürich (see also the headquarter benchmark study in this edition on this topic).

Exhibit 3 **Satisfaction with Framework Conditions for Innovation**



Average of replies on score from 1 to 5

Source: Arthur D. Little

In view of the high level of dissatisfaction with the framework conditions, the answer to the question of where managers intend to invest future R&D resources is not surprising: wherever it is relevant, they plan to expand their R&D capacity mostly outside Europe, either by expanding existing capacity or by building up new capacity, possibly through the re-location of R&D capacity out of their home country. Expanding existing R&D capacity - let alone building up new R&D capacity - elsewhere within Europe is not part of managers' plans.

Obviously, for many companies, especially the smaller ones, expanding or building R&D capacity outside Europe is not an option. While small companies can market their innovations worldwide by exporting or manufacturing locally, costs and issues of critical mass make it very hard to do R&D in several places at once.

The above leads to a troublesome conclusion. Unless policy-makers improve the framework conditions, three phenomena will accelerate:

Wherever it is relevant, managers plan to expand their R&D capacity mostly outside Europe, either by expanding existing capacity or by building up new capacity.

1. Companies for which re-location of R&D capacity is an option will indeed build up their R&D capacity outside Europe;

2. Companies for which re-location is hardly an option, ie mostly small companies, risk innovating less and consequently losing their competitiveness;

3. Arguably worst of all, many new innovative companies will not be created in the first place.

We are pretty confident that, despite some significant differences between individual countries, the overall findings from these four countries can be generalised to Europe as a whole. This conclusion can be reached from similar innovation-related studies recently undertaken by Arthur D. Little in other European countries, notably Sweden and the United Kingdom, from the overwhelming messages emanating from cross-European events such as the European Business Summit 2004 (of which Arthur D. Little is the knowledge partner), and from the Europe-wide studies mentioned earlier. A telling example from

Finland, rightly heralded as one of the best-performing European countries, concerns Nokia's recent decision to build up its R&D capacity for mobile phones in China, not only because of the importance of emerging markets but also because of that country's lower R&D costs.

As a consequence, we will no longer dwell on diagnoses and priorities for change, since awareness and consensus about these are already quite high. In the remainder of this article we will discuss concrete policy choices to remedy the shortcomings.

Choices for Policy-Makers

The most important framework conditions that influence the innovation capacity of a country and the companies operating in it can be grouped into five areas (see Exhibit 4). Governments must make policy choices for each of these.

Exhibit 4 **Areas Requiring Policy Choices**

1 R&D costs	• Corporate and personal income taxes • Para-fiscal charges • Government subsidies
2 Science landscape	• Clusters (a.k.a. valleys, networks, platforms) • Role of universities in the knowledge chain • The country's brand image
3 Risk capital	• Gap between demand and supply • Exit opportunities • Share of private sector in seed capital
4 "Red tape"	• Permits and approvals • Protection of intellectual property • Innovation and efficiency of the (non-profit) service sector
5 Culture & people	• Attitude toward risk and comfort • Trust in science • Supply and demand in brains

Source: Arthur D. Little

Of course, the five areas cannot be dissociated from each other: the innovation challenge is a systemic one, requiring an integrated policy approach. For example, is Europe's innovation capacity eroding because there is an insufficient number of scientists and engineers? Or is there an insufficient supply of brains because companies do not want to invest in high-cost Europe, and therefore make a career in R&D unattractive? For practical purposes, however, we will tackle the five areas one by one.

As far as policy choices are concerned, there is a wide spectrum. At one end is the "laisser-faire" philosophy; at the other is the "interventionist" philosophy. A government adopting the latter will be directive, ie it will set specific innovation goals and targets, such as the infamous European Council target of having R&D expenditures reach 3% of GDP by 2010. It will also be "selective", ie it will make explicit choices of sectors, types of companies, etc that it wants to support through specific tailored measures. A government adopting the "laisser-faire" philosophy, on the other hand, will limit its role to creating supportive framework conditions, thereby counting on a natural and gainful progression. It will also introduce generic measures that apply equally to all groups of beneficiaries, and cause the least distortion.
Below we will describe examples of alternative policy choices at both ends of the spectrum for each of the five areas.

1. R&D Costs

Governments directly affect companies' R&D costs in three ways: through corporate and personal income taxes, para-fiscal charges such as social security contributions, and financial subsidies for R&D (see Exhibit 5). Two examples of selective (para-)fiscal measures are the "jeune entreprise innovante" in France, by which start-ups (ie companies less than eight years old) do not pay income tax during their first three profitable years and are partly exempted from social security contributions for R&D employees if at least 15% of their costs are R&D costs, and the measure in Ireland that gives a tax credit of 20% on incremental R&D expenditures, with unused credits carried over indefinitely. An example of a selective subsidy measure is to make the size of the R&D subsidy conditional upon the number of new jobs created.

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The criticisms levelled at many selective policies are that their eventual effect is often marginal compared to the magnitude of Europe's innovation challenge; that the complexity and cost - to both businesses and governments - of requesting, administering and controlling the support subsidies may outweigh their benefits; that many measures are incoherent or even contradictory; and that it is

inherently difficult if not impossible for governments to make good R&D-related choices and then stick to them.

Examples of generic policies are flat reductions in corporate or personal income tax rates. The underlying idea is that companies operating in a competitive market will channel the extra net profits back into innovation activities and that lower personal income taxes will allow companies to attract scientists and engineers at lower gross salary levels. The fact that a reduction of corporate income taxes is effective for profitable companies only - ie less so for start-ups which do not yet make profits - can be tackled by allowing carry-forward of losses for up to 7-10 years.

Governments bent on a "laisser-faire" philosophy could finance the lower income tax rates by scrapping R&D subsidies to both businesses and public research institutes. In addition, they could introduce R&D vouchers. Tradable vouchers are demand-driven instruments: each company decides for itself with which accredited institutes (across Europe) it will spend its voucher, thus forcing these institutes to be more market-oriented.

Exhibit 5 **Examples of Policy Choices for Lowering R&D Costs**

	"Laisser-faire"	"Interventionist"
Corporate and personal income taxes	■ Flat undifferentiated reduction of income taxes, including carry-forward of losses	■ Selective measures focusing on "R&D workers" in academia and enterprises, or on start-ups
Para-fiscal charges	■ Cap employers' social security contributions for all employees	■ Take selective measures (e.g. special statute for "knowledge workers" or for foreign scientists, etc.)
Government subsidies	■ Scrap R&D subsidies to business and public research institutes; introduce R&D vouchers	■ Provide selective and conditional support (e.g. by sector, by type of R&D, by employment effect, etc.)

Source: Arthur D. Little

2. Science Landscape

Governments can support innovation by kick-starting initiatives that would not ignite through natural market forces alone (see Exhibit 6). The creation of science valleys is such an initiative, with California's Silicon Valley being the ultimate popular example. Silicon Valley is an ecosystem with a genuine food chain, vicious competition (for brains, ideas, intellectual property, funds, customers, partners, etc.), and a diversity of species (universities, entrepreneurs, venture capitalists, law firms, etc). In the "laisser-faire" philosophy, government does not intervene directly nor attempt to mandate the emergence of a valley: it simply provides some oxygen, for example through advantageous rules for stock and option plans, attractive science park infrastructure and favorable public-private partnership conditions. In the "interventionist" philosophy, on the other hand, government picks and funds a supposedly winning technology area. These attempts can fail due to the tendency to pick too many winners and the lack of critical mass and continuity.

Many European countries have too many universities and suffer from research fragmentation. One approach is to merge top research departments across universities so that they become real leaders with critical mass, with specific incentives to excel in science and transfer knowledge to industry.

Governments can also influence the contribution of the universities to the knowledge chain, which stretches from fundamental research to marketable inventions. Many European countries have too many universities and suffer from research fragmentation. One train of thought is to merge top research departments across universities so that they become real leaders with critical mass, with specific incentives to excel in science and transfer knowledge to industry. These incentives relate to tenure rules, structural instead of project-based funding, ownership of intellectual property, degrees of freedom in setting tuition fees and staff compensation policy, spin-off rules, etc. Other universities and departments would orient themselves toward broad-based and less costly teaching.

Governments also have a great influence on their country's or region's brand image in the global knowledge market. Multinational companies make decisions about where to make R&D investments on the basis of numbers and facts. But their decisions are also informed by perceptions. Think of examples such as Ireland, Finland or Medicon Valley in Denmark/south Sweden that are associ-

ated, rightly or wrongly, with the places to be for software, wireless telecom and biotech. Or think of Switzerland, which is succeeding in attracting European headquarters, such as that of Biogen Idec, the world's third-largest biotechnology company. Government can try to select a desired brand image up-front (linked with "picking winners"), and build initiatives such as promotion campaigns around it. Alternatively, government can decide not do anything specific, reasoning that the positive results from all other innovation policies combined will speak for themselves.

Exhibit 6 **Examples of Policy Choices for Improving the Science Landscape**

	"Laisser-faire"	"Interventionist"
Clusters (a.k.a. valleys, networks, platforms)	■ Framework conditions stimulating the natural emergence and flourishing of "ecosystems"	■ Picking winners
Role of universities in knowledge chain	■ Keep current system in place, with each "universal" university trying to prove itself	■ Build a few top research departments with critical mass focusing on basic science, with proper incentives; separate teaching universities
The country's brand image	■ No direct action: "Results will speak for themselves"	■ Kick-start through purposeful and consistent positioning initiatives

Source: Arthur D. Little

3. Risk Capital

As far as exit opportunities are concerned, government could stimulate the (re-)emergence of a unique pan-European stock market for growth companies, as an alternative to Nasdaq.

Many government officials and some entrepreneurs claim that the gap between demand and supply of risk capital for the financing of high-tech starters reflects a market failure, and therefore requires government intervention (see Exhibit 7). Direct government intervention can consist of conditional grants of (pre-)seed money, fiscal incentives for private people to invest in funds or companies, bank loan guarantees, a starter's bonus, interest subsidies, easy access to the European Commission's framework programmes, subsidies to business angel networks, etc.

Others claim that the gap is not due to a market failure but the quality of the projects submitted, the riskiness of the environment, structural constraints on investments in venture capital and the lack of attractive exit opportuni-

ties. According to this reasoning, government could promote entrepreneurship courses so as to improve business plan quality. It could reduce investor risk by improving the framework conditions, such as strengthening the continuity of these conditions, cutting red tape and lowering R&D costs. And it could remove the numerous tax and legal restrictions that impede fundraising and investments at national and pan-European level, as is suggested by the European Venture Capital Association.

As far as exit opportunities are concerned, government could stimulate the (re-)emergence of a unique pan-European stock market for growth companies, as an alternative to Nasdaq. It could stimulate the awareness of non-European investors about imminent exit-linked takeover opportunities. It could provide incentives to reward investors who take a longer exit horizon.

Exhibit 7 **Examples of Policy Choices for Stimulating Access to Risk Capital**

	"Laisser-faire"	"Interventionist"
Gap between demand and supply	■ Stimulate business plan quality, and reduce investor risk through better framework conditions	■ Intervene to correct market failure (funds, guarantees, private incentives, starter's bonus, cheap loans, access to EC programmes, etc.)
Exit opportunities	■ Support initiatives that broaden the scope of available exit channels or reward longer exit horizons	■ Provide exit guarantees of some sort
Share of private sector in seed capital	■ Stop funding by public sector	■ Stimulate private capital formation

Source: Arthur D. Little

4. "Red Tape"

Red tape is the government's most visible impact on innovation. Complaints about permits and approvals relate to the required number (eg separate building and environmental permits), the lead-time (eg for the approval of new drugs), the number of authorities to be consulted (local, regional, etc.), complexity and quality, restrictive or uncertain nature (eg for R&D in the field of genetically modified organisms) and inconsistent enforcement (see Exhibit 8).

Of course, red tape is inspired by a noble intention: as the guardian of the public good, government introduces regulations to simultaneously reassure citizens and reduce uncertainty for business. To achieve that goal, the "laisser-faire" philosophy stresses principles, self-regulation and remedial action, and measures success by what is the least disruptive; it demands that the potential effects on competitiveness of any new regulation are examined before it is introduced. The "interventionist" philosophy stresses rules, imposed prescriptions and precaution, and measures success by what is the most protective. The choice between the two of course depends on the subject matter (eg compare drug safety with, say, workplace training).

The cost of obtaining and enforcing patent protection in Europe is several times that in the United States, due to translation and litigation costs.

One area of particular concern is the protection of intellectual property (IP). The cost of obtaining and enforcing patent protection in Europe is several times that in the US, due to translation and litigation costs. One can wait until the European Council approves the long-promised "community patent" or an equivalent, or in the meantime government may stimulate the formation of a community of IP professionals, in particular to serve small and medium-sized enterprises and academic institutions.

Another area of high concern relates to the (non-profit) service sectors, whose importance for innovation is twofold. First, many service sectors such as health, education and transport could be more innovative in their own right. Second, inefficient service sectors hinder innovation and competitiveness in other sectors. To unleash the innovation potential of state-controlled service sectors in particular, the "laisser-faire" philosophy advocates the introduction of market mechanisms, such as free competition and profit-and-loss accountability. The "interventionist" philosophy advocates the upholding of state involvement, while improving service quality through directive performance contracts between the state and the monopoly service provider.

Exhibit 8 **Examples of Policy Choices for Cutting Red Tape**

	"Laisser-faire"	"Interventionist"
Permits and approvals	■ Based on principles, self regulation, and remedial; benchmark on "least disruptive"; competitiveness impact assessment	■ Based on rules, imposed prescriptions, and precaution; benchmark on "most protective"
Protection of intellectual property	■ Wait and see for "community patent"	■ Stimulate formation of an IP professionals community, for use along knowledge chain (universities, SMEs, etc.) for patenting and licensing
Innovation and efficiency of (non-profit) service sector	■ De-regulate and allow market mechanisms for greater competitiveness (health, education, transport, etc.)	■ Reinforce performance contracts between state and service provider

Source: Arthur D. Little

5. Culture and People

The final and arguably most important area concerns the human side of innovation (see Exhibit 9). Europeans by and large are said to be less entrepreneurial than their Asian or US equivalents, a view which Global Entrepreneurship Monitor data appear to bear out. Explanations for this phenomenon are sought in Europeans' attitude toward risk and comfort, and their governments' influence on it. Adherents of the "interventionist" philosophy want government to stimulate entrepreneurship by changing education from primary school onwards through to university, and to communicate better about the exciting aspects of entrepreneurship through prizes, technology fairs and the like. Adherents of the "laisser-faire" philosophy want government to knock over the lack of entrepreneurship by reducing the comfort of the social safety net provided to those who shy away from risks.

Another aspect on which government has a major bearing is the too-widespread distrust of science by the general public, as evidenced by the discussions about biotechnology, nano-technology, nuclear energy, etc. If government is seen as the trustworthy and evenhanded guardian of the public good, evidence-based government regulations can both reassure citizens and reduce uncertainty for business without unduly hampering innovation. Furthermore, government can communicate positively about the benefits of science, directly and through its own actions (for

example, by not mandating the phase-out of nuclear energy for the wrong reasons).

Finally government can have a major impact on the supply and demand in brains, ie the shortage of well educated scientists and engineers (S&E). The short supply of brains in Europe is linked to the low intake of S&E students (especially women), the brain drain from Europe to the US, the difficulty of convincing S&E-educated people to return and the constraints on the immigration of brains from other regions. One "laisser-faire" suggestion to encourage S&E student intake is to increase university tuition fees and stimulate a cheap loan programme from a pool funded and managed by business, the assumption being that such a fund will lend primarily to S&E students and thus provide an incentive toward those studies.

Adherents of the "laisser-faire" philosophy also emphasise the demand side of the brains equation. Supply is insufficient because demand from business is unattractive: low salaries, limited career opportunities, poor scientific infrastructure and a dreary peer environment. Government can have a direct impact on the quality of demand by making it more attractive for business to invest in innovation in Europe. The most straightforward example is the enabling of higher salaries as a result of reducing R&D costs. Many of the other policies described in this article will have a similar effect.

Exhibit 9 **Examples of Policy Choices Concerning the Culture & People Side of Innovation**

	"Laisser-faire"	"Interventionist"
Attitude toward risk and comfort	■ Reduce comfort of non-risk takers (social safety net, etc.)	■ Directly stimulate entrepreneurship (through education, communication, etc.)
Trust in science	■ Government communication and actions demonstrating public sector's own trust in "science"	■ Government regulation to reduce both distrust of "science" by general public and uncertainty for business
Supply and demand in brains	■ Focus on demand side	■ Focus on supply side (student intake, brain drain, immigration)

Source: Arthur D. Little

Two Examples: Sweden and Ireland

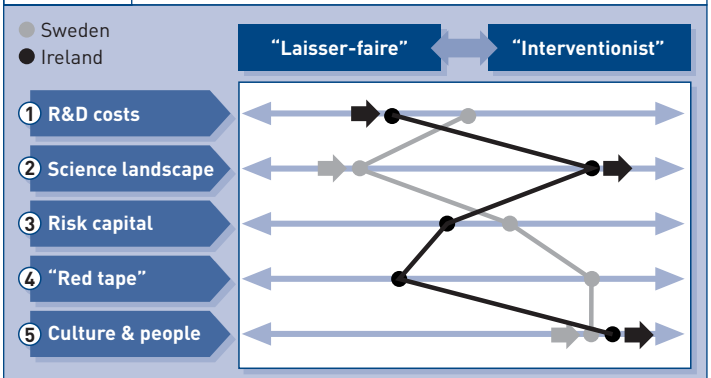
We do not pretend to have the answer as to which government policy mix is the most effective. Most important for government is to establish a clear policy mix to begin with, make the mix sufficiently radical given the magnitude of the innovation challenge, ensure that the individual policies are mutually coherent and secure the stability of the policy mix over time. The specific policy mix then depends on the current situation, future objectives and differentiation strategy of the country or region concerned.

The short supply of "brains" in Europe is linked to the low intake of S&E students (especially women), the brain drain from Europe to the United States, the difficulty of convincing S&E-educated people to return and the constraints on the immigration of brains from other regions.

For example, the UK government appears to be much less concerned about having R&D expenditures reach 3% of GDP than most other European Union countries. It reckons that in its service-oriented, market-led economy the efficiency of the system is at least as important as the level of expenditures. The Hungarian government, being a new member of the European Union, realises that a vigorous knowledge-intensive industry will have to replace foreign direct investment as the engine of future growth. Within that context, it has set up a Research & Technology Innovation Fund that is 50 percent financed by companies through a tax of 0.3 percent of turnover, but with a company's R&D expenditures to be offset against the tax. The Swiss government appears to have chosen a policy mix in which an attractive fiscal regime is the major differentiator with other leading nations in Europe.

For the sake of illustration, we have sketched in some more detail the policy mix of two countries, namely Sweden and Ireland (see Exhibit 10 and the insert).

Exhibit 10 **Policy Mix in Sweden and Ireland**



Source: Arthur D. Little

Sweden

Due to concerns about lagging growth rates, the Swedish government has been taking policy measures toward the "interventionist" end of the scale. It has worked in particular on the areas of people & culture, red tape and science landscape. The Swedish Agency for Innovation Systems (VINNOVA) and the Swedish Business Development Agency (Nutek) administer selective programmes to support entrepreneurs. The government tries to steer the educational system toward a higher student intake into science-focused programmes by expanding and financing the supply of science-focused university places (which, for the time being, is not being matched by an equal increase in demand). While Swedish society is heavily regulated, regulation arguably is relatively efficient. The public service sector in particular is among the most market-driven in Europe. As far as the science landscape is concerned, the government is concentrating research at fewer universities in order to attain critical mass, thereby reversing the 1980s policy of creating a large number of small regional universities. The intention is to be more selective with subsidies and concentrate these on fewer clusters among the 38 identified.

Ireland

Ireland is also implementing more "interventionist" policy measures. R&D costs have long benefited from low overall tax rates as well as direct support grants, but a decision has been made to introduce R&D tax credits. In the science landscape, there is increased interest in and appetite for cluster and network promotion. Basic research funding has been dramatically increased, partly in order to increase the supply of talented graduates and researchers: this investment in knowledge creation is a strong asset in promoting the inward investment "brand". Some stimulation of the market in innovation finance is being undertaken. Red tape is relatively modest, but Ireland is systematically seeking to improve regulation by thinking about the impact on business of any new measure, and deregulation is well advanced in some areas. A voluntary code of practice on intellectual property from publicly funded research has been preferred over a legislative approach. Much attention is directed towards culture and people: Ireland is showing an improved entrepreneurial culture especially among the young, but government is taking steps to improve trust in science (to be led by a newly appointed Chief Scientific Adviser) and to raise interest in science and engineering at primary school level and all stages beyond.

Insights for the Public Policy-Maker and Executive

We will summarise with the messages that emerged loud and clear from the third European Business Summit that was held in Brussels in March this year. First, Europe has a tremendous amount of resources, assets and knowledge at its disposal. Whether we talk about food and drink technology, nano-technology, energy technology, environmental technology, wireless technology or aerospace technology, Europe clearly occupies leading positions. This is clear from the number of scientific publications and patents, but also from the worldwide leadership positions occupied by many European companies in these fields. In a number of areas, such as pharmaceuticals, Europe has

lost its leadership position. In others, such as biotechnology, it has been lagging behind for a long time.

The second message is that the world and society continue to have a great need for innovations of all kinds. Innovations are essential to create more wealth, better health, greater safety and a cleaner environment. For example, food may never have been safer than today, but there is a need to identify and remedy new risks. Likewise, society will need new energy sources to ultimately replace fossil fuels, and new security remedies to cope with large-scale social insecurity. In other words, there are limitless needs and opportunities for innovation. Enterprises have a unique position and responsibility to bring these innovations to life.

The third message is a paradox. While Europe has a tremendous amount of knowledge, and society has a limitless need for innovation, Europe appears to be lagging behind America and Asia in converting its knowledge into innovation. Why? Why is it that enterprises, which should be the main source of innovation, cannot do so sufficiently well in Europe? There is no simple answer to that question, but one thing is clear: the framework conditions within which enterprises can innovate in Europe are insufficiently supportive. If Europe wants to galvanise its knowledge and enable its enterprises to create the transformational innovations that society needs, governments - be they at the European level or at the level of the member states - must take urgent action to improve the climate for innovation. If Europe wants a piece of the cake - and with nine billion people forecast to populate our world in 2050, the global cake is growing - now is the time for leadership and action.

Finally, there is no reason to be defeatist about Europe. Self-flagellation is as bad as complacency - both tend to be self-fulfilling prophecies. What Europe needs is a strong dose of economic growth, an environment that is conducive to innovation, and excellent innovation managers. The three feed on each other.

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