

Creating an Innovative Europe

**Report of the Independent Expert Group on R&D and
Innovation appointed following the Hampton Court Summit**

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The Expert Group

Mandate

The Mandate of the Group is to provide the European Commission, ahead of the 2006 Spring European Council, with its views, advice and recommendations on (1) ways to accelerate the implementation of planned new initiatives at EU or national level aimed at reinforcing EU research and innovation performance in the context of the revised Lisbon Strategy; and (2) additional issues and initiatives the group considers relevant.

Membership

- **Mr. Esko Aho (Chairman)** - Former Prime Minister of Finland & President of the Finnish national fund for research and development (Sitra)
- **Dr. Jozef Cornu** - Chairman of the Information Society Technologies Advisory Group of the Commission (ISTAG), former President and COO of Alcatel Telecom, board member at Alcatel, KBC Group, AfgaGevaert, Barco & Arinso.
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- **Prof. Antoni Subirá** - Former Catalan Government Minister of Industry, Trade & Tourism, Professor at the IESE Business School (Barcelona), Chairman of the Advisory Board of the competitiveness institute TCI, Board Member at Mercapital & Member of Advisory Board for Europe at Air Products.

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Summary

This report presents a strategy to create an **Innovative Europe**. Achieving this requires a combination of a market for innovative goods and services, focussed resources, new financial structures and mobility of people, money and organisations. Together these constitute a paradigm shift going well beyond the narrow domain of R&D and innovation policy.

Our central recommendation is that a **Pact for Research and Innovation** is needed to drive the agenda for an Innovative Europe. This requires a **huge act of will and commitment from political, business and social leaders**. Current efforts towards the revised Lisbon Agenda should be continued and reinforced but are not enough. In addition, simultaneous and synchronous efforts are needed in the three areas which constitute the Pact and which we use to structure this report:

1. At the core of our recommendations is the need for Europe to provide an **innovation-friendly market** for its businesses, the lack of which is the main barrier to investment in research and innovation. This needs actions on regulation, standards, public procurement, intellectual property and fostering a culture which celebrates innovation. A combination of supply and these measures to create demand should be focused in **large scale strategic actions**. We identify several examples: **e-Health, Pharmaceuticals, Energy, Environment, Transport and Logistics, Security**, and **Digital Content**. An **independent High Level Coordinator** should be appointed to orchestrate European action in each area.
2. We see the 3% target as an indicator of an Innovative Europe, not as an end in itself. Measures are needed to increase **resources** for excellent science, industrial R&D and the science-industry nexus. Productivity of R&D must be increased. The proportion of structural funds spent on research and innovation should be trebled.
3. Far greater **mobility** is needed at three levels: **Human resources** need a step change in mobility across boundaries; **Financial mobility** requires an effective venture capital sector and new financial instruments for the knowledge-based economy; **Mobility in organisation and knowledge** means cutting across established structures to allow new linkages to be made through the instruments of European technology platforms and clusters.

More resources for R&D and innovation are a necessity but they are an insufficient means to achieve the goal of an Innovative Europe. A **paradigm change** is needed in which European values are preserved but in a new social structure.

An **independent monitoring panel** with support from the Commission should **report annually on progress** in relation to the Pact.

Europe and its citizens should realise that their way of life is under threat but also that the path to prosperity through research and innovation is open if large scale action is taken now by their leaders **before it is too late**.

Creating an Innovative Europe

Our proposal is to create in Europe a market that stimulates and encourages innovation and in so doing provides firms with the incentive to raise their R&D level and to apply successfully the full range of new technologies.

1. Strategy and the need for action

This report presents a strategy to create an Innovative Europe along with the concrete steps needed to implement that strategy. The course of action we shall propose is simple but its application is complex and requires a huge act of will and commitment from political, business and social leaders. It is a route which resonates strongly with the origins of the European Union as a Common Market and with one of its greatest achievements, the drive towards the Single Market.

Market for innovations as the central driver

Achieving the goal of an Innovative Europe requires a new paradigm of mobility, flexibility and adaptability to allow **R&D and innovation to create the value** that can then support our quality of life. The paradigm shift cannot be confined to the narrow domain of R&D and innovation policy, important though that is. Simultaneous and synchronous efforts are needed at all levels in three areas, which we use to structure this report:

- creation of a market for innovative products and services;
- providing sufficient resources for R&D and innovation; and
- improving the structural mobility and adaptability of Europe.

Cutting across these areas is a fourth which we treat horizontally, being the necessity for more positive European attitudes and culture towards entrepreneurship and risk taking.

Why is such a change needed? Europe must break out of structures and expectations established in the post-WW2 era which leave it today living a moderately comfortable life on slowly declining capital. This society, averse to risk and reluctant to change, is in itself alarming but it is also unsustainable in the face of rising competition from other parts of the world. For many citizens without work, or in less-favoured regions, even the claim to comfort is untrue. This report is about putting research and innovation at the centre of the endeavour to recapture the entrepreneurial vigour and value-creation that are needed to sustain and improve the European way of life.

Europe breaking out from an unsustainable path

We aim to build upon the achievements and actions already in process through the revised Lisbon Strategy for growth and jobs, the National Reform Programmes and actions towards the 3% objective, but also to

broaden the scope of measures being employed and to intensify and accelerate those already being implemented.¹

There is a large gap between the rhetoric of a political system that preaches the knowledge society and the reality of budgetary and other priorities that have shown little shift in preparing to engage with it. Our emphasis is on remedies not diagnosis but we must also recognize the magnitude of the problem. There are many indicators both of insufficient effort to innovate and of the consequences of not doing so:

Remedies not diagnosis alone but first recognise the problems

- **Productivity falling behind.** For the first time in the post WW2 era the average growth rates of real GDP, labour productivity and total factor productivity have continued to fall further behind those of the USA for a period of almost a decade.²
- **Failing to capitalize on the application of ICT.** Productivity growth has in recent years been driven mainly by the ICT-using services sector and it is precisely here that the difference is most obvious - productivity growth in the EU is relatively stable across time in contrast to a very large acceleration in the USA as it successfully applies ICT.
- **Losing out as large firms globalize their R&D.** The net imbalance of R&D investment by EU firms in the USA compared with US firms in Europe increased five-fold between 1997 and 2002, from about €300m in 1997 to almost €2b in 2002. It is well known that several major European firms no longer site new R&D initiatives in Europe. Additionally, US R&D investment has been growing at a much greater rate in areas outside the EU – about 8% per year in the EU and 25% per year in China.
- **Locked into unmodernised traditional sectors and under-investing in services R&D.** Europe has a manufacturing profile that has a relatively low share in ICT –related sectors, and a structural trade deficit in high-tech manufacturing. Its services sector invests considerably less in R&D (0.2% GDP compared with 0.7 % of GDP in the US).

Falling behind

¹ We note in particular the significant Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: More Research and Innovation - Investing for Growth and Employment: A Common Approach, Brussels, 12.10.2005, COM(2005) 488 final

² EU productivity and competitiveness: An industry perspective Can Europe resume the catching-up process? Mary O'Mahony and Bart van Ark (ed.) European Commission 2003

The productivity challenge is made more urgent by an ageing population. Europe is caught in a demographic squeeze of declining birth rates and rising life expectancies. According to Eurostat, by 2050 the working population will decrease by 52 million, even after allowing for net migration, and there will be a sharply rising dependency ratio, with the proportion of people over 65 rising from 16.4% in 2004 to 29.9% in 2050³. In this situation, the present health and welfare systems are not sustainable. Ageing is also a specific problem in the research labour force with over one third of highly qualified scientists in the 45-64 age group. This, coupled with the declining interest of young people in a research career creates a double effect, dramatically cutting the available human resources needed to realize the European knowledge society.

To this list can be added a series of underpinning social and cultural challenges, including creating jobs, absorbing immigrants, improving education (particularly to create interest and excitement in science and technology), exploiting cultural diversity and addressing inequalities within the EU exacerbated by enlargement. There are growing problems in the transport network and high external dependency in energy supplies. Businesses face high labour market costs and inflexibility, inefficient regulation, risk aversion and lack of entrepreneurial spirit. For new Member States the difficulties in extracting maximum benefit from Structural Funds remain a barrier. More generally, they face a brain drain to better off Members and beyond Europe, and a second brain drain away from science and technology into better rewarded professions.

Additional challenges

A market-led vision does not mean an abandonment of what is distinctive about European values but rather the use of the force of the market to preserve them, both by harnessing innovation to engage with public services and by creating the wealth necessary to finance the equality, health, social cohesion and common security that our citizens desire. Investments in education, science, research and innovation should not be seen as alternatives to investments in the welfare society in Europe, but as necessary though not sufficient means to ensure its sustainability, albeit through a reformed social model conducive to innovation.

Affording and reinforcing European values

³ Eurostat news release 48/2005 - 8 April 2005

2. Creating a market for innovative products and services

It is well-known that the 3% target cannot be approached without a very substantial increase in business investment in R&D and innovation. For companies, the principal barrier to investment in Europe is the lack of an innovation friendly market. In particular, the fragmentation of markets across the national boundaries of Member States provides a major disincentive for innovation. Despite progress towards the Single Market and some notable successes, the reality for most innovators remains that they face an obstacle course of multiple levels of regulations and requirements, each of which raises costs and lowers incentives. By comparison, the large national markets of the USA and increasingly of China provide a more fertile ground in which to launch innovations. Europe must gear its Internal Market to foster a transition to the knowledge-based economy.

**Fragmented
markets
disadvantage
Europe**

If Europe cannot offer an innovation-friendly market for the creative outputs of its businesses then those businesses will fail to thrive or will go elsewhere. Such markets are important for several reasons:

- **Lead users** or launching customers are those who are prepared to take the higher initial costs and risks involved in early adoption of an innovation. They can provide important feedback to the final development of the product or service;
- In return they can gain better abilities to use and benefit from the innovation, and increase the chance that it meets their specific needs;
- An **early market** of sufficient scale offers the potential for a higher return on investment and with that, reduced risk;
- Proximity and local requirements are key features of many such markets and relationships and hence influence the choice of R&D and business location.

**The importance
of lead users**

These barriers seem particularly acute in the service sector, which we have already noted is critical to productivity growth. A recent study concluded that the lack of demanding and novelty-seeking customers who are willing and able to pay for upgraded, improved or novel services is a major barrier in service innovation which enterprises find difficult to overcome.⁴

⁴ Innovation in Services – Issues at Stake and Trends, J.Howells and B Tether, INNO-Studies 2001: Lot 3 (ENTR-C/2001), European Commission 2004

The market does not always reward its lead users adequately.⁵ What then can Europe do to help firms enter the dynamic virtuous circle of growing demand, reduced manufacturing or service costs, reduced prices, further growth in sales and a new cycle of innovation? Many elements for lead markets are already in place, including relatively high incomes and a willingness to purchase higher quality goods. However, this is not enough - further steps need to be taken to:

- Provide a harmonised **regulatory environment** across the EU favourable to innovation and based on early anticipation of needs;
- Use **standards**-setting powers to demand high technical performance levels and reach agreement on new standards quickly and efficiently;
- Use **public procurement** to drive demand for innovative goods, while at the same time improving the level of public services; and
- Foster a **cultural shift which celebrates innovation** and a desire to possess innovative goods and experience innovative services, such that Europe develops as a natural home for innovators⁶.

**Key steps
to create
lead
markets**

It is particularly important that public sector productivity grows strongly in Europe because of its relatively large public sector and citizen's expectations of a high standard of service. In the area of public procurement, new EU directives have created opportunities for public authorities to purchase innovative solutions, with key changes including:

- Possibilities for technical and competitive dialogues between purchaser and supplier, a necessary condition if each side is to understand the other;
- The facility to specify requirements in terms of functional performance or standards, which allows suppliers to produce any configuration of technology they feel can meet the need;
- Options to permit variants, thus opening up bids to alternative ideas; and

**Exploiting
new
opportunities
for public
procurement
to drive
innovation**

⁵ There are several reasons for this: the utility of some products rises with the number of users (for example in telecommunications or in areas requiring infrastructure such as fuel cells), meaning that early users benefit less and run the risk that network effects will not occur; users may have high sunk costs in complementary products and infrastructures and be unwilling to break out of the cycle; and the benefits, safety and reliability of innovations are often only fully understood in the context of application. Early users carry out this learning on behalf of their successors.

⁶ The 2005 Innobarometer showed European citizens evenly split between positive and negative attitudes towards innovative products and services.

- Conditions that allow transfer of intellectual property to the suppliers, and hence allow them to exploit their innovations in wider markets.

However, to reap the benefits of these changes actions are needed. Demand needs to be coordinated or aggregated to create sufficiently large orders to make innovation worthwhile. On the other hand opportunities need to be opened up for innovative SMEs to have the chance to bid for parts of the larger packages. A key to successful procurement for innovation is the “intelligent customer” who is able to be aware of potential new solutions, and can specify and manage contracts of this kind throughout their lifecycle. This means actions to develop a cohort of trained professionals and to support them through networks to exchange ideas and raise skills. It also means a new attitude to risk among public authorities, matched with an emphasis on the whole-life costs of their purchases rather than the lowest price at the point of purchase. European Agencies should assume the role of lead market customers.

The Commission has taken actions to raise awareness and to spread good practice in this domain⁷ but these are only necessary first steps – the real challenge is to apply these concepts in key areas of public purchasing and at a European level to explore ways of aggregating and coordinating demand through common standards, regulations and joint procurement.

Other market changes are needed to improve the operating environment for innovative firms. These include:

- The need for light touch and harmonised regulation and the removal of those which are creating ever rising compliance costs without clear benefit. In this context the Better Regulation element of the Lisbon Strategy with its aim to withdraw, screen and assess the impact of regulation is an important element if entrepreneurship is to flourish;
- Setting world-class standards that grab the market, in the mould of the GSM and ADSL experiences.

Intellectual property systems – including national and Community legislation, court systems, assistance services, etc. – also structure the market and the knowledge economy. European intellectual property systems provide a high level of protection but suffer from drawbacks such as national discrepancies and high costs, which hamper both developers and users of technology, especially when considering cross-border collaborations and transactions.

**Efficient
and
effective
intellectual
property
systems**

⁷ Actions include an expert group report: Wilkinson R. et al, Public procurement for research and innovation, DG Research, September 2005, EUR 21793 and a study leading to a Handbook on raising the technological and innovative intensity of publicly procured goods and services.

A balanced set of improvements is called for, including the Community patent system for obtaining and enforcing patents on an EU-wide basis. In the short-term, urgent action is needed to finalise the draft European Patent Litigation Agreement, which would address the national fragmentation of the existing European patent system, and the associated high litigation costs and legal uncertainty.

Action is also required on more specific fronts. For instance, there is a need to balance the interests of holders and users of intellectual property, particularly when compliance with a standard involves use of patented knowledge. It is also important to facilitate the transfer of knowledge and intellectual property from publicly-funded institutions to industry. Finally, better awareness and training regarding intellectual property has to be offered more systematically in the education system, in order to equip all new graduates with the knowledge management skills Europe needs in the 21st century.

Strategic Areas for Action

We have identified some examples of key areas where a market for innovation can work and public policy can have a significant role, as they have for past successes such as GSM and Airbus. The sectors listed account for a large portion of GDP and impact upon the daily lives of citizens. These are not the only areas for concerted action but nonetheless focus and concentration of resources is necessary. They are e-Health, Pharmaceuticals, Transport and Logistics, Environment, Digital Content, Energy, and Security. We comment briefly on each below, except for the last two, as these are being dealt with by other Hampton Court follow-up reports.

Each of these areas is of critical importance. The degree of coordination necessary requires the appointment of a senior individual of high standing and demonstrated independence with the remit to create a platform and orchestrate European action in the area across DGs, Member States and regions and to liaise between R&D performers, regulators, users and sectoral stakeholders.⁸

A High Level Coordinator appointed to orchestrate European action in each area

e-Health:

The healthcare sector combines great need with many possibilities for revolutionary innovation. It already accounts for 9% of GDP in Europe and the share is growing at 6% pa as costly new treatments and an ageing population exert pressures. However, in an increasingly service intensive

⁸ Including the recently established INNOVA Sectoral Groups and the European Technology Platforms

sector 7% of costs are consumed by administration (more than the cost of general practitioners), a situation ripe for ICT-led innovation to reduce costs. Opportunities lie in eHealth, a term which describes the application of information and communications technologies (ICTs) across the whole range of functions that affect the health sector. e-Health, it is estimated, will account for 5% of the total Member States' health budget by 2010⁹.

Specific challenges include the cost of duplication in non-standardised medical files, the high administrative costs and coping with an ageing population requiring prolonged medical care. Massive savings could be made by digitising all diagnostic tests and images so that results are available to clinicians immediately. The cost of access to such records created and delivered manually is huge and causes unacceptable delays in processing patients. Patient supervision at a distance using communications and analysis/sensor technologies is another major opportunity for saving. Health services also have massive purchasing power yet can be late and slow adopters of new technology¹⁰ with negative consequences for both health and expenditure. Organisational and operational changes are needed. A recent foresight report noted the opportunities European collaboration brings for standardisation, shared assessment of technologies and hence market creation¹¹.

Pharmaceuticals:

Europe's position as the world's leading manufacturing location for pharmaceuticals, is under long-term threat despite being the only high technology sector to consistently show a growing positive trade balance.¹² It employs 588,000 people including 100,000 in R&D, with an R&D investment of €20,500 million. Huge opportunities remain to be exploited in genomics and their combination with other technologies. Better regulation can also help innovation to reduce healthcare costs. Nonetheless there is cause for concern. In 1990, major European research-based companies spent 73% of their worldwide R&D expenditure in EU territory. In 1999, they spent only 59% in EU territory.¹³ The USA was the main beneficiary of this transfer of R&D Expenditure. Furthermore, in 1992 six out of the ten top selling pharmaceuticals were

⁹ Deloitte and Touche (2003) eHealth. Health Information Network Europe. Final report.

¹⁰ Wanless D (2002) *Securing our Future Health: Taking a Long-term View. Final Report*, HM Treasury: London, April 2002.

¹¹ Braun A (2005) Healthcare: Key Technologies for Europe

¹² Data from European Federation of Pharmaceutical Industries and Associations

¹³ Innovative Medicines for Europe, Vision Document, 2004, http://europa.eu.int/comm/research/fp6/p1/innovative-medicines/pdf/vision_en.pdf

produced by European companies. In 2002, this figure had fallen down to two out of ten.

The European Technology Platform in this area is addressing key barriers to development of new drugs in Europe:

- Safety, addressing the bottlenecks predictive toxicology and risk assessment with authority
- Efficacy, addressing the bottlenecks predictive pharmacology, biomarkers identification and validation, patient recruitment and risk assessment with authority
- Knowledge Management, leveraging the potential of new technologies to analyse a huge amount of information in an integrative and predictive way
- Education and Training, addressing certain gaps in expertise which need to be resolved in order to change and support the biopharmaceutical research and development process

This approach involves bringing together a wide range of stakeholders in the manner we envisage including large and small firms, academics, patients and their representatives, clinicians, regulatory agencies, government at several levels, health providers and charities. Beyond this, achievement of a single market in pharmaceuticals requires continuing efforts in simplification of legislation and regulation at EU and national levels and speeding up national negotiations on reimbursement and pricing.

Transport and logistics:

The European transport system is a vital element to European economic and social prosperity. It serves key roles in the transportation of people and goods in a local, regional, national, European and international context. The whole sector employs around 20 million people, that is 12% of jobs available in Europe. It accounts for around 17% of the EU GNP. The growth forecast is higher than average, ranging from 2 to 6% depending on the specific sector.

An integrated approach linking all transport modes: Aeronautics, Rail, Road, Waterborne, which addresses the socio-economic and technological dimensions of research and knowledge development, and encapsulates both innovation and the policy framework is essential in ensuring that sustainable and competitive transport solutions will make a visible and positive “difference” for Europe, its citizens and its industry.

Freight transport is growing strongly in Europe and worldwide. Road transport takes an ever-increasing share of the volume of freight

transported. This leads to congestion, decrease in reliability, environmental damage, and rising costs. Freight transport should be considered as a key component of an integrated logistics system in which the choices made will influence the efficiency and operating costs of a fully integrated, sustainable business. Freight transport can be improved in Europe through quality intermodal logistics. Elements with scope for action may include quality standards, training, promotion, intermodal statistics, multimodal liability, short sea shipping, rail, and technical standardisation.

We note the priorities for action given by the Technology Platforms set up in these fields¹⁴ as an initial basis for strategic actions.

Environment:

Environment technologies or eco-innovation industries in the EU account for about one-third of the global market and employ over 2 million people. Last year exports grew by around eight per cent and there was a trade surplus of over €600 million. Overall, the sector has enjoyed growth of around 5% a year since the mid-1990s.

As well as being an area of significant technological opportunity and importance for quality of life, this sector is amenable to promotion through measures complementary to R&D such as the promotion of energy efficiency, and the use of green public procurement and economic instruments such as taxation. The range of technologies encompassed is very large, including energy technologies and conservation, recycling, waste and emissions control, and also is central to most sectors including construction, transport and agriculture. It will be necessary to find a focus for large-scale strategic actions. Outside the energy sector, a good prospect could be **water supply and sanitation**, which combines resource management with almost all of the above mentioned dimensions. The water sector alone accounts for 1% of GDP and has fast growing turnover and employment. Worldwide markets for water and waste water amounted to more than €250 billion in 2002 and growth of 60% by 2010 is foreseen. Water also provides a strong basis for cooperation beyond Europe's borders.

Digital content industry:

The creative industries are estimated to account for more than 7% of the World's GDP and in OECD countries are growing at a rate of between 5 and 20% annually.¹⁵ While these figures include advertising and marketing, there is a strong component with a cultural content, covering

¹⁴ ACARE for aeronautics and air transport, ERRAC for rail transport, ERTRAC for road transport, WATERBORNE TP for waterborne transport

¹⁵ United Nations Conference on Trade and Development (UNCTAD) (2004) *Creative Industries and Development*, Eleventh session, Sao Paolo, 13-18 June 2004.
http://www.unctad.org/en/docs/tdxibpd13_en.pdf

sectors such as broadcasting, film, Internet, mobile content, music, print and electronic publishing and video and computer games. Europe's strong cultural heritage provides a sound basis for this sector and this is reflected in a 29% world market share (worth \$130 billion) in 2000, though this reflects a strong element in printed media.¹⁶ The sector is important for innovation in two ways. Firstly it is increasingly dependent upon new media technologies dependent upon digitalisation. A recent foresight paper on this sector noted that the value chain for the industries is being changed by the disruptive technologies of ICT and digital coding¹⁷.

Convergence of shared technologies and markets, protection of intellectual property and the emergence of new distribution channels are all key factors. Given the global reach and borderless nature of the network environment, a review is called for in respect of the territorial aspects of the copyright system and of appropriate frameworks for efficient licensing of copyrighted content across national borders. Secondly, R&D is itself seen as a creative industry and is argued that it flourishes as an element of a creative economy that draws together the spheres of innovation (technological creativity), business (economic creativity) and culture (artistic and cultural creativity) into one another, in more intimate and more powerful combinations.¹⁸ Increasingly the combination of content and technology is seen as a core of knowledge regions attractive to entrepreneurs.

¹⁶ UNESCO, www.unesco.org/culture/en

¹⁷ Marcus, C., Future of Creative Industries – Implications for Research Policy, European Commission Working Document, EUR 21471, April 2005

¹⁸ Florida, R., (2002 republished 2004), The rise of the creative class, New York, Basic Books

3. Resources for R&D and innovation in Europe

Resources for R&D and innovation at a globally competitive level are a prerequisite for Europe to move forward. This has been recognised in the renewed Lisbon agenda with knowledge and innovation for growth, including the 3% target for R&D, being the first pillar. This is a direct investment in value creation and a necessary but not sufficient condition for an innovative Europe. We note that virtually all-national Lisbon programmes have R&D as a top priority and half of them set national R&D investment targets inspired by the Barcelona 3% goal. R&D was reconfirmed as a priority at Hampton Court. In our paradigm we regard the 3% target primarily as an *indicator* that Europe has achieved its innovative goals.

The Lisbon challenge is not one of intent, it is one of implementation

What has been agreed on the basis of the Lisbon and Barcelona European Councils is all in the right direction. The challenge is not one of intent, it is one of implementation. The ambitions are laudable but progress towards the target has been uninspiring and even today few concrete measures are in evidence. If credibility is to be maintained the existing momentum must be built upon and accelerated. It is for these reasons that we emphasise the importance of markets and the private sector as the key drivers. The situation today is that:

- Growth of R&D investment as a % of GDP has been stagnating since 2000 and only grew 0.2% in real terms between 2002 and 2003
- Europe devotes a much lower share of its wealth to R&D than the US and Japan (1.93% of GDP in the EU in 2003, as compared to 2.59% in the US and 3.15% in Japan). Furthermore China is on track to match the research intensity of the EU by 2010.¹⁹
- The 3% target depends upon business raising its share of R&D from the present 55% to two-thirds of the total. Already behind competitors, R&D investment by EU companies grew by only 0.7% in nominal euro terms in 2003-4.²⁰ Even this is a significant improvement over last year where an overall decline of 2.0% was reported for EU companies.
- A widening gap with non-EU Scoreboard companies, which increased R&D investment by 6.9% (in euro terms), compared with an increase by EU companies of 3.9% last year.
- Europe's best companies do invest at world class levels (for example in pharmaceuticals). However, they are few in number and account for a very high proportion in the most R&D intensive

A widening gap with US and Japan in research and innovation

¹⁹ Key Figures 2005 on Science, Technology and Innovation, Towards a European Knowledge Area, July 2005, DG Research

²⁰ EU Industrial R&D Scoreboard 2005 http://eu-iriscorboard.jrc.es/scoreboard_2005.htm

sectors for example in Electronics and electrical equipment the top five European firms account for 88% of all the sector's R&D while for non-EU companies the equivalent figure is 58%.

The picture is no more reassuring when we turn to innovation. The latest Innovation Scoreboard shows that the US and Japan are far ahead of the EU15 on a composite innovation indicator.²¹ This gap is driven by a weak performance in patenting and the proportion of the population with a tertiary education. Even allowing for sectoral differences the gap is large and in the case of Japan it is widening. Europe is on average weak in translating innovation inputs, such as research and education, into innovation outputs, in particular new products and services and in patents.

The current trends lead us to a position outside the world's top economic powers by 2030. Now that the second round of the Lisbon process is under way and national targets have been set, it is time to ensure their implementation. The Lisbon commitment is not binding in the way that the single market and the common currency were. A new, more binding kind of commitment is needed, while simultaneously recognising the different starting points of Member States.

In the meantime, however, it is also essential that Europe makes the most of the policy instruments it has available:

Public finance for R&D has an important leveraging effect on industrial R&D. It does this in two ways:

A. Through supporting the most excellent scientists with a generous level of resources. Along with project funds there should be a world-class infrastructure at EU-level and further measures to promote the mobility of leading young researchers, from within and outside Europe, firstly to create critical mass in key teams and secondly to spread excellence when many eventually return to their home environment. World-class industry is attracted by leading-edge science both as a source of ideas and cooperation and as the basis for its own R&D recruitment. Centres of excellence are necessary in some areas and achieving a sufficient scale of activity may imply a degree of national specialisation.

Support excellence in science to attract industry and for “creative system disruption”

Researchers should be particularly encouraged to engage in what a recent report termed “Creative system disruption”, that is to keep a close watch for emerging sectors where as yet no research gap exists and where Europe could take the lead.²²

²¹ Trendchart European Innovation Scoreboard 2005

²² Creative System Disruption – Towards a Research Strategy Beyond Lisbon – Synthesis Report, report from Key Technologies Expert Group, DG Research 2005

Examples of areas of science and technology where Europe needs to invest today so as not to face a gap analogous to that we see in ICT (which of course continues to be a critical area itself) in the future include:

- Biotechnologies including Genomics
- Nanotechnologies
- Cognitive and neuro-sciences

A recent report saw these pervasive technologies as converging with and enabling each other and with new ideas from the social sciences and humanities.²³

An underexploited source of income for research is philanthropic donation. A recent expert group report on this theme cited obstacles and disincentives which inhibit giving by individuals and corporations, and which hinder the flow of more funds from foundations and the non-profit sector to research, or hamper a more effective use of existing funds²⁴. They called for a mix of initiatives by foundations themselves, national actions, and, where appropriate, for EC support. A useful first action would be the creation of a forum for exchange of experience in using R&D support to achieve the goals of foundations. There is also scope to improve the fiscal and regulatory environment for foundations which fund research, albeit on a State by State basis, in terms of the generosity of tax treatment for donations, and linking of favourable tax status with funding obligations.

B. Through smart use of R&D grants and fiscal incentives for industry. Later in this report we will also argue that all measures can potentially be amplified by locating them in the context of coordinated initiatives and clusters. There are also several specific points to be made:

- **Policy measures should recognise that large firms are essential for the innovation system.** The recent trend of concentrating resources on SMEs ignores the natural ecology of industry.²⁵ A recent international meeting of both small and large firms from 18 European countries, organised by the Dutch Chair of EUREKA, issued a statement saying that small firms thrive in the slipstream of large firms (who are their key customers) and that both groups wish to work within the same initiatives. A neglected

Reinforce the natural ecology of industry with small and large firms working together

²³ Converging Technologies – Shaping the Future of European Societies, a report from the High Level Expert Group on Foresighting the New Technology Wave, DG Research EUR21357, 2004

²⁴ Mény Y et al, Giving More for Research in Europe: the role of foundations and the non-profit sector in boosting R&D investment, Report by an expert group, DG Research 2005, EUR21785

²⁵ Coombs R and Georghiou L “A new “Industrial Ecology” “ *Science* Vol 296 19 April 2002 471

- target group is the medium-sized firm above the SME threshold. This sector probably has the greatest potential for growth in R&D spending but has also been struggling in recent years;
- **Fiscal incentives are best concentrated on visible effects for firms**, for example the reduction or elimination of social costs for R&D workers. We understand that the forthcoming Communication on R&D tax incentives announced in the Lisbon Programme will provide guidance for their design, implementation and evaluation on a coordinated basis. Good evaluation is particularly important given the present uncertainty surrounding the effects of some of these measures;
 - **R&D grants have an important role** and should be maintained. Recent OECD work has shown that grants can help firms to achieve strategic change and to improve their organisational routines and attitudes to technology, as well as the more obvious effect of providing resources.²⁶
 - **The present State Aid framework that is currently under review is outmoded and disadvantages Europe** in relation to global competitors. We welcome the Commission's State Aid Action Plan and its aim to shift support away from ailing industries to research and innovation but also emphasise the need for modernising the definitions of industrial R&D to reflect the present reality of business research and innovation practice.²⁷ In keeping with our earlier point about the role of large firms, any difference in support for large and small firms should be based on the goals of the policy measure concerned and not be enacted in the framework.

Modernised State Aid framework implemented to support ecology of industry

Science-industry collaboration is a necessity. The open innovation system is a reality, meaning that firms, universities and research centres must work closely together while at the same time preserving their distinctive contributions. The rapid emergence of outsourcing (now 10% of business R&D) and further development of R&D collaboration emphasise the need for an effective European market for R&D services where the best matched partners can easily identify each other, wherever they are located, and work together without bureaucratic impediment. Important

Responsible Partnering between universities and industry for effective knowledge transfer

²⁶ Georghiou L and Clarysse B summarise an 11 country cooperation in the synthesis report: The Behavioural Additionality of R&D Grants – an Introduction and Preliminary Synthesis, DSTI/STP/TIP(2005)9/REV1, OECD Paris

²⁷ In particular, it is unacceptable that the current state aid rules for R&D are based on the linear model of innovation when there is a broad academic, governmental and industry consensus that the model is wrong. The interactive innovation process that is necessary to take advantage of the market-driven approach we are advocating means that the obsolete, artificial distinction between “industrial research” and “precompetitive development” should be replaced by a single category “industrial R&D” (including prototyping, software, testing and trials) with an allowable aid intensity of at least 50 % should be implemented.

changes are going on with an increasing emphasis upon durable partnerships across a broad spectrum of activities.

We fully endorse the voluntary programme of Responsible Partnering²⁸ advocated in a recently produced Handbook for cooperation between public research and industry. However, there is a need for progress on dismantling remaining barriers to such cooperation. Forthcoming EU Guidelines are seeking to facilitate cross-border partnerships in particular, through spread of best practice and model contracts. Actions remain both for Member States and for universities themselves to ensure both that remaining structural barriers to cooperation with industry such as civil service restrictions on university staff are removed and that academic career incentive mechanisms reward involvement with innovation-related activities.

The focus of the European Research Council on basic research and single academic teams emphasises the need to **focus the rest of the Framework Programme on its core business of networking and mobilising firms and other research actors** in accordance with the strong concept of European Added-Value proposed in the Ormala evaluation of FP5.²⁹

The core contribution of the Framework Programme is in fostering linkage

It is vital also to increase the productivity of R&D in Europe.³⁰ We are conscious that the 3% target is one representing an input rather than an outcome, or even an output. Business R&D and scientific research have made substantial productivity improvements through the increased automation of experiments, notably in the life sciences, and through use of simulation. Organisational changes such as the outsourcing discussed above may also drive productivity improvements as firms slim down expensive corporate laboratories. However, the biggest increase in productivity for the research system as a whole comes from:

Improve productivity of R&D

²⁸ Responsible Partnering – Joining Forces in a World of Open Innovation, A Guide to better practices for collaborative research and knowledge transfer between science and industry, EUA, ProTon Europe, EARTO and EIRMA, published by the European Commission January 2005

²⁹ Ormala E et al, Five Year Assessment of the European Union Framework Programmes 1999-2003, European Commission, December 2004

³⁰ Productivity is also a concern in innovation – The European Innovation Scoreboard shows wide disparities between Member States in the efficiency with which a country transforms its innovation inputs (education, investment in innovation) into innovation outputs (turnover coming from new products, employment in high-tech sectors, and patents). However, in the absence of an adequate model to link the two this remains at present an observation.

- A focus on excellence and a willingness to cut sub-standard or low priority research to free up resources to be spent on the best; and
- Ensuring that the brightest minds are provided with adequate capital and human resources to support them. For some this may mean access to resources beyond national borders.

In keeping with our broad message about a new paradigm, **structural funds should be seen as a key means of supporting research and innovation capacity and in particular for pursuing cohesion** in this area. No part of the EU should contemplate giving lower priority to research and innovation – there are no economic and social goals that are not touched by them. We propose that Member States agree a minimum voluntary commitment of such funds for this purpose of the order of 20%. This would represent a major increase from the present 5.9% of the overall envelope of the European Regional Development Fund and European Social Fund that are at present spent on R&D and innovation support. At the same time the bureaucracy involved in using these funds should be streamlined to allow fast and effective application.

Treble the use of structural funds to build research and innovation capacity for cohesion

The more that those responsible for research can show that they offer value for money, the more credible the case for increased resources becomes. Present evaluation techniques have a tendency to undervalue the contribution of R&D – it is essential that rigorous and innovative approaches to socio-economic evaluation of research are used to demonstrate both its past and future value.

Measure the true contribution of research and innovation

As well as support for R&D we must also consider ways in which governments can support innovation more directly through provision of the right infrastructure. There is a very large community of "institutions", some of which may be associations or not-for-profit companies, whose task is to support innovation, particularly by SMEs. Science parks, incubators, regional and local government bodies and knowledge transfer organisations. These provide important support for young high-tech SMEs and even for more traditional ones that are contemplating transforming to innovation-based strategies. Such measures are needed to take SMEs to the point where they are able to play their role in the innovation ecosystem described above. They are often most effective in the context of the clusters we describe in the next section. There is a steep quality gradient in such institutions, making it imperative that weaker performers and new entrants learn from the success of others.

Infrastructure for innovation

The last point to be made on resources concerns the European Union budget. This needs to be shifted strongly towards the creation of an Innovative Europe. This entails not only a shift towards budgets directly concerned with research and competitiveness but also the acceptance

Focus the EU budget on innovation

that innovation is a horizontal objective to be pursued under all budgetary headings.

4. Structural mobility as the basis for innovation-driven success

Alongside the operation of sufficient markets, one significant constraint to the efficient exploitation of research and knowledge lies in the surrounding framework conditions and structures, which today limit mobility and adaptability.

We take mobility to mean somewhat more than geographical movement. Rather we see it as both the symbol and the reality of paradigm change in Europe. It is about creating structures and changing values to allow movement of institutions, people and resources in a way that accelerates the transition to an Innovative Europe. The paradigm shift we advocate implies replacing a social framework developed and adapted to an industrial, resource-based society to one which supports innovative growth in a knowledge-based society. Efforts in R&D and innovation policy will not succeed without these complementary changes.

Several layers of structural mobility are needed to make innovation prosper. At the very heart are the structures for research, development and innovation. Intermediary structures are needed to support the diffusion and successful application of innovation in existing industries, services and products. The broadest supportive framework constitutes the whole innovation ecology. Many of the existing structures in Europe are designed to support innovation under the traditional paradigm. We explore this need for structural mobility in three dimensions: people; finance; and organisation and infrastructure.

Human resources are inefficiently used because of lack of mobility.

One of the key barriers to Innovative Europe lies in insufficient mobility of people. Though openness to migration of highly skilled people is an aspect, this traditional geographical view is not at the core of our concern. Greater problems lie in:

- **The facility with which older people change jobs.** The combination of the ageing population and rapid change means that suitable employment will have to be found for people in late career stages, perhaps without the expectation of rising income with age that characterised the industrial era. Re-skilling also grows in importance. The need is for such changes in employment to be facilitated by the legal and pensions environment. Research careers provide only one instance of this broader need.
- **Science-industry mobility is strongly insufficient and a major reason for the reluctance to cooperate across this divide.** Flows of established researchers (as opposed to newly qualified students) are minimal. The lack of movement is largely due to structural barriers and lack of incentives. A particular problem is the difficulty for many academics to take up part time, or even full time

but limited-term appointments in industry and be able to return to their tenured appointments once the relevant project is complete. Ten per cent of the workforce in each year should be moving, with as high a proportion as is feasible engaged in cross-border movement.

Increased financial mobility is also essential to ensure access to external sources of finance for firms at different stages of development. This concerns access to venture capital but also access to loans, guarantee mechanisms and other financial instruments. Regarding **venture capital**, the first point to make is that an adequate supply of venture capital is essential if the European industrial ecology is to be dynamic and support the entry and growth of new entrepreneurial firms. We note the growing role of private equity and venture capital in Europe, with a 40% increase in the number of companies supported since 1995 and €10.3 billion being invested in 5,557 venture companies in 2004. A recent study concludes that 630,000 new jobs were created by venture-backed companies in between 2000 and 2004, with almost 1 million people working in venture-backed companies³¹. Finally we note the significant contribution to R&D of these companies: they are six times as R&D intensive per employee as the top 500 EU25 R&D spenders and every third employee works in R&D. This suggests that the investment in 2004 could be seen as equivalent in R&D terms to that of two companies the size of Hewlett Packard.

Venture funded firms a key source of growth and job creation...

However, behind this very positive picture there are some severe difficulties. The venture capital industry is still living with the consequences of the burst technology bubble in 2000-2001. Many investors have disappeared and institutional investors are not committing new funds to this sector. In consequence, funds have been used up. VC companies in Europe managed to raise only €946 million in 2004 compared to €5,370 million in 2002 and €9,660 million in 2000. Yet VC firms recognise that they have to invest much more in each firm and stay in longer, both of which tie up funds. There has also been a significant shakeout in the USA but the top tier firms are doing well. Three key differences from Europe are:

...but new funds are scarce, especially for early stage investments

- In the fragmented European market, the average amount invested per company in Europe is one sixth of that in the USA;
- Early stage funding is particularly scarce in Europe because of the lack of a sufficient Business Angel community. The risk profile and the small scale investments at this stage deters professional

³¹ Achleitner A-K and Klöckner O, Employment contribution of private equity and venture capital in Europe, CEFS Research Paper on behalf of the European Venture Capital Association, November 2005

venture capital. There is now more mobile wealth to tap in Europe but the system is far from adequate; and

- Building up a company is slower and more expensive in Europe making the potential power of US venture funding much greater with a large homogenous home market in which to launch the product or service. It is economic for US corporations, including venture backed firms to pay substantial sums to acquire good European early stage businesses with unique technology before they grow to a global size. US companies also have the advantage of a single highly liquid, high growth company stock market (NASDAQ) on which they can become publicly quoted and raise funds for acquisitions. This also fuels an active acquisition culture. European companies are poorly served in comparison.

Once more we see lack of a suitable market as a key factor.

Remedies include:

- A “Single Fund Structure” to avoid double taxation for an investor located in one EU member state investing through a fund in another.
- Strengthen the valuable role already being played by the European Investment Fund so that it maintains venture capital funding in the counter-cycle but also does this on market terms. The counter-cycle role should be stressed further to prevent an excessive technology boom returning when the market recovers.
- Encourage the venture capital sector to specialise and build up its expertise in key areas for the future – specialised knowledge adds greatly to the value of the investment and reduces risk; and
- To recycle money from successful exits to the next generation needs an active and highly liquid high growth company stock market in Europe, rather than the complex and sub-critical set of exchanges that presently operates. This will also fuel and underpin a more active mergers and acquisition market in Europe.

Incentivise success, smooth out the cycle and encourage specialisation

Loan finance: The “Innovation 2010” initiative of the European Investment Bank (EIB) which was launched in 2000 led to a major increase of the Bank lending volume in research and innovation from an annual average of 30 million in the 1990’s to several billion in 2004. This points to the need to encourage banks and other financial institutions to evolve and become full players in the shift from a resource-based to a knowledge-based economy by recognising the importance of intangible assets and developing the tools and expertise that are necessary to invest in such assets. We note for example that, with a comparable number of companies, the biotechnology sector in the US used in 2004 four times as

Financial institutions to adapt products to needs of knowledge economy

much debt financing as in Europe and that the volume of debt financing exceeded that of venture capital³².

Mobility in organisation and knowledge means cutting across established structures to allow new linkages to be made that are well-adapted to emerging knowledge-based industries. Many of these elements are already emerging and require reinforcement or recognition:

European technology platforms are a key organisational innovation in the creation and exploitation of innovation-friendly markets. These assemble all interested parties in strategically important sectors for the EU so as to foster effective public-private partnership and bring together key stakeholders, under the leadership of industry, around a shared vision for the development and deployment of the technologies concerned. A key function has been to define the necessary research and technical priorities in the medium-long term for the sector. This may influence and create new coalitions in funding in FP7 (either as JTI's or as foci for collaborative projects), national and regional programmes (including joint programmes between several member states) and Structural Funds, as well as take advantage of the increased interest of the European Investment Bank in the area of high-tech and financially risky projects in the field of technology. The normal model is that the scope and rules of the platform are defined by core firms in the sector, then others are free to join. Market building measures, including the participation of regulators and users, are part of the concept but their precise nature is likely to be specific to each sector. Anticipatory regulation becomes feasible in this context.

Extended
platforms
as a core
instrument

Technology platforms form an effective vehicle for the course of action that we propose, allowing flexible use of resources and the opportunity to combine market creation and technological development. We urge the Commission and national governments to be selective about which platforms they invest in, ensuring first that there is a genuine need and commitment. When this hurdle is passed then a total resource package of private and public investment should be mobilized, with €1 billion as a guide to scale.

A model to commend is the combination of pre-committed Member State funds with a top-up from EU funds, within a defined legal structure and in a harmonized and synchronous manner³³. This approach is being developed in the context of collaboration between the EU and the

³² : Report for EuropaBio (European Association of Biotech Industry) entitled "Critical I comparative study for EuropaBio" released at the BioVision Conference in Lyon on 13 April 2005

³³ Examples include the Eurostars initiative and the proposals for support for the ARTEMIS European Technology Platform.

EUREKA Intergovernmental Initiative. It combines the flexible bottom-up character of EUREKA (plus its role in drawing up national funds for European collaboration) with the financial muscle of Framework Programme funding.

Clusters and, more generally, regional agglomerations are often at the core of innovative development. It is widely recognised that new firms thrive in the proximity with other companies, investors, educational institutions and research centres afforded by clusters particularly in the presence of world class academic institutions. Mobility can be maximised when there is a local labour market that allows regular flows of people from one situation to another, with accompanying diffusion of knowledge. As well as the greater opportunity range it is clear that barriers such as the need to move house or schooling for families are removed. However, it also emphasises that minimising such barriers more generally will create a more functional society. It is important to ensure that clusters are defined in terms of the new market and knowledge relationships needed for emerging sectors to thrive. It is even counter-productive to reinforce traditional sectoral clusters as these may inhibit the necessary mobility. Firms in traditional sectors are far more likely to find innovative growth by forming new linkages and applying new technology to their existing products and services. This can be facilitated by opening the clusters to cooperation with and learning from other clusters in the same or other sectors.³⁴ Finally, it is very likely that for clusters to thrive **effective multi-level governance** arrangements will need to be in place, combining regional, national and supra-national elements.

³⁴ See Europe INNOVA cluster projects :
<http://www.cordis.lu/innovation/en/policy/europe-innova.htm>

5. A Pact for Research and Innovation

Our central recommendation is that a **Pact for Research and Innovation** is needed to drive the agenda for an Innovative Europe. This requires a **huge act of will and commitment from political, business and social leaders** to deliver on the goals of the Lisbon Agenda. The practical and symbolic value of this action would be to show that all the drivers of Europe's innovation ecology are willing to work together to achieve European prosperity, competitiveness and quality of life.

At the core of the Pact are actions to **create a market that stimulates innovation** and provides firms with the incentive to perform R&D and innovate. This demand-side deficiency is the primary barrier to investment in research and innovation in Europe. The market needs to be achieved simultaneously with **provision of sufficient resources for R&D and innovation**, and **improving the structural mobility of Europe** and building positive attitudes and a culture favourable towards entrepreneurship and risk taking. These three areas taken together constitute a paradigm shift in the way we integrate innovation and social values.

We take it as a given that the **current efforts towards the revised Lisbon Agenda should be continued and reinforced**. Below we highlight only new actions or those where a higher level of effort is needed. The following measures are needed, simultaneously and synchronised at all levels and by all parties:

Creating a Market for Innovative Goods and Services

At the core of our recommendations is the need for Europe to provide an innovation-friendly market for the creative outputs of its businesses and to gear the Internal Market in this direction. This needs:

- a harmonised **regulatory environment** across the EU favourable to innovation and based on early anticipation of needs;
- ambitious use of **standards-setting** powers to demand high technical performance levels and a reorganisation of the process such that agreement on new standards is reached quickly and efficiently;
- use of **public procurement** to drive demand for innovative goods, while at the same time improving the productivity of Europe's large public service sector. The role of the public sector purchaser as intelligent customer should be fostered, for example as a part of the large-scale actions we propose. Among actions to mobilise procurement are the need to coordinate or aggregate demand to create sufficiently large orders to make innovation worthwhile.

- a globally competitive **intellectual property rights** regime requires the Community Patent to be achieved and, in the short term, finalisation of the draft European Patent Litigation Agreement.
- a **cultural shift which celebrates innovation**, using the media and other means to encourage citizens to embrace innovative goods and services.

A combination of supply and the above measures to create demand should be focused in **large scale strategic actions**. We identify several examples: **e-Health, Pharmaceuticals, Energy, Environment, Transport and Logistics, Security** and **Digital Content**. An **independent High Level Coordinator** should be appointed to orchestrate action across Europe in each area.

Resources for R&D and innovation in Europe

We see the 3% target as an indicator of an Innovative Europe, not as an end in itself. Given the critical role of growth in business R&D, the market approach is the main driver but Europe also needs to make the most of existing instruments:

Support for science:

- The most excellent scientists should be supported with a generous level of resources and a world-class infrastructure at EU-level.
- Centres of excellence are necessary in some areas and achieving a sufficient scale of activity may imply a degree of national specialisation.

Support for industry:

- Support for large and small firms should not be separated but should reinforce the natural innovation ecology in which the two are interdependent. A neglected target group is the medium-sized firm above the SME threshold.
- Fiscal incentives are best concentrated on visible effects for firms, for example the reduction or elimination of social costs for R&D workers.
- The State Aid framework needs modernising and an important symbol is changing the definitions of industrial R&D to reflect the present reality of business research and innovation practice.

Support for the Science-Industry Nexus:

- **Highly functional industry-science linkages are essential** and remaining structural barriers to cooperation must be eliminated by all parties. The core contribution of the Framework Programme is in fostering linkage across borders and sectors. Science parks and incubators play an important role in knowledge transfer. Efforts are needed to raise their average practice towards the best.

- **A rapid reaction should be made to emerging sectors** where as yet no research gap exists and where Europe already has or could take the lead.
- **Pervasive technologies:** ICT, Biotechnologies including Genomics, Nanotechnologies, Cognitive and neuro-sciences, and their interaction with Social science and humanities require both R&D support and early action to anticipate and smooth the path to their commercialisation and application.

It is vital also to increase the productivity of R&D in Europe through a focus on excellence and a willingness to cut sub-standard or low priority research to free up resources to be spent on the best.

Structural funds are a key means of giving all regions a stake in the knowledge economy. The present expenditure on research and innovation should be trebled to a minimum voluntary commitment of 20% of these funds.

The EU budget should shift towards research and innovation and treat innovation as a horizontal objective in all budgets.

Structural mobility as the basis for innovation-driven success

In achieving the goal of an Innovative Europe, increasing mobility, flexibility and adaptability across several domains is a key part of the new paradigm which allows R&D and innovation to create the value needed to support European competitiveness and quality of life. The efficient exploitation of research and knowledge depends upon improving the surrounding framework conditions and structures which today limit mobility and adaptability.

Human resources are inefficiently used because of lack of mobility:

- Ten per cent of the research workforce in each year should be moving across the science/industry/government boundaries, with as high a proportion as is feasible in cross-border movement.

Financial mobility requires an effective venture capital sector and new financial instruments for the knowledge economy:

- For venture capital, a “Single Fund Structure” is needed to avoid double taxation for an investor located in one EU member state investing through a fund in another.
- The European Investment Fund has a key role in maintaining venture capital funding (on market terms) in the counter-cycle.
- The venture capital sector should be encouraged to specialise and build up its expertise in key areas for the future.

- To recycle money from successful exits to the next generation needs an active and highly liquid high-growth company stock market in Europe.
- Banks and other financial institutions must become full players in the shift to a knowledge-based economy by recognising the importance of intangible assets and developing the tools and expertise that are necessary to invest in them.

Mobility in organisation and knowledge means cutting across established structures to allow new linkages to be made that are well-adapted to emerging knowledge-based industries:

- **European technology platforms are needed to create and to take advantage of innovation-friendly markets.** Resources should be focussed on the strongest prospects with €1 billion as a guide to scale.
- **Clusters provide an important setting for mobility and a multiplier for other measures.** It is important to ensure that clusters are defined in terms of new market and knowledge relationships and not traditional sectors. Effective multi-level governance arrangements are needed.

An **independent monitoring panel** with support from the Commission should **report annually on progress** in relation to the Pact. As well as the data already being compiled in relation to 3% targets and related measures, this reporting process should develop and implement new metrics for items such as innovative procurement, service innovation and mobility as discussed and defined above.

A final word - The opportunity to implement the proposed actions will not be available for much longer. Europe and its citizens should realise that their way of life is under threat but also that the path to prosperity through research and innovation is open if large scale action is taken now by their leaders **before it is too late.**